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Hitachi Freedom Storage™
Lightning 9900™ V Series

Hitachi TrueCopy User and Reference Guide

(Synchronous and Asynchronous for UNIX®/PC Servers)

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Document Revision Level

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Source Documents for this Revision

- *Hitachi Lightning 9900™ Hitachi TrueCopy User and Reference Guide*, MK-91RD051-4a.

- TC45D0.DOC, TC45D0a.DOC (RSD input for 9900V TrueCopy document)

- RD108_Pa.doc (RSD review of this 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 Freedom Storage™ Lightning 9900™ V Series Hitachi TrueCopy User and Reference Guide* describes and provides instructions for performing Hitachi TrueCopy operations on the Hitachi Lightning 9900™ V Series (9900V) subsystem. This document assumes that:

- the user has a background in data processing and understands direct-access storage device 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 systems (e.g., opening, closing, minimizing, and restoring windows; using the keyboard and mouse to navigate on screen and select objects).

Note: The term "9900V" refers to the entire Hitachi 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, or visit Hitachi Data Systems online at http://www.hds.com.

Note: This document does not cover TrueCopy – S/390® operations. For information and instructions on performing TrueCopy S/390® operations, please refer to the *Hitachi Lightning 9900™ V Series Hitachi TrueCopy – S/390® User and Reference Guide* (MK-92RD107).

Note: The use of Hitachi TrueCopy, the TrueCopy Remote Console 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 versions 21-01-*xx* and higher.

COMMENTS

Please send us your comments on this document: doc.comments@hds.com.

Make sure to include the document title, number, and revision.
Please refer to specific page(s) and paragraph(s) whenever possible.

(All comments become the property of Hitachi Data Systems Corporation.)

Thank you!

Contents

List of Figures

List of Tables

Chapter 1   Overview of Hitachi Copy Solutions

1.1   Hitachi TrueCopy

The Hitachi TrueCopy feature enables you to create and maintain duplicate copies of all user data stored on the Hitachi Lightning 9900™ V Series 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.

This document describes and provides instructions for performing TrueCopy operations using the licensed 9900V Hitachi Remote Console – Storage Navigator software. The 9900V 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 open-systems data stored on the 9900V. In the event of a system failure or disaster at the primary (main) site, the 9900V Remote Console software also simplifies and expedites disaster recovery procedures.

Hitachi TrueCopy operations are nondisruptive and allow the primary (main) volume of each TrueCopy volume pair to remain online to all hosts for both read and write I/O operations. Once established, TrueCopy operations continue unattended to provide continuous, real-time data backup. For fibre-channel connection, TrueCopy operations can be performed across distances of up to 30 km (18.6 miles) using single-mode longwave optical fibre cables in a switch configuration. For serial interface connection, TrueCopy operations 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 connections.

Hitachi TrueCopy operations can be performed in conjunction with Hitachi ShadowImage operations (see section 1.2) to provide multiple internal copies of TrueCopy volumes. TrueCopy also supports the LUN Expansion (LUSE), Virtual LVI/LUN, and FlashAccess features of the 9900V subsystem, ensuring that all user data can be protected by remote copy operations. See section 3.6 for further information on combining Hitachi TrueCopy with these and other data management features.

Hitachi TrueCopy operations can also be performed from the UNIX® or PC server host using the Command Control Interface (CCI) software product. For information and instructions on using CCI to perform TrueCopy (and/or ShadowImage) operations, please refer to the *Hitachi Lightning 9900™ V Series and 9900 Command Control Interface (CCI) User and Reference Guide* (MK-90RD011).

Note: The use of the TrueCopy 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 Hitachi ShadowImage and ShadowImage – S/390®

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

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

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

1.3 Hitachi Multiplatform Backup/Restore (HMBR)

The Hitachi Multiplatform Backup/Restore (HMBR) feature of the Hitachi Lightning 9900™ V Series subsystem can also be used in conjunction with the ShadowImage feature to provide S/390®-based backup of ShadowImage volumes. HMBR operations should be configured to back up the ShadowImage primary volumes (P-VOLs), since the ShadowImage S-VOLs are not available to hosts (except when the pair has been split). If you need to perform HMBR operations on ShadowImage S-VOLs, you must split the pairs first to allow host access.

1.4   HXRC and CC for S/390® Data

The HXRC feature of the 9900V subsystem is functionally compatible with the industry-standard IBM Extended Remote Copy (XRC) S/390® host software function. HXRC is also compatible with the DFSMS data mover which is common to the XRC environment. HXRC operations are performed in the same manner as XRC operations, by issuing XRC TSO commands from the host system to the 9900V subsystem. The HXRC feature must be enabled using the 9900V Remote Console PC.

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

Please contact your Hitachi Data Systems account team for further information on these 9900V features, or visit Hitachi Data Systems online at http://www.hds.com.

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

Chapter 2   Overview of TrueCopy Operations

Hitachi TrueCopy provides a storage-based hardware solution for disaster recovery which enables fast and accurate system recovery. Once TrueCopy operations are established, duplicate copies of data are automatically maintained for backup and disaster recovery purposes. During normal TrueCopy operations, the primary volumes remain online to all hosts and continue to process both read and write I/O operations. In the event of a disaster or system failure, the secondary copy of data can be rapidly invoked to allow recovery with a very high level of data integrity. TrueCopy can also be used for data duplication and migration tasks.

TrueCopy 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 primary site, the secondary TrueCopy Synchronous data can be rapidly invoked to allow recovery at the volume level with an extremely high level of data integrity.

TrueCopy Asynchronous represents a unique and outstanding disaster recovery solution for large amounts of data which span multiple volumes. The TrueCopy Asynchronous 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 TrueCopy Asynchronous volume groups at the remote site can be recovered with full update sequence consistency, but the updates will be behind the primary site due to the asynchronous remote copy operations.

TrueCopy Asynchronous provides update sequence consistency for user-defined groups of volumes (e.g., large databases) as well as protection for write-dependent applications in the event of a disaster.

This overview of Hitachi TrueCopy operations describes:

- TrueCopy components (see section 2.1),

- TrueCopy operations (see section 2.2),

- TrueCopy Asynchronous recordset operations (see section 2.3),

- TrueCopy Asynchronous consistency group operations (see section 2.4),

- TrueCopy volume pair status and split/suspend types (see section 2.5).

2.1 Components

Hitachi TrueCopy operations involve the 9900V subsystems (and/or 9900) at the primary and secondary (remote) sites, the physical communications paths between these subsystems, and the 9900V TrueCopy Remote Console software. TrueCopy copies the original online data at the primary site to the offline backup volumes at the secondary (remote) site via the dedicated fibre-channel and/or ESCON® remote copy connections. The TrueCopy software is included in the Hitachi Remote Console – Storage Navigator Java applet program, and all TrueCopy functions and operations can be performed from within a web browser.

Note: Host failover software is required for effective disaster recovery with TrueCopy.

Figure 2.1 and Figure 2.2 show the TrueCopy 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 (MCU and RCU)

- Volume pairs (P-VOLs and S-VOLs)

- TrueCopy Asynchronous consistency groups

- 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

- 9900V TrueCopy Remote Console software

- Host failover software
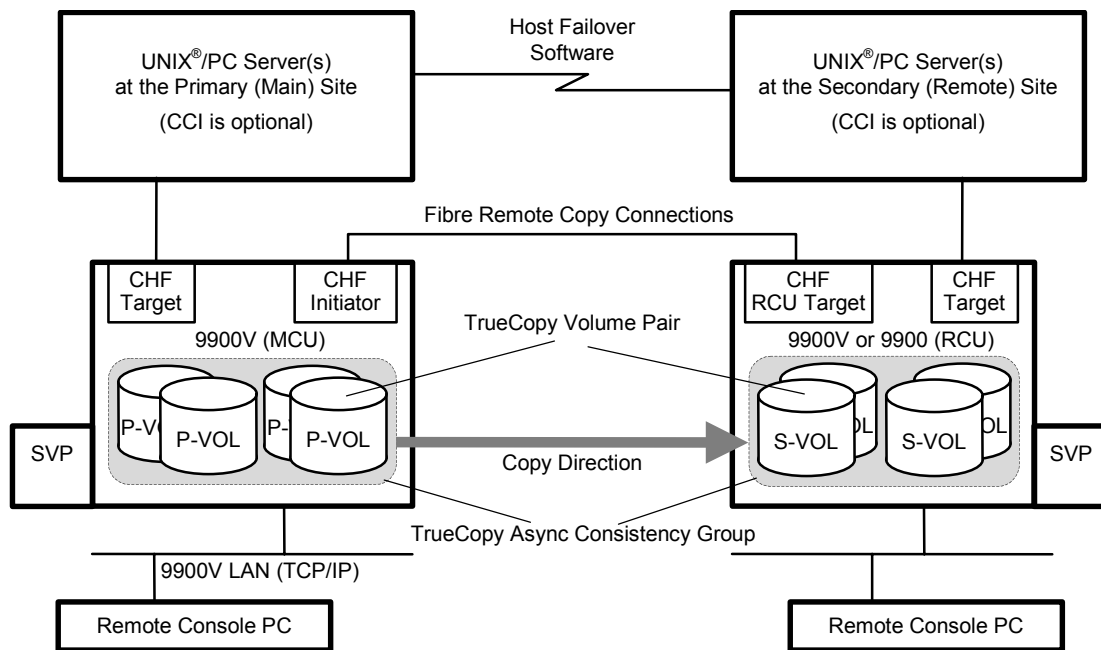
Figure 2.1   TrueCopy Components for Fibre-Channel Connection
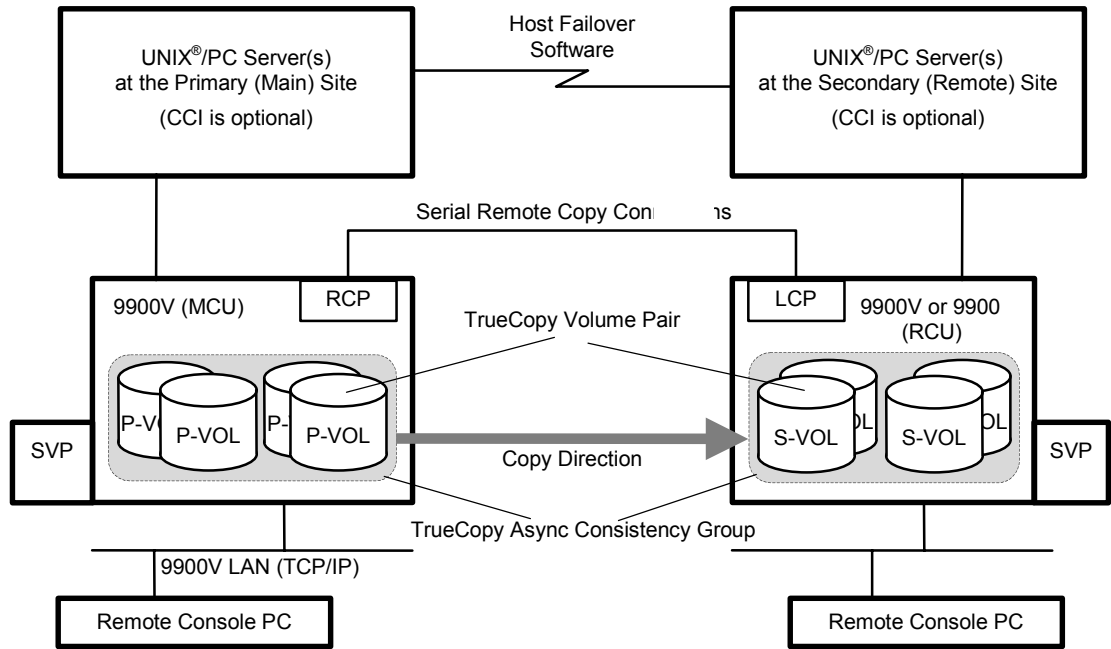
Figure 2.2   TrueCopy Components for Serial (ESCON®) Connection

Note: Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy connections.

2.1.1 Lightning 9900™ V Series Storage Subsystems

Hitachi TrueCopy operations involve the primary (main) subsystems and the secondary (remote) subsystems (MCUs and RCUs). This document covers TrueCopy operations in which the main subsystem is a 9900V and the remote subsystem is a 9900V (or 9900) subsystem. The MCUs contain the TrueCopy primary volumes (P-VOLs), which contain the original data and are online to the host(s). The RCUs contain the TrueCopy secondary volumes (S-VOLs), which are the synchronous or asynchronous copies of the P-VOLs. TrueCopy supports all CU images, logical volumes, and physical hard drive options for the 9900V subsystem. TrueCopy supports RAID 1 and RAID 5 configurations.

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 serial-interface TrueCopy 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 mode information.

Table 2.1   9900V Modes for TrueCopy (Serial Interface Only)

Mode	Description
21	Required ON for MCUs and RCUs which connect to CNT channel extenders.
109	Prevents condition code 3 when using TrueCopy with CNT channel extenders.

2.1.2   Main and Remote Control Units (MCUs and RCUs)

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

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

- The RCU is the CU in the remote subsystem which controls the S-VOLs of the TrueCopy volume pairs. The RCU assists in managing the TrueCopy pair status and configuration (e.g., rejects write I/Os to TrueCopy S-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 TrueCopy volume pair. The 9900V CU can function simultaneously as an MCU for one or more P-VOLs and as an RCU for one or more S-VOLs, provided the remote copy connections and fibre-channel or serial interface ports are properly configured. The 9900V CU provides up to 32 logical CU images (0-1F), with each CU image controlling up to 256 logical devices (LDEVs). The TrueCopy software allows you to select the desired CU image in the connected MCU and specify the desired CU image in the RCU. Hitachi TrueCopy operations can be performed on all LDEVs except for the 9900V command device. For further information on the 9900V command device, please refer to the *Hitachi Lightning 9900™ V Series and 9900 Command Control Interface (CCI) User and Reference Guide* (MK-90RD011).

Note: This document provides instructions for performing TrueCopy operations with 9900V subsystems as the MCUs. If you are using 9900 subsystems as MCUs, please use the *Hitachi Lightning 9900™ V Series TrueCopy User and Reference Guide* (MK-91RD051). The 9900 subsystem can be used as an RCU connected to a 9900V MCU for TrueCopy Synchronous and/or TrueCopy Asynchronous operations.

2.1.3   Volume Pairs (P-VOLs and S-VOLs)

Hitachi TrueCopy performs remote copy operations for logical volume pairs created by the user. Each TrueCopy pair consists of one primary volume (P-VOL) and one secondary volume (S-VOL) which can be located in the same subsystem or in different subsystems. The TrueCopy P-VOLs are the primary volumes (LUs) which contain the original data, and the TrueCopy S-VOLs are the secondary or mirrored volumes (LUs) which contain the backup or duplicate data. The primary and secondary volumes must have the same format and capacity (and SCSI path definition is required).

During normal TrueCopy operations, the P-VOL remains available to all hosts at all times for read and write I/O operations. During normal TrueCopy operations, the RCU rejects all host-requested write I/Os for the S-VOLs. The S-VOL write enable option allows write access to an S-VOL while the pair is split and uses the S-VOL and P-VOL cylinder or track maps to resynchronize the pair (see section 2.2.4).

Hitachi TrueCopy supports the basic logical unit (LU) types available on the 9900V subsystem (e.g., OPEN-3, OPEN-9, OPEN-L). TrueCopy also supports the LUN Expansion (LUSE), Virtual LVI/LUN, and FlashAccess features, ensuring that all user data can be backed up or duplicated. See section 3.2.2 for further information on LU requirements and support.

Hitachi TrueCopy supports a maximum of 8192 pairs (entire 9900V RCU). When TrueCopy pairs include size-expanded LUs, the maximum number of pairs decreases. When the CCI command device is defined, the maximum number of pairs in the 9900V subsystem is 8191.

2.1.4   Asynchronous Consistency Groups

A TrueCopy 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 volume pair must be assigned to a consistency group. TrueCopy allows you to configure up to 128 consistency groups (0-7F) for each MCU and provides group-based operations for consistency groups (e.g., split and resync 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 TrueCopy Asynchronous consistency group operations.

2.1.5   Remote Copy Connections

The remote copy connections are the physical paths used by the MCUs to communicate with the RCUs. The number of physical paths in the MCU is limited to eight per logical CU image (depending on the availability of ports). The MCUs and RCUs are connected via fibre-channel interface or serial (ESCON®) interface cables.

Note: Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy connections.

- 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. 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. See section 3.3.1 for further information on installing and configuring the FC remote copy connections.

- When serial interface connections are used, ESCON® directors (ESCDs) and/or ESCON® repeaters are required for distances greater than 3 km (1.9 miles). TrueCopy operations can be performed at 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 (e.g., T1/T3/ATM). See sections 3.3.2 and 3.3.3 for further information on installing and configuring the serial-interface remote copy connections.

The MCU-to-RCU remote copy configuration (see section 3.3.2) for TrueCopy Asynchronous has different requirements than the TrueCopy Synchronous configuration, as follows:

- TrueCopy 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 32 CU images). TrueCopy 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 Asynchronous supports 1-to-1 remote copy connections within the same consistency group. The P-VOLs and S-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 TrueCopy 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 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).

Note: Two or more initiator ports must be configured before you can add the RCUs and create the TrueCopy 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.

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.

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 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 interface port of the 9900V subsystem can be configured as an RCP. The TrueCopy 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.

Note: Two or more RCPs must be configured before you can add the RCUs and create the TrueCopy volume pairs. The RCPs cannot communicate with the host processor channels and are dedicated to TrueCopy operations. The host channel interface paths must be connected to the other interface ports on the 9900V subsystem.

2.1.8   9900V TrueCopy Remote Console Software

The 9900V Hitachi Remote Console – Storage Navigator Java™ applet program product includes TrueCopy and TrueCopy - S/390® 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 perform TrueCopy operations using CCI, you must use the TrueCopy software to add the consistency groups and select the desired group options and async options before you can add any TrueCopy pairs. These functions can only be performed using the TrueCopy Remote Console software. Once the consistency groups and async options have been configured, the CCI software can be used to establish and manage TrueCopy pairs.

If you will be using the 9900V Remote Console software to perform TrueCopy operations (not CCI), the MCU of each TrueCopy volume 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 9900V LAN at the remote site enables you to access the RCUs and TrueCopy S-VOLs and perform TrueCopy 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 operations in the reverse direction from the remote site to the primary site (e.g., disaster recovery), the 9900V TrueCopy Remote Console software at the remote site simplifies and expedites this process.

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

2.1.9   Host Failover Software

Host failover software, which transfers information between host servers at the primary and remote sites, is a critical component of any disaster recovery effort. Host failover is configured using the desired host failover software product for the platform (e.g., Microsoft Cluster Server), depending on your installation requirements and standards. The 9900V Remote Console software products do not provide any host failover functions.

When TrueCopy is used as a data migration tool, host failover is recommended but not required. When TrueCopy is used as a disaster recovery tool, host failover is required to ensure effective disaster recovery operations. When a TrueCopy pair is suspended due to an error condition, the MCU generates sense information which should be transferred to the remote site via the host failover software for effective disaster detection and recovery.

2.2 Remote Copy Operations

Figure 2.3 illustrates the two types of TrueCopy remote copy operations: initial copy and update copy. To reduce the overhead associated with these remote copy activities and maximize data transfer, the Lightning 9900™ V Series subsystem utilizes a special write command which is allowed only for TrueCopy 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 TrueCopy write command eliminates the overhead required for performing FBA-to-CKD and CKD-to-FBA conversions.
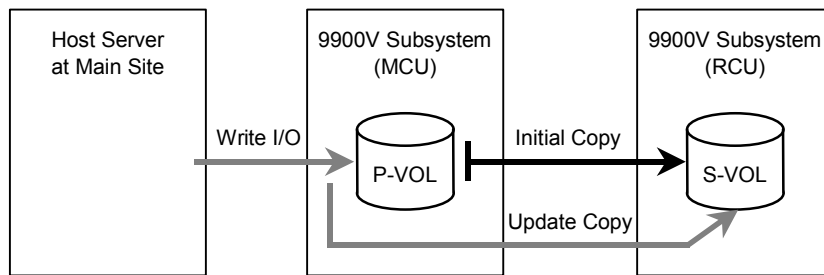
Figure 2.3   Remote Copy Operations

This section describes the following aspects of TrueCopy 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 P-VOL and S-VOL independently of host I/O processes. The initial copy operation is the same for TrueCopy Sync and TrueCopy Async pairs. A TrueCopy initial copy operation takes place when you add a pair (paircreate) or resume a split/suspended pair (pairresync). When a new pair is created, the entire contents of the P-VOL are copied to the S-VOL cylinder by cylinder, except for the diagnostic and unassigned alternate tracks. You can also select **None** for the initial copy mode, which copies only cylinder #0 to the S-VOL. If **None** is selected, the user is responsible for ensuring that the P-VOL and S-VOL are already identical. The MCU cannot verify the contents of the volumes. When a split/suspended pair is resumed (pairresync), only cylinder #0 and out-of-sync cylinders/tracks (updated by write I/Os during split/suspend) are copied to the S-VOL.

Note: For further information on cylinder/track difference management, see section 2.2.5.

When the S-VOL write enable pairsplit option is used, the RCU keeps track of S-VOL updates and sends the S-VOL cylinder/track bitmap to the MCU when the split pair is resumed. In this case the MCU merges the P-VOL and S-VOL bitmaps to identify the out-of-sync cylinders/tracks.

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

- The **number of tracks** option allows you to specify how many tracks are copied simultaneously by the TrueCopy initial copy operation when creating/resuming a TrueCopy pair. This option can only be specified using the Hitachi TrueCopy Remote Console software (not Hitachi Command Control Interface).

- The **initial copy priority** option allows you to specify the order in which the initial copy operations are performed when creating/resuming multiple TrueCopy pairs. This option can only be specified using the TrueCopy Remote Console software (not CCI).

- The **maximum initial copy activity** 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 TrueCopy Remote Console software (not CCI).

2.2.2 Update Copy Operation

An update copy operation occurs when the host issues a write I/O operation to the P-VOL of a TrueCopy pair. The update copy operation duplicates the P-VOL write I/O at the S-VOL to keep the volume pair synchronized. TrueCopy provides two modes for update copy operations: synchronous and asynchronous. The update copy mode is specified when you add a TrueCopy pair and cannot be changed.

For synchronous update copy mode, the MCU ensures that the P-VOL and S-VOL are synchronized at all times. The MCU does not return final ending status for the P-VOL write I/O until both the P-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:

- a write command whose data length is short enough not to pass the track-end, or

- write data to the track-end, whose total length is long enough to pass the track-end, or

- write data to the last track for the command.

Note: No matter how long the write data is, update copy is executed for each track.

For asynchronous update copy mode, the MCU stores the P-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 along with their associated control information are called TrueCopy Async recordsets. The RCU stores the TrueCopy Async recordsets in cache and performs the updates to the S-VOLs in the same order as they were performed at the MCU(s) according to the TrueCopy time-stamp and sequence information. For further information on TrueCopy Asynchronous recordset operations, see section 2.3.

Priority of initial and update copy: In both TrueCopy Synchronous and TrueCopy 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 TrueCopy 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 Volumes

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

When an MCU receives a write command for a TrueCopy Synchronous P-VOL with COPY status and the track has already been copied to the S-VOL, the MCU performs a synchronous update copy operation to complete the write at the S-VOL. When an MCU receives a write command for a TrueCopy Asynchronous P-VOL with COPY status and the track has already been copied to the S-VOL, the MCU performs an asynchronous update copy operation.

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

- **Synchronous Mode:** The MCU performs the write operation on the P-VOL, starts the update copy operation for the S-VOL, and then reports final ending status to the host only after the update copy operation is complete. If the P-VOL write or S-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 P-VOL as failed. If a failure occurs at the P-VOL or the S-VOL, the corresponding volume of the TrueCopy pair will decommit the update to maintain exact synchronization of the volumes.

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

The RCU does not allow a TrueCopy S-VOL to be online (mounted) during normal TrueCopy operations and rejects all host-requested write I/O operations for an S-VOL. The special TrueCopy S-VOL write enable option enables write access to an S-VOL while the pair is split (see section 2.2.4). The S-VOL write option can only be enabled when you split the pair from the MCU.

2.2.4 S-VOL Write Option

For additional flexibility, Hitachi TrueCopy provides an S-VOL write option which enables write access to the S-VOL of a split TrueCopy pair. The S-VOL write option can be selected by the user during the pairsplit-r operation and applies only to the selected pair(s). The S-VOL write option can be accessed only when you are connected to the MCU. When you resync a split TrueCopy pair which has the S-VOL write option enabled, the RCU sends the S-VOL cylinder/track bitmap to the MCU, and the MCU merges the P-VOL and S-VOL bitmaps to determine which cylinders (or tracks) are out-of sync. This ensures proper resynchronization of the pair.

2.2.5 Difference Management

The differential data (updated by write I/Os during split or suspension) between P-VOL and S-VOL is stored in each cylinder bitmap. When a split/suspended pair is resumed (pairresync), the MCU merges the P-VOL and S-VOL bitmaps, and the differential data is copied to the S-VOL. The unit of data stored in the bitmap is track or cylinder. When you add a pair (paircreate), 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 and CCI.

Note: For mixed subsystem configurations (e.g., 9900V MCU and 9900 RCU), the difference management option is not available during the paircreate 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
Command Control Interface software	Available	Available	Available	Available

* **Default:** Track or Cylinder is automatically set according to the basic LU type. For OPEN-E and OPEN-L LU types, the default is Cylinder. For other basic LU 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 create 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. (When you add a TrueCopy pair with Track using the CCI software, you cannot use this function, and the paircreate operation will fail.)

■   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 LU 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:

$$(\, (\uparrow (\, (\, (\uparrow (\, (\, (\uparrow (\text{Max. LBA}/96) \uparrow) \, / 15) \uparrow) + 1) \times 15) \, / 75{,}136) \uparrow) - 1$$

The ↑…↑ 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 LU Type	Number of Cylinders	Maximum Number of Pairs
OPEN-3	3,339	8,192
OPEN-9	10,017	8,192
OPEN-E	19,760	3,492
OPEN-L	49,440	1,164

2.3 TrueCopy Asynchronous Recordset Operations

The TrueCopy Async recordsets contain the P-VOL updates and the associated control information, including the time-stamp of the P-VOL update (MCU SVP time), which enables the RCU to maintain update consistency of the TrueCopy Async S-VOLs. TrueCopy Async 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, and
- Inflow control for sidefiles.

2.3.1 Creating and Storing Recordsets at the MCU

When an MCU performs an update (host-requested write I/O) on a TrueCopy P-VOL, the MCU creates a TrueCopy Async recordset which contains: the updated record, time-stamp information, sequence number, record location (device, cylinder, track, record number), and record length. The TrueCopy Async 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 S-VOL(s) in the same order as the P-VOL(s).

The TrueCopy time-stamp information is acquired from the 9900V SVP. 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). *Note:* TrueCopy Asynchronous operations continue uninterrupted if the SVP reboots or even if the SVP fails (in this case the time-stamps may not be correct).

2.3.2 Sending Recordsets to the RCU

The MCU sends the TrueCopy Async recordsets to the RCU in a similar manner as the TrueCopy Synchronous updates. The MCU's RCP 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 data. The MCU can send several recordsets using a single RIO, even if their sequence numbers are not contiguous. Therefore, TrueCopy Async 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 S-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 the TrueCopy Asynchronous channel command are different than for TrueCopy 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 S-VOLs. The RCU queuing mechanism for TrueCopy Async uses time-stamping provided by the MCU SVP to control the sequence in which S-VOL updates are applied, and uses sequence numbers also provided by the MCU to check for 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 TrueCopy Async recordsets.

Figure 2.4 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 (MCU SVP time) 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.
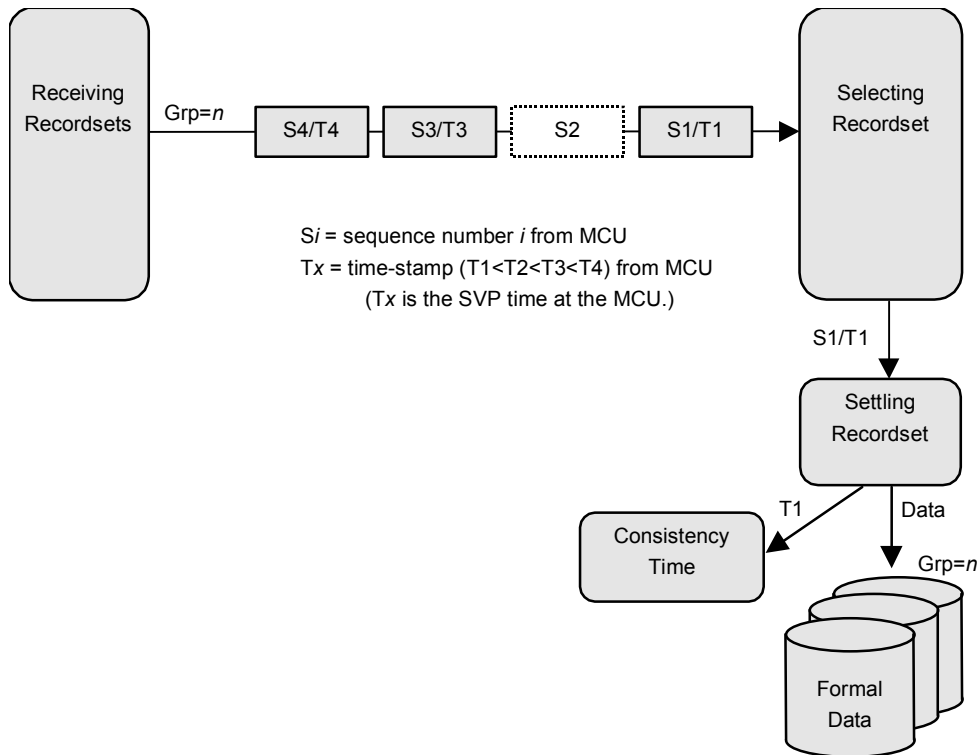
Figure 2.4   Selecting and Settling TrueCopy Async Recordsets at the RCU

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.

2.3.6   Inflow Control of Recordsets

As described in the previous sections, both the MCU and RCU create sidefiles for storing TrueCopy (and TrueCopy – S/390®) Asynchronous 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 subsystems use the following parameters for TrueCopy Asynchronous cache inflow control, and the TrueCopy Async Option panel (see section 4.3.1) allows you to modify these parameters:

- **Pending Update Data Rate (%)**: sidefile (TrueCopy) threshold = maximum cache % available for use by TrueCopy Asynchronous sidefiles.

- **Offloading Timer (sec.)**: maximum time between TrueCopy Async recordset transfers.

Inflow Control by MCU. When the amount of MCU sidefile cache reaches the user-specified threshold (**pending update data rate**), the subsystem's I/O response is delayed. If the MCU is not able to send a recordset to the RCU within the user-specified **offloading timer** value, the MCU suspends all affected TrueCopy Async volume pairs and resets the SCP condition to avoid hanging up the system.

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

Inflow Control by RCU. When the amount of RCU sidefile cache reaches the user-specified threshold (**pending update data rate**), 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 the pending recordsets. If the RCU is not able to settle a recordset within the user-specified **offloading timer** value, the RCU suspends all TrueCopy Asynchronous volume pairs and resets the channel-command-retry condition to avoid hanging up the MCU.

Table 2.4 shows the sidefile threshold values for TrueCopy Asynchronous operations and write pending operations and describes the actions that occur when each threshold is reached.

Table 2.4　Sidefile Thresholds

Operation	Threshold(s)	Action(s)
TrueCopy Asynchronous	Sidefile threshold = 50%. Threshold can be adjusted using the Hitachi TrueCopy Remote Console software (30, 40, 50, 60, 70%).	MCU reaches threshold: I/O delay. RCU reaches threshold: command retry to MCU.
Write Pending	[write pending] / [avail cache - sidefile] = 70%	Command retry.

Note: FlashAccess operations may decrease the total amount of cache available for TrueCopy Asynchronous 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.

For information on HXRC and Concurrent Copy (CC) cache sidefile operations, please refer to the *Hitachi Lightning 9900™ V Series Hitachi TrueCopy – S/390® User and Reference Guide*. Subsystems performing TrueCopy Asynchronous in combination with HXRC and/or CC must have sufficient cache installed to handle the increased sidefile activity.

2.4   TrueCopy Asynchronous Consistency Group Operations

TrueCopy Asynchronous consistency groups enable update sequence consistency to be maintained across a group of volumes. The P-VOLs and S-VOLs of the pairs in a consistency group must be located within one physical MCU and one physical RCU (1-to-1 requirement). The TrueCopy consistency group operations include:

- Group options,
- Group consistency time, and
- Group operations.

2.4.1   Group Options

Hitachi TrueCopy provides the following options for each consistency group: **Time Out (Copy Pending)**, and **Time Out (RCU Ready)**. These options are selected when you add a group, and can only be modified when the group does not contain any P-VOLs in the MCU.

Time Out (Copy Pending). This group option specifies the maximum delay allowed for TrueCopy Async copy operations. The RCU will suspend all S-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 group option specifies the maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off. During MCU power-on, the MCU re-establishes communication with all registered RCUs. If the MCU is not able to re-establish communication with an RCU within the specified time, the MCU suspends all affected TrueCopy Asynchronous volume pairs.

2.4.2 Group Consistency Time

During normal TrueCopy operations, the consistency time (C/T) of a group corresponds to the time-stamp value (MCU SVP time) of the most recently settled recordset at the RCU. The group C/T is indicated as part of the TrueCopy Async S-VOL pair status only for split or suspended TrueCopy Async pairs and only at the RCU. As the primary system continues to update the P-VOLs, the difference between the current SVP time and the group consistency time indicates the amount of time that the S-VOLs are behind the P-VOLs. The P-VOL updates which take place during this time may be lost when a disaster occurs.

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

Once TrueCopy Asynchronous operations are established, you should monitor the consistency time of each group at the RCU(s) (please ask your Hitachi Data Systems representative for assistance). 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 P-VOL update and the corresponding S-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 Asynchronous provides the following group-based operations to simplify and expedite disaster/failure recovery procedures:

- Group operations at the MCU:

  – Split (pairsplit-r) all pairs in a consistency group. See section 5.6 for a description of the **Suspend Range-Group** pairsplit option.

  – Resume (pairresync) all split or suspended pairs in a group. See section 5.7 for a description of the TrueCopy **Resume Range-Group** pairresync option.

  – Delete (pairsplit-S) all pairs in a group. See section 5.8 for a description of the **Delete Range-Group** pairdelete option.

- Group operations at the RCU:

  – Split (pairsplit-r) all pairs in a consistency group. See section 5.6 for a description of the **Suspend Range-Group** pairsplit option.

  – Delete (pairsplit-S) all split/suspended pairs in a consistency group except for any inconsistent pairs. See section 5.8 for a description of the **Delete Range-C/T** pairdelete option.

  – Delete (pairsplit-S) all pairs in a group regardless of their consistency status. See section 5.8 for a description of the **Delete Range-Group** pairdelete option.

Hitachi TrueCopy also provides the **Error level** pair option (see section 5.4) which is used to trigger automatic suspension of an entire consistency group. When a TrueCopy Async pair is suspended due to failure (not user-requested), this TrueCopy Async pair option determines whether all pairs in the same consistency group will also be suspended. If you selected the **Group** error level for the TrueCopy pair, all pairs in the same group will be suspended. If you selected the **LU** error level, only the affected TrueCopy pair will be suspended.

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

2.5   TrueCopy Volume Pair Status

Hitachi TrueCopy displays the pair status for each volume in the connected 9900V subsystem. Table 2.5 lists and describes the TrueCopy pair status descriptions. The MCU maintains the status of the P-VOL and can change the pair status of the P-VOL and S-VOL. The RCU maintains the status of the S-VOL and can change the pair status of the S-VOL but not the P-VOL. The MCU will detect when the RCU changes the S-VOL status (if the path status is normal) and will change the P-VOL status accordingly. You can display the detailed pair status information at the Remote Console PC (Hitachi TrueCopy Pairdisplay panel) or at the UNIX®/PC server host (CCI Pairdisplay command).

A volume which is not assigned to a TrueCopy pair has the status **SMPL**. When a TrueCopy pair is started, the MCU changes the status of the P-VOL and S-VOL to **COPY**. When the initial copy operation is complete, the MCU changes the status of both volumes to **PAIR**. When a TrueCopy pair is split by the user (pairsplit-r), the MCU/RCU changes the status of the P-VOL and S-VOL to **PSUS** (if the path status is normal). When a pair is suspended due to an error condition, the MCU/RCU changes the P-VOL and S-VOL status to **PSUE** (if the path status is normal). When a pair is deleted by the user from the MCU (pairsplit-S), the MCU changes the status of the P-VOL and S-VOL to **SMPL** (if path status is normal). When a pair is deleted from the RCU, the RCU changes the S-VOL status to **SMPL**, and the MCU detects the pair deletion (if path status is normal) and changes the P-VOL status to **PSUS**.

When a TrueCopy pair is split or suspended, the MCU generates a service information message (SIM) to notify the host(s). If SNMP is installed and operational for the 9900V, this SIM results in an SNMP trap which indicates the reason for suspension.

TrueCopy LUSE Pair Status

For TrueCopy LUSE pairs only, the **PDUB** status indicates that the status of the TrueCopy LUSE volume pair is **COPY** or **PAIR**, but the status of one or more individual LDEV pairs within the TrueCopy LUSE pair is **SMPL** or **PSUE** (due to some error condition).

TrueCopy Asynchronous Pair Status

The TrueCopy **Suspending** and **Deleting** transitional states occur when a request to change TrueCopy Async pair status has been accepted, but the change to the requested status (**PSUS**, **PSUE**, or **SMPL**) 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 **PSUE**, the suspended status is reported at the beginning of the transition.

Table 2.5 TrueCopy Volume Pair Status

Pair Status	Description	P-VOL Access	S-VOL Access
SMPL (simplex)	This volume is not currently assigned to a TrueCopy volume pair. When this volume is added to a TrueCopy pair, its status will change to COPY.	Read/write	Read/write
COPY	The initial copy operation for this pair is in progress. This pair is not yet synchronized. When the initial copy is complete, the status changes to PAIR.	Read/write	Read only
PAIR	This pair is synchronized. Updates to the P-VOL are duplicated on the S-VOL.	Read/write	Read only
PSUS (pair suspended-split) (see Table 2.6 for split types)	This pair is not synchronized, because the user has split this pair (pairsplit-r), or because the user has deleted this pair from the RCU (pairsplit-S). For TrueCopy Async pairs, the MCU and RCU keep track of any recordsets that were discarded during the pairsplit-r operation. While a pair is split, the MCU and RCU keep track of the P-VOL and S-VOL cylinders/tracks which are updated. – When you split a pair from the MCU, the MCU changes the status of the P-VOL and S-VOL to PSUS. When you split a pair from the RCU, the RCU changes the status of the S-VOL to PSUS. The MCU detects this (if path status is normal) and changes P-VOL status to PSUS. – When you delete a pair from the RCU, the RCU changes the S-VOL status to SMPL. The MCU detects this (if the path status is normal) and changes the P-VOL status to PSUS. You must delete the pair from the MCU in order to change the P-VOL status to SMPL.	Read/write	Read only; Read and write, if write enable split option is selected.
PSUE (pair suspended-error) (see Table 2.8 for suspend types)	This pair is not synchronized, because the MCU or RCU has suspended the pair due to an error condition. For Async pairs the MCU and RCU keep track of any recordsets that were discarded during the suspension operation. The MCU keeps track of the P-VOL cylinders/tracks which are updated while the pair is suspended. – For TrueCopy Synchronous pairs, if the MCU cannot keep the pair synchronized for any reason, the MCU changes the status of the P-VOL and S-VOL (if possible) to PSUE. – For TrueCopy Asynchronous pairs, if the MCU detects a TrueCopy Async suspension condition (see section 2.5.3), the MCU changes the P-VOL and S-VOL status (if possible) to PSUE. – For TrueCopy Asynchronous pairs, if the RCU detects a TrueCopy Async suspension condition (see section 2.5.3), the RCU changes the S-VOL status to PSUE, and the MCU detects this (if the path status is normal) and changes the P-VOL status to PSUE.	Read/write; Read only if fenced.	Read only
Pair Status for TrueCopy LUSE volumes only:			
PDUB	This TrueCopy pair consists of LUSE volumes (e.g., OPEN3*n), and an individual LDEV within this TrueCopy LUSE pair has failed due to some error condition. The status of the TrueCopy LUSE volume is PAIR or COPY, and the status of one or more LDEV pairs is PSUE or SMPL.	Read/write	Read only
Pair Status for TrueCopy Asynchronous only:			
Suspending	This pair is not synchronized. This pair is in transition from PAIR or COPY to PSUS/PSUE. When the split/suspend pair operation is requested, the status of all affected pairs changes to **Suspending**. When the split/suspend operation is complete, the status changes to PSUS/PSUE.	Read/write	Read only
Deleting	This pair is not synchronized. This pair is in transition from PAIR, COPY, or PSUS/PSUE to SMPL. When the pairsplit-S operation is requested, the status of all affected pairs changes to **Deleting**. When the pairsplit-S operation is complete, the status changes to SMPL.	Read/write	Read only

2.5.1 TrueCopy Split Types (PSUS)

Table 2.6 lists and describes the TrueCopy split types. A TrueCopy pair can be split by the user at any time after the initial copy operation is complete. The user must split a TrueCopy pair in order to perform media maintenance on the P-VOL or to access the S-VOL (S-VOL write enable).

When a TrueCopy Synchronous pair is split by the user, the MCU ensures synchronization by completing any pending update copy operation before changing the status to PSUS. After the pair status changes to PSUS, the MCU stops performing update copy operations to the S-VOL and may or may not continue accepting write I/Os for the P-VOL, depending on the P-VOL fence level and pairsplit options. If the P-VOL accepts write operations while the pair is split, the MCU keeps track of the P-VOL cylinders/tracks which are updated. If you enabled the S-VOL write option when you split the pair, the RCU keeps track of the S-VOL cylinders or tracks which are updated while the pair is split. When the pair is resumed (pairresync), the RCU sends the S-VOL bitmap to the MCU, and the MCU merges the P-VOL and S-VOL bitmaps to determine which cylinders/tracks are out-of-sync.

When a TrueCopy Asynchronous pair is split 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 pairsplit option. The MCU and RCU keep track of any recordsets that were discarded during the pairsplit operation. After the pair status changes to PSUS, the MCU stops performing recordset operations for the pair, continues accepting write I/Os for the split TrueCopy Async P-VOL, and keeps track of the P-VOL cylinders/tracks which are updated while the pair is split. If you enabled the S-VOL write option when you split the pair, the RCU also keeps track of the S-VOL cylinders/tracks which are updated while the pair is split. When the pair is resumed, the RCU sends the S-VOL bitmap to the MCU, and the MCU merges the P-VOL and S-VOL bitmaps to determine which cylinders/tracks are out-of-sync.

A split (or suspended) TrueCopy Async S-VOL has an additional status called the consistency status. The consistency status is displayed only at the RCU and indicates the S-VOL's update sequence consistency with respect to the other S-VOLs in the same group. Table 2.7 lists and describes the consistency status descriptions for split or suspended TrueCopy Async S-VOLs (the consistency status is displayed only at the RCU).

Table 2.6   Split Types (PSUS)

Type	Applies to	Description
PSUS, P-VOL by Operator	P-VOL (TrueCopy Sync only)	The user split the pair from the MCU using the **P-VOL Failure** option. The S-VOL split type is **PSUS-by MCU**.
PSUS, S-VOL by Operator	P-VOL, S-VOL	The user split the pair from the MCU or RCU using the **S-VOL** option.
PSUS, by MCU	S-VOL	The RCU received a request from the MCU to split the pair. The P-VOL split type is **PSUS-P-VOL by Operator** or **PSUS-S-VOL by Operator**.
PSUS, Delete pair to RCU	P-VOL	The MCU detected that the S-VOL status changed to **SMPL** because the user deleted the pair (pairsplit-S) from the RCU. The pair cannot be resumed because the S-VOL does not have the **PSUS/PSUE** status.

Table 2.7   Consistency Status for Split/Suspended TrueCopy Async S-VOLs

Consistency Status (displayed at RCU)	Description
Volume	This TrueCopy Asynchronous volume pair was probably split or suspended alone. Update sequence consistency between this S-VOL and other S-VOLs in this consistency group is not ensured. This S-VOL cannot be used for disaster recovery at the secondary site. This status is indicated when: – This pair was split by the user using the **Suspend Range-LU** pairsplit option. – This 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 **LU**.
Group	This TrueCopy Asynchronous volume pair was split or suspended along with the other pairs in its consistency group. Update sequence consistency between this S-VOL and other S-VOLs in this consistency group is ensured. This S-VOL can be used for disaster recovery at the secondary (remote) system (after deleting the TrueCopy pair from the RCU). This status is indicated when: – This pair was split by the user using the **Suspend Range-Group** pairsplit option. – All 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). – One pair in the group was suspended due to a failure that did not affect the entire group, and the **Error Level** pair option for this pair is set to **Group**.

2.5.2   TrueCopy Suspend Types

Table 2.8 lists and describes the TrueCopy suspend types, which indicate the reason for the suspension. TrueCopy Synchronous pairs can only be suspended by the MCU. TrueCopy Asynchronous pairs can be suspended by the MCU or by the RCU. For further information on TrueCopy Async suspension conditions, please see section 2.5.3.

The MCU suspends a TrueCopy pair when it detects any of the following suspension conditions:

■   When the MCU detects that the user has deleted the volume pair from the RCU,

■   When the MCU detects an error condition related to the RCU, S-VOL, or a TrueCopy update copy operation,

■   When the MCU is unable to communicate with the RCU, or

■   When the MCU detects a TrueCopy Asynchronous suspension condition.

When a TrueCopy Synchronous pair is suspended, the MCU stops performing update copy operations to the S-VOL and may or may not continue accepting write I/Os for the P-VOL, depending on the P-VOL fence level pair option. If a synchronous update copy operation fails, the MCU maintains exact synchronization by reporting a unit check and decommitting the P-VOL update, so that the host system and application program regard that write operation to the P-VOL as failed. If the MCU accepts subsequent write I/Os for a suspended P-VOL, the MCU keeps track of the P-VOL cylinders/tracks which are updated while the pair is suspended. When a suspended TrueCopy Sync pair is resumed, the MCU copies the out-of-sync P-VOL cylinders/tracks to the S-VOL. TrueCopy does not allow access to an S-VOL while the pair is suspended (only when split).

Note: You must stop host I/Os before suspending TrueCopy Synchronous pairs with the **Data** fence level and the following conditions: TrueCopy Synchronous and Asynchronous pairs exist in the same subsystem, and there are host I/Os to the TrueCopy Asynchronous pairs. If you do not stop host I/Os, the pairs might be forcibly suspended because of a time-out error, and host I/Os will be rejected.

When a TrueCopy Asynchronous pair is suspended, the MCU stops performing TrueCopy Async recordset operations for the pair. The MCU continues accepting write I/Os for the suspended P-VOL and keeps track of the P-VOL cylinders/tracks which are updated while the pair is suspended. The MCU and RCU also keep track of any recordsets that were discarded during the pair suspension. When a suspended TrueCopy Async pair is resumed, the RCU sends the S-VOL bitmap to the MCU, and the MCU merges the P-VOL and S-VOL bitmaps to determine which cylinders/tracks are out-of-sync. This method ensures that all cylinders/tracks which contain recordsets that were discarded at the RCU are resynchronized at this time.

A suspended (or split) TrueCopy Async S-VOL has an additional status called the consistency status. The consistency status is displayed only at the RCU and indicates the S-VOL's update sequence consistency with respect to the other S-VOLs in the same group. Refer to Table 2.7 (above) for a description of consistency status for suspended/split TrueCopy Async S-VOLs.

Table 2.8   Suspend Types (PSUE)

Type	Applies to	Description
PSUE, by RCU	P-VOL, S-VOL	The MCU detected an error condition at the RCU which caused the MCU to suspend the TrueCopy volume pair. The S-VOL suspend type is **PSUE-S-VOL Failure**.
PSUE, S-VOL Failure	P-VOL, S-VOL	The MCU detected an error during RCU communication or an error during update copy. In this case, the S-VOL suspend type is usually **PSUE-S-VOL Failure**. This suspend type is also used when the number of paths falls below the minimum number of paths setting on the RCU Option panel.
PSUE, MCU IMPL	P-VOL, S-VOL TrueCopy Async	The MCU could not find valid control information in its nonvolatile memory during IMPL. This condition occurs only if the MCU is without power for more than 48 hours (i.e., power failure and fully discharged backup batteries).
PSUE, Initial Copy Failed	P-VOL, S-VOL	The TrueCopy pair was suspended before the initial copy operation was complete. The data on the S-VOL is not identical to the data on the P-VOL.
PSUE, MCU P/S OFF	S-VOL (TrueCopy Async only)	The RCU received a request from the MCU to suspend the S-VOL due to MCU power-off. The RCU stops expecting recordsets from that MCU. The P-VOL status does not change due to MCU power-off.
PSUS, Sidefile overflow (TrueCopy Async only)	P-VOL, S-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".

2.5.3 TrueCopy Asynchronous Suspension Conditions

TrueCopy Asynchronous operations involve additional suspension conditions related to the recordset operations. Both the MCU and RCU can detect TrueCopy Async suspension conditions and suspend TrueCopy Async pairs. When a TrueCopy Async pair is suspended, the cylinders/tracks which contain the following records are marked in the bitmap as modified (to be copied during the pairresync operation):

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

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

If a recordset is lost in transmission from the MCU to the RCU, the MCU's bitmap ensures that the missing recordset is marked. After the MCU sends the recordset to the RCU, the MCU does not remove the sidefile entry for the recordset from its cache until it receives an I/O completion signal (device end) from the RCU.

Table 2.9 describes the TrueCopy Asynchronous suspension conditions and indicates which CU detects the condition and which pairs are suspended. The TrueCopy offloading timer option (see section 4.3.1) and timeout group options (see section 4.3.3) are used to control the TrueCopy Asynchronous suspension conditions. See Table 7.4 in section 7.1 for troubleshooting information for TrueCopy Asynchronous suspension conditions.

Table 2.9   TrueCopy Asynchronous Suspension Conditions

Suspension Condition	Detected by:	TrueCopy Async Pairs to be Suspended
The MCU could not send a pending recordset to the RCU before the **offloading timer** async option expired.	MCU	All TrueCopy Async pairs with P-VOLs in the MCU.
During MCU power-on, the MCU could not establish communication with the RCU before the **Time Out (RCU Ready)** group option expired.	MCU	All TrueCopy Async pairs with P-VOLs in the MCU.
The RCU could not settle a pending recordset before the **Time Out (Copy Pending)** group option expired.	RCU	All TrueCopy Async S-VOLs in the consistency group.
The RCU could not communicate with the MCU before the **Time Out (Copy Pending)** group option expired (see section 4.3.3).	RCU	All TrueCopy Async S-VOLs in the consistency group.
The RCU could not receive the recordset successfully due to a hardware failure.	RCU	Only the affected S-VOL.
The RCU detected a logical error while selecting the recordset to be settled.	RCU	All TrueCopy Async S-VOLs in the consistency group, or only the affected S-VOL, depending on the type of failure and the **error level** pair option.
The RCU could not settle the recordset due to a hardware failure, track condition, or logical error.	RCU	

Chapter 3   Preparing for TrueCopy Operations

3.1   System Requirements

Hitachi TrueCopy operations involve the 9900V MCUs and RCUs containing the primary and secondary volumes, the remote copy connections between the MCUs and RCUs, the host(s) at the primary and remote sites, and the licensed TrueCopy Remote Console software.

Note: TrueCopy can coexist with TrueCopy – S/390® (all copy modes) in the same 9900V subsystem.

The TrueCopy system requirements are:

- **MCU:** Hitachi Lightning 9900™ V Series subsystem with TrueCopy installed. *Note:* For information on performing remote copy using the 9900 as an MCU, please refer to the *Hitachi Lightning 9900™ V Series TrueCopy User and Reference Guide* (MK-91RD051).

- **RCU:** Hitachi Lightning 9900™ V Series subsystem with TrueCopy installed. *Note:* The 9900 subsystem can also be used as an RCU connected to a 9900V MCU. For assistance with mixed subsystem configurations, please contact your Hitachi Data Systems team.

  Note: The 9900V subsystems may have additional installation requirements (e.g., SVP modes, DKC-F460I-8HSE). For information on SVP modes for TrueCopy, see Table 2.1.

- **Host platforms:** The 9900V subsystem supports TrueCopy operations for a variety of UNIX®-based and PC-server platforms, including the Sun® Solaris®, IBM® AIX®, HP-UX®, Windows NT®, and Windows® 2000 platforms. Please contact your Hitachi Data Systems account team for the latest information on 9900V platform support for TrueCopy.

- **Remote copy connections – fibre channel:**
  - 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.

  Note: All fibre-channel remote copy activities between two 9900V subsystems (i.e., TrueCopy Sync and Async, TrueCopy – S/390® Sync and Async) can share the same remote copy connections.

■ **Remote copy connections – serial** (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 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 solutions are provided based on user requirements and workload characteristics.
  Note: Usage of channel extenders may require additional 9900V configuration (e.g., SVP mode 21).

  Note: All serial remote copy activities between two 9900V subsystems (i.e., TrueCopy Sync and Async, TrueCopy – S/390® Sync and Async) can share the same remote copy connections.

■ **Remote Console Software and TrueCopy license code(s):**

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

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

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

Note: You must operate the 9900V Remote Console software in modify mode to perform TrueCopy operations. Users in view mode can only view TrueCopy information.

3.2 Requirements and Restrictions

Hitachi TrueCopy has the following requirements and restrictions:

- One-to-one volume copy operations
- Logical unit (LU) type (also called device emulation or type)
- Consistency groups
- Accessing TrueCopy P-VOLs and S-VOLs
- Cache and NVS
- Host failover software
- Duplicate volume
- Host system crash

3.2.1 One-to-One Volume Copy Operations

Hitachi TrueCopy requires a one-to-one relationship between the logical volumes of the volume pairs. A volume (LU) can only be assigned to one TrueCopy pair at a time. TrueCopy does not support operations in which one P-VOL is copied to more than one S-VOL, or more than one P-VOL is copied to one S-VOL. Because TrueCopy operates on logical volumes rather than on files, multivolume files require special attention. For complete duplication and recovery of a multivolume file (e.g., a large database file which spans several volumes), make sure that all volumes of the file are copied to TrueCopy S-VOLs, and use TrueCopy Asynchronous to ensure update sequence consistency across this group of S-VOLs.

3.2.2 Logical Unit (LU) Types

Hitachi TrueCopy supports the basic LU types which can be configured on the 9900V subsystem (e.g., OPEN-3, OPEN-E, OPEN-9, OPEN-L). The TrueCopy software displays the LU type of the P-VOLs and S-VOLs. A TrueCopy pair must consist of LUs of the same type and capacity (e.g., OPEN-3 to OPEN-3). Multiplatform volumes (e.g., 3390-3A/B/C) cannot be assigned to TrueCopy pairs. *Note:* Please contact your Hitachi Data Systems account team for the latest information on supported devices for your platform.

TrueCopy supports the LUN Expansion (LUSE) feature of the 9900V, which allows you to configure expanded LUs using two or more contiguous LDEVs (up to 36). When LUSE volumes are assigned to a TrueCopy pair, the P-VOL and S-VOL must contain the same type and number of LDEVs (e.g., OPEN-3*6 to OPEN-3*6). The number of LDEV pairs in a TrueCopy LUSE pair equals the number of LDEVs in each LUSE volume. When the status of all LDEV pairs within one TrueCopy LUSE pair is not the same (e.g., one LDEV pair is suspended), the pair status of the TrueCopy LUSE pair changes to PDUB.

TrueCopy also supports the Virtual LVI/LUN feature of the 9900V subsystem, which allows you to configure custom-size LUs which are smaller than standard-size LUs. When custom-size LUs are assigned to a TrueCopy pair, the S-VOL must have the same capacity as the P-VOL.

3.2.3   Consistency Groups

The TrueCopy Asynchronous consistency groups have the following requirements:

- Each TrueCopy Async pair must be assigned to one and only one consistency group.

- The maximum number of volume pairs in one consistency group is 4096 (4095 when the CCI command device is defined).

- The maximum number of consistency groups established for one MCU-RCU pair is 128 (00-7F). The RCU supports a maximum of 128 groups. This limit includes both TrueCopy and TrueCopy – S/390® groups (e.g., 64 TrueCopy + 64 TrueCopy – S/390®).

- A TrueCopy consistency group must consist only of TrueCopy Asynchronous pairs (no TrueCopy Synchronous pairs).

3.2.4   Accessing TrueCopy P-VOLs and S-VOLs

To ensure maximum data integrity during normal TrueCopy operations, the RCU rejects all write operations issued by a host to a TrueCopy S-VOL. If you need write access to a TrueCopy S-VOL, you must split the pair using the S-VOL write option (see section 2.2.4). When you resume (resync) the split pair, the RCU will send the S-VOL cylinder/track bitmap to the MCU to ensure proper resynchronization of the pair.

3.2.5   Cache and Nonvolatile Storage (NVS)

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

3.2.6   Host Failover Software

The 9900V Remote Console software product does not provide any host failover functions for disaster recovery. Host failover software is a critical component of any disaster recovery effort. When an MCU fails to maintain synchronization of a TrueCopy pair, the MCU generates sense information. It is very important that this information be transferred to the remote site via the host failover software for effective disaster recovery.

3.2.7   Duplicate Volumes

Since the contents of the P-VOL and S-VOL of a TrueCopy pair are identical, the S-VOL can be considered a duplicate of the P-VOL. Since the host operating system does not allow duplicate volumes, the host system administrator must take precautions to prevent system problems related to duplicate volumes. You must define the TrueCopy S-VOLs so they do not auto-mount or come online to the same host at the same time as the P-VOLs (see **WARNING** below).

Hitachi TrueCopy does not allow the S-VOL to be online (except when the pair is split). If the S-VOL is online, the TrueCopy paircreate operation will fail.

WARNING: If the TrueCopy S-VOLs are physically attached to the same host server(s) as the TrueCopy P-VOLs, the following problem can occur:

- When a TrueCopy pair is deleted, the old S-VOL is usually offline. If the host is then restarted, the system administrator may be offered both volumes and asked which volume should be left offline. This can be confusing and is prone to error.

If the TrueCopy S-VOLs and P-VOLs are connected to the same host(s), Hitachi Data Systems strongly recommends that the S-VOLs are defined to remain offline to avoid this problem.

3.2.8   Host System Crash

The contents of the P-VOL and S-VOL of a TrueCopy pair may become inconsistent if the host system hangs (crashes) while a write operation is being performed on the TrueCopy P-VOL, and the write operation cannot be retried because of the following reasons:

- A check condition is reported to the host due to a failure in the subsystem when the write command for the TrueCopy pair is issued.

- A reset command is issued from the host and the write operation is stopped (the write operation is incomplete).

If these conditions occur, you must retry the job to complete the write operation.

3.3   Installing the Hardware

Initial installation of the TrueCopy hardware is performed by the user and the Hitachi Data Systems representative. The hardware configurations for TrueCopy Synchronous and TrueCopy Asynchronous are the same.

To install the hardware required for TrueCopy operations:

1. **User:** Identify the locations of the TrueCopy primary and secondary volumes (P-VOLs and S-VOLs), so that the TrueCopy hardware can be installed and configured properly.

2. **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.

3. **Hitachi Data Systems Representative:** Make sure that the MCUs and RCUs are properly configured for TrueCopy operations (e.g., cache, NVS) (see section 3.2.5). Set the SVP clock to local time so the TrueCopy time-stamps will be correct, and make sure that the desired SVP modes are enabled (see Table 2.1). Make sure that adequate cache is installed and available for asynchronous operations (TrueCopy Asynchronous, XRC, CC). You must also consider the amount of FlashAccess data to be stored in cache when determining the required amount of cache.

4. **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 server to enable reporting of sense information in case of a problem with an S-VOL or RCU. If the remote site is unattended, the RCUs should be attached to a host server at the primary site, so that the system administrator can monitor the operational condition of the RCUs.

5. **Hitachi Data Systems Representative:** If power sequence control cables are used, set the power select switch for the cluster to LOCAL to prevent the MCU from being powered off by the host. Also make sure the RCU will not be powered off during TrueCopy operations. See section 5.10 for further information on powering off/on the MCUs and RCUs.

6. **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., 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 Maintenance Manual for further information.

    Note: For the DKC-F460I-8HSE, you can set each port independently as an initiator or RCU Target port, enabling you to connect hosts and remote links randomly.

7. **Hitachi Data Systems Representative:** Install the TrueCopy 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 sections 3.3.1-3.3.3 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., TrueCopy Sync and Async, TrueCopy – S/390® Sync and Async) can share the same remote copy connections. See section 3.3.3 for information on using channel extenders.

3.3.1　Fibre-Channel Remote Copy Connections

Figure 3.1 shows the remote copy connection configurations for fibre-channel interface TrueCopy operations. The MCU and RCU of each TrueCopy 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. TrueCopy 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.
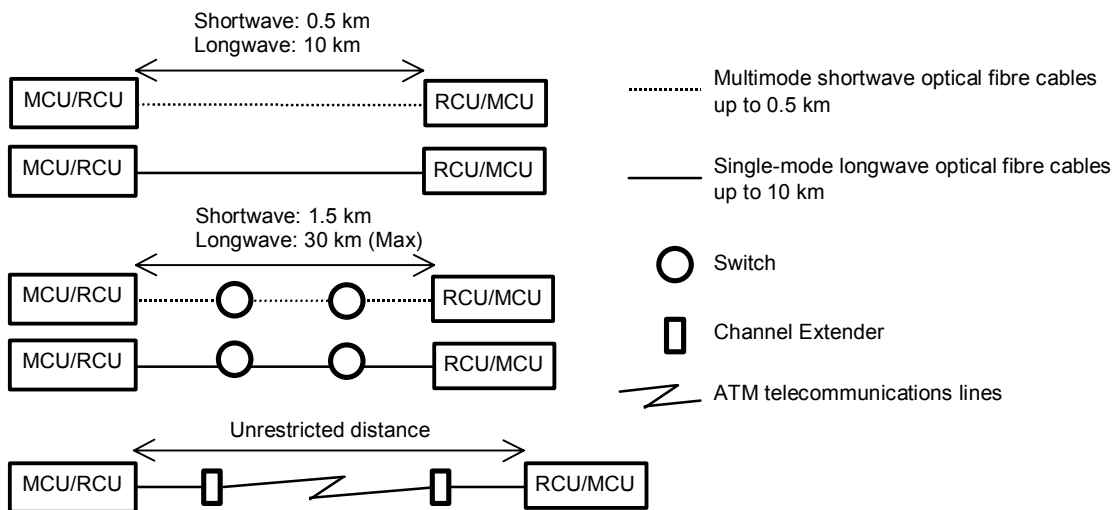
Figure 3.1　Fibre-Channel Remote Copy Connection Configurations

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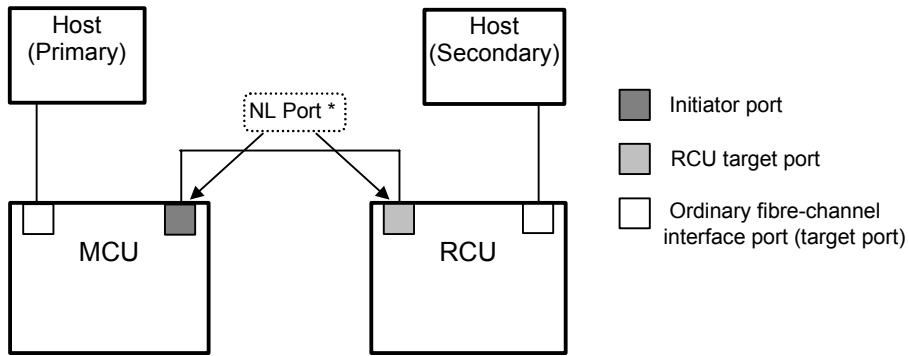
* To set ports, use LUN Manager and set port topology to: Fab off, FC-AL.

Figure 3.2   Fibre-Channel Interface Direct Connection (NL_Port)
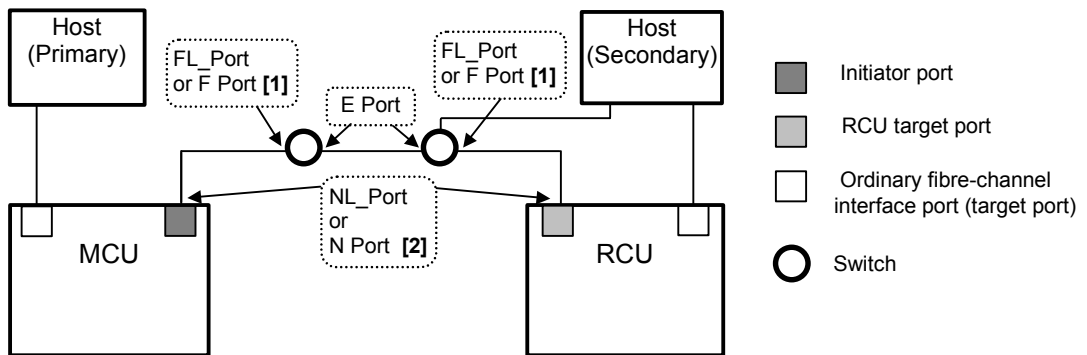
1. Some switch vendors require F port (e.g., McData ED5000).
2. To set ports, use LUN Manager and set port topology to:
     NL port: Fab on, FC-AL
     N port: Fab on, Point-to-Point

Figure 3.3   Fibre-Channel Interface Switch Connection (NL_Port or N_Port)
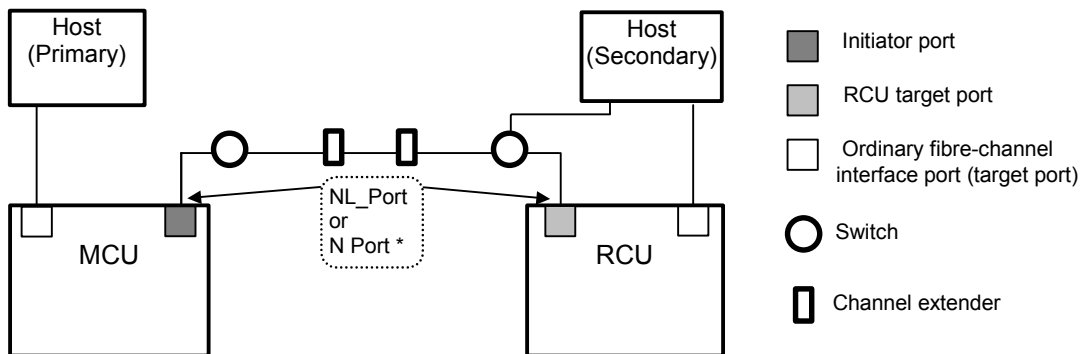
* To set ports, use LUN Manager and set port topology to:
     NL/FL port: Fab on, FC-AL
     F port: Fab on, Point-to-Point

Figure 3.4   Fibre-Channel Interface Extender Connection

3.3.2   Serial Remote Copy Connections

Figure 3.5 shows the TrueCopy serial remote copy connection configurations. The MCU and RCU of each 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. 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 TrueCopy subsystems are more than 9 km apart, the XDF connections provided by the ESCDs or ESCON® repeaters are required. TrueCopy operations can be performed at distances of up to 43 km (26.7 miles) using standard ESCON® support. Long-distance solutions are provided using approved channel extenders and communication lines.

Figure 3.5   Serial Remote Copy Connection Configurations

Note: Please contact your Hitachi Data Systems account team for the latest information on the availability of serial-channel TrueCopy connections.

Dedicated ESCON® channels may be installed, or existing ESCON® channels connected by ESCDs may be used. The logical paths between the MCU and RCU must be separate from the logical paths between the host and RCU. *Note:* All remote copy activities between two 9900V subsystems (i.e., TrueCopy and TrueCopy – S/390®) can share the same remote copy connections.

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).
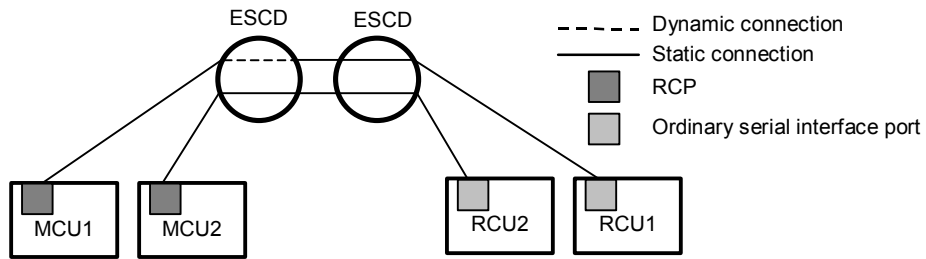
Figure 3.6   N Pairs of Remote Copy Connections
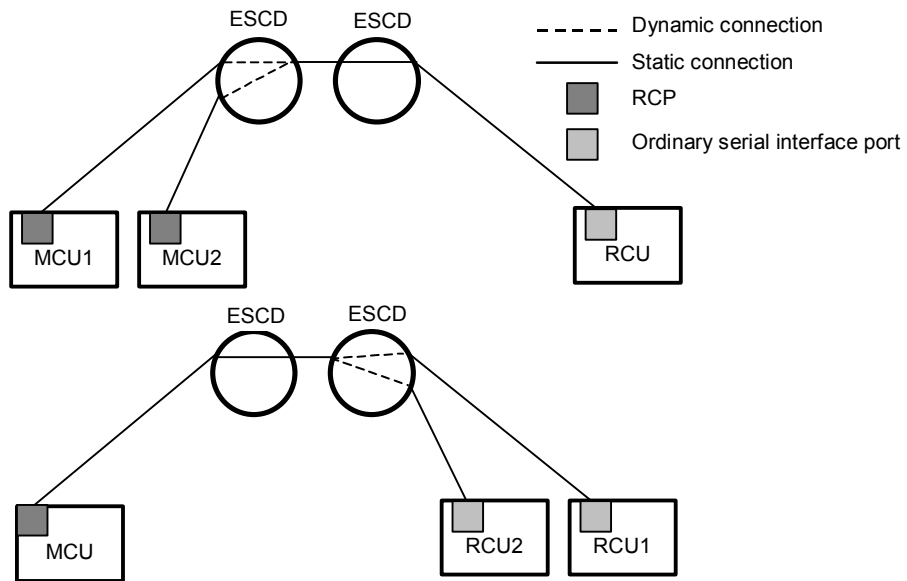
Figure 3.7   N-to-1 and 1-to-N Remote Copy Connections (N≤4)

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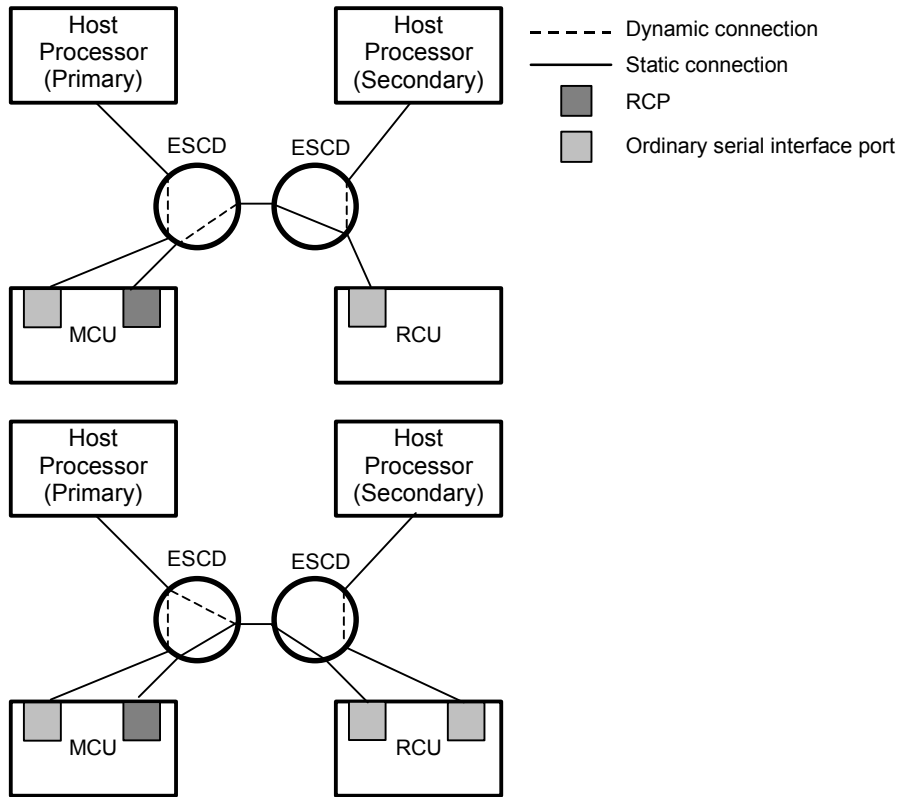
Figure 3.8   Remote Copy Connections Shared With Channel-to-RCU Connections

3.3.3 Channel Extenders For TrueCopy Serial

TrueCopy Asynchronous 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 TrueCopy.

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.

- TrueCopy 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 paircreate operation will terminate with an error. For CNT UltraNet, this operation must be 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 TrueCopy Asynchronous channel command. The parameter length and detailed specification of the TrueCopy Asynchronous channel command are different than for TrueCopy Synchronous RIOs.

- The LDEV IDs of the S-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 TrueCopy paircreate 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	
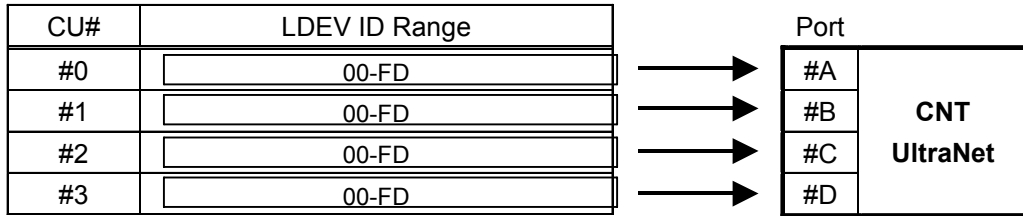
Example 1: Assigning the same LDEV IDs of a specific CU number to each port.

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	
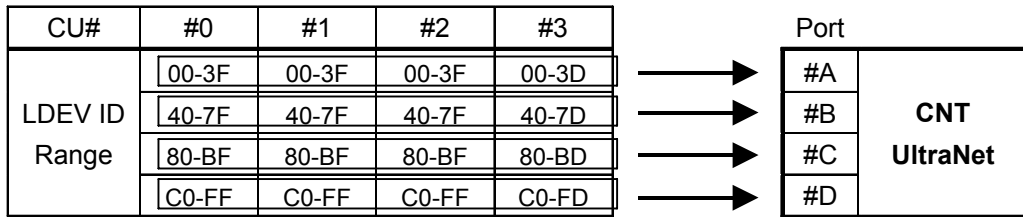
Example 2: Assigning specific LDEV IDs on each CU number to each port.

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

3.4   Enabling the TrueCopy Option(s)

You must enable the TrueCopy option(s) (Asynchronous and/or Synchronous) on the 9900V subsystems using the 9900V Remote Console software. Each TrueCopy 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 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 options, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide*.

Caution: Before disabling a TrueCopy option, you must delete all affected pairs and MCU-RCU paths. Please see section 4.6 for instructions on discontinuing TrueCopy operations.

3.5 Configuring the MCUs and RCUs for TrueCopy Operations

After you have installed the TrueCopy hardware and software, you can configure the MCUs and RCUs for TrueCopy operations. The configuration depends on the interface type of the remote copy connections: fibre channel or serial. *Note:* At this time fibre-channel and serial 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 TrueCopy fibre-channel operations:

1. Identify the volumes that will become the TrueCopy P-VOLs and S-VOLs. You need to know the subsystem S/N, SSID, and CU image of each TrueCopy 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 port, target ID, and LUN of each volume.

2. At the RCUs (i.e., remote site), use the TrueCopy 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 TrueCopy MCU. You must log in with Administrator or TrueCopy write access, and you must be in modify mode.

4. Select the **TrueCopy** button () to display the TrueCopy 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 TrueCopy Asynchronous pairs with P-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 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.
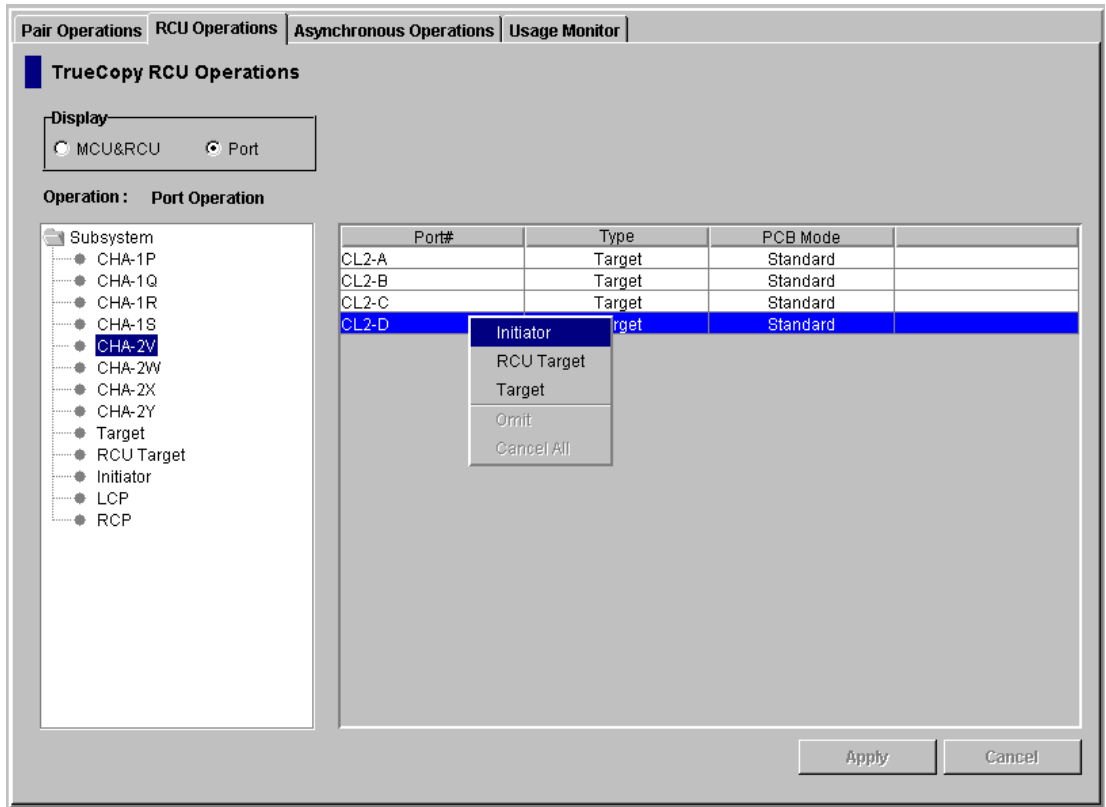
Figure 3.10   Configuring the RCU Target and Initiator Ports
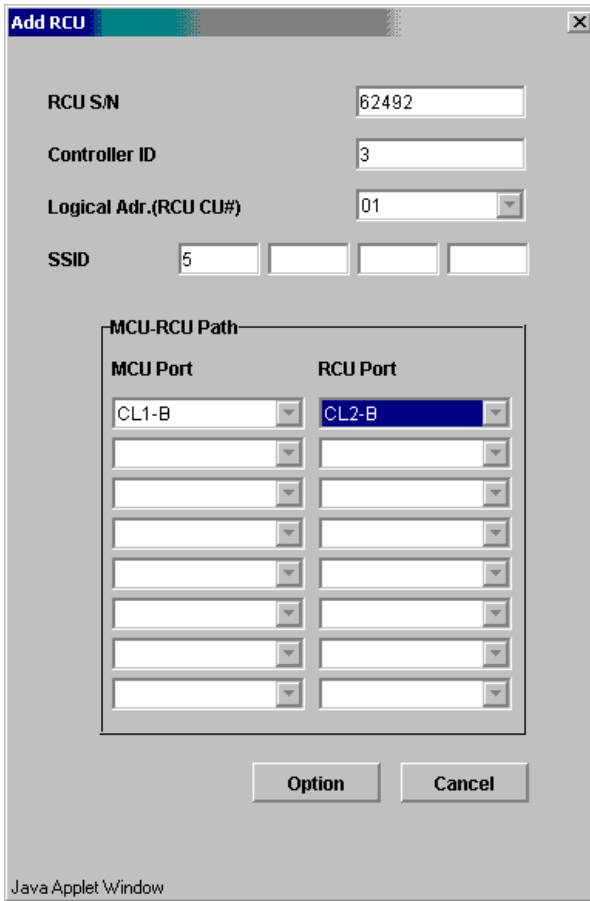
Figure 3.11   Adding the RCUs
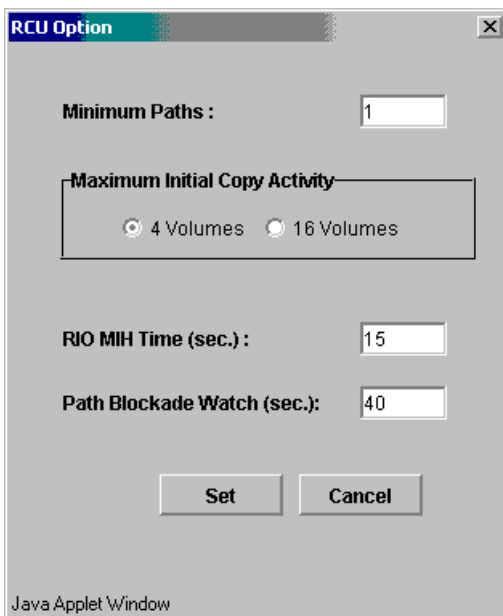
Figure 3.12   Configuring the RCU Options
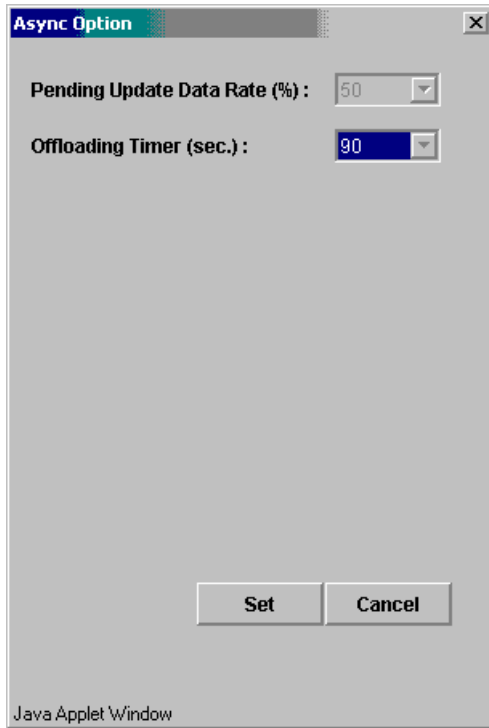
Figure 3.13   Setting the Async Options
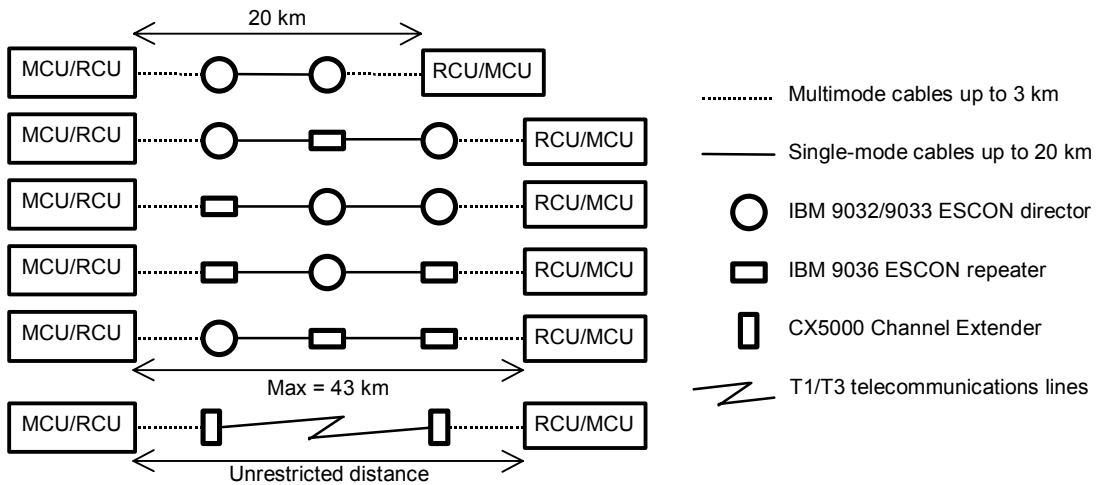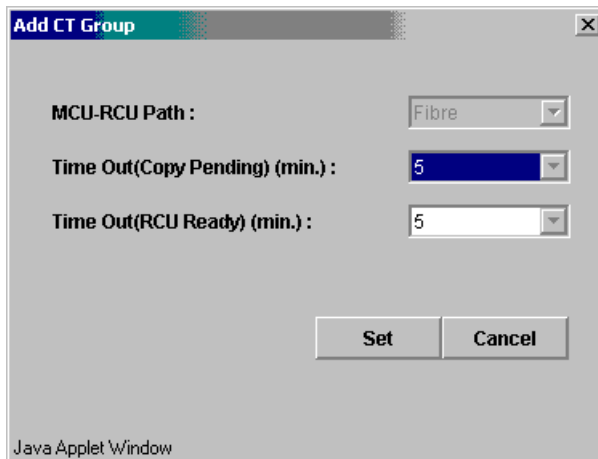

Figure 3.14   Adding the Consistency Groups

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 connections.

To configure the MCUs and RCUs for TrueCopy serial-channel operations:

1. Identify the volumes that will become the TrueCopy P-VOLs and S-VOLs. You need to know the subsystem S/N, SSID, and CU image of each TrueCopy 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 port, target ID, and LUN of each volume.

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

3. Select the **TrueCopy** button (![icon]) to display the TrueCopy 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 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 Remote Console software, and disconnect from the subsystem.

8. Repeat steps (3)–(7) 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.

3.6 Combining TrueCopy with Other Data Management Operations

TrueCopy supports concurrent operations with the following data management functions:

- **LUN Expansion (LUSE).** LUSE volumes can be assigned to TrueCopy pairs, provided that the P-VOL and S-VOL have the same LU type and the same number of LDEVs. If you need to perform LUSE operations on an existing TrueCopy P-VOL or S-VOL, you must delete the pair first to return the volume to SMPL status.

- **Virtual LVI/LUN.** Virtual LVI/LUN volumes can be assigned to TrueCopy pairs, provided that the S-VOL has the same capacity than the P-VOL. If you need to perform Virtual LVI/LUN operations on an existing TrueCopy P-VOL or S-VOL, you must delete the pair first to return the volume to SMPL status.

- **FlashAccess.** FlashAccess volumes can be assigned to TrueCopy pairs, and FlashAccess operations can be performed on TrueCopy P-VOLs and S-VOLs.

- **Hitachi SANtinel.** Hitachi SANtinel operations do not affect TrueCopy operations. Volumes which are under secure ports and/or which are assigned to World Wide Name (WWN) groups and/or LUN groups can also be assigned to TrueCopy pairs. Volumes which are assigned to TrueCopy pairs can also be assigned to secure ports, WWN groups, and/or LUN groups for Hitachi SANtinel. *Note:* TrueCopy S-VOLs cannot be accessed by any UNIX®/PC server host except when the pair is split.

- **ShadowImage.** ShadowImage volumes can be assigned to TrueCopy pairs, and TrueCopy volumes can be assigned to ShadowImage pairs. See section 3.6.1 for information on TrueCopy and ShadowImage shared volume configurations.

  Note: ShadowImage is recommended for intra-subsystem copy operations. If ShadowImage is not installed, TrueCopy (Synchronous only) can be used to copy within the same 9900V subsystem. This configuration requires at least one external fibre cable or ESCON® loop.

- **Priority Access.** The initiator ports in the MCU do not support the Priority Access option.

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

3.6.1   Combining TrueCopy and ShadowImage

Hitachi TrueCopy and ShadowImage can be used together in the same subsystem and on the same volumes to provide multiple copies of data at the primary and/or remote sites. Table 3.1 describes the host pair status reporting for TrueCopy volumes, ShadowImage volumes, and TrueCopy/ShadowImage shared volumes. Table 3.2 shows the currency of the data on a shared TrueCopy/ShadowImage volume based on TrueCopy and ShadowImage pair status.

- For shared TrueCopy/ShadowImage volumes, the TrueCopy pair status is reported to the host if you query the TrueCopy P-VOL or S-VOL. To obtain the ShadowImage pair status, query the P-VOL of the ShadowImage pair.

- ShadowImage supports multiple S-VOLs for each P-VOL. If you issue a pair status query to a ShadowImage P-VOL (e.g., pairdisplay), the status for only one ShadowImage pair is reported (the pair with the S-VOL with the lowest LDEV ID). To obtain the pair status for the ShadowImage pair(s) with the other S-VOL(s), you must direct the host query to the specific S-VOL using the S-VOL's LDEV ID in the host command. The ShadowImage Remote Console software displays the LDEV ID and ShadowImage pair status of all S-VOLs associated with a P-VOL.

Table 3.1   Host Pair Status Reporting for TrueCopy/ShadowImage Shared Volumes

Number of TrueCopy Pairs	Number of ShadowImage S-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 S-VOL has the lowest LDEV ID
1	0	TrueCopy pair status
1	1	TrueCopy pair status
1	2 or more	TrueCopy pair status

Table 3.2   Data Currency of a Shared TrueCopy/ShadowImage Volume

TrueCopy Pair Status	ShadowImage Pair Status					
	COPY (PD)	PAIR	COPY(SP)	PSUS	COPY(RS/RS-R)	PSUE
COPY	Not current	Not current	Not current	CURRENT	Not current	Not current
PAIR	Not current	Not current	Not current	CURRENT	Not current	Not current
PSUS/PSUE	Not current	CURRENT	CURRENT	CURRENT	CURRENT	Not current

Figures 3.13 through 3.16 show the various TrueCopy/ShadowImage configurations which share volumes. TrueCopy supports synchronous and asynchronous operations for shared TrueCopy/ShadowImage volumes.

- Figure 3.15 shows an example of a TrueCopy P-VOL which is also functioning as a ShadowImage P-VOL. This configuration allows you to use ShadowImage for on-site data backup in case of a TrueCopy failure, and to use TrueCopy to provide remote backup of the ShadowImage P-VOL in case of a ShadowImage failure.

- Figure 3.16 shows an example of a TrueCopy S-VOL which is also functioning as a ShadowImage P-VOL. This configuration allows you to use ShadowImage to provide multiple backup copies of a single TrueCopy P-VOL.

- Figure 3.17 combines the configurations shown in Figure 3.15 and Figure 3.16. Within a single TrueCopy pair, the P-VOL and S-VOL are both functioning as ShadowImage P-VOLs, providing multiple copies at the primary and remote sites.

- Figure 3.18 shows an example of a ShadowImage S-VOL which is also used as a TrueCopy P-VOL. *Caution:* This configuration requires that the ShadowImage pair be established in duplex mode (PAIR) and then split (PSUS) before the TrueCopy pair is created.
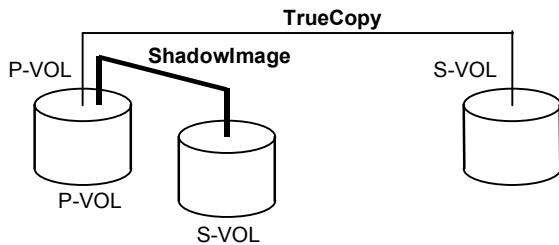
Figure 3.15   Shared TrueCopy P-VOL/ShadowImage P-VOL
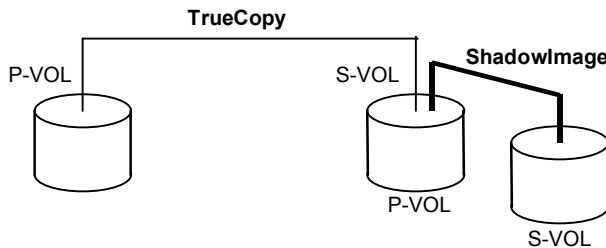
Figure 3.16   Shared TrueCopy S-VOL/ShadowImage P-VOL
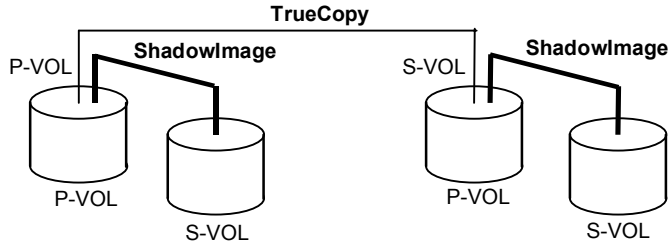
Figure 3.17   Shared TrueCopy/ShadowImage P-VOL with Shared TrueCopy S-VOL/ShadowImage P-VOL
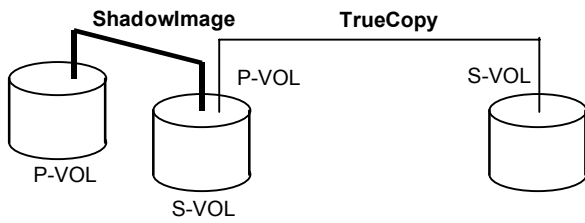
Figure 3.18   Shared ShadowImage S-VOL/TrueCopy P-VOL

Chapter 4   Performing TrueCopy Configuration Operations

The TrueCopy main panel and its four tabs (see section 4.1) provide access to all TrueCopy operations: pair operations, RCU operations, Asynchronous operations, and usage monitor. 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 operations:

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

Asynchronous operations. The Asynchronous operations (see section 4.3) configure the TrueCopy 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.

Optimizing TrueCopy operations. Section 4.5 provides information on optimizing TrueCopy 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 operations. Section 4.6 provides information on discontinuing TrueCopy operations. When you want to discontinue TrueCopy operations, you must perform the required 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 Main Panel

The TrueCopy main panel (see Figure 4.1) displays the TrueCopy information for the connected subsystem and provides access to all TrueCopy functions and operations. To open the TrueCopy main panel:

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

2. On the Remote Console main panel, select modify mode to perform TrueCopy operations. Users in view mode can only view TrueCopy information.

3. Select the TrueCopy button ( ) to open the TrueCopy 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).
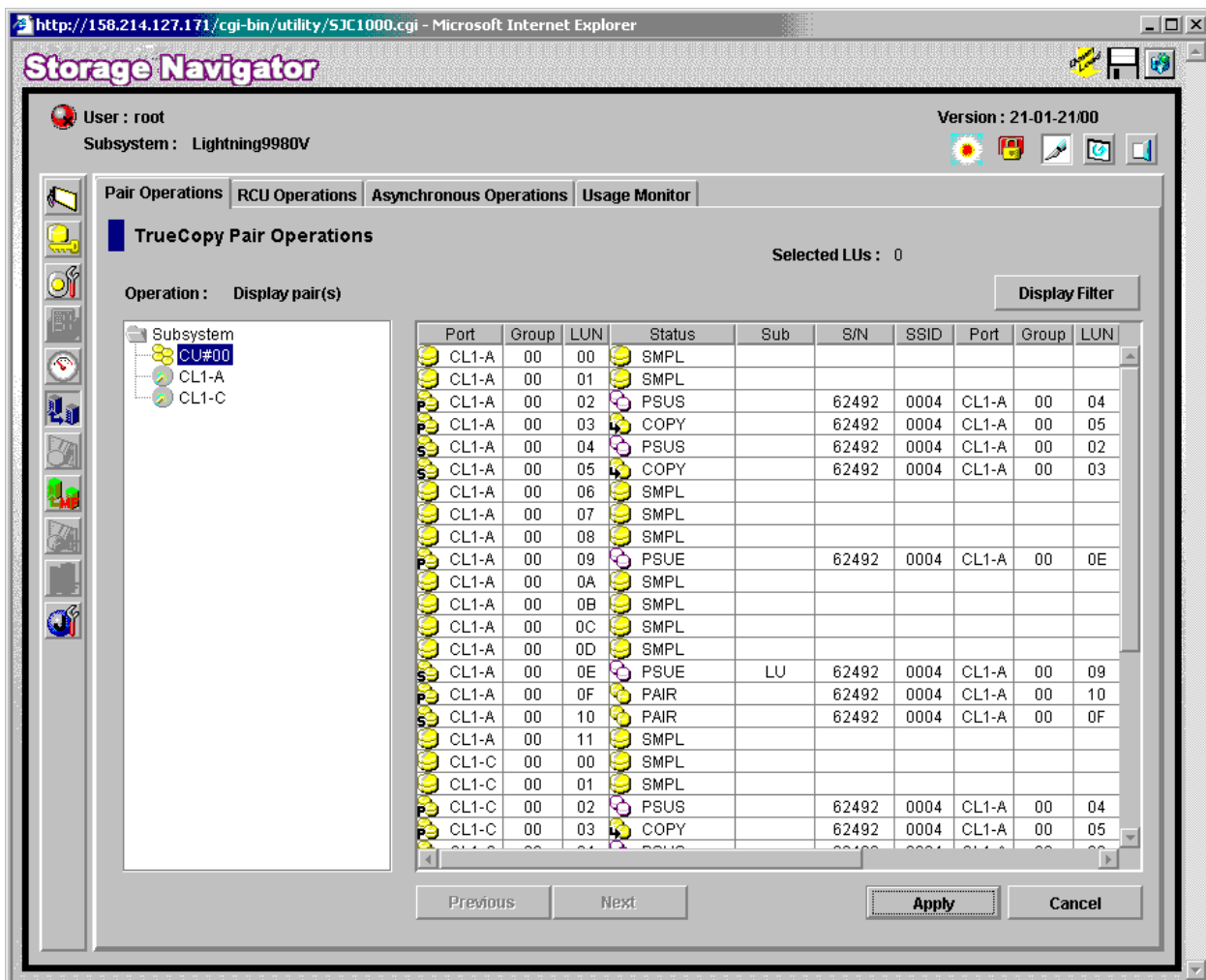
Figure 4.1   TrueCopy Main Panel

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

Table 4.1   TrueCopy Functions

Tab	Menu Command	Description
Pair Operations (see Chapter 5)	Pairdisplay	Displays CU information, path information, pair status, and options for TrueCopy pairs. *Note:* Monitoring LDEV status is not supported.
	Paircreate → Synchronous	Allows you to create new TrueCopy Synchronous pairs.
	Paircreate → Asynchronous	Allows you to create new TrueCopy Asynchronous pairs.
	Pairsplit - S	Allows you to delete TrueCopy pairs.
	Pairsplit - r	Allows you to split or suspend TrueCopy pairs.
	Pairresync	Allows you to resume TrueCopy pairs which are split or suspended.
	Change Pair Option	Allows you to change the TrueCopy 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 status information for existing consistency groups.
	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.

Note: The snapshot, operation history, and scripting 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 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 ( ) (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 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).
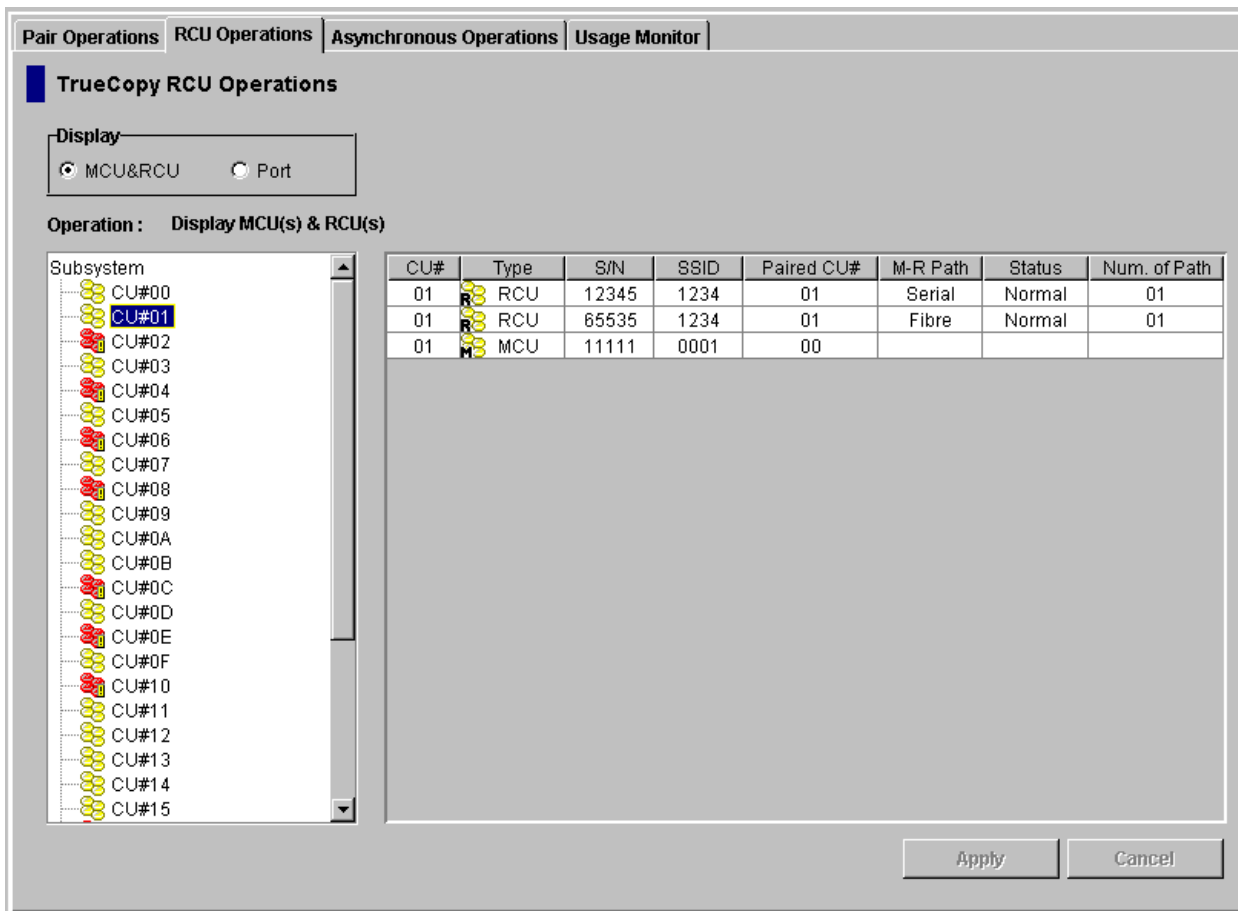
Figure 4.3   MCU&RCU Display on the RCU Operations Tab

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).

| Pair Operations | RCU Operations | Asynchronous Operations | Usage Monitor |

TrueCopy RCU Operations

Display
○ MCU&RCU   ◉ Port

Operation :   **Port Operation**

Subsystem
- CHA-1P
- CHA-1Q
- CHA-2V
- CHA-2W
- Target
- RCU Target
- Initiator

Port	Type	PCB Mode	
CL1-A	Target	Standard	
CL1-B	Initiator	Standard	
CL1-C	Target	Standard	
CL1-D	Initiator	Standard	
CL1-E	Target	Standard	
CL1-G	Target	Standard	
CL2-A	Target	Standard	
CL2-B	RCU Target	Standard	
CL2-C	Target	Standard	
CL2-D	RCU Target	Standard	
CL2-E	Target	Standard	
CL2-G	Target	Standard	

[Apply]   [Cancel]

Figure 4.4   Port Display on 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 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 (![refresh]) (top right of Remote Console panel). The CT group information is also updated when you select the **Apply** button.
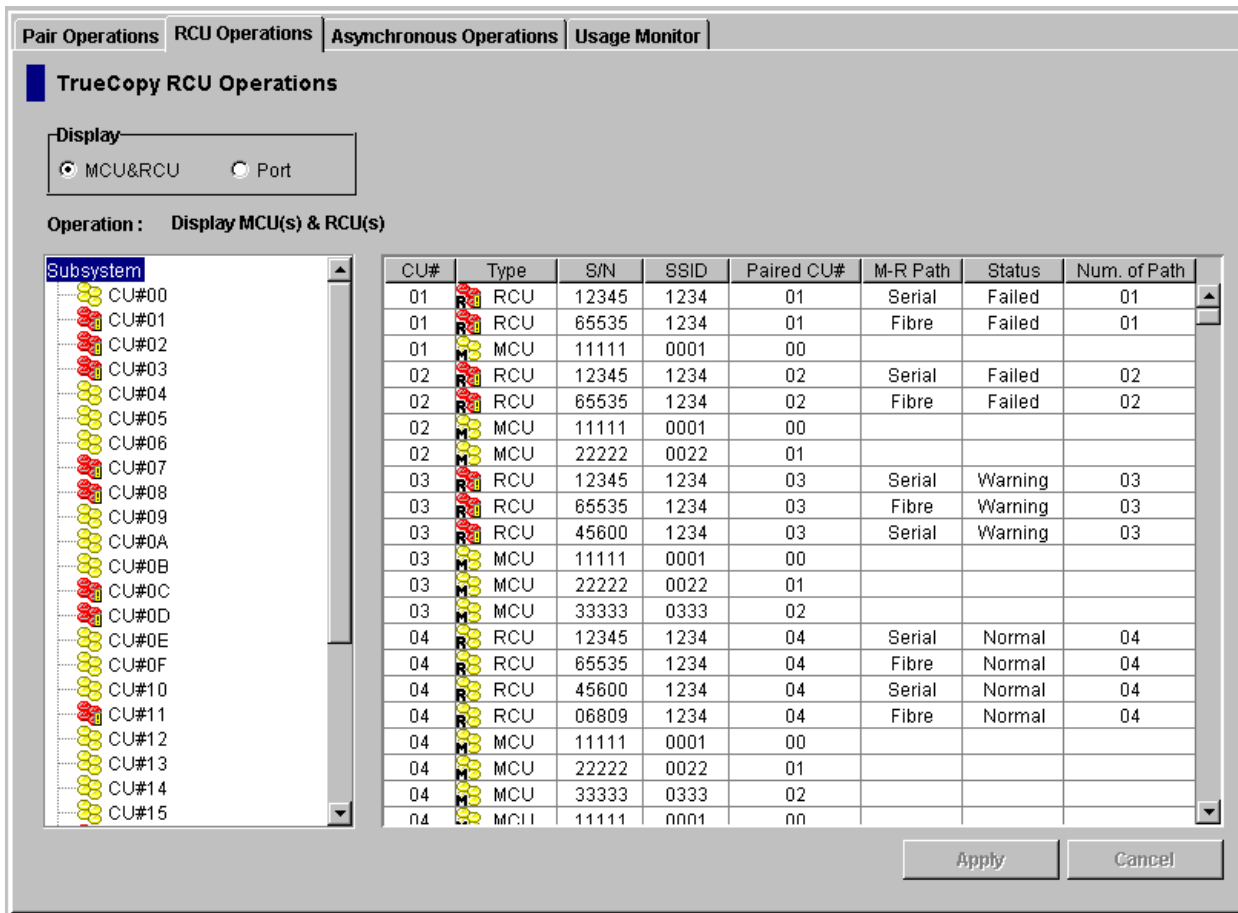
| Pair Operations | RCU Operations | Asynchronous Operations | Usage Monitor |

TrueCopy Asynchronous Operations

Operation :   Display all CT groups   Pending Update Data Rate :   050 (%)   Offloading Timer :   090 (sec.)

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					
09					
0A					
0B					
0C					
0D					
0F	M&R	Fibre	62492	0004	
10					
11					
12	MCU	Fibre			
13					
14					
15					
16					
17					
18					

Apply   Cancel
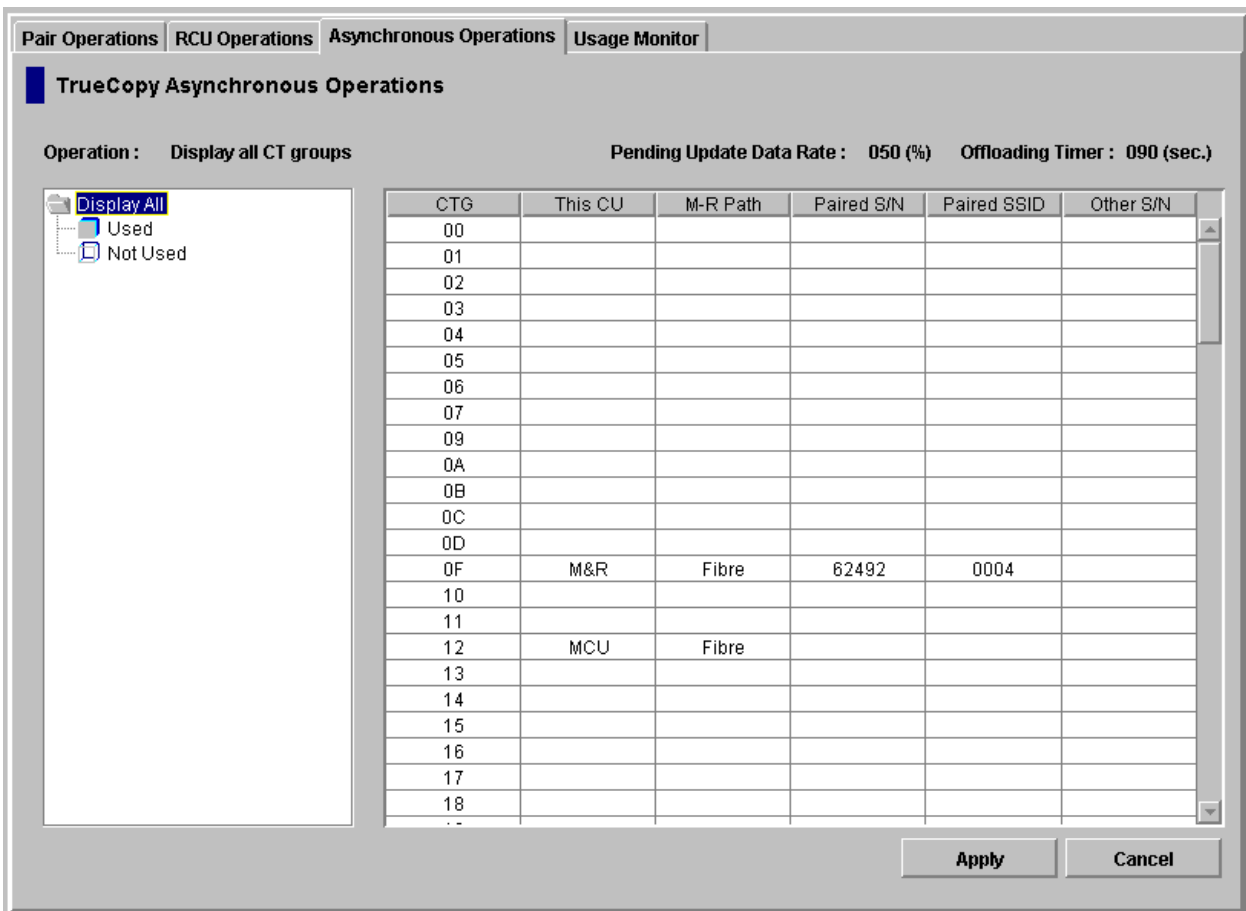
Figure 4.6   Asynchronous Operations Tab

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 Asynchronous sidefiles.

- **Offloading Timer**: indicates the maximum time between TrueCopy 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 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 |

TrueCopy Usage Operations

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

Apply   Cancel
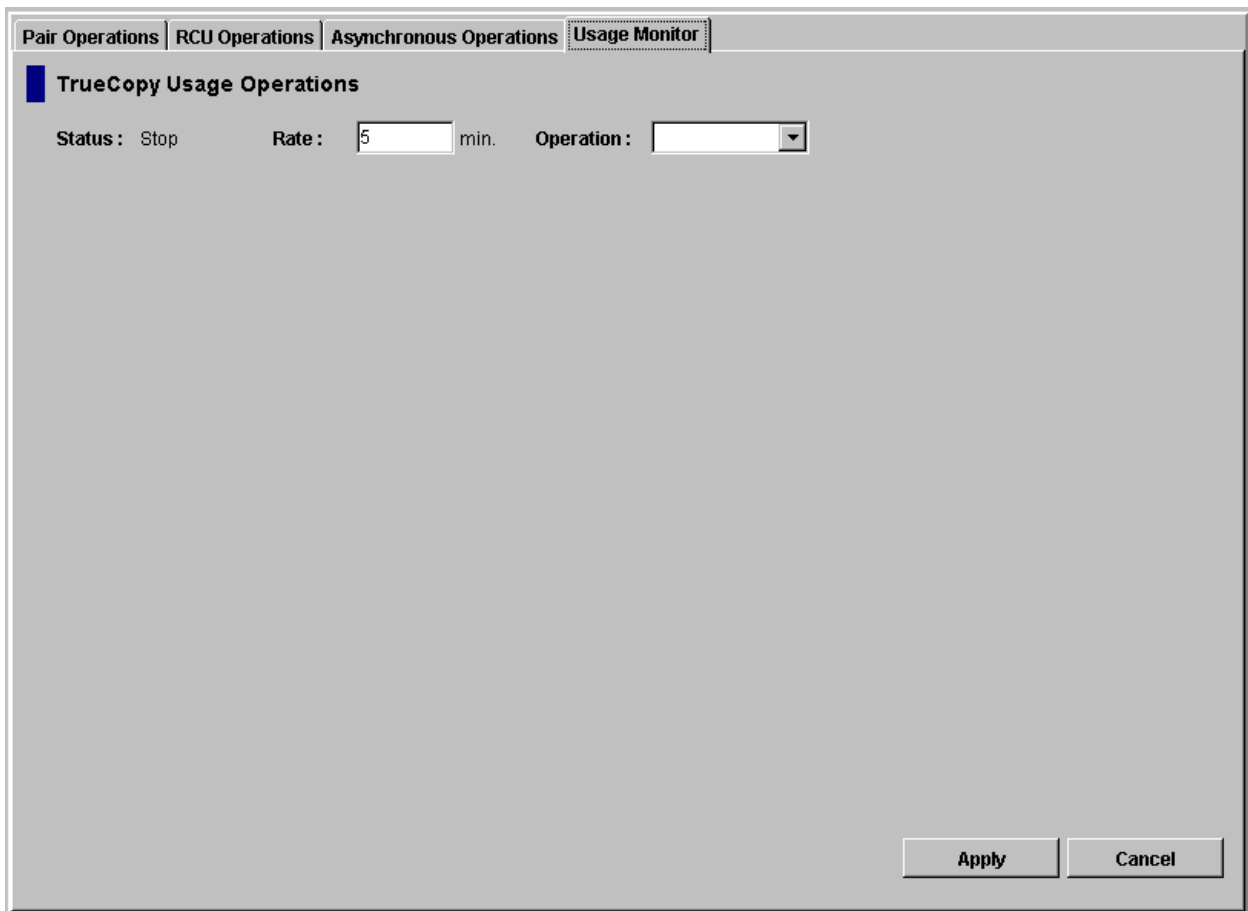
Figure 4.7   Usage Monitor Tab

4.2   RCU Operations

The RCUs are the control units which control the S-VOLs of the TrueCopy volume pairs. The RCUs are connected to the MCUs via the remote copy connections and receive and process commands from the MCUs. For TrueCopy operations, the 9900V Remote Console should be installed on a separate LAN at the remote site to allow TrueCopy 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 P-VOLs of the volume pairs. The MCUs receive and process user-requested TrueCopy 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 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 4.8 and Figure 4.9).

   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 the **Apply** button (lower right of TrueCopy panel). To cancel all operations and return the list view to its original display, select **Cancel**.
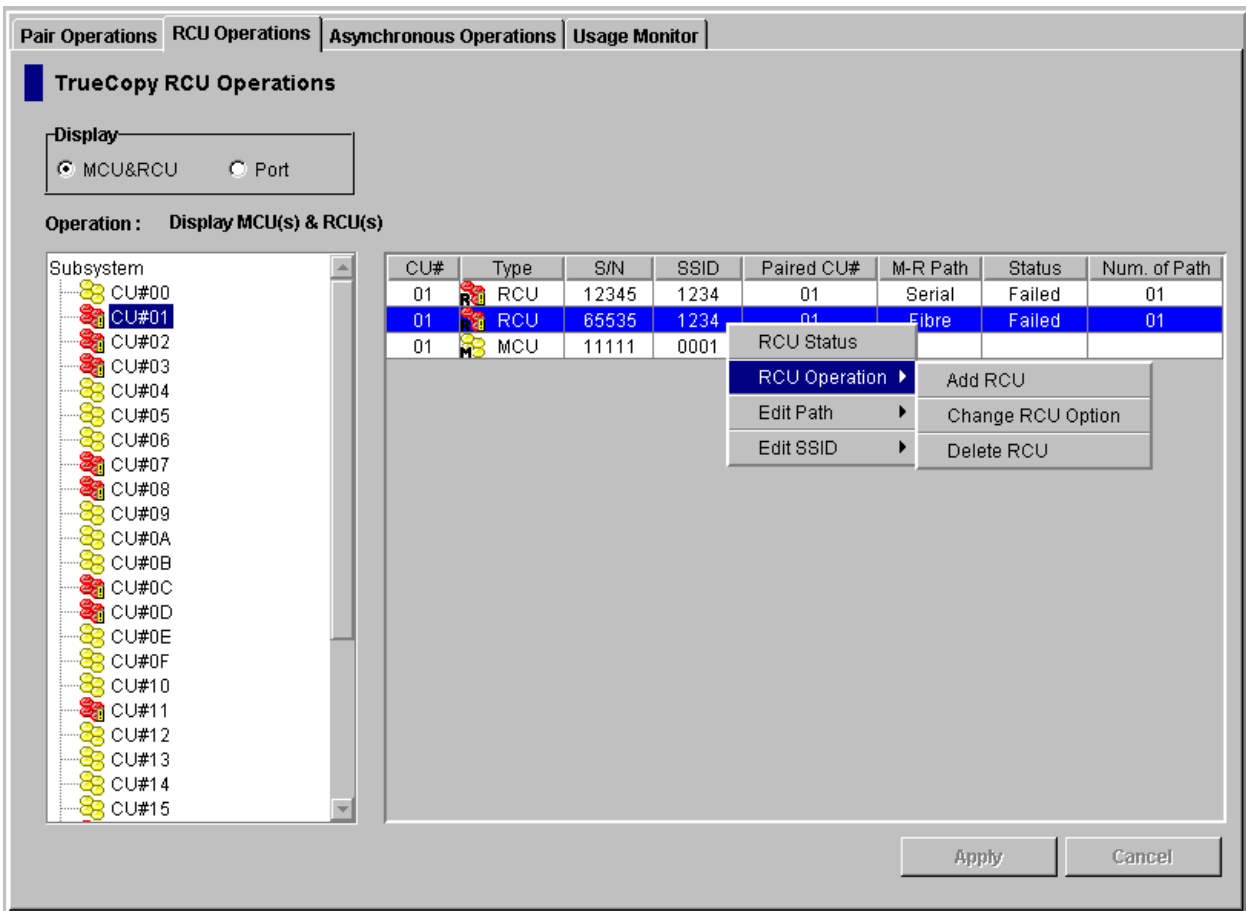
Figure 4.8   Pop-up Menu for MCU & RCU Operations
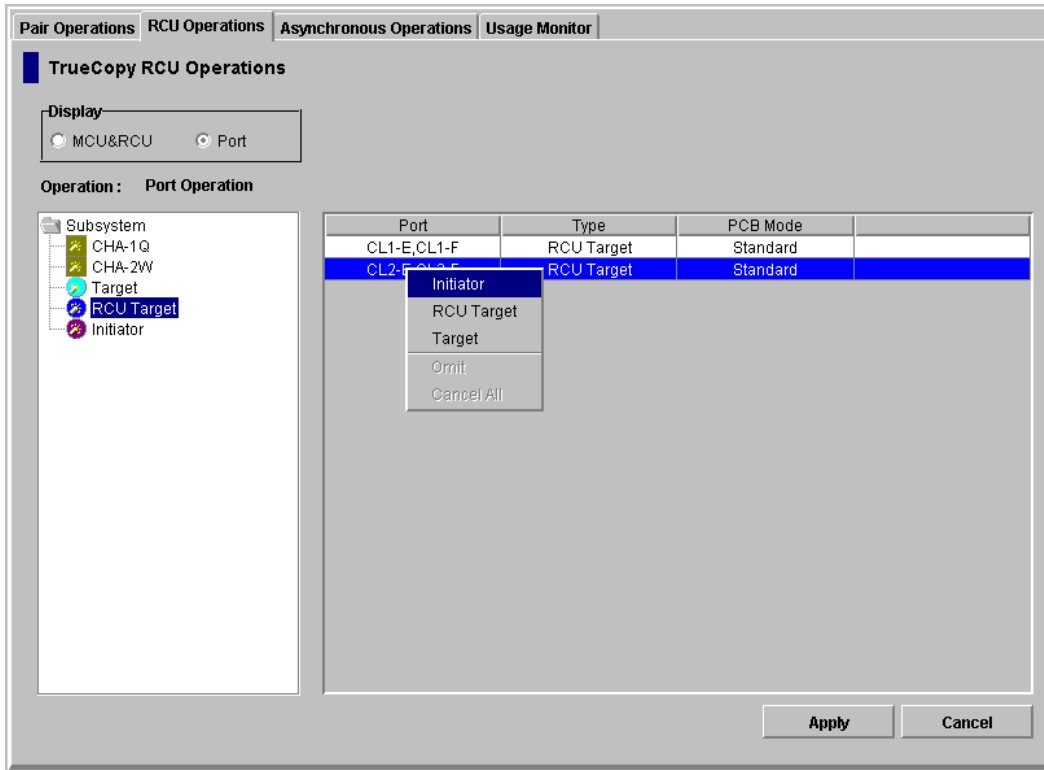
Figure 4.9   Pop-up Menu for Port Operations

4.2.1 Configuring the Host Interface Ports

The TrueCopy software allows you to change the configuration of the 9900V host interface ports as needed to accommodate the desired host and TrueCopy 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 TrueCopy 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 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).

■ **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 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 pairs.

WARNING: Before changing a fibre-channel port to an initiator port, disconnect the port from the host, delete all affected TrueCopy 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 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, 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 the **Apply** button (lower right of TrueCopy panel). To cancel all operations and return the list view to its original display, select **Cancel**.

> *WARNING:* Before changing the operation mode of a serial port from LCP to RCP, remove all channel paths to the specified port using S/390® host system console or ESCD commands.

> *WARNING:* Before changing the mode of a port from RCP to LCP, delete all affected TrueCopy pairs, delete all paths to the RCU from that RCP, and then delete the RCU from the MCU.

To configure the 9900V serial-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: LCP or RCP.

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 the **Apply** button (lower right of TrueCopy 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 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 pairs which have S-VOLs in the newly added RCU.

The Add RCU panel (see Figure 4.10) 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 4.10   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 4.10).

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 (see section 4.2.3), and enter the desired settings for **Minimum Paths**, **Maximum Initial Copy Activity**, **RIO MIH Time**, and **Path Blockade Watch** (fibre only).

   Note: For multiplatform 9900V configurations with both TrueCopy and TrueCopy – S/390® paths, set the Maximum Initial Copy Activity 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 4.11).

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 the **Apply** button (lower right of TrueCopy 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	
01234	0004				Fibre	01	CL1-B	

RCU Port1	MCU Port2	RCU Port2	MCU Port3	RCU Port3	MCU Port4	RCU Port4	MCU Port5	
CL1-E								

RCU Port5	MCU Port6	RCU Port6	MCU Port7	RCU Port7	MCU Port8	RCU Port8	Min.Path	
							01	

Activity	MIH Time	Path Watch
04	015	040

Figure 4.11   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 4.12 shows a sample TrueCopy fibre-channel interface configuration with connections going through switches and the TrueCopy 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 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 4.13 shows a sample TrueCopy serial-channel configuration with two paths.
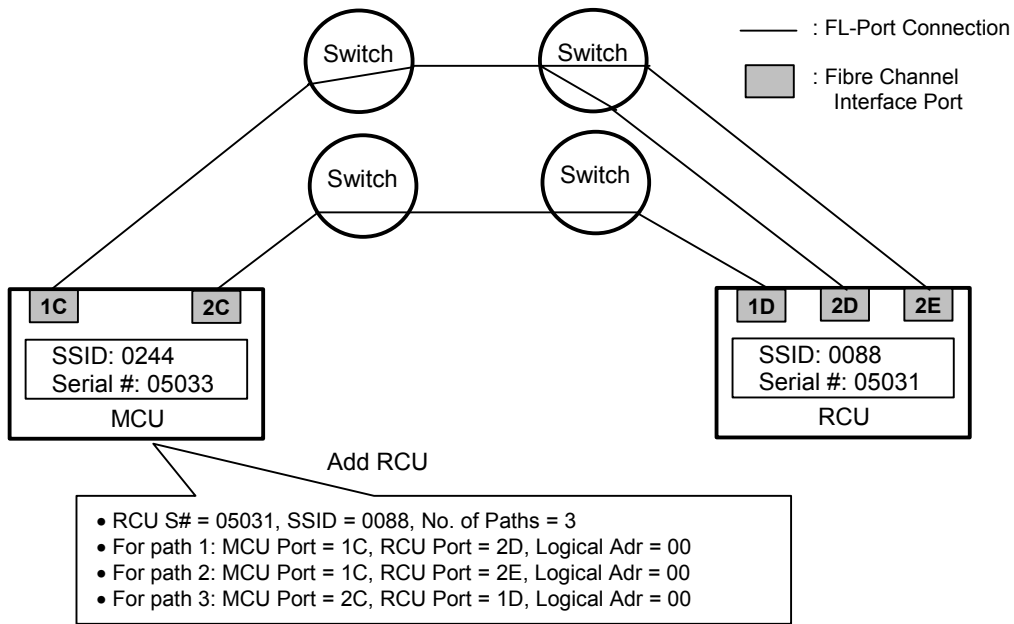
Figure 4.12   Add RCU Operation – Example 1, Fibre-Channel Interface
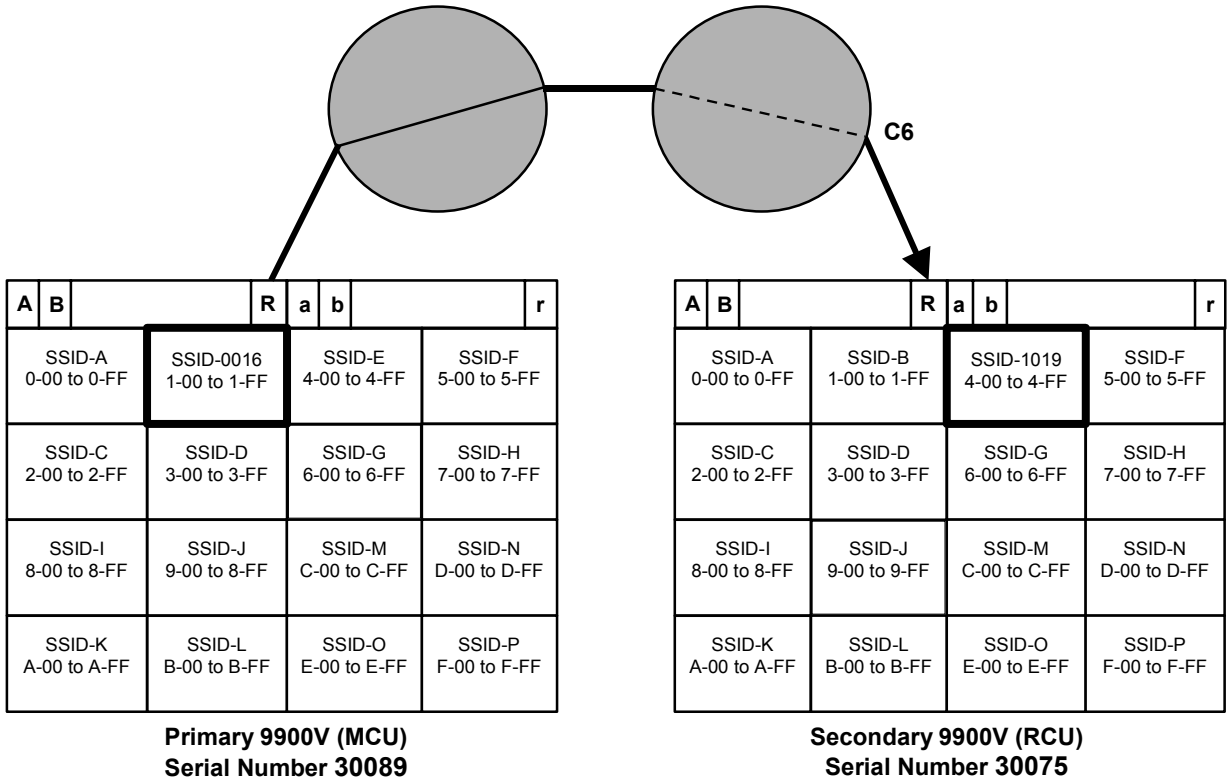
Figure 4.13   Add RCU Operation – Example 2, Serial-Channel Interface

4.2.3   Changing the RCU Options

The RCU Option panel (see Figure 4.14) 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.
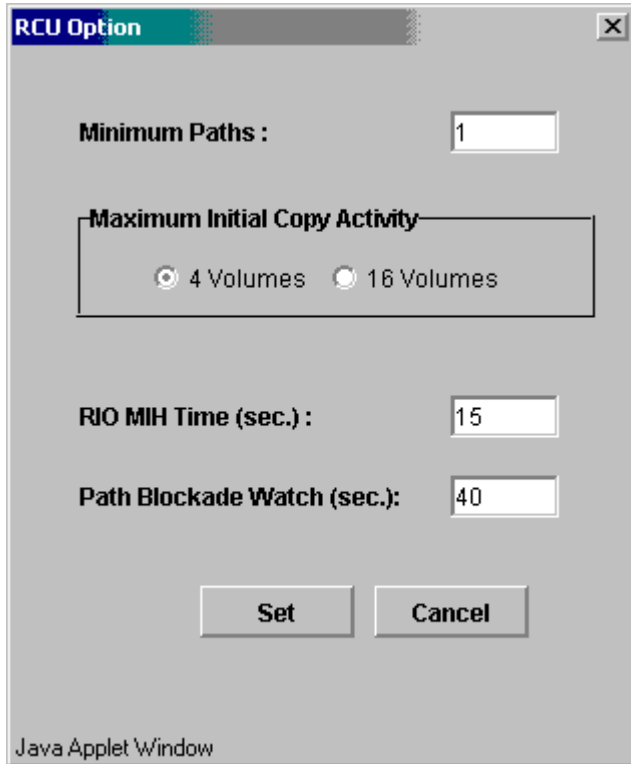
Figure 4.14   RCU Option Panel

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 (and TrueCopy – S/390®) pairs to prevent remote copy operations from adversely affecting performance due to the inadequate number of paths. If the MCU contains TrueCopy pairs which contain critical data for disaster recovery, set the minimum number of paths to one, so that TrueCopy 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 volume pairs are suspended because the number of paths has dropped below this setting, the P-VOL fence level pair option (see section 5.4) determines whether the TrueCopy Synchronous P-VOLs are fenced (i.e., reject all write operations).

The **Maximum Initial Copy Activity** setting specifies the number of concurrent initial copy operations: 4 Volumes or 16 Volumes. The default setting is 4 Volumes. TrueCopy 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 created at the same time. The maximum initial copy activity 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 activity to 4 Volumes and then create five TrueCopy 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 activity 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 and TrueCopy – S/390® operations. For multiplatform 9900V configurations with both TrueCopy and TrueCopy – S/390® paths, the Maximum Initial Copy Activity must be set to 4 Volumes, and the most recently entered Minimum Paths value (entered on TrueCopy or TrueCopy – S/390® RCU Option panel) will be applied to both TrueCopy and TrueCopy – S/390® operations.

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 fibre-channel and serial interfaces. For further information on the MIH, please refer to the Hitachi 9900V TrueCopy – S/390® User and Reference Guide.

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.

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 4.14).

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 4.15).

   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 the **Apply** button (lower right of TrueCopy 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
65535	1234	Fibre	03	04	025	030

Figure 4.15   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 will automatically start using the new path to perform TrueCopy copy activities.

The Add Path panel (see Figure 4.16) 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.
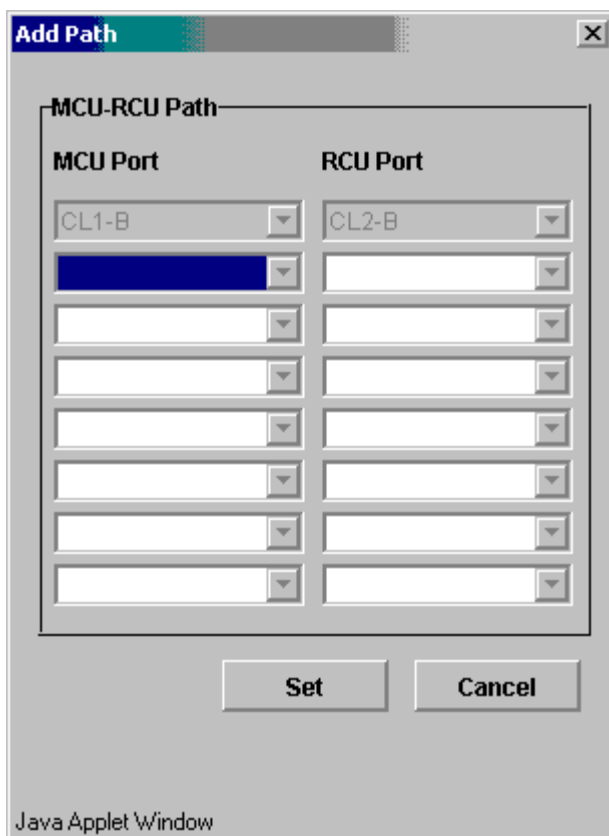
Figure 4.16   Add Path Panel

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.

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 4.17).

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 4.18).

   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 the **Apply** button (lower right of TrueCopy panel). The MCU will automatically begin using the new logical path for TrueCopy activities. To cancel the operation and return the list view to its original display, select **Cancel**.
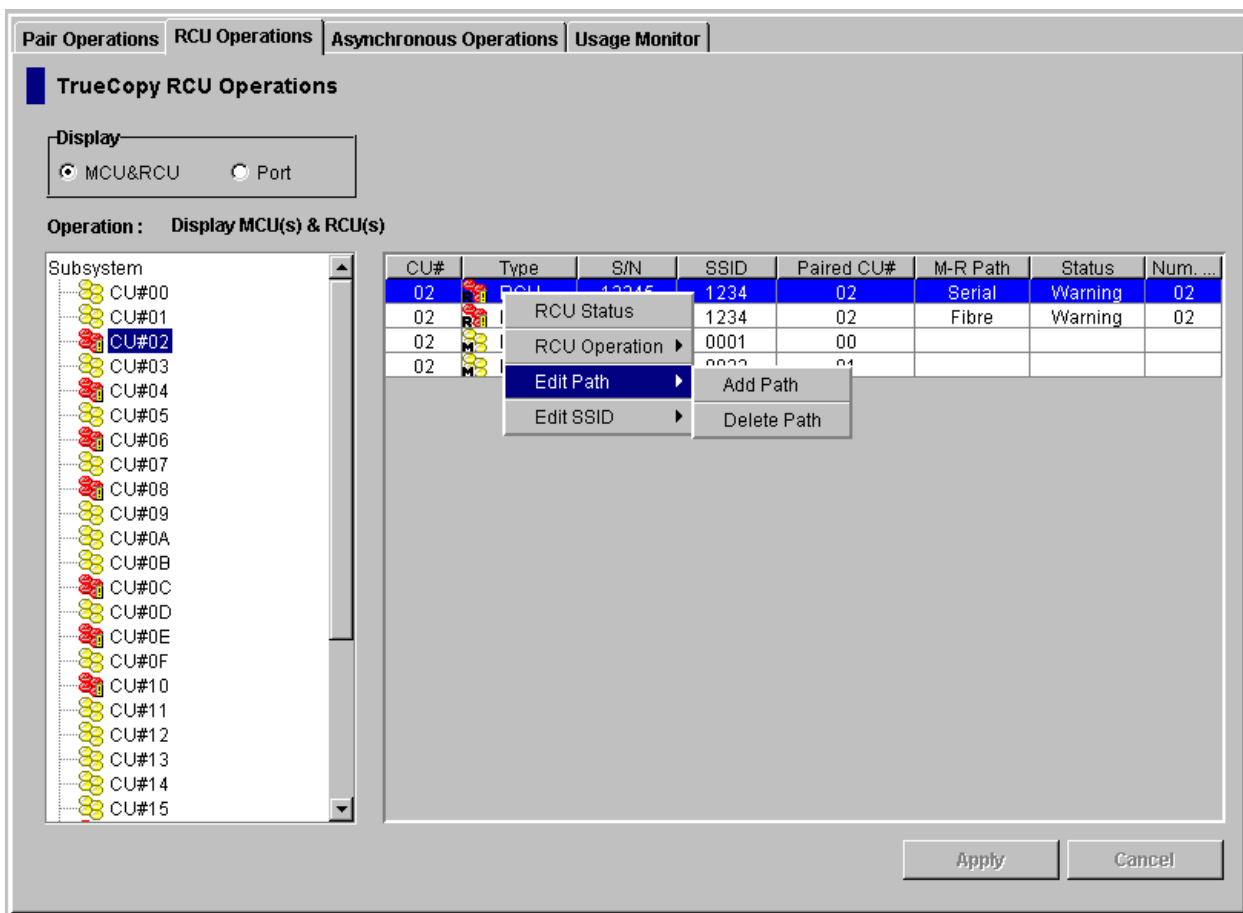
Figure 4.17   Opening the Add Path Panel

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 4.18   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 4.19).

   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 the **Apply** button (lower right of TrueCopy 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 4.19   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 4.20) 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.
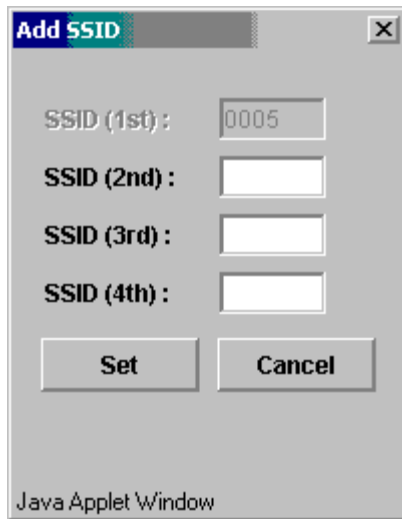
Figure 4.20   Add SSID Panel

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 4.21).

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 4.22).

    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 the **Apply** button (lower right of TrueCopy panel). To cancel the operation and return the list view to its original display, select **Cancel**.
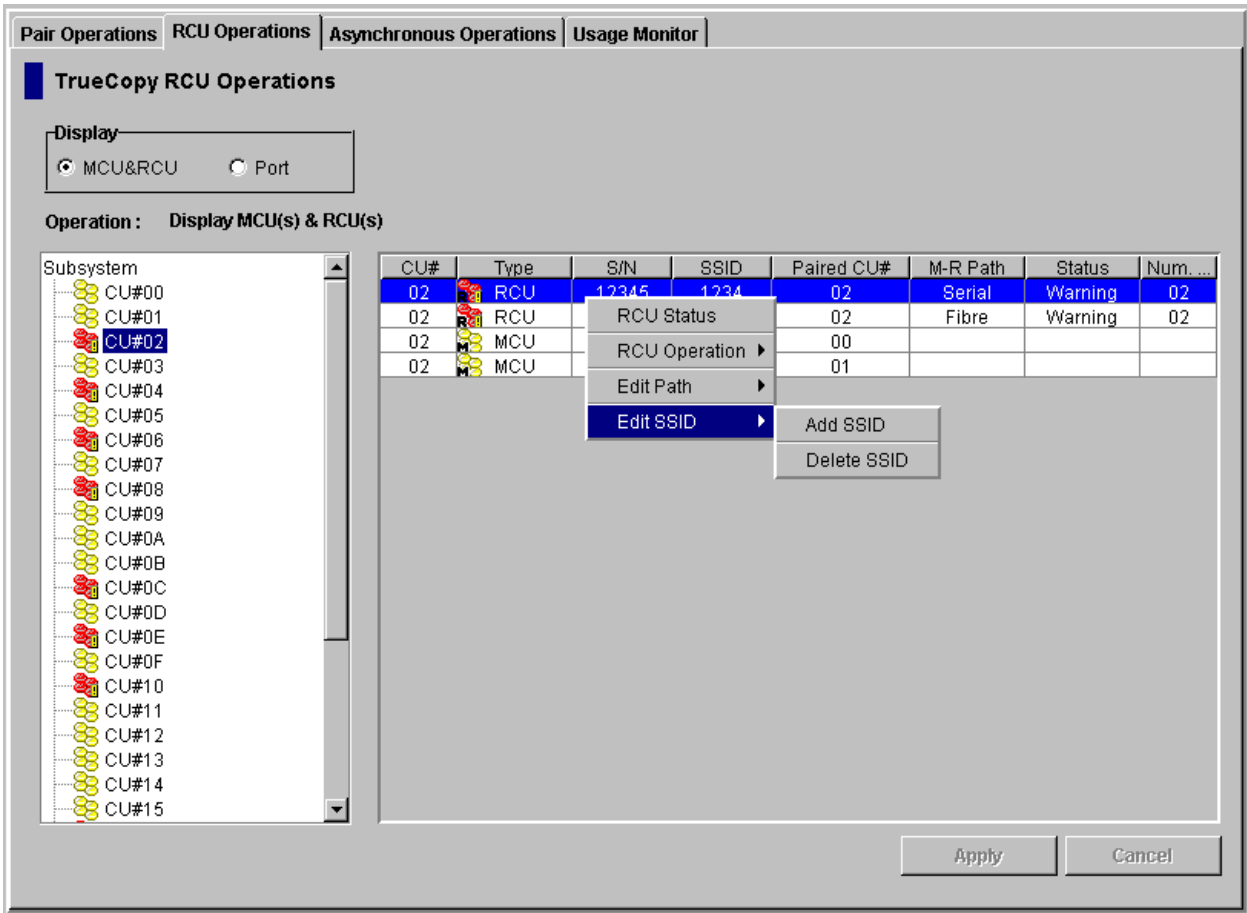
Figure 4.21   Opening the Add SSID Panel

S/N	SSID1	SSID2	SSID3	SSID4
65535	-	-	5678	1233

Figure 4.22   Verifying the Add SSID Operation

Before deleting an SSID, make sure that all affected TrueCopy pairs (pairs having S-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 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:
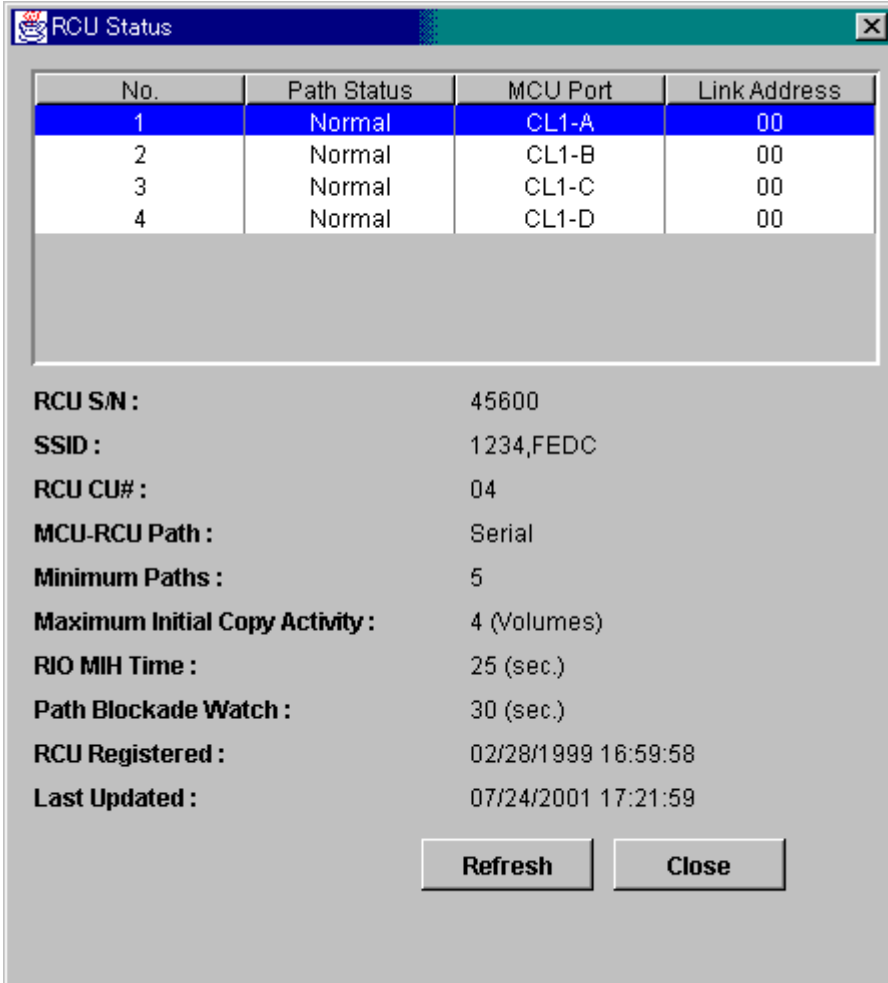
1. Select the **RCU Operations** tab, and select the **MCU&RCU** display button.
2. Select the desired MCU CU image in the outline view, and then select the RCU for which you want to delete an SSID.
3. Right-click on the RCU, select **Edit SSID**, and then select **Delete SSID**. The list view now displays the requested delete SSID operation.
4. Verify the requested operation displayed in the list view (refer to Figure 4.22).
   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 the **Apply** button (lower right of TrueCopy 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 4.23) 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	Link Address
1	Normal	CL1-A	00
2	Normal	CL1-B	00
3	Normal	CL1-C	00
4	Normal	CL1-D	00

RCU S/N :	45600
SSID :	1234,FEDC
RCU CU# :	04
MCU-RCU Path :	Serial
Minimum Paths :	5
Maximum Initial Copy Activity :	4 (Volumes)
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

Refresh   Close

Figure 4.23   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 **Link Address** number (link address = RCU port number for fibre-channel interface).
- **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 Activity**: Number of concurrent initial copy operations.
- **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 fibre-channel 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.

Table 4.2   Logical Path Status

Status Description	Condition
Normal	This path has been successfully established and can be used for TrueCopy 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 Number Mismatch	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 path between MCU and RCU.

4.2.7 Deleting an RCU

You can delete an RCU from an MCU only after all TrueCopy 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 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 pairs have not been deleted, the MCU will reject the delete RCU operation to prevent accidental deletion of TrueCopy 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 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 the **Apply** button (lower right of TrueCopy panel). To cancel the operation(s) and return the list view to its original display, select **Cancel**.

4.3   Asynchronous Operations

The TrueCopy 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 4.24):

    Async Option: allows you to set the parameters for asynchronous copy operations (section 4.8.5).

    CT Group Operation: allows you to perform the following operations: add CT group (section 4.8.2), change CT group option (section 4.8.3), view CT group status (section 4.8.1), and delete CT group (section 4.8.4).

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 the **Apply** button (lower right of TrueCopy panel). To cancel all operations and return the list view to its original display, select **Cancel**.

Figure 4.24   Pop-up Menu for the Asynchronous Operations Tab

4.3.1　Setting the Asynchronous Copy Options

The Async Option panel (see Figure 4.25) allows you to set and modify the TrueCopy 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 P-VOLs and S-VOLs behind the control unit. The async options can only be modified when no TrueCopy Asynchronous pairs or groups exist in the connected CU (P-VOLs or S-VOLs).
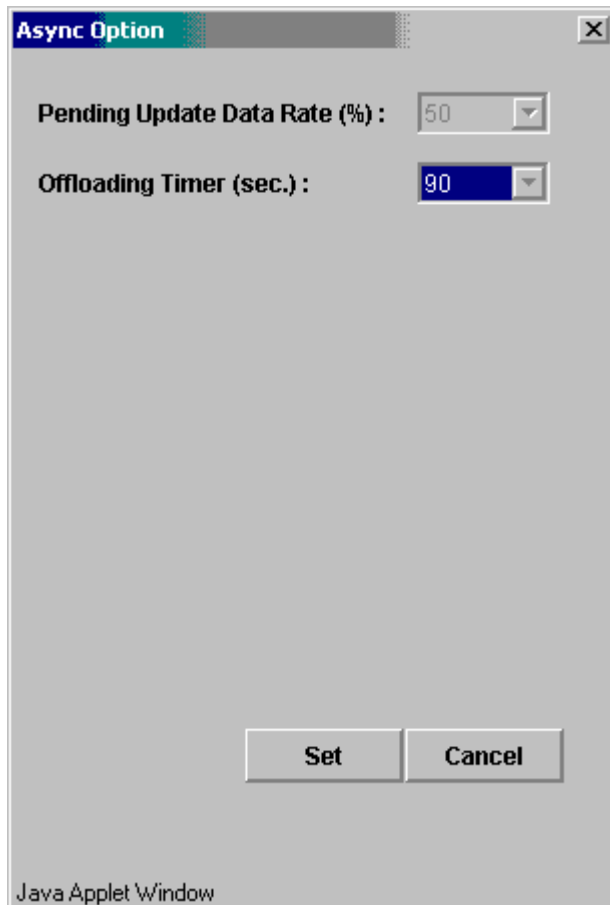
Figure 4.25　Async Option Panel

The **Pending Update Data Rate (%)** option allows you to specify the TrueCopy Asynchronous (and TrueCopy – S/390® Asynchronous) sidefile threshold, which is the maximum amount of cache that can be used for storing TrueCopy (and TrueCopy – S/390®) 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 and TrueCopy – S/390® operations. The most recently entered value (on the TrueCopy or TrueCopy – S/390® Async Option panel) will be applied to all TrueCopy Async operations.

Note: If one or more consistency groups exist (TrueCopy or TrueCopy – S/390®), 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 recordset to the RCU. The MCU will suspend all affected TrueCopy 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 Async, the offloading timer should be set to 35 seconds or less to avoid affecting host I/O performance.

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 4.25). The async options can only be modified when no TrueCopy Asynchronous pairs or groups exist in the connected CU (P-VOLs or S-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 4.26).

   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 the **Apply** button (lower right of TrueCopy panel). To cancel the operation and return the list view to its original display, select **Cancel**.
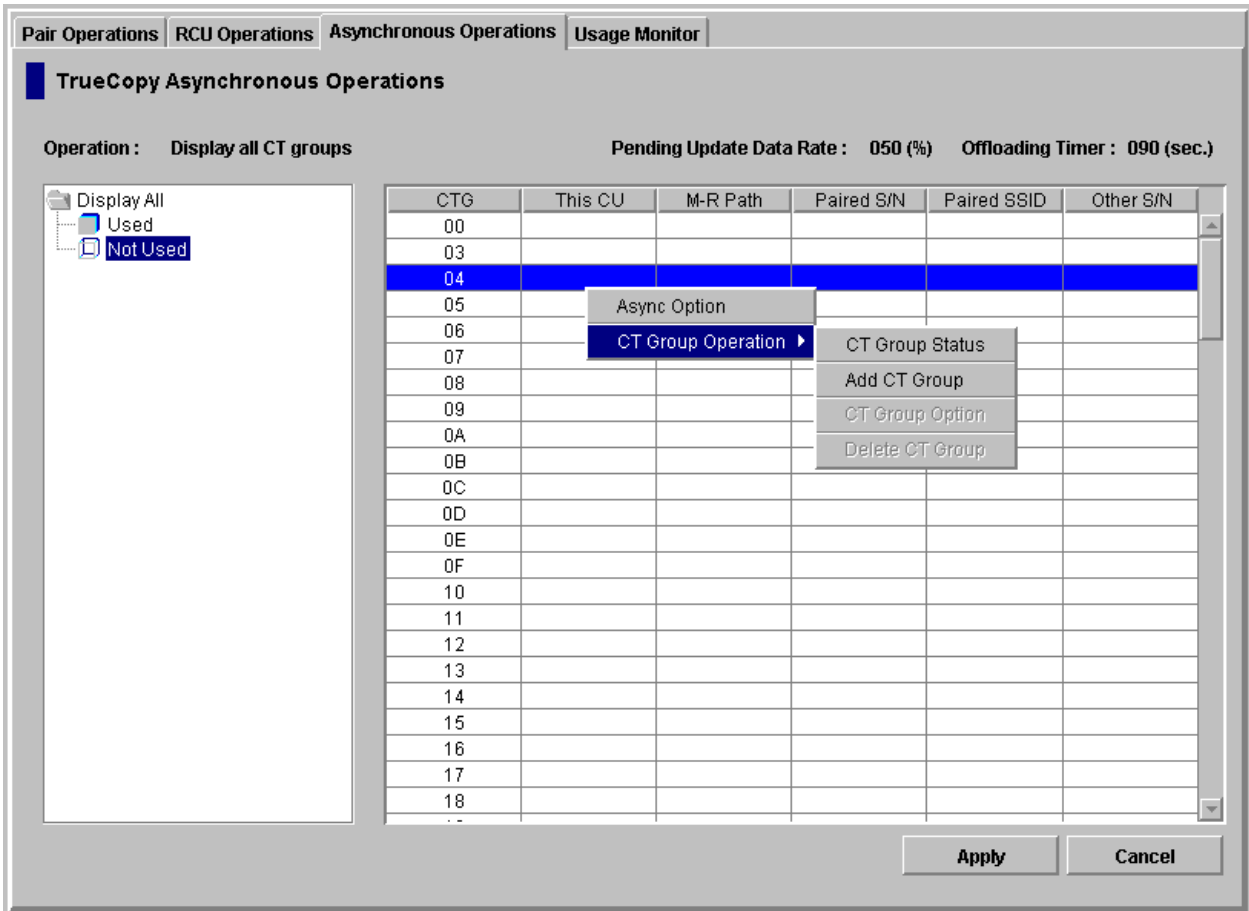
Pending Rate	Offloading
050	079

Figure 4.26   Verifying the Async Option Operation

4.3.2 Adding Consistency Groups

The Add CT Group panel (see Figure 4.27) 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**.
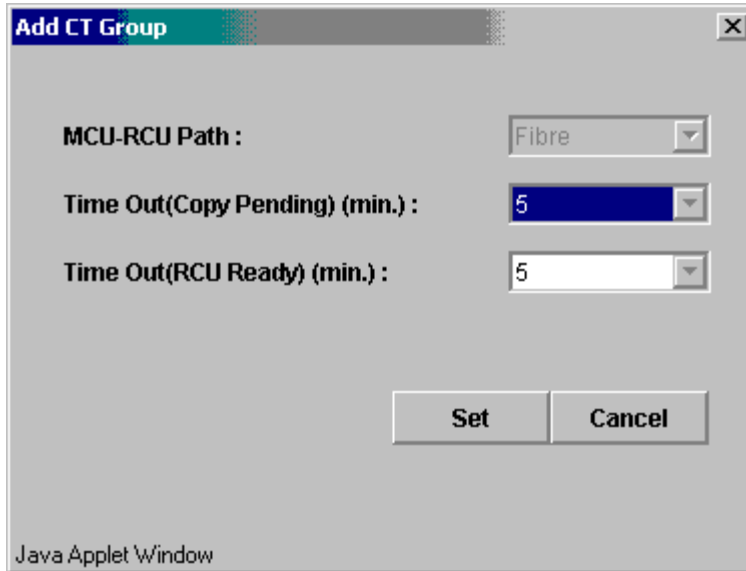
Figure 4.27   Add CT Group Panel

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

Time Out (Copy Pending) (min.): allows you to select the maximum delay allowed for TrueCopy 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 TrueCopy P-VOL update and the corresponding S-VOL update reaches the specified time, the RCU will suspend all S-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.

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 P-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 4.27).

5. On the Add CT Group panel, select the desired path type and group options (copy pending timeout, RCU ready timeout). *Note:* You will not be able to modify the path 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 4.28).

    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 the **Apply** button (lower right of TrueCopy panel). To cancel all operations and return the list view to its original display, select **Cancel**.

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

Figure 4.28   Verifying the Add CT Group Operation

4.3.3 Changing the Consistency Group Options

The CT Group Option panel (see Figure 4.29) 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 split all pairs in the group first.
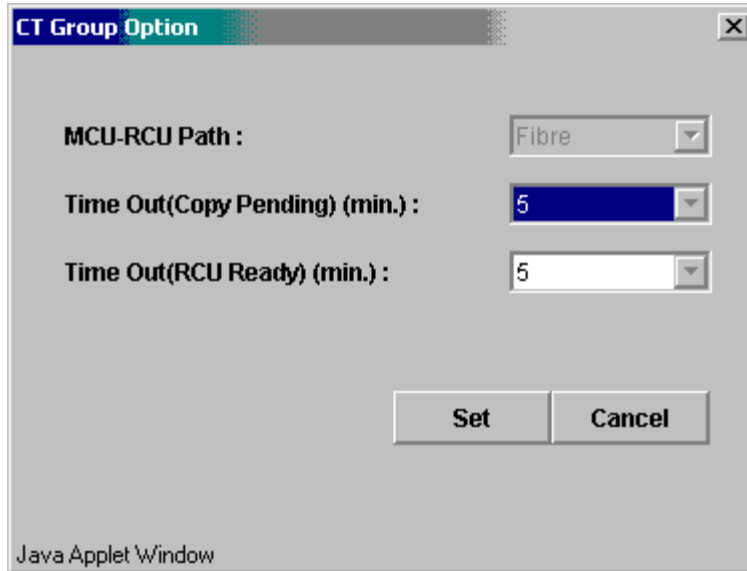
Figure 4.29   CT Group Option Panel

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 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 TrueCopy P-VOL update and the corresponding S-VOL update reaches the specified time, the RCU will suspend all S-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.

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 P-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 split (Pairsplit-r), so that you can change the group options. See section 5.6 for instructions on splitting 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 4.29). If the **CT Group Option** command is not enabled, you need to split 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 path type when the group does not contain any pairs.

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 4.30).

   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 the **Apply** button (lower right of TrueCopy 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 (resync) all pairs in the group(s) (Pairresync). See section 5.7 for instructions on resuming pairs.

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

Figure 4.30   Verifying the CT Group Option Operation

4.3.4 Viewing Consistency Group Status

The CT Group Status panel (see Figure 4.31) displays the detailed status information for the selected TrueCopy 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.
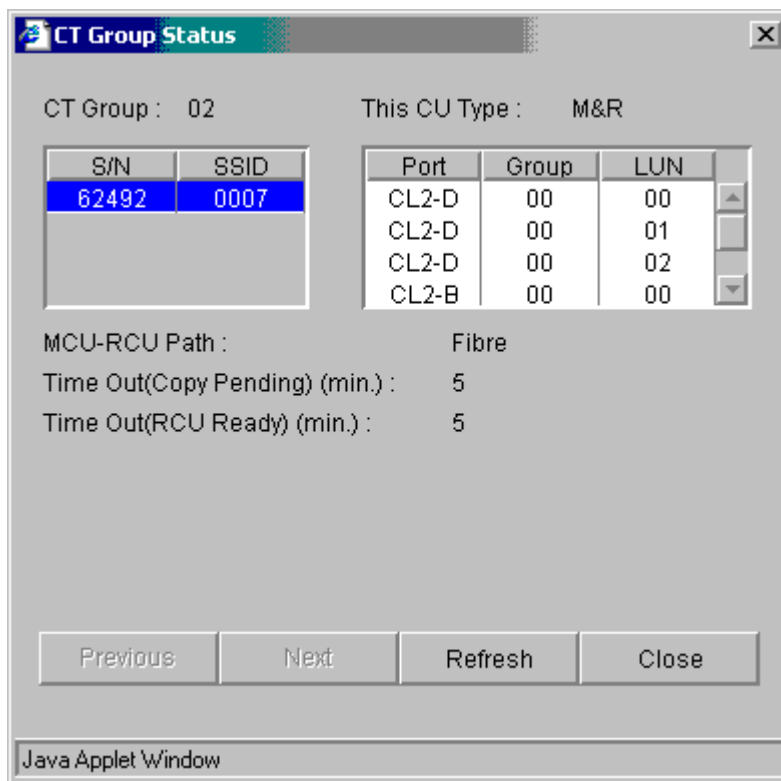
Figure 4.31   CT Group Status Panel

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.

Port, **Group, LUN**: Pairs in the connected CU that are in the selected consistency group. For LUs with more than one path, only the first path is listed.

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

Time Out (Copy Pending): Maximum delay allowed for TrueCopy 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).

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 P-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 P-VOLs in the current MCU.

To delete one or more consistency groups from an MCU:

1. Make sure that all affected TrueCopy 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 P-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 the **Apply** button (lower right of TrueCopy 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 the **Apply** button (lower right of TrueCopy panel). To cancel your settings and return the panel to its original display, select **Cancel**.
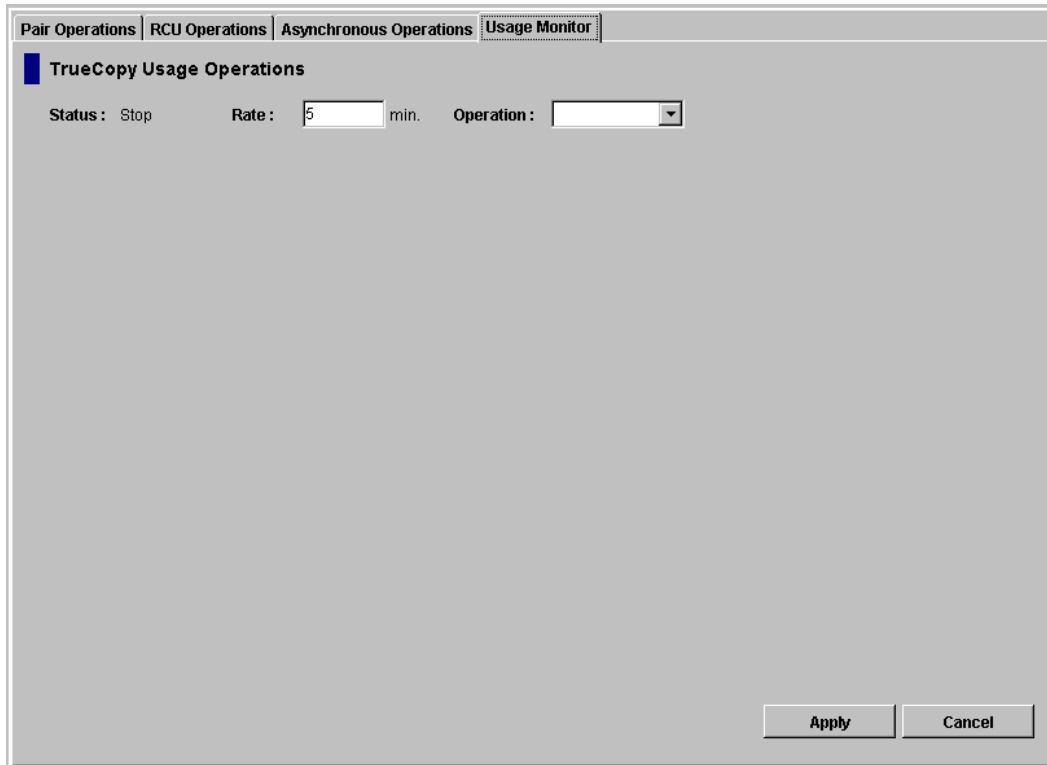
Figure 4.32   Usage Operations Panel

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 4.33).

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 4.34, Figure 4.35).

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 4.34), and then select **Download**.

   – After you have downloaded the usage monitor file at least once, select **Existing Export Data** (see Figure 4.35), 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.
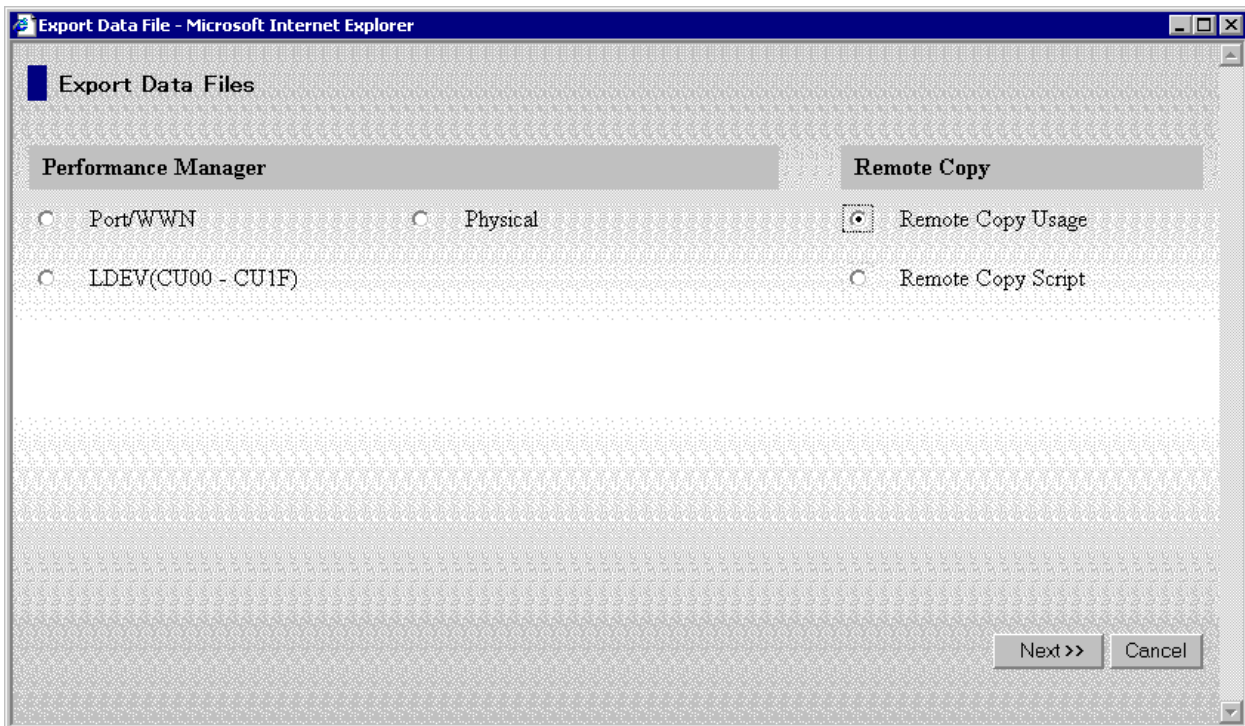
Figure 4.33   Export Data Files Panel
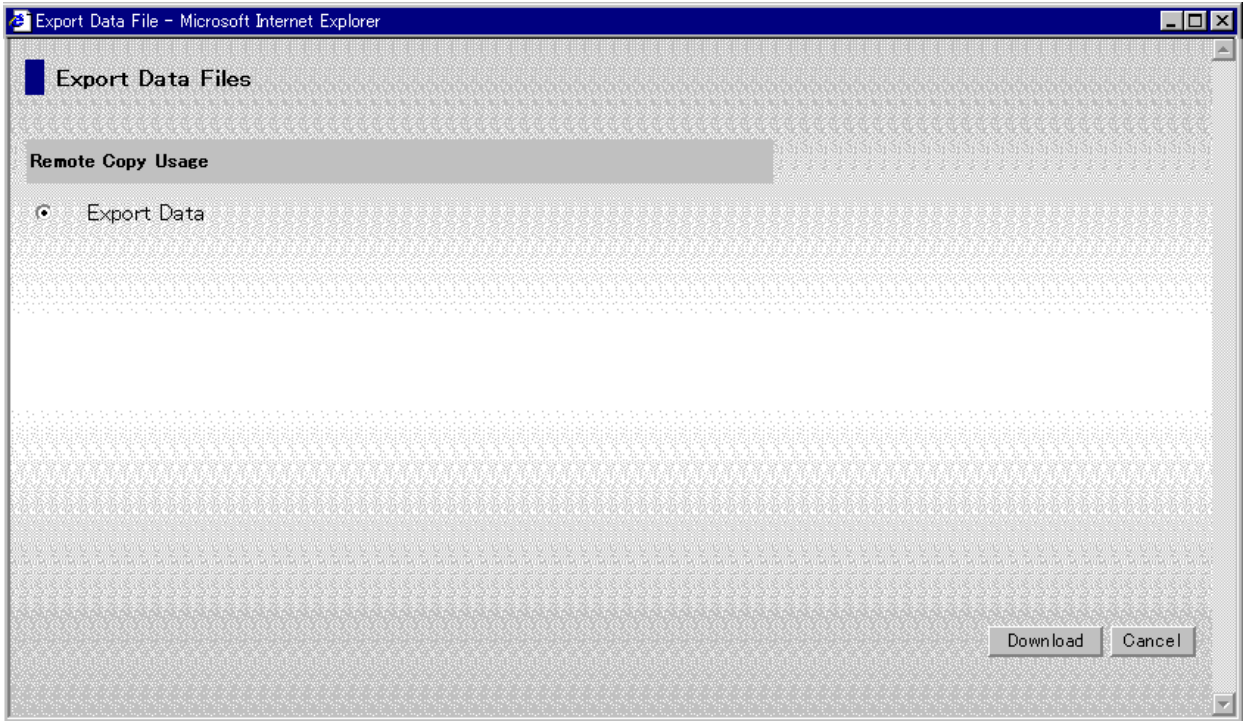
Figure 4.34　Export Data Files – Remote Copy Usage (first export operation shown)
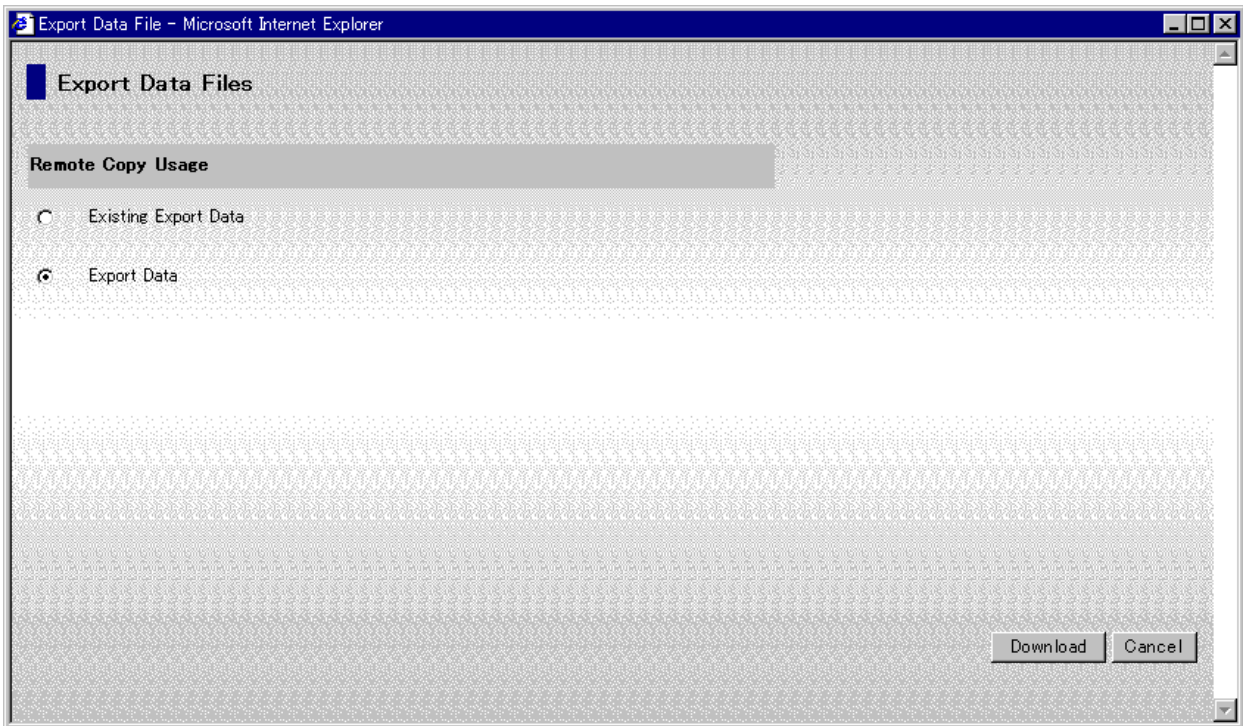
Figure 4.35　Export Data Files – Remote Copy Usage

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 the **Apply** button (lower right of TrueCopy panel). To cancel your setting and return the panel to its original display, select **Cancel**.

4.5   Optimizing TrueCopy Operations and Subsystem Performance

Hitachi TrueCopy 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 TrueCopy update copy mode (synchronous or asynchronous) determines exactly how the remote copy operations will impact subsystem performance as follows:

■   **Synchronous** copy mode has an additional effect on subsystem performance: increased service and disconnect time for write I/Os to TrueCopy P-VOLs due to the delay between channel-end and device-end. The length of this delay increases as the distance between the P-VOL and S-VOL increases, so that the longest delay occurs when the primary and secondary volumes are the maximum distance apart.

■   **Asynchronous** copy mode eliminates all delays associated with TrueCopy Synchronous operations while providing increased protection for write-dependent applications in the event of a disaster. Write I/Os for TrueCopy Asynchronous P-VOLs are processed in the same way as writes for simplex volumes, without any increase in service or disconnect time. The asynchronous S-VOL updates are performed completely independent of all host I/O processes at the P-VOLs, and there are no restrictions on subsequent read/write operations to TrueCopy Asynchronous P-VOLs. The only performance concerns for TrueCopy Asynchronous are (1) ensuring that adequate cache resources are available for sidefiles which are used to store the recordsets at both the MCUs and RCUs, and (2) ensuring that sufficient MCU-RCU paths are defined for copy operations.

In addition to the TrueCopy update copy mode, several other factors can also affect 9900V subsystem performance. You can optimize both the TrueCopy operations and the I/O performance of the subsystems by analyzing workloads and addressing system-level conditions (e.g., number of host interface paths) which can affect subsystem performance. You can also control the impact of TrueCopy 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), initial copy options (see section 5.3.1), and pair options (see section 5.3.2) for each TrueCopy pair. In addition, you can upgrade the TrueCopy hardware components and/or adjust the configuration of the components to improve subsystem performance under a wide range of operating conditions.

Table 4.3 lists some of the conditions which affect subsystem performance and provides recommendations for addressing these conditions.

Table 4.3   Optimizing TrueCopy Operations and 9900V Subsystem Performance

Condition	Description	Recommendation(s)
Write-intensive workloads	Write-intensive workloads, such as 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 DB 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	TrueCopy 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 TrueCopy pairs. Instead, restore data to a scratch volume and then create the TrueCopy 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 TrueCopy remote copy operations.TrueCopy Async (and HXRC and Concurrent Copy) requires additional cache for sidefile data. Insufficient cache resources can result in command retries, state-change-pending (SCP) notifications, and puncture conditions.	Consider increasing the cache size of the TrueCopy subsystems to handle sidefile operations and to improve overall subsystem performance. For best results, the cache and NVS capacity of the primary and secondary subsystems should be the same (the RCU sidefile requirements for TrueCopy Async are twice 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 TrueCopy remote copy operations among several remote subsystems to avoid overloading any one RCU.
Paths	An inadequate number of paths may decrease subsystem performance. Performing TrueCopy Synchronous operations over long distances can also degrade performance. TrueCopy Asynchronous is recommended for long distances.	Make sure to install an adequate number of paths between the primary and secondary subsystems. This is especially important for subsystems which contain both P-VOLs and S-VOLs.

4.6   Discontinuing TrueCopy Operations

If you plan to use TrueCopy for nondisruptive data migration or duplication (see section 5.9), you will configure and establish TrueCopy operations, allow TrueCopy to synchronize the volumes, redirect application I/Os (if migrating), and then discontinue TrueCopy operations. When you are ready to discontinue TrueCopy operations, you will need to perform TrueCopy operations in the correct order to avoid generating error messages. For example, TrueCopy will not allow you to delete an RCU path until you have deleted all TrueCopy pairs still using that path, and you cannot delete a group until you have deleted all TrueCopy Asynchronous pairs in that group.

To discontinue all TrueCopy operations, perform the following actions in the following order:

1. First delete all TrueCopy pairs from the MCU(s) (pairsplit-S, see section 5.8). For TrueCopy Async pairs, you can use the Delete Range-Group option to delete all pairs in a group using just one operation. Verify that the pair status has changed to SMPL for all TrueCopy volumes before continuing.

2. Delete the TrueCopy Async 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.

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. Reconfigure the 9900V ports as needed (e.g., reset the initiator ports to ordinary target ports at the MCUs) (see section 4.2.1).

Chapter 5   Performing TrueCopy Pair Operations

5.1   Preparing for TrueCopy Volume Pair Operations

Before starting TrueCopy operations, you must consider the relative importance of subsystem I/O performance and disaster recovery preparation. As described in section 4.5, remote copy operations can affect the I/O performance of the MCUs and RCUs. TrueCopy provides many options (RCU options, initial copy options, pair options, group options, async options) which allow you to control the impact of TrueCopy operations on I/O performance. These options can be set separately for each pair, for each TrueCopy Async group, and for each MCU to provide maximum flexibility. You can select options which minimize the impact of TrueCopy operations on subsystem performance, or options which maximize the effectiveness of TrueCopy operations to ensure the best level of backup data integrity. System-level factors (e.g., number of paths) can also affect TrueCopy operations and subsystem performance (see section 4.5).

For TrueCopy disaster recovery operations, you should make sure that the RCUs are attached to a host server to enable reporting of sense information and transfer of host failover information. If the remote site is unattended, you should attach the RCUs to a host server at the main site, so that the system administrator can monitor the operational condition of the RCUs.

To prepare for TrueCopy volume pair operations, you need to identify the volumes (by port, TID, and LUN and/or by LDEV ID) for which you want to establish TrueCopy remote copy operations. You should identify volumes which are required for system operation as well as volumes which contain important data to be backed up (e.g., DB log files). Copying these volumes 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, you should plan to establish a TrueCopy Asynchronous consistency group for each database, so that the update sequence consistency of the database can be ensured at the remote site.

You can start creating the TrueCopy volume pairs as soon as you have:
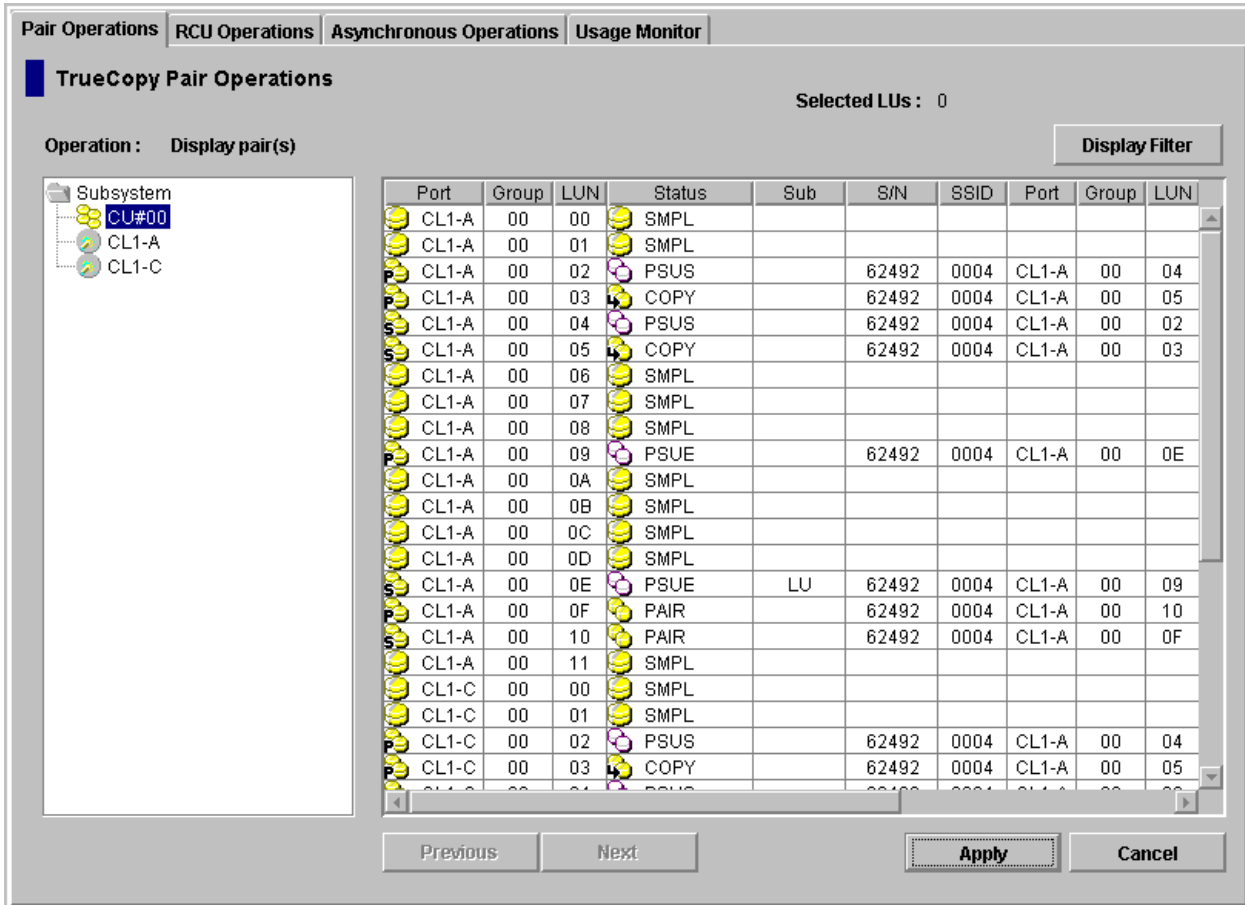
- Identified the volumes (LUs) which will become the TrueCopy P-VOLs (and S-VOLs),

- Ensured that all system and TrueCopy requirements have been met (sections 3.1 and 3.2),

- Completed hardware and software installation (see sections 3.3 and 3.4), and

- Configured the MCUs and RCUs for TrueCopy operations (see section 3.5).

If you will be using the TrueCopy Remote Console software to perform TrueCopy operations, the MCU of each TrueCopy 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 CCI commands instead of the Hitachi TrueCopy Remote Console software, please contact your Hitachi Data Systems account team for information on TrueCopy configuration services.

5.2   Pair Operations Tab

The **Pair Operations** tab (see Figure 5.1) displays the TrueCopy pair information for the connected subsystem and allows you to perform all TrueCopy volume 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.

Pair Operations	RCU Operations	Asynchronous Operations	Usage Monitor							

TrueCopy Pair Operations

Selected LUs : 0

Operation :   Display pair(s)   Display Filter

Port	Group	LUN	Status	Sub	S/N	SSID	Port	Group	LUN
CL1-A	00	00	SMPL						
CL1-A	00	01	SMPL						
CL1-A	00	02	PSUS		62492	0004	CL1-A	00	04
CL1-A	00	03	COPY		62492	0004	CL1-A	00	05
CL1-A	00	04	PSUS		62492	0004	CL1-A	00	02
CL1-A	00	05	COPY		62492	0004	CL1-A	00	03
CL1-A	00	06	SMPL						
CL1-A	00	07	SMPL						
CL1-A	00	08	SMPL						
CL1-A	00	09	PSUE		62492	0004	CL1-A	00	0E
CL1-A	00	0A	SMPL						
CL1-A	00	0B	SMPL						
CL1-A	00	0C	SMPL						
CL1-A	00	0D	SMPL						
CL1-A	00	0E	PSUE	LU	62492	0004	CL1-A	00	09
CL1-A	00	0F	PAIR		62492	0004	CL1-A	00	10
CL1-A	00	10	PAIR		62492	0004	CL1-A	00	0F
CL1-A	00	11	SMPL						
CL1-C	00	00	SMPL						
CL1-C	00	01	SMPL						
CL1-C	00	02	PSUS		62492	0004	CL1-A	00	04
CL1-C	00	03	COPY		62492	0004	CL1-A	00	05

Subsystem
  CU#00
    CL1-A
    CL1-C

Previous   Next   Apply   Cancel

Figure 5.1   Pair Operations Tab

The **Pair Operations** tab presents:

- **Outline view**: displays the connected subsystem and the CU images and ports which contain LUs (CU images and ports without LUs are not displayed). Select the subsystem to display all LUs, or select the desired CU image or port to display the LUs for that CU image or port. You can only select one CU image or port at a time.

- **List view**: displays the detailed LU information (see section 5.2.1.1) for the selected item (subsystem, CU, or port). The LU information can be sorted by column and in ascending or descending order. For LUs with more than one path, each path is displayed in a separate row.

- **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 host group, port (if a CU image is selected), CU image (if a port is selected), pair type (sync and/or async), volume type (P-VOL and/or S-VOL), CT group, path type, pair status, and async 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 LU information.

The **Pair Operations** tab allows you to perform the TrueCopy 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. *Note:* When a port is selected, pair operations cannot be performed.

2. Select the desired LU(s) or pair(s) in the list view.

3. Right-click on the selected LU(s)/pair(s) to display the pop-up menu (see Figure 5.2):

   Pairdisplay: displays the LU/pair status (see section 5.3).

   Paircreate: allows you to create new pairs (sync or async) (see section 5.4).

   Pairsplit-S: allows you to delete pairs (see section 5.7).

   Pairsplit-r: allows you to split (suspend) pairs (see section 5.5).

   Pairresync: allows you to resume pairs (see section 5.6).

   Change Pair Option: allows you to change the pair options (see section 5.8).

   Note: The availability of the commands (enabled/disabled) depends on the status of the LU(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 the **Apply** button (lower right of TrueCopy 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 (LU) in the selected CU image or port (or entire subsystem when the subsystem is selected). You can sort the LUs in the volume list by selecting the column heading to sort on. The **Port** column is selected by default. The screen in Figure 5.3 shows the volume list sorted by port 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.

Figure 5.3   List View on the Pair Operations Tab

The detailed volume (LU) information includes:

- Volume icon: Indicates the status of volumes.
  - : P-VOL or the volume status of SMPL.
  - : S-VOL.

- **Port**, **Group**, and **LUN**: port number, host group number, and LU number. For LUs with more than one path, each path is displayed in a separate row. *Note:* The LDEV(s) associated with each LU is/are not displayed by TrueCopy. Use the LUN Manager Remote Console software to view the LDEV information for the LUs.

- **Status**: (see section 2.5 for further information on TrueCopy pair status)
  - : SMPL. The volume is not currently assigned to a TrueCopy pair. When the initial copy is started by a paircreate operation, the volume status changes to COPY.
  - : COPY. The TrueCopy 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 PAIR.
  - : PAIR. The volume is currently assigned to a TrueCopy pair, and the pair is synchronized. All updates from the host to the P-VOL are duplicated at the S-VOL.
  - : PSUE. The pair has been suspended by the MCU or RCU due to an error condition. The volumes in this pair are not synchronized.
  - : PSUS. The pair has been split by the user (pairsplit-r), or the pair has been deleted by the user from the RCU (pairsplit-S). The volumes in this pair are not synchronized.
  - : PDUB. This TrueCopy LUSE pair is in the COPY or PAIR state, but at least one LDEV pair within the TrueCopy LUSE pair is in the SMPL or PSUE state.
  - : Suspending. TrueCopy Asynchronous only. This pair is not synchronized. This pair is in transition from the PAIR or COPY state to the PSUS/PSUE state.
  - : Deleting. TrueCopy Asynchronous only. This pair is not synchronized. This pair is in transition from the PAIR, COPY, or PSUS/PSUE state to the SMPL state.

- **Sub:** Suspend Sub Status

  - **Grp:** Consistency time of volume is same as that of the consistency group.

  - **LU:** 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.

- **Port**, **Group**, and **LUN:** port number, host group number, and LUN of the other volume of the volume pair.

- **Type:** Pair mode: Synchronous or Asynchronous.

- **Fence:** The P-VOL fence level of the TrueCopy volume pair: data, status, or never. See sections 5.3.2 and 6.1.1 for a complete description of the P-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 (group or LU) 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 SMPL 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, CU image, or port) determines which display filter settings are available. When the entire subsystem is selected, all settings on the Display Filter panel are available. When a CU image is selected, the CU# setting is not available. When a port is selected, the port setting is not available.
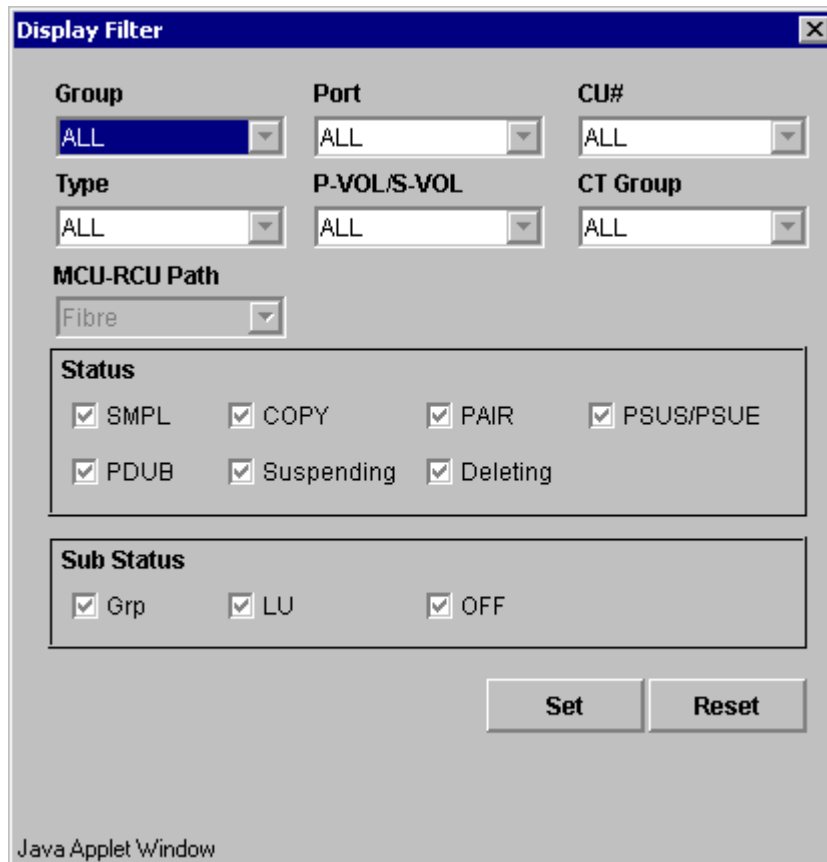
Figure 5.4   Display Filter Panel

Group: allows you to select the host group (or all host groups) to be displayed.

Port: allows you to select the port (or all ports) to be displayed.

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.

P-VOL/S-VOL: allows you to select the volume type, P-VOL or S-VOL (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.

MCU-RCU Path: allows you to select the path type, fibre or serial (or all types), to be displayed.

Status: allows you to display only volumes which have the selected pair status: SMPL, COPY, PAIR, PSUS/PSUE, PDUB (LUSE only), Suspending (async only), and/or Deleting (async only). *Note:* When PDUB is selected, simplex volumes are not displayed.

Sub Status: allows you to select the consistency status of the Asynchronous pairs.

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 Creating TrueCopy Volume Pairs (Paircreate)

The Paircreate panel (see Figure 5.5 and Figure 5.6) allows you to create new TrueCopy pairs and set the initial copy options and pair options for the new pairs. To open the Paircreate panel, select the **Pair Operations** tab, select the desired MCU CU image, select the LU(s) which will be the P-VOL(s) of the new pair(s), right-click, select **Paircreate**, and then select the desired copy mode (sync or async) for the new pair(s).
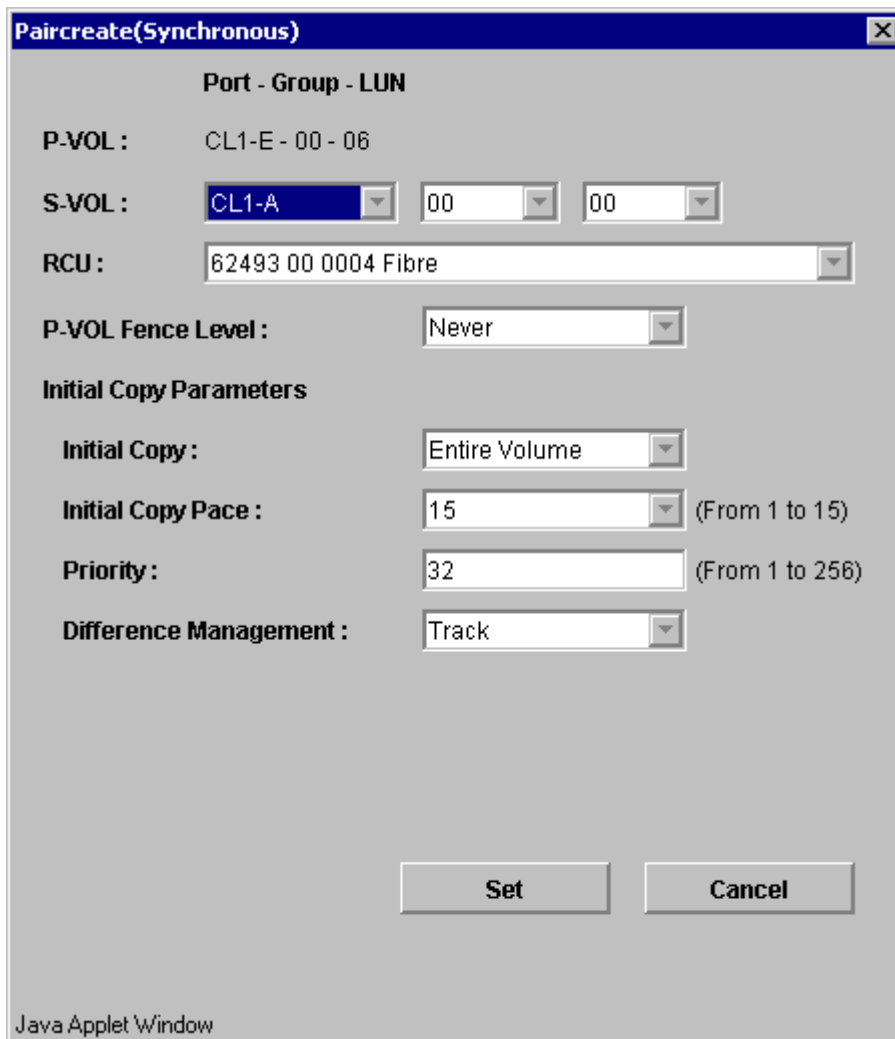
Figure 5.5   Paircreate Panel for Synchronous Pairs
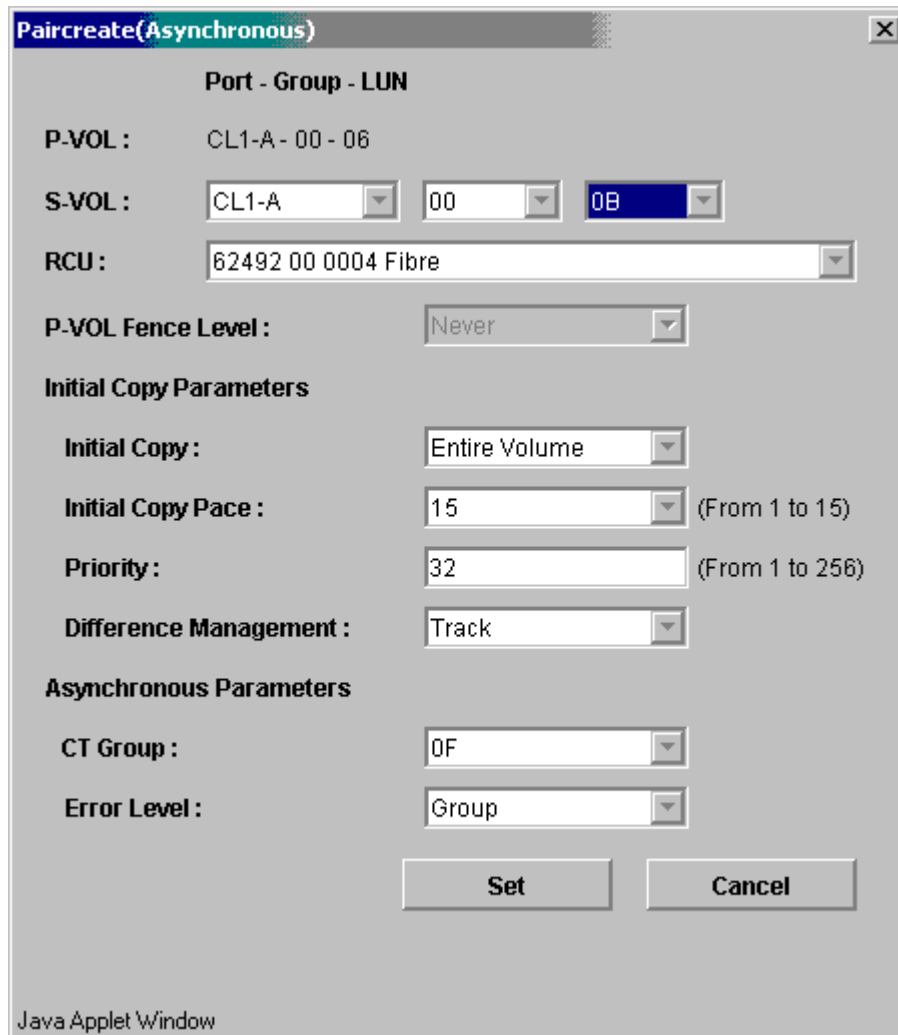
Figure 5.6   Paircreate Panel for Asynchronous Pairs

- **Port – Group – LUN**

    – **P-VOL:** displays the port, group, and LUN of the selected LU(s). If you selected more than one P-VOL, the P-VOL with the lowest LUN is displayed.

    – **S-VOL:** allows you to select the S-VOL(s) for the new pair(s). If you selected more than one P-VOL, select the S-VOL for the P-VOL being displayed. The S-VOLs for the rest of the P-VOLs are automatically assigned according to the LUN. For example, if you select three P-VOLs and select LUN01 as the S-VOL for the first P-VOL, the S-VOLs for the two other P-VOLs will be LUN02 and LUN03.

    Note: When creating more than one pair at a time, make sure that the S-VOLs to be assigned automatically are available. If an S-VOL is not available, you will have to select the S-VOL individually.

- **RCU:** Select the RCU (serial number, CU number, SSID, and path type) for the TrueCopy 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.

- **P-VOL Fence Level** (sync only): Select the fence level for the new pair(s) (default = Never). The fence level determines the conditions under which the MCU will reject write operations to the P-VOL. See section 5.3.2 for further information on this option.

    – **Never**: the P-VOL will never be fenced.

    – **Data**: the P-VOL will be fenced when the MCU cannot successfully execute an update copy operation for any reason.

    – **Status**: the P-VOL will be fenced only if the MCU is not able to change the S-VOL status to suspended when an update copy operation fails.

- **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. *Note:* These options cannot be changed after a pair has been added.

    – **Initial Copy**: **Entire** = copy all P-VOL data to S-VOL; **No Copy** = do not copy any P-VOL data to S-VOL. The default setting is Entire.

    WARNING: The user must ensure that the P-VOL and S-VOL are already identical when using the **No Copy** setting.

    – **Initial Copy Pace**: desired number of tracks to be copied at one time (1-15) during the initial copy operation. The default setting is 15.

    – **Priority**: priority (scheduling order) of the initial copy operations (1-256). The default setting is 32.

- **Difference Management**: Select **Cylinder** or **Track** as the basis for managing the differential data. For most device types, the default setting is Track. For OPEN-E and OPEN-L, the default is Cylinder. See section 5.3.1 for further information on this option. *Note:* This option cannot be changed after a pair has been added.

- **Asynchronous Parameters** (async 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**: error level for the new pair(s): **Group**, or **LU** (default = Group). See section 5.3.2 for further information on the error level option.

The **Cancel** button cancels the settings you have made and closes the Paircreate panel. The **Set** button sets the parameters and closes the Paircreate panel.

To create one or more new TrueCopy volume pairs:

1. At the remote site:

   a) Make sure that the LU(s) which will be the S-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 LUs that will be S-VOLs) has been added to the correct MCU CU image (contains the LUs that will be P-VOLs). See section 4.2.2 for instructions on adding an RCU.

3. Select the **Pair Operations** tab, and select the CU image or port which contains the LU(s) which will be the P-VOL(s) of the new pairs. Use the Display Filter as needed to display the desired LUs (e.g., select SMPL status only) (see section 5.2.1.2).

4. Select the LU(s) which will be the P-VOL(s) of the new TrueCopy pair(s). You can create multiple pairs at the same time only when: (1) the S-VOLs are in the same RCU, and (2) the pairs have the same copy mode (sync or async). You cannot create TrueCopy Sync pairs and TrueCopy Async pairs at the same time.

5. Right-click, select **Paircreate**, and then select the desired pair mode (Synchronous or Asynchronous) to open the Paircreate 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 (for disaster recovery or migration), the number of pairs, and the write I/O activity to the P-VOLs.

6. On the Paircreate panel, enter the desired S-VOL for the pair, and select the RCU. If you are creating multiple pairs, select the S-VOL for the P-VOL being displayed. The S-VOLs for the rest of the P-VOLs will be assigned automatically according to the LUN. For example, if you select three P-VOLs and select LUN01 as the S-VOL for the first P-VOL, the S-VOLs for the two other P-VOLs will be LUN02 and LUN03.

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 paircreate operations (see step 9).

8. Select **Set** to close the Paircreate panel. The requested paircreate 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 TrueCopy options for each new pair are correct. After a pair has been created, you can only change the fence level (sync only) and error level (async only) 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 the **Apply** button (lower right of TrueCopy 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 paircreate operation(s) is/are displayed correctly (COPY status) in the list view. To monitor the progress of the paircreate operation(s), select **Refresh** to update the information in the list view, or use the Pairdisplay 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 main panel for which LUs the paircreate operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed LUs, and retry the paircreate operation.

Note: The Paircreate operation will be rejected if the P-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.

Port	Group	LUN	S/N	SSID	Port	Group	LUN
CL1-A	00	0A	12345	1234	CL1-A	00	00

Type	Mode	Fence	Pace	Priority	Diff	CTG	ErrLvl
Async	Entire	Never	15	032	Cylinder	02	Group

Figure 5.7   Verifying the Paircreate Operation(s)

5.3.1   Initial Copy Options

When you create new TrueCopy pairs, you select the initial copy options on the Paircreate panel. After a pair has been created (i.e., the paircreate 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) (default = Entire):

- **Entire Volume**: the initial copy operation will copy all cylinders/tracks on the P-VOL (except diagnostic and unassigned alternate tracks) to the S-VOL.

- **No Copy**: the initial copy operation will not be performed. The MCU will begin performing update copy operations as needed. *WARNING:* The user must ensure that the P-VOL and S-VOL are already identical when using this setting.

Initial Copy Pace: specifies the maximum number of tracks (1-15) that can be copied at one time by the TrueCopy initial copy operation before the MCU accepts another host request for that P-VOL (default = 15). A high setting (e.g., 15 tracks) speeds up the initial copy operation but may affect the subsystem's I/O performance if the P-VOL is experiencing high write I/O activity. A lower setting (e.g., 3 tracks) slows down the initial copy operation to minimize the impact of the initial copy operation on the subsystem's I/O performance.

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 activity 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 TrueCopy 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 that the maximum initial copy activity setting is four, and you create six pairs at the same time (for LUNs 00 through 05) with the initial copy priority set as follows:

P-VOL of Pair	Priority
LUN 03	1
LUN 05	2
LUN 00	3
LUN 04	4
LUN 01, 02	5

The MCU will start the initial copy operations for LUNs 03, 05, 00, and 04 immediately, then start LUN 01 when one of the first four initial copy operations is complete, and then start LUN 02 when the next initial copy operation is complete. If more TrueCopy pairs are created, the MCU also prioritizes the initial copy operations by time requested, so that all pairs in the first group are started before any pair in the next group is started.

5.3.2   Pair Options

When you create new TrueCopy pairs, you select the pair options on the Paircreate panel (see section 5.3). You can change the fence level and error level pair options after a pair has been added (see section 5.4). You cannot change the difference management or CT group of an existing pair. You need to delete and then restart the pair to change these options.

Fence Level (Synchronous only): specifies the conditions under which the MCU will reject write operations to the P-VOL, which is known as "fencing": never, data, or status (default = Never). This parameter is very important for disaster recovery planning (see section 6.1.1).

- **Never**: the P-VOL will never be fenced. If the TrueCopy pair is split or suspended, write operations to the P-VOL will be accepted. (The fence level for all TrueCopy Asynchronous pairs is Never.)

- **Data**: the P-VOL will be fenced when the MCU cannot successfully execute an update copy operation for any reason.

- **Status**: the P-VOL will be fenced only if the MCU is not able to change the S-VOL status to suspended when an update copy operation fails. If the MCU changes the S-VOL status to suspended, subsequent write operations to the P-VOL will be accepted, and the MCU will keep track of all P-VOL updates while the pair is suspended.

Difference management: specifies the measurement method that TrueCopy will use to manage the differential data for the pair: cylinder, or track. For most device types, the default setting is Track. For OPEN-E and OPEN-L, the default is Cylinder.

CT Group (Asynchronous only): specifies the consistency group number for new pairs. All TrueCopy Asynchronous pairs must be assigned to a consistency group. To change the consistency group to which a pair is assigned, you must delete and then restart the pair with the desired group selected.

Error level (Asynchronous only) (default = Group):

- **Group**: When the specified pair is suspended, all 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 pairs which are essential to disaster recovery. Suspended TrueCopy Asynchronous S-VOLs with the **LU** error level should not be used for disaster recovery.

- **LU**: 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 TrueCopy pairs.

5.4 Changing the Pair Options (Change Pair Option)

The Change Pair Option panel (see Figure 5.8) allows you to change the pair options (fence level, error level) for existing TrueCopy 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**.
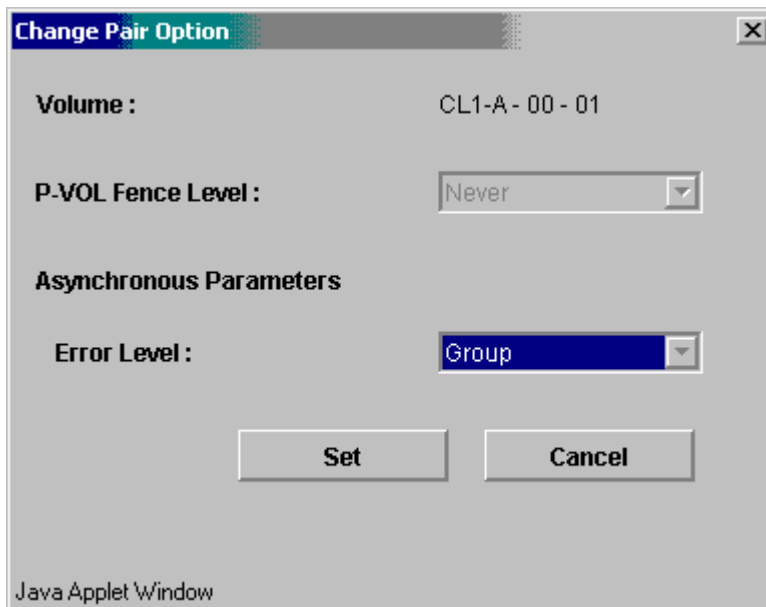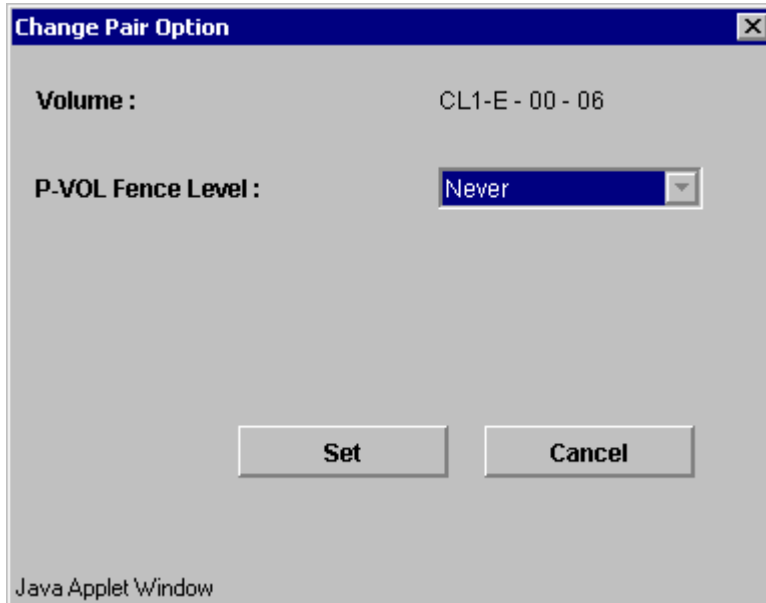
Figure 5.8   Change Pair Option Panel (Synchronous and Asynchronous)

To change the fence level or error level pair option for one or more TrueCopy volume pairs:

1. Connect to the MCU of the pair(s) for which you want to change the pair option, and open the TrueCopy main panel.

2. In the outline view, select the CU image or port which contains the P-VOL(s) of the pair(s).

3. In the list view, select the pair(s) for which you want to change the pair option. Select either TrueCopy Sync pairs or TrueCopy Async 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 pair option 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 change pair option, select the **Apply** button (lower right of TrueCopy panel). To cancel all operations and return the list view to its original display, select the **Cancel** button.

8. On the **Pair Operations** tab, verify that the change pair option operation(s) completed successfully.

Port	Group	LUN	S/N	SSID	Fence	ErrLvl
CL1-E	00	03	33333	3333	Status	Group

Figure 5.9   Verifying the Change Pair Option Operation(s)

5.5 Viewing TrueCopy Pair Status (Pairdisplay)

The Pairdisplay panel (see Figure 5.10) displays the detailed pair status information for the selected pair. To open the Pairdisplay panel, select the **Pair Operations** tab, select any item in the outline list (subsystem, CU image, or port), select the desired pair, right-click, and then select **Pairdisplay**.
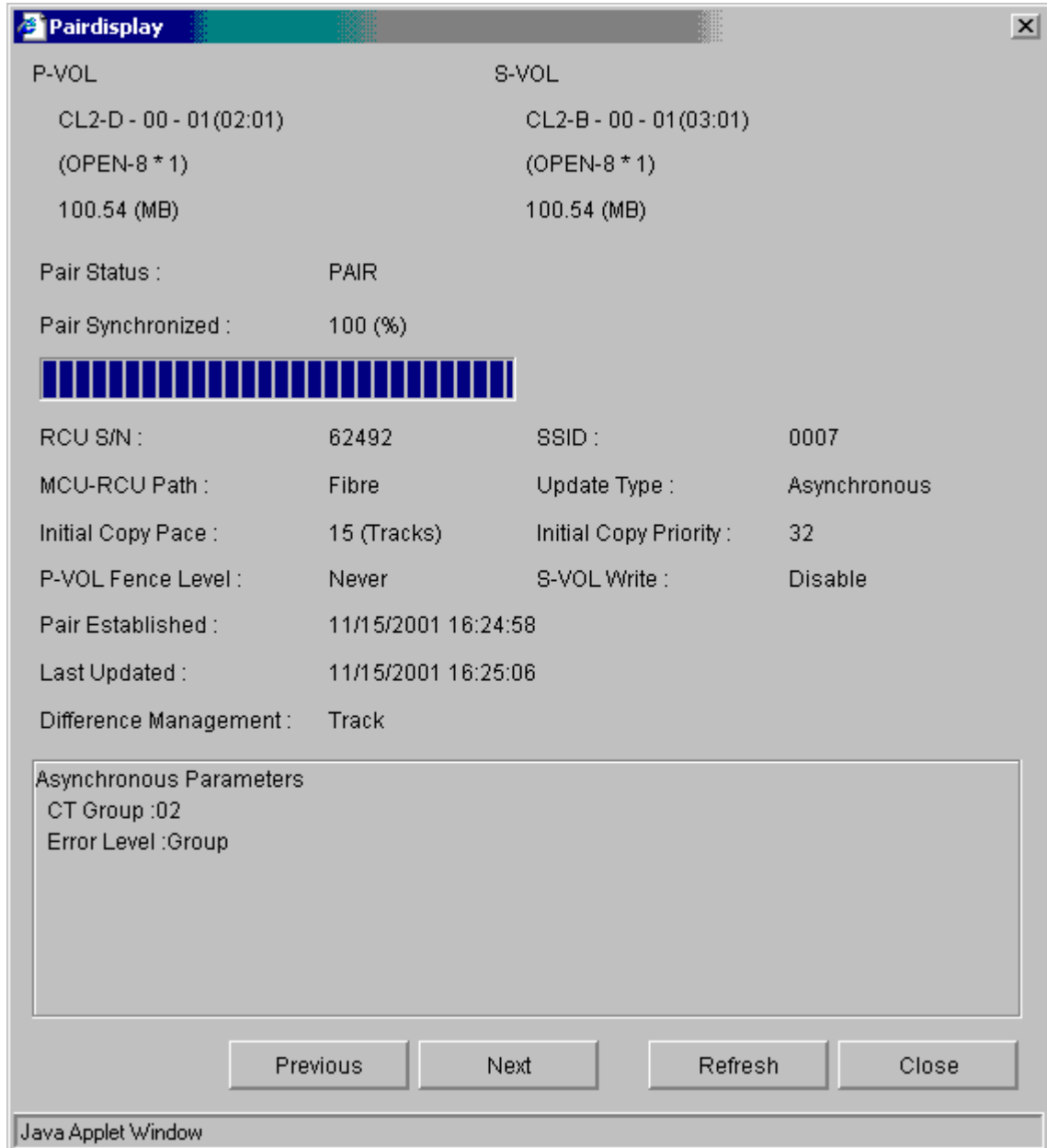
Figure 5.10   Pairdisplay Panel

P-VOL and **S-VOL**:

- Port - host group ID - LUN (lowest LDEV number for a LUSE pair).

- Device emulation type.

- Capacity in MB (to two decimal places).

Pair Status: SMPL, COPY, PAIR, PSUE, PSUS, PDUB, Suspending or Deleting (see section 2.5 for further information on TrueCopy pair status). If the pair is split or suspended, the split/suspended type is also displayed.

Pair Synchronized: progress of the initial copy operation (percentage and progress bar).

RCU S/N and **SSID**: Serial number and SSID of the RCU (or MCU if an S-VOL is selected).

MCU-RCU Path: Channel type of the path interface between the subsystems (fibre, serial).

Update Type: Synchronous or Asynchronous.

Initial Copy Pace: 1-15 tracks (disabled when status becomes PAIR).

Initial Copy Priority: 1-256 (disabled when the status becomes PAIR).

P-VOL Fence Level (sync only): Never, Data, or Status (see section 5.3.2).

S-VOL Write: Enabled or disabled for this pair (enabled only when the pair is split).

Pair Established: Date and time that the volume pair was created.

Last Updated: Date and time that the volume pair status was last updated.

Difference Management: Cylinder or track (see section 5.3.2).

Asynchronous Parameters:

- **CT Group**: Consistency group to which the TrueCopy Async pair is assigned.

- **Error Level**: Error level of the TrueCopy Async pair.

- **Suspended by**: Consistency status (group or LU) of the TrueCopy Async pair (see section 2.5) (displayed only at the RCU and only for a split or suspended pair).

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 Pairdisplay 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 Pairdisplay panel can only be used for the currently displayed 256 rows.

5.6 Splitting TrueCopy Pairs (Pairsplit-r)

The Pairsplit-r panel (see Figure 5.11) allows you to split existing TrueCopy pairs and select the pairsplit options for the pair(s). To open the Pairsplit-r panel, select the **Pair Operations** tab, select any item in the outline list (subsystem, CU image, or port), select the desired pair(s), right-click, and then select **Pairsplit-r**. For further information on split TrueCopy pairs, see section 2.5.1.

Note: You can split a TrueCopy pair only after the initial copy operation is complete.
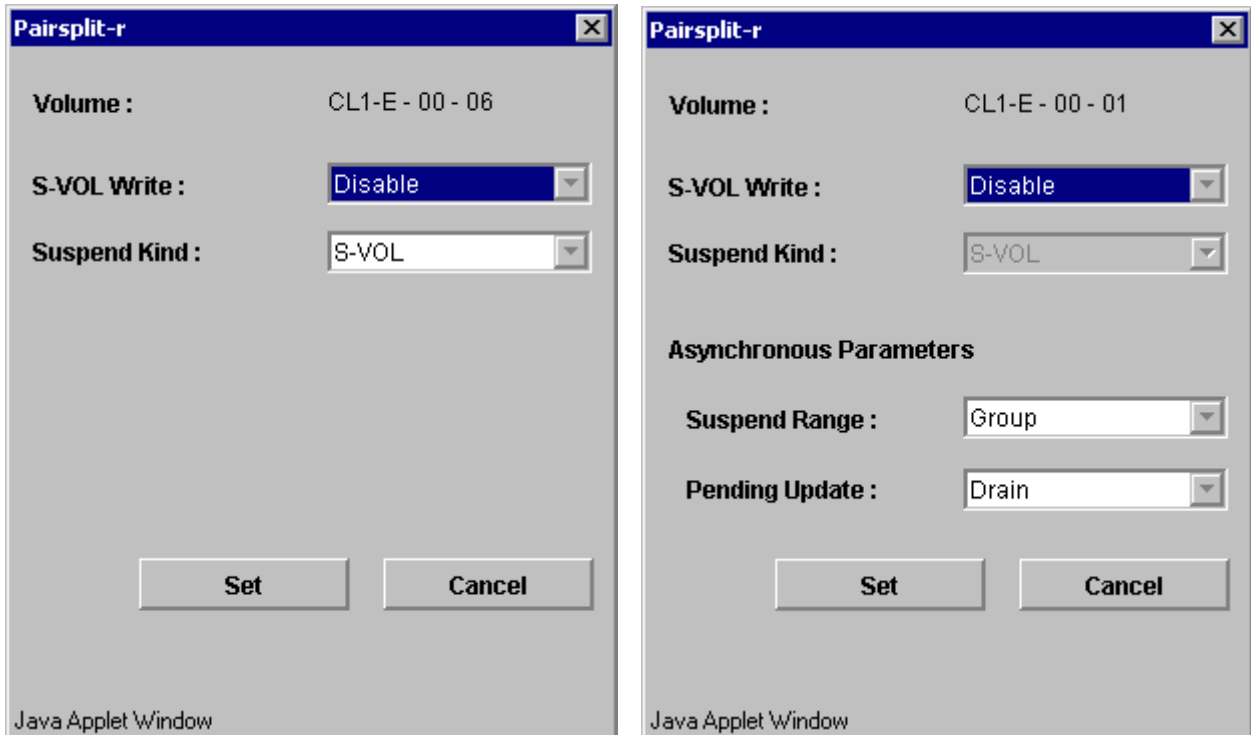
Figure 5.11   Pairsplit-r Panel (Synchronous and Asynchronous)

The pairsplit options are:

- **S-VOL Write** (default = disabled):
  - **Enable**: the S-VOL of this pair will accept read and write I/Os while the pair is split. If you select Enable and you want to resync the pair later, select the **S-VOL suspend kind** option to ensure that the P-VOL and S-VOL bitmaps are merged at the MCU. This option is available only when the selected volume is a TrueCopy P-VOL.
  - **Disable**: the S-VOL of this pair will accept only read I/Os while the pair is split.

- **Suspend Kind** (default = S-VOL):
  - **S-VOL**: the P-VOL will accept all subsequent write I/O operations, and the MCU will keep track of updates while the pair is split. Subsequent write I/O operations to the P-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 P-VOL online. All TrueCopy Asynchronous pairs have this setting.

- **P-VOL Failure** (available only for TrueCopy Synchronous and only when connected to the MCU): the MCU will reject all write I/O operations to the P-VOL while the pair is split, regardless of the P-VOL fence level setting. This setting should be used if you need to maintain synchronization of the TrueCopy pair.

■ **Asynchronous Parameters**:

- **Suspend Range**: Group or LU (default = Group when one pair is selected, default = Volume when two or more pairs are selected).

  Group: The MCU/RCU will split all other pairs in the same consistency group as the selected pair. This option is available only when one pair is selected.

  LU: The MCU/RCU will split only the specified pair(s) (even if the error level of the pair is Group).

- **Pending Update**: Drain or Purge (default = Drain).

  Drain: The MCU will change the pair status from Suspending to PSUS only after the RCU accepts the pairsplit 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 pairsplit-r request and forcibly suspend all affected TrueCopy Asynchronous pairs. Thus, you can use the copy pending timeout parameter to limit the amount of time it takes to complete the split-drain operation.

  Purge: The MCU will change the pair status from Suspending to PSUS as soon as the RCU accepts the pairsplit operation. The MCU and RCU discard any pending recordsets and mark the cylinders/tracks that contain discarded recordsets as modified in the P-VOL and S-VOL bitmaps, respectively. When the pair is resumed (pairresync), the P-VOL and S-VOL bitmaps will be merged at the MCU, and all cylinders/tracks marked as modified will be copied to the S-VOL.

  Note: If the MCU does not receive acknowledgement of the pairsplit-r operation from the RCU within the copy pending timeout setting, the MCU will forcibly suspend all affected TrueCopy Asynchronous pairs.

To split one or more TrueCopy volume pairs:

1. Connect to the MCU or RCU of the pair(s) to be split, open the TrueCopy main panel, and select the **Pair Operations** tab. You do not need to vary the P-VOL(s) offline.

   Note: If you want to use the **S-VOL write enable** option, you must connect to the MCU and select the P-VOL of the pair(s).

2. In the outline view, select the CU image or port which contains the pair(s) to be split.

3. In the list view, select the TrueCopy pair(s) that you want to split. Select either TrueCopy Synchronous or TrueCopy Asynchronous pairs (not both). The pair status must be PAIR. Use the Display Filter as needed to display the desired pairs (e.g., select PAIR status and Async only) (see section 5.2.1.2).

Note: If a LUSE pair that you want to split has the status PDUB, the status of the LUSE pair is COPY or PAIR, but the status of one or more individual LDEV pairs within the LUSE pair is SMPL or PSUE (due to some error condition). Before splitting the pair, perform the pairresync operation on the LUSE pair to change the status to PAIR.

4. Right-click, and select **Pairsplit-r** to open the Pairsplit-r panel (refer to Figure 5.11).

5. On the Pairsplit-r panel, select the desired pairsplit options for the pair(s), and select **Set** to close the Pairsplit-r panel. The list view now displays the requested pairsplit operation(s).

6. Verify the requested operation(s) in the list view (see Figure 5.12). Make sure that the pairsplit options for each pair are correct. The suspend kind option (S-VOL or P-VOL failure) and fence level pair option (never, data, or status) determine whether the P-VOL will accept write I/O operations after the pair is split.

   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**.

   WARNING: Do not use the P-VOL failure suspend kind option if the P-VOL is required for system operation. Make sure to use the S-VOL suspend kind option, so that the P-VOL continues accepting I/Os.

7. If you want to execute the requested operation(s) as quickly as possible, select the **Use Time-Saving Mode** box (above the list view).

8. 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 TrueCopy Synchronous pairs, the MCU will complete all P-VOL write operations in progress and the associated update copy operations at the S-VOL before splitting the pair, so that the pair is synchronized at the time of pairsplit. For TrueCopy Asynchronous pairs, the pending update option (drain or purge) determines whether the pair is synchronized at the time of pairsplit.

9. On the **Pair Operations** tab, verify that the pairsplit operation(s) is/are completed successfully (PSUS status in the list view). To monitor the progress of the pairsplit operation(s), select **Refresh** to update the information in the list view, or use the Pairdisplay panel (see section 5.5) to monitor the detailed status of each pair.

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 pairsplit-r operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed pairs, and retry the pairsplit-r operation.

Port	Group	LUN	S/N	SSID	S-VOL Wrt	Kind	Range	Mode
CL1-A	00	0C	11111	0011	Disable	S-VOL	Group	Drain

Figure 5.12   Verifying the Pairsplit-r Operation(s)

5.7 Resuming TrueCopy Volume Pairs (Pairresync)

While a TrueCopy pair is split or suspended, the MCU does not perform any update copy operations to the S-VOL.

- For a split/suspended TrueCopy Synchronous pair, the MCU may or may not continue accepting write I/Os for the P-VOL depending on the P-VOL fence level pair option (see section 5.3.2) and suspend kind pairsplit option (if user-requested) (see section 5.6).

- For a split/suspended TrueCopy Asynchronous pair, the MCU and RCU keep track of any recordsets that were discarded during pairsplit/suspension, and the MCU continues to accept write I/Os for the P-VOL. The MCU keeps track of the P-VOL cylinders/tracks which are updated while the pair is split/suspended.

If the RCU accepts write I/Os for a split S-VOL (S-VOL write enable pairsplit option), the RCU keeps track of the S-VOL cylinders/tracks which are updated. When the split pair is resumed, the MCU merges the P-VOL and S-VOL cylinder/track bitmaps to determine the out-of-sync cylinders/tracks and ensure accurate resynchronization.

The Pairresync panel (see Figure 5.13) allows you to resume split and suspended TrueCopy pairs and select the pairresync options. To open the Pairresync panel, select the **Pair Operations** tab, select any item in the outline list (subsystem, CU image, or port), select the desired pair(s), right-click, and then select **Pairresync**.
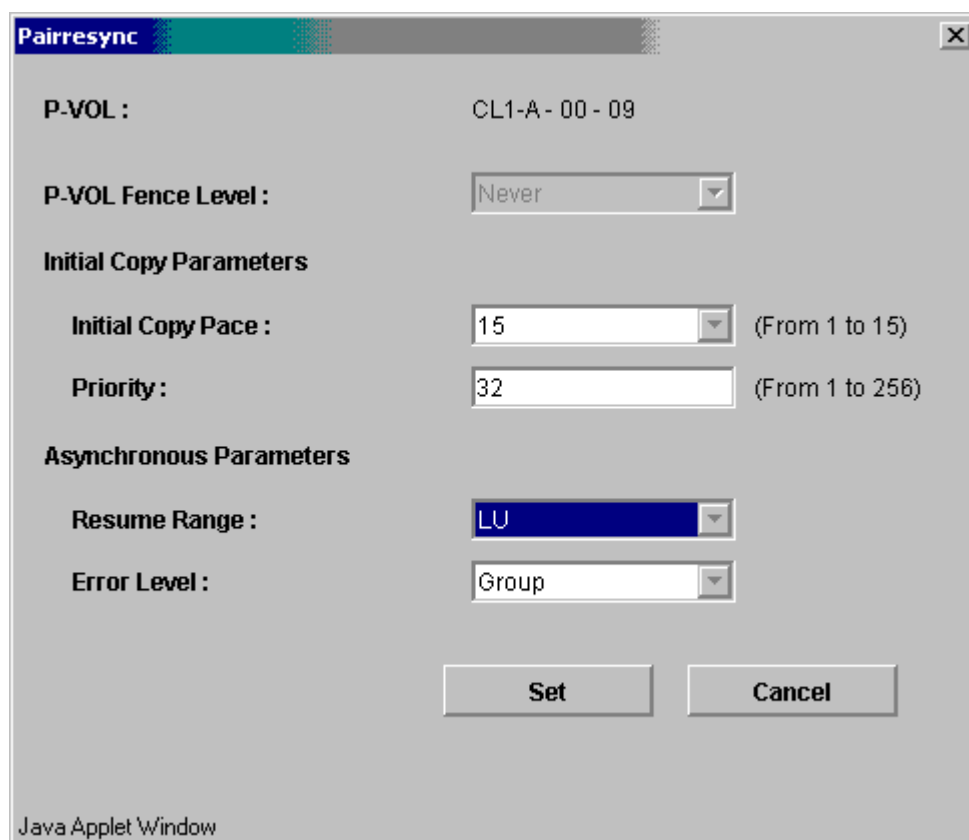
Figure 5.13   Pairresync Panel for Synchronous and Asynchonous Pairs

The pairresync options are:

- **P-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** (from 1 to 15): select the number of the tracks 1-15 for the resync operation(s) (default = 15).

    – **Priority** (from 1 to 256): set the desired priority (1-256) (scheduling order) for the resync operations (default = 32).

- **Asynchronous Parameters**:

    – **Resume Range** (default = Group):

    Group: all split or suspended TrueCopy Async pairs in the same group as the selected pair will be resumed.

    LU: only the selected TrueCopy 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 LU 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 pairs are suspended, the P-VOL/S-VOL bitmaps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders/tracks of all split or suspended TrueCopy volumes as modified, so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed.

To resync one or more split or suspended TrueCopy volume pairs:

1. If any pair was suspended due to an error condition (use the Pairdisplay 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 resync the pair(s) until the error condition has been removed.

2. Connect to the MCU of the pair(s) to be resynced, open the TrueCopy main panel, and select the **Pair Operations** tab.

3. In the outline view, select the CU image or port which contains the pair(s) to be resynced. Use the Display Filter as needed to display the desired pairs (e.g., select Async and PSUS status only) (see section 5.2.1.2).

4. In the list view, select the P-VOL(s) of the pair(s) to be resynced. Select either Sync or Async pairs (not both). Select either PSUS or PSUE pairs (not both) (or PDUB pairs, see note below). If you want to use the Group Resume Range option, select only one TrueCopy Async pair in the group.

   Note: You can use pairresync to change LUSE pairs from PDUB status to PAIR status.

5. Right-click, and select **Pairresync** to open the Pairresync panel (refer to Figure 5.13).

6. On the Pairresync panel, select the desired pairresync options, and select **Set** to close the Pairresync panel. The list view now displays the requested pairresync operation(s).

   Note: If you want to resync all split/suspended pairs in a consistency group, select the **Group** Resume Range option on the Pairresync panel.

7. Verify the requested operation(s) in the list view (see Figure 5.14). Make sure that the pairresync 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 pairresync 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**.

10. On the **Pair Operations** tab, verify that the pairresync operation(s) is/are completed successfully (PAIR status in the list view). To monitor the progress of the pairresync operation(s), select **Refresh** to update the information in the list view, or use the Pairdisplay panel (see section 5.5) to monitor the detailed status of each pair.

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.

Port	Group	LUN	S/N	SSID	Priority	Pace	Fence	ErrLvl	Range
CL1-E	00	03	33333	3333	011	03	Status	Group	Group

Figure 5.14   Verifying the Pairresync Operation(s)

5.8   Deleting TrueCopy Volume Pairs (Pairsplit-S)

A TrueCopy pair should be deleted from the MCU only when it is no longer necessary to maintain a remote copy of the P-VOL. When a TrueCopy pair is deleted from the MCU, the MCU stops all update copy operations for that pair and changes the pair status of the P-VOL and S-VOL to SMPL. After a TrueCopy pair is deleted, the MCU continues to accept all subsequent write I/O operations to the P-VOL and will not keep track of the P-VOL updates.

A TrueCopy pair should be deleted from the RCU only for disaster recovery (see Chapter 6). When a TrueCopy pair is deleted from the RCU, the RCU changes the S-VOL pair status to SMPL but does not change the pair status of the corresponding P-VOL. When the MCU performs the next TrueCopy operation for that pair, the MCU detects that the S-VOL status has changed and changes the P-VOL status to PSUS-pairsplit-S to RCU. To restart a pair that was deleted from the RCU, you must first delete the pair from the MCU, and then create the pair from the MCU using the appropriate initial copy option (Entire Volume or None) to restart the pair.

If you want to delete all TrueCopy Async pairs in a consistency group, you must delete the pairs from the MCU. The TrueCopy pair status will change to Deleting when the pairsplit-S operation is accepted by the MCU and RCU, and then to SMPL after the internal pairsplit-S process is complete. If you want to delete TrueCopy Async pairs according to their consistency status (e.g., for disaster recovery), you must delete the pairs from the RCU.

WARNING: When you delete a TrueCopy pair from the RCU, remember that the S-VOL and P-VOL are identical (e.g., same volume label), and take appropriate precautions to prevent a system problem due to duplicate volumes.

WARNING: As a general rule, when you want to delete a TrueCopy Asynchronous pair from the MCU, it is strongly recommended that you perform the pairsplit-S operation after the update copy operation is completed. If you request the pairsplit-S operation while the update copy process is still in progress, it may take a long time to complete the pairsplit-S operation. However, when you urgently need to delete a TCA pair, you can perform the pairsplit-S operation from the RCU. In this case, you will find the PSUE status at the MCU after performing the pairsplit-S operation from the RCU.

The Pairsplit-S panel (see Figure 5.15) allows you to delete TrueCopy pairs and select the pairdelete options. To open the Pairsplit-S panel, select the **Pair Operations** tab, select any item in the outline list (subsystem, CU image, or port), select the desired pair(s), right-click, and then select **Pairsplit-S**.
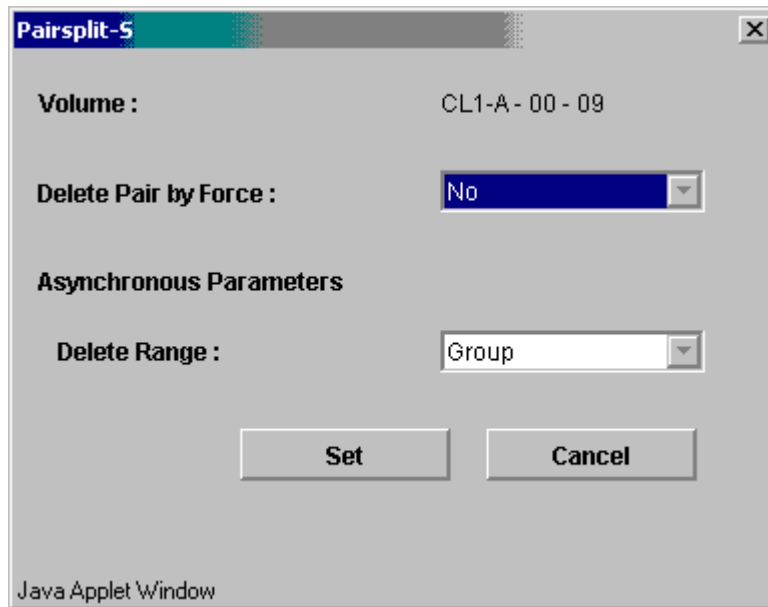
Figure 5.15   Pairsplit-S Panel for Synchronous and Asynchronous Pairs

Volume: Port - Group - LUN of the selected volume.

Delete Pair by Force:

■ **Yes**: 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.

■ **No**: The pair(s) will only be deleted if the MCU is able to change the pair status of the P-VOL and S-VOL to SMPL.

When the status of the pair(s) to be deleted is SMPL or Deleting, the default setting is Yes (cannot be changed). Otherwise, the default setting is No.

Asynchronous Parameters:

■ **Delete Range**: The delete range option simplifies disaster recovery operations for TrueCopy Asynchronous consistency groups at the RCU (secondary (remote) subsystem).

– **Group** (MCU or RCU): the MCU/RCU will delete all TrueCopy 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 TrueCopy Async pairs which have the same consistency time.

– **LU** (MCU or RCU): the MCU/RCU will delete only the specified TrueCopy Async pair(s). This option can be used to remove individual LUs from consistency groups.

The default delete range settings are:
– When two or more pairs are selected: LU.
– When one pair is selected from the MCU (P-VOL is selected): Group.
– When one pair is selected from the RCU (S-VOL is selected): C/T.

Note: When the Delete Pair By Force option is selected, the Delete Range option is set to Group to protect the integrity of the consistency group.

To delete one or more TrueCopy volume pairs:

1. Connect to the MCU or RCU* of the pair(s) to be deleted, open the TrueCopy 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.

2. In the outline view, select the CU image or port 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).

3. In the list view, select the pair(s) that you want to delete. Select either TrueCopy Sync or TrueCopy Async pairs (not both). If you plan to use the C/T or Group delete range option, select only one TrueCopy Asynchronous pair in the group.

4. Right-click, and select **Pairsplit-S** to open the Pairsplit-S panel (refer to Figure 5.15).

5. On the Pairsplit-S panel, select the desired pairdelete options, and select **Set** to close the Pairsplit-S panel. The list view now displays the requested pairsplit-S operation(s).

6. Verify the requested operation(s) in the list view (see Figure 5.16). Make sure that the pairdelete 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**.

7. If you want to execute the requested pairsplit-S operation(s) as quickly as possible, select the **Use Time-Saving Mode** box (above the list view).

8. 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**.

9. On the **Pair Operations** tab, verify that the pairsplit-S operation(s) is/are completed successfully (SMPL or Deleting then SMPL status, not PSUE). To monitor the progress of the pairsplit-S operation(s), select **Refresh** to update the information in the list view, or use the Pairdisplay panel (see section 5.5) to monitor the detailed status of each pair.

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 main panel for which pair(s) the pairsplit-S operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed pair(s), and retry the pairsplit-S operation.

Port	Group	LUN	S/N	SSID	Mode	Range
CL1-A	00	0C	11111	0011	No	Group

Figure 5.16 Verifying the Pairsplit-S Operation(s)

5.9   Using TrueCopy for Data Migration and Duplication

5.9.1   Data Migration Using TrueCopy Synchronous

TrueCopy Synchronous can be used for device or workload migration with minimal impact to host applications. You may need to migrate data from one LU (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 an LU to accommodate other activities (e.g., repair), or

- To relocate LUs to balance workloads and distribute I/O activity evenly within and across subsystems for the purpose of improving subsystem and system performance.

The TrueCopy initial copy operation copies the entire contents of the P-VOL to the S-VOL. The P-VOL and S-VOL are identical and synchronized when the initial copy operation completes and the pair status changes from COPY to PAIR. The TrueCopy pair is then deleted to change the state of the devices to SMPL, and host high-availability (HA) software can then be used to complete the data migration nondisruptively. To support host-based application automation, data migration using TrueCopy must be managed by integrating the Command Control Interface (CCI) software with TrueCopy operations and host HA software functions.

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 TrueCopy Synchronous to migrate data from one volume to another:

1. Vary the S-VOL(s) offline from all attached hosts. The S-VOLs are the target volumes onto which you are migrating the data. The P-VOLs (source volumes) can remain online.

2. Connect to the subsystem containing the volume(s) to be migrated, and then start the TrueCopy software. 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. On the TrueCopy main panel, select the desired CU image, select the LU(s) to be migrated, and start the TrueCopy Sync pair(s) (see section 5.3).

4. Monitor the progress of the initial copy operation(s) and the status of the pair(s) on the TrueCopy main panel. Refresh the panel as needed. When the status has changed from COPY to PAIR, the P-VOL and S-VOL are identical and synchronized.

5. If you are not using CCI commands and host software to complete the migration, use the following procedure to stop using the P-VOL(s) and switch to the S-VOL(s):

   a) Stop all host updates to the P-VOL(s).

   b) When all update activity to the P-VOL(s) has stopped, connect to the MCU, select the correct CU image, and delete the TrueCopy volume pair(s) (see section 5.8).

   c) If the P-VOL(s) and S-VOL(s) are attached to the same host, vary the P-VOL(s) offline first, and then vary the S-VOL(s) online. The P-VOL(s) and S-VOL(s) have the same volume labels and cannot be online to the same host(s) at the same time.

d) If you want to keep the volumes synchronized, establish the same TrueCopy pair(s) in the reverse direction using the **None** initial copy option (see section 5.3.1). If the original P-VOL(s) will be temporarily unavailable for update copy operations, you can split the new pair(s) (pairsplit-r) so that the new MCU keeps track of changes.

e) Start the applications with the S-VOL(s). When the original P-VOL(s) become available, you can resume the pair(s) (see section 5.7).

5.9.2 Point-in-Time (PiT) Data Duplication Using TrueCopy Asynchronous

Hitachi TrueCopy Asynchronous enables you to make Point-in-Time (PiT) duplicates of groups of volumes. The TrueCopy Async **Group** and **Drain** pairsplit options can be used together to create a PiT copy, relative to an application, of an entire TrueCopy Async consistency group of volumes. To produce a PiT duplicate of an existing TrueCopy Async consistency group:

1. Stop all host updates to all TrueCopy Async P-VOLs in the group.

2. After all P-VOL updates have completed, split the TrueCopy Async group using the **Group** and **Drain** pairsplit options. If you are splitting the group at the main site, issue the pairsplit-r/group command to one P-VOL in the MCU. If you are splitting the group at the remote site, issue the pairsplit-r/group command to one S-VOL in the RCU.

    Note: The copy pending timeout setting for the group determines the maximum amount of time that the pairsplit-r/drain operation can take (see description of **Drain** above).

3. When the status of all TrueCopy Async pairs in the group has changed to **PSUS**, the duplicate set of volumes is complete. If desired, you can restart the application at the main site.

5.10 Powering Off/On TrueCopy Components

The user is responsible for controlling power-off activities for subsystems involved in TrueCopy operations. If you need to power off the 9900V subsystem, please call your Hitachi Data Systems representative or the Support Center for assistance. The following sections provide instructions for performing planned outages of TrueCopy components.

If power is removed from an MCU while TrueCopy operations are in progress, the TrueCopy pairs are not affected, but the update sequence consistency of the TrueCopy Async groups at the RCU may be affected (see section 5.10.1 for further information). When power is restored to an MCU, the MCU communicates with its RCU(s) to confirm the pair status of the S-VOLs. Make sure that TrueCopy communications are fully restored (all paths have normal status) before beginning I/O operations to the P-VOLs. If the MCU accepts a write I/O operation for a P-VOL before this confirmation is complete, the MCU will suspend the pair and change the status of the P-VOL to *suspended-by RCU* (the MCU will not be able to change the pair status of the S-VOL).

If power is removed from an RCU or remote copy connection while TrueCopy operations are in progress, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs reporting the failures. The MCU will change the status of the P-VOLs to *suspended-by RCU* but will not be able to change the status of the S-VOLs.

Note: If an MCU/RCU is powered off and its backup batteries are fully discharged while TrueCopy pairs are suspended, the P-VOL/S-VOL cylinder/track maps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders/tracks of all suspended TrueCopy P-VOLs as modified, so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed. (The S-VOL cylinder/track map is used for TrueCopy Async operations and for the TrueCopy S-VOL write enable option.)

5.10.1 Planned Outage of the MCU

A planned MCU outage does not affect TrueCopy Synchronous. For TrueCopy Asynchronous operations, the MCU must communicate with the RCU even when there are no P-VOL update I/Os from the primary system. During the power-off sequence, the MCU will automatically suspend all TrueCopy Async pairs in the PAIR and COPY states (suspend type = MCU P/S-OFF). During the power-on-reset sequence, the MCU will automatically resume these suspended pairs (pairs with other suspend types are not automatically resumed).

5.10.2 Planned Outage of the RCU or Remote Copy Connection

You must split all affected TrueCopy pairs prior to a planned outage of an RCU or of a remote copy connection component (e.g., switch, ESCON® director, channel extender). If you do not split the pairs first, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs reporting the failures. To perform a planned outage of a TrueCopy RCU or remote copy connection component:

1. Identify all TrueCopy P-VOLs which will be affected by the equipment outage. You need to know the MCU, CU image, and ID (port, TID, LUN) for each of these P-VOLs.

   a) For RCU power-off, identify all P-VOLs which are paired with S-VOLs in the RCU to be powered off.

   a) For remote copy connection outage, identify all P-VOLs in all MCUs which use the path/component to be powered off.

2. Connect to each MCU which contains affected P-VOLs, and split all affected TrueCopy pairs. Make sure to confirm the pair status changes (**Pair Operations** tab or Pairdisplay panel).

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 (pairresync) all TrueCopy pairs at each MCU. Make sure to confirm the pair status changes.

5.10.3 Planned Outage of the MCU and RCU

When you plan an outage of TrueCopy 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 TrueCopy 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 **Time Out (RCU ready)** group option (see section 2.4.1) for each TrueCopy Async group with S-VOLs in the RCU(s) to be powered off.

2. Perform the planned outage of the MCU(s) as described in section 5.10.1. 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 split those TrueCopy pairs before powering off the RCU.

4. Perform the planned outage of the RCU(s) as described in section 5.10.2.

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 split any pairs in step (3), you can also resume (pairresync) those pairs now.

Chapter 6   TrueCopy Disaster Recovery Operations

6.1   Preparing for Disaster Recovery

The type of disaster and the status of the TrueCopy volume pairs will determine the best approach for disaster recovery. For example, if all TrueCopy volume pairs are in the **PAIR** state when a total system failure occurs at a single point in time, the S-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.

The major steps in preparing for disaster recovery are:

1. Identify the volumes and groups which contain important files and data for disaster recovery. In addition to supporting TrueCopy remote copy operations as well as CCI 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 Remote Console PC and TrueCopy hardware and software, and establish TrueCopy operations for the volumes and groups identified in step (1). Make sure to select the proper CU images/ports to access the desired volumes. Refer to Chapter 3 for TrueCopy installation instructions. Refer to Chapter 4 for instructions on performing TrueCopy configuration operations. Refer to Chapter 5 for instructions on performing TrueCopy pair operations.

3. Use the appropriate combination of TrueCopy options for disaster recovery:

    —   TrueCopy Async **offloading timer** option (see section 4.3.1) and **Time Out (Copy Pending)** 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.

        Note: The offloading timer value should be less than the HBA timeout value.

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

    —   TrueCopy Async **Error Level** pair option, and TrueCopy Synchronous **P-VOL Fence Level** pair option (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. Make sure that the host system at the primary site is configured to receive sense information from the 9900V MCUs (e.g., via CCI or SNMP).

6. Install and configure host failover software between the main and remote sites. Host failover capability is essential if you use the fence level setting of **Status** or **Never** for any TrueCopy volume pairs.

6.1.1   Considering the P-VOL Fence Level Setting

The P-VOL fence level setting (see section 5.4) for each TrueCopy Synchronous volume pair determines whether the P-VOL will be fenced when TrueCopy remote copy operations fail. Table 6.1 summarizes the effect of the fence level setting on a TrueCopy Sync P-VOL.

Note: The P-VOL fence level setting does not apply to TrueCopy Asynchronous pairs. TrueCopy Async P-VOLs are never fenced due to suspension of the pair.

Table 6.1   Effect of the Fence Level Setting on a TrueCopy P-VOL

Type of Failure		Fence Level Setting		
		Data	Status	Never
The update copy operation failed, and the MCU was able to change the status of the S-VOL to PSUE.	Write I/O operations to the P-VOL will be:	REJECTED	Accepted	Accepted
The update copy operation failed, and the MCU was NOT able to change the status of the S-VOL to PSUE.	Write I/O operations to the P-VOL will be:	REJECTED	REJECTED	Accepted

Data. When **Data** is selected, the P-VOL will be fenced if an update copy operation fails. This P-VOL fence level setting ensures that the S-VOL remains identical to the P-VOL once the TrueCopy volume pair is synchronized, but makes the P-VOL inaccessible for updates whenever TrueCopy 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 S-VOL during disaster recovery efforts. This setting is also designed for applications which can continue to operate with another device pair.

Status. When **Status** is selected, the P-VOL is fenced only if the MCU is not able to change the S-VOL pair status to **PSUE**. If the MCU successfully changes the S-VOL pair status to **PSUE**, subsequent write I/O operations to the P-VOL will be accepted, and the MCU will keep track of updates to the P-VOL. This allows the volume pair to be resumed quickly using the pairresync operation (out-of-sync-cylinders/tracks only). This setting will also reduce the amount of time required to analyze the S-VOL currency during disaster recovery.

Never. When **Never** is selected, the P-VOL is never fenced when the pair is suspended. This P-VOL fence level setting ensures that the P-VOL remains available to applications for updates, even if all TrueCopy copy operations have failed. The S-VOL may no longer be in sync with the P-VOL, but the MCU will keep track of updates to the P-VOL while the pair is suspended. Host failover capability is essential if this fence level setting is used. For disaster recovery, the currency of the S-VOL is determined by using the sense information transferred via host failover or by comparing the S-VOL contents with other files confirmed to be current.

6.1.2   Setting the Fence Level

When a take-over by the S-VOL occurs as shown in Figure 6.1 (two errors have already occurred), Data(V) remains in the rollback process at the secondary host, and full recovery cannot be performed. To avoid this situation, you can define the fence level of the Redo log file as **Data**, so that the P-VOL returns an error if a data disagreement is expected to occur concerning a write request issued from the host. The **Data** fence level setting maintains full consistency between the Redo log file and the data file, since no data is written to the data file due to the write error at the log file. However, when the fence level is defined as **Data**, a write I/O causes an error even when processing has been suspended due to an error at the S-VOL. In this case, a take-over by the S-VOL occurs, and the significance of the duplex system will be lost. Therefore, if you define the fence level as **Data**, applications must be able to cope with write I/O errors by handling them. Systems that allow disk errors by means of multiplication can function with the **Data** fence level setting. For example, Oracle multiplies the Redo log file by itself (default = three times).
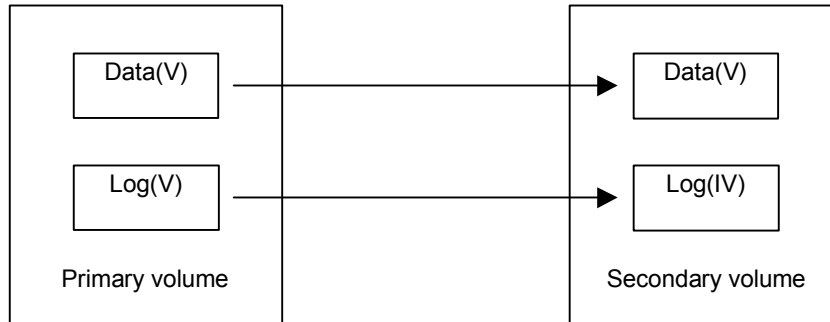
Figure 6.1   Relationship Between Log File and Data File in PAIR Status

Since most UNIX® file systems (excluding JFS and VxFS) have no journal files, the P-VOL fence level should be defined as **Never**. When a take-over by the S-VOL occurs, **fsck** is executed on the volume and the file system is cleaned up, even if the S-VOL is undefined at the secondary host. The data that will be lost depends on how much differential data is contained in the P-VOL when the S-VOL is suspended. During operation, error recovery should be performed when the suspended status (PSUE) is detected (when one error occurs).

6.1.3   Transferring Sense Information Between Sites

When the MCU (or RCU for TrueCopy Async) suspends a TrueCopy 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 S-VOL, and must be transferred to the remote site via the host failover software.

6.1.4   File and Database Recovery Procedures

When a TrueCopy Synchronous pair is suspended, or when the MCU fails due to a disaster, the S-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 TrueCopy Sync 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.

TrueCopy 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). The TrueCopy Async group consistency time (C/T) (MCU SVP time) can be 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/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., database log files which have been verified as current). To ensure the currency of these files, use the **Data** fence level setting for the TrueCopy pairs which contain these important files.

- The sense information with local time-stamp which will be transferred via host failover.

Important: Remote copy and disaster recovery procedures are inherently complex. Consult your Hitachi Data Systems account team on sense-level settings and recovery procedures.

Important: Please remember that the TrueCopy Async time-stamp and C/T information indicates MCU SVP time, not host system time.

Note: See Appendix A for information on recovering a pinned track on a TrueCopy volume.

6.2   Switching Operations to the Remote Site

If a disaster or failure occurs at the primary site, the first disaster recovery activity is to switch your operations to the secondary site. The TrueCopy Synchronous S-VOLs are recovered individually based on the pair status and P-VOL fence level information for each pair. The TrueCopy Async S-VOLs are recovered based on pair status and consistency status (at the RCU).

The basic procedures for switching operations to the remote backup site are:

1. Analyze the currency of the TrueCopy Synchronous S-VOLs (see section 6.2.1) and the consistency of the TrueCopy Asynchronous S-VOLs (see section 6.2.2).

2. Record the consistency time (C/T) of each TrueCopy Async group. The suspended TrueCopy Async S-VOLs with consistency status of *group* will indicate the same C/T. The consistency status and consistency time are displayed only at the RCU.

    Important: Remember that the TrueCopy Async time-stamp and C/T information indicates MCU SVP time, not host system time.

3. Perform file recovery as needed (see section 6.1.4). The C/T of each TrueCopy Async group can be used to retrieve lost updates.

4. At the remote site, connect to each RCU, and delete all TrueCopy Synchronous pairs. For TrueCopy Asynchronous pairs, delete all consistent pairs in a group at the same time using the pairsplit-S command with the **C/T** delete range option. This option prevents you from accidentally using inconsistent pairs for disaster recovery.

    Caution: Once an S-VOL changes to simplex, you cannot distinguish it from a non-TrueCopy simplex volume. The TrueCopy Async consistency time is also discarded when the pair is deleted.

5. If necessary, use the logical volume manager to change the volume labels of the S-VOLs.

6. Make sure that all required file recovery procedures have been completed before varying the S-VOLs online.

7. At this point you may start critical applications at the remote site with the previous S-VOLs taking the place of their P-VOLs.

6.2.1   Analyzing the Currency of TrueCopy Synchronous S-VOLs

Table 6.2 shows how to determine the currency of a TrueCopy Synchronous S-VOL based on its pair status and P-VOL fence level setting. For TrueCopy Sync pairs with a P-VOL fence level setting of **Never**, further analysis will be required to determine the currency of these S-VOLs. The currency of these S-VOLs can be determined by using the sense information transferred via the host failover, or by comparing the contents of the S-VOL with other files which are confirmed to be current (e.g., database log files). These S-VOLs should be recovered using the files which are confirmed to be current.

Note: Actual data recovery must be done using recovery point data in the database redo log.

Table 6.2   Analyzing the Currency of TrueCopy Synchronous S-VOLs

Status of S-VOL	Fence Level	Currency of S-VOL
SMPL	Data Status Never	**Inconsistent**. This S-VOL does not belong to a TrueCopy volume pair. (*Note:* Even if you established a TrueCopy pair for this volume, you must regard this volume as inconsistent.)
COPY	Data Status Never	**Inconsistent**. This S-VOL is not synchronized because not all cylinders have been copied from the P-VOL yet. This S-VOL must be initialized (or copied from the P-VOL at a later time).
PAIR	Data Status	**Current**. This S-VOL is synchronized with its P-VOL.
	Never	**Needs to be analyzed**. This S-VOL requires further analysis to determine its level of currency.
PSUE - initial copy failed	Data Status Never	**Inconsistent**. This S-VOL is not synchronized because not all cylinders/tracks have been copied from the P-VOL yet. This S-VOL must be initialized (or copied from the P-VOL at a later time).
PSUS - S-VOL by operator	Data Status Never	**Suspect**. This S-VOL is not synchronized with its P-VOL if any write I/Os were issued to the P-VOL after the pair was split. This pair should be restarted using the **Entire Volume** initial copy option, but the **None** option can be used if you are sure that no data on the P-VOL changed.
PSUS/PSUE - all other types	Data	**Current**. This S-VOL is synchronized with its P-VOL.
	Status Never	**Suspect**. This S-VOL is not synchronized with its P-VOL if any write I/Os were issued to the P-VOL after the pair was split or suspended. Restore the consistency of this S-VOL and update it, if required. The time of suspension indicated on the Pairdisplay panel will help to determine the last time this S-VOL was updated.

6.2.2 Analyzing the Consistency of TrueCopy Asynchronous S-VOLs

Table 6.3 shows how to determine the consistency of a TrueCopy Async S-VOL based on its pair status and consistency status. For TrueCopy Async S-VOLs with a consistency status of **LU**, 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 S-VOLs. The currency of these S-VOLs can be determined by using the sense information transferred via host failover software or by comparing the contents of the S-VOL with other files which are confirmed to be current (e.g., database log files). These S-VOLs should be recovered using the files which are confirmed to be current. *Important:* Remember that the TrueCopy Async time-stamp and consistency time information indicates MCU SVP time, not host system time.

Note: Actual data recovery must be done using recovery point data in the database redo log.

Table 6.3   Analyzing the Consistency of TrueCopy Asynchronous S-VOLs

Status of S-VOL	Usable for Recovery?	Description
PAIR COPY SMPL	No No No	These states do not usually occur during TrueCopy Asynchronous disaster recovery, because the RCU suspends all TrueCopy Async S-VOLs when communication with the MCU is lost. TrueCopy Async S-VOLs in these states should not be used for disaster recovery. *Note:* Simplex volumes cannot be distinguished from S-VOLs which have already been deleted by the pairsplit-S operation.
PSUE-Group	Yes	The update sequence consistency across these S-VOLs is ensured at the point in time indicated by the consistency time. These S-VOLs can be used for disaster recovery at the secondary system. *Note:* Updates which were performed at the primary system after the indicated consistency time were probably lost.
PSUE-LU	No	The contents of this S-VOL may be behind the other S-VOLs in the consistency group. If this volume must be consistent with the other volumes in the same group, this S-VOL should not be used for disaster recovery. The cause for this status is: – The TrueCopy Async **Error Level** pair option for this pair is **LU** (not **Group)**, AND – 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 Primary Site

Once the applications are running at the secondary (remote) site, the next activity is to restore the primary (main) site and transfer operations back to the primary site. To transfer operations to the primary site:

1. Bring up the host server(s) at the primary site, and make sure that all TrueCopy components are fully operational.

2. At the primary site, delete all TrueCopy pairs at the MCUs. The **Delete Pair by Force** option must be used, because the previous S-VOLs are in the SMPL state at the secondary site.

3. At the main site, delete all TrueCopy Async 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 ordinary target ports, or change the existing RCPs to LCPs.

6. If you plan to use the same switches, change the operating mode to the opposite direction (see section 3.3.1).

    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 appropriate ports to enable TrueCopy operations in the reverse direction (change target ports to initiator ports for fibre, change LCPs to RCPs for serial). This enables the original RCUs to send TrueCopy remote copy operations to the original MCUs to bring the original P-VOLs up to date.

8. At the remote site, establish the same TrueCopy Async groups and TrueCopy pairs in the reverse direction to synchronize the original P-VOLs with the S-VOLs. Make sure to use the **Entire Volume** initial copy option.

6.4   Resuming Normal Operations at the Primary Site

Once the TrueCopy pairs have been established in the reverse direction, you are ready to resume normal operations at the primary (main) site. Remember that the TrueCopy terminology is now reversed: the original RCUs and S-VOLs (secondary site) are now the MCUs and P-VOLs, and the original MCUs and P-VOLs (primary site) are now the RCUs and S-VOLs.

To resume normal operations at the primary site:

1. At the secondary site, make sure that all TrueCopy pairs are in the PAIR (duplex) state. This indicates that the TrueCopy initial copy operations are complete.

2. Halt the applications at the remote site, and vary the P-VOLs (original S-VOLs) offline at the remote site. This maintains synchronization of the TrueCopy Sync pairs.

3. Split (pairsplit-r) all TrueCopy pairs at the MCUs (original RCUs) to destage any pending data from cache. Confirm that the pairs are split (PSUS) before proceeding. If an error occurs, resolve it before proceeding.

4. Delete all TrueCopy pairs at the MCUs (original RCUs). You do not need to use the **Delete Pair by Force** option. For TrueCopy Async pairs, the MCU and RCU complete all pending updates before changing the pair status to SMPL.

5. Change the TrueCopy settings at the MCUs (original RCUs) to prepare for normal TrueCopy operations. Delete the TrueCopy Async 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, change RCPs back to LCPs).

6. If you plan to use the same switches, change the operating mode back to the original direction (see section 3.3.1).

    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 primary site, configure the initiator ports or RCPs, add the RCUs, and add the TrueCopy Async groups.

8. At the primary site, establish all TrueCopy groups and pairs in the original direction. You may use the **None** initial copy option because all P-VOLs and S-VOLs are synchronized. If there is any possibility that the volumes are not 100% synchronized, use the **Entire Volume** initial copy option to be safe.

9. Vary the MCU and P-VOLs online, and start the applications at the primary site.

Chapter 7   Troubleshooting

7.1   Troubleshooting TrueCopy Operations

Table 7.1 provides general troubleshooting information for Hitachi TrueCopy. Table 7.2 provides troubleshooting information for RCU paths. Table 7.3 provides troubleshooting information for suspended TrueCopy pairs (Synchronous and Asynchronous). Table 7.4 provides troubleshooting information for TrueCopy Asynchronous suspension conditions.

See section 7.2 for a description of the TrueCopy error messages displayed on the Remote Console PC. See section 7.3 for a brief description of the 9900V service information messages (SIMs). If you need to call the Hitachi Data Systems Support Center, please refer to section 7.4 for instructions.

Table 7.1   General TrueCopy Troubleshooting

Error	Corrective Action
The Remote Console PC hangs, or TrueCopy operations do not function properly.	Make sure that the problem is not being caused by the PC or Ethernet hardware or software, and restart the PC. Restarting the Remote Console PC does not affect subsystem operations.
	Make sure that all TrueCopy requirements and restrictions are met (e.g., same LU type). See sections 3.1 and 3.2.
	Make sure that the MCU and RCU and remote copy connections are powered on and fully operational (NVS, cache).
	Check all input values and parameters to make sure that you entered the correct information on the Remote Console PC (e.g., RCU S/N and SSID, path parameters, P-VOL and S-VOL IDs).
An initiator or RCP channel-enable LED indicator (on the 9900V control panel) is off or flashing.	Please call the Hitachi Data Systems Support Center for assistance.
The pairs and/or RCUs are not displaying correctly.	Make sure that the correct CU image is selected.
A TrueCopy error message is displayed on the PC.	Resolve the error, and then try the TrueCopy operation again.
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 pair status (Pairdisplay panel), and see Table 7.3.
Paircreate or pairresync operation resulted in a timeout error.	Hardware failure: If the timeout error was caused by a hardware failure, a SIM will be generated. If this occurs, call service personnel, and retry TrueCopy operations after the problem is fixed.
	Heavy workload: If no SIM was generated, wait for a while (5 or 6 minutes), then check the pair status of the pair(s) being created or resumed. If the pair status changed correctly, the failed operation completed after the timeout message was issued. If the pair status did not change as expected, heavy workload might have prevented the TrueCopy operation from being completed. In this case, retry the TrueCopy operation again when the subsystem has a lighter workload.
	If a communication error between the Remote Console and SVP occurs, refer to the *9900 V Series Remote Console User's Guide* for instructions.
There is a pinned track on a TrueCopy volume.	See Appendix A for instructions.

Table 7.2   Troubleshooting RCU Path Status Problems

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 (port, link address, logical address). Fibre: make sure the correct MCU port is configured as an initiator port and the correct RCU port is configured as an RCU target port. Serial: make sure the correct MCU port is configured as an RCP and the correct RCU port is configured as an LCP.
Communication Time Out	Communication between the MCU and RCU timed out.	Make sure the RCU is powered on and fully functional (NVS, cache). Make sure that the remote copy connection hardware (cables, connectors, switches, ESCDs, extender devices, communication lines, and all other devices connected to the extenders) are properly configured and functional. 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 to each RCU. Make sure that 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 (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. Fibre: 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.	Fibre: make sure the correct MCU port is configured as an initiator port and the correct RCU port is configured as an RCU target port. Serial: make sure the correct MCU port is configured as an RCP and the correct RCU port is configured as an LCP. Make sure that you entered the correct RCU S/N and SSID and path parameters (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.	Make sure that you entered the correct RCU port number. Correct the port number if necessary. Make sure that the MCU and RCU are physically connected. 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 RCU port is not configured as an RCU target port.	Make sure that the RCU port is configured as an RCU target port.

Table 7.2   Troubleshooting RCU Path Status Problems (continued)

Path Status	Description	Corrective Action
Communication Failed	The MCU connected to the RCU successfully, but logical communication timeout occured.	Make sure that the RCU port and remote copy connection hardware (cables and switches) are properly configured and functioning.
<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 Pairs

| Suspend Type	Applies to	Description	Corrective Action
PSUE, by RCU	P-VOL	The MCU detected an error condition at the RCU which caused the MCU to suspend the volume pair. The S-VOL suspend type is *by MCU*.	Clear the error condition at the RCU or S-VOL. If you need to access the S-VOL, split the pair (pairsplit-r) from the MCU using the S-VOL write enable option. Resume the pair (pairresync) from the MCU after the error condition is cleared.
PSUE, S-VOL Failure	P-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 S-VOL is usually *by MCU*.	Check the path status on the RCU Status panel (see section 4.2.6). Clear any error conditions at the RCU or S-VOL. If you need to access the S-VOL, split the pair (pairsplit-r) from the MCU using the S-VOL write enable option. Resume the pair (pairresync) from the MCU after the error condition is cleared.
PSUE, MCU IMPL	P-VOL, S-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 (pairresync) from the MCU. The MCU will perform an entire initial copy operation in response to the pairresync request.
PSUE, Initial Copy Failed	P-VOL, S-VOL	The MCU suspended this pair during the initial copy operation. The data on the S-VOL is not identical to the data on the P-VOL.	Delete the pair from the MCU. Clear all error conditions at the MCU, P-VOL, RCU, and S-VOL. Restart the initial copy operation using the Paircreate panel.
PSUE, MCU P/S-OFF	S-VOL (Async)	The MCU suspended all TrueCopy Async pairs due to MCU power-off.	None. The MCU will automatically resume these TrueCopy Async pairs during power-on.
PSUS, Sidefile Overflow	P-VOL S-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 TrueCopy Async 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 TrueCopy Async volume pairs to be suspended.

Table 7.4   Resolving TrueCopy Async 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. The pending recordset cannot be retained because one side of cache storage or shared memory has been blocked due to hardware failure. MCU-Creating/sending recordset failed due to unrecoverable hardware failure. RCU-Reading/settling recordset failed due to unrecoverable hardware failure. The drive parity group was in correction-access status while the TrueCopy pair was in COPY state.	DB0x DB1x DB2x	According to SIM, remove the hardware blockade or failure. Re-establish failed volume pairs (pairresync).
MCU-RCU communication	During the power-on-reset sequence, the MCU could not communicate with the RCU within the specified RCU ready timeout. 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 DB1x	Remove the failed condition at the RCU/MCU or on the remote copy connection. Re-establish failed pairs (pairresync).
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. No recordset could be sent within the specified copy pending timeout. 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 (pairsplit-S). Reconsider the performance resources necessary, and increase resources as needed (cache amount, number of MCU-RCU paths, etc.). Re-establish failed pairs (paircreate).
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. Re-establish failed pairs (pairresync).
MCU planned outage	The TrueCopy Async 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 Error Codes

The Hitachi Remote Console – Storage Navigator software displays error messages when error conditions occur during TrueCopy operations (see Figure 7.1). The error message describes the error and provides a part code and 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 error code(s). Please refer to the 9900V document *Hitachi Lightning 9900™ V Series Remote Console Error Codes* (MK-92RD132) for a list of the error codes displayed on the 9900V Remote Console PC.
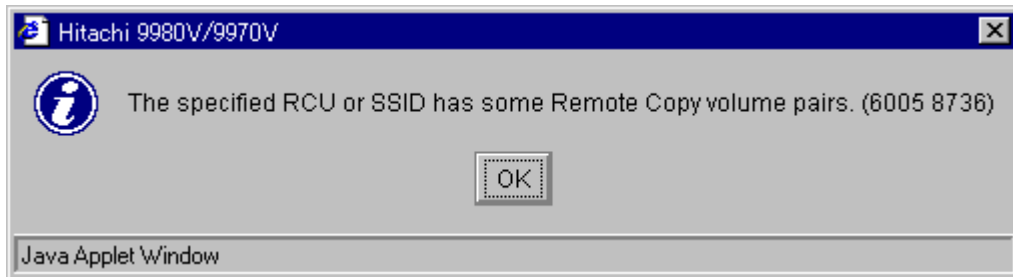
Delete RCU failed because the RCU still contains one or more pairs with the current MCU.

Figure 7.1   TrueCopy Error Message for Failed Delete RCU Operation

7.3   Service Information Messages (SIMs)

The Hitachi Lightning 9900™ V Series subsystem generates a SIM when it is necessary to notify the user of a possible service requirement for the subsystem. SIMs can be generated by the channel and storage path microprocessors of the subsystem and by the service processor (SVP) of the subsystem. The SVP reports all SIMs related to TrueCopy operations. 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 SIMs are classified according to severity for reporting and logging purposes: service, moderate, serious, or acute. All SIMs are logged on the 9900V SVP and displayed on the Remote Console PC. During TrueCopy operations, the MCU and RCU generate a service SIM each time the pair status of the P-VOL or S-VOL changes for any reason, including normal status transitions (e.g., COPY to PAIR). SIMs generated by the MCU will include the P-VOL device ID (byte 13), and SIMs generated by the RCU will include the S-VOL device ID (byte 13). For further information on the 9900V SIMs, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide* and/or the *Hitachi Lightning 9900™ V Series User and Reference Guide*, or call the Hitachi Data Systems Support Center for assistance.

If SNMP is installed and operational for the 9900V subsystem, each SIM will result in an SNMP trap being sent to the appropriate host(s). For further information on SNMP operations, please refer to the *Hitachi Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator User's Guide*, or contact your Hitachi Data Systems account team.

7.4   Calling the 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 Hitachi Remote Console – Storage Navigator User's Guide*),

- The circumstances surrounding the error or failure,

- The exact content of any error messages displayed on the host system(s),

- The TrueCopy (or other) error code(s) displayed by the 9900V Remote Console software, and

- The reference codes and severity levels of the recent service information messages (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 Pinned Track Recovery for TrueCopy Volumes

If a pinned track occurs on a TrueCopy P-VOL or S-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 TrueCopy pair (pairsplit-S) which contains the volume with the pinned track.

3. If the volume is offline (e.g., S-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, or contact your Hitachi Data Systems representative for assistance in recovering the pinned track.

5. If the volume was previously offline (e.g., S-VOL), make sure to vary the volume offline again.

6. Restart the volume pair using the Paircreate panel, and make sure to use the **Entire Volume** initial copy option.

Acronyms and Abbreviations

Adr	address
ATM	asynchronous transfer mode
CCI	Command Control Interface
CNT	Computer Network Technology Corporation
CU	control unit
DASD	direct access storage device
DB2	Database 2
DFSMS	Data Facility Storage Management Subsystem
DWL	duplex write line
ESCON®	Enterprise System Connection (IBM trademark for optical channels)
ESCD	ESCON® director
ExSA	extended serial adapters
HBA	host bus adapter
HRX	Hitachi RapidXchange
I/O	input/output
IBM	International Business Machines Corporation
IMPL	initial microprogram load
IMS	Information Management System
IOCDS	I/O configuration dataset
LAN	local-area network
LCP	local control port
LED	light-emitting diode
LUN	logical unit (also called device emulation or device type)
Mb/s	megabits per second
MCU	main control unit
NVS	nonvolatile storage
PC	personal computer system
PCB	printed circuit board
P/K	package
PSUE	pair suspended-error
PSUS	pair suspended-split
P-VOL	primary volume
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
RIO	remote IO

SIM	service information message
SMPL	simplex
S/N	serial number (also abbreviated as s#)
SNMP	simple network management protocol
SSB	sense byte
SSID	storage subsystem identification
S-VOL	secondary volume
SVP	service processor
sync	synchronous
s#	serial number (also abbreviated as S/N)
VOL	volume