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Performing TrueCopy Configuration Operations

Starting TrueCopy

Asynchronous Operations Window

Performing TrueCopy Configuration Operations

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Registering an RCU

Configuring the Host Interface Ports

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Registering an RCU

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• “Preparing for TrueCopy Operations” on page 45
• “Starting TrueCopy” on page 65
• “Performing TrueCopy Configuration Operations” on page 66
• “Performing TrueCopy Pair Operations” on page 115
• “TrueCopy Disaster Recovery Operations” on page 140
• “Troubleshooting” on page 147
• “Using PPRC Commands for TrueCopy” on page 153
• “Pinned Track Recovery for TrueCopy Volumes” on page 183
• “SIM Reporting” on page 183
• “TrueCopy Scripting” on page 187
• “HXRC Device Blocking and Load Balancing” on page 212

Supported storage platforms and firmware

In this guide, the term array refers to the following storage platforms:

• HP StorageWorks XP12000 Disk Array
• HP StorageWorks XP10000 Disk Array
• HP StorageWorks 200 Storage Virtualization System

For information about required firmware versions, see the HP StorageWorks XP Remote Web Console user guide for XP12000/XP10000/SVS200.

Intended audience

This guide is intended for customers and HP authorized service providers experienced with the following:

• Disk array hardware and software
• Storage systems

Prerequisites

Prerequisites for using this product include:

• Installation of the license key for this product
• Set up the HP StorageWorks XP disk arrays

Related documentation

In addition to this guide, please refer to other documents for this product:

• HP StorageWorks Command View XP User Guide for XP Disk Arrays
• Hitachi HPAV for z/OS® User Guide
• Planning for IBM® Remote Copy

These and other HP documents can be found on an HP web site: http://www.hp.com/support/.
Table 1  Document conventions

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<td>Medium blue text: Figure 1</td>
<td>Cross-reference links and e-mail addresses</td>
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<td>Medium blue, underlined text (<a href="http://www.hp.com">http://www.hp.com</a>)</td>
<td>Web site addresses</td>
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**Bold font**
- Key names
- Text typed into a GUI element, such as into a box
- GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes

**Italics font**
- Text emphasis

**Monospace font**
- File and directory names
- System output
- Code
- Text typed at the command-line

**Monospace, italic font**
- Code variables
- Command-line variables

**Monospace, bold font**
- Emphasis of file and directory names, system output, code, and text typed at the command-line

⚠ **CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

¶ **IMPORTANT:** Provides clarifying information or specific instructions.

¶ **NOTE:** Provides additional information.

¶ **TIP:** Provides helpful hints and shortcuts.

**HP technical support**

Telephone numbers for worldwide technical support are listed on the HP web site: [http://www.hp.com/support/](http://www.hp.com/support/).

Collect the following information before calling:
- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

For continuous quality improvement, calls may be recorded or monitored.
Subscription service

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• http://www.hp.com/support
TrueCopy (TC390) creates and maintains remote copies of the S/390® data stored on the XP1024/XP128/XP12000/XP10000 for data duplication, backup, and disaster recovery purposes. TC390 provides synchronous and asynchronous copy modes to accommodate a wide variety of user requirements and data copy/movement scenarios. TrueCopy Asynchronous (TC390A) provides a superior hardware-based solution for data duplication, data migration, remote copy, and disaster recovery tasks.

NOTE: This manual refers to the "z/OS" operating system, however, other operating systems are also supported. Contact your HP account support representative for a list of supported operating systems.

NOTE: In this chapter, the term “TC390” refers to both TrueCopy Synchronous and TrueCopy Asynchronous unless otherwise noted.

TC390 operations are nondisruptive, allowing the main (primary) volume of each TC390 pair to remain online to all hosts for both read and write I/O operations. After operations have been established, TC390 operations continue unattended to provide continuous data backup. For serial interface connection, TC390 operations can be performed across distances of up to 43 km (26.7 miles) using standard ESCON® support. For Fibre Channel connection, TC390 operations can be performed across distances of up to 30 km (18.6 miles) using single-mode longwave optical fibre cables in a switch configuration. Long-distance solutions are provided, based on user requirements and workload characteristics, using approved channel extenders and communication lines. TC390 is a key component of HP’s solutions and service offerings.

After hardware connectivity between XP1024/XP128/XP12000/XP10000 (or between XP1024/XP128/XP12000/XP10000 and other XP disk arrays) is established, TC390 operations can be performed from Command View XP or XP Remote Web Console and/or from the zSeries and S/390 system software for maximum usability:

• TC390 running under Command View XP or XP Remote Web Console displays detailed TC390 information and performs all TC390 operations. In the event of a system failure or disaster at the main site, the TC390 software also simplifies and expedites disaster recovery procedures. For operating systems that do not support Peer-to-Peer Remote Copy (PPRC) or ICKDSF PPRCOPY commands, TC390 operations are performed using Command View XP or XP Remote Web Console.

• TC390 is functionally compatible with industry-standard IBM® Peer-to-Peer Remote Copy (PPRC) host software functions. PPRC TSO commands (or ICKDSF PPRCOPY commands) combined with disaster recovery PTFs may be used to perform TC390 and disaster recovery operations on XP1024/XP128/XP12000/XP10000. TC390 supports the PPRC/Dynamic Address Switching (P/DAS) host software function so you can use TC390 to relocate volumes nondisruptively. TC390 also supports the PPRC CGROUP TSO command, which is used with IBM’s Geographically Dispersed Parallel Sysplex® (GDPS) service offering.

TC390 can be performed in conjunction with ShadowImage (SI390) (see “Other Data Duplication Features” on page 15) to provide multiple internal copies of TC390 volumes. TC390 also supports the Virtual LVI/LUN and Cache LUN XP features of the XP1024/XP128/XP12000/XP10000, ensuring that all zSeries and S/390 user data can be protected by TC390 remote copy operations. For more information on combining TC390 with other data management features, see “Combining TrueCopy with Other Data Management Operations” on page 58.

Other Data Duplication Features

In addition to TC390, the XP1024/XP128/XP12000/XP10000 provides several other data duplication features that are described below. For more information about these features, contact your HP account support representative.

Business Copy XP and ShadowImage

You can use the Business Copy (BC) XP and SI390 data duplication features to set up and maintain multiple copies of logical volumes within the same XP1024/XP128/XP12000/XP10000. BC operations
for zSeries and S/390 data are performed using the SI390 through Command View XP or XP Remote Web Console and can also be managed using the TSO and/or ICKDSF commands. BC operations for UNIX®/PC server-based data are performed using the licensed BC software through Command View XP or XP Remote Web Console or the Raid Manager software on the UNIX/PC server host.

The RAID-protected SI390 duplicates are created within the same XP1024/XP128/XP12000/XP10000 at hardware speeds. SI390 can be used in conjunction with TC390 to maintain multiple copies of critical data at your primary and/or secondary (remote) sites. For more information on combining TC390 and SI390 operations, see “Combining TrueCopy and ShadowImage” on page 62.

Hitachi Extended Remote Copy

The Hitachi Extended Remote Copy (HXRC) feature of the XP1024/XP128/XP12000/XP10000 is functionally compatible with the industry-standard IBM Extended Remote Copy (XRC) host software function and is provided as a program product. HXRC is also compatible with the DFSMS® data mover that 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 XP1024/XP128/XP12000/XP10000.

This chapter provides disk array-specific HXRC information (for example, SVP modes), but does not cover XRC operations.

SVP modes: For important information on XP1024/XP128/XP12000/XP10000 SVP modes for HXRC, refer to Table 4 on page 20.

16 session support: The XP1024/XP128/XP12000/XP10000 must be configured with 3990-6E emulation (no 3380 LVIs) and 256 LDEVs/SSID for 16 session (per disk array) support. APAR OW36948 must be applied. A disk array power cycle is required when the SSID boundary is changed (64 Û 256).

Device blocking, load balancing: For important information on HXRC device blocking support and load balancing control, refer to “HXRC Device Blocking and Load Balancing” on page 212.

Changing from 3990 to 2105: For important information and instructions on changing from 3990 to 2105 emulation for disk arrays with existing HXRC volumes, refer to “CU Emulation Types” on page 23.

HXRC operations, as well as TC390A operations, use additional cache to store the sidefile queue of asynchronous recordsets. If you are maintaining HXRC pairs and TC390A pairs, verify that your XP1024/XP128/XP12000/XP10000 has adequate cache installed and available to support your asynchronous remote copy workloads. Contact your HP account support representative to determine how much cache will be needed for your disk array configuration.

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

**NOTE:** If the ANTA5107E (RC=9014, REAS=604, or REAS=608) console message is displayed during the XADDPAIR operation, the HXRC PP option may not have been installed. Verify that the HXRC PP option is installed and if not, install the HXRC PP option.

**NOTE:** The HXRC option is only required for the 2105 CU emulation type. You can use HXRC for the 3990 controller emulation type without enabling the HXRC option.
If you use HXRC with FICON®, carefully set the path configuration. Refer to the following table.

### Table 2  HXRC path configuration with FICON

<table>
<thead>
<tr>
<th>Application Site Path (System - DKC)</th>
<th>Record Set Transfer Path (System Data Mover - DKC)</th>
<th>For Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCON</td>
<td>ESCON</td>
<td>No</td>
</tr>
<tr>
<td>ESCON</td>
<td>FICON</td>
<td>Supported</td>
</tr>
<tr>
<td>FICON</td>
<td>ESCON</td>
<td>Not Recommended¹</td>
</tr>
<tr>
<td>FICON</td>
<td>FICON</td>
<td>Supported</td>
</tr>
</tbody>
</table>

¹. If you use FICON for the path of application site, you should also use FICON for the path of System Data Mover (SDM) because of the difference in performance between FICON and ESCON.

### Continuous Access XP

As an enterprise advantage, the XP1024/XP128/XP12000/XP10000 can be concurrently connected to zSeries and S/390 and a variety of UNIX-based and PC-server hosts. Contact your HP account support representative for the latest information on platform and version support. You can use the Continuous Access (CA) XP feature to maintain remote copies of the UNIX/PC server data stored on the XP1024/XP128/XP12000/XP10000. TC390 volumes and CA volumes can exist concurrently in the same XP1024/XP128/XP12000/XP10000.

### Overview of TrueCopy Operations

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

TC390 Synchronous provides:

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

TC390 Asynchronous (TC390A) represents a unique and outstanding disaster recovery solution for large amounts of data that span multiple volumes and even multiple XP1024/XP128/XP12000/XP10000. TC390A’s group-based update sequence consistency solution enables fast and accurate database recovery, even after a “rolling” disaster, without the need for time-consuming data recovery procedures. The TC390A volume groups at the remote site can be recovered with full update sequence consistency, but the updates will be behind the main site due to the asynchronous remote copy operations.

TC390A provides:

- Update sequence consistency for user-defined groups of volumes (such as large databases).
- Protection for write-dependent applications in the event of a disaster.

This overview of TC390 operations describes:

- TC390 components (see page 18)
- TC390 operations (see page 27)
- TC390A recordset operations (see page 30)
- TC390A consistency group operations (see page 34)
- TC390 volume pair status and suspend types (see page 36)
- PPRC support, including P/DAS and GDPS (CGROUP) operations (see page 41)
Components

TC390 operations involve the XP1024/XP128/XP12000/XP10000 (and/or other XP disk arrays) at the main and remote sites, the physical communications paths between the main and remote disk arrays, and the Command View XP management station or XP Remote Web Console. The main and remote disk arrays must have the same controller emulation. TC390 copies the original online data at the main site to the offline backup volumes at the remote site through the dedicated Fibre Channel remote copy connections. The Command View XP management station or XP Remote Web Console hosts the TC390 software and provides a user-friendly Windows®-based graphical user interface (GUI) for all TC390 functions and operations. The I/O time-stamping host software function, provided by MVS DFSMSdfp, is required for TC390A consistency groups that span multiple disk arrays. Error reporting communications (ERC) is required for effective disaster recovery with TC390.

Figure 1 on page 18 and Figure 2 on page 19 show the TC390 components and their functions. The TC390 components are:

- XP1024/XP128/XP12000/XP10000
- Main and remote control units (MCUs and RCUs)
- Volume pairs (local M-VOLs and remote R-VOLs)
- TC390A consistency groups
- Host I/O time-stamping function
- Remote copy connections
- Remote control ports (RCPs) and local control ports (LCPs) for serial interface
- Ordinary target ports, initiator ports, and RCU target ports for Fibre Channel interface
- Command View XP management station or XP Remote Web Console with TC390 software
- Error reporting communications

NOTE: You need the additional Shared Memory option to use TC390.
TC390 operations involve the main (primary) disk arrays and the remote (secondary) disk arrays. This chapter covers TC390 operations in which the main disk array is an XP1024/XP128/XP12000/XP10000 and the remote disk array is either an XP1024/XP128/XP12000/XP10000 or other XP disk arrays. The main disk arrays contain the TC390 main volumes (M-VOLs), which contain the original data and are online to the host(s). The remote disk arrays contain the TC390 secondary volumes (R-VOLs), which are the synchronous or asynchronous copies of the M-VOLs. TC390 supports all CU images and logical volumes of the XP1024/XP128/XP12000/XP10000. TC390 supports RAID1, RAID5, and RAID6 configurations (see Table 3).

Table 3  RAID Level Configurations of TC390

<table>
<thead>
<tr>
<th>Application Site Path (System - DKC)</th>
<th>RAID Level of R-VOL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RAID1</td>
</tr>
<tr>
<td>RAID1</td>
<td>supported</td>
</tr>
<tr>
<td>RAID5</td>
<td>supported</td>
</tr>
<tr>
<td>RAID6</td>
<td>supported</td>
</tr>
<tr>
<td>Fibre supported</td>
<td>supported</td>
</tr>
</tbody>
</table>

All XP1024/XP128/XP12000/XP10000 with TC390 installed are compatible with the IBM PPRC host software function. For more information on PPRC, see “Using PPRC Commands for TrueCopy” on page 153. TC390 also supports all physical hard disk drive options and RAID5/RAID1 configurations for the XP1024/XP128/XP12000/XP10000.

To provide greater flexibility and to enable the XP1024/XP128/XP12000/XP10000 to be tailored to unique customer operating requirements, additional operational parameters, or optional modes, are available for the XP1024/XP128/XP12000/XP10000. At installation, the XP1024/XP128/XP12000/XP10000 modes are set to their default values so HP recommends that you discuss these settings with your HP representative. Only your HP representative can change the XP1024/XP128/XP12000/XP10000 modes. Table 4 shows the XP1024/XP128/XP12000/XP10000 modes related to TCz and PPRC operations.
NOTE: This mode information was current at the time of publication of this document, but it may change. Contact your HP account support representative for the latest XP1024/XP128/XP12000/XP10000 SVP mode information.

XP1024/XP128/XP12000/XP10000 performing TC390A operations (main and remote) use sidefiles in cache for storing the TC390A recordsets. HXRC also uses cache sidefiles. Disk arrays performing TC390A and/or HXRC must have sufficient cache installed to handle the increased sidefile usage. Insufficient cache can degrade disk array I/O performance and cause command retry requests and state-change-pending (SCP) messages. For more information on cache usage and sidefile thresholds, see “Inflow Control of Recordsets” on page 32.

Table 4 XP1024/XP128/XP12000/XP10000 modes for TrueCopy for z/OS

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Enables TC390 – RVOL read-only function (RCU only).</td>
</tr>
<tr>
<td>21</td>
<td>Required ON for MCUs and RCUs that connect to channel extenders.</td>
</tr>
</tbody>
</table>
| 36   | TC390 Synchronous – Selects function of CRIT=Y(ALL) or CRIT=Y(PATHS).  
Mode 36 ON: CRIT=Y(ALL) => equivalent to Fence Level = Data.  
Mode 36 OFF: CRIT=Y(PATHS) => equivalent to Fence Level = Status. |
| 38   | TC390 – Changes SSB reported against the WRITE I/O to the M-VOL in critical state.  
Mode 38 ON: Intervention required.  
Mode 38 OFF: Sidefile threshold activates Sleep Wait timer at the sleep wait threshold. |
| 45   | HXRC – Sleep Wait suppressing option (see modes 61, 85, 86, 97; see “HXRC Device Blocking and Load Balancing” on page 212). When Mode 45 is ON and Mode 61 is ON, WRITE I/Os for LDEVs are blocked by the threshold specified by SDM.  
Mode 45 OFF: Sidefile threshold activates Sleep Wait timer at the sleep wait threshold.  
Mode 45 ON: Sidefile threshold does not activate Sleep Wait timer at the sleep wait threshold. |
| 61   | HXRC – Enables the DONOTBLOCK option of the XADDPAIR command (see mode 45; see “HXRC Device Blocking and Load Balancing” on page 212).  
Must be OFF if the operating system does not support the DONOTBLOCK option.  
Mode 61 OFF: DONOTBLOCK option ignored.  
Mode 61 ON: DONOTBLOCK option activated. |
| 64   | TC390 CGROUP – Defines scope of CGROUP command within the XP1024/XP128/XP12000/XP10000. Must be OFF for GDPS.  
Mode 64 OFF: TC390 volumes behind the specified LCU pair (main and remote LCUs).  
Mode 64 ON: All TC390 volumes in this XP1024/XP128/XP12000/XP10000. |
| 85, 86 | HXRC – Variable sidefile threshold (see modes 45, 97, 98; see “HXRC Device Blocking and Load Balancing” on page 212).  
Mode 85 ON and Mode 86 OFF: Thresholds for Sleep wait/SCP/Puncture = 30/40/50%  
Modes 85 and 86 OFF: Thresholds for Sleep wait/SCP/Puncture = 40/50/60%  
Mode 85 OFF and Mode 86 ON: Thresholds for Sleep wait/SCP/Puncture = 50/60/70%  
Modes 85 and 86 ON: Thresholds for Sleep wait/SCP/Puncture = 60/70/80% |
**Table 4** XP1024/XP128/XP12000/XP10000 modes for TrueCopy for z/OS (continued)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
</table>
| 93   | Graduated delay process for sidefile control (see “Graduated Delay Sidefile Management” on page 33):  
Mode 93 OFF (default) = strong delay type  
Mode 93 ON = soft delay type  
Amount of sidefile Strong delay type Soft delay type  
threshold – [15-20%] (HWM) 100 ms x 1 time 20 ms x 1 time  
threshold – [10-15%] 200 ms x 1 time 40 ms x 1 time  
threshold – [5-10%] 300 ms x 1 time 60 ms x 1 time  
threshold – [0-5%] 400 ms x 1 time 80 ms x 1 time  
threshold or higher 500 ms x permanent 100 ms x permanent |
| 97   | HXRC – Variable Sleep Wait timer duration (see modes 45, 85, 86; see “HXRC Device Blocking and Load Balancing” on page 212).  
Mode 97 OFF: Sleep Wait timer duration = 100 ms.  
Mode 97 ON: Sleep Wait timer duration = 10 ms. |
| 98   | HXRC – Selects SCP or session cancel (see modes 45, 85, 86; see “HXRC Device Blocking and Load Balancing” on page 212).  
Mode 98 OFF: SCP.  
Mode 98 ON: Forced session cancel. |
| 104  | TC390 CGROUP – Selects disk array default for CGROUP FREEZE option. Applies to 3990 emulation only.  
Mode 104 is invalid if the controller emulation is 2105. For 2105, use the CGROUP option of CESTPATH.  
Mode 104 ON: FREEZE enabled.  
Mode 104 OFF (default): FREEZE disabled. |
| 114  | TC390 – Allows dynamic port mode setting (RCP/LCP for serial, Initiator/RCU target for Fibre Channel) through PPRC CESTPATH and CDELPATH commands.  
Mode 114 ON: Initiator ports will automatically change to RCU target ports. or vice versa.  
Mode 114 OFF (default): Initiator ports will not automatically change to RCU target ports, nor vice versa.  
For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.  
**NOTE:** Even if you set ON for SVP mode 114, initiator ports will not automatically change to RCU target ports, nor vice versa, when these ports are in initiator/external mix mode.  
Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed. |
Control Units (MCUs and RCUs)

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

- The MCU is the control unit (CU) in the main disk array that controls the M-VOLs of the TC390 volume pairs. The Command View XP management station must be LAN-attached to the MCU of each TC390 pair. The MCU communicates with the RCU through the dedicated ESCON or Fibre Channel remote copy connections. The MCU controls the host I/O operations to the TC390 M-VOLs as well as the TC390 initial copy and remote copy operations between the M-VOLs and R-VOLs. The MCU also manages the TC390 pair status and configuration information.

- The RCU is the CU in the remote disk array that controls the R-VOLs of the TC390 volume pairs. The RCU assists in managing the TC390 pair status and configuration (for example, rejects write I/Os to TC390 R-VOLs). The RCU executes the remote copy operations issued by the MCU. The secondary Command View XP management station should be LAN-attached to the RCUs at the remote site. 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 disk array and to provide disaster recovery capabilities.

### Table 4: XP1024/XP128/XP12000/XP10000 modes for TrueCopy for z/OS (continued)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
</table>
| 118  | TC390A – SIM notification when the TC390A sidefile reaches high-water mark (HWM = sidefile threshold - 20%) (see mode 93).  
Mode 118 ON: Generate SIM.  
Mode 118 OFF (default): No SIM generated.  
**NOTE:** The reported SIM when this mode is ON is not reported per CLPR. |
| 308  | Allows you to select whether the Remote Copy Path status, SIM218x, will be reported to the host or not.  
Mode 308 ON: SIM218x will be reported to the host.  
Mode 308 OFF: SIM218x will not be reported to the host. |
| 464  | TC390A – Allows you to select whether to generate SIM when the sidefile of TC390A, XRC Replication, and CC reaches high-water mark (HWM = sidefile threshold - 20%. See mode 93). This mode takes effect on the volume to which the inflow control is not set.  
Mode 464 ON: Generate SIM.  
Mode 464 OFF: No SIM generated.  
The SIM is generated according to Mode 464 ON is the same as Mode 118 ON.  
If both Mode 464 and Mode 118 are ON, the SIM will be generated for the volume that was detected to have reached the high-water mark earlier.  
**NOTE:** The reported SIM when this mode is ON is not reported per CLPR. |
| 484  | Allows you to select the indication type if you use the PPRC CQUERY command to display the remote copy path status.  
- Mode 484 ON: The status of path as using the fibre channel interface will be displayed. WWNN will be indicated.  
- Mode 484 OFF: The status of path as using an ESCON interface will be displayed. WWNN is invalid.  
**NOTE:** If the former type subsystem or the subsystem of TagmaStore USP microcode version 50-05-XX-XX or earlier is connected, mode 484 must be OFF. |
The MCU and RCU can be defined separately for each TC390 pair. The XP1024/XP128/XP12000/XP10000 CU can function simultaneously as an MCU for one or more M-VOLs and as an RCU for one or more R-VOLs, provided the remote copy connections and ports are properly configured. The XP1024/XP128/XP12000/XP10000 CU provides up to 32 logical CU images. TC390 operations can be performed on all logical devices (LDEVs) in all logical CU images. You can use TC390 to select a CU image in the connected MCU and specify a CU image in the RCU.

**CAUTION:** If you are connecting the XP1024/XP128/XP12000/XP10000 and other XP disk arrays in a mixed configuration, verify that each disk array has a unique serial number. Although this would be extremely rare, it is possible that a serial number overlap could occur. If you have two disk arrays with the same serial number and you need to configure remote copy pairs between the two disk arrays, contact your HP account support representative for assistance.

## CU Emulation Types

TC390 supports 3990-3, 3990-6, 3990-6E, and 2105 controller emulation types for the MCU and RCU. The emulation type of the MCU and RCU can be different. The 3990-6, 3990-6E, or 2105 emulation is required for SMS I/O time-stamping of TC390A recordsets. The 2105 emulation type is required for HPAV operations.

**Changing from 3990 to 2105:** If you need to change the emulation from 3990 to 2105 for an XP1024/XP128/XP12000/XP10000 that has existing HXRC pairs, you must:

1. Stop all jobs and delete all HXRC pairs.
2. Change the CU emulation type of all CHA packages in the XP1024/XP128/XP12000/XP10000 to 2105. Do not intermix 3990 and 2105 emulations in the same disk array.
3. Restart jobs and re-establish HXRC pairs.

**NOTE:** The PPRC commands are different for 3990 and 2105 emulation types. For more information on using PPRC TSO commands with 2105 emulation, refer to “Using PPRC Commands for TrueCopy” on page 153.

**NOTE:** For important information on GDPS support and 2105 emulation, see “GDPS Support” on page 42.

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

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

During normal TC390 operations, the TC390 M-VOL remains available to all hosts at all times for read and write I/O operations. The RCU rejects all I/Os to a TC390 R-VOL. The R-VOL read option (see “R-VOL Read Option” on page 29) allows read-only access to a TC390 R-VOL while the pair is suspended.

TC390 supports a maximum of 16,384 pairs (entire XP1024/XP128/XP12000/XP10000). If the command device for Business Continuity Manager is defined, the TCz pair can be created up to 16,383 pairs. TC390 supports the basic logical volume images (LVIs) available on the XP1024/XP128/XP12000/XP10000, such as 3390-3, 3390-3R, 3390-9, and 3390-L. For information on LVI requirements and support, see “Logical Volume Image (LVI)” on page 48.
Remote Copy Connections

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

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

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

The MCU-to-RCU remote copy configuration for TC390A has different requirements than the TC390 Synchronous configuration:

- TC390 Synchronous supports 1-to-n and n-to-1 remote copy connections (n ≤ 4). One MCU can be connected to as many as four RCUs, and one RCU can be connected to as many as four MCUs (one MCU/RCU = one physical CU, including all CU images). TC390 supports the dynamic switching capability of the ESCDs that 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.

- TC390A supports 1-to-1 remote copy connections within the same consistency group. The M-VOLs and R-VOLs of the pairs in a consistency group must be located within one physical MCU and one physical RCU. This configuration ensures backup integrity for data which is spread across multiple volumes within one disk array.

CA 1-to-n and n-to-1 configurations are valid for TC390A, as long as each consistency group does not span local or remote disk arrays.

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

**NOTE:** HP 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.

- One MCU port (initiator port) can be connected to 64 RCU ports (RCU target ports). One RCU port can be connected to 16 MCU ports. However, the number of logical paths that can be specified does not depend on the number of connectable RCU or MCU ports.

For disk arrays with both TC390 and FICON host attachment, you must set the path configuration carefully. The following table lists the possible path configurations and indicates which combinations are supported.

<table>
<thead>
<tr>
<th>Application Site Path (System - DKC)</th>
<th>MCU-RCU</th>
<th>For Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCON</td>
<td>ESCON</td>
<td>Not Supported</td>
</tr>
<tr>
<td>ESCON</td>
<td>Fibre Channel</td>
<td>Supported</td>
</tr>
</tbody>
</table>
Initiator Ports and RCU Target Ports

The initiator ports are the dedicated Fibre Channel interface ports on the main disk array (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 XP1024/XP128/XP12000/XP10000 can be configured as an initiator port. Use the Port Change window to change the configuration of the XP1024/XP128/XP12000/XP10000 Fibre Channel ports (ordinary target port, initiator port, or RCU target port) as needed.

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 XP1024/XP128/XP12000/XP10000 can be configured as an RCU target port. The RCU target ports can be connected to the host channel paths via the Fibre Channel switch.

To fully support an automated environment, the XP1024/XP128/XP12000/XP10000 is capable of automatically configuring a Fibre Channel port as an Initiator or RCU target if required in response to the TSO CESTPATH and CDELPATH commands. See the SVP mode 114 in Table 4 on page 20.

NOTE: For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management.

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

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

The remote control ports (RCPs) are the dedicated serial interface ports on the main disk subsystem (MCU) to which the RCUs are connected. The RCPs emulate host processor channels to enable the MCUs to send write I/O operations directly to the RCUs. The RCPs support the dynamic switching capability provided by the ESCDs. Any serial port of the XP1024/XP128/XP12000/XP10000 can be configured as an RCP. You can use TC390 to change the configuration of the disk array serial ports (LCP or RCP) as needed.

The local control ports (LCPs) are used for connecting with the host processor channel interface. All serial interface ports on the XP1024/XP128/XP12000/XP10000 have a default setting of LCP. An RCU port connected to an MCU must be in LCP mode to receive remote copy I/O operations from the MCU.

To fully support an automated environment, the XP1024/XP128/XP12000/XP10000 is capable of automatically configuring a serial port as an RCP or LCP if required in response to the TSO CESTPATH and CDELPATH commands. See the SVP mode 114 in Table 4 on page 20.

CAUTION: Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.
Two or more RCPs must be configured before you can add the RCUs and establish the TC390 volume pairs. The RCPs cannot communicate with the host processor channels and are dedicated to TC390 operations. The host channel interface paths must be connected to the other serial interface ports on the disk array.

Also, the serial interface ports, 1S-1Z and 2S-2Z, cannot be specified as RCPs.

The CHA package port that is added to DKA slot cannot be specified as RCPs. Therefore, if you specify this port number to use TSO CESTPATH command, an error will occur.

Command View XP Management Station or XP Remote Web Console

The Command View XP management station or XP Remote Web Console communicates with the each attached XP1024/XP128/XP12000/XP10000. The SVP at the main site must be connected to the MCU of each TC390 volume pair. A second SVP should also be installed at the remote site and connected to the RCUs. With another SVP at the remote site, you can modify the async options of the RCU (pending update data rate, offloading timer) and access the TC390 R-VOLs (for example, to perform ICKDSF). If you need to perform TC390 operations in the reverse direction from the remote site to the main site (for example, disaster recovery), using TC390 through Command View XP or XP Remote Web Console simplifies and expedites this process.

If you plan to perform TC390A operations, you must use the TC390 software to add the consistency groups and select group options and async options before you can add any TC390A pairs. These functions can be performed only using TC390 through Command View XP or XP Remote Web Console. After the consistency groups and asynchronous options have been configured, the PPRC TSO commands can be used to establish and manage TC390A pairs.

NOTE: For information on TC390A configuration services, contact your HP account support representative.

Asynchronous Consistency Groups

A TC390A consistency group is a user-defined set of volume pairs across which update sequence consistency is maintained and ensured at the remote site. Each TC390A volume pair must be assigned to a consistency group. You can use TC390A to configure up to 128 consistency groups (0-7F) for each MCU and provides group-based operations for consistency groups (for example, suspend and resume group).

You can use consistency groups to maintain update sequence consistency for databases that span multiple volumes, allowing immediate database recovery at the remote site when needed. For more information on TC390A consistency group operations, see “TrueCopy Asynchronous Consistency Group Operations” on page 34.

Host I/O Time-Stamping Function

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

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

Error Reporting Communications

Error reporting communications (ERC), which transfers information between host processors at the main and remote sites, is a critical component of any disaster recovery effort. You can configure ERC using channel-to-channel communications, NetView® technology, or other interconnect technologies, depending on your installation requirements and standards. Neither TC390 nor Command View XP or XP Remote Web Console provides ERC between the main and remote sites.
When TC390 is used as a data migration tool, ERC is recommended but is not required. When TC390 is used as a disaster recovery tool, ERC is required to ensure effective disaster recovery operations. When a TC390 pair is suspended due to an error condition, the MCU generates sense information, which results in an IEA491E system console message. This information should be transferred to the remote site through ERC for effective disaster detection and recovery.

Remote Copy Operations

The following figure illustrates the two types of TC390 remote copy operations: initial copy and update copy. To reduce the overhead associated with these remote copy activities and maximize data transfer, the XP1024/XP128/XP12000/XP10000 uses a special write command that is allowed only for TC390 initial and update copy operations. This command transfers the control parameters and the FBA-format data for consecutive updated records in a track using a single write operation.

![Figure 3 TrueCopy remote copy operations](image)

Initial Copy Operations

The initial copy operation synchronizes the M-VOL and R-VOL independently of host I/O processes. The initial copy operation is the same for TC390 Synchronous and TC390A pairs. A TC390 initial copy operation takes place when you add a new pair or resume a suspended pair. When a new pair is established, the entire contents of the M-VOL are copied to the R-VOL cylinder by cylinder, including the VTOC (volume table of contents) but not including the diagnostic and unassigned alternate tracks. For new pairs, you can also select **No Copy** or **None** for the initial copy mode, which copies only the VOLSER (volume serial number) to the R-VOL. If **No Copy** or **None** is selected, the user is responsible for ensuring that the M-VOL and R-VOL are already identical. The MCU cannot verify the contents of the volumes. When a suspended pair is resumed (also called a resync operation), only the VOLSER and out-of-sync cylinders (updated by write I/Os while the pair was suspended) are copied to the R-VOL.

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

- Use the **number of tracks** option to specify how many tracks are copied simultaneously by the TC390 initial copy operation when adding/resuming a TC390 pair. This option can be specified using TC390 through Command View XP or XP Remote Web Console (Add Pair-Option) and the CESTPAIR TSO command (PACE parameter).
- Use the **Initial Copy Parameters: Priority** option to specify the order in which the initial copy operations are performed when adding/resuming multiple TC390 pairs. This option can only be specified using TC390 through Command View XP or XP Remote Web Console (Add Pair).
- Use the **Maximum Initial Copy Activities** option 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 TC390 through Command View XP or XP Remote Web Console (RCU Option window).

Update Copy Operations

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

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

- The last write command in the current domain, specified by the preceding locate record command.
- A write command that requires switching to the next track.
- A write command that was not preceded by a locate record command.

**NOTE:** If many consecutive records are updated by a single CCW chain that does not use the locate record command (for example, long sequential chained write operations), disk array performance may be significantly impacted.

For asynchronous update copy mode, the MCU stores the M-VOL updates along with additional control information in cache, and sends the updates and control information to the RCU completely independent of the host I/O processes. These updates with their associated control information are called TC390A recordsets. The RCU stores the TC390A recordsets in cache and performs the updates to the R-VOLs in the same order as they were performed at the MCU(s) according to the TC390A time-stamp and sequence information. For more information on TC390A recordset operations, see “TrueCopy Asynchronous Recordset Operations” on page 30.

**Priority of initial and update copy:** In both TC390 Synchronous and TC390A, 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 TC390A, update copy is executed asynchronously, but the same scheduling conflict can occur between the asynchronous update copy (write recordset) and initial copy.

**Read and Write I/O Operations for TrueCopy Volumes**

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

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

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

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

- **Asynchronous Mode:** The MCU completes M-VOL write operations independently of the associated update copy operations at the R-VOL. The RCU manages the R-VOL updates according to the TC390A recordset information and maintains time-based data consistency for the R-VOLs. If the M-VOL write operation fails, the MCU reports a unit check and does not create the TC390A recordset for this operation. If the update copy operation fails, the RCU suspends either the affected pair or all TC390A pairs in the consistency group, depending on the type of failure. When the suspended TC390A pair or group is resumed, the MCU and RCU negotiate the resynchronization of the pair(s). For more information on suspended TC390A pairs, see “Suspended TrueCopy Asynchronous Pairs” on page 40.

The RCU does not allow a TC390 R-VOL to be online and rejects all host-requested read and write I/O operations for a TC390 R-VOL. The TC390 R-VOLs must be offline during normal TC390 operations. TC390 provides a special R-VOL read option that allows read-only access to the R-VOL while the pair is suspended (see “R-VOL Read Option” on page 29 for information on the R-VOL read option). If you need write access to a TC390 R-VOL, you must delete the pair.
R-VOL Read Option

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

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

Difference Management

The differential data (updated by write I/Os during split or suspension) between M-VOL and R-VOL is stored in each cylinder bitmap. When a deleted/suspended pair is resumed (Resume Pair), the MCU merges the M-VOL and R-VOL bitmaps, and the differential data is copied to the R-VOL. The unit of data stored in the bitmap is Track or Cylinder. When adding a pair (Add Pair), you can select Track or Cylinder and you can also confirm the unit.

**Table 6** Operation of the unit of data stored in bitmap

<table>
<thead>
<tr>
<th>Program</th>
<th>The Unit of Data Stored in Bitmap</th>
<th>Confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Default (Auto)(^1)</td>
<td>Track</td>
</tr>
<tr>
<td>Command View XP</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td>or XP Remote Web Console</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPRC TSO</td>
<td>Not available</td>
<td>Not available</td>
</tr>
</tbody>
</table>

\(^1\) Default (Auto) means that Track or Cylinder is automatically set according to the capacity (number of cylinders or number of cylinders set by VLL) of the volumes used for the pairs. For volumes that have 10,019 cylinders or more, Cylinder is set. For other volumes, Track is set.

When you add a pair with the setting of Track, the number of pairs you can create is restricted. If you create the pairs more than the restricted number, a pair is automatically added with Cylinder. You can restrict the automatic change of the setting. Before using this function, contact your HP account support representative.

The restriction of the number of pairs depends on the capacity of the volumes used for the pairs. Both of the MCU and RCU are restricted.

The number of bitmap area in the disk array is 10,476. You can calculate the number of bitmap area. If the calculated bitmap area exceeds the number of bitmap area in the disk array, adding pairs operation is restricted.

To calculate the number of bitmap area, you can use the following equation:

\[ \left( \left( \uparrow \text{Number of Cylinders} \times 15 \right) / 75,136 \right) - 1 \]

**Table 7** Maximum Number of Pairs According to Each Emulation Type, when pairs are created without use of customized volume

<table>
<thead>
<tr>
<th>Emulation Type</th>
<th>Number of Cylinders</th>
<th>Number of Bitmap Areas</th>
<th>Maximum Number of Pairs (Added Shared Memory: 1 set)</th>
<th>Maximum Number of Pairs (Added Shared Memory: 2 sets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3380-J</td>
<td>885</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
<tr>
<td>3380-E</td>
<td>1,770</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
<tr>
<td>3380-K</td>
<td>2,655</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
</tbody>
</table>
Table 7  Maximum Number of Pairs According to Each Emulation Type, when pairs are created without use of customized volume

<table>
<thead>
<tr>
<th>Emulation Type</th>
<th>Number of Cylinders</th>
<th>Number of Bitmap Areas</th>
<th>Maximum Number of Pairs (Added Shared Memory: 1 set)</th>
<th>Maximum Number of Pairs (Added Shared Memory: 2 sets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3380-3</td>
<td>3,339</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
<tr>
<td>3390-1</td>
<td>1,113</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
<tr>
<td>3390-2</td>
<td>2,226</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
<tr>
<td>3390-3</td>
<td>3,339</td>
<td>1</td>
<td>11,605</td>
<td>16,384</td>
</tr>
<tr>
<td>3390-3R</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3390-9</td>
<td>10,017</td>
<td>2</td>
<td>5,802</td>
<td>14,335</td>
</tr>
<tr>
<td>3390-L</td>
<td>32,760</td>
<td>5</td>
<td>2,321</td>
<td>5,734</td>
</tr>
<tr>
<td>3390-M</td>
<td>65,520</td>
<td>9</td>
<td>1,289</td>
<td>3,185</td>
</tr>
</tbody>
</table>

**Table 7**  Maximum Number of Pairs According to Each Emulation Type, when pairs are created without use of customized volume

**TrueCopy Asynchronous Recordset Operations**

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

- Creating and storing recordsets at the MCU
- Sending recordsets to the RCU
- Storing recordsets at the RCU
- Selecting and settling recordsets at the RCU
- Types of recordsets
- Inflow control for sidefiles

**Creating and Storing Recordsets at the MCU**

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

The time-stamp information is acquired from the (MVS) host’s I/O time-stamp function. This time stamp provides a protective measure for write-dependent applications and minimizes recovery time in the event of a disaster. The sequence number indicates the number of recordsets that the MCU has created for each consistency group. The recordset information, except for the updated records, is stored and queued in an area of cache known as sidefile cache. For more information on sidefile cache, see “Inflow Control of Recordsets” on page 32.

**Sending Recordsets to the RCU**

The MCU sends the TC390A recordsets to the RCU in a similar manner to the TC390 Synchronous updates. The MCU’s RCPs and/or initiator ports act as host processor channels and issue special I/O operations, called remote I/Os (RIOs), to the RCU. The RIO transfers the recordsets in FBA format (not CKD) using a single channel command, eliminating the overhead associated with FBA-CKD conversion and thus providing more efficient transfer of user data. The MCU can send several recordsets using a single RIO, even if their sequence numbers are not contiguous. Therefore, TC390A recordsets are usually sent to the RCU in a different order than the arrivals at the MCU. The RCU ensures that records are applied to the RVOls in the correct sequence. This method of remote I/O provides the most efficient use of MCU-to-RCU link resources.
NOTE: The parameter length and detailed specification of this TC390A channel command are different than for TC390 Synchronous RIOs. Verify that your channel extenders are capable of supporting this command. For further details, contact your HP account support representative.

Storing Recordsets at the RCU

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

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

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 (for example, 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 that has the earliest time-stamp value, and then settles this recordset.
3. The RCU repeats this process to select and settle TC390A recordsets.

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

• If the corresponding track is in cache (track-hit), the updated records in the recordset are copied to the existing cached track and the cache space for the sidefile is released.
• If the corresponding track is not in cache (track-miss), the RCU changes the cache designation of the sidefile to formal data. The data is not physically moved.

Types of Recordsets

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

Figure 4 Selecting and settling TrueCopy Async recordsets at the RCU

Inflow Control of Recordsets

As described in the previous sections, both the MCU and RCU create sidefiles for storing TC390A recordsets. Because the sidefiles occupy exclusive space in cache, both the MCU and RCU perform inflow control to prevent an overload of the disk array’s cache resources. The XP1024/XP128/XP12000/XP10000 uses the following parameters (specified on the TC390 Async Option window, see “Asynchronous Copy Option” on page 108) for TC390A cache inflow control:

- **Sidefile Threshold** = maximum cache % available for use by TC390A sidefiles. Table 8 on page 33 shows the TC390A sidefile threshold values and describes the actions that occur when each threshold is reached.
  - The “high-water mark” (HWM), which is the sidefile threshold minus 20%, indicates when graduated delay begins for TC390A volume pairs (see the following section). If SVP mode 118 is ON, a warning SIM is also generated.
  - The puncture threshold, which is the sidefile threshold plus 10%, indicates when the TC390A pairs will be suspended due to sidefile overflow (see “CESTPATH” on page 156).

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

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

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

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

HXRC. HXRC operations use a different cache sidefile than TC390A. Table 8 on page 33 also shows the sidefile threshold values for HXRC operations and describes the actions that occur when each threshold is reached. Disk arrays performing TC390A in combination with HXRC must have sufficient cache installed to handle the increased sidefile activity. If a “sidefile puncture” condition occurs (HXRC sidefiles reach 10% over threshold), the XRC session having the highest sidefile usage is terminated.

SIM reporting for sidefile conditions is disabled when mode 118 is OFF (Table 4 on page 20).

NOTE: Cache LUN XP operations may decrease the total amount of cache available for TC390A and HXRC operations, but do not directly affect sidefile cache usage. Available cache is defined as the amount of physical cache memory installed on the disk array minus any cache reserved for the Cache LUN XP feature.

Table 8  Sidefile thresholds

<table>
<thead>
<tr>
<th>Operation</th>
<th>Threshold(s)</th>
<th>Action(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC390A</td>
<td>High-water mark (HWM) = sidefile threshold – 20%</td>
<td>MCU (RCU) reaches HWM: command retry to host (MCU), begin graduated delay. Delay times can be adjusted using mode 93 (see Table 4 on page 20).</td>
</tr>
<tr>
<td></td>
<td>Sidefile threshold = 30%-70% of cache, default = 50%. TC390A threshold can be adjusted from 30-70% (in 10% increments) using TC390 through Command View XP or XP Remote Web Console.</td>
<td>MCU (RCU) reaches threshold: command retry to host (MCU), max delay time (500 or 100 ms). Delay time can be adjusted using mode 93 (see Table 4 on page 20).</td>
</tr>
<tr>
<td></td>
<td>Puncture threshold = sidefile threshold + 10%</td>
<td>MCU (RCU) reaches puncture: suspend affected TC390A pairs due to sidefile overflow condition.</td>
</tr>
</tbody>
</table>

HXRC¹ | [XRC sidefile] / [avail cache] = 40%, 50%, 60% |
|      | XRC thresholds can be adjusted by using modes 85 and 86 (see Table 4 on page 20). |
|      | Threshold 1/2/3 = 30/40/50%, 40/50/60%, or 60/70/80% |
|      | Threshold 1 = command retry. Threshold 2 = SCP message. Threshold 3 = puncture condition. |

Write Pending | [write pending] / [avail cache - sidefile] = 70% | Command retry. |

¹ For more information on sidefile thresholds for HXRC operations, refer to “HXRC Device Blocking and Load Balancing” on page 212.

Graduated Delay Sidefile Management

The following figure shows the graduated delay process for TC390A sidefile management. When the TC390A sidefile value reaches the high-water mark (threshold minus 20%), the XP1024/XP128/XP12000/XP10000 begins command retry delay for host updates to TC390A M-VOLs and reports a warning SIM to the host. As the amount of sidefile increases, the delay increases incrementally as shown in the following figure. Use Mode 93 on the XP1024/XP128/XP12000/XP10000 SVP (refer to Table 4 on page 20) to select the delay type (long or short). This graduated delay methodology minimizes the potential for sidefile overcommitment, while at the same time providing another level of automation control.
**NOTE:** If there is a network problem, lack of bandwidth, or lack of sufficient Fibre links, the sidefile will grow and the microcode will add delay to host I/O until the sidefile goes below a certain level again. Disabling this function will cause the pairs to suspend.

SIM reporting for TC390A sidefile conditions is enabled only when SVP mode 118 or 464 is ON (see Table 4 on page 20). The reported SIMs when SVP mode 118 or 464 is ON, however, do not support a CLPR. When this SIM is reported to the host, the SIM reference code is indicated as 490x-yy (“x” is CU number, and “yy” is LDEV number). For more information about the SIM reference code, call your HP Account Support Representative.

You can disable the command retry delay for a limited number of critical volumes using the special “No delay” parameter for the CESTPAIR TSO command (see “CESTPAIR” on page 160). When this parameter is set, the XP1024/XP128/XP12000/XP10000 will not delay host write I/Os to the M-VOL until the TC390A sidefile amount reaches the puncture threshold (threshold + 10%). This prevents performance degradation for critical volumes and should be used only for a small number of volumes.

**Figure 5** Graduated delay process for sidefile management

**TrueCopy Asynchronous Consistency Group Operations**

TC390A consistency groups enable update sequence consistency to be maintained across a group of volumes. The R-VOLs of the pairs in a consistency group must be located within one RCU (n-to-1 requirement). The TC390A consistency group operations include the following:

- Group options
- Group consistency time
- Group operations

Only TCzA pairs that belong to the same CLPR can be allocated to one consistency group.

**Group Options**

TC390A provides the following options for each consistency group: Timer Type, Time Out [Copy Pending], and Time Out [RCU Ready]. These options are selected when you add a group. If you want to change the timeout options of a group, you must suspend all pairs in the group first. If you want to change the timer type option, you must delete all pairs. The Timer Type and Time Out [Copy Pending] options must be the
same for all MCUs that contain M-VOLs in the group. The **Time Out [RCU Ready]** option can be different at each MCU if necessary.

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

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

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

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

**Time Out [Copy Pending].** This group option specifies the maximum delay allowed for TC390A copy operations. For instructions on selecting the correct **Time Out [Copy Pending]** setting for your operational environment, see “Adding Consistency Groups (Add CT Group)” on page 105.

The RCU will suspend all RVOLs 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.

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

**Group Consistency Time**

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

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

After you have established TC390A operations, you should monitor the consistency time of each group at the RCU(s). If the average delay is longer than your disaster recovery design can accept, you should consider adding remote copy resources (for example, paths or cache) and/or reducing the I/O workload to improve disk array performance. If the delay between the M-VOL update and the corresponding RVOL 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.

**Group Operations**

TC390A provides the following group-based operations to simplify and expedite disaster/failure recovery procedures:

- **Group operations at the MCU:**
  - Suspend all pairs in a consistency group. For a description of the TC390A **Group** suspend option (supported by CSUSPEND TSO command), see “**Suspending TrueCopy Pairs (Suspend Pair)**” on page 126.
  - Resume all suspended pairs in a consistency group. For a description of the TC390A **Resume-Group** pair option (supported by the CESTPAIR TSO command with the parameter MODE=RESYNC), see “**Resuming TrueCopy Volume Pairs (Resume Pair)**” on page 129.
  - Delete all pairs in a consistency group. For a description of the TC390A **Group** delete option (supported by CDELPAIR TSO command), see “**Deleting TrueCopy Volume Pairs (Delete Pair)**” on page 132.

- **Group operations at the RCU:**
  - Suspend all pairs in a consistency group. For a description of the TC390A **Group** suspend option (supported by CSUSPEND TSO command), see “**Suspending TrueCopy Pairs (Suspend Pair)**” on page 126.
  - Delete all suspended pairs in a consistency group except for any inconsistent pairs. For a description of the TC390A **C/T** delete option (not supported by CDELPAIR, CDELPAIR cannot be issued to the RCU), see “**Deleting TrueCopy Volume Pairs (Delete Pair)**” on page 132.
  - Delete all pairs in a consistency group regardless of their consistency status. For a description of the TC390A **Group** delete option (not supported by CDELPAIR, CDELPAIR cannot be issued to the RCU), see “**Deleting TrueCopy Volume Pairs (Delete Pair)**” on page 132.

TC390A also provides the **Error level** pair option (see “**Creating TrueCopy Volume Pairs (Add Pair)**” on page 121) that is used to trigger automatic suspension of an entire consistency group. When a TC390A pair is suspended due to failure (not user-requested), this TC390A pair option determines whether all pairs in the same consistency group will also be suspended. If you select the **Group** error level for a TC390A pair, all pairs in the same group will be suspended. If you select the **Volume** error level, only the affected TC390A pair will be suspended.

---

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

### TrueCopy Volume Pair Status

TC390A displays the pair status for each volume in the selected logical CU image (CUI) of the connected XP1024/XP128/XP12000/XP10000. The MCU maintains the status of the M-VOL and is responsible for keeping the M-VOL and its R-VOL synchronized. The RCU maintains the status of the R-VOL. The MCU can change the pair status of the M-VOL and R-VOL. The RCU can change the pair status of the R-VOL but not the M-VOL. The MCU will detect when the RCU changes the R-VOL status (if the path status is normal) and will change the M-VOL status accordingly. The TC390 pair status can be acquired from the MCU and RCU using the TC390 software (Pair Status) and the CQUERY TSO command.

**Table 9** on page 37 lists and describes the TC390 volume pair status descriptions. A volume that is not assigned to a TC390 volume pair has the status *simplex*. When a TC390 pair is started, the MCU changes the status of both volumes (M-VOL and R-VOL) to *pending duplex*. When the initial copy operation is complete, the MCU changes the status of both volumes to *duplex*. When a pair is suspended from the MCU, the MCU changes the status of the M-VOL and R-VOL (if the path status is normal) to *suspended*. When a pair is suspended from the RCU, the RCU changes the status of the R-VOL to *suspended*, and the MCU detects the pair suspension (if the path status is normal) and changes the M-VOL status to *suspended*. 

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**TrueCopy for the XP1024/XP128/XP12000/XP10000**

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When you delete a pair from the MCU, the MCU changes the status of the M-VOL and R-VOL (if the path status is normal) to simplex. When you delete a pair from the RCU, the RCU changes the R-VOL status to simplex, and the MCU detects the pair deletion (if the path status is normal) and changes the M-VOL status to suspended.

**TC390A-Specific Pair Status**

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

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

- An application may issue update I/Os bypassing the MVS standard I/O procedure.
- The I/O time-stamping function may not be active at the primary system.

**Table 9** TrueCopy volume pair status

<table>
<thead>
<tr>
<th>Pair Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplex</td>
<td>This volume is not currently assigned to a TC390 volume pair. When this volume is added to a TC390 volume pair, its status will change to pending duplex.</td>
</tr>
<tr>
<td>Pending Duplex</td>
<td>The TC390 initial copy operation for this volume pair is in progress. This volume pair is not yet synchronized. When the initial copy is complete, the status changes to duplex.</td>
</tr>
<tr>
<td>Duplex</td>
<td>This volume pair is synchronized. Updates to the M-VOL are duplicated on the R-VOL.</td>
</tr>
</tbody>
</table>
| Suspended (see Table 10 on page 39 for suspend types) | This volume pair is not synchronized:  
   - For TC390 Synchronous only, if the MCU cannot keep the pair synchronized for any reason, the MCU changes the status of the M-VOL and R-VOL (if possible) to suspended.  
   - For TC390A only, if the MCU detects a TC390A suspension condition (see “Suspending TrueCopy Asynchronous Pairs” on page 40), the MCU changes the M-VOL status and R-VOL status (if possible) to suspended.  
   - For TC390A only, when the RCU detects a TC390A suspension condition (see “Suspending TrueCopy Asynchronous Pairs” on page 40), the RCU changes the R-VOL status to suspended.  
   - For TC390 Synchronous only, the MCU changes the status of all TC390 Synchronous pairs to suspended when it performs the CGROUP/RUN command (see “CGROUP (FREEZE/RUN) Support” on page 169).  
   - When you suspend a pair from the MCU, the MCU changes the status of the M-VOL and R-VOL (if possible) to suspended. When you suspend a pair from the RCU, the RCU changes the status of the R-VOL to suspended.  
   - When the MCU detects that the pair was suspended or deleted from the RCU, the MCU changes the status of the M-VOL to suspended. |

**Pair Status for TC390A only:**

| Suspensing | This pair is not synchronized. This pair is in transition from duplex or pending duplex to suspended. When the suspension is requested (by user, MCU, or RCU), the status of all affected pairs changes to suspending. When the suspension is complete, the status changes to suspended. |
Suspended Pairs

Table 10 on page 39 lists and describes the TC390 suspend types, which indicate the reason for suspension. A user can suspend a TC390 pair at any time after the initial copy operation is complete. The user must suspend a TC390 pair to perform ICKDSF maintenance on the M-VOL or to access the R-VOL (read only mode). TC390 pairs are also suspended when the CGROUP/RUN command is processed (see “CGROUP (FREEZE/RUN) Support” on page 169). When the user suspends a TC390 Synchronous pair, the MCU ensures synchronization by completing any pending update copy operation before changing the status to suspended. When the user suspends a TC390A pair, the MCU and RCU ensure synchronization by either completing or discarding any pending update copy operations according to the user-specified drain/purge suspend option.

A TC390 pair is suspended by the MCU when any of the following suspension conditions are detected. A TC390A pair can also be suspended by the RCU (see “Suspended TrueCopy Asynchronous Pairs” on page 40).

- When the MCU detects that the user has deleted the volume pair from the RCU (for example, to access an R-VOL at the remote site).
- When the MCU detects an error condition related to the RCU, R-VOL, a TC390 Synchronous update copy operation or a TC390A recordset operation (see “Suspended TrueCopy Asynchronous Pairs” on page 40).
- When the RCU cannot execute DFW (DASD fast write) to the R-VOL (only if DFW required is selected).
- When the MCU is unable to communicate with the RCU.

If a TC390 Synchronous update copy operation fails, the MCU maintains exact synchronization by reporting a unit check and decommitting the M-VOL update so that the host system and application program regard that write operation to the M-VOL as failed. For information on failed TC390A recordset operations, see “Suspended TrueCopy Asynchronous Pairs” on page 40.

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

A suspended TC390A R-VOL has an additional status called the consistency status that is displayed only at the RCU. The consistency status of a suspended TC390A R-VOL indicates its update sequence consistency with respect to the other R-VOLSs in the same group. Table 11 on page 40 lists and describes the consistency status descriptions for suspended TC390A R-VOLSs.

When a TC390 pair is suspended, whether user-requested or due to failure, the MCU generates sense information to notify the host(s). If the host system supports IBM PPRC and the PPRC support RCU option is enabled, this notification results in an IEA494I and/or IEA491E system console message that indicates the reason for suspension. For more information on the IEA494I and IEA491E system console messages, see “IEA494I and IEA491E Console Messages” on page 175.
**NOTE:** If you need write access to an R-VOL, you must delete the pair.

### Table 10  Suspend types

<table>
<thead>
<tr>
<th>Suspend Type</th>
<th>Applies to</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-VOL by operator</td>
<td>M-VOL (TC390 Sync only)</td>
<td>The user suspended the pair from the MCU using the <strong>M-VOL Failure</strong> option. The R-VOL suspend type is by MCU.</td>
</tr>
<tr>
<td>R-VOL by operator</td>
<td>M-VOL, R-VOL</td>
<td>The user suspended the pair from the MCU or RCU using the <strong>R-VOL Failure</strong> option.</td>
</tr>
<tr>
<td>by MCU</td>
<td>R-VOL</td>
<td>The RCU received a request from the MCU to suspend the volume pair. The M-VOL suspend type is M-VOL by Operator or R-VOL by Operator.</td>
</tr>
<tr>
<td>by RCU</td>
<td>M-VOL</td>
<td>The MCU detected an error condition at the RCU that caused the MCU to suspend the TC390 volume pair. The R-VOL suspend type is by MCU.</td>
</tr>
<tr>
<td>Delete Pair to RCU</td>
<td>M-VOL</td>
<td>The MCU detected that the R-VOL status changed to simplex because the user deleted the pair from the RCU. The pair cannot be resumed because the R-VOL does not have the suspended status.</td>
</tr>
<tr>
<td>R-VOL Failure</td>
<td>M-VOL</td>
<td>The MCU detected an error during communication with the RCU or an I/O error during update copy. In this case, the R-VOL suspend type is usually by MCU.</td>
</tr>
<tr>
<td>MCU IMPL</td>
<td>M-VOL, R-VOL</td>
<td>The MCU could not find valid control information in its nonvolatile memory during the IMPL procedure. This condition occurs only if the MCU is completely without power for more than 48 hours (for example, power failure and fully discharged backup batteries).</td>
</tr>
<tr>
<td>Initial Copy failed</td>
<td>M-VOL, R-VOL</td>
<td>The volume pair was suspended before the initial copy operation was complete. The data on the R-VOL is not identical to the data on the M-VOL.</td>
</tr>
<tr>
<td>by FREEZE</td>
<td>M-VOL, R-VOL (TC390 Sync only)</td>
<td>The volume pair was suspended by the CGROUP/RUN TSO command. See “CGROUP (FREEZE/RUN) Support” on page 169.</td>
</tr>
<tr>
<td>MCU P/S-OFF</td>
<td>R-VOL (TC390A only)</td>
<td>The RCU received a request from the MCU to suspend the R-VOL due to MCU power-off. The RCU stops expecting recordsets from that MCU.</td>
</tr>
<tr>
<td>by sidefile overflow</td>
<td>M-VOL, R-VOL (TC390A only)</td>
<td>The amount of sidefile exceeds the specified “current pending update data rate” and the RCU data is not transferred within the specified “offloading timer”.</td>
</tr>
</tbody>
</table>
Suspended TrueCopy Asynchronous Pairs

TC390A operations involve additional suspension conditions related to the asynchronous recordset operations. Both the MCU and RCU can detect TC390A suspension conditions and suspend TC390A pairs. The following table describes the TC390A suspension conditions and indicates which CU detects the condition and which volume pairs are suspended. The TC390A offloading timer asynchronous option (see “Asynchronous Copy Option” on page 108) and timeout group options (see “Adding Consistency Groups (Add CT Group)” on page 105) are used to control the TC390A suspension conditions. For troubleshooting information for TC390A suspension conditions, see Table 32 on page 152.

### Table 11 Consistency status for suspended TrueCopy Async R-VOLs

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

### Table 12 TrueCopy Asynchronous suspension conditions

<table>
<thead>
<tr>
<th>Suspension Condition</th>
<th>Detected by</th>
<th>TC390A Pairs to be Suspended</th>
</tr>
</thead>
<tbody>
<tr>
<td>The MCU could not send a pending recordset to the RCU before the offloading timer asynchronous option expired. See “Inflow Control of Recordsets” on page 32.</td>
<td>MCU</td>
<td>All TC390A pairs with M-VOLs in the MCU.</td>
</tr>
<tr>
<td>During MCU power-on, the MCU could not establish communication with the RCU before the RCU ready timeout group option expired. See “Group Options” on page 34.</td>
<td>MCU</td>
<td>All TC390A pairs with M-VOLs in the MCU.</td>
</tr>
<tr>
<td>The RCU could not settle a pending recordset before the copy pending timeout group option expired.</td>
<td>RCU</td>
<td>All TC390A R-VOLs in the consistency group.</td>
</tr>
<tr>
<td>The RCU could not communicate with the MCU before the copy pending timeout group option expired.</td>
<td>RCU</td>
<td>All TC390A R-VOLs in the consistency group.</td>
</tr>
<tr>
<td>The RCU could not receive the recordset successfully due to a hardware failure.</td>
<td>RCU</td>
<td>Only the affected R-VOL.</td>
</tr>
<tr>
<td>The RCU detected a logical error while selecting the recordset to be settled.</td>
<td>RCU</td>
<td>All TC390A R-VOLs in the group, or only the affected R-VOL, depending on the failure type and error level TC390A pair option.</td>
</tr>
<tr>
<td>The RCU could not settle the recordset due to a hardware failure, a track condition, or a logical error.</td>
<td>RCU</td>
<td>All TC390A R-VOLs in the group, or only the affected R-VOL, depending on the failure type and error level TC390A pair option.</td>
</tr>
</tbody>
</table>
The MCU stores a cylinder bitmap in cache for each TC390A M-VOL and the RCU stores a cylinder bitmap in cache for each TC390A R-VOL. When a TC390A pair is suspended, the cylinders that contain the following records are marked in the cylinder bitmap as modified (to be copied during the resume pair operation):

- The recordsets that were created by the MCU but not yet sent to the RCU. After marking these cylinders as modified, the MCU discards these recordsets.
- The recordsets that were sent to the RCU but not acknowledged by the RCU. The MCU marks these M-VOL cylinders as modified and discards these recordsets. This ensures that recordsets that are lost during transmission to the RCU are identified and marked.
- The recordsets that reached the RCU but have not yet been settled. After marking these cylinders as modified, the RCU discards these recordsets.
- The M-VOL records updated by host-requested write I/Os after the volume pair was suspended (same function as for TC390 Synchronous pairs).

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

**PPRC Support**

An XP1024/XP128/XP12000/XP10000 with TC390 installed supports IBM PPRC host software functions. You can perform most TC390 operations by issuing PPRC TSO (or ICKDSF PPRCOPY) commands from the host system console to the XP1024/XP128/XP12000/XP10000. Using PPRC commands, you can establish and delete remote copy communication paths; establish, suspend, resume, and delete TC390 Synchronous and TC390A pairs/groups; and view TC390 path and pair status. For more information on using PPRC TSO and ICKDSF commands with the XP1024/XP128/XP12000/XP10000, see “Using PPRC Commands for TrueCopy” on page 153.

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

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

- **SVP mode 114** (see Table 4 on page 20) must be enabled to allow automatic port configuration in response to PPRC commands. To fully support an automated environment, the XP1024/XP128/XP12000/XP10000 is capable of automatically configuring a serial port as an RCP or LCP, or a Fibre Channel port as an initiator or RCU target port if required in response to the TSO CESTPATH and CDELPATH commands. However, even if you set ON for SVP mode 114, initiator ports will not automatically change to RCU target ports, nor vice versa, when these ports are in initiator/external mix mode. The XP1024/XP128/XP12000/XP10000 will verify that the specified MCU port is offline to the host and will automatically configure it as an RCP or initiator port if required. Similarly, the corresponding RCU port will also be configured as an LCP or RCU target port if required. When the CDELPATH command is issued, the TC390 logical paths are removed, and if there are no more TC390 or TC logical paths on the port, the port is automatically changed from RCP mode to LCP mode, or from initiator port mode to RCU target port mode.

**NOTE:** For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.
⚠️ **CAUTION:** Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active logical paths still exist, the add path operation will fail because the port mode (LCP/RCP) cannot be changed.

- **You cannot use the PPRC commands to:**
  - **Change the RCU options.** The current default values are: minimum paths = 1, max. initial copy activity = 4, SCP delay time = 120 seconds, incident of RCU = to any host, PPRC support = yes, remote copy service SIM = not report, RIO MIH Time = 15 seconds. The TC390 software must be used to change these options.
  - **Change the TC390 async options.** The current default values are: sidefile threshold = 50%, offloading timer = 5 minutes. The TC390 software must be used to change these options.
  - **Configure TC390A consistency groups.** Because each TC390A pair must belong to one group, the TC390 software must be used to add and configure the groups (timer type, copy pending timeout, RCU ready timeout) before you can add any TC390A pairs. After the asynchronous options, groups, and group options are configured, the PPRC commands can be used to control/monitor TC390A pairs.
  - **Change the initial copy priority.** CFW data option, or DFW to R-VOL option. If CESTPAIR is used to establish a TC390 pair, the following options will be used: initial copy priority = 0, CFW data = copy to R-VOL, and DFW to R-VOL = not required. The TC390 software must be used to change these options.

⚠️ **NOTE:** By using Remote Copy Function Switch, you can set the following option with PPRC command: CFW data = only M-VOL. If you want to use this function, please contact your HP account support representative.

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

---

**P/DAS Support**

TC390 Synchronous supports the IBM P/DAS host software function. You can use P/DAS to relocate or migrate data by redirecting all application I/Os from the M-VOL of a TC390 pair to the R-VOL without interrupting access to the data. TC390A does not support P/DAS SWAP.

**Restrictions**

- P/DAS does not support CFW operations. You must stop CFW applications before performing P/DAS operations on TC390 volumes.
- P/DAS through channel extenders is not supported.
- P/DAS swap option #2 (switch pair and swap) is supported for P/DAS between the XP1024/XP128/XP12000/XP10000 and other XP disk arrays.

Contact your HP account support representative for the latest information on P/DAS support.

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**GDPS Support**

TC390 provides remote copy support for IBM’s Geographically Dispersed Parallel Sysplex (GDPS) facility. GDPS is an IBM service offering for mirroring data and balancing workload on disk arrays spread across two or more sites up to 40 km (~20 miles) apart. With this support, users who are running IBM Parallel Sysplex systems can take advantage of the XP1024/XP128/XP12000/XP10000 suite of remote copy options for data availability.

GDPS operations feature automatic control of groups of PPRC-managed volumes using host-based scripts and PPRC commands (for example, CESTPATH CGROUP option for 2105, CGROUP (FREEZE/RUN) for
GDPS support may have additional installation requirements for the XP1024/XP128/XP12000/XP10000 TC390 MCUs and RCUs, depending on XP1024/XP128/XP12000/XP10000 microcode levels and Command View XP or XP Remote Web Console software versions. Check the following items with your HP representative:

- **SVP modes.** For operations in a GDPS environment:
  
  **Mode 64 must be OFF.**
  
  **Mode 104 must be ON for 3990 controller emulation (not valid for 2105 emulation).**
  
  For more information on XP1024/XP128/XP12000/XP10000 SVP modes related to TC390 operations, refer to Table 4 on page 20.

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

### RMF PPRC Link-path Statistical Information Support

When you use z/OS Resource Measurement Facility (RMF), and if you specify the IBM TotalStorage Enterprise Storage Server® (ESS), you can acquire the PPRC Fibre Link-path statistical information. For further information on the PPRC Link-path statistical information acquisition, please refer to the IBM® publications.

Table 13 and Table 14 give the XP1024/XP128/XP12000/XP10000 USP system adaptor ID(SAID) values for the LINK parameters (ports) that are displayed when you acquire the PPRC Link-path statistical information using RMF.

**NOTE:** The XP1024/XP128/XP12000/XP10000 USP system adaptor ID(SAID) values in Table 13 and Table 14 are different from the ones for the LINK parameters of TSO commands (see Table 34 and Table 35).

**NOTE:** If you acquire the PPRC Fibre Link-path statistical information by using RMF, and if the total data size per the interval for which you acquire the data is 100 kB and below, zero may be reported for the data size. Even if the data is not updated by host I/O during TCzA operations, the data size is reported. This is because the recordset which does not have data is sent from MCU to RCU. In this case, if the total data size per the interval for which you acquire the data is 100 kB and below, zero may also be reported for the data size.

**Table 13** SAID Values for the LINK Parameters (=ports) of RMF PPRC Link-path Statistical Information (FRONT CL1 Package Location)

<table>
<thead>
<tr>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1E</td>
<td>CL1-A</td>
<td>X’0000’</td>
<td>1G</td>
<td>CL1-J</td>
<td>X’0020’</td>
<td>1K</td>
<td>CL9-N</td>
<td>X’0070’</td>
<td>1B</td>
<td>CL9-E</td>
<td>X’0050’</td>
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<td>(Basic)</td>
<td>CL3-A</td>
<td>X’0001’</td>
<td>(Add 2)</td>
<td>CL3-J</td>
<td>X’0021’</td>
<td>(Add4)</td>
<td>CLB-N</td>
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<td>(Add6)</td>
<td>CLB-E</td>
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<td></td>
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<td>CL5-J</td>
<td>X’0024’</td>
<td>CLD-N</td>
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<td>CLD-E</td>
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<td>CL7-J</td>
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<td>CLF-N</td>
<td>X’0075’</td>
<td>CLF-E</td>
<td>X’0055’</td>
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<tr>
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<td>CL1-B</td>
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<td>CL1-K</td>
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<td>CLF-F</td>
<td>X’005D’</td>
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<tr>
<td></td>
<td>CL1-C</td>
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**Table 13** SAID Values for the LINK Parameters (=ports) of RMF PPRC Link-path Statistical Information (FRONT CL1)

<table>
<thead>
<tr>
<th>Package Location</th>
<th>Port</th>
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<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
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<td>CL1-M</td>
<td>X'002A'</td>
<td>CL9-R</td>
<td>X'007A'</td>
<td>CL9-H</td>
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<td>X'002B'</td>
<td>CLB-R</td>
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<td>CL5-M</td>
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<td>CL1-R</td>
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<td>X'006A'</td>
<td>CL9-D</td>
<td>X'004A'</td>
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</tr>
<tr>
<td>CL3-H</td>
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<td>CL3-R</td>
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* Please note that the SAID values in Table 13 are different from the ones in Table 14, Table 37 and Table 38.

**Table 14** SAID Values for the LINK Parameters (=ports) of RMF PPRC Link-path Statistical Information (REAR CL2)

<table>
<thead>
<tr>
<th>Package Location</th>
<th>Port</th>
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<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
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<tbody>
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<td>CL2-J</td>
<td>X'00A0'</td>
<td>2W</td>
<td>CLA-N</td>
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<td>X'0081'</td>
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<td>X'00A1'</td>
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<td>X'00F5'</td>
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<td>X'00F8'</td>
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<td>X'00FC'</td>
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<td>X'00DC'</td>
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</table>
Preparing for TrueCopy Operations

System Requirements

TC390 operations involve the XP1024/XP128/XP12000/XP10000 MCUs and RCUs containing the main and remote volumes, the remote copy connections between the MCUs and RCUs, the zSeries and S/390 host(s) at the main and remote sites, and TC390 running through Command View XP or XP Remote Web Console.

The TC390 system requirements are:

- **MCU**: XP1024/XP128/XP12000/XP10000 with TC390 installed.
- **RCU**: XP1024/XP128/XP12000/XP10000 with TC390 installed.

---

**Table 14**

SAID Values for the LINK Parameters (=ports) of RMF PPRC Link-path Statistical Information (REAR CL2)

<table>
<thead>
<tr>
<th>Package Location</th>
<th>Port</th>
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<th>Port</th>
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<td>CL2-L</td>
<td>X'00A2'</td>
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<td>X'00F2'</td>
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* Please note that the SAID values in Table 13 are different from the ones in Table 14, Table 37 and Table 38.
**NOTE:** Other XP disk arrays with TC390 installed can be used as an RCU connected to an XP1024/XP128/XP12000/XP10000 MCU. For assistance with mixed disk array configurations, contact your HP account support representative.

TC390 can coexist with CA (all copy modes) in the same XP1024/XP128/XP12000/XP10000. Full Fibre Channel support will allow concurrent fibre-mode CA and TC390 operations.

The XP1024/XP128/XP12000/XP10000 may have additional installation requirements, such as SVP modes, hardware features such as CHF WP411-B, additional cache, and so forth. For more information on XP1024/XP128/XP12000/XP10000 SVP modes for TC390, refer to Table 4 on page 20.

- **Serial remote copy connections** (see “Serial Remote Copy Connections” on page 52):
  - Multimode serial interface (ESCON) cables are required at both the MCU and RCU.
  - For distances from 3 km to 43 km (1.9 to 26.7 miles), single-mode serial interface cables with IBM 9032 or 9033 ESCON directors (ESCDs) and/or 9036 ESCON repeaters are required.
  - For distances greater than 9 km (5.6 miles), the extended distance facility (XDF) provided by the ESCDs and/or ESCON repeaters is required.
  - For distances greater than 43 km (26.7 miles), approved third-party channel extender products and telecommunications lines are required. Long-distance TC390 solutions are provided based on user requirements and workload characteristics.

**NOTE:** Use of channel extenders may require additional XP1024/XP128/XP12000/XP10000 configuration (for example, mode 21).

All serial remote copy activities between two XP1024/XP128/XP12000/XP10000s, such as TC390, TC390A, CA Sync, and CA Async, can share the same remote copy connections.

- **Remote copy connections – Fibre Channel** (see “Fibre Remote Copy Connections” on page 50):
  - 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.
  - **zSeries and S/390 host**: MVS/DFP® 3.2.0 + PTF, or VM/ESA® 2.1.0 + PTF.
    - Optional error recover procedure (ERP) functions require MVS/DFP 3.2.0 or later.
    - ICKDSF R16 + PTF functions require VM/ESA 2.1.0 or later.
    - If the primary and/or secondary system consists of several CPU complexes, a **SYSPLEX timer** is required to provide a common time reference for the host I/O time-stamping function.
    - APAR OW36948 is required for 16-session support for HXRC.
  - **Command View XP management station and Command View XP or XP Remote Web Console software.** The Command View XP management station is supplied by the user. The Web browser is required to operate the Command View XP or XP Remote Web Console Java™ Applet programs. Also, the license key code is required to operate the TC390 software.

**NOTE:** Administrator access to the Command View XP management station or XP Remote Web Console is required to perform TC390 operations. Users without administrator access can only view TC390 information.
TC390 option(s) enabled on the XP1024/XP128/XP12000/XP10000 and on the Command View XP management station or XP Remote Web Console (see “Installing the TrueCopy Software” on page 54).

Requirements and Restrictions

TC390 has the following requirements and restrictions:

- Track format
- One-to-one volume copy operations
- Duplicate VOLSER (Volume Serial Number)
- Logical volume image (LVI) (also called device emulation or device type)
- Accessing TC390 M-VOLs and R-VOLs
- Cache, NVS, and DASD fast write
- Consistency groups

Track Format

TC390 has the following disk track format requirements that the user must follow. TC390 cannot detect exceptions to these requirements. The MCU will abort the TC390 initial copy operation if the track format for both the M-VOL and R-VOL does not meet the following requirements:

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

One-to-One Volume Copy Operations

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

Duplicate VOLSER

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

⚠️ CAUTION: ⚠️

- If the volumes that will become TC390 R-VOLs are physically attached to the same system images as the production volumes that will become the TC390 M-VOLs, the following problems can occur:
  - When a TC390 pair is established using the TSO CESTPAIR command, the secondary volume might be online. PPRC allows this, but TC390 does not (see the following note). This could produce a duplex secondary online to a host image, the results of which are not predictable.
  - When a TC390 pair is deleted, the old secondary volume is usually offline. If a host image is IPL’d, the operator will be offered both volumes and asked which volume should be left offline – the old duplicate volser message. This can be confusing and is prone to error. To avoid duplication of VOLSER
    1. identify the volumes that will not be accessed by the host system
    2. perform CHP OFF or some other operation to ensure that the volumes are inaccessible.

After you complete the steps, when performing IPL, you must perform LOAD CLEAR.
• To avoid these problems, HP strongly recommends that the user specify OFFLINE=YES if the secondary volumes are to be generated in the production host’s IOCP and system generation.

**NOTE:** If you cannot create a pair because the TC390 R-VOL is online with hosts, all paths must be offline from all hosts. If you cannot identify the hosts that are online, please contact your HP account support representative.

### Logical Volume Image (LVI)

TC390 supports basic mainframe LVIs that can be configured on the XP1024/XP128/XP12000/XP10000 (for example, 3390-3, -3R, -9, or -L). TC390 does not support multiprogram volumes (3390-1, -2, -3A/B/C, 3380-K, -E, -J, or -KA/B/C). TC390 can copy data between volumes with the same emulation and capacity (for example, 3390-3R to 3390-3R), and can also copy from smaller volumes to larger volumes (for example, 3390-3 to 3390-3R) of the same emulation (VTOC expansion must be used). TC390 also supports the Virtual LVI/LUN feature of the XP1024/XP128/XP12000/XP10000 to establish TC390 pairs with custom-size LVIs as well as standard-size LVIs. When custom-size LVIs are assigned to TC390 pairs, the R-VOL must have the same or larger capacity than the M-VOL. TC390 displays the LVI of the M-VOLS and R-VOLS.

**NOTE:** The host I/O time-stamping function is not supported by 3380 LVIs. If you plan to use TC390A pairs, the TC390A M-VOLS and R-VOLS must be 3390 LVIs.

In the case that M-VOL or R-VOL is 3390-L LVI under the connection of the disk array, and the number of cylinders is more than 10,017, the capacity of the M-VOL and R-VOL must be the same.

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

**CAUTION:** If you use a Fujitsu operating system, and utilize TC390A to copy from a smaller capacity of M-VOL to the larger capacity of R-VOL, an error will occur when the write operation will be performed to the former R-VOL after the pair has been deleted. If the write operation is required on this volume, make the capacity of M-VOL and R-VOL same, and then create a pair.

### Accessing TrueCopy M-VOLS and R-VOLS

Write operations to a TC390 M-VOL that specify normal authorization are duplicated on the R-VOL of the TC390 pair. Write operations with diagnostic or device support authorization, such as ICKDSF, are completed at the M-VOL but are not duplicated at the R-VOL. Therefore, you must suspend a TC390 volume pair before performing ICKDSF media maintenance on the M-VOL. For instructions on running ICKDSF on TC390 volumes, see "ICKDSF Considerations for TrueCopy Volumes" on page 136.

To ensure maximum data integrity during normal TC390 operations, the RCU rejects all read and write operations issued by a host to a TC390 R-VOL. If you need read-only access to a TC390 R-VOL, you must have the R-VOL read option (see "R-VOL Read Option" on page 29) enabled on the RCU and you must suspend the pair to read the R-VOL. The R-VOL read option can be enabled by the HP representative only. If you need write access to a TC390 R-VOL (for example, to perform ICKDSF), you must delete the pair from the RCU to change the R-VOL pair status to simplex. For instructions on running ICKDSF on TC390 volumes, see "ICKDSF Considerations for TrueCopy Volumes" on page 136.
Cache, NVS, and DASD Fast Write

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

DASD fast write (DFW) is required at the MCU and RCU only when the DFW-to-R-VOL required TC390 pair option (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121) is specified. If DFW to an R-VOL is blocked and the TC390 pair was established with the DFW-to-R-VOL required pair option, the MCU detects DFW OFF at the R-VOL and suspends the pair. TC390 pairs that were established using PPRC commands use the default value of not required and therefore are not suspended when DFW to the R-VOL is blocked.

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

Consistency Groups

The TC390A consistency groups have the following requirements:

- All TC390A pairs must be assigned to one and only one consistency group.
- The maximum number of volume pairs in one consistency group is 4,096 (entire RCU).
- The maximum number of consistency groups established for one MCU-RCU pair is 128. The RCU supports a maximum of 128 groups. This limit of 128 groups includes both TC390A groups and TC Asynchronous groups (for example, 64 TC390A + 64 CA Asynchronous).
- Each update I/O to the M-VOLs in one consistency group must be time-stamped using a common timer facility. The primary host system cannot access volume pairs of the same consistency group if the pairs do not have a common timer reference.
- A consistency group must consist of TC390A pairs or CA Asynchronous pairs, but not both.
- Only TC390A pairs that belong to the same CLPR can be allocated to one consistency group. For further information on CLPR, please refer to the HP StorageWorks Command View XP User Guide for XP Disk Arrays or the HP StorageWorks XP Remote Web Console User Guide for the specific disk array.

Installing the TrueCopy Hardware

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

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

2. **User**: On the host operating system, verify that the missing interrupt handler (MIH) value (also called host I/O patrol time) is set high enough to accommodate the number of volume pairs, the cable length between the MCUs and RCUs, and the initial copy pace. The recommended MIH value for TC390 operations is 60 seconds. For MVS, the MIH value is specified in the SYS1.PARMLIB file.

   NOTE: The recommended MIH value for HXRC is different than for TC390. If you are performing TC390 and HXRC on the same XP1024/XP128/XP12000/XP10000 (or other XP disk arrays) at the same time, contact your HP account support representative for assistance.

3. **User and HP Representative**: Install the Command View XP management station near the TC390 MCU(s) and connect the Command View XP management station to the TC390 MCU(s) through the LAN. HP recommends that you also install a Command View XP management station connected to the RCUs at the remote site.

4. **HP Representative**: Enable TC390 on all MCUs and RCUs. Verify that the cache, NVS, and DFW of the MCUs and RCUs are properly configured for TC390 operations. See “Cache, NVS, and DASD Fast Write” on page 49. If the user plans to perform TC390A and/or HXRC operations in the same disk
array, make sure to install adequate cache to handle the increased sidefile usage. When determining the required amount of cache, you must also consider the amount of Cache LUN XP data to be stored in cache.

5. **HP Representative**: Verify that the necessary SVP modes are enabled. See Table 4 on page 20.

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

7. **HP Representative**: For serial interface connections, install the serial port adapter features. For example, the DKC-F4101-8S 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 disk arrays, there may be available serial interfaces and additional serial port adapter features may not be required. For Fibre Channel interface connections, install the Fibre Channel adapter features (CHF P/K (WP411-B)).

8. **HP Representative**: If the user plans to use the **Local** TC390A timer type option, set the SVP clock to local time so that the TC390A timestamps will be correct.

9. **HP Representative**: Install the TC390 remote copy connections between the MCU(s) and RCU(s). This hardware (optical fibre cables, switches, and so forth) is supplied by the user. For remote copy configurations, see “Serial Remote Copy Connections” on page 52. 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 serial interface connections, all remote copy activities between two XP1024/XP128/XP12000/XP10000s, such as TC390, TC390A, CA Sync, and CA Async, can share the same remote copy connections. For Fibre Channel interface connections, only TC390 activities (Sync and Async) can share the same fibre remote copy connections (future support will eliminate this restriction). For information on using channel extenders, see “Channel Extenders for Serial Remote Copy Connections” on page 54.

**Fibre Remote Copy Connections**

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

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**Figure 6** 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 XP1024/XP128/XP12000/XP10000.

Fibre Channel interface connection provides three different configurations:

- **Direct connection**: Two devices are connected directly together.

In the following figure: * To set ports, use LUN Management and set port topology to: Fab off, FC-AL.

![Figure 7 Fibre Channel interface direct connection (NL port)](image)

- **Switch connection**: Up to three optical fibre cables are connected together through the switches to connect the devices. Up to two switches can be used.

In the following figure:
1. Some switch vendors require F port (for example, McData ED5000).
2. To set ports, use LUN Management and set port topology to:
   - NL port: Fab on, FC-AL
   - N port: Fab on, Point-to-Point

![Figure 8 Fibre Channel interface switch connection (FL port or F port)](image)

- **Extender connection**: Channel extenders and switches are used to connect the devices across large distances.

In the following figure: * To set ports, use LUN Management and set port topology to:

   - NL port: Fab on, FC-AL
Serial Remote Copy Connections

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

Figure 10 Serial remote copy connection configurations

The ESCDs can accommodate multiple MCU-RCU remote copy connections.
N-to-1 or 1-to-n remote copy connections \((n \leq 4)\) can also be configured by using the dynamic switching capability of the ESCDs to share the physical interface cables between the components.

**NOTE:**

1-to-n configurations (one main disk array and multiple remote disk arrays) are valid for TC390A, as long as a consistency group does not span remote disk arrays.

In addition, the ESCDs can accommodate channel-to-MCU and channel-to-RCU connections in addition to the remote copy connections.
Channel Extenders for Serial Remote Copy Connections

TC390A can be integrated with third-party channel extender products to provide remote data backup for distances greater than 43 km. Contact your HP account support representative for the latest information on channel extender support for TC390.

Installing the TrueCopy Software

The user installs the software required for TC390 operations on the Command View XP management station.

To install the TC390 software:

1. Install the Command View XP software on the Command View XP management station that is connected to the TC390 disk array(s).
2. Add each TC390 disk array to the Command View XP management station.
3. Enable the TC390 options on the Command View XP management station and on each TC390 disk array.

Configuring the MCUs and RCUs for TrueCopy Operations

After you have installed the TC390 hardware and software, you can configure the MCUs and RCUs for TC390 operations. The configuration depends on the interface type of the remote copy connections, serial or Fibre Channel.

**NOTE:** At this time serial interface and Fibre Channel interface configurations cannot coexist for the same MCU. Future support is planned.

Serial interface connection is not supported for this version.

Serial Interface Configuration

To configure the MCUs and RCUs for serial-interface TC390 operations:

1. Identify the volumes that will become the TC390 M-VOLs and R-VOLs. You need to know the disk array S/N, SSID, and CU image of each TC390 volume so that you can configure the MCUs and RCUs correctly for the appropriate pairs and async groups. When you create the pairs, you will need to know the port, group ID, and LUN of each volume.
2. Connect to the disk array that you want to configure as a TC390 MCU.

**NOTE:** You must operate the Command View XP management station or XP Remote Web Console in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

3. From the Identity window, click the **Mainframe** tab, and then click the **TrueCopy** button ( ) to start the TC390 software. The TrueCopy main window is displayed and the **Pair Operations** tab is displayed at the top.
4. Configure the serial interface ports that are connected to the RCUs as RCPs by the Port Change operation.
5. Register the RCU(s) to the current MCU CU image using the Add RCU window and set the options for the registering RCU using the RCU Option window. For additional instructions, see “Registering an RCU (Add RCU)” on page 87.
6. If you plan to create TC390A pairs with M-VOLs in this MCU, configure the MCU async options as shown in the following figure. For additional instructions, see “Asynchronous Copy Option” on page 108.

![Async Option](image)

Figure 14 Setting the Async options

Then register the consistency group to the MCU as shown in the following figure. For additional instructions, see “Adding Consistency Groups (Add CT Group)” on page 105.

![Add CT Group](image)

Figure 15 Adding the consistency groups

7. When you are finished configuring this MCU, exit the TrueCopy main window and close Command View XP or XP Remote Web Console.

8. Repeat step 2 - step 7 for each disk array that will function as a TC390 MCU. After you have configured the MCUs, registered the RCUs, and configured the TC390 Async options and consistency groups, you are ready to begin TC390 volume pair operations.

Fibre Channel Interface Configuration

To configure the MCUs and RCUs for TC390 Fibre Channel operations:

1. Identify the volumes that will become the TC390 M-VOLs and R-VOLs. You need to know the disk array S/N, SSID, and CU image of each TC390 volume so that you can configure the MCUs and RCUs correctly for the appropriate pairs and async groups. When you create the pairs, you will need to know the port, target ID, and LUN of each volume.

2. Connect to the disk array that you want to configure as a TC390 MCU.
NOTE: You must operate the Command View XP management station XP or XP Remote Web Console in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

3. Click the Mainframe tab, and then click the TrueCopy button ( ) to start the TC390 software. The TrueCopy main window is displayed and the Pair Operations tab is displayed at the top.

4. Configure the Fibre Channel interface ports that are connected to the RCUs as Initiators by the Port Change operation.

5. Register the RCU(s) to the current MCU CU image using the Add RCU window.

![Add RCU window](Figure 16 Add the RCUs)
Set the options for the registering RCU using the RCU Option window as shown in the following figure. For additional instructions, see “Registering an RCU (Add RCU)” on page 87.

**Figure 17** Configuring the RCU options

6. If you plan to create TC390A pairs with M-VOLs in this MCU, configure the MCU async options as shown in the following figure. For additional instructions, see “Asynchronous Copy Option” on page 108.

**Figure 18** Setting the Async options
Then register the consistency group(s) to the MCU as shown in the following figure. For additional instructions, see “Adding Consistency Groups (Add CT Group)” on page 105.

![Add CT Group](image)

Figure 19 Adding the consistency groups

7. When you are finished configuring this MCU, exit the TrueCopy main window and close Command View XP or XP Remote Web Console.

8. Repeat step 2 - step 7 for each disk array that will function as a TC390 MCU. After you have configured the MCUs, registered the RCUs, and configured the TC390 Async options and consistency groups, you are ready to begin TC390 volume pair operations.

Combining TrueCopy with Other Data Management Operations

Some types of volumes used by non-TCz and non-TCAz functions can also be used as M-VOL and R-VOL of TCz and TCAz. Table 15 on page 58 explains whether non-TCz and non-TCAz volumes are also usable as TCz and TCAz volumes.

<table>
<thead>
<tr>
<th>Functions and Volumes</th>
<th>Can the Volumes be Used as TCz M-VOL?</th>
<th>Can the Volumes be Used as TCz R-VOL?</th>
<th>Can the Volumes be Used as TCAz M-VOL?</th>
<th>Can the Volumes be Used as TCAz R-VOL?</th>
</tr>
</thead>
<tbody>
<tr>
<td>ShadowImage for z/OS (Stz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-VOL in Split status</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>S-VOL in Resync-R status</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>S-VOL that is also used as a URz primary data volume or URz secondary data volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>S-VOL (none of the above)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>T-VOL in Split status</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>T-VOL (none of the above)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Reserved volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Compatible Mirroring for IBM FlashCopy® (FlashCopy® Mirror)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-VOL</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>T-VOL</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>----------------</td>
<td>-------</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><strong>Compatible Mirroring for IBM FlashCopy® Version 2 (FlashCopy® Mirror Version 2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-VOL</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>T-VOL</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Compatible Replication for IBM® XRC (XRC Replication)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XRC Replication main volume</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>XRC Replication remote volume</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Concurrent Copy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concurrent Copy volume</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Cross-System Copy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External mainframe volume that are not used as a P-VOL or S-VOL of a Cross-System Copy pair</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External mainframe volume that are used as a P-VOL or S-VOL of a Cross-System Copy pair</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Volume Migration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source volume (when volume migration is in progress)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Source volume (after volume migration is finished)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Target volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Reserved volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Universal Replicator for z/OS (URz)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary data volume in Pending duplex status</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Status Description</td>
<td>Yes</td>
<td>No.</td>
<td>YKRESYNC REVERSE</td>
<td>No</td>
</tr>
<tr>
<td>--------------------------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>------------------</td>
<td>----</td>
</tr>
<tr>
<td>Primary data volume in Duplex status</td>
<td>Yes</td>
<td>No.</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>YKRESYNC REVERSE</td>
<td></td>
</tr>
<tr>
<td>Primary data volume in Suspend status</td>
<td>Yes</td>
<td>No.</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>YKRESYNC REVERSE</td>
<td></td>
</tr>
<tr>
<td>Primary data volume that is suspended due to a failure</td>
<td>Yes</td>
<td>No.</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>YKRESYNC REVERSE</td>
<td></td>
</tr>
<tr>
<td>Secondary data volume in Pending status</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary data volume in Duplex status</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary data volume in Suspend status</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary data volume in Swapping status</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary data volume that is suspended due to a failure</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TC390 supports concurrent operations with the following data management functions:

- **Virtual LVI/LUN.** Virtual LVI/LUN volumes can be assigned to TC390 pairs as long as the RVOL has the same or larger capacity than the M-VOL. If you need to perform Virtual LVI/LUN operations on an existing TC390 M-VOL or R-VOL, you must delete the pair first to return the volume to simplex status. For further information on Virtual LVI/LUN, please refer to the LUN Expansion (LUSE)/Virtual LVI/LUN (VLI) User’s Guide.

- **Cache LUN XP.** Cache LUN XP volumes can be assigned to TC390 pairs and Cache LUN XP operations can be performed on TC390 M-VOLs and RVOLs.

<table>
<thead>
<tr>
<th>Multiplatform Backup</th>
<th>Volume Retention Manager</th>
<th>Volume Security</th>
<th>Cross-OS File Exchange</th>
<th>Cache Residency Manager</th>
<th>Cache Residency Manager volume</th>
<th>Compatible PAV for Mainframe</th>
<th>Compatible PAV for Mainframe volume</th>
<th>Virtual LVI</th>
<th>Virtual LVI volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiplatform Backup volume</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Volume with Read/Write attribute</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Volume with Read Only attribute</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Volume with Protect attribute</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Volume registered in a security group</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Volume usable by both mainframe and open systems</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cache Residency Manager volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Compatible PAV for Mainframe</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Compatible PAV for Mainframe volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Virtual LVI</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Virtual LVI volume</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**NOTE:** When TCzA, TCA and Universal Replicator coexist in the same Hitachi TagmaStore™ USP subsystem, TCzA pairs, TCA pairs and Universal Replicator pairs cannot be mixed in one consistency group. If TCA pair has been allocated to Consistency group No. 00, TCzA pair and Universal Replicator pair cannot be allocated to Consistency group No. 00. TCzA and TCA share the same cache sidefile area.
• **SANtinel - S/390.** SANtinel operations do not affect TC390 operations. Secure volumes can be assigned to TC390 pairs, and TC390 volumes can be assigned to secure ports and/or groups for SANtinel operations.

   **NOTE:** TC390 R-VOLs cannot be accessed by any host except when the pair is split.

• **HXRC.** The XP1024/XP128/XP12000/XP10000 is functionally compatible with the IBM Extended Remote Copy (XRC) function. See Table 16 on page 62.

• **SI390.** SI390 volumes can be assigned to TC390 pairs and TC390 volumes can be assigned to SI390 pairs. For information on TC390 and SI390 shared volume configurations, see “Combining TrueCopy with Other Data Management Operations” on page 58. This configuration requires at least one external ESCON or fibre cable loop.

   **NOTE:** When TC390 and SI390 are both active on the same XP1024/XP128/XP12000/XP10000, each consistency group must contain either TC390A pairs or CA Asynchronous pairs (not both), and TC390A and CA Asynchronous share the same cache sidefile area.

• **Prioritized Port Control.** The initiator ports in the MCU do not support the Prioritized Port/WWN Control option because they are dedicated for TC390 operations.

   **NOTE:** When TC390 and CA coexist in the same XP1024/XP128/XP12000/XP10000, each consistency group must contain either TC390A pairs or CA Asynchronous pairs (not both), and TC390A and CA Asynchronous share the same cache sidefile area.

**Combining TC390 and HXRC.** The following table shows the requirements and restrictions for combining TC390 and HXRC operations on the same XP1024/XP128/XP12000/XP10000 device.

<table>
<thead>
<tr>
<th>Combination allowed?</th>
<th>TC390 M-VOL</th>
<th>TC390 R-VOL</th>
<th>HXRC Primary</th>
<th>HXRC Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC390 M-VOL</td>
<td>--</td>
<td>No</td>
<td>Yes for TC390 Sync No for TC390 Async</td>
<td>Yes</td>
</tr>
<tr>
<td>TC390 R-VOL</td>
<td>No</td>
<td>--</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>HXRC Primary</td>
<td>Yes for TC390 Sync No for TC390 Async</td>
<td>No</td>
<td>--</td>
<td>Yes¹</td>
</tr>
<tr>
<td>HXRC Secondary</td>
<td>Yes</td>
<td>No</td>
<td>Yes¹</td>
<td>--</td>
</tr>
</tbody>
</table>

¹. An XP1024/XP128/XP12000/XP10000 volume that is an HXRC secondary device cannot also be an HXRC primary in the same XRC session, but it can be an HXRC primary device in another XRC session.

**Combining TrueCopy and ShadowImage**

ShadowImage volumes can be assigned to TCz pairs, and TCz volumes can be assigned to ShadowImage pairs. For further information on ShadowImage for z/OS®, please refer to the ShadowImage User’s Guide.

**NOTE:** When TCz and ShadowImage are both active on the same Hitachi TagmaStore™ USP subsystem, TCz cannot be used to copy within that subsystem. ShadowImage is recommended for subsystem-internal copy. If ShadowImage is not active, TCz Synchronous supports intra-subsystem copy and requires at least one external ESCON® cable loop or fibre cable loop.
TC390 and SI390 can be used together in the same disk array and on the same volumes to provide multiple copies of data at the main and/or remote sites. The following table describes the host pair status reporting for TC390 volumes, SI390 volumes, and TC390/SI390 shared volumes. Table 18 on page 63 shows the currency of the data on a shared TC390/SI390 volume based on TC390 and SI390 pair status.

- For shared TC390/SI390 volumes, the TC390 pair status is reported to the host if you query the R-VOL. To obtain the SI390 pair status, query the target volume (T-VOL) of the pair.
- SI390 supports multiple target volumes (T-VOLs) for each source volume (S-VOL). If you issue a pair status query to an SI390 S-VOL (for example, CQUERY), the status for only one SI390 pair is reported (the pair with the T-VOL with the lowest LDEV ID). To obtain the pair status for the SI390 pair(s) with the other T-VOL(s), you must direct the host query to the specific T-VOL using the T-VOL’s LDEV ID in the host command (for example, CQUERY DEVN parameter). SI390 through Command View XP or XP Remote Web Console displays the LDEV ID and SI390 pair status of all T-VOLs associated with an S-VOL.

**Table 17 Host pair status reporting for TrueCopy/ShadowImage shared volumes**

<table>
<thead>
<tr>
<th>Number of TC390 Pairs</th>
<th>Number of SI390 T-VOLs</th>
<th>Pair Status Reported by XP1024/XP128/XP12000/XP10000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Simplex</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>SI390 pair status</td>
</tr>
<tr>
<td>0</td>
<td>2 or more</td>
<td>ShadowImage pair status for the pair whose T-VOL has the lowest LDEV ID</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>TC390 pair status</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>TC390 pair status</td>
</tr>
<tr>
<td>1</td>
<td>2 or more</td>
<td>TC390 pair status</td>
</tr>
</tbody>
</table>

**Table 18 Data currency of a shared TrueCopy/ShadowImage volume**

<table>
<thead>
<tr>
<th>TC390 Pair Status</th>
<th>ShadowImage Pair Status</th>
<th>Pending</th>
<th>Duplex</th>
<th>Split-Pending</th>
<th>Split</th>
<th>Resync</th>
<th>Suspended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pending Duplex</td>
<td></td>
<td>Not current</td>
<td>Not current</td>
<td>Not current</td>
<td>CURRENT</td>
<td>Not current</td>
<td>Not current</td>
</tr>
<tr>
<td>Duplex</td>
<td></td>
<td>Not current</td>
<td>Not current</td>
<td>Not current</td>
<td>CURRENT</td>
<td>Not current</td>
<td>Not current</td>
</tr>
<tr>
<td>Suspended</td>
<td></td>
<td>Not current</td>
<td>CURRENT</td>
<td>CURRENT</td>
<td>CURRENT</td>
<td>CURRENT</td>
<td>Not current</td>
</tr>
</tbody>
</table>

The following figures show the various TC390/ShadowImage configurations that share volumes. TC390 supports synchronous and asynchronous operations for shared volumes. The following figure shows an example of a volume that is functioning as both a TC390 M-VOL and a ShadowImage S-VOL. With this configuration, you can:

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

**Figure 20 TrueCopy and ShadowImage: shared M-VOL/S-VOL**
The following figure shows an example of a volume that is functioning as both a TC390 R-VOL and an SI390 S-VOL. With this configuration, you can use SI390 to provide additional remote copies of TC390 M-VOLs. This configuration is not allowed when At-Time Split is used on SI390.

Figure 21  TrueCopy and ShadowImage: shared R-VOL/S-VOL

The following figure shows an example of a volume that is functioning as both a TC390 M-VOL and an SI390 S-VOL, while the R-VOL of the same TC390 pair is also functioning as the S-VOL of another SI390 pair. With this configuration, you can:

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

Figure 22  TrueCopy and ShadowImage: shared M-VOL/S-VOL and R-VOL/S-VOL

The following figure shows an example of a volume functioning as both a TC390 M-VOL and an SI390 T-VOL.

NOTE:  This configuration does not allow SI390 and TC390 to copy at the same time. Create the SI390 pair first, and then split the pair before creating the TC390 pair. You must suspend the TC390 pair to resync the SI pair.

Figure 23  TrueCopy and ShadowImage: shared M-VOL/T-VOL

Combining TrueCopy for z/OS® and Virtual LVI/LUN

Virtual LVI/LUN volumes can be assigned to TCz pairs, as long as the R-VOL has the same or larger capacity than the M-VOL. If you need to perform Virtual LVI/LUN operations on an existing TCz M-VOL or R-VOL, you must delete the pair first to return the volume to simplex status. For further information on Virtual LVI/LUN, please refer to the LUN Expansion (LUSE)/Virtual LVI/LUN (VLL) User’s Guide.

Combining TrueCopy for z/OS® and Cache Residency Manager

Cache Residency Manager volumes can be assigned to TCz pairs, and Cache Residency Manager operations can be performed on TCz M-VOLs and R-VOLs. For further information on Cache Residency Manager, please refer to the Cache Residency Manager User’s Guide.
Combining TrueCopy for z/OS® and Server Priority Manager

The Server Priority Manager (SPM) software can give higher priority to the I/O operations of the server that requires the high processing performance than the I/O operations of the other servers. SPM can set the priority of I/O operation to ports, but if the remote copy is performed with the fibre channel interface connection, the initiator ports do not support the Server Priority Manager option. For further information on Server Priority Manager (SPM), please refer to the Performance Manager User’s Guide.

Combining TrueCopy for z/OS® and Graph-Track

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

Starting TrueCopy

You must operate the Command View XP management station or XP Remote Web Console in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

To access TC390:

1. Click the Mainframe tab, and then click the TrueCopy button ( ). The TrueCopy main window is displayed and the Pair Operations tab is displayed at the top.

NOTE: The storage partition administrator cannot perform TrueCopy for z/OS® operations.

Figure 24 TrueCopy main window

⚠️ CAUTION: Do not perform TC390 operations using the TrueCopy main window while the TC390 scripting function is being executed. To perform TC390 operations on the TrueCopy main window, wait until the script is complete or verify that the script in execution is aborted.
Performing TrueCopy Configuration Operations

The TC390 configuration operations include the MCU operations, RCU operations, TC390A control operations, discontinuing TC390 operations, and scripting. The TrueCopy main window (see page 66) provides access to all TC390 configuration operations.

RCU operations. The RCU operations (see “RCU Operations” on page 82) configure the RCUs for TC390 operations:

- Configuring host interface ports for MCU-RCU connection
- Adding the RCUs
- Setting the RCU options
- Adding/deleting logical paths to an RCU
- Adding/deleting SSIDs for an RCU
- Viewing RCU status
- Deleting RCUs

Asynchronous operations. The TC390A control operations (see “Asynchronous Operations” on page 102) configure the TC390A groups and options:

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

Usage Monitor operations. Use the usage monitor operations (see page 110) to collect the I/O statistics for the LDEVs on the disk array.

Script operations. Use the scripting function to specify and execute a series of TC390 operations without having to issue commands separately (see “Script Operations” on page 113).

History operations. Use the history operations (see “History Operations” on page 113) to export the remote copy history file.

Other operations. The other operations (see “Other Operations” on page 113) include clearing SIMs.

You can optimize TC390 operations and XP1024/XP128/XP12000/XP10000 performance by selecting the TC390 settings and options for your operational environment and also by addressing conditions that can affect disk array performance. For more information, see “Optimizing TrueCopy Operations and Disk Array Performance” on page 113.

To discontinue TC390 operations, perform the required TC390 operations (for example, pair deletion, RCU deletion, port reconfiguration, and so forth) in a specific order to ensure smooth operations and avoid command rejects and error conditions. For more information, see “Discontinuing TrueCopy Operations” on page 115.

TrueCopy Main Window

To access any of the TrueCopy windows, click one of the following tabs: Pair Operations, RCU Operations, Asynchronous Operations, Usage Monitor, Script Operations, History Operations, and Other Operations tabs.

The TrueCopy main window (also known as the Pair Operations window) is displayed by clicking the Pair Operations tab. This window shows the information for the selected CU image of the connected disk array and provides access to all TC390 functions.
The following table shows the TC390 functions of each tab. The function menus can be displayed by right-clicking the list. To apply the settings you made on the TC390 function tabs, click **Apply**.

**Table 19  TC390 functions**

<table>
<thead>
<tr>
<th>Tab</th>
<th>Menu Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair Operations</td>
<td>Pair Status</td>
<td>Displays the CU information, path information, pair status, and settings information of the TC390 pairs.</td>
</tr>
<tr>
<td></td>
<td>Add Pair &gt; Synchronous</td>
<td>Sets new TC390 Synchronous pairs.</td>
</tr>
<tr>
<td></td>
<td>Add Pair &gt; Asynchronous</td>
<td>Sets new TC390A pairs.</td>
</tr>
<tr>
<td></td>
<td>Delete Pair</td>
<td>Deletes the TC390 pairs that are already set.</td>
</tr>
<tr>
<td></td>
<td>Suspend Pair</td>
<td>Suspends the TC390 pairs.</td>
</tr>
<tr>
<td></td>
<td>Resume Pair</td>
<td>Resumes the TC390 pairs that are suspended.</td>
</tr>
<tr>
<td></td>
<td>Change Pair Option</td>
<td>Modifies the pair options that are originally set (Fence level or Error level).</td>
</tr>
<tr>
<td></td>
<td>Snapshot</td>
<td>Create the new snapshot file.</td>
</tr>
<tr>
<td>RCU Operations</td>
<td>RCU Status</td>
<td>Displays the RCU status and TC390 port numbers that are already set.</td>
</tr>
<tr>
<td></td>
<td>RCU Operation &gt; Add RCU</td>
<td>Registers the RCU at the remote disk array. RCU controls the R-VOL of the TC390 volume pair.</td>
</tr>
<tr>
<td></td>
<td>RCU Operation &gt; Delete RCU</td>
<td>Deletes the RCU that is already registered.</td>
</tr>
<tr>
<td></td>
<td>RCU Operation &gt; Change RCU Option</td>
<td>Modifies the options for RCUs that are already registered.</td>
</tr>
<tr>
<td></td>
<td>Edit SSID(s) &amp; Path(s) &gt; Add Path</td>
<td>Adds the paths to RCUs.</td>
</tr>
<tr>
<td></td>
<td>Edit SSID(s) &amp; Path(s) &gt; Delete Path</td>
<td>Deletes the paths to RCUs.</td>
</tr>
<tr>
<td></td>
<td>Edit SSID(s) &amp; Path(s) &gt; Add SSID</td>
<td>Adds the SSIDs of RCUs that are connected to MCU.</td>
</tr>
<tr>
<td></td>
<td>Edit SSID(s) &amp; Path(s) &gt; Delete SSID</td>
<td>Deletes the SSIDs of RCUs that are already connected to MCU.</td>
</tr>
<tr>
<td></td>
<td>Port</td>
<td>Sets or changes the port type at the MCU (Target, RCU Target or Initiator).</td>
</tr>
<tr>
<td>Asynchronous</td>
<td>Async Option</td>
<td>Sets and modifies the asynchronous copy options.</td>
</tr>
<tr>
<td>Operations</td>
<td>CT Group Operation &gt; CT Group Status</td>
<td>Displays the information of the consistency groups that are already registered.</td>
</tr>
<tr>
<td></td>
<td>CT Group Operation &gt; Add CT Group</td>
<td>Assigns the CUs to the consistency groups.</td>
</tr>
<tr>
<td></td>
<td>CT Group Operation &gt; CT Group Option</td>
<td>Modifies the settings for the consistency groups that are already assigned.</td>
</tr>
<tr>
<td></td>
<td>CT Group Operation &gt; Delete CT Group</td>
<td>Deletes the consistency groups that are already assigned.</td>
</tr>
<tr>
<td>Usage Monitor</td>
<td>-</td>
<td>Obtains the I/O statistics using the Remote Copy Monitoring function.</td>
</tr>
<tr>
<td>Script Operations</td>
<td>-</td>
<td>Uses the script function.</td>
</tr>
</tbody>
</table>
The following sections describe the configuration of each tab and how to use the tabs to operate the TC390 functions (see “Performing TrueCopy Pair Operations” on page 115 for TC390 volume pair configuration).

TrueCopy Main Window (Pair Operations Window)

The first window that is displayed after clicking the TrueCopy button is the TrueCopy main window, also known as the Pair Operations window. To display this window at any time, click the Pair Operations tab from any of the other TrueCopy windows.

The TrueCopy main window displays information for the selected CU image of the connected disk array. From this window, you can configure the volume pairs. This section describes the components of the TrueCopy main window. For the information about the TC390 volume pair configuration, see “Performing TrueCopy Pair Operations” on page 115.

Information displayed on the TrueCopy main window is updated when the TrueCopy main window is opened, when the tab is switched from one to another, and when the Refresh button is clicked.

<table>
<thead>
<tr>
<th>Tab</th>
<th>Menu Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>History Operations</td>
<td></td>
<td>Displays the operation history of TC390 volume pairs.</td>
</tr>
<tr>
<td>Other Operations</td>
<td>Clear SIM</td>
<td>Clears all the remote copy SIMs.</td>
</tr>
</tbody>
</table>

The following sections describe the configuration of each tab and how to use the tabs to operate the TC390 functions (see “Performing TrueCopy Pair Operations” on page 115 for TC390 volume pair configuration).

Table 19  TC390 functions (continued)

<table>
<thead>
<tr>
<th>Tab</th>
<th>Menu Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>History Operations</td>
<td></td>
<td>Displays the operation history of TC390 volume pairs.</td>
</tr>
<tr>
<td>Other Operations</td>
<td>Clear SIM</td>
<td>Clears all the remote copy SIMs.</td>
</tr>
</tbody>
</table>

Figure 25 TrueCopy main window (Pair Operations window)

The TrueCopy main window consists of the CU Number tree, the Volume list (see “Volume List” on page 69), the Display Filter button (see “Display Filter” on page 70), and the Previous/Next button.

Subsystem is selected on the CU Number tree when you first open the TrueCopy main window. Under Subsystem, there are branches of the CU numbers ( ). Only the CU, which contain the available volumes, are shown in the CU Number tree. A CU number can be selected in the CU Number tree to specify the information displayed in the Volume list. More than one CU number cannot be selected.
The Volume list displays information for each volume of the connected disk array (see “Volume List” on page 69). The information displayed in this list is sorted in the order of the Device number by default. The information for the volumes, which are defined for several paths, are displayed in several rows as many as the path defined.

The Display Filter button opens the Display Filter window (see “Display Filter” on page 70), which you can use to select the volumes displayed on the Volume list. The volumes can be selected specifying pair status, pair type, and group number.

In the Volume list, eight to twelve rows of volume information are displayed at once. The 256 rows can be displayed using the scroll bar. The Previous/Next buttons switches the Volume list to the previous or next 256 rows.

Volume List

The Volume list displays the following information for each volume of the connected disk array. The information displayed in this list is sorted in the order of the Port number by default. Each item can be sorted in ascending order or descending order. To sort the items, click the head of the list (for example, Device or Status). Not all of the items of the Volume list can be displayed at once. To see all the items of the list, use the scroll bar below the Volume list.

NOTE: To change the number of items that can be displayed without scrolling, change the font size.

<table>
<thead>
<tr>
<th>Source Vol</th>
<th>Status</th>
<th>Target Vol</th>
<th>CopyPace</th>
<th>Prog./Sync.</th>
<th>Type</th>
<th>Capacity(CY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07:00</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:01</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:02</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:03</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:04</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:05</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:06</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:07</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:08</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:09</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:0A</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:0B</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
<tr>
<td>07:0C</td>
<td>SimpL</td>
<td></td>
<td></td>
<td></td>
<td>3390-9</td>
<td>10017</td>
</tr>
</tbody>
</table>

Figure 26 Volume list

- **Volume icon**: Indicates the status of volumes.
  - ☑️: Simplex
  - ☐️: M-VOL
  - ☐️: R-VOL
- **CU**: CU number of the main LDEV.
- **Device**: Device number.
- **Status**: For more information on TC390 pair status, see “TrueCopy Volume Pair Status” on page 36.
  - ☑️: Simplex. The volume is not currently assigned to a TC390 pair. When the initial copy is started by an Add pair operation, the volume status changes to Pending.
  - ☐️: Pending. The TC390 initial copy operation is in progress. Data on the pair is not fully identical. When the initial copy is complete, the status will change to Duplex.
  - ☐️: Duplex. The volume is currently assigned to a TC390 pair and the pair is 100% synchronized. All updates from the host to the M-VOL are duplicated at the R-VOL.
• **Suspending.** The TC390A pair is being suspended. When the TC390A suspend operation is complete, suspending changes to suspended.

• **Suspend.** The TC390 pair has been suspended. Open the Pair Status window to view the suspend type (see “TrueCopy Volume Pair Status” on page 36) and detailed pair status information.

• **Deleting.** TC390A only. This pair is not synchronized. This pair is in transition from the Duplex, Pending duplex, or Suspend state to the Simplex state.

• **Sub:** Suspend Sub Status
  - **GRP:** Consistency time of the current volume is the same as that of the consistency group.
  - **VOL:** Consistency time of the current volume is not the same as that of the consistency group.
  - **OFF:** Suspended by the PS OFF by the MCU.

• **S/N** and **SSID** of the other disk array (MCU or RCU) of the volume pair.

• **CU** number of the other volume of the volume pair.

**NOTE:** If “#” is added to the end of LDEV number (i.e. 00:3C#), the LDEV that the LDEV number indicates is an external volume. If the pair is created with TrueCopy for z/OS of the microcode program version 50-03-6xx-xx or earlier, “#” is not added. For details on an external volume, please refer to Hitachi HPAV for z/OS User Guide.

• **Device** number of the other volume of the volume pair.

• **Type:** Pair mode, Synchronous or Asynchronous.

• **Fence:** The M-VOL fence level of the TC390 volume pair: data, status, or never. For a complete description of the TC390 M-VOL fence-level parameter, see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121.

• **Diff:** The information about the differential data.

• **CTG:** Consistency Group number of the pair (only for the Asynchronous pairs).

• **ErrLvl:** Error level of the pair (only for the Asynchronous pairs).
  - **Group:** When the specified pair is suspended, all TC390A pairs in the same consistency group will be suspended, even if the failure affects only that pair and not the entire group.
  - **Volume:** If the failure affects only the specified pair, then only that pair will be suspended. A failure that affects an entire group will always result in the suspension of all pairs in the group, as well as all other affected TC390 pairs.

• **CLPR:** The number and name of the CLPR to which the volumes forming pairs belong. For more information about CLPRs, see the HP StorageWorks Command View XP User Guide for XP Disk Arrays or the HP StorageWorks XP Remote Web Console User Guide for the specific disk array.

Select the **Group** error level for all TC390A volumes that are essential to disaster recovery. Do not use suspended TC390A R-VOLs that have the **Volume** error level for disaster recovery.

**NOTE:** The **S/N**, **SSID**, and **Fence** columns might be blank while the pair is in transition from a pair status to Simplex. To display the latest information in these columns, refresh the window.

Volumes that are currently assigned to SI390 pairs are displayed in the Volume list as simplex. The user is responsible for managing volumes assigned to SI390 and HXRC pairs.

**Display Filter**

The **Display Filter** button opens the Display Filter window. Use the Display Filter window to select which volumes to be displayed on the Volume list. You can select the CU number, Consistency group number, Pair type, Volume type, Copy type and Pair status.

When you select the CU number on the CU Number tree, the selection in the CU Number tree has precedence over the specification in the Display Filter window. When the CU number is selected in the tree, the specification on the Display Filter window for the CU number is not available. To make all the
settings on the Display Filter window available, select **Subsystem** in the **CU Number** view. The Display Filter settings are available while you are operating the TC390 software until you reset the settings.

**NOTE:** You cannot use other windows without closing the Display Filter window.

**Display Filter**

<table>
<thead>
<tr>
<th>CU#</th>
<th>CT Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>ALL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>M-VOL/R-VOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL</td>
<td>ALL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MCU-RCU Path</th>
<th>Fibre</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Status</th>
<th>Simpex</th>
<th>Pending</th>
<th>Duplex</th>
<th>Suspend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub Status</th>
<th>ORP</th>
<th>VOL</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **NOTE:** You cannot use other windows without closing the Display Filter window.

**Figure 27** Display Filter window

Use the **CU#** list to specify the number of the CU to be displayed.

Use the **CT Group** list to specify the number of the consistency group to be displayed. This specification is available only for the Asynchronous pair.

Use the **Type** list to specify the pair type, synchronous or asynchronous.

Use the **M-VOL/R-VOL** list to specify the Volume type, M-VOL or R-VOL.

Use the **MCU-RCU Path** list to specify the channel type (Fibre).

Use **CLPR** to select the CLPR (or all CLPRs).

Use **Internal/External VOL** to select the volume type, internal or external (or all types), to be displayed.

Use the **Status** check boxes to display only volumes that have the selected pair status: **Simpex**, **Pending**, **Duplex**, **Suspend**, **Suspending** (async only), and/or **Deleting** (async only). The Simpex volumes are always displayed otherwise the **SEQ[SEQCHK]Only** check box is selected.

Use the **Sub Status** check boxes to select the consistency status of the Asynchronous pairs.

Use the **SEQ[SEQCHK]Only** check box to display only the TC390A pairs that are in the SEQCHK status. When this check box is selected, TC390 Synchronous and Simplex volumes are not displayed.

The **Reset** button clears your specifications and displays the default settings. All of the lists become **ALL**. The **Set** button applies your specifications to the Volume list and closes the Display Filter window.
Snapshot Function

The TC390 snapshot function reports the user-selected TC390 pair status information. The reported status information is determined by your selections in the Display Filter window.

NOTE: If # is added to the end of an LDEV number, such as 3F#, the LDEV is an external volume. For more information about external volumes, see Hitachi HPAV for z/OS User Guide.

To create a TC390 snapshot file:

1. Click Display Filter to display the Display Filter window.
2. Select the options you want in the Display Filter window and close the window.
3. From the Pair Operations window, right-click to display the pop-up menu and click Snapshot. A confirmation dialog box is displayed.
4. Click OK to create the snapshot file.

NOTE: If a snapshot file already exists, the new snapshot file data will overwrite the existing snapshot file.

An example of snapshot file is shown in the following figure.

<table>
<thead>
<tr>
<th>Vol</th>
<th>Status</th>
<th>Sub</th>
<th>S/N</th>
<th>SSID</th>
<th>Vol</th>
<th>Type</th>
<th>Fence</th>
<th>Diff</th>
<th>CTG</th>
<th>EL</th>
<th>Prio</th>
<th>Sync</th>
<th>CLPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00</td>
<td>Simplex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>00:CLPR0</td>
</tr>
<tr>
<td>00:01</td>
<td>Duplex</td>
<td>12345</td>
<td>0001</td>
<td>1F:1E</td>
<td>Sync(M)</td>
<td>Data</td>
<td>Cylinder</td>
<td>032</td>
<td>100</td>
<td>01:CLPR1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00:02</td>
<td>Suspend GRP</td>
<td>12345</td>
<td>0001</td>
<td>1F:1D</td>
<td>Asyn(R)</td>
<td>Never</td>
<td>Cylinder</td>
<td>0C</td>
<td>050</td>
<td>02:CLPR2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 28 Example of snapshot file

<table>
<thead>
<tr>
<th>(1)</th>
<th>LDEV number</th>
<th>(8)</th>
<th>Fence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2)</td>
<td>Status of the pair</td>
<td>(9)</td>
<td>Differential data setting</td>
</tr>
<tr>
<td>(3)</td>
<td>Suspend sub status</td>
<td>(10)</td>
<td>Consistency group number</td>
</tr>
<tr>
<td>(4)</td>
<td>Other CU S/N</td>
<td>(11)</td>
<td>Error level</td>
</tr>
<tr>
<td>(5)</td>
<td>Other CU SSID</td>
<td>(12)</td>
<td>Copy priority</td>
</tr>
<tr>
<td>(6)</td>
<td>LDEV number of other CU</td>
<td>(13)</td>
<td>Pairing progress (%)</td>
</tr>
<tr>
<td>(7)</td>
<td>Pair mode</td>
<td>(14)</td>
<td>CLPR number and CLPR name</td>
</tr>
</tbody>
</table>

RCU Operations Window

Clicking the RCU Operations tab displays the RCU Operations window, which shows the RCU information and provides access to the TC390 RCU setting operations (see “RCU Operations” on page 82).

The RCU Operations window consists of the Display buttons, the Operation information, the CU number/Port tree, the MCU/RCU list (see “CU Number Tree and MCU/RCU List” on page 73), and the Port list (see “Port Tree and Port List” on page 75). MCU/RCU list is displayed by default.
The RCU Operations window is updated when the tab is switched from one to another, when the Refresh button ( ) is clicked, and when the settings for the RCU are applied. For the RCU settings operation, see “RCU Operations” on page 82.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TrueCopy - 6/390(R) RCU Operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 29 RCU Operations window](image)

The Display buttons switch the contents of the tree and the list. Clicking MCU&RCU displays the CU Number tree and the MCU/RCU list (see “CU Number Tree and MCU/RCU List” on page 73). Clicking Port displays the Port tree and the Port list (see “Port Tree and Port List” on page 75).

The Operation information indicates the current operation performed on the RCU Operations window.

### CU Number Tree and MCU/RCU List

The CU Number tree and the MCU/RCU list are displayed when the MCU&RCU option is selected in the Display box. In the CU Number tree, only the CU numbers, which include active MCUs or RCUs, are displayed. There is no branch under the CU Number tree. When the CU contains RCU that has the failed path, the error icon ( ) is shown for the CU number in the CU Number tree.
In the CU Number tree, the CU number can be selected to display the specified information in the MCU/RCU list. You can select only one CU number on the CU Number tree.

Figure 30  RCU Operations window with the MCU&RCU option button selected

- **CU#:** CU number that is selected on the tree.
- **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 failure path between the RCU. Failed indicates that there is failure paths between the RCU. This column is blank when the pair CU is MCU.
- **Num. of Path:** Number of paths (is blank when the pair CU is MCU).
Port Tree and Port List

Clicking Port in the Display box displays Port tree and the Port list. The Port tree displays the channel adapters and the port types. Only the ports that are installed and can be selected for remote copy operations are displayed.

![Port Tree and Port List Figure](image)

- **Port**: Cluster and port number (CL1-A to CL2-R).
- **Type**: Port type (Initiator, Target, RCU Target, External, Internal/External).
- **PCB Mode**: Speed mode of the port, only for the Fibre ports (standard, high-speed, or MIX).
- **CU#**: Range of CU images: 16 CU: 00-0F (00 through 0F), 10-1F (10 through 1F).

**NOTE:** High-speed (2 port) mode is available only if the XP disk array has firmware version 21.06.22 or later installed.

The port information in each row depends on the type of channel adapter.

- 1 port in one row (standard).
- 2 ports in one row (standard).
- 2 ports per row (high-speed, 2 port).
- 4 ports in one row (high-speed).

![Port Information Table](image)

**Figure 32** Standard speed, two ports per row
In the Port tree, the port type can be selected to display the specified information in the Port list. For example, when RCU Target is selected in the Port tree, the system looks for ports of Initiator from all the ports entered and lists the RCU Target ports in the Port list as shown in the following figure. Only one Port type can be selected in the tree.

### Asynchronous Operations Window

Clicking the Asynchronous Operations tab displays the Asynchronous Operations window, which shows the consistency group information for the connected disk array and provides access to the TC390A pair operations (see “Asynchronous Operations” on page 102).

The Asynchronous Operations window consists of the information about the SideFile and the information about the consistency group that is displayed in the Consistency Group tree and the Consistency Group list.

**Figure 35** Asynchronous Operations window

The Operation information indicates the current operation performed on the Asynchronous Operations window.
Pending Update Data Rate is always displayed and shows the maximum cache % available for use by TC390 Async sidefiles.

Offloading Timer indicates the maximum time between TC390 Async recordset transfers.

Display All is selected in the Consistency Group tree when the Asynchronous Operations window is displayed. All consistency groups (00-7F) are listed in the Consistency Group list. When Used ( ) of Consistency Group tree is selected, the consistency groups that are already registered are listed in the Consistency Group list. When Not Used ( ) of Consistency Group tree is selected, the consistency groups that are not registered are listed.

Consistency Group list consists of the following items:

- **CTG**: Consistency group number.
- **This CU**: The CU that initially registered the consistency group. When the consistency group is not registered, the column is blank. **MCU**: The local CU registered the consistency group. **RCU**: The consistency group is registered from the paired CU (the local CU is RCU). **M&R**: MCU and RCU are in the same disk array.
- **M-R Path**: Channel type, Fibre or Serial. When the consistency group is not registered, the column is blank.
- **Paired S/N**: Serial number of the paired disk array (the disk array with the lowest serial number). When the consistency group is not registered, the column is blank.
- **Paired SSID**: SSID (Storage subsystem ID) of paired disk array (the disk array with the lowest SSID). When the consistency group is not registered, the column is blank.
- **Other S/N**: Indicates that there are RCU other than the one with the lowest serial number. When there is no other RCU, the column is blank.
- **CLPR**: the number and name of the CLPR which the volumes forming pairs belong to. If the consistency group is not in use, this column is blank. For further information on CLPRs, please refer to the HP StorageWorks Command View XP User Guide for XP Disk Arrays or the HP StorageWorks XP Remote Web Console User Guide for the specific disk array.

Usage Monitor Window

Click the Usage Monitor tab to display the Usage Monitor window and perform the Remote Copy Monitoring function. The Remote Copy Monitoring function obtains the I/O statistics for all the LDEVs on the connected disk array.
NOTE: You must operate Command View XP or XP Remote Web Console in Modify mode to perform TC390 operations. Users in view mode can only view TC390 information.

|-----------------|----------------|-------------------------|---------------|------------------|------------------|

**Figure 36 Usage Monitor window**

The Usage Monitor window displays the following information:

- **Status**: Displays **Running** when monitoring is on and displays **Stop** when monitoring is off. When monitoring is stopped, the usage monitor graph is closed. The usage monitor graph can only be displayed when monitoring is running.
- **Rate**: Displays the data collection rate for usage monitoring (default = 5). When monitoring is stopped, the default value (5) is displayed in the Rate box.
- **Operation**: Used to select the usage monitor operation.
- **Update**: Displays the most recent data sample time of the data on the graph.

**Script Operations Window**

TC390 running on Command View XP or XP Remote Web Console supports scripting for managing pre-defined TC390 operations. The TC390 scripting function defines multiple TC390 operations in a text file that Command View XP or XP Remote Web Console reads and executes as a batch file. Use the scripting function to perform a series of TC390 operations without having to issue the commands separately. Using TC390 scripting, you can set up and execute a large number of TC390 commands within a short period of time. Use the TC390 scripting function to:

- Save time by executing multiple TC390 operations with a single command.
- Run a series of predefined and tested TC390 operations after hours or overnight.
- Allow a non-resident system administrator to set up and start an entire day’s worth of TC390 operations in the limited time that the administrator is on-site.

This section describes the selection and execution of an existing TC390 script file. “TrueCopy Scripting” on page 187 describes and specifies the requirements for the TC390 script files.
CAUTION: Do not perform TC390 operations using the Pair Operations window while the scripting function is being executed. To perform TC390 operations on the Pair Operations window, wait until the script is complete, or verify that the script in execution is aborted.

NOTE: The script file must be transferred to the SVP before executing the script.

Clicking the Script Operations tab displays the Script Operations window, which shows information for the script being executed.

At this time, exporting script trace files is not supported.

Figure 37  Script Operations window

The Status box displays the status of the script execution.

- **Stop**: The script has not been executed yet or the script execution has been completed.
- **Analyzing**: The script analysis operation is running.
- **Running**: The script is running.

In the Script File Name box, select the name of the TC390 script file.

In the Operation box, select a command. TC390 software operation mode must be the Modify mode.

- **Run**: Run the TC390 script file that is selected in the Script File Name box. If the script file is in the running status, Run cannot be selected.
- **Stop**: Stop the TC390 script file that is running. The script operation is stopped on the script line basis. If the script file execution has been completed, Stop cannot be selected.

To check the status of the script file, click the Refresh button ( ). The information of the Status box is updated.

The Result box displays the error code in four-digit hexadecimal number.

The Information boxes displays the script information.

- **Message**: The message is displayed when the script operation has been completed. Normal End indicates that the operation completed normally. When the script is ended abnormally because of the
error in the script file, the message, which indicates the abnormal end, is displayed. When the script is stopped by the Stop command, Abort by operator is displayed.

- **Date**: The date when the script status changed.
- **Line**: The script file line number being executed.
- **Loop**: The current/total repetition count for a looped command (for example, 150/300).
- **Macro**: The macro being executed. Macros that execute a process for a device are listed: CreateHrcPair, ChangeHrcPair, SuspendHrcPair, ResumeHrcPair, and DeleteHrcPair.

The following figure shows the example of the **Script Operations** tab during the execution of a Script File.

![Figure 38 Script Operations window during execution of a script file](image)

**History Window**

Click the **History Operations** tab to display the History Operations window, which displays the history information for the TC390 pairs. Use this window to perform TC390 history operations. The history information includes the records of the main status changes, such as pair creation and deletion, of the TC390 pairs. See “History Operations” on page 113 for information and instructions on performing TrueCopy - S/390 history operations.
The History Operations window is updated when the Refresh button is clicked. The information on the History Operations window is not updated by clicking another tab and then clicking the History Operations tab again.

Figure 39  History Operations window

The History Operations window contains the following information:

- **Status** displays the current status of the history file:
  - **No history file exist.** The history file does not exist.
  - **Reading a history failed.** A failure occurred during referring to the history file.
  - **Update history... n (%)**. Updating of the history file is now in progress. “n (%)” indicates the progress (in %) of the updating process of the history file.
  - **Complete.** Updating of the history file has been completed.

When the updating process is in progress, the checking process automatically continues until the updating process finishes. The updating process is checked at ten-second intervals.

- **Last Update** displays the updated date and time of the history file.

- **The History List** displays the history information for the TC390 pairs in the connected disk array. By default, the list is in the order in which the information are received from the disk array.

History List shows the following information:

- **Operation Date/Time**: The date and time when the operation was completed.
- **Start Date/Time**: The date and time when the operation was started.
- **Operation**: The operations are **Pairing Start** (add pair operation was started); **Pairing Complete** (add pair operation was completed); **Pair Delete** (the pair was deleted); **Suspend Operation** (pair suspending operation was performed); **Pair Suspend (Failure)** (the pair was suspended because of a failure); **Pair Resync. Start** (resume pair operation was started); and **Pair Resync. Complete** (resume pair operation was completed).
- **VOL**: CU number and LDEV number of the operated volume.
- **Paired VOL**: CU number and LDEV number of the paired volume.
- **Copy Time**: The time taken for the operation (from the start of the operation to the end). Displayed only for **Pairing Complete** and **Pair Resync. Complete** operations.
History information older than seven days is automatically deleted. However, if the number of operations exceeds 65,535, the oldest operations are deleted in chronological order to keep the number at 65,535, even if the operations occurred within the last week. The history file always contains the most recent operations up to a maximum of 65,535 operations. The maintenance information for an entire week may not always be available.

The history information can be sorted by column and in ascending or descending order.

- **Previous** and **Next** buttons: The list displays up to a maximum of 16,384 operations at a time. Use these buttons to display the previous or next 16,384 operations.

**Other Operations Window**

Clicking the **Other Operations** tab displays the Other Operations window, which includes the Clear SIM function. For more information, refer to “Script Operations” on page 113.

![Other Operations Window](image)

**Figure 40** Other Operations window

**RCU Operations**

The RCUs are the control units that control the R-VOLs of the volume pairs. The RCUs are connected to the MCUs through the remote copy connections and receive and process commands from the MCUs. For TC390 operations, the secondary Command View XP management station at the remote site should be connected to the RCUs to allow TC390 commands to be issued directly to the RCU (for example, in case of disaster or failure at the primary site).

The MCUs are the control units which control the M-VOLs of the volume pairs. The MCUs receive and process user-requested TC390 commands from the Command View XP management station or XP Remote Web 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 TC390 configurations. The RCU operations are:

- Configuring the host interface ports for MCU-RCU connection (see page 83)
- Viewing RCU status (see page 85)
- Registering RCUs (see page 87)
- Setting the RCU options (see page 87)
  - The RCU options apply to all CU images of the MCU.
• Modifying the RCU options (see page 90)
• Deleting RCUs (see page 97)
• Adding and deleting logical paths to an RCU (see page 97)
• Adding and deleting SSIDs for an RCU (see page 100)
• Modifying parameters and omitting selected settings (see page 101)

From the RCU Operations window (see page 72), you can perform the RCU operations. All the operations that can be performed from the RCU Operations window have a common procedure.

To perform the RCU operations from the RCU Operations tab:

1. Select a CU number or a Port number in the tree.
2. Select one or more RCU or Port in the list. For registering RCU operation, RCU does not have to be selected. For this step, the list can be blank.
3. Right-click the list to display the pop-up menu.
   a. When the **MCU&RCU** button is selected in the Display box, the pop-up menu consists of the following:
      • **RCU Status**: Displays the RCU status (see “Viewing RCU Status (RCU Status)” on page 85).
      • **RCU Operation**: Performs the following RCU operations: Add RCU (Fibre or Serial) (see “Registering an RCU (Add RCU)” on page 87), Change RCU Option (see “Registering an RCU (Add RCU)” on page 87 and “Modifying RCU Options (Change RCU Option)” on page 92), and Delete RCU (see “Deleting an RCU (Delete RCU)” on page 97).
      • **Edit SSID(s) & Path(s)**: Performs the following path settings operations: Add Path and Delete Path (see “Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)” on page 97). Also performs the following SSID setting operations: Add SSID and Delete SSID (see “Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)” on page 100).

   When the list is blank, only the **RCU Operation** command can be activated.
   b. When the **Port** button is selected at the Display box, the pop-up menu consists of **Initiator**, **RCU Target**, **Target**, **Omit**, and **Cancel All**.

4. Select a command. If two or more RCUs are selected in step 2, only the **RCU Operation** command can be selected.

   There is no separate window for the port change operation. Select the port type and return to the Volume list (go to step 6).

5. Click **Set**. The window closes and the MCU/RCU list changes to the **RCU Settings Parameter list**. Only the RCUs selected in step 2 are listed and items in the list depend on the selected command.

   **NOTE**: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Settings” on page 101.

6. Click **Apply** on the TrueCopy main window.

   The following sections describe in detail for each command and operation.

### Configuring the Host Interface Ports

You can use TC390 to change the configuration of the disk array host interface ports as needed to accommodate the host and TC390 communications paths.

The disk array Fibre Channel interface ports can be configured as target ports (default), initiator ports, or RCU target ports.

- **Target**: The Fibre Channel ports that 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 that will be used for TC390 communications to the RCUs must be configured as initiator ports. Initiator mode emulates a host channel to enable the MCU to send write I/O operations directly to the RCU target port. Two or more initiator ports must be configured before you can add the RCUs and create the TC390 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.

• **External**: This attribute can be set by the Universal Volume Manager software. The external port is used for Universal Volume Manager, not TrueCopy for z/OS®. To use this port for TrueCopy for z/OS®, please change the attribute to the initiator, RCU target or target port.

• **Initiator/External**: This setting shows the combination of ports that have an initiator port and an external port attributes. Only port that has an initiator port attribute within these ports can be used for TrueCopy for z/OS®. This attribute cannot be changed by the TrueCopy for z/OS® software. For details on the port to which an initiator/external mix mode is set, please refer to the Universal Volume Manager User’s Guide.

**NOTE:** Note: The port assigned to SLPR other than SLPR0 can be set to the Target port attribute only.

The disk array serial interface ports can be configured as LCPs or RCPs.

• **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 TC390 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 TC390 pairs.

The serial interface ports, 1S-1Z and 2S-2Z, cannot be specified as RCPs.

The External port that appears on the RCU Operations window cannot be used with TC390.

**NOTE:** The attribute of the port assigned to SLPR except SLPR0 cannot be set to the attribute except Target or LCP.

Before changing a Fibre Channel port to an initiator port, disconnect the port from the host, delete all affected TC390 pairs, delete all paths from the port to the MCU (if RCU target), and then remove all channel paths to the port.

Also, before changing a Fibre Channel port from initiator to target or RCU target, delete all affected TC390 pairs, delete all paths from the initiator port to the RCU, and then delete the RCU from the MCU.

Before changing the operation mode of a serial port from LCP to RCP, remove all channel paths to the specified port using host system console or ESCD commands. Before changing the mode of a port from RCP to LCP, delete all affected TC390 pairs, delete all paths to the RCU from that RCP, and then delete the RCU from the MCU.

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.

To configure the Fibre Channel or serial ports:

1. Click **Port** in the Display box on the RCU Operations window to change the tree to the Port tree and the list to the Port list.

2. Select a port or a port type from the Port tree. Only the selected port or the selected port type is displayed in the Port list.

3. Select the port(s) of the CU that you want to configure from the Port list.

4. Right-click to display the pop-up menu, which consists of **Initiator, RCU Target, and Target** for the Fibre Channel, or **RCP and LCP** for the Serial channel.

5. Click a port type from the pop-up menu.

For the port change operation, there is no separate window and the list continues to display the Port list.
Viewing RCU Status (RCU Status)

Use the **RCU Status** command to display the RCU status information.

To display the RCU status information:

1. Click **MCU&RCU** in the Display box.
2. From the CU Number/Port tree, select a CU number that includes the RCU that you want to display the status information.
3. From the MCU/RCU list, select an RCU and right-click to display the pop-up menu.

4. Click **RCU Status** from the pop-up menu. The RCU Status window is displayed.
**NOTE:** If you select more than one RCU in step 2, only **RCU Operation** can be clicked from the pop-up menu. Select one RCU in step 2 to display the status information.

![RCU Status window](image)

**Figure 42** RCU Status window

- **Path list:**
  - **No.** Path number (serial number of the list).
  - **Path Status:** Path status. **Normal** is displayed when the path status is normal.
  - **MCU Port number** and **RCU Port number.** When the channel type is serial, the link address is listed on the **RCU Port** column.
  - **RCU S/N:** Serial number of the RCU.
  - **SSID:** SSID of the RCU.
  - **RCU CU#:** CU number of the RCU.
  - **MCU-RCU Path:** Channel type of the path interface between the disk arrays (Serial or Fibre).
  - **Minimum Paths:** Minimum number of paths required for the selected RCU connected to the MCU.
  - **Maximum Initial Copy Activity:** Number of concurrent initial copy operations.
  - **Incident:** The host(s) to which the RCUs will report link incident records.
  - **PPRC Support by Host:** The host status of the PPRC support.
  - **Service SIM of Remote Copy:** Whether the MCU will report the service-level remote-copy SIMs to the host(s).
  - **RIO MIH Time:** Time value for the remote I/O (RIO) missing interrupt handler (MIH), which is the wait time until data transfer from the MCU to RCU is complete.
  - **Path Blockade Watch:** Time for monitoring blockade in the Fibre Channel paths on the MCU side.
  - **RCU Registered:** The date and time when the RCU is registered.
• **Last Updated**: The date and time when the RCU is last updated.
• **SCP Time**: State-Change-Pending (SCP) time.
• **FREEZE Option**: Support for the CGROUP (FREEZE/ RUN) PPRC TSO command.
• The **Refresh** button refreshes the information displayed on the window. The **Close** button closes the window.

The **Path Status** box lists the path status and the following table describes each status. For troubleshooting information about MCU-RCU paths, see “General TrueCopy Troubleshooting” on page 147.

### Table 20  Logical path status

<table>
<thead>
<tr>
<th>Status Description</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>This logical path has been successfully established and can be used for TC390 remote copy activities.</td>
</tr>
<tr>
<td>Initialization Failed</td>
<td>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.</td>
</tr>
<tr>
<td>Communication Timeout</td>
<td>A timeout error has occurred between the MCU and RCU.</td>
</tr>
<tr>
<td>Resource Shortage</td>
<td>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.</td>
</tr>
<tr>
<td>Serial Number Mismatch</td>
<td>The serial number of the control unit that is connected to this logical path does not match the serial number specified by the Add RCU window.</td>
</tr>
<tr>
<td>Invalid Port</td>
<td>The serial interface port specified is not in the RCP or Initiator mode.</td>
</tr>
</tbody>
</table>
| RCU Port Number Mismatch | There are three possible factors as follows:  
  - The specified port in the RCU is physically disconnected from the MCU.  
  - The port is not configured as an RCU target port.  
  - The specified port number is not available. |
| RCU Port Type Mismatch | The microprogram at the RCU side does not support the Fibre remote copy function. Or the specified port type is not RCU Target. |
| Communication Failed | A timeout error has occurred on the Fibre path between MCU and RCU. |

### Registering an RCU (Add RCU)

You can register up to four RCUs to each MCU, and establish up to eight paths to each RCU. You must register each CU image as a separate RCU. 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 × 4 RCUs per MCU).

The remote copy connections and MCU ports must be properly installed and configured before you can register an RCU. When you register an RCU, the current CU image of the MCU registers the specified CU image as a TC390 RCU and establishes the specified number of logical paths to the RCU. After you have registered an RCU (and path status is normal), you can create TC390 pairs that have R-VOLs in the newly registered RCU.

Use the Add RCU window to register the RCU(s) to the current CU image of the connected MCU. When the **Add RCU** command for each channel type is selected, the Add RCU window is displayed and you can set the RCU(s) to be registered.
NOTE: If four RCUs (the maximum number of RCUs you can register) have already been registered, the Add RCU command cannot be selected.

Figure 43 Add RCU windows (Fibre and Serial)

Use the RCU S/N, Controller ID, and Logical Adr. (RCU CU#) boxes to enter the serial number, Controller ID (subsystem family ID), and CU number of the RCU being registered. S/N is in five-digit and CU number is 0-1F. For the Controller ID (for Fibre port type), enter “2” for an XP48/XP512 or “3” for an XP1024/XP128/XP12000/XP10000.

Use the SSID boxes to enter the SSID(s) of the RCU being registered. The XP1024/XP128/XP12000/XP10000 uses one SSID for each set of 256 volumes and four SSIDs per CU image. SSID is 4-FFFE in hexadecimal.

The MCU-RCU Path box includes:
- The MCU Port box, which you use to enter the MCU port number. Only the Initiators are listed in the list and you can select the MCU port from the list.
- The RCU Port box, which you use to enter the RCU port number. The RCU Target port must be selected. This box is for Fibre port type.
- The Link Address box, which you use to enter the link address. The link address is 0-FD in hexadecimal. This box is for Serial port type.

The Option button opens the RCU Option window. The Cancel button cancels the settings you made on the Add RCU window, and closes the window.

To register an RCU to the connected MCU:
1. Verify the remote copy connections and MCU ports are properly configured. Get the S/N of the RCU and the SSID(s) for the CU image in the RCU. The register RCU operation will fail without this information. The XP1024/XP128/XP12000/XP10000 should have a label or tag indicating its S/N and SSIDs. The HP representative can also get the RCU S/N and SSIDs using the RCU’s SVP at the remote site.
2. Click MCU&RCU in the Display box.
3. From the CU number tree on the RCU Operations window, select the correct CU image. For this step, the list can be blank. You must register RCUs to each CU image separately.

4. From the MCU/RCU list on the RCU Operations window, right-click to display the pop-up menu. For registering RCU operation, the RCU does not have to be selected on the list.

5. From the pop-up menu, click **RCU Operation** and then click **Add RCU** (see Figure 44). The Add RCU window is displayed.

6. From the Add RCU window, enter the S/N of the RCU and the Controller ID, CU number, and SSID(s) for the CU image. You can enter the Controller ID for Fibre port type. The MCU verifies the S/N when the paths are established, and verifies the SSIDs when the volume pairs are created. If needed, add and delete SSIDs later using the Add SSID window (see “Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)” on page 100).

7. Select the **MCU Port** and the **RCU Port**. The MCU will not establish less than the minimum number of paths as specified on the RCU Option window. If needed, add and delete paths later using the Add Path window (see “Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)” on page 97).

8. Click **Option** to open the RCU Option window. To cancel the settings you made on the Add RCU window, click **Cancel**.

9. From the RCU Option window, enter or select the settings for adding RCU parameters. For multiplatform XP1024/XP128/XP12000/XP10000 configurations with both TC390 and CA paths, set the **Maximum Initial Copy Activity** to **4 Volumes**.

10. From the RCU Option window, click the **Set** even if you made no changes. To cancel the settings, click **Cancel**. The list changes to the **RCU Settings Parameter list**.

11. The new RCU is displayed in the **RCU Settings Parameter list**. To check the path status for this RCU, select the RCU, right-click to display the pop-up menu, and then click **RCU Status**. For detailed information on the path status, refer to Table 30 on page 149.

**NOTE:** The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Settings” on page 101.
12. Click **Apply** on the TrueCopy main window.

**RCU Path Parameters**

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. TC390 uses the “port” parameter instead of the subchannel number to specify the MCU’s port. For the XP1024/XP128/XP12000/XP10000, the logical address must correspond to the CU number. The following figures shows a sample TC390 serial channel configuration with two paths.

**Figure 45** Typical TC390 remote copy configuration with two paths

- **Primary XP Disk Array (MCU)**
  - Serial Number: 30089

- **Secondary XP Disk Array (RCU)**
  - Serial Number: 30075

* RCU S# = 30075, SSID = 1019, No. of Paths = 1
* For path 1: MCU Port = 1R, Link Address = C6, Logical Adr = 04
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. The following figures shows a sample TC390 Fibre Channel interface configuration with connections going through switches and the TC390 Add RCU window used to define this configuration.

Figure 46 Add RCU window – serial interface

Figure 47 Fibre Channel interface connections going through switches
Modifying RCU Options (Change RCU Option)

Use the RCU Option window 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 window is presented during the
add RCU process, and can also be opened by right-clicking on the RCUs and clicking RCU Operation > Change RCU Option.

![RCU Option window (Change RCU Option)](image)

**Figure 49** RCU Option window (Change RCU Option)

Use the **Minimum Paths** option to specify the minimum number of paths required for each RCU connected to the current MCU. You can specify 1, 2, 3, 4, or 8 for this option. If the number of paths falls below the specified number (for example, due to a failed path), the MCU will suspend all affected TC390 (and TC) pairs to prevent remote copy operations from adversely affecting performance due to the inadequate number of paths. For TC390 pairs that contain critical data for disaster recovery, the minimum number of paths should be set to one so that TC390 operations continue even if there is only one path to an RCU. If you need to maintain high performance at the MCU, set the minimum paths to two or more (max paths = 8 for fibre, 8 for serial 2105, 4 for serial 3990), depending on the number of pairs managed by the MCU.

⚠️ **CAUTION:** If TC390 volume pairs are suspended because the number of paths has dropped below this setting, the M-VOL fence-level pair option (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121) determines whether the TC390 Synchronous M-VOLs are fenced (that is, reject all write operations).

The **Maximum Initial Copy Activity** setting specifies the number of concurrent initial copy operations (minimum = 1, maximum = 4). TC390 initial copy activities can impact the performance of the main disk array, depending on the amount of I/O activity and the number of pairs being added at the same time. The maximum initial copy activity setting limits the impact of initial copy activities on disk array performance. For example, if you set the maximum initial copy activity to four and then add five TC390 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. The maximum initial copy activity value can be set only when adding new pairs. After you have added a TC390 volume pair, this setting cannot be changed for that pair.

The **SCP Delay Time** setting specifies the state-change-pending (SCP) delay time in seconds (0-600 seconds). CGROUP/FREEZE uses the SCP state to suspend host I/Os to TC390 M-VOLs (see “CGROUP (FREEZE/RUN) Support” on page 169). TC390A uses the SCP state for inflow control to prevent cache storage.
overload (see “Inflow Control of Recordsets” on page 32). Make sure to set the SCP delay time after you have added all MCU-RCU paths.

NOTE: SCP Delay Time of TrueCopy for z/OS and the state-change-pending time of FlashCopy® Mirror Version 2 are same. To determine the SCP Delay Time of TrueCopy for z/OS, take into account the fact that if you change the SCP Delay Time setting by the CU Option panel, the state-change-pending time of FlashCopy® Mirror Version 2 will change. For more information on state-change-pending time of FlashCopy® Mirror Version 2, please refer to the ShadowImage for z/OS® User’s Guide.

△ CAUTION: You must click OK on the RCU Option window to register the SCP Delay Time setting, even if you did not make any changes to the RCU options. Ensure to select the appropriate SCP delay time for your TC390 system configuration.

The RIO MIH Time setting specifies the time value for the remote I/O (RIO) missing interrupt handler (MIH), which is the wait time until data transfer from the MCU to RCU is complete. The RIO MIH time value must be from 10 to 100 seconds. The default setting is 15 seconds. This setting is available for both serial and Fibre Channel interfaces. For more information on the MIH, refer to the “Installing the TrueCopy Hardware” on page 49.

The Path Blockade Watch setting 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. This setting is available for Fibre Channel interface only.

NOTE: If you create a pair with the synchronous mode, and if the status of all paths becomes “Monitoring” because of a path error, MIH may occur in the host. The time of the Path blockade Watch must be shorter than the setting time of MIH timer in the host.

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

Use the PPRC support option to specify whether the MCU will generate sense information that is compatible with IBM PPRC. This option is extremely important for TC390 disaster recovery planning. If the host does not support PPRC, select No to configure the MCU to report SIMs. If the host system supports PPRC, select Yes to configure the MCU to generate PPRC-compatible sense information when a TC390 pair is suspended instead of a service information message (SIM). If Yes is selected, the MCU will still report moderate- and serious-level SIMs, as well as DF40 and DF48 device SIMs. For more information on PPRC support, refer to “Using PPRC Commands for TrueCopy” on page 153.

NOTE: If you plan to use the CGROUP (FREEZE/RUN) command for TC390 pairs, you must select Yes.

Use the Service SIM of Remote Copy option to specify whether the MCU will report the service-level remote-copy SIMs to the host(s). (The moderate-, serious-, and acute-level SIMs are always reported to the host.) Select Report to configure the MCU to report the service-level remote-copy SIMs to the host(s). The Report setting should be selected for TC390 disaster recovery planning. Select Not Report to suppress service-level SIM reporting. For a description of the TC390 and TC390A SIMs, see “SIM Reporting” on page 183. All service-level SIMs will be logged in the SSB.LOG file on the XP1024/XP128/XP12000/XP10000 SVP, regardless of this setting.

The FREEZE Option setting enables or disables support for the CGROUP (FREEZE/ RUN) PPRC TSO command (see “CGROUP (FREEZE/RUN) Support” on page 169). The FREEZE option is available only when PPRC support = Yes. If you select Enable, the MCU will accept and perform the CGROUP command. If you
select **Disable**, the MCU will reject the CGROUP command. Enable the FREEZE option only after all MCU-RCU paths have been added.

The **Round Trip Time** setting is used for Initial Copy operations. This setting gives a priority to a remote I/O for an update copy operation.

When an Initial Copy operation is in progress, the copy pace is automatically adjusted based on the value (the actual time required for the initial copy), which can be obtained by subtracting the specified Round Trip time (obtained using the formula below) from the remote I/O response time. When the actual time required for the initial copy operation is large, it means that the workload of the update copy is relatively high. Therefore, the copy pace of the initial copy will be slowed. When the time is relatively small, the copy pace will speed up to the specified value. In this way, we can curb the influence of the exclusive line use in the initial copy operation on the host performance.

---

**NOTE:** This option is available only in the case of TCz pairs (In the case of TCzA pairs, this option value is invalid).

The default value of **Round Trip Time** is 1 ms. You may specify 1 ms to 500 ms. You can use the following formula to figure out the Round Trip Time.

\[
\text{Round Trip time} = \text{Round Trip Time between MCU-RCU} \times 2^1 + \text{Initial Copy response time (ms)}
\]

1. A data transfer between MCU and RCU involves two response sequences in one command issuance. Therefore, you need to double the Round Trip Time between MCU-RCU.

For Round Trip Time between MCU and RCU, please ask your carrier, or use a ping command and etc. to measure the time. If you do not use lines etc. between MCU and RCU, specify “1.”

Initial Copy response time is the response time required for multiple initial copy operations. You can use the following formula to get the Initial Copy response time. To get the time, you should use the following
values: the initial copy pace, the max number of initial copy VOLs, the speed of the line between MCU and RCU, and the number of lines.

\[
\text{Initial Copy response time (ms) = } (1\text{[MB]}/\text{"Speed of line between MCU-RCU[MB/ms]"} \times (\text{"initial copy pace"}/15) \times (\text{"max number of initial copy VOLs"}/\text{"Number of lines between MCU-RCU"}))
\]

1. When you connect MCU with RCU without lines etc., specify 0.17[MB/ms] in “Speed of line between MCU and RCU.”
2. For “initial copy pace” in the formula above, see Table 21.
3. For the maximum number of initial copy volumes, see “Initial Copy Operations” on page 27. The default is 64.
4. Even if “Max number of initial copy VOLs”/“Number of lines between MCU-RCU” is larger than 16, specify “Max number of initial copy VOLs”/“Number of lines between MCU-RCU” as 16.

**Table 21** Initial Copy Pace for Calculating The Initial Copy Response Time

<table>
<thead>
<tr>
<th>Operation</th>
<th>Perform Initial Copy Only</th>
<th>Perform Initial Copy and Update Copy at a Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Navigator</td>
<td>Initial copy pace specified at the time of pair creation</td>
<td>Initial copy pace specified at the time of pair creation</td>
</tr>
<tr>
<td>Business Continuity Manager</td>
<td>Initial copy pace specified at the time of pair creation</td>
<td>Initial copy pace specified at the time of pair creation</td>
</tr>
<tr>
<td>PPRC command (TSO/ICKDSF) and CU emulation type=3390</td>
<td>Initial copy pace specified at the time of pair creation</td>
<td>Initial copy pace specified at the time of pair creation</td>
</tr>
<tr>
<td>PPRC command (TSO/ICKDSF) and CU emulation type=2150</td>
<td>151</td>
<td>81</td>
</tr>
</tbody>
</table>

1. When a PPRC command (TSO/ICKDSF) is used and the CU emulation type is 2105, the initial copy pace specified is invalid. Therefore, the fixed value will be set.

**Table 22** Example setting

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Round Trip Time [ms]</th>
<th>Line Speed b/w MCU/RCU [MB/ms]</th>
<th>Number of Lines b/w MCU/RCU</th>
<th>Initial Copy Pace</th>
<th>Max. Number of Initial Copy VOLs</th>
<th>Round Trip Time Specified [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0.1</td>
<td>4</td>
<td>15</td>
<td>64</td>
<td>160</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>0.1</td>
<td>4</td>
<td>15</td>
<td>64</td>
<td>220</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>0.1</td>
<td>4</td>
<td>15</td>
<td>64</td>
<td>360</td>
</tr>
</tbody>
</table>

The **Cancel** button cancels the registering RCU operation. The **Set** button sets the registering RCU operation with the option you set on the RCU Option window.

**NOTE:** You cannot use the PPRC commands to change the RCU options. For more information on PPRC TSO and ICKDSF commands, refer to “Using PPRC Commands for TrueCopy” on page 153.
To modify the RCU option:
1. From the CU Number tree on the RCU Operations window, verify the correct CU image is selected.
2. From the MCU/RCU list on the RCU Operations window, select RCU whose options you want to modify.
3. Right-click to display the pop-up menu, click RCU Operation, and then click Change RCU Option. The RCU Option window is displayed.
4. From the RCU Option window, modify the RCU options. When the RCU Option window is opened, all the boxes display the current settings. Complete the boxes with the RCU options you want to modify.
5. Click Set to set the changes you made. The list changes to the RCU Settings Parameter list (RCU Option). To cancel all the changes you made, click Cancel.

**NOTE:** The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Settings” on page 101.

6. Click Apply on the TrueCopy main window.

Deleting an RCU (Delete RCU)
You can delete an RCU from an MCU only after all TC390 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 TC390 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 (RCPs to LCPs for serial; initiator ports to ordinary target ports for fibre) to provide additional host channels for the MCU.

Use the Delete RCU command to delete the selected RCU from the current MCU CU image. If all affected pairs have not been deleted, the MCU will reject the delete RCU operation to prevent accidental deletion of TC390 pairs.

To delete an RCU from an MCU:
1. Connect to the MCU.
2. Verify that all affected TC390 volume pairs have been deleted. The volume pairs that consist of a M-VOL in the connected MCU and CU image and an R-VOL in the selected RCU must be deleted.
3. From the CU number/Port tree on the RCU Operations window, verify the correct CU image is selected.
4. From the MCU/RCU list on the RCU Operations window, select the RCU that you want to delete.
5. Right-click to display the pop-up menu, click RCU Operation, and then click Delete RCU.
6. Click Apply on the TrueCopy main window.

Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)
Before adding a path to an RCU, verify that the remote copy connection is properly installed, that the appropriate MCU ports are configured as RCPs (serial) or Initiator ports (fibre), and that 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, TC390 will automatically start using the new path to perform TC390 copy activities.
When the **Add Path** command is selected, the Add Path window is displayed. Use the Add Path window to set the path(s) to an RCU.

![Add Path Window](image)

**Figure 50**  Add Path window (for Fibre)

The **MCU-RCU Path** box includes:

- The **MCU Port** boxes, which you use to enter the MCU port number. The Initiator and the RCP are listed in the list and can be selected.
- The **RCU Port** boxes, which you use to enter the RCU port number. The RCU Target port must be specified.
- The **Link Address** boxes, which you use to enter the Link Address.

The **Cancel** button cancels the settings you made. The **Set** button applies the settings you made and changes the list.

**NOTE:** The number of effectively displayed boxes depends on the number of paths that can be added.

For more information on the path status, refer to Table 30 on page 149.

To add a new logical path from the connected MCU to an existing RCU:

1. From the CU Number tree on the RCU Operations window, verify the correct CU image is selected.
2. From the MCU/RCU list on the RCU Operations window, select the RCU to which you want to add a path.
3. Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Add Path** (see Figure 51). The Add Path window is displayed.

![Add Path window](image)

Figure 51 Opening the Add Path window

4. From the Add Path window, enter the new path(s).
5. Click **Set** in the Add Path window to set the paths. The list changes to the **Path Settings Parameter list**.

   NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Settings” on page 101.

6. Click **Apply** on the TrueCopy main window. The MCU will automatically begin using the new logical path for TC390 activities.

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

To delete a path from the connected MCU to an existing RCU:

1. Open the RCU Option window and check the minimum number of 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 number of paths so that you can delete the appropriate path.
2. From the CU Number/Port tree on the RCU Operations window, verify the correct CU image is selected.
3. From the MCU/RCU list on the RCU Operations window, select the RCU with the path you want to delete.
4. Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Delete Path**. The list changes to the **Path Settings Parameter list**. Only the selected RCUs are listed.

   NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Settings” on page 101.

5. Click **Apply** on the TrueCopy main window.
Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)

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

When the **Add SSID** command is selected, the Add SSID window is displayed. Use the Add SSID window to add three SSIDs at once to the selected RCU CU image.

![Add SSID window](image)

**Figure 52** Add SSID window

The Add SSID window displays three SSID boxes to enter. You can enter up to three SSIDs at once with the Add SSID window. You can add up to four SSIDs (the maximum number of the SSID) in total.

The **Cancel** button cancels the settings you made. The **Set** button applies the settings you made and changes the list.

To add or delete an SSID for an existing RCU:

1. From the CU Number tree on the RCU Operations window, verify the correct CU image is selected.
2. From the MCU/RCU list on the RCU Operations window, select the RCU that you want to add or delete the SSID(s).
3. To add an SSID:
   a. Right-click to display the pop-up menu, click **Edit SSID(s) & Path(s)**, and then click **Add SSID**. The Add SSID window is displayed.
   b. From the Add SSID window, enter the new SSID(s) in the SSID boxes. You can add up to four SSIDs (in total) to the RCU.
   c. Click **Set** to add the SSIDs. The list changes to the **SSID Settings Parameter list**. The added SSIDs are listed.
4. To delete the SSID(s): Right-click to display the pop-up menu, click Edit SSID(s) & Path(s), and then click Delete SSID. The list changes to the SSID Settings Parameter list. Only the RCUs that are to be deleted are listed.

5. Click Apply on the TrueCopy main window.

Modifying Parameters and Omitting Selected Settings

After the RCU, Path, and/or SSID operation, the parameters can be modified individually. Also the RCUs, Paths, and/or SSIDs that you have set by the each operation can be omitted from the pair operation.

To modify the parameters:
1. Select a RCU, Path, or SSID whose parameters you want to modify on the list.
2. Right-click to display the pop-up menu and click Modify to modify the parameters. A window for each operation is displayed.
3. Modify the parameters and click Set in the window.
4. Click Apply on the TrueCopy main window.

NOTE: After the delete operation of the RCU, Path, and/or SSID operation, the Modify command is not available.

To omit the RCUs, Paths, or SSIDs from the operation:
1. Select the RCUs, Paths, or SSIDs to be omitted from the operation on the list.
2. Right-click to display the pop-up menu and click **Omit**. The RCUs, Paths, or SSIDs selected in step 1 are deleted from the list, and the deleted RCUs, Paths, or SSIDs have been removed from the operations.

3. Click **Apply** on TrueCopy main window.

The **Cancel All** command deletes all the RCUs, Paths, or SSIDs on the list, and all the RCUs, Paths, or SSIDs have been removed from the operations. All the RCUs, Paths or SSIDs can also be deleted from the list using the **Omit** command by selecting all of the RCUs, Paths, or SSIDs on the list. When all the RCUs, Paths, or SSIDs are deleted from the list (by the **Cancel All** or **Omit** command), the list status becomes the Volume list.

### Asynchronous Operations

The TC390A control operations include:

- Viewing consistency group status (see page 103)
- Adding consistency groups (see page 105)
- Modifying the consistency group options (see page 106)
- Deleting consistency groups (see page 107)
- Setting the Asynchronous copy options (see page 108)
- Modifying parameters and omitting consistency groups (see page 109)

Click the **Asynchronous Operations** tab (see page 76) to perform the asynchronous operations. All the operations that can be performed from the Asynchronous Operations window have a common procedure.

**To perform the asynchronous operations:**

1. Select a consistency group mode (**Display All**, **Used**, or **Not Used**) in the Consistency Group tree.
2. Select one or more consistency group in the Consistency Group list.
3. Right-click to display the pop-up menu. The pop-up menu consists of the following:
   - **Async Option**: Sets the parameters for the asynchronous copy operation (see "Asynchronous Copy Option" on page 108).

**NOTE:** For more information about CLPRs, see the *HP StorageWorks Command View XP User Guide for XP Disk Arrays* or the *HP StorageWorks XP Remote Web Console User Guide* for the specific disk array.

- **CT Group Operation**: Performs the following consistency group operations: **CT Group Status** (see “Viewing Consistency Group Status (CT Group Status)” on page 103), **Add CT Group** (see “Adding Consistency Groups (Add CT Group)” on page 105), **CT Group Option** (see “Modifying Consistency
4. Select a command and use the window to make your settings.

5. Click Set. The Consistency Group list changes to the Consistency Group Settings Parameter list or the Asynchronous Options Settings Parameter list. Only the consistency groups selected in step 2 are listed and items in the list depend on the selected command.

**NOTE:** The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Consistency Groups” on page 109.

6. Click Apply on the TrueCopy main window.

The following sections describe in detail for each command and operation.

### Viewing Consistency Group Status (CT Group Status)

The **CT Group Status** command can be used to display the consistency group status information.

To display the consistency group status information:

1. From the Consistency Group tree, select the consistency group mode that includes the consistency group with the status information you want to display.
2. From the Consistency Group list, select a consistency group. Select only one consistency group.

![CT Group Status window](image)

- **CT Group**: Consistency group number of the selected consistency group in the list.
- **This CU Type**: Registering side (MCU or RCU) of the consistency group.
- **CLPR**: The number and name of the CLPR to which the volumes forming pairs belong.
- **S/N, SSID list box**: Serial number and SSID of the CUs that are the components of the selected consistency group.
- **Pair list box**: Pair list of the original CU of the selected consistency group. For a device that is set with more than one path, only the first path is listed.
- **MCU-RCU Path**: Channel type of the path interface between the disk arrays (Serial or Fibre).
- **Time Out (Copy Pending)**: The maximum delay allowed for TC390A copy (see “Adding Consistency Groups (Add CT Group)” on page 105).
- **Time Out (RCU Ready)**: The maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (see “Adding Consistency Groups (Add CT Group)” on page 105).
- **C/T**: Current consistency time of this group (For the TC390A pairs only).
- **Timer Type**: Specified timer type of this group (For the TC390A pairs only).
- **SEQCHK**: Yes indicates that at least one pair of this group has SEQCHK status (For the TC390A pairs only).

**NOTE:**
- The RCU manages the C/T and SEQCHK status, and the MCU acquires these from the RCU. If MCU-RCU communications are down, the MCU may not display the latest C/T and SEQCHK information. Always use the group status and R-VOL status displayed at the RCU for disaster recovery.
- The SEQCHK status is also displayed as a TC390A pair status. To determine exactly which pair(s) in the group has the SEQCHK status, check the R-VOL pair status at the RCU.

The **Previous** button displays information about the consistency group before the current consistency group. The **Next** button displays information about the consistency group after the current consistency group. The **Refresh** button refreshes the displayed information. The **Close** button closes the CT Group Status window.
Adding Consistency Groups (Add CT Group)

The **Add CT Group** command adds a consistency group to the connected MCU. When the **Add CT Group** command is selected, the Add CT Group window is displayed. Use the Add CT Group window to select the group options for the group.

![Add CT Group Window](image)

**Figure 56** Add CT Group window

Use the **Timer Type** box to select the timer type option for the group.

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

Use the **MCU-RCU Path** box to select the port type (**Fibre**) for the remote copy connections.

Use the **Time Out (Copy Pending) (min.)** box to select the maximum delay allowed for TC390A copy (none or from 3 to 15 min., none = 0 timeout for TC390A copy pending). The default setting is five minutes. If the delay between the TC390A M-VOL update and the corresponding R-VOL update reaches the specified time, the RCU will suspend all R-VOLs in the group. A timeout occurs when the RCU was not able to settle a recordset within the specified time, or when the RCU has not had any communication from one of the MCUs in the group within the specified time.

**NOTE:** The copy pending timeout value should be less than the I/O timeout value of the host system.

**CAUTION:** For instructions on selecting the correct **Time Out (Copy Pending)** setting for your operational environment, see step 9 below.

Use the **Time Out (RCU Ready) (min.)** box to select the maximum delay allowed for re-establishing MCU-RCU communications following MCU power-off (none or from 0 to 10 min., 0 = no timeout for TC390A RCU ready). The default setting is five minutes. If the MCU is not able to re-establish communication with the RCU within the specified time, the MCU suspends all M-VOLs in the group.

The **Cancel** button cancels the settings you made. The **Set** button sets the consistency group options you changed.
To add a consistency group:

1. Connect to the MCU.
2. Verify that the async options are configured as needed (refer to "Asynchronous Copy Option" on page 108).
3. From the Consistency Group tree, select a consistency group mode that includes the consistency group that you want to add.
4. From the Consistency Group list, select the consistency group(s) to add. Make sure to select more than one group that is not registered yet.
5. Right-click to display the pop-up menu, click CT Group Operation, and then click Add CT Group. The Add CT Group window is displayed.
6. From the Add CT Group window, select the port type (serial or fibre) and group options: copy pending timeout and RCU ready timeout. Remember that you will not be able to modify the port type of the group after you assign a pair to the group.
7. Click Set in the Add CT Group window. The Add CT Group window is closed and the list changes to the Consistency Group Settings Parameter list.

**NOTE:** The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Consistency Groups” on page 109.

8. Click Apply on the TrueCopy main window.
9. If you are using TC390 Async in the n-to-1 configuration, reset the Time Out (Copy Pending) option as follows to avoid suspension of TC390 pairs due to timeout errors:
   a. Suspend all pairs in the group so that you can change the group options.
   b. Select the group on the Main window, select Group Option, change the Time Out (Copy Pending) option to None, and select OK.
   c. Resume all pairs in the group, and then perform your normal TC390 Async operations.
   d. Acquire the current TC390 async copy delay time by calculating the difference between the host I/O time-stamp information and the consistency time shown on the CT Group Status window.
   e. Suspend all pairs in the group again and set the Time Out (Copy Pending) group option to a value greater than the current copy delay time. If the value exceeds the maximum time (15 min.), reduce the host I/O rate, or set the option to None.
   f. Resume all pairs in the group.

**Modifying Consistency Group Options (CT Group Option)**

The CT Group Option command modifies the consistency group options you have set when the consistency group is added. When the CT Group Option command is selected, the CT Group Option window is displayed. The CT Group Option window consists of the same boxes as the Add CT Group window (see “Adding Consistency Groups (Add CT Group)” on page 105).
If you want to change the group options, you must split all pairs in the group first.

NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Consistency Groups” on page 109. However, Timer Type cannot be changed when there is a pair in concerned CT Group.

Deleting Consistency Groups (Delete CT Group)

A consistency group can be deleted only from the MCU and only if the MCU does not contain any M-VOLs still assigned to the group. Deleting a consistency group from an MCU does not affect the consistency groups registered at other MCUs. The RCU will automatically delete a consistency group when the last volume pair in the group is deleted.
The **Delete CT Group** command deletes the selected group from the current MCU. You cannot delete a group that still has M-VOLs in the current MCU.

**To delete a consistency group from an MCU:**

1. Connect to the MCU.
2. From the **Consistency Group** tree, select a consistency group mode that includes the consistency group you want to delete.
3. From the Consistency Group list, select the consistency group(s) to delete. Make sure to select more than one consistency group whose This CU column indicates **MCU**.
4. Right-click to display the pop-up menu, click **CT Group Operation**, and then click **Delete CT Group**. The list changes to the Consistency Group Settings Parameter list. If the **Delete CT Group** command is not enabled, the selected group still contains M-VOLs in this MCU.

**NOTE:** The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Consistency Groups” on page 109.

5. Click **Apply** in the TrueCopy main window to apply the deletion to the disk array.

**Asynchronous Copy Option**

Use the **Async Option** command to select the parameters for the TC390A copy operation. When the **Async Option** command is selected, the Async Option window is displayed. Use the Async Option window to specify the TC390A copy option parameters for the connected disk array. The async options apply to the entire physical control unit, including all TC390 M-VOLs and R-VOLs behind the control unit. The async options can be modified only when no TC390A pairs or groups exist in the connected CU (M-VOLs or R-VOLs).

**Figure 58** Async Option window

All the default settings indicate the current settings.

The **CLPR(#)** list specifies CLPR ID. The default setting is 00.

Use the **Pending Update Data Rate (%)** box to specify the TC390A (and CA Asynchronous) sidefile threshold that is the maximum amount of cache that can be used for storing TC390 (and CA) Async recordsets (sidefiles). You can select any value between 30% and 70% (10% increments) (see “Inflow Control of Recordsets” on page 32). The current pending update data rate is common to both TC390 and CA operations. The most recently entered value (on the TrueCopy or CA Async Option window) will be applied to TC390A and CA Asynchronous operations. When the amount of cache being used for TC390A and CA Asynchronous recordsets reaches the specified threshold value, the MCU/RCU performs cache inflow control as follows:

- The MCU’s I/O response is delayed.
• The RCU accepts only the one specific recordset that will enable it to settle the pending recordsets in the queue(s). For all other recordsets the RCU responds to the MCU with the channel-command-retry request.

NOTE: If one or more consistency groups exist (TC390 or CA), this setting cannot be changed. This setting can be changed only when no consistency groups are assigned.

Use the Offloading Timer (min.) box to specify the amount of time, 0-20 minutes that the MCU will wait to send a TC390A recordset to the RCU. The MCU will suspend all affected TC390A volume pairs if it has not been able to offload a recordset to the RCU within the specified time (for example, the RCU is still responding channel-command-retry).

Use the PPRC TSO Command option to select the XP256-compatible format for PPRC TSO commands (see “Using PPRC Commands for TrueCopy” on page 153). This option should be selected only if you are using XP256 as RCUs connected to this XP1024/XP128/XP12000/XP10000. The XP256 format limits PPRC operations to sixteen consistency groups (0-F). The disk array-compatible format (default) performs PPRC operations for all 128 consistency groups (00-7F) of the XP1024/XP128/XP12000/XP10000.

To set the asynchronous option parameters:

1. From the Consistency Group list, right-click to display the pop-up menu and click the Async Operation command. The Async Option window is displayed.

   NOTE: You do not have to select a consistency group on the list.

2. From the Async Option window, select the appropriate parameters.

3. Click Set to set the parameters. The list changes to the Asynchronous Option Settings Parameter list.

   NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Consistency Groups” on page 109.

4. Click Apply on the TrueCopy main window to apply the option settings to the disk array.

Modifying Parameters and Omitting Consistency Groups

After the Consistency Group (CT Group) and/or Asynchronous Option operation, the parameters can be modified individually. Also the consistency groups that you have set by the operation can be omitted.

To modify the parameters:

1. After you have performed the CT Group Operation, select a consistency group whose parameters you want to modify on the list. To modify the parameters for Async Option operation, you do not have to select the row on the list.

2. Right-click to display the pop-up menu and click Modify to modify the parameters. A window for each operation is displayed.

3. Modify the parameters as needed and click Set.

4. Click Apply on the TrueCopy main window.

To omit the consistency groups: from the operation

1. Select the consistency groups to be omitted from the operation on the list.

2. Right-click to display the pop-up menu and click Omit. The Consistency Groups selected in step 1 are deleted from the list and the deleted Consistency Groups have been removed from the operations.

3. Click Apply on the TrueCopy main window to apply the deletion to the disk array.

For the CT Group Operation, the Cancel All command deletes all the consistency groups on the list and all the consistency groups have been removed from the operations. All the consistency groups can also be deleted using the Omit command by selecting all of the consistency groups on the list. When all the
consistency groups are deleted (by the \texttt{Cancel All} command or the \texttt{Omit} command), the list status becomes the Volume list.

For the Asynchronous Option operation, the Delete command is not available. You can either modify the options you have set or cancel all the option settings you made.

\textbf{NOTE:} After the delete operation of the \texttt{CT Group Operation} command, the \texttt{Modify} command is not available.

\section*{Usage Monitor Operations}

Use the Usage Monitor window to perform the remote copy usage monitoring operations for the connected disk array. The remote copy usage monitoring function can collect I/O statistics for all LDEVs on the connected disk array.

The usage monitor operations are:

- Starting and stopping monitoring (see page 110)
- Displaying the usage monitor graph (see page 110)

\subsection*{Starting and Stopping 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 disk array.

To start monitoring:

1. From the Usage Monitor window, enter the sampling time interval in minute(s) in the \texttt{Rate} list. You can enter from 1 to 546 minutes. Entering more than five minutes is recommended.
2. Click \texttt{Run} in the \texttt{Operation} list.
3. Click \texttt{Apply}.

The collection of monitoring data continues, even if the window is closed, until you stop monitoring operations. Monitoring data collection continues even if the SVP is rebooted. If a monitor starts, the data of the sidefile usage is stored.

To stop monitoring:

1. From the Usage Monitor window, click \texttt{Stop} in the \texttt{Operation} list.
2. Click \texttt{Apply}. The monitoring process is stopped.

\subsection*{Displaying the Usage Monitor Graph}

When usage monitoring is running, the Usage Operations window can display user-selected remote copy I/O statistics in real time. The I/O statistics data is collected according to the data-sampling rate selected in the \texttt{Rate} list.

The usage monitor graph plots the user-selected I/O statistics (up to 65 data points) on an x-y graph. The x-axis displays time and the y-axis displays the number of I/Os during the last sampling period. The legend is displayed on the right side of the graph. When the value for y-axis exceeds 10,000,000, the value is displayed in exponential notation. For example, $1\times10^7 = 10,000,000$; $2\times10^8 = 200,000,000$. The \texttt{Update} box displays the most recent data sample time for the data graph.

To display the usage monitor graph:

1. Verify that the usage monitoring is running. Status should be \texttt{Running}.  

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To display the usage monitor graph:

1. Verify that the usage monitoring is running. Status should be \texttt{Running}.
2. In the graph area of the Usage Monitor window, right-click to display the pop-up menu and click **Display Item**. The Display Item window is displayed.

![Display Item Window](image)

**Figure 59** Selecting data for Usage Monitor Graph

3. In the **Select Device** box of the Display Item window, click one:
   - **Subsystem Total**: The I/O statistics data of all the LDEVs in the disk array is displayed.
   - **Device**: An LDEV of the CU image can be selected. In the **CU** box, 00-1F can be entered. In the **Device** box, 00-FF can be entered. If a device that is not installed is entered, the graph is not displayed.

**NOTE:**
- CU_LDEV is displayed on the top of the graph. If # is added to the end of an LDEV number, such as 3F#, the LDEV is an external volume. For more information about external volumes, see *Hitachi HPAV for z/OS User Guide for the XP1024/XP128/XP12000/XP10000*.
- If you want to display I/O statistics for the sidefile data, select **CLPR**, and then select the desired CLPR from the drop-down list.

4. In the **Monitor Data** box of the Display Item window, select the I/O statistics data to display on the graph. More than one check box needs to be selected.

5. Click **Set** to close the Display Item window. The Usage Operations window now displays a graph showing the selected I/O statistics data for the selected LDEV(s).

   To enlarge the displayed graph, right-click on the graph and click **Large Size**. To return the graph to normal size, right-click on the graph and click **Normal Size**.

   **To close the graph:**
   1. In the graph display area, right-click on the graph you want to close.
   2. Click **Close** from the pop-up menu, or click **Close All** to stop displaying all the graphs. **A confirmation dialog box is displayed.**
3. Click **OK**.

Other methods of closing the graph:

- Select another tab.
- Select another program product or exit Command View XP or XP Remote Web Console.
- Select **Stop** in the **Operation** box of the Usage Monitor window and click **Apply**.

The following table lists and describes the I/O statistics that can be selected on the **Monitor Data** box of the Display Item window.

**Table 23  I/O statistics**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RIO count</strong></td>
<td></td>
</tr>
<tr>
<td>All RIO count</td>
<td>Total number of remote I/Os</td>
</tr>
<tr>
<td>All read count</td>
<td>Total number of remote read I/Os</td>
</tr>
<tr>
<td>All write count</td>
<td>Total number of remote write I/Os</td>
</tr>
<tr>
<td><strong>Initial Copy</strong></td>
<td></td>
</tr>
<tr>
<td>Initial copy RIO count</td>
<td>Number of initial copy remote I/Os</td>
</tr>
<tr>
<td>Initial copy hit count</td>
<td>Number of initial copy hits</td>
</tr>
<tr>
<td>Average transfer rate (KB/S)</td>
<td>Average transfer rate (KB/sec) for initial copy remote I/Os</td>
</tr>
<tr>
<td>Average response (ms)</td>
<td>Average response time (msec) for initial copy remote I/Os</td>
</tr>
<tr>
<td><strong>Migration Copy</strong></td>
<td></td>
</tr>
<tr>
<td>Migration copy RIO count</td>
<td>Number of migration copy remote I/Os</td>
</tr>
<tr>
<td>Migration copy hit count</td>
<td>Number of migration copy hits</td>
</tr>
<tr>
<td><strong>Update Copy</strong></td>
<td></td>
</tr>
<tr>
<td>Update copy RIO count</td>
<td>Number of update copy remote I/Os</td>
</tr>
<tr>
<td>Update copy hit count</td>
<td>Number of update copy hits</td>
</tr>
<tr>
<td>Average transfer rate (KB/S)</td>
<td>Average transfer rate (KB/sec) for update copy remote I/Os</td>
</tr>
<tr>
<td>Average response (ms)</td>
<td>Average response time (msec) for update copy remote I/Os</td>
</tr>
<tr>
<td><strong>Restore Copy</strong></td>
<td></td>
</tr>
<tr>
<td>Restore copy RIO count</td>
<td>Number of restore copy remote I/Os</td>
</tr>
<tr>
<td>Restore copy hit count</td>
<td>Number of restore copy hits</td>
</tr>
<tr>
<td><strong>Async. Copy</strong></td>
<td></td>
</tr>
<tr>
<td>Async. RIO count</td>
<td>Number of asynchronous update copy remote I/Os</td>
</tr>
<tr>
<td>Total number of recordsets</td>
<td>Number of TC390A recordsets</td>
</tr>
<tr>
<td>RCU command retries</td>
<td>Number of command retries due to RCU channel-command-retry messages.</td>
</tr>
<tr>
<td>MCU command retries</td>
<td>Number of command retries due to MCU SCP messages.</td>
</tr>
<tr>
<td>Average transfer rate (kB/sec)</td>
<td>Average transfer rate (kB/sec) for TC390/TC async update copy remote I/Os</td>
</tr>
<tr>
<td>Average RIO response (ms)</td>
<td>(Total RIO process time on a subsystem or selected volume for a certain interval period) / (Asynchronous RIO count); where RIO process time = time between the asynchronous data transfer request and the actual transfer of the recordset(s) to the RCU.</td>
</tr>
</tbody>
</table>
NOTE: Migration Copy and Restore Copy apply only to internal use. All other RIO statistics include both TC390 and TC remote copy operations (async RIO count = TC390A RIOs + TCA RIOs). However, Synchronization is not supported for this version.

Script Operations
At this time, exporting script trace files is not supported.
For more information about the Script Operations window, refer to “Script Operations Window” on page 78.

History Operations
At this time, exporting history files is not supported.
For more information about the History window, refer to “History Window” on page 80.

Other Operations
Click the Clear SIM button on the Other Operations window to clear all remote copy SIMs (service information messages) from the connected disk array. Remote copy SIMs include all SIMs issued for TC390 and CA operations.

The clear SIM function is intended for use during disaster recovery operations, while switching operations to the remote (secondary) backup site. Please see “Switching Operations to the Remote Site” on page 143 for specific instructions on clearing remote copy SIMs during disaster recovery operations.

To clear all remote copy SIMs from the disk array:
1. Click the Other Operations tab, and then click Clear SIM.
2. From the Clear SIM confirmation window, click Yes to clear all remote copy SIMs from the connected disk array, or click No to cancel your request to clear SIMs.
3. If you clicked Yes, the disk array verifies that the existing SIMs are being cleared.

Optimizing TrueCopy Operations and Disk Array Performance
All TC390 operations result in increased utilization of the disk array’s channel resources because of the additional write (remote copy) operations to the secondary volumes. The TC390 update copy mode (synchronous or asynchronous) determines exactly how the remote copy operations will impact disk array performance as follows:

• Synchronous copy mode (TC390 Synchronous) has an additional effect on disk array performance: increased service and disconnect time for write I/Os to TC390 M-VOLs due to the delay between channel-end and device-end. The length of this delay increases as the distance between the M-VOL and R-VOL increases so that the longest delay occurs when the main and remote volumes are the maximum distance apart.
- **Asynchronous** copy mode (TC390A) eliminates all delays associated with TC390 Synchronous operations while providing increased protections for write-dependent applications in the event of a disaster. Write I/Os for TC390A M-VOLs are processed in the same way as writes for simplex volumes, without any increase in service or disconnect time. The asynchronous R-VOL updates are performed completely independent of all host I/O processes at the M-VOLs and there are no restrictions on subsequent read/write operations to TC390A M-VOLs. The only performance concerns for TC390A are ensuring that adequate cache resources are available for sidefiles that are used to store the recordsets at both the MCUs and RCUs.

In addition to the TC390 update copy mode, several other factors can also affect XP1024/XP128/XP12000/XP10000 performance. You can optimize both the TC390 operations and the I/O performance of the disk arrays by analyzing workloads and addressing system-level conditions (for example, number of remote copy paths) that can affect disk array performance. You can also control the impact of TC390 operations on disk array performance by selecting the appropriate RCU options for each MCU (see “Registering an RCU (Add RCU)” on page 87) and the appropriate update copy mode (synchronous or asynchronous) and pair options (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121) for each TC390 pair. In addition, you can upgrade the TC390 hardware components and/or adjust the configuration of the components to improve disk array performance under a wide range of operating conditions. The following table lists some of the conditions that affect disk array performance and provides recommendations for addressing these conditions.

### Table 24 Optimizing TrueCopy operations and XP1024/XP128/XP12000/XP10000 performance

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
<th>Recommendation(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write-intensive workloads</td>
<td>Write-intensive workloads, such as SPOOL volumes and database logging volumes, can have a significant impact on disk array I/O response times.</td>
<td>Spread write-intensive data across several volumes to minimize queuing. Also consider increasing the duplex write line (DWL) of the disk array using Performance Manager.</td>
</tr>
<tr>
<td>Large block size</td>
<td>Workloads with large write block sizes, such as DB2® deferred writes, can impact performance.</td>
<td>Spread workloads with large write block sizes across several volumes.</td>
</tr>
<tr>
<td>High host channel demand</td>
<td>The demand on the MCU’s host channels can affect performance.</td>
<td>Spread the workload across several disk arrays to use additional channels.</td>
</tr>
<tr>
<td>Sequential write operations</td>
<td>TC390 operations can have a negative impact on workloads with a high percentage of sequential write operations, such as batch processing operations (for example, dump/restore or sort operations).</td>
<td>Avoid performing restore operations to volumes that belong to TC390 pairs. Instead, restore data to a scratch volume and then establish the TC390 volume pair.</td>
</tr>
<tr>
<td>Cache size</td>
<td>Large cache size improves read hit performance, which allows more disk array resources to be devoted to write operations. The resulting performance improvement can offset some or all of the performance loss due to the TC390 remote copy operations. TC390A and HXRC require additional cache for sidefile data. Insufficient cache resources can result in command retries, SCP notifications, and puncture conditions.</td>
<td>Consider increasing the cache size of the TC390 disk arrays to handle TC390A and HXRC sidefile operations and to improve overall disk array performance. For best results, the cache and NVS capacity of the main and remote disk arrays should be the same (for TC390A the RCU sidefile requirements are 2x that of the MCU) to enable the remote site to function adequately during disaster recovery.</td>
</tr>
</tbody>
</table>
Discontinuing TrueCopy Operations

If you plan to use TC390 for nondisruptive data migration or duplication (see “ICKDSF Considerations for TrueCopy Volumes” on page 136), you will need to configure and establish TC390 operations, allow TC390 to synchronize the volumes, redirect application I/Os (if migrating), and then discontinue TC390 operations. When you are ready to discontinue TC390 operations, you will need to perform TC390 operations in the correct order to avoid generating error messages. For example, you cannot delete an RCU path until you have deleted all TC390 pairs still using that path and you cannot delete a group until you have deleted all TC390A pairs in that group.

To discontinue all TC390 operations:

1. Delete all TC390 pairs from the MCU(s) (Delete Pair, see “Deleting TrueCopy Volume Pairs (Delete Pair)” on page 132). For TC390A 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 Simplex for all TC390 volumes before continuing.
2. Delete the TC390A group(s) from the MCU(s) (see “Deleting Consistency Groups (Delete CT Group)” on page 107). The RCU will automatically delete a group when all pairs in the group have been deleted.
3. Delete the RCUs (see “Deleting an RCU (Delete RCU)” on page 97). Check each CU image of each MCU to verify 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 (for example, repeaters, and switches), call HP technical support for assistance.
5. For serial interface, reset the RCP(s) to LCP(s) at the MCU(s). For Fibre Channel interface, reset the initiator port(s) to ordinary target(s) at the MCU(s).

Performing TrueCopy Pair Operations

Preparing for TrueCopy Volume Pair Operations

Before starting TC390 operations, you must consider the relative importance of disk array I/O performance and disaster recovery preparation. As described in “Optimizing TrueCopy Operations and Disk Array Performance” on page 113, remote copy operations can affect the I/O performance of the MCUs and RCUs. TC390 provides many options, such as initial copy options, pair options, group options, and async options, that controls the impact of TC390 operations on I/O performance. These options can be set separately for each pair, for each TC390A group, and for each MCU to provide maximum flexibility. You can select options that minimize the impact of TC390 operations on disk array performance, or options that maximize the effectiveness of TC390 operations to ensure the best level of backup data integrity. System-level factors (for example, number of paths) can also affect TC390 operations and disk array performance (see Table 24 on page 114).

For TC390 disaster recovery operations, you should verify 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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
<th>Recommendation(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCU capacity</td>
<td>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.</td>
<td>Distribute TC390 remote copy operations among several remote disk arrays to avoid overloading any one RCU.</td>
</tr>
<tr>
<td>Remote copy connection paths</td>
<td>An inadequate number of Remote copy connection paths may decrease disk array performance. Performing TC390 Synchronous operations over long distances can also degrade disk array performance. TC390A is recommended for long distances.</td>
<td>Make sure to install an adequate number of Remote copy connection paths between the main and remote disk arrays. This is especially important for disk arrays that contain both M-VOLs and R-VOLs.</td>
</tr>
</tbody>
</table>
To prepare for TC390 volume pair operations, you need to identify the volumes by LDEV ID for which you want to establish TC390 remote copy operations. You should identify volumes that are required for system operation as well as volumes that contain important data to be backed up (for example, 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 that span multiple volumes, you should plan to establish a TC390A consistency group for each database so that the update sequence consistency of the database can be ensured at the remote site.

You can start creating the TC390 volume pairs as soon as you have:

- Identified the volumes that will become the TC390 M-VOLs (and R-VOLs)
- Ensured that all system and TC390 requirements have been met (see “System Requirements” on page 45 and “Requirements and Restrictions” on page 47)
- Completed hardware and software installation (see “Installing the TrueCopy Hardware” on page 49 and “Installing the TrueCopy Software” on page 54)
- Configured the MCUs and RCUs for TC390 operations (see page 54)

**NOTE:** TC390 and SI390 can function together in the same XP1024/XP128/XP12000/XP10000 to provide both internal and remote backup for your data. If you are planning to combine TC390 and SI390, read the important configuration information in “Combining TrueCopy with Other Data Management Operations” on page 58.

If you will be using the TC390 software to perform remote copy operations, the management station must be LAN-attached to the MCU of each TC390 volume pair. You should also install and attach a management station to the RCUs at your remote site. If you will be using PPRC commands instead of Command View XP or XP Remote Web Console, contact your HP account support representative for information on TC390 configuration services. The following TC390 operations cannot be performed using PPRC commands: asynchronous options, group addition/deletion, and group options. For more information on using PPRC commands with the XP1024/XP128/XP12000/XP10000, see “Using PPRC Commands for TrueCopy” on page 153.

**Common Procedure for TrueCopy Pair Operation**

From the Pair Operations window (see “TrueCopy Main Window (Pair Operations Window)” on page 68), you can perform the pair setting operations. All the operations that can be performed from the Pair Operations window have a common procedure.

To perform the pair settings operation:

1. Select a CU number in the CU Number tree.

**NOTE:** A CU number must be selected in the tree.

2. Select one or more devices or pairs in the Volume list.

3. Right-click to display the pop-up menu (see Figure 60). The pop-up menu consists of the following:
   - **Pair Status**: Displays the volume status (see “Viewing the Status of TrueCopy Volume Pairs (Pair Status)” on page 118).
   - **Add Pair**: Creates a volume pair using the following commands: **Synchronous** and **Asynchronous** (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121).
   - **Delete Pair**: Deletes the pairs (see “Deleting TrueCopy Volume Pairs (Delete Pair)” on page 132).
   - **Suspend Pair**: Splits (Suspends) the pairs (see “Suspending TrueCopy Volume Pairs (Suspend Pair)” on page 126).
   - **Resume Pair**: Resumes the pairs (see “Resuming TrueCopy Volume Pairs (Resume Pair)” on page 129).
- **Change Pair Option**: Changes the pair option (see “Changing the Pair Options (Change Pair Option)” on page 135).
- **Snapshot**: Creates the snapshot file (see “Snapshot Function” on page 72).

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### List after the Command Selection

After the window is closed, only the Volumes selected in step 2 of the procedure described in the “Common Procedure for TrueCopy Pair Operation” on page 116 are displayed in the list. The items of the list are also changed. The Volume list that is in this status is called the Pair Settings Parameter list. The items of the Pair Settings Parameter list depend on the command selected from the pop-up menu and the operation you performed. The items for each command are described in the sections.

Use the **Set** button on each parameter window to preset the parameters to the Pair Settings Parameter list. To apply the parameters to the system, click **Apply** on the TrueCopy main window.

The **Cancel** button closes the window, but does not set the parameters. The **Cancel All** button returns you to the Volume list.

### Modifying Parameters and Omitting Selected Volumes

After the pair settings operation, the volume parameters can be modified individually. Also the volumes that are selected to be the pairs can be omitted from the pair operation.

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**NOTE**: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Volumes” on page 117.

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4. Select a command and use the window to make your settings.

5. Click **Set**.

6. Click **Apply** on the TrueCopy main window.

The status of the command (active or inactive) depends on the status of the volumes selected in the Volume list.

The following sections describe in detail for each command and operation.
To modify the parameters of a volume:
1. Select a volume whose parameters to be modified on the **Pair Settings Parameter list**.
2. Right-click to display the pop-up menu and click **Modify** to modify the parameters. A window is displayed.
3. Modify the parameters and click **Set**.
4. Click **Apply** on TrueCopy main window.

To omit the selected volumes:
1. Select the volumes to be omitted from the operation on the **Pair Settings Parameter list**.
2. Right-click to display the pop-up menu and click **Omit**. The volumes selected in step 1 are deleted from the **Pair Settings Parameter list** and the deleted volumes have been removed from the pair settings operations.
3. Click **Apply** on the TrueCopy main window.

The **Cancel All** command deletes all the volumes listed on the **Pair Settings Parameter list** and all the volumes have been removed from the pair settings operations. All the volumes can also be deleted from the list using the **Omit** command by selecting all of the volumes on the **Pair Settings Parameter list**. When all the volumes are deleted from the list (by the **Cancel All** command or the **Omit** command), the list status becomes the **Volume list**.

**Viewing the Status of TrueCopy Volume Pairs (Pair Status)**

The **Pair Status** command can be used to display the TC390 pair status information in detail.

To display the TC390 pair status information:
1. From the tree, select **Display All** or a **CU number**. The **Pair Status** command can be selected when **Display All** or **CU number** is selected in the tree.
2. From the Volume list, select a volume whose pair status information to be displayed.
3. Right-click and click **Pair Status** from the pop-up menu. The Pair Status window is displayed.

![Pair Status window](image)

**Figure 61** Pair Status window

- **M-VOL** and **R-VOL**: The first row: CU number and Device ID. The second row: Device emulation type. The third row: Capacity (number of cylinders).
  - The CLPR number and CLPR name are not displayed under the volume paired with the local volume.

**NOTE:** If `#` is added to the end of the device ID, such as **00:3F#**, the LDEV is an external volume. If the pair created with TrueCopy for z/OS of the microcode program version 50-03-6-xx and earlier, “#” is not added to the volume paired with the local volume. For more information about external volumes, see *Hitachi *HPAV for z/OS User Guide for the XP1024/XP128/XP12000/XP10000.*

- **CLPR**: The CLPR number and the CLPR name of the volume on the primary site are displayed.
- **Pair Status**: Simplex, Pending, Duplex, Suspended, Suspending, Deleting, Suspended (Continue), or Suspending (Continue). For more information for TC390 pair status, see “TrueCopy Volume Pair Status” on page 36. If the pair is split or suspended, the split/suspended type is also displayed.
- **Pair Synchronized**: Displays how far the initial copy operation progressed in percentage and the progress bar.
- **RCU S/N** and **SSID**: Serial number and SSID of the RCU (or MCU if R-VOL is selected).
- **MCU-RCU Path**: Channel type of the path interface between the disk arrays (Serial or Fibre).
- **Update Type**: Synchronous or Asynchronous.
- **Initial Copy Pace**: 3 tracks or 15 tracks (displayed during initial copy and resume copy).
- **Initial Copy Priority**: 1 - 256 (displayed during initial copy and resume copy).
- **M-VOL Fence Level**: Conditions under which the MCU will reject write operations to the M-VOL. **Never**: Never fence the operation. **Data**: Fence when the MCU cannot successfully execute an update copy.
operation for any reason. **Status:** Fences only if the MCU is not able to change the R-VOL status to the same status as the M-VOL.

- **R-VOL Write:** Enabled (Write operation to the R-VOL is enabled) or disabled (Write operation to the R-VOL is disabled) for this pair. The Write operation to the R-VOL is enabled only when the Asynchronous pair is split. However, Enabled is not usually recommended. When R-VOL Write Enabled is required, contact your HP account support representative.

- **Pair Established:** The date and time that the volume pair was created.

- **Last Updated:** The date and time that the volume pair status was last updated.

- **Difference Management:** Auto, Cylinder, or Track.

- **CFW Data:** The CFW Data option specifies whether the CFW data will be copied to the R-VOL:
  - If Copy to R-VOL is selected, the MCU will copy the CFW data to the R-VOL.
  - If Only M-VOL is selected, the MCU will not copy the CFW data to the R-VOL. This setting is recommended for two reasons: (1) copying the CFW data impacts disk array performance and (2) CFW data is typically used for temporary files (for example, sort work datasets) that are not usually required for disaster recovery.

**NOTE:** If a TC390 pair is established using PPRC commands, the CFW data option is set to the Copy to R-VOL setting.

- **DFW to R-VOL:** The DFW to R-VOL option (TC390 Synchronous only) specifies whether the MCU will suspend a TC390 volume pair when the RCU cannot execute DFW to the R-VOL:
  - If DFW not required is selected, the MCU will not suspend the TC390 volume pair when DFW on the RCU is blocked. This option is recommended if you need to maintain synchronization of the TC390 volume pair.

**NOTE:** If a TC390 pair is established using PPRC commands, the DFW to R-VOL option is set to not required.

  - If DFW required is selected, the MCU will suspend the pair when DFW on the RCU is blocked. This option is recommended if you need to maintain high MCU I/O performance.

**CAUTION:** The interaction of the DFW required setting and the M-VOL fence level setting can cause a host application to fail with a permanent I/O error when attempting to update an M-VOL. Keep track of which volume pairs have the DFW required setting and verify that the DFW to the R-VOL is not blocked.

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

**NOTE:** When you create a TC390 pair, and if you select only M-VOL for the CFW data option, the data set which is updated by CFW in M-VOL cannot be used in R-VOL. To use this data set in R-VOL, delete a TC390 pair, and format the data set.

- **Asynchronous Parameter** box consists of the following:
  - **CT Group:** Consistency group to which the TC390A pair is assigned.
  - **Error Level:** Error level for the TC390A pair(s)
• **C/T Type**: Timer type of the consistency group (System, Local or None).
• **Consistency time**: Consistency time of the group to which the TC390A pair is assigned
• **SEQCHK**: Displayed when the TC390A pair has the SEQCHK status. This status is managed by the RCU and the MCU may not have the most current information. Always use the R-VOL pair status information displayed at the RCU for disaster recovery.

• The **Previous** button changes the displayed pair status information to that of the previous Volume on the Volume list (the Volume of the row above). The **Next** button changes the displayed pair status information to that of the next Volume on the Volume list (the Volume of the row below). The **Refresh** button refreshes the pair status information. The **Close** button closes the Pair Status window.

**NOTE:** The Display Filter settings can affect how Previous or Next is recognized.
The Volume list can display 256 rows at once. Therefore, the **Previous** and the **Next** buttons can be used to display the 256 rows at once.

---

### Creating TrueCopy Volume Pairs (Add Pair)

The **Add Pair** command creates one or more new TC390 pairs. When the **Add Pair** command is selected, the Add Pair window is displayed. Use the Add Pair window to select the R-VOL, RCU, and initial copy options for the pair(s) being created.

**NOTE:** Make sure to select the appropriate CU image before creating any TC390 pairs.

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**Figure 62** Add Pair (Synchronous) window
**NOTE:** When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **M-VOL:** Device ID of the M-VOL.

  **NOTE:** If # is added to the end of an LDEV number, such as 00:3F#, the LDEV is an external volume. For more information about external volumes, see *Hitachi HPAV for z/OS User Guide*.

- **R-VOL:** Select the R-VOL device ID for the specified M-VOL. If you selected more than one volume, R-VOLs will automatically be assigned to the rest of the selected M-VOLs based on device ID. For example, if you select three volumes on the Volume list and select LUN01 as R-VOL for the first M-VOL, R-VOLs of the following M-VOLs are LUN02 and LUN03.

  **NOTE:** Verify all the assigned R-VOLs are available. If the automatically assigned R-VOLs are already used for the other operation, you have to modify the R-VOL individually (see “Modifying Parameters and Omitting Selected Volumes” on page 117 for instructions).

- **RCU:** Select an RCU (Serial number, CU number, SSID, and Port type) for the TC390 pair(s) being created. The RCUs that are already registered can be selected from the list. The RCU must be the same for all pairs being created during this operation.

- **M-VOL Fence Level:** The **M-VOL Fence Level** option (TC390 Synchronous only) specifies the conditions under which the MCU will reject write operations to the M-VOL, which is known as “fencing.” This option is very important for disaster recovery planning (see “Considering the M-VOL Fence Level Setting” on page 141). TC390A M-VOLs are never fenced.

  - If **Data** is selected, the M-VOL will be fenced when the MCU cannot successfully execute an update copy operation for any reason. This setting is functionally equivalent to the CRIT(YES-ALL) parameter for the CESTPAIR command.
• If **Status** is selected, the M-VOL will be fenced only if the MCU is not able to change the R-VOL pair status to suspended when an update copy operation fails. If the MCU changes the R-VOL pair status to suspended, subsequent write operations to the M-VOL will be permitted and the MCU will keep track of all updates to the M-VOL while the pair is suspended. This setting is functionally equivalent to the CRIT(YES-PATHS) parameter for the CESTPAIR command.

• If **Never** is selected, the M-VOL will never be fenced. If the TC390 volume pair is suspended, write operations to the M-VOL will be accepted. This setting is functionally equivalent to the CRIT(NO) parameter for the CESTPAIR command.

**Initial Copy Parameters:** Select the initial copy options.

• **Initial Copy.** This option specifies the initial copy mode for the new pair(s).
  
  **Entire** is selected, the initial copy operation will copy all cylinders on the M-VOL (except diagnostic and unassigned alternate tracks) to the R-VOL. This setting is functionally equivalent to the MODE=COPY parameter for the CESTPAIR command.
  
  **No Copy** is selected, the initial copy operation will not be performed. The MCU will begin performing update copy operations as needed. This setting is functionally equivalent to the MODE=NOCOPY parameter for the CESTPAIR command.

**CAUTION:** The user must ensure that the M-VOL and R-VOL are already identical when using this setting.

• **Initial Copy Pace** option specifies the maximum number of tracks that can be copied at one time by the TC390 initial copy operation before the MCU accepts another host request:
  
  The **15 Tracks** setting speeds up the initial copy operation, but may affect the disk array’s I/O performance if the M-VOL is experiencing high write I/O activity. This setting is functionally equivalent to the PACE=2255 parameter for the CESTPAIR TSO command.

  The **3 Tracks** setting slows down the initial copy operation to minimize the impact of the initial copy operation on the disk array’s I/O performance. This setting is functionally equivalent to the PACE=1 parameter for the CESTPAIR command.

• **Priority (From 1 to 256):** The initial copy 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 window (see “Registering an RCU (Add RCU)” on page 87). The highest priority is 1 and the lowest priority is 256 (current default = 32). The TC390 initial copy priority option can be used to spread initial copy operations across disk array groups and/or disk array domains (ACP pairs) to reduce initial copy time as well as host I/O contention.

**Example:** The maximum initial copy activity setting is 4 and you add 6 TC390 pairs at the same time (for LDEVs 00 through 05) with the initial copy priority set as follows:

<table>
<thead>
<tr>
<th>M-VOL of TC390 pair</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDEV 03</td>
<td>1</td>
</tr>
<tr>
<td>LDEV 05</td>
<td>2</td>
</tr>
<tr>
<td>LDEV 00</td>
<td>3</td>
</tr>
<tr>
<td>LDEV 04</td>
<td>4</td>
</tr>
<tr>
<td>LDEVs 01, 02</td>
<td>5</td>
</tr>
</tbody>
</table>

The MCU will start the initial copy operations for LDEVs 03, 05, 00, and 04 immediately, then start LDEV 01 when one of the first four initial copy operations is complete, and then start LDEV 02 when the next initial copy operation is complete. If additional TC390 pairs are added, the MCU also prioritizes the initial copy operations by time requested so that all TC390 pairs in the first group are started before any pair in the next group is started.
**NOTE:** The CESTPAIR TSO command does not support the initial copy priority option. When CESTPAIR is used to establish TC390 pairs, the initial copy operations are performed in the order that the CESTPAIR commands are issued.

- **Difference Management:** Select Auto, Cylinder, or Track as the basis for managing the differential data. The default is Auto. When you select Auto, either Cylinder or Track is selected depending on the basic size of the logical volume image.

- The **CFW Data** option specifies whether the CFW data will be copied to the R-VOL:
  - If Copy to R-VOL is selected, the MCU will copy the CFW data to the R-VOL.
  - If Only M-VOL is selected, the MCU will not copy the CFW data to the R-VOL. This setting is recommended for two reasons: (1) copying the CFW data impacts disk array performance and (2) CFW data is typically used for temporary files (for example, sort work datasets) that are not usually required for disaster recovery.

**NOTE:** When you create a TC390 pair, and if you select only M-VOL for the CFW data option, the data set which is updated by CFW in M-VOL cannot be used in R-VOL. To use this data set in R-VOL, delete a TC390 pair, and format the data set.

**NOTE:** If a TC390 pair is established using PPRC commands, the CFW data option is set to the Copy to R-VOL setting.

**NOTE:** By using Remote Copy Function Switch, you can set the following option with CESTPAIR: CFW data = only M-VOL. If you want to use this function, please contact your HP account support representative.

- The **DFW to R-VOL** option (TC390 Synchronous only) specifies whether the MCU will suspend a TC390 volume pair when the RCU cannot execute DFW to the R-VOL:
  - If DFW not required is selected, the MCU will not suspend the TC390 volume pair when DFW on the RCU is blocked. This option is recommended if you need to maintain synchronization of the TC390 volume pair.

**NOTE:** If a TC390 pair is established using PPRC commands, the DFW to R-VOL option is set to not required.

If DFW required is selected, the MCU will suspend the pair when DFW on the RCU is blocked. This option is recommended if you need to maintain high MCU I/O performance.

**CAUTION:** The interaction of the DFW required setting and the M-VOL fence level setting can cause a host application to fail with a permanent I/O error when attempting to update an M-VOL. Keep track of which volume pairs have the DFW required setting and verify that DFW to the R-VOL is not blocked.

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

- **Asynchronous Parameters:** Can be selected only for the Asynchronous pair(s).
• **CT Group: C/T Group.** This option specifies the consistency group for the pair(s) being added (TC390A only). All TC390A pairs must be assigned to a consistency group.

**NOTE:** Only TCzA pairs belonging to the same CLPR can be allocated to one consistency group. For more information about CLPRs, see the *HP StorageWorks Command View XP User Guide for XP Disk Arrays* or the *HP StorageWorks XP Remote Web Console User Guide* for the specific disk array.

**NOTE:** The CESTPAIR command can be used to start TC390A pairs and assign them to groups, but the groups must already be configured (using the Add C/T Group window, see “Adding Consistency Groups (Add CT Group)” on page 105).

• **The Error Level (Async) option (TC390A only) specifies the error level for the TC390A pair(s):**
  - **Group:** When the specified pair is suspended, all TC390A pairs in the same consistency group will be suspended, even if the failure affects only that pair and not the entire group.
  - **Select the Group error level for all TC390A volumes that are essential to disaster recovery.**
  - **Suspended TC390A R-VOLs that have the Volume error level should not be used for disaster recovery.**
  - **Volume:** If the failure affects only the specified pair, then only that pair will be suspended. A failure that affects an entire group will always result in the suspension of all pairs in the group, as well as all other affected TC390 pairs.

**NOTE:** You can also use the CESTPAIR TSO command to specify the error level for TC390A pairs (see “Using PPRC Commands for TrueCopy” on page 153).

The **Pair Resume (Async) option (TC390A only)** is available only when the Pair Option window is opened during the resume TC390A pair operation (see “Resuming TrueCopy Volume Pairs (Resume Pair)” on page 129). Use the TC390A **Group** resume option to resume all suspended TC390A pairs in a group. Use the TC390A **Volume** resume option to resume only the selected TC390A pair(s).

• **The Cancel button cancels the settings you have made and closes the Add Pair window. The Set button sets the parameters and closes the Add Pair window.**

When you are creating two or more pairs at the same time, the initial copy options will be the same for all the pairs. You can modify these initial copy options for individual pairs as needed. The procedure to modify the options, see “Modifying Parameters and Omitting Selected Volumes” on page 117.

To create one or more new TC390 volume pairs:

1. **Verify that the volumes that will be the TC390 R-VOLs are offline from all hosts.**
2. **Connect to the disk array that contains the M-VOLs of the pair(s) you are creating and start the TC390 software.** The RCPs or Initiator ports must be configured (see “Configuring the Host Interface Ports” on page 83) and the RCU(s) must be registered already (see “Registering an RCU (Add RCU)” on page 87).
3. **From the CU Number tree on the TrueCopy main window, select the CU number.**
4. **From the Volume list on the TrueCopy main window, select the volume(s) that will be the M-VOL(s) of the TC390 volume pair(s).** You can select one or more volumes and establish one or more pairs at a time only if the R-VOLs are in the same RCU and the pairs will have the same copy mode (Sync or Async). You cannot start TC390 Sync and TC390A pairs at the same time.
5. **Right-click to display the pop-up menu, click Add Pair, and click the pair mode (Synchronous or Asynchronous).** The Add Pair window is displayed.
NOTE: Pair mode specifies the update copy mode (see “Update Copy Operations” on page 27) for the new pair(s): Synchronous or Asynchronous. The selection of mode has the greatest impact on performance and must be considered carefully. Factors in mode selection include (but are not limited to) the use of TC390 (for disaster recovery or migration), the number of pairs, and the write I/O activity to the M-VOLs.

6. From the Add Pair window, enter the R-VOL for the pair, select the RCU, and select the initial copy options for the pair(s) being created (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121).

7. Click Set to close the Add Pair window and set the parameters.
   The list changes to the Pair Settings Parameter list (Add Pair). The Pair Settings Parameter list (Add Pair) is updated by the parameter settings and displays all pairs being created. The initial copy options and pair options you selected are applied to all pairs, but you can modify the options for each pair individually as needed (see “Modifying Parameters and Omitting Selected Volumes” on page 117).

8. From the Pair Settings Parameter list (Add Pair), check the RCU S/N and SSID, R-VOL, and copy options for each pair. You can modify the options as needed (see “Modifying Parameters and Omitting Selected Volumes” on page 117). Verify that all TC390 options for each new pair are correct.

9. If you want to execute the Add Pair requests quickly, select the Use Time-Saving Mode check box above the Pair Settings Parameter list (Add Pair).

10. Click Apply on the TrueCopy main window to create (start) the specified TC390 pair(s). The MCU will start the initial copy operations according to the initial copy priority and the maximum initial copy activities setting of the RCU.

11. From the TrueCopy main window, verify that the new TC390 pair(s) is/are displayed correctly (Pending status) in the Volume list. To monitor the status of the new pair(s), click Refresh to update the information in the Volume list or use the Pair Status window (see “Viewing the Status of TrueCopy Volume Pairs (Pair Status)” on page 118) to monitor the detailed status of each pair.

NOTE: The Add Pair operation will be rejected if the M-VOL is in the correction access or correction copy state. If this occurs, wait for the volume state to change and then repeat this procedure. If the status is not displaying correctly, verify that the correct CU image is selected. For information on troubleshooting suspended pairs, see “General TrueCopy Troubleshooting” on page 147.

CAUTION: If a timeout error occurs after clicking the Use Time-Saving Mode option, confirm on the TrueCopy main window for which volumes the Add Pair operation could not be performed. Deselect the Use Time-Saving Mode option for the failed volumes and retry the Add Pair operation.

Suspending TrueCopy Pairs (Suspend Pair)

The Suspend Pair command suspends TC390 pairs. When the Suspend Pair command is selected, the Suspend Pair window is displayed. Use the Suspend Pair window to select the Suspend Pair options for the
pair(s). You can split a TC390 pair only after the initial copy operation is complete. For more information on split TC390 pairs, see “Suspended Pairs” on page 38.

![Suspend Pair window](image)

**Figure 64** Suspend Pair window (Asynchronous)

- **Volume**: Device ID of M-VOL.
  
  **NOTE:** If # is added to the end of an LDEV number, such as `00:3F#`, the LDEV is an external volume. For more information about external volumes, see *Hitachi HPAV for z/OS User Guide*.

- **SSB [F/M = FB]**: When this option is enabled (and PPRC Support = Yes), the MCU will notify all attached hosts (IEA494I message) that the pair was suspended. This option should always be enabled.
  
  **NOTE:** If PPRC support = No, the x’FB’ sense information will not be reported to the host, even if the SSB (F/M = FB) suspend option is enabled.

- **Suspend Kind**: This option specifies the suspend type of the selected pair(s). The default setting is R-VOL.
  
  - **M-VOL Failure**: This setting can be used only for TC390 Synchronous pairs. The MCU will reject all write I/O operations to the M-VOL while the pair is suspended, regardless of the fence level setting. Use this setting if you need to maintain synchronization of the TC390 pair. This setting is functionally equivalent to CSUSPEND with the optional PRIMARY parameter (without QUIESCE).
• **R-VOL.** The M-VOL will accept all subsequent write I/O operations and the MCU will keep track of updates while the pair is suspended. Use this setting if you need to keep the M-VOL online. This setting is functionally equivalent to CSUSPEND without the optional PRIMARY parameter.

**Asynchronous Parameters:**

- **Suspend Range:** Use this option to select the TC390A suspend group operation. The CSUSPEND TSO command supports the TC390A suspend group operation (see “Using PPRC Commands for TrueCopy” on page 153)
  - **Group.** The MCU/RCU will suspend all other TC390A pairs in the same consistency group as the specified pair(s).
  - **Volume.** The MCU/RCU will suspend only the specified TC390A pair(s) (even if the error level of the pair is group).

**NOTE:** With the setting of Volume for Suspend Range, if there are Duplex status pairs and pairs other than Duplex status in the same consistency group, unexpected suspend may occur during the pair operations (Suspend, Delete, and Resume) under the heavy I/O load conditions. You can estimate whether the I/O load condition is heavy or not from the rate of sidefile cache (around 30%), or from the frequency of the host I/O if you cannot see the rate of sidefile cache. The pair operations should be performed under the light I/O load condition.

- **Pending Update:** This option specifies the TC390A suspend mode. The CSUSPEND TSO command supports the TC390A suspend mode option (“Using PPRC Commands for TrueCopy” on page 153).
  - **Drain.** The RCU will finish settling all pending recordsets for the pair as soon as the RCU accepts the suspend operation. After settling all the recordsets, if there is no recordset for a fixed period of time, the MCU will change the TC390A pair status from suspending to suspended.

**NOTE:** If the RCU is not able to complete these actions within the copy pending timeout setting, the RCU will discontinue the original suspend request and forcibly suspend the affected volume pairs. Thus, you can use the copy pending timeout parameter to limit the amount of time it takes to complete the suspend/drain operation.

- **Purge.** The MCU will change the TC390A pair status from suspending to suspended as soon as the RCU accepts the suspend operation. The MCU and RCU discard any pending recordsets and mark the cylinders that contain discarded recordsets as modified in the M-VOL and R-VOL bitmap, respectively. When the pair is resumed, the M-VOL and R-VOL bitmaps will be merged at the MCU, and all cylinders marked as modified will be copied to the R-VOL.

**NOTE:** If the MCU does not receive acknowledgement of the suspend operation from the RCU within the copy pending timeout setting, the MCU will forcibly suspend all affected pairs and report an IEA491E host console message.

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**To suspend one or more TC390 volume pairs:**

1. Connect to the MCU (or RCU) of the volume pair(s) to be suspended. You do not need to vary the M-VOL(s) offline. If you want to use the R-VOL write enable option, you must connect to the MCU and select the M-VOL of the pair.
2. From the CU Number tree on the TrueCopy main window, select the number of the correct CU image.
3. From the Volume list on the TrueCopy main window, select the TC390 volume pair(s) that you want to suspend. Select either TC390 Synchronous or TC390A pairs, but not both. The pair status must be **Duplex.**
4. Right-click to display the pop-up menu and click **Suspend Pair.** The Suspend Pair window is displayed.
5. From the Suspend Pair window, select the options for the pair(s), and then click **Set** to close the Suspend Pair window and set the parameters. The list changes to the Pair Settings Parameter list (Suspend Pair). You can modify the options as needed (see “Modifying Parameters and Omitting Selected Volumes” on page 117). Verify that the Suspend Pair options for each pair are correct. The suspend kind option
(R-VOL or M-VOL failure) and fence level pair option determine whether the M-VOL will accept write I/O operations after the pair is split.

△ **CAUTION:** If you need to split a pair and the M-VOL is required for system operation, do not use the M-VOL Failure suspend kind option. Make sure to use the R-VOL suspend kind option so that the M-VOL continues accepting I/Os.

6. If you want to execute the Suspend Pair requests quickly, select the Use Time-Saving Mode check box above the Pair Settings Parameter list (Suspend Pair).

7. Click Apply on the TrueCopy main window to split the specified pair(s). For the TC390 Synchronous pairs, the MCU will complete all M-VOL write operations in progress and the associated update copy operations at the R-VOL before splitting the pair so that the pair is synchronized at the time of Suspend Pair.

8. From the TrueCopy main window, verify that the TC390 pair(s) is/are displayed correctly (Suspended status) in the Volume list. The Resume Pair command (see “Resuming TrueCopy Volume Pairs (Resume Pair)” on page 129) resumes suspended TC390 volume pair(s).

△ **CAUTION:** If a timeout error occurs after clicking the Use Time-Saving Mode option, confirm on the TrueCopy main window for which volumes the Suspend Pair operation could not be performed. Deselect the Use Time-Saving Mode option for the failed volume and retry the Suspend Pair operation.

**Resuming TrueCopy Volume Pairs (Resume Pair)**

While a TC390 pair is suspended, the MCU does not perform any update copy operations. For a suspended TC390 Synchronous pair, the MCU may or may not continue accepting write I/Os for the M-VOL depending on the M-VOL fence level and suspend option (if user-requested). If the MCU accepts write I/Os for a suspended M-VOL, the MCU keeps track of the M-VOL cylinders that are updated while the pair is suspended, and then copies the VOLSER and out-of-sync cylinders to the R-VOL when the pair is resumed. For a suspended TC390A pair, the MCU and RCU keep track of any recordsets that were discarded during suspension, and the MCU continues accepting write I/Os for the M-VOL. When a TC390A pair is resumed, the MCU merges the M-VOL and R-VOL cylinder bitmaps and then copies the VOLSER and out-of-sync cylinders to the R-VOL to resynchronize the pair.
The **Resume Pair** command resumes split/suspended TC390 pairs. When the **Resume Pair** command is selected, the Resume Pair window is displayed. Use the Resume Pair window to change the pair options and select the resume range option (asynchronous) for the selected pair(s).

![Resume Pair window](image)

**Figure 65** Resume Pair window

**NOTE:** When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **M-VOL:** Device ID of the M-VOL.

**NOTE:** If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see *Hitachi HPAV for z/OS User Guide*.

- **M-VOL Fence Level:** Select the fence level. **Never:** Never fence the operation. **Data:** Fence when the MCU cannot successfully execute an update copy operation for any reason. **Status:** Fences only if the MCU is not able to change the R-VOL status to the same status as the M-VOL. For synchronous mode only. When the asynchronous pair(s) is being created, **Never** is set automatically.

- **Initial Copy Parameters:**
  - **Initial Copy Pace (3 or 15):** Select the number of the tracks 3 or 15 for resume copy. The default setting is 15.
  - **Priority (From 0 to 256):** Set the priority (0-256) for the resume operation, which determines the order in which the resume operations will be performed.

- **Asynchronous Parameters:**
  - **Resume Range:** When **Group** is selected, resume all split or suspended TC390A pairs in the same group as the selected pair. When **Volume** is selected, resume only the selected TC390A pair(s).
  - **Error Level:** The **Error Level** option specifies the error level for the TC390A pair(s): Group or Volume. This option is available only when **Volume** is selected for the Resume Range.
NOTE: With the setting of Volume for Resume Range, if there are Duplex status pairs and pairs other than Duplex status in the same consistency group, unexpected suspend may occur during the pair operations (Suspend, Delete, and Resume) under the heavy I/O load conditions. You can estimate whether the I/O load condition is heavy or not from the rate of sidefile cache (around 30%), or from the frequency of the host I/O if you cannot see the rate of sidefile cache. The pair operations should be performed under the light I/O load condition.

For more information about the option parameters, see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121.

NOTE: The CEStPAIR (MODE=RESYNC) command can be used to resume suspended TC390 Synchronous and TC390A pairs (see “Using PPRC Commands for TrueCopy” on page 153).

NOTE: If you select a pair from the volume list and change the settings, and if you use a drop-down list to set blank to a parameter, the parameter takes the default value for each pair. If you select the settings from the preset list before applying the changed settings, and if you use a drop-down list to set blank to a parameter in the Resume Pair panel, the parameter value in the preset list will not be changed.

NOTE: If an MCU/RCU is powered off and its backup batteries are fully discharged while TC390 pairs are suspended, the M-VOL/R-VOL cylinder bitmaps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders of all split or suspended TC390 volumes as modified so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed.

To resume one or more split or suspended TC390 volume pairs:

1. If any pair was suspended due to an error condition (use the Pair Status window to view the suspend type), verify that the error condition has been removed (see “General TrueCopy Troubleshooting” on page 147 for troubleshooting instructions). The MCU will not resume the pair(s) until the error condition has been removed.
2. Connect to the MCU of the pair(s) to be resumed and start the TC390 software.
3. From the CU Number tree on the TrueCopy main window, select the number of the correct CU image.
4. If you are resuming split or suspended Volumes, select the pair(s) on the Volume list on the TrueCopy main window. Select Suspended pairs. Select either Sync or Async pairs (not both). If you plan to use the Resume Range option, select only one TC390A pair in the group.
5. Right-click to display the pop-up menu and click Resume Pair. The Resume Pair window is displayed.
6. From the Resume Pair window, select the appropriate pair options, and click Set to close the Resume Pair window and set the parameters. The list changes to the Pair Settings Parameter list (Resume Pair). Verify that all resume options and pair options for each pair are correct.

NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Volumes” on page 117.

If you want to resume all split/suspended TC390A pairs in a consistency group, verify that the Resume Range option on the Resume Pair window is set to Group.

7. If you want to execute the Resume Pair requests quickly, select the Use Time-Saving Mode check box above the Pair Settings Parameter list (Resume Pair).
8. Click Apply on the TrueCopy main window to resume the specified pair(s).
9. From the TrueCopy main window, verify that the TC390 pair(s) is/are displayed correctly (Pending duplex or Duplex status) in the Volume list.
CAUTION: If a timeout error occurs after clicking the Use Time-Saving Mode option, confirm on the TrueCopy main window for which volumes the Resume Pair operation could not be performed. Deselect the Use Time-Saving Mode option for the failed volumes and retry the Resume Pair operation.

Deleting TrueCopy Volume Pairs (Delete Pair)

A TC390 pair should be deleted from the MCU only when it is no longer necessary to maintain a remote copy of the M-VOL. When a TC390 volume pair is deleted from the MCU, the MCU stops all TC390 copy operations for that pair and changes the pair status of the M-VOL and R-VOL to simplex. After a pair is deleted, the MCU continues to accept all subsequent write I/O operations to the M-VOL and will not keep track of the M-VOL updates.

A TC390 pair should be deleted from the RCU only if you need to access the R-VOL, such as to perform ICKDSF on the R-VOL (see “ICKDSF Considerations for TrueCopy Volumes” on page 136) or for disaster recovery (see “TrueCopy Disaster Recovery Operations” on page 140). When a TC390 volume pair is deleted from the RCU, the RCU changes the R-VOL pair status to simplex, but does not change the pair status of the corresponding M-VOL. When the MCU performs the next TC390 operation, the MCU detects that the R-VOL status changed and changes the status of the M-VOL to suspended-delete pair to RCU. When you delete a pair from the RCU to access the R-VOL, remember that the R-VOL and M-VOL have the same VOLSER and take appropriate precautions to prevent a system problem due to duplicate VOLSERs. To restart a pair that was deleted from the RCU, you must first delete the pair from the MCU, and then add the pair from the MCU using the appropriate initial copy option (Entire or No Copy) to restart the pair.

You can delete all TC390 Synchronous pairs between an MCU and RCU (same CU image). You can also delete all TC390A pairs in a consistency group by connecting to the MCU. The TC390A pair status will change to deleting when the delete operation is accepted by the MCU and RCU, and then to simplex after the internal delete pair process is complete. In addition, you can delete TC390A pairs according to their consistency status (for example, for disaster recovery) by connecting to the RCU (the RCU maintains the consistency status).

NOTE: The CDELPAIR TSO command can be used to delete TC390 pairs and TC390A groups of pairs from the MCU (see “Using PPRC Commands for TrueCopy” on page 153).

CAUTION: For information about duplicate VOLSERs, see the caution in “Duplicate VOLSER” on page 47.

As a general rule, when you want to delete a TC390A pair from the MCU, it is strongly recommended that you perform the Delete Pair operation after the update copy operation is completed. If you demand the Delete Pair operation while the update copy process is still in progress, it will take a long time to complete the Delete Pair operation. However, when you urgently need to delete a TC390A pair, you can perform the Delete Pair operation from the RCU. In this case, you will find the suspended status at the MCU after the Delete Pair operation from the RCU.
The **Delete Pair** command deletes one or more TC390 pairs. When the **Delete Pair** command is selected, the Delete Pair window is displayed. Use the Delete Pair window to change the Delete Pair options (by force and TC390A delete range) for the pair(s) selected on the Volume list of the Pair Operations window.

![Delete Pair window](image)

**Figure 66** Delete Pair window (Asynchronous)

**NOTE:** When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

**NOTE:** If you select a pair from the volume list and change the settings, and if you use a drop-down list to set blank to a parameter, the parameter takes the default value for each pair. If you select the settings from the preset list before applying the changed settings, and if you use a drop-down list to set blank to a parameter in the Delete Pair panel, the parameter value in the preset list will not be changed.

- **Volume**: Device ID of the MCU.

**NOTE:** If # is added to the end of an LDEV number, such as **00:3F#**, the LDEV is an external volume. For more information about external volumes, see *Hitachi HPAV for z/OS User Guide*.

- **Deleting Mode**: Select the restriction on deleting a TC390 volume pair.
  - **Normal**: Normal deleting operation is performed.
  - **All**: Deletes all TC390 Synchronous pairs with the same MCU and RCU (same CU image) as the selected pair. This option can be selected from the MCU or RCU, and the **Force** option must also be selected. This option deletes the pairs more quickly than if you select all pairs on the TrueCopy main window and delete them.
  - **Force**: Overrides the restrictions on deleting a TC390 volume pair. If this option is selected, the pair(s) will be deleted even if the MCU is unable to communicate with the RCU. This option may be used to free a host waiting for device-end from an MCU that cannot communicate with its RCU, thus allowing host operations to continue. If this option is not selected, the pair(s) will only be deleted if the MCU is able to change the pair status of the M-VOL and RVOL to *simplex*.

When the status of the pair that is deleted is Simplex or Deleting, the default setting is **Force** (cannot be changed). When the status of the pair is not Simplex or Deleting, the default setting is **Normal**.
• **Asynchronous Parameters, Delete Range**: Select the TC390A delete range option. This option simplifies disaster recovery operations for TC390A consistency groups at the RCU (secondary or remote disk array).

The TC390 delete range options are:

- **Group** (MCU or RCU). When **Group** is selected, the MCU/RCU will delete all TC390A pairs in the same consistency group as the specified pair regardless of pair status and consistency status.

⚠️ **CAUTION**: Do not use this option when deleting pairs at the RCU during disaster recovery. This option is available only when one pair is selected.

- **C/T** (RCU only). When **C/T** is selected, the RCU will delete all TC390A pairs that have the same consistency time.
- **Volume** (MCU or RCU). When **Volume** is selected, the MCU/RCU will delete only the specified TC390A pair(s). This option can be used to remove individual volumes from consistency groups.

⚠️ **NOTE**: With the setting of Volume for Delete Range, if there are Duplex status pairs and pairs other than Duplex status in the same consistency group, unexpected suspend may occur during the pair operations (Suspend, Delete, and Resume) under the heavy I/O load conditions. You can estimate whether the I/O load condition is heavy or not from the rate of sidefile cache (around 30%), or from the frequency of the host I/O if you cannot see the rate of sidefile cache. The pair operations should be performed under the light I/O load condition.

The default settings are as follows:

- More than one pairs are selected: Volume.
- One pair is selected and the pair is M-VOL: Group.
- One pair is selected and the pair is R-VOL: C/T.

⚠️ **NOTE**: When an asynchronous pair is forcibly deleted, the TC390 delete range option must be Group. Therefore, more than one pair cannot be forcibly deleted.

To delete one or more TC390 volume pairs:

1. If you need to delete the volume pair(s) from the RCU to access the R-VOL(s) (for example, to perform ICKDSF), connect to the MCU(s) and suspend the volume pair(s) first (see “Suspending TrueCopy Pairs (Suspend Pair)” on page 126 for instructions).

2. Connect to the MCU or RCU of the pair(s) to be deleted and start the TC390 software. If you plan to use the TC390A C/T delete range option, you must connect to the RCU.

3. From the CU Number tree on the TrueCopy main window, select the CU number of the correct CU image.

4. From the Volume list on the TrueCopy main window, select the TC390 volume pair(s) that you want to delete. Select either TC390 Sync or Async pairs, but not both. If you plan to use the TC390A C/T or Group delete range option, select only one TC390A pair in the group.

5. Right-click to display the pop-up menu and click **Delete Pair**. The Delete Pair window is displayed.

6. From the Delete Pair window, select the Delete Pair options for the selected pair(s), and click **Set** to close the Delete Pair window and set the parameters. The list changes to the Pair Settings Parameter list (Delete Pair). Repeat this step as needed to set Delete Pair options for the pair(s).

⚠️ **NOTE**: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Volumes” on page 117.

7. If you want to execute the Delete Pair requests quickly, select the **Use Time-Saving Mode** check box above the Pair Settings Parameter list (Delete Pair).
8. Click **Apply** on the TrueCopy main window to delete the specified pair(s).

9. When deleting TC390A pairs, verify that the Delete Pair request was completed successfully by checking the detailed TC390 pair status information on the Pair Status window (should be **Simplex**, not **Deleting** or **Suspended**).

When deleting TC390 Sync pairs, verify that the Delete Pair request was completed successfully by checking the pair status on the **Pair Operations** tab (**Simplex** status).

10. To restart a pair that was deleted from the RCU, first delete the pair from the MCU, and then use the **Add Pair** command with the appropriate TC390 initial copy option (**Entire** or **No Copy**) to restart the pair.

**NOTE:** If a timeout error occurs after clicking the **Use Time-Saving Mode** option, confirm on the TrueCopy main window for which volumes the Delete Pair operation could not be performed. Deselect the **Use Time-Saving Mode** option for the failed volumes and retry the Delete Pair operation.

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### Changing the Pair Options (Change Pair Option)

The **Change Pair Option** command changes the pair options, **Fence level**, **CFW Data**, and **Error level** (asynchronous pairs only). When the **Change Pair Option** command is selected, the Change Pair Option window is displayed. From the Change Pair Option window, the pair options can be changed.

![Change Pair Option window](image)

**NOTE:** When you set the several pairs at once and you want to keep some of the individual settings, leave the parameter box blank. Then, only the parameters you enter are available.

- **Volume**: The CU number and the device ID.
NOTE: If # is added to the end of a device ID, such as 00:3F#, the LDEV is an external volume. For more information about external volumes, see Hitachi HPAV for z/OS User Guide for the XP1024/XP128/XP12000/XP10000.

- **M-VOL Fence Level (Synchronous only):** Select the fence level for the new pair(s). The fence level determines the conditions under which the MCU rejects write operations to the M-VOL. Never is automatically set for an asynchronous pair. See “Performing TrueCopy Pair Operations” on page 115 for more information about this pair option.
  - **Never:** M-VOL is never fenced.
  - **Data:** M-VOL is fenced when the MCU cannot successfully execute an update copy operation for any reason.
  - **Status:** M-VOL is fenced only if the MCU cannot change the R-VOL status to suspended when an update copy operation fails.
- **CFW Data:** Specifies whether the CFW data is copied to the R-VOL. For TCPD-MF, only Copy to R-VOL is available.
- **Asynchronous Parameters (Async only):**
  - **Error Level:** Error level for the new pair(s): Group, or Volume.

NOTE: To set the parameters on multiple volumes at once without changing individual parameters per volume, make the box for the parameters you do not want to change blank. Only parameters you input are changed.

- **Cancel:** Cancels settings you made and closes the Change Pair Option panel.
- **Set:** Sets parameters and closes the Change Pair Option panel.

To change the pair options for one or more TC390 volume pairs:
1. Connect to the MCU of the pair(s) to be changed the options and start the TC390 software.
2. From the CU Number tree on the TrueCopy main window, select the CU number of the correct CU image.
3. From the Volume list on the TrueCopy main window, select the TC390 volume pair(s) that you want to modify the options. Select either TC390 Sync or Async pairs, but not both.
4. Right-click to display the pop-up menu and click Change Pair Option. The Change Pair Option window is displayed.
5. From the Change Pair Option window, select the pair options for the selected pair(s), and click Set to close the Change Pair Option window and set the parameters. The list changes to the Pair Settings Parameter list (Change Pair Option). Repeat this step as needed to change the pair options for the pair(s).

NOTE: The options can be modified and/or canceled after you have set them. See “Modifying Parameters and Omitting Selected Volumes” on page 117.

6. If you want to execute the pair option change requests quickly, select the Use Time-Saving Model check box above the Pair Settings Parameter list (Change Pair Option).
7. Click Apply on the TrueCopy main window to change the options for the specified pair(s).
8. From the TrueCopy main window, verify that the pair option change was completed successfully.

**ICKDSF Considerations for TrueCopy Volumes**

The XP1024/XP128/XP12000/XP10000 supports the use of the ICKDSF utility program. ICKDSF performs functions for the installation, use, and maintenance of DASD as well as service functions, error detection, and media maintenance.
ICKDSF on a TrueCopy M-VOL

ICKDSF activities involve write I/O operations with device support authorization instead of normal authorization. Because the MCU does not duplicate write I/O operations with device support authorization at the R-VOL of a TC390 volume pair, you must suspend a TC390 pair before running ICKDSF on a TC390 M-VOL.

To perform ICKDSF on a TC390 M-VOL:
1. Connect to the MCU of the volume pair, and then start the TC390 software.
2. Suspend the volume pair, if not already suspended, using the R-VOL suspend option and the TC390A Volume and Purge suspend options (see “Suspending TrueCopy Pairs (Suspend Pair)” on page 126). You can also use the CSUSPEND TSO command to suspend the pair.
3. After the M-VOL status changes to suspended/R-VOL by operator, run ICKDSF to repair the M-VOL.
4. When volume repairs are complete, resume the TC390 pair. When resuming a suspended TC390A pair, make sure to use the appropriate Resume level pair option (see “Resuming TrueCopy Volume Pairs (Resume Pair)” on page 129). You can also use the CESTPAIR (MODE=RESYNC) command to resume the pair.

ICKDSF on a TrueCopy R-VOL

If you need to run ICKDSF on a TC390 R-VOL, you must change the status of the R-VOL to simplex to allow write access to the R-VOL. The TC390 pair must then be restarted using the appropriate initial copy options.

To perform ICKDSF on a TC390 R-VOL:
1. For TC390 Synchronous pairs, you can stop write I/Os to the M-VOL while the R-VOL is being repaired. To do this, suspend the pair from the MCU using the M-VOL Failure suspend option (see “Suspending TrueCopy Pairs (Suspend Pair)” on page 126) (or use CSUSPEND to suspend the pair).
2. Connect to the disk array containing the R-VOL, and then start the TC390 software.
3. On the TrueCopy main window, locate and select the R-VOL to be repaired, and then delete the pair. For a TC390A R-VOL, make sure to use the Volume delete option (see “Deleting TrueCopy Volume Pairs (Delete Pair)” on page 132). You can also use CRECOVER to delete the pair at the RCU.
4. If necessary, change the R-VOL VOLSER to avoid problems due to duplicate VOLSERs.
5. Vary the R-VOL online and run ICKDSF to repair the R-VOL. When the volume repairs are complete, vary the R-VOL offline.
6. Connect to the MCU, locate and select the M-VOL, note the group number, and delete the pair. For a TC390A M-VOL, make sure to use the Volume delete option.
7. Restart the pair using the Add Pair window (or CESTPAIR). Use the Entire initial copy option to resynchronize the M-VOL and R-VOL.

**NOTE:** If you are absolutely sure that the M-VOL and R-VOL are still identical, you can restart the pair using the No Copy option.

Using TrueCopy for Data Migration and Duplication

**Data Migration Using TrueCopy Synchronous**

TC390 Synchronous can be used for device or workload migration with minimal impact to host applications. You may need to migrate data from one volume to another for any of the following reasons:

- To load data onto new or scratch volumes, such as for a new or upgraded disk arrays.
- To temporarily move data off a volume to accommodate other activities, such as repairing.
- To relocate volumes to balance workloads and distribute I/O activity evenly within and across disk arrays for the purpose of improving disk array and system performance.
NOTE: TC390 operations within one XP1024/XP128/XP12000/XP10000 can be performed only if the SI390 option is not active on the disk array.

The TC390 initial copy operation copies the entire contents of the M-VOL to the R-VOL. The data migration is complete when the initial copy operation completes and the pair status changes from pending duplex to duplex. The P/DAS host software function is used with TC390 Synchronous to complete the data migration nondisruptively.

NOTE: If you are migrating data between disk arrays using P/DAS, both disk arrays must be the same type (XP1024/XP128/XP12000/XP10000 or other XP disk arrays). If you need to migrate data from other vendors’ storage disk arrays onto the XP1024/XP128/XP12000/XP10000, contact your HP account support representative.

To use TC390 Synchronous to migrate data from one volume to another:

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

2. Connect to the disk array containing the volume(s) to be migrated, and then start the TC390 software. If not already done, install the remote copy connections and configure the ports (RCPs for serial, initiator ports for fibre) (if migrating between disk arrays), and then add the RCUs.

3. On the TrueCopy main window, select the correct CU image and the appropriate volume(s), and then start the TC390 Synchronous pair(s) using the Add Pair window (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121).

4. Monitor the progress of the initial copy operation(s) and the status of the pair(s) on the Pair Status window (see “Viewing the Status of TrueCopy Volume Pairs (Pair Status)” on page 118). Refresh the window as needed. When the status has changed from pending duplex to duplex, the M-VOL and R-VOL are identical and synchronized.

5. Use the IBM P/DAS host software function (see “P/DAS Support” on page 42) to redirect all application I/Os to the R-VOL(s) nondisruptively. If the host system does not support P/DAS, use the following procedure to stop using the M-VOL(s) and switch to the R-VOL(s):
   a. Disable all applications using the M-VOL(s).
   b. When all update activity to the M-VOL(s) has stopped, connect to the MCU, select the correct CU image, and delete the TC390 volume pair(s) (see “Deleting TrueCopy Volume Pairs (Delete Pair)” on page 132).
      If the M-VOL(s) and R-VOL(s) are attached to the same host, vary the M-VOL(s) offline first, and then vary the R-VOL(s) online. The M-VOL(s) and R-VOL(s) have the same VOLSERs and cannot be online to the same host(s) at the same time.
   c. If an R-VOL contains more cylinders than its M-VOL, update the R-VOL volume table of contents (VTOC) using ICKDSF/REFORMAT.
   d. If you want to keep the volumes synchronized, establish the same TC390 pair(s) in the reverse direction using the No Copy initial copy option (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121). If the original M-VOL(s) will be temporarily unavailable for update copy operations, you can suspend the new pair(s) so that the new MCU keeps track of changes.
   e. Start the applications with the R-VOL(s). When the original M-VOL(s) are available, you can resume the pair(s) using the Resume Pair window (see “Resuming TrueCopy Volume Pairs (Resume Pair)” on page 129).

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

You can use TC390 to make Point-in-Time (PiT) duplicates of groups of volumes. The TC390A Group and Drain suspend options can be used together to create a PiT copy, relative to an application, of an entire TC390A consistency group of volumes.
To produce a PiT duplicate of an existing TC390A consistency group:

1. Disable the applications accessing the TC390A M-VOLs to stop all update activity to all M-VOLs in the group.
2. After all M-VOL updates have completed, suspend the TC390A group using the Group and Drain suspend options. If you are suspending the group at the main site, issue the suspend/group command to one M-VOL in the MCU. If you are suspending the group at the remote site, issue the suspend/group command to one R-VOL in the RCU.

**NOTE:** The copy pending timeout setting for the group determines the maximum amount of time that the suspend/drain operation can take.

3. When the status for all TC390A pairs in the group has changed to suspended, the duplicate set of volumes is complete. If needed, you can restart the application at the main site.

### Powering Off/On TrueCopy Components

The user is responsible for controlling power-off activities for disk arrays involved in TC390 operations. If you need to power off the XP1024/XP128/XP12000/XP10000, call your HP representative or HP technical support for assistance. This section provides instructions for performing planned outages of TC390 components.

If power is removed from an MCU while TC390 operations are in progress, the TC390 pairs are not affected, but the update sequence consistency of the TC390A groups at the RCU may be affected. For more information, see “Planned Outage of the MCU” on page 139. When power is restored to an MCU, the MCU communicates with its RCU(s) to confirm the pair status of the R-VOLs. Verify that TC390 communications are fully restored (all RCU paths have normal status) before beginning I/O operations to the M-VOLs. If the MCU accepts a write I/O operation for an M-VOL before this confirmation is complete, the MCU will suspend the pair and change the status of the M-VOL to suspended-by RCU (the MCU will not be able to change the pair status of the R-VOL).

If power is removed from an RCU or remote copy connection while TC390 operations are in progress, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs and console messages reporting the failures. The MCU will change the status of the M-VOLs to suspended-by RCU, but will not be able to change the status of the R-VOLs.

**NOTE:** If an MCU/RCU is powered off and its backup batteries are fully discharged while TC390 pairs are suspended, the M-VOL/R-VOL cylinder maps will not be retained. In this unlikely case, the MCU/RCU will mark all cylinders of all suspended TC390 volumes as modified so that the MCU will perform the equivalent of an entire initial copy operation when the pairs are resumed. (The R-VOL cylinder map is used only for TC390A operations.)

### Planned Outage of the MCU

A planned MCU outage does not affect TC390 Synchronous pairs. For TC390A operations, the MCU must communicate with the RCU even when there are no M-VOL update I/Os from the primary system. During the power-off sequence, the MCU will automatically suspend all TC390A pairs in the duplex and duplex pending state (suspend type = MCU P/S-OFF). During power-on-reset sequence, the MCU will automatically resume these suspended pairs (pairs with other suspend types are not automatically resumed).

If a TC390A group contains M-VOLs in the MCU being powered off and in other MCU(s) that is/are not being powered off, the pairs behind the other MCU(s) will not be suspended and will continue to be updated.

To maintain a fully consistent group at the RCU during the planned MCU outage:

1. Disable the applications using all M-VOLs in the consistency group.
2. Suspend the group at the RCU using the Group suspend option. You can use the Purge or Drain suspend option because the M-VOL updates have stopped.
3. Perform the planned outage of the TC390 MCU.
4. When the MCU is fully powered on and ready to resume operations, resume the TC390A pairs at all MCUs that were powered off (use the resume group option).

Planned Outage of the RCU or Remote Copy Connection

You must suspend all affected TC390 pairs prior to a planned outage of an RCU or of a remote copy connection component (for example, switch, or extender). If you do not suspend the pairs first, the MCU(s) will detect the communication failure, suspend all affected pairs, and generate SIMs and console messages reporting the failures.

To perform a planned outage of a TC390 RCU or remote copy connection component:

1. Identify all TC390 M-VOLs that will be affected by the equipment outage. You need to know the MCU, CU image, and LDEV ID for each of these M-VOLs.
   - For RCU power-off, identify all M-VOLs that are paired with R-VOLs in the RCU to be powered off.
   - For remote copy connection outage, identify all M-VOLs in all MCUs that use the path/component to be powered off.
2. Connect to each MCU that contains affected M-VOLs and suspend all affected TC390 pairs. Make sure to confirm the pair status changes (TC390 Pair Status window or CQUERY TSO command).
3. Perform the planned outage of the RCU or remote copy connection.
4. When the RCU is fully powered on and ready to resume operations, resume all TC390 pairs at each MCU. Make sure to confirm the pair status changes.

Planned Outage of the MCU and RCU

When you plan an outage of TC390 MCUs and RCUs at the same time, the MCUs must be powered off before the RCUs and powered on after the RCUs.

To perform a planned outage of a TC390 MCU and RCU:

1. If RCU power-on will be difficult to control (for example, Power-Control-Interface setting), consider increasing or disabling the RCU ready timeout group option (see “Group Options” on page 34) for each TC390A group with R-VOLs in the RCU(s) to be powered off.
2. Perform the planned outage of the MCU(s) as described in “Planned Outage of the MCU” on page 139. Do not power-on the MCU(s) yet.
3. If an RCU to be powered off is connected to an MCU that is not powered off, make sure to suspend those TC390 pairs before powering off the RCU as described in “Planned Outage of the RCU or Remote Copy Connection” on page 140.
4. Perform the planned outage of the RCU(s).
5. Power on the RCU(s). Verify that they are fully operational and ready to resume operations before powering on the MCUs.
6. Power on the MCU(s) and verify that they are ready to resume operations. If you suspended any pairs in step 3, you can also resume those pairs now.

TrueCopy Disaster Recovery Operations

Preparing for Disaster Recovery

The type of disaster and the status of the TC390 volume pairs will determine the best approach for disaster recovery. For example, if all TC390 volume pairs are in the duplex state when a total system failure occurs at a single point in time, the R-VOLs are current and recovery is straightforward. Unfortunately, some disasters are not so “orderly” and involve intermittent or gradual failures occurring over a longer period of time. The user should anticipate and plan for all types of failures and disasters.

The major steps in preparing for disaster recovery are:

1. Identify the volumes and volume groups that contain important files and data for disaster recovery, such as DB2 log files, master catalog, key user catalogs, and system control data sets. In addition to supporting TC390 remote copy operations as well as PPRC commands, the XP1024/XP128/XP12000/XP10000 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 Command View XP or XP Remote Web Console and TC390 hardware and software, and establish TC390 operations for the volumes and groups identified in step 1. Make sure to select the correct CU images to access the appropriate volumes.

3. Use the appropriate combination of TC390 options for disaster recovery:
   • RCU options: Incident of RCU, PPRC Support, Service SIM of Remote Copy, and FREEZE Option (see “Registering an RCU (Add RCU)” on page 87).
   • TC390A offloading timer asynchronous option (see “Asynchronous Copy Option” on page 108) and TC390A copy pending timeout group option (see “Adding Consistency Groups (Add CT Group)” on page 105). The copy pending timeout group option can be used to limit the time duration during which updates may be lost.
   • TC390A Error Level pair option and M-VOL Fence Level pair option for TC390 Synchronous pairs (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121).

4. Establish file and database recovery procedures. These procedures should already be established for recovering volumes that are inaccessible due to control unit failure.

5. Install and configure error reporting communications (ERC) between the main and remote sites. ERC is essential if you use the M-VOL fence level setting of R-VOL Status or Never for any TC390 volume pairs.

6. Configure the primary host system to use the IEA494I message as a trigger for automation rather than the IEA491E message. The IEA491E message is reported to only one host, whereas the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes. For more information on the IEA494I and IEA491E system console messages, see “IEA494I and IEA491E Console Messages” on page 175.

Considering the M-VOL Fence Level Setting

The M-VOL fence level setting (see “Creating TrueCopy Volume Pairs (Add Pair)” on page 121) for each TC390 Synchronous volume pair determines whether the M-VOL will be fenced when TC390 remote copy operations fail. The following table summarizes the effect of the fence level setting on a TC390 Synchronous M-VOL.

\[\textbf{NOTE: }\] The M-VOL fence level setting does not apply to TC390A pairs. The TC390A M-VOL is never fenced due to suspension of the pair.

<table>
<thead>
<tr>
<th>Table 25 Fence level setting on a TrueCopy M-VOL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Failure</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>The update copy operation failed and the MCU was able to change the status of the R-VOL to suspended.</td>
</tr>
<tr>
<td>The update copy operation failed and the MCU was NOT able to change the status of the R-VOL to suspended.</td>
</tr>
</tbody>
</table>

R-VOL Data (CRIT=Y(ALL)). When this fence level setting is selected, the M-VOL will be fenced if an update copy operation fails. This M-VOL fence level setting ensures that the R-VOL remains identical to the M-VOL after the TC390 volume pair is synchronized, but makes the M-VOL inaccessible to applications for updates whenever TC390 remote copy operations fail. This setting should be considered for the most critical volumes for disaster recovery. This setting will reduce the amount of time required to analyze the
currency of the R-VOL during disaster recovery efforts. This setting is also designed for applications that can continue to operate with another device pair (for example, IMS logger dual write log files).

**R-VOL Status (CRIT=Y(PATHS)).** When this fence level is selected, the M-VOL is fenced only if the MCU is not able to change the R-VOL pair status to suspended. If the MCU successfully changes the R-VOL pair status to suspended, subsequent write I/O operations to the M-VOL will be accepted and the MCU will keep track of updates to the M-VOL. This allows the volume pair to be resumed quickly using the resync (out-of-sync-cylinders) copy operation (MODE=RESYNC). This setting will also reduce the amount of time required to analyze the R-VOL currency during disaster recovery.

**Never (CRIT=NO).** When this fence level is selected, the M-VOL is never fenced when the pair is suspended. This M-VOL fence level setting ensures that the M-VOL remains available to applications for updates, even if all TC390 copy operations have failed. The R-VOL may no longer be in sync with the M-VOL, but the MCU will keep track of updates to the M-VOL while the pair is suspended. ERC is essential if this fence level setting is used. For disaster recovery, the currency of the R-VOL is determined by using the sense information transferred through ERC or by comparing the R-VOL contents with other files confirmed to be current.

**NOTE:** To exchange CRIT=Y(ALL) and CRIT=Y(PATHS), XP1024/XP128/XP12000/XP10000 mode 36 can be used. For more information on the XP1024/XP128/XP12000/XP10000 modes, see Table 4 on page 20.

### Transferring Sense Information Between Sites

When the MCU (or RCU for TC390A) suspends a TC390 pair due to an error condition, the MCU/RCU sends sense information with unit check status to the appropriate host(s). This sense information is used during disaster recovery to determine the currency of the R-VOL. If the host system does not support IBM PPRC, you must transfer the sense information to the remote site through the error reporting communications (ERC). If the host system supports IBM PPRC and receives PPRC-compatible sense information related to a TC390 pair, the host operating system will:

1. Temporarily suspend all application I/O operations to the M-VOL.
2. Enter an IEA491E message in the system log (SYSLOG) that indicates the time that the M-VOL was suspended. Verify that the system log is common to both the main and remote operating systems.
3. Place specific information about the failure (SIM) in the SYS1.LOGREC dataset for use by service personnel. For more information on the TC390 SIMs, see “SIM Reporting” on page 183.
4. Wait for the IEA491E message to reach the remote system.
5. Resume all host application I/O operations to the M-VOL. If the M-VOL fence level setting does not allow subsequent updates, the MCU will return a unit check for all subsequent write I/O operations and the application will terminate.

**NOTE:** Verify that the MCUs and RCUs are configured to report the service-level SIMs to the host. Select the Service SIM of Remote Copy = Report setting on the RCU Option window.

### File and Database Recovery Procedures

When a TC390 Synchronous pair is suspended or when the MCU fails due to a disaster, the R-VOL may contain in-process data. A data set could be open or transactions may not have completed. Even if you use the R-VOL Data fence level for all TC390 Synchronous pairs, you need to establish file recovery procedures. These procedures should be the same as those used for recovering any volume that is inaccessible due to control unit failure. These procedures are more important if the R-VOL Status or Never fence level settings are used.

TC390A does not provide any procedure for detecting and retrieving lost updates. To detect and recreate lost updates, you must check other current information, such as a database journal log file that was active at the primary system when the disaster occurred. Note that the journal log file entries of most DBMS have the same system TOD clock information that is used for the I/O time-stamps (when timer type = system). The TC390A group consistency time can be extremely useful when performing this detection and retrieval.
Because this detection/retrieval process can take a while, your disaster recovery scenario should be designed so that detection and retrieval of lost updates is performed after the application has been started at the secondary system.

You should prepare for file and database recovery by using:

- Files for file recovery (for example, DB2 log files that have been verified as current). To ensure the currency of these files, use the \texttt{R-VOL Data} fence level setting for the TC390 pairs that contain these important files.
- The sense information with system time stamp that will be transferred through ERC.

Remote copy and disaster recovery procedures are inherently complex. Consult your HP account team on sense-level settings and recovery procedures.

For information on recovering a pinned track on a TC390 volume, see “Pinned Track Recovery for TrueCopy Volumes” on page 183.

\section*{CSUSPEND/QUIESCE TSO Command}

\textbf{CAUTION:} The QUIESCE option of the CSUSPEND command has been disabled by APAR OW15247 or APAR OW15248. For detailed information on the QUIESCE option of the CSUSPEND command, refer to either of these APARs. Check with your HP account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on an XP1024/XP128/XP12000/XP10000 (or other XP disk array). If the CSUSPEND command with the QUIESCE option is issued to certain volumes (for example, active SPOOL, PAGE, or CATALOG datasets, or active SYSRES volume), the attached host(s) may enter a deadlock condition and may require a storage control IML to correct the condition. TC390A does not support the CSUSPEND/QUIESCE option.

\textbf{NOTE:} If you select a pair from the volume list and change the settings, and if you use a drop-down list to set blank to a parameter, the parameter takes the default value for each pair. If you select the settings from the preset list before applying the changed settings, and if you use a drop-down list to set blank to a parameter in the Suspend Pair panel, the parameter value in the preset list will not be changed.

\section*{IEA494I System Console Message}

The IEA494I message is recommended as a trigger for automation over the IEA491E message because the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes, whereas the IEA491E message is reported to only one host system. For more information on the IEA494I and IEA491E messages, see “IEA494I and IEA491E Console Messages” on page 175.

\section*{Switching Operations to the Remote Site}

If a disaster or failure occurs at the main site, the first disaster recovery activity is to switch your operations to the remote backup site. The TC390 Synchronous R-VOLs are recovered individually based on the pair status and M-VOL fence level information for each pair. The TC390A R-VOLs are recovered based on pair status, consistency status, and consistency time.

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

1. Analyze the currency of the TC390 Synchronous R-VOLs (see “Analyzing the Currency of TrueCopy Synchronous R-VOLs” on page 144) and the consistency of the TC390A R-VOLs (see “Analyzing the Consistency of TrueCopy Asynchronous R-VOLs” on page 145).
2. Record the consistency time (C/T) of each group. The suspended TC390A R-VOLs with consistency status of group will indicate the same C/T.
3. Perform file recovery as needed (see “File and Database Recovery Procedures” on page 142). The C/T of each TC390A group can be used to retrieve lost updates.
4. At the remote site, suspend all pairs by issuing the CSUSPEND TSO command to the R-VOLs. Use the TCzA group and drain suspend options to destage pending updates in cache to the R-VOLs. And then, change the state of R-VOLs to \textit{simplex} by issuing the CRECOVER TSO command.
NOTE: If PPRC is not installed, connect to each RCU and delete all TC390 pairs. For TC390A pairs, use the C/T delete option to delete all consistent pairs in the group at the same time. This option prevents you from accidentally using inconsistent pairs for disaster recovery. Delete all TC390 sync pairs in the MCU using the Delete by Force and Delete All Pairs options.

△ CAUTION: After an RVOL changes to the simplex state, you cannot distinguish it from a non-TC390 simplex volume. The TC390A C/T is also discarded when the pair is deleted.

5. If necessary, use ICKDSF REFORMAT to change the labels (VOLSERs) of the RVOLs.
6. Verify that all required file recovery procedures have been completed before varying the RVOLs online. If an IPL of the remote host system is not required, bring the RVOLs online. If an IPL is required:
   a. Clear the remote copy SIMs from the RCUs before OS IPL. Connect to each RCU and click Clear SIM in the Other Operations window (see “Other Operations” on page 113). Please note that only an HP CE or ASE should remove SIMs.
   b. Perform IPL of the remote host system.
   c. Wait until the IPL is complete, and then vary the RVOLs online (if they did not come online automatically).
7. At this point you may start critical applications at the remote site with the previous RVOLs taking the place of their M-VOLs.

Analyzing the Currency of TrueCopy Synchronous RVOLs

The following table shows how to determine the currency of a TC390 Synchronous RVOL based on its pair status and M-VOL fence level setting. For TC390 Synchronous pairs with an M-VOL fence level setting of Never, further analysis will be required to determine the currency of these RVOLs. The currency of these RVOLs can be determined by using the sense information transferred through ERC or by comparing the contents of the RVOL with other files that are confirmed to be current (for example, DB2 log files). These RVOLs should be recovered using the files that are confirmed to be current.

<table>
<thead>
<tr>
<th>Status of R-VOL</th>
<th>Fence Level</th>
<th>Currency of R-VOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplex</td>
<td>Data Status</td>
<td>Inconsistent. This RVOL does not belong to a TC390 volume pair. Even if you established a TC390 pair for this volume, you must regard this volume as inconsistent.</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Pending Duplex</td>
<td>Data Status</td>
<td>Inconsistent. This RVOL is not synchronized because not all cylinders have been copied from the M-VOL yet. This RVOL must be initialized (or copied from the M-VOL at a later time).</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Duplex</td>
<td>Data Status</td>
<td>Current. This RVOL is synchronized with its M-VOL.</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>Needs to be analyzed. This RVOL requires further analysis to determine its level of currency.</td>
</tr>
<tr>
<td>Suspended - initial copy failed</td>
<td>Data Status</td>
<td>Inconsistent. This RVOL is not synchronized because not all cylinders have been copied from the M-VOL yet. This RVOL must be initialized (or copied from the M-VOL at a later time).</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Suspended - RVOL by operator</td>
<td>Data Status</td>
<td>Suspect. This RVOL is not synchronized with its M-VOL if any write I/Os were issued to the M-VOL after the pair was suspended. This pair should be restarted using the Entire initial copy option, but the No Copy option can be used if you are sure no data on the M-VOL changed.</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td></td>
</tr>
</tbody>
</table>
Analyzing the Consistency of TrueCopy Asynchronous R-VOLs

The following table shows how to determine the consistency of a TC390A R-VOL based on its pair status and consistency status. For TC390A R-VOLs with a consistency status of **Volume**, the volume is not consistent with other volumes in the same group and further analysis will be required to determine the currency of each of these R-VOLs. To determine the currency of these R-VOLs, use the sense information transferred through ERC or compare the contents of the R-VOL with other files that are confirmed to be current, such as DB2 log files. These R-VOLs should be recovered using the files that are confirmed to be current.

<table>
<thead>
<tr>
<th>Status of R-VOL</th>
<th>Fence Level</th>
<th>Currency of R-VOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended - all other types</td>
<td>Data</td>
<td><strong>Current.</strong> This R-VOL is synchronized with its M-VOL</td>
</tr>
<tr>
<td></td>
<td>Status</td>
<td><strong>Suspect.</strong> This R-VOL is not synchronized with its M-VOL if any write I/Os were issued to the M-VOL after the pair was suspended. Restore the consistency of this R-VOL and update it, if required. The system time stamp information transferred through ERC or the time of suspension indicated on the Pair Status window will help to determine the last time this R-VOL was updated.</td>
</tr>
</tbody>
</table>

### Table 27 Analyzing the consistency of TrueCopy Asynchronous R-VOLs

<table>
<thead>
<tr>
<th>Status of R-VOL</th>
<th>Usable for Recovery?</th>
<th>Description</th>
</tr>
</thead>
</table>
| Duplex                | No                   | These states do not usually occur during TC390A disaster recovery because the RCU suspends all TC390A pairs when communication with the MCU is lost. TC390A R-VOLs in these states should not be used for disaster recovery.
| Pending Duplex        | No                   | Simplex volumes cannot be distinguished from R-VOLs that have already been deleted by the Delete Pair operation. |
| Simplex               | No                   |                                                                 |
| Suspended-Group       | Yes                  | The update sequence consistency across these R-VOLs is ensured at the point in time indicated by the group consistency time. These R-VOLs can be used for disaster recovery at the secondary system.
|                       |                      | Updates that were performed at the primary system after the indicated consistency time were probably lost. |
| Suspended-Volume      | No                   | The contents of this R-VOL may be behind the other R-VOLs in the consistency group. If this volume must be consistent with the other volumes in the same group, this R-VOL should not be used for disaster recovery.
|                       |                      | The cause for this status is:
|                       |                      | The TC390A **Error Level** pair option for this pair is **Volume** (not **Group**).
|                       |                      | Also, this pair was suspended before the disaster/failure, at the beginning of the rolling disaster, or during the initial copy operation. |

### Transferring Operations Back to the Main Site

After the applications are running at the remote site, the next activity is to restore the main site and transfer operations back to the main site.

**NOTE:** For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.
To transfer operations to the main site:

1. Bring up the host system at the main (primary) site and ensure that all TC390 components are fully operational.

2. At the main site, delete all TC390 pairs at the MCUs. The **Delete Pair by Force** option must be used because the previous R-VOLs are now in the **simplex** state at the remote site. Use the **Delete All Pairs** option to delete all TC390 sync pairs in each CU image. Use the **Delete-Group** option to delete all TC390A pairs in each group. Make sure to connect with all MCUs and all CU images to delete all TC390 pairs.

3. At the main site, delete all TC390A consistency groups at the MCUs.

4. At the main site, delete the RCUs. Remember to connect with each MCU and each CU image to verify 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 RCPs to LCPs and change the existing initiator ports to RCU target ports. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the CESTPATH command to add the pairs at the secondary site.

6. If you plan to use the same channel extenders, change the operating mode to the opposite direction. The boxes/nodes connected to the MCUs must be set to channel-mode and the boxes/nodes connected to the RCUs must be set to device-mode.

7. At the remote site, configure the RCU ports to enable TC390 operations in the reverse direction (change LCPs to RCPs for serial, change RCU target ports to initiator ports for fibre). This enables the original RCUs to send TC390 remote copy operations to the original MCUs to bring the original M-VOLs up to date. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the remote site.

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

8. At the remote site, establish the same TC390A groups and TC390 pairs in the reverse direction to synchronize the original M-VOLs with the R-VOLs. Make sure to use the **Entire** TC390 initial copy option. The following table shows the correct timer types for performing TC390A operations in the reverse direction.

### Table 28  Selecting the correct timer type for TrueCopy Async disaster recovery

<table>
<thead>
<tr>
<th>Original Configuration</th>
<th>Timer Type</th>
<th>I/O Time-Stamp Function at Secondary System?</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU-RCU Configuration</td>
<td>Timer Type</td>
<td>I/O Time-Stamp Function at Secondary System?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>n-to-1 (n&gt;1)</td>
<td>System</td>
<td>None</td>
</tr>
<tr>
<td>1-to-1</td>
<td>System</td>
<td>System</td>
</tr>
<tr>
<td></td>
<td>Local</td>
<td>Local</td>
</tr>
</tbody>
</table>

### Resuming Normal Operations at the Main Site

After the TC390 pairs have been established in the reverse direction, you are ready to resume normal operations at the main site. Remember that the TC390 terminology is now reversed: the original RCUs and R-VOLs (remote site) are now the MCUs and M-VOLs, and the original MCUs and M-VOLs (main site) are now the RCUs and R-VOLs.

To resume normal operations at the main site:

1. At the remote site, verify that all TC390 pairs are in the **duplex** state. This indicates that the TC390 initial copy operations are complete.
2. Halt the applications at the remote site and vary the M-VOLs (original R-VOLs) offline at the remote site. This maintains synchronization of the TC390 Synchronous pairs.

3. At the remote site, suspend all TC390 pairs at the MCUs (original RCUs) to destage any pending data from cache. Confirm that the pairs are suspended before proceeding. If an error occurs, resolve it before proceeding.

4. At the remote site, delete all TC390 pairs at the MCUs (original RCUs) using the **Delete All Pairs** option for TC390 sync pairs and the **Delete-Group** option for TC390A pairs. For TC390A pairs, the MCU and RCU complete all pending updates before changing the pair status to simplex.

5. At the remote site, change the TC390 settings at the MCUs (original RCUs) to prepare for normal TC390 operations. Delete the TC390A groups and the RCUs (original MCUs). If you plan to use the same remote copy connections, reconfigure the ports (change RCPs back to LCPs for serial, change initiator ports back to ordinary target ports for fibre). If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the main site.

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

6. If you plan to use the same channel extenders, change the operating mode back to the original direction. The boxes/nodes connected to the MCUs must be set to channel-mode and the boxes/nodes connected to the RCUs must be set to device-mode.

7. At the main site, configure the RCPs or initiator ports, add the RCUs, and add the TC390A groups. If SVP mode 114 is enabled on all MCUs and RCUs, the ports will reconfigure automatically if you use the TSO CESTPATH command to add the pairs at the main site.

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

8. At the main site, establish all TC390A groups and TC390 pairs in the original direction. You may use the **No Copy** initial copy option because all M-VOLs and R-VOLs are synchronized. If there is any possibility that the volumes are not 100% synchronized, use the **Entire** initial copy option to be safe.

9. Vary the MCU and M-VOLs online and start the applications at the main site.

**Troubleshooting**

**General TrueCopy Troubleshooting**

In the unlikely event of a problem with the Command View XP management station or Command View XP or XP Remote Web Console software, first verify that the problem is not being caused by the PC or Ethernet hardware or software, and then try restarting the PC. Restarting the Command View XP management station does not affect TC390 operations already in progress. For a description of the TC390 error messages displayed on the Command View XP management station or XP Remote Web Console, see “TrueCopy Software Error Codes” on page 152.

**NOTE:** Use the **FDCOPY** function to copy the Command View XP or XP Remote Web Console configuration information onto diskette and give the diskette(s) to HP service personnel.

The following table provides general troubleshooting information for TC390. Table 30 on page 149 provides troubleshooting information for RCU paths. Table 31 on page 150 and Table 32 on page 152
provide troubleshooting information for suspended TC390 pairs. For troubleshooting information on TC390 scripting, see “TrueCopy Scripting” on page 187.

Table 29 General TrueCopy troubleshooting

<table>
<thead>
<tr>
<th>Error</th>
<th>Corrective Action</th>
</tr>
</thead>
</table>
| TC390 operations do not function properly.      | Verify that all TC390 requirements and restrictions are met (for example, track format, LVI, VOLSER, or DFW). See “System Requirements” on page 45 and “Requirements and Restrictions” on page 47.  
Verify the MCU and RCU are powered on and fully operational (NVS, cache, DFW).  
Check all input values and parameters to verify you entered the correct information on the Command View XP management station (for example, RCU S/N and SSID, path parameters, and M-VOL and R-VOL IDs). |
<p>| The volume pairs and/or RCUs are not displaying correctly. | Verify that the correct CU image is selected.                                                                                                                                                                      |
| An R-SIM warning is displayed on the Command View XP management station or XP Remote Web Console. | Locate the SIM using the RMCMAIN R-SIM window. For SIMs related to TC390 operations, see “SIM Reporting” on page 183.                                                                                            |
| A TC390 error message is displayed on the Command View XP management station or XP Remote Web Console. | Resolve the specified error condition, and then try the TC390 operation again.                                                                                                                                     |
| There is a problem with the Command View XP management station, XP Remote Web Console, or TC390. | Verify that the problem is not the PC or LAN hardware or software. Try restarting the PC and reconnecting to the disk array.                                                                                     |
| The RCU path status is not normal.              | Check the path status (RCU Status window) and see Table 30 on page 149.                                                                                                                                           |
| The pair status is suspended.                   | Check the detailed pair status (Pair Status window) and see Table 30 on page 149 and Table 31 on page 150 for suspend types and corrective action for suspended TC390 pairs.                                           |</p>
<table>
<thead>
<tr>
<th>Path Status</th>
<th>Description</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initialization Failed</td>
<td>The link initialization procedure to the RCU failed.</td>
<td>Verify that you entered the correct RCU S/N and SSID and path parameters (Fibre: MCU port, RCU port, CU number and Controller ID. Serial: port, link address and logical address). For serial, verify that the correct MCU port is configured as an RCP and that the correct RCU port is configured as an LCP. For Fibre Channel interface, verify that the Fibre Channel topology settings of the MCU and RCU ports are correct.</td>
</tr>
<tr>
<td>Communication Time Out</td>
<td>Communication between the MCU and RCU timed out.</td>
<td>Verify that the RCU is powered on and fully functional (NVS and cache ON). Verify that the remote copy connection hardware is properly configured and functional, including cables, connectors, ESCDs, repeaters, extender devices, communication lines, and all other devices connected to the extenders. Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.</td>
</tr>
<tr>
<td>Resource Shortage (MCU/RCU)</td>
<td>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.</td>
<td>Delete the failed path, and also delete all paths and RCUs not currently in use. The MCU can be connected to up to four RCUs with up to eight paths (four for serial 3990) to each RCU. Verify all MCU and RCU ports are properly configured: • Serial – LCPs for hosts and MCUs, RCPs for RCUs. • Fibre – ordinary target ports or RCU target ports for hosts, RCU target ports for MCUs, initiator ports 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 Add Path or Add RCU.</td>
</tr>
<tr>
<td>Serial Number Mismatch</td>
<td>The RCU’s S/N does not match the specified S/N.</td>
<td>Verify that you entered the correct RCU S/N and SSID and path parameters (Fibre: MCU port, RCU port, CU number and Controller ID. Serial: port, link address and logical address). Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU. For Fibre Channel interface, verify that you entered the correct Controller ID and that the Fibre Channel topology settings of the MCU and RCU ports are correct.</td>
</tr>
</tbody>
</table>
Table 30  Troubleshooting RCU path status problems (continued)

<table>
<thead>
<tr>
<th>Path Status</th>
<th>Description</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid Port</td>
<td>The specified port is not configured as an RCP or initiator port, or this path already exists.</td>
<td>For serial, verify that the correct MCU port is configured as an RCP and that the correct RCU port is configured as an LCP.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For Fibre Channel interface, verify that the Fibre Channel topology settings of the MCU and RCU ports are correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify that you entered the correct RCU S/N and SSID and path parameters (Fibre: MCU port, RCU port, CU number and Controller ID. Serial: port, link address and logical address).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.</td>
</tr>
<tr>
<td>RCU Port Number Mismatch</td>
<td>The specified port in the RCU is physically disconnected from the MCU.</td>
<td>Verify that you entered the correct RCU port number. Correct the port number if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify that the MCU and RCU are physically connected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For Fibre Channel interface, verify that the Fibre Channel topology settings of the MCU and RCU ports are correct.</td>
</tr>
<tr>
<td>RCU Port Type Mismatch</td>
<td>The specified port in the RCU is not configured as an RCU Target port.</td>
<td>Verify that the port in the RCU configured as an RCU Target port. Configure the port as an RCU Target port if necessary.</td>
</tr>
<tr>
<td>Communication failed.</td>
<td>The MCU connects to the RCU successfully, but logical communication time out occurred.</td>
<td>Verify that the RCU port and remote copy connection hardware (cables and switches) are properly configured and functioning.</td>
</tr>
<tr>
<td>Port Number Mismatch</td>
<td>The specified port number is not correct, or the cable is not connected to the specified port.</td>
<td>Delete the error path.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify that you entered the correct port number.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify that the cable is connected.</td>
</tr>
<tr>
<td>Fibre Remote Copy is not Supported</td>
<td>The RCU microcode does not support fibre remote copy.</td>
<td>Install the microcode that supports fibre remote copy at the RCU.</td>
</tr>
<tr>
<td>Communication Error</td>
<td>Communication between the MCU and RCU through the fibre path timed out.</td>
<td>Delete the failed path.</td>
</tr>
<tr>
<td>&lt;blank&gt;</td>
<td>This path was not established.</td>
<td>Delete the failed path. You may need to change the minimum paths setting or delete the RCU to delete the path. Then add the path/RCU using Add Path or Add RCU.</td>
</tr>
</tbody>
</table>

Table 31  Troubleshooting suspended TrueCopy pairs

<table>
<thead>
<tr>
<th>Suspend Type</th>
<th>Applies to</th>
<th>Description</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-VOL by Operator</td>
<td>M-VOL</td>
<td>The user suspended the pair from the MCU using the <strong>M-VOL Failure</strong> option. The R-VOL suspend type is by MCU.</td>
<td>Resume the pair from the MCU.</td>
</tr>
<tr>
<td>R-VOL by Operator</td>
<td>M-VOL, R-VOL</td>
<td>The user suspended the pair from the MCU or RCU using the <strong>R-VOL</strong> option.</td>
<td>Resume the pair from the MCU.</td>
</tr>
</tbody>
</table>
The following table provides troubleshooting instructions for the TC390A suspension conditions caused by the offloading timer asynchronous option, the group timeout options (copy pending and RCU ready), and

<table>
<thead>
<tr>
<th>Suspend Type</th>
<th>Applies to</th>
<th>Description</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>by MCU</td>
<td>R-VOL</td>
<td>The RCU received a request from the MCU to suspend the pair. The M-VOL suspend type is M-VOL by Operator or R-VOL by Operator.</td>
<td>Resume the pair from the MCU.</td>
</tr>
<tr>
<td>by RCU</td>
<td>M-VOL</td>
<td>The MCU detected an error condition at the RCU that caused the MCU to suspend the volume pair. The R-VOL suspend type is by MCU.</td>
<td>Clear the error condition at the RCU or R-VOL. If you need to access the R-VOL, delete the pair from the RCU. If any data on the R-VOL has changed, delete the pair from the MCU and then restart the pair (Add Pair). If not, resume the pair from the MCU.</td>
</tr>
<tr>
<td>Delete Pair to RCU</td>
<td>M-VOL</td>
<td>The MCU detected that the R-VOL status changed to simplex because the user deleted the pair from the RCU. The pair cannot be resumed because the R-VOL does not have the suspended status.</td>
<td>Delete the pair from the MCU and then restart the pair. You should use the Entire initial copy option to resynchronize the pair. You can use the No Copy initial copy option only if no data on the M-VOL or R-VOL changed.</td>
</tr>
<tr>
<td>RVOL Failure</td>
<td>M-VOL</td>
<td>The MCU detected an error during communication with the RCU or an I/O error during update copy. In this case, the suspend type for the R-VOL is usually by MCU.</td>
<td>Check the path status on the RCU Status window (see Table 30 on page 149). Clear any error conditions at the RCU/R-VOL. If you need to access the R-VOL, delete the pair from the RCU. If any data on the R-VOL has changed, delete the pair from the MCU and then restart the pair (Add Pair). If not, resume the pair from the MCU.</td>
</tr>
<tr>
<td>MCU IMPL</td>
<td>M-VOL, R-VOL</td>
<td>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).</td>
<td>Resume the pair from the MCU. The MCU will perform an entire initial copy operation in response to the resume pair request.</td>
</tr>
<tr>
<td>Initial Copy Failed</td>
<td>M-VOL, R-VOL</td>
<td>The MCU suspended this pair during the initial copy operation. The data on the R-VOL is not identical to the data on the M-VOL. Invalid track format can cause this suspension.</td>
<td>Delete the pair from the MCU. Clear all error conditions at the MCU, M-VOL, RCU, and R-VOL. Reformat failed track using ICKDSF. Restart the initial copy operation using the Add Pair window.</td>
</tr>
<tr>
<td>by FREEZE</td>
<td>M-VOL, R-VOL</td>
<td>All TC390 Synchronous pairs in the MCU were suspended by the CGROUP/RUN command.</td>
<td>Resume the pair(s) from the MCU using Resume Pair or the CESTPAIR (MODE=RESYNC) TSO command.</td>
</tr>
<tr>
<td>MCU P/S-OFF</td>
<td>R-VOL</td>
<td>The MCU suspended all TC390A pairs due to MCU power-off.</td>
<td>None. The MCU will automatically resume these TC390A pairs during power-on.</td>
</tr>
<tr>
<td>by Sidefile Overflow</td>
<td>M-VOL, R-VOL</td>
<td>The amount of sidefile exceeds the specified current pending update data rate and the RCU data is not transferred within the specified offloading timer.</td>
<td>Add cache memory, increase the number of paths between MCU and RCU, or decrease the number of Async pairs or host I/Os.</td>
</tr>
</tbody>
</table>
TrueCopy Software Error Codes

The TC390 software displays error messages on the Command View XP management station or XP Remote Web Console when error conditions occur during TC390 operations. The error message describes the error and provides a four-digit error code. The error code may include the

---

**Table 32** Resolving TrueCopy Asynchronous suspension conditions

<table>
<thead>
<tr>
<th>Classification</th>
<th>Causes of Suspension</th>
<th>SIM</th>
<th>Recovery procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU/RCU hardware</td>
<td>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 has been in the correction-access status while the TC390 volume pair was in pending state.</td>
<td>DB0x</td>
<td>According to SIM, remove the hardware blockade or failure. Re-establish failed volume pairs (Resume Pair).</td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td>DB1x</td>
<td>Remove the failed condition at the RCU/MCU or on the remote copy connection. Re-establish failed pairs (Resume Pair).</td>
</tr>
<tr>
<td>RIO overload</td>
<td>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.</td>
<td>DB1x</td>
<td>Delete failed pairs (Delete Pair). Reconsider the performance resources necessary and increase resources as needed (cache amount, number of MCU-RCU paths, and so forth). Re-establish failed pairs (Add Pair).</td>
</tr>
<tr>
<td>RIO failure</td>
<td>The RIO (remote I/O) could not complete due to the failure at the RCU.</td>
<td>DB2x</td>
<td>According to SIM generated at the RCU, remove the failure. Re-establish failed pairs (Resume Pair).</td>
</tr>
<tr>
<td>MCU planned outage</td>
<td>The TC390A pairs were temporarily suspended due to a planned outage of the MCU.</td>
<td>DB8x</td>
<td>No recovery procedure is required. The MCU will automatically remove the suspension condition during the next power-on-reset sequence.</td>
</tr>
</tbody>
</table>
XP1024/XP128/XP12000/XP10000 SVP error code. If you need to call HP technical support for assistance, report the TC390 and SVP error codes.

**Figure 68** Example of the TC390 error message

### Using PPRC Commands for TrueCopy

#### Overview of PPRC Commands

The XP1024/XP128/XP12000/XP10000 supports IBM Peer-to-Peer Remote Copy (PPRC) TSO and ICKDSF commands to perform TC390 operations from the zSeries and S/390 host system. PPRC TSO commands are issued from the system console to the M-VOL or R-VOL of a TC390 pair. PPRCOPY ICKDSF commands are issued from JCL job cards. The TC390 feature must be installed on the XP1024/XP128/XP12000/XP10000 and IBM PPRC must be installed on the host operating system. For TC390A operations, special switches and parameters are used to control and monitor TC390A pairs and groups using PPRC commands.

The following TC390 operations cannot be performed using PPRC commands: async options, and TC390A group addition/deletion. The async options and groups must be configured using the Command View XP management station or XP Remote Web Console before you can add any TC390A pairs (CESTPAIR). You also cannot change the RCU options, initial copy priority, or the DFW to R-VOL pair options using PPRC commands. For more information on the restrictions associated with using PPRC commands instead of TC390 through Command View XP or XP Remote Web Console, see “PPRC Support” on page 41.

Port configuration (LCP→RCP, RCU target→initiator) is supported through the CESTPATH and CDELPATH TSO commands only when SVP mode 114 ON (refer to Table 4 on page 20). If SVP mode 114 is OFF, you must configure the ports using the licensed TC390 software on the Command View XP management station or XP Remote Web Console before adding paths and after deleting paths.

**NOTE:** Even if you set ON for SVP mode 114, initiator ports will not automatically change to RCU target ports, nor vice versa, when these ports are in initiator/external mix mode.

Table 33 on page 154 lists the TC390 operations and describes the corresponding PPRC TSO and ICKDSF commands. “Using PPRC TSO Commands with TrueCopy Asynchronous” on page 156 provides instructions for using the PPRC TSO commands with TC390A pairs.

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

PPRC TSO command parameter support depends on the CU emulation (3990 or 2105). PPRC command extensions are supported when running with 2105 emulation.

The PPRC TSO and ICKDSF commands have required and optional parameters that are not described in detail in this chapter. These commands use slightly different command/keyword names to provide equivalent PPRC functions. For example, the CESTPAIR TSO command is equivalent to the PPRCOPY ESTPAIR ICKDSF command. This chapter describes the PPRC TSO commands.
The CESTPATH RESETHP option rejects the host I/O operations. Before you use the RESETHP option of the CESTPATH command, stop the I/O operations from the host.

### Table 33  TrueCopy operations versus PPRC TSO and ICKDSF commands

<table>
<thead>
<tr>
<th>TC390 Operation</th>
<th>TSO Command</th>
<th>ICKDSF Command</th>
<th>Command Issued to:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configure Port</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>If SVP mode 114 is OFF, the ports must be configured using the Command View XP management station or XP Remote Web Console (or SVP). If SVP mode 114 is ON, the ports are configured automatically (LCP/RCP to RCP/LCP, RCU target/initiator to initiator/RCU target) in response to the CESTPATH and CDELPATH TSO commands. However, even if you set ON for SVP mode 114, initiator ports will not automatically change to RCU target ports, nor vice versa, when these ports are in initiator/external mix mode. For Fibre Channel interface, do not use the CESTPATH and CDELPATH commands at the same time as the SCSI path definition function of LUN Management. The Fibre Channel interface ports need to be configured as initiator ports or RCU target ports before the CESTPATH and CDELPATH commands are issued.</td>
</tr>
<tr>
<td>Add RCU</td>
<td>CESTPATH</td>
<td>PPRCOPY ESTPATH</td>
<td>MCU</td>
<td>Establishes logical paths from an MCU to an RCU. The default RCU options are used (see “PPRC Support” on page 41). For details on using CESTPATH for TC390A, see “CESTPATH” on page 156.</td>
</tr>
<tr>
<td>Delete RCU</td>
<td>CDELPATH</td>
<td>PPRCOPY DELPATH</td>
<td>M-VOL</td>
<td>Deletes all active paths between an MCU and an RCU.</td>
</tr>
<tr>
<td>RCU Status</td>
<td>CQUERY/PATHS</td>
<td>PPRCOPY QUERY/PATHS</td>
<td>MCU</td>
<td>Displays the status of all paths for the CU specified by the DEVN parameter. TC390 supports the optional FORMAT/UNFORMAT and VOLUME/PATHS parameters.</td>
</tr>
<tr>
<td>Asynchronous Options</td>
<td>----</td>
<td>----</td>
<td>MCU/RCU</td>
<td>The default TC390A options are used (see “PPRC Support” on page 41).</td>
</tr>
<tr>
<td>Add Group</td>
<td>----</td>
<td>----</td>
<td>MCU</td>
<td>Must be performed using the TC390 software. The group options are selected during add group (see “Adding Consistency Groups (Add CT Group)” on page 105).</td>
</tr>
<tr>
<td>Group Status</td>
<td>----</td>
<td>----</td>
<td>MCU/RCU</td>
<td>Must be performed using the TC390 software (see “Viewing Consistency Group Status (CT Group Status)” on page 103).</td>
</tr>
<tr>
<td>Delete Group</td>
<td>----</td>
<td>----</td>
<td>MCU</td>
<td>Must be performed using the TC390 software (see “Deleting Consistency Groups (Delete CT Group)” on page 107).</td>
</tr>
</tbody>
</table>
### Table 33  TrueCopy operations versus PPRC TSO and ICKDSF commands (continued)

<table>
<thead>
<tr>
<th>TC390 Operation</th>
<th>TSO Command</th>
<th>ICKDSF Command</th>
<th>Command Issued to:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Pair</td>
<td>CESTPAIR (MODE= COPY)</td>
<td>PPRCOPY ESTPAIR</td>
<td>M-VOL</td>
<td>Establishes a TC390 pair and sets the initial copy and pair options (copy mode = synchronous or asynchronous only, priority = 0, CFW data = copy to RVOL, DFW to RVOL = not required). TC390 supports the optional MODE, PACE, and CRIT parameters. The MSGREQ parameter defaults to NO (not applicable to TC390A). For details on using CESTPAIR for TC390A, see “CESTPAIR” on page 160.</td>
</tr>
<tr>
<td>Suspend Pair</td>
<td>CSUSPEND</td>
<td>PPRCOPY SUSPEND</td>
<td>M-VOL or R-VOL</td>
<td>Suspends a TC390 pair (or TC390A group). TC390 supports the optional PRIMARY parameter. See Caution below on the QUIESCE parameter. For details on CSUSPEND for TC390A, see “CSUSPEND” on page 162.</td>
</tr>
<tr>
<td>Delete Pair (to MCU)</td>
<td>CDELPAIR</td>
<td>PPRCOPY DELPAIR</td>
<td>M-VOL</td>
<td>Deletes a TC390 pair (or TC390A group) from the MCU. For details on using CDELPAIR for TC390A, see “CDELPAIR” on page 163.</td>
</tr>
<tr>
<td>Delete Pair (to RCU)</td>
<td>CRECOVER</td>
<td>PPRCOPY RECOVER</td>
<td>R-VOL</td>
<td>Deletes a TC390 pair (or TC390A group) from the RCU. For details on using CRECOVER for TC390A, see “CRECOVER” on page 163.</td>
</tr>
<tr>
<td>Pair Status</td>
<td>CQUERY/ VOLUME</td>
<td>PPRCOPY QUERY/ VOLUME</td>
<td>M-VOL or R-VOL</td>
<td>Displays the TC390 and TC390A pair status of the volume. TC390 supports the optional FORMAT/UNFORMAT and VOLUME/PATHS parameters. For details on using CQUERY for TC390A, see “CQUERY for Serial Interface” on page 164.</td>
</tr>
<tr>
<td>Resume Pair</td>
<td>CESTPAIR (MODE= RESYNC)</td>
<td>PPRCOPY ESTPAIR</td>
<td>M-VOL</td>
<td>Resumes a TC390 pair (or TC390A group), and sets the TC390 initial copy options and pair options. TC390 supports the optional MODE, PACE, and CRIT parameters. For details on using CESTPAIR/RESYNC for TC390A, see “CESTPAIR” on page 160.</td>
</tr>
<tr>
<td>P/DAS SWAP</td>
<td>----</td>
<td>----</td>
<td>M-VOL and R-VOL</td>
<td>Supported by TC390 Synchronous. Command is rejected by TC390A pairs. Redirects application I/Os from the M-VOL to the R-VOL. For details on using P/DAS SWAP with TC390, see “P/DAS Support” on page 42.</td>
</tr>
<tr>
<td>CGROUP (FREEZE/ RUN)</td>
<td>----</td>
<td>----</td>
<td>MCU (M-VOL or simplex)</td>
<td>Supported by TC390 Synchronous. Command is rejected by TC390A pairs. For details on using CGROUP (FREEZE/RUN) with TC390 Synchronous pairs, see “CGROUP (FREEZE/RUN) Support” on page 169.</td>
</tr>
</tbody>
</table>
△ **CAUTION:** The QUIESCE option of the CSUSPEND command has been disabled by APAR OW15247 or APAR OW15248. For detailed information on the QUIESCE option of the CSUSPEND command, refer to either of these APARs. Check with your HP account team before using the CSUSPEND command with the QUIESCE option to suspend TC390 volume pairs on an XP1024/XP128/XP12000/XP10000 (or other XP disk array). If the CSUSPEND command with the QUIESCE option is issued to certain volumes (for example, active SPOOL, PAGE, or CATALOG datasets, or active SYSRES volume), the attached host(s) may enter a deadlock condition and may require a storage control IML to correct the condition. TC390A does not support the CSUSPEND/QUIESCE option.

### Using PPRC TSO Commands with TrueCopy Asynchronous

For TC390A operations, special switches and parameters are used to control and monitor TC390A pairs and groups using PPRC commands. This section describes this special use of PPRC TSO commands for TC390A volumes on the XP1024/XP128/XP12000/XP10000. Table 34 on page 156 describes the typographic conventions used for the PPRC TSO commands described in this section.

**NOTE:** PPRC TSO command parameter support depends on the emulation (for example, 2105 or 3990). PPRC command extensions are supported when running with 2105 emulation.

Use the **PPRC TSO Command** option on the Async Option window to select the XP256-compatible format for PPRC TSO commands (groups 0-F instead of 00-3F).

**NOTE:** The DEVSERV PATHS command displays the pair status of a TC390A volume in the **DC-STATE** box. The contents of this box are the same as for TC390 Synchronous. Note that the TC390A transition states (suspending and deleting) are not displayed.

This section does not specifically address the equivalent PPRCOPY ICKDSF commands. Use caution when issuing ICKDSF commands to TC390A volumes.

<table>
<thead>
<tr>
<th>Typeface/Symbol</th>
<th>Example</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal text</td>
<td>CRIT(YES)</td>
<td>Command/keyword names or console outputs.</td>
</tr>
<tr>
<td>Italic</td>
<td>ssid</td>
<td>Parameter to be replaced with an appropriate character or numeric string.</td>
</tr>
<tr>
<td>Bold</td>
<td>cmd_param</td>
<td>Command/keyword names, parameters, or console outputs that involve/denote special meaning for TC390A.</td>
</tr>
<tr>
<td>Square brackets</td>
<td>[PACE(15)]</td>
<td>Keywords/parameters that can be omitted.</td>
</tr>
<tr>
<td>Vertical pipe</td>
<td>(YES</td>
<td>NO)</td>
</tr>
<tr>
<td>Underline</td>
<td>(YES</td>
<td>NO)</td>
</tr>
<tr>
<td>Strikethrough</td>
<td>[QUIESCE]</td>
<td>Invalid keywords/parameters for TC390A.</td>
</tr>
</tbody>
</table>

### CESTPATH

Use the CESTPATH command to establish remote copy paths for the XP1024/XP128/XP12000/XP10000 and can be used for either serial or Fibre Channel interface. However, the ESCON® cable connection is not supported for the XP1024/XP128/XP12000/XP10000.

For fibre, the RCU controller ID is specified. The syntax for the CESTPATH command (ESCON Interface) is:

For 3990-3, -6 and -6E controller emulations:

CESTPATH DEVN(X’dev#’) PRIM(X’ssid’ serial#) SEC(X’ssid’ serial#) LINK(X’aabbccddd’)

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For 2105 controller emulation (‘lss’ parameter for LCU no., CGROUP and RESETHP options):

CESTPATH DEVN(X’dev#’) PRIM(X’ssid’ serial# X’lss’) SEC(X’ssid’ serial# X’lss’) LINK(X’aabbccdd’)
[CGROUP(YES|NO) RESETHP(YES|NO)]

**NOTE:** For fibre, do not use the RESETHP option. For serial, the RESETHP option rejects host I/O operations. Before you use this option, stop the I/O operations from the host.

For 2105 emulation, use the CESTPATH CGROUP option to control freeze. Do not use the CGROUP FREEZE option. If you use the FREEZE option, the CESTPATH command will be rejected.

**CAUTION:** Before issuing the CESTPATH command, verify that the relevant paths are offline from the host(s) (for example, configure the Chipid offline, deactivate the LPAR, or block the port in the ESCD). If any active paths still exist, the add path operation will fail because the port mode cannot be changed.

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

The following table describes the CESTPATH LINK parameter for the Fibre Channel interface.

### Table 35  CESTPATH LINK parameter (ESCON Interface)

<table>
<thead>
<tr>
<th>LINK Parameter</th>
<th>Fibre Channel Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>aa</td>
<td>Bit 0-3: RCU controller ID</td>
</tr>
<tr>
<td></td>
<td>x2xF: Number stands for RCU controller ID.</td>
</tr>
<tr>
<td></td>
<td>(x’4’ is specified.)</td>
</tr>
<tr>
<td></td>
<td>Bit 4-7: FREEZE option</td>
</tr>
<tr>
<td></td>
<td>x0:keep the status</td>
</tr>
<tr>
<td></td>
<td>x1:Enabled</td>
</tr>
<tr>
<td></td>
<td>x2:Disabled</td>
</tr>
<tr>
<td>Second two digits of SAID, see Table 37 on page 159.</td>
<td></td>
</tr>
<tr>
<td>bb</td>
<td>MCU port number (0x00-0x1ff)</td>
</tr>
<tr>
<td>Second two digits of SAID, see Table 37 on page 159.</td>
<td></td>
</tr>
<tr>
<td>cc</td>
<td>RCU port number (0x00-0x1ff)</td>
</tr>
<tr>
<td>dd</td>
<td>CU number (0x00-0x3f)</td>
</tr>
</tbody>
</table>

The syntax for the CESTPATH command (fibre channel Interface) is:

CESTPATH DEVN(X’dev#’) PRIM(X’ssid’ WWNN X’lss’) SEC(X’ssid’ WWNN X’lss’) LINK(X’aabbccddd’) [CGROUP (YES|NO)]

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WWNN (World Wide Node Name) is the unique number for the controller and is indicated as shown in Figure 69.

**NOTE:** The parameter of PRIM and SEC of CDELPATH command are indicated as same as the parameter of CESTPATH command.

If the subsystem is connected to the former type subsystem that does not support the fibre channel interface, a unit check is reported.

The following table gives the XP1024/XP128/XP12000/XP10000 system adapter ID (SAID) values for the CESTPATH LINK parameter.

- The last two digits of the link parameter must specify the logical CU number (00-1F for an XP1024/XP128/XP12000/XP10000, 00-0F for an XP256).
- For 3990 controller emulation, the first two digits can be 00, 01, or 02. This option controls freeze as follows:
  - 00 = use mode 104
  - 01 = freeze enabled
  - 02 = freeze disabled

---

**Table 36  CESTPATH LINK Parameter (Fibre Channel Interface)**

<table>
<thead>
<tr>
<th>LINK Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>aabb</td>
<td>SAID of MCU (x’00 and the port number)</td>
</tr>
<tr>
<td>ccdd</td>
<td>SAID of RCU (x’00 and the port number)</td>
</tr>
</tbody>
</table>

---

**Figure 69  Example of WWNN**

If the serial number is 99999 (x’189F’), WWNN will be x’5060E301489F 00’.
• For 2105 emulation, the first two digits must be 00. The CGROUP option of the CESTPATH command is used to control freeze for 2105 emulation.

### Table 37  SAID Values for the LINK Parameters (=ports) (FRONT CL1)

| Package Location | Port | SAID*     | Package Location | Port | SAID* | Package Location | Port | SAID*     | Package Location | Port | SAID*     |
|------------------|------|-----------|------------------|------|-------|------------------|------|-----------|------------------|------|-----------|------------------|------|-----------|------------------|------|-----------|
| 1E               | CL1-A | X’0000’  | G                | CL1-J | X’0008’  | K                | CL1-N | X’008C’ | B                | CL1-E | X’0084’  |
|                  | CL3-A | X’0020’  | (Add 2)          | CL3-J | X’0028’  | (Add4)          | CL3-N | X’004C’ | (Add6)          | CL3-E | X’00A4’  |
|                  | CL5-A | X’0040’  |                 | CL5-J | X’0048’  |                 | CL5-N | X’00CC’ |                 | CL5-E | X’004C’  |
|                  | CL7-A | X’0060’  |                 | CL7-J | X’0068’  |                 | CL7-N | X’00EC’ |                 | CL7-E | X’00E4’  |
|                  | CL1-B | X’0001’  |                 | CL1-K | X’0009’  |                 | CL9-P | X’008D’ |                 | CL9-F | X’0085’  |
|                  | CL3-B | X’0021’  |                 | CL3-K | X’0029’  |                 | CLB-P | X’00AD’ |                 | CLB-F | X’00A5’  |
|                  | CL5-B | X’0041’  |                 | CL5-K | X’0049’  |                 | CLB-P | X’00CD’ |                 | CLB-F | X’00C5’  |
|                  | CL7-B | X’0061’  |                 | CL7-K | X’0069’  |                 | CL9-P | X’00ED’ |                 | CL9-F | X’00E5’  |
|                  | CL1-C | X’0002’  |                 | CL1-L | X’000A’  |                 | CL9-Q | X’008E’ |                 | CL9-G | X’0086’  |
|                  | CL3-C | X’0022’  |                 | CL3-L | X’002A’  |                 | CLB-Q | X’00AE’ |                 | CLB-Q | X’00A6’  |
|                  | CL5-C | X’0042’  |                 | CL5-L | X’004A’  |                 | CLB-Q | X’00CE’ |                 | CLD-G | X’00C6’  |
|                  | CL7-C | X’0062’  |                 | CL7-L | X’006A’  |                 | CLB-Q | X’00EE’ |                 | CLB-G | X’00E6’  |
|                  | CL1-D | X’0003’  |                 | CL1-M | X’0008’  |                 | CL9-R | X’008F’ |                 | CL9-H | X’0087’  |
|                  | CL3-D | X’0023’  |                 | CL3-M | X’0028’  |                 | CL9-R | X’00AF’ |                 | CL9-H | X’008A’  |
|                  | CL5-D | X’0043’  |                 | CL5-M | X’0028’  |                 | CLD-R | X’00CF’ |                 | CLD-H | X’00C7’  |
|                  | CL7-D | X’0063’  |                 | CL7-M | X’0028’  |                 | CLD-R | X’00EF’ |                 | CLD-H | X’00E7’  |
| 1F               | CL1-E | X’0004’  |                 | CL1-N | X’003C’  |                 | CL9-J | X’0088’ |                 | CL9-A | X’0080’  |
|                  | CL3-E | X’0024’  | (Add3)          | CL3-N | X’003C’  | (Add5)          | CLB-J | X’00A8’ | (Add7)          | CLB-A | X’00A0’  |
|                  | CL5-E | X’0044’  |                 | CL5-N | X’003C’  |                 | CLB-J | X’00C8’ |                 | CLB-A | X’00C0’  |
|                  | CL7-E | X’0064’  |                 | CL7-N | X’003C’  |                 | CLB-J | X’00E8’ |                 | CLB-A | X’00E0’  |
|                  | CL1-F | X’0005’  |                 | CL1-P | X’003D’  |                 | CL9-K | X’0089’ |                 | CL9-B | X’0081’  |
|                  | CL3-F | X’0025’  |                 | CL3-P | X’003D’  |                 | CLB-K | X’00A9’ |                 | CLB-B | X’00A1’  |
|                  | CL5-F | X’0045’  |                 | CL5-P | X’003D’  |                 | CLB-K | X’00C9’ |                 | CLB-B | X’00C1’  |
|                  | CL7-F | X’0065’  |                 | CL7-P | X’003D’  |                 | CLB-K | X’00E9’ |                 | CLB-B | X’00E1’  |
|                  | CL1-G | X’0006’  |                 | CL1-Q | X’003E’  |                 | CL9-L | X’008A’ |                 | CL9-C | X’0082’  |
|                  | CL3-G | X’0026’  |                 | CL3-Q | X’003E’  |                 | CLB-L | X’00AA’ |                 | CLB-C | X’00A2’  |
|                  | CL5-G | X’0046’  |                 | CL5-Q | X’003E’  |                 | CLD-L | X’00CA’ |                 | CLD-C | X’00C2’  |
|                  | CL7-G | X’0066’  |                 | CL7-Q | X’003E’  |                 | CLD-L | X’00EA’ |                 | CLD-C | X’00E2’  |
|                  | CL1-H | X’0007’  |                 | CL1-R | X’003F’  |                 | CL9-M | X’008B’ |                 | CL9-D | X’0083’  |
|                  | CL3-H | X’0027’  |                 | CL3-R | X’003F’  |                 | CLB-M | X’00AB’ |                 | CLB-D | X’00A3’  |
|                  | CL5-H | X’0047’  |                 | CL5-R | X’003F’  |                 | CLD-M | X’00CB’ |                 | CLD-D | X’00C3’  |
|                  | CL7-H | X’0067’  |                 | CL7-R | X’003F’  |                 | CLF-M | X’00EB’ |                 | CLF-D | X’00E3’  |

* Please note that the SAID values in Table 37 are different from the ones Table 38, Table 13 and Table 14.
Table 39 on page 161 describes how to use the CESTPAIR command to establish TC390A pairs and resume TC390A pairs and groups. The syntax for the CESTPAIR command is:

<table>
<thead>
<tr>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
<th>Package Location</th>
<th>Port</th>
<th>SAID*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2Q</td>
<td>CL2-A</td>
<td>X'0010'</td>
<td>2T</td>
<td>CL2-J</td>
<td>X'002A'</td>
<td>2W</td>
<td>CLA-N</td>
<td>X'009C'</td>
<td>2N</td>
<td>CLA-E</td>
<td>X'0094'</td>
</tr>
<tr>
<td>(Basic)</td>
<td>CL4-A</td>
<td>X'0031'</td>
<td>(Add 2)</td>
<td>CL4-J</td>
<td>X'003A'</td>
<td>(Add3)</td>
<td>CLC-N</td>
<td>X'00BC'</td>
<td>(Add6)</td>
<td>CLC-E</td>
<td>X'00B4'</td>
</tr>
<tr>
<td>CL6-A</td>
<td>X'0054'</td>
<td>CL6-J</td>
<td>X'0058'</td>
<td>CLE-N</td>
<td>X'00DC'</td>
<td>CLE-E</td>
<td>X'00D4'</td>
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<tr>
<td>CL8-A</td>
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<td>CL8-J</td>
<td>X'0068'</td>
<td>CLG-N</td>
<td>X'00FC'</td>
<td>CLG-E</td>
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<tr>
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<td>CL2-K</td>
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<td>CLAP-P</td>
<td>X'009D'</td>
<td>CLA-F</td>
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<td>X'0039'</td>
<td>CLCP-P</td>
<td>X'00BD'</td>
<td>CLCF</td>
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<td>X'0059'</td>
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<td>CLE-F</td>
<td>X'00D5'</td>
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<td>X'0079'</td>
<td>CLGP-P</td>
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<td>CLG-F</td>
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<tr>
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<td>CL2-L</td>
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<td>X'009E'</td>
<td>CLA-G</td>
<td>X'0096'</td>
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<td>CL4-L</td>
<td>X'003A'</td>
<td>CLCQ-P</td>
<td>X'00BE'</td>
<td>CLC-Q</td>
<td>X'00B6'</td>
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</tr>
<tr>
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<td>CL6-L</td>
<td>X'005A'</td>
<td>CLEQ-P</td>
<td>X'00DE'</td>
<td>CLE-G</td>
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</tr>
<tr>
<td>CL8-C</td>
<td>X'0072'</td>
<td>CL8-L</td>
<td>X'007A'</td>
<td>CLGQ-P</td>
<td>X'00FE'</td>
<td>CLG-G</td>
<td>X'00F6'</td>
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</tr>
<tr>
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<td>CL2-M</td>
<td>X'001B'</td>
<td>CLAR-P</td>
<td>X'009F'</td>
<td>CLA-H</td>
<td>X'0097'</td>
<td></td>
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<tr>
<td>CL4-D</td>
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<td>CL4-M</td>
<td>X'003B'</td>
<td>CLCR-P</td>
<td>X'00BF'</td>
<td>CLC-H</td>
<td>X'00B7'</td>
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<td></td>
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<tr>
<td>CL6-D</td>
<td>X'0053'</td>
<td>CL6-M</td>
<td>X'005B'</td>
<td>CLEP-R</td>
<td>X'00DF'</td>
<td>CLH-E</td>
<td>X'00D7'</td>
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</tr>
<tr>
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<td>CL8-M</td>
<td>X'007B'</td>
<td>CLGR-P</td>
<td>X'00FF'</td>
<td>CLG-H</td>
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<td></td>
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<tr>
<td>2R</td>
<td>CL2-E</td>
<td>X'0014'</td>
<td>2U</td>
<td>CL2-N</td>
<td>X'001C'</td>
<td>2X</td>
<td>CLAJ</td>
<td>X'0098'</td>
<td>2M</td>
<td>CLA-A</td>
<td>X'0090'</td>
</tr>
<tr>
<td>(Add1)</td>
<td>CL4-E</td>
<td>X'0034'</td>
<td>(Add3)</td>
<td>CL4-N</td>
<td>X'003C'</td>
<td>(Add5)</td>
<td>CLCJ</td>
<td>X'00B8'</td>
<td>(Add7)</td>
<td>CLCA</td>
<td>X'00B0'</td>
</tr>
<tr>
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<td>X'0054'</td>
<td>CL6-N</td>
<td>X'005C'</td>
<td>CLFJ</td>
<td>X'00D8'</td>
<td>CLA-A</td>
<td>X'00D0'</td>
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<td>X'007C'</td>
<td>CLGJ</td>
<td>X'00F8'</td>
<td>CLG-A</td>
<td>X'00F0'</td>
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<td></td>
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</tr>
<tr>
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<td>X'001D'</td>
<td>CLAK-P</td>
<td>X'0099'</td>
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<td></td>
</tr>
<tr>
<td>CL4-F</td>
<td>X'0035'</td>
<td>CL4-P</td>
<td>X'003D'</td>
<td>CLCK-P</td>
<td>X'00B9'</td>
<td>CLB-E</td>
<td>X'00B1'</td>
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</tr>
<tr>
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<td>CL6-P</td>
<td>X'005D'</td>
<td>CLEK-P</td>
<td>X'00D9'</td>
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<td>X'00D1'</td>
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<td>X'007D'</td>
<td>CLGK-P</td>
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<td>X'00F1'</td>
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<tr>
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<td>X'001E'</td>
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<td>X'009A'</td>
<td>CLA-C</td>
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<td>CL4-G</td>
<td>X'0036'</td>
<td>CL4-Q</td>
<td>X'003E'</td>
<td>CLCL-P</td>
<td>X'00BA'</td>
<td>CLC-C</td>
<td>X'00B2'</td>
<td></td>
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</tr>
<tr>
<td>CL6-G</td>
<td>X'0056'</td>
<td>CL6-Q</td>
<td>X'005E'</td>
<td>CLEC-P</td>
<td>X'00DA'</td>
<td>CLEC-C</td>
<td>X'00D2'</td>
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<td>X'007E'</td>
<td>CLGL-P</td>
<td>X'00FA'</td>
<td>CLG-C</td>
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<tr>
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<td>CLCM-P</td>
<td>X'00BB'</td>
<td>CLC-D</td>
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<td></td>
</tr>
<tr>
<td>CL6-H</td>
<td>X'0057'</td>
<td>CL6-R</td>
<td>X'005F'</td>
<td>CLEM-P</td>
<td>X'00DB'</td>
<td>CLD-E</td>
<td>X'00D3'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CL8-H</td>
<td>X'0077'</td>
<td>CL8-R</td>
<td>X'007F'</td>
<td>CLGM-P</td>
<td>X'00FB'</td>
<td>CLG-D</td>
<td>X'00F3'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Please note that the SAID values in Table 37 are different from the ones Table 38, Table 13 and Table 14.
For 3990-3, -6 and -6E controller emulations:

```plaintext
CESTPAIR DEVN(X'\dev#') PRIM(X'\ssid' \cmd_param X'\cca') SEC(X'\ssid' \serial# X'\cca')
[MODE(COPY|NOCOPY|RESYNC)] [PACE(pace)] [CRIT(YES|NO)] [MSGREQ(YES|NO)]
```

For 2105 controller emulation (new ‘lss’ parameter for LCU number):

```plaintext
CESTPAIR DEVN(X'\dev#') PRIM(X'\ssid' \cmd_param X'\cca' X'\lss') SEC(X'\ssid' \serial# X'\cca' X'\lss')
[MODE(COPY|NOCOPY|RESYNC)] [PACE(pace)] [CRIT(YES|NO)] [MSGREQ(YES|NO)]
```

Table 39 Using CESTPAIR to establish and resume TrueCopy Async pairs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cmd_param</strong></td>
<td>\AGnnd (nn = \text{consistency group number (00-7F) or master volume number (00-FF: for dummy pair mode).} ) (d = 0, N, \text{or} \ D)</td>
<td>Without MODE(RESYNC): Specifies the consistency group number (nn) to which the volume pair will belong. With MODE(RESYNC): Specifies that all M-VOLs in the consistency group should be resynchronized (resumed). (nn) must specify the consistency group number of the addressed device or the master volume number. For dummy pair mode, (nn) must specify the master volume number. (d) specifies the delay option for command retry due to sidefile: (0 = \text{normal delay for command retry starting at HWM (see “Graduated Delay Sidefile Management” on page 33)}) (N = \text{no delay time: no command retry delay due to sidefile for this pair. Use the N setting only for a limited number of critical volumes.} ) (D = \text{dummy pair mode (nn must specify the master volume number).} )</td>
</tr>
</tbody>
</table>

| **AVnnd** | \(nn = \text{consistency group number (00-7F) or master volume number (00-FF: for dummy pair mode).} \) \(d = 0, N, \text{or} \ D\) | With MODE(RESYNC): Specifies that only the addressed device should be re-synchronized. \(nn\) must specify the consistency group number of the addressed device or the master volume number. For dummy pair mode, \(nn\) must specify the master volume number. \(d\) specifies the delay option for command retry due to sidefile: \(0 = \text{normal delay for command retry starting at HWM (see “Graduated Delay Sidefile Management” on page 33)}\) \(N = \text{no delay time: no command retry delay due to sidefile for this pair. Use the N setting only for a limited number of critical volumes.} \) \(D = \text{dummy pair mode (nn must specify the master volume number).} \) |

| **PACE** | (pace) | Specifies the pace of the initial copy operation: 1-255, default=15 tracks. |

| **CRIT** | (YES) | Specifies the Error Level (TC390A pair option) of Group. |
| | (NO) | Specifies the Error Level (TC390A pair option) of Volume. |

- If the first digit of the \(\cmd_param\) is other than \(A\), the disk array interprets this command as pair establishment for TC390 Synchronous or SI390.
- The consistency group \(nn\) must be registered prior to this command. Otherwise this command will be rejected.
- When MODE(RESYNC) is specified, the consistency group number \(n\) must be the consistency group number to which the addressed device belongs. If a different number is specified, this command will be rejected.
- When MODE(RESYNC) is specified, the copy mode (synchronous or asynchronous) cannot be changed. If a different copy mode is specified, this command will be rejected.
• If the consistency group requirements (see “Consistency Groups” on page 49) are not satisfied, this command may/may not be rejected.
• The delay option prevents command retry delay for this pair when sidefile is above the HWM (see “Graduated Delay Sidetile Management” on page 33). If not specified correctly, command is rejected (F/M=04).
• When cmd_param AGxxx is specified, this command ends before the actual pair establishment/re-establishment successfully starts. Confirmation by CQUERY or IEA494I console message is recommended after this command.

**CSUSPEND**

Table 40 on page 162 describes how to use the CSUSPEND command to suspend TC390A pairs and groups. The syntax for the CSUSPEND command is:

For 3990-3, -6 and -6E controller emulations:

```
CSUSPEND DEVN(X'\text{dev#}') PRIM(X'\text{ssid}' cmd_param X'\text{cca}') SEC(X'\text{ssid}' serial# X'\text{cca}') [PRIVATE] [QUIESCE]
```

For 2105 controller emulation, addressed device is M-VOL (new ‘lss’ parameter for LCU no.):

```
CSUSPEND DEVN(X'\text{dev#}') PRIM(X'\text{ssid}' cmd_param X'\text{cca}' X'lss') SEC(X'\text{ssid}' serial# X'\text{cca}' X'lss') [PRIVATE] [QUIESCE]
```

For 2105 controller emulation, addressed device is R-VOL (new ‘lss’ parameter for LCU no.):

```
CSUSPEND DEVN(X'\text{dev#}') PRIM(X'\text{ssid}' cmd_param X'\text{cca}' X'lss') SEC(X'\text{ssid}' serial# X'\text{cca}' X'lss') [PRIVATE] [QUIESCE]
```

*NOTE:* If you need write access to an R-VOL, you must delete the pair (CDELPAIR).

**Table 40** Using CSUSPEND to suspend TrueCopy Async pairs

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd_param</td>
<td>AGD00</td>
<td>Specifies that all the volume pairs in the consistency group should be suspended after all pending recordsets are settled (Drain suspend option).</td>
</tr>
<tr>
<td></td>
<td>AGP00</td>
<td>Specifies that all the volume pairs in the consistency group should be suspended. Pending recordsets are not always settled before suspension (Purge suspend option).</td>
</tr>
<tr>
<td></td>
<td>AVD00</td>
<td>Specifies that only addressed volume pair should be suspended after the pending recordset for addressed volume settled (Drain suspend option).</td>
</tr>
<tr>
<td></td>
<td>AVP00</td>
<td>Specifies that only the addressed volume pair should be suspended. Pending recordsets for addressed volume are not always settled (Purge suspend option).</td>
</tr>
<tr>
<td>PRIMARY</td>
<td></td>
<td>Invalid keyword for TC390A volume pairs.</td>
</tr>
<tr>
<td>QUIESCE</td>
<td></td>
<td>Invalid keyword for TC390A volume pairs.</td>
</tr>
</tbody>
</table>

*If the addressed device is the M-VOL, only TC390A pairs in the same disk array are suspended. Volume pairs whose M-VOLs are behind other MCUs are not affected.

• If the first digit of the cmd_param is other than A, the disk array interprets this command as pair suspension for TC390 Synchronous or SI390.
• The D and P in cmd_param stand for the Drain and Purge options, respectively. For a detailed description of these TC390A suspend options, see “Suspending TrueCopy Pairs (Suspend Pair)” on page 126.
• When P (Purge) is specified, it is not possible to determine exactly which recordset will be settled before the addressed volume pair is suspended.
Regardless of the number of volume pairs to be suspended, this command ends before the actual pair suspension is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

**CDELPARI**

The following table describes how to use the CDELPAIR command to delete TC390A pairs and groups at the MCU. The syntax for the CDELPAIR command is:

For 3990-3, -6 and -6E controller emulations:

CDELPAIR DEVN(X’m#’) PRIM(X’ssid’ cmd_param X’cca’ X’lss’) SEC(X’ssid’ serial# X’cca’ X’lss’)

For 2105 controller emulation (new ‘lss’ parameter for LCU number):

CDELPAIR DEVN(X’m#’) PRIM(X’ssid’ cmd_param X’cca’ X’lss’) SEC(X’ssid’ serial# X’cca’ X’lss’)

*Only TC390A pairs in the same disk array are deleted. Volume pairs whose M-VOLs are behind other MCUs are not affected.

- If the first digit of the **cmd_param** is other than A, the disk array interprets this command as pair deletion for TC390 Synchronous or SI390.
- The specified pair(s) will be deleted regardless of their pair status. After the pair(s) is/are deleted, the volume(s) will not indicate their pair status before pair deletion. To delete TC390A pairs with their update sequence consistency ensured:
  - Issue the CSUSPEND command with **cmd_param** of AGP00 or AGD00.
  - Issue CQUERY to confirm that the specified pairs have been successfully suspended with the consistency status of Group.
  - Issue the CDELPAIR command.
- Regardless of the number of volume pairs to be deleted, this command ends before the actual pair deletion is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

**CRECOVER**

The following table describes how to use the CRECOVER command to delete TC390A pairs and groups at the RCU. The syntax for the CRECOVER command is:

For 3990-3, -6 and -6E controller emulations:

CRECOVER DEVN(X’m#’) PRIM(X’ssid’ cmd_param X’cca’) SEC(X’ssid’ serial# X’cca’

[old_volser new_volser])

For 2105 controller emulation (new ‘lss’ parameter for LCU number):
CRECOVER DEVN(’dev#’) PRIM(’ssid’ serial# X’cca’ X’lss’) SEC(’ssid’ cmd_param X’cca’ X’lss’) [ID(old_volser[new_volser])]

Table 42 Using CRECOVER to delete TrueCopy Async pairs/groups at the RCU

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd_param</td>
<td>AC000</td>
<td>Specifies that all volume pairs (R-VOLs) in the consistency group whose consistency status is Suspended-Group should be deleted.</td>
</tr>
<tr>
<td></td>
<td>AGP00</td>
<td>Specifies that all volume pairs (R-VOLs) in the consistency group should be deleted regardless of pair status and consistency status. All pending recordsets will be settled before deleting the pairs.</td>
</tr>
<tr>
<td></td>
<td>AVD00</td>
<td>Specifies that the addressed volume pair (R-VOL) should be deleted regardless of pair status and consistency status. All pending recordsets for the addressed pair will be settled before deleting the pair.</td>
</tr>
<tr>
<td>[ID(old_volser[new_volser])]</td>
<td>TC390A does not support this keyword. Depending on the timing, the write command to change the volume serial number may be rejected.</td>
<td></td>
</tr>
</tbody>
</table>

- The addressed device must be the R-VOL.
- If the first digit of the `cmd_param` is other than A, the disk array interprets this command as pair deletion for TC390 Synchronous or SI390.
- Regardless of the number of volume pairs to be deleted, this command ends before the actual pair deletion is successfully completed. Confirmation by CQUERY or IEA494I console message is recommended after this command.

**CQUERY for Serial Interface**

The CQUERY command can be issued to a TC390A pair to determine its detailed pair status as well as its TC390A pair and group options. The following example shows the output of the CQUERY command with the VOLUME parameter issued to a TC390A M-VOL.

**NOTE:** When the controller emulation type is 3990, the CQUERY command only displays the path types and path status of the first four paths, even if more than four paths have been added.

**NOTE:**
- The LIC LEVEL value in the following output is for example only, not valid number.
- The WWNN value in the following figure will be valid if mode 484 is ON. If mode 484 is OFF, the WWNN value is example only, not valid number.
- If mode 484 is ON, the status of path as using the fibre channel interface will be displayed. If mode 484 is OFF, ESCON will be indicated for the path status.
- If the former type subsystem or the subsystem of TagmaStore USP microcode version 50-05-XX-XX or earlier is connected, mode 484 must be OFF.
**CQUERY Output Example: M-VOL/FORMAT/VOLUME**

<table>
<thead>
<tr>
<th><em>DESI</em>E</th>
<th>LE<em>VE</em>L</th>
<th>S<em>TA</em>TE</th>
<th>P<em>A</em>T*H STATUS</th>
<th>S*ERIAL#</th>
<th>S*ERIAL#</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENDING</td>
<td>ACTIV<em>E</em></td>
<td>4300 10 00</td>
<td>4300 11 00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRIT(NO)...</td>
<td>CGRP<em>LB</em>(NO).</td>
<td>00A7FS0V0000</td>
<td>000000099999</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PATHS**, **SAID**, **DEST**, **STATUS**, and **DESCRIPTION** fields indicate the path status for this pair. If you issue the CQUERY command to the volume pair with the PATH parameter, all paths that can be used for this volume pair are displayed.

The **FIRST/LAST CYL OUT OF SYNC** and **PERCENT OF COPY COMPLETE** boxes indicate the first/last cylinder number and percentage of cylinders (including R-VOL cylinders) to be copied for pair resynchronization. For a more detailed description, see “Resuming TrueCopy Volume Pairs (Resume Pair)” on page 129.

The **TRACKS OUT OF SYNC** field indicates the number of tracks out of sync. The **TRACKS ON VOLUME** field indicates the total number of tracks that the paired volumes have. The **PERCENT OF COPY COMPLETE** indicates the percentage of cylinders that have already been copied for pair resynchronization. See “Viewing the Status of TrueCopy Volume Pairs (Pair Status)” on page 118 for a more detailed description.
The MCU serial number field is used to display the TCzA information shown in Figure 70.

**Figure 70** Controller Emulations

For 2105 controller emulations:

![Diagram for 2105 controller emulations]

For 3990-3, -6, and -6E controller emulations:

![Diagram for 3990-3, -6, and -6E controller emulations]

**Table 43** CQUERY output for serial and Fibre Channel

<table>
<thead>
<tr>
<th>LINK Parameter</th>
<th>Fibre Channel Interface</th>
<th>Fibre Channel Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode 484 OFF</td>
<td>Mode 484 ON</td>
</tr>
<tr>
<td>aa</td>
<td>Bit 0-3: RCU controller ID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>x2XF: Number stands for RCU controller ID.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bit 4-7: FREEZE option</td>
<td></td>
</tr>
<tr>
<td></td>
<td>x0: keep the status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>x1: Enabled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>x2: Disabled</td>
<td></td>
</tr>
<tr>
<td>bb</td>
<td>MCU port number (0x00-0xff)</td>
<td>SAID of MCU</td>
</tr>
<tr>
<td></td>
<td>(x00/ and the port number)</td>
<td></td>
</tr>
</tbody>
</table>
Table 44

The following example shows the output of the CQUERY command with the VOLUME parameter issued to a TC390A R-VOL.

**CQUERY Output Example: R-VOL/FORMAT/VOLUME**

<table>
<thead>
<tr>
<th>LINK Parameter</th>
<th>Fibre Channel Interface</th>
<th>Fibre Channel Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode 484 OFF</td>
<td>Mode 484 ON</td>
</tr>
<tr>
<td>cc</td>
<td>RCU port number (0x00-0xff)</td>
<td>SAID of RCU</td>
</tr>
<tr>
<td>dd</td>
<td>CU number (0x00-0xff)</td>
<td>(x’00’ and the port number)</td>
</tr>
</tbody>
</table>

The **SECONDARY WAS SUSPENDED (YMD/GMT)** box displays the consistency time of this pair if the pair status is Suspended and the timer type is System. For more information on the TC390A consistency time, see “Group Consistency Time” on page 35.

If the timer type for the consistency group is System, the RCU indicates the content of the time-stamp given by the primary system with no modification.
The MCU serial number field is used to display the TCzA information shown in Figure 71.

**Figure 71 Controller Emulations**

For 2105 controller emulation:

```
00 A 7F S G V 0 000
```

- Indicates the mode of the volume pair:
  - 1-3 = master pair, (1-3) indicates the number of dummy pairs.
  - D = dummy pair.
  - 0 = the volume pair is not a master pair or dummy pair.

- Indicates the Error Level of this volume pair:
  - G for Group, V for Volume.

- Indicates the consistency status of this volume pair:
  - G for Group, V for Volume, S for SEQCHK, M for MCU PS OFF.
  - The priority of these indicators is: M, S, G or V.

- Indicates the Timer Type of the consistency group:
  - S for System, L for Local, and N for None.

- Indicates the consistency group number (00-7F).

- Indicates the master volume number for dummy pair mode.

- Indicates that this volume pair is TCz Asynchronous, always A.

For 3990-3, -6 and -6E controller emulations:

```
A 00 S G G 0 030954
```

- Indicates the serial number of the RCU.

- Indicates the mode of the volume pair:
  - 1-3 = master pair, (1-3) indicates number of dummy pairs.
  - D = dummy pair.
  - 0 = the volume pair is not a master pair or dummy pair.

- Indicates the Error Level of this volume pair:
  - G for Group, V for Volume.

- Indicates the consistency status of this volume pair:
  - G for Group, V for Volume, S for SEQCHK, M for MCU PS OFF.
  - The priority of these indicators is: M, S, G or V.

- Indicates the Timer Type of the consistency group:
  - S for System, L for Local, and N for None.

- Indicates the consistency group number (00-7F).

- Indicates the master volume number for dummy pair mode.

- Indicates that this volume pair is TCz Asynchronous, always A.

**CQUERY for Fibre Channel Interface**

The path types and path status for Fibre Channel remote copy connections can be displayed by the CQUERY command. The RCU controller ID can also be displayed.

The following example shows the output of the CQUERY command and Table 45 on page 169 describes the parameters used in the example for both serial and Fibre Channel interface.

- **NOTE:** When the controller emulation type is 3990, the CQUERY command only displays the path types and path status of the first four paths, even if more than four paths have been added.

- **NOTE:**
  - The LIC LEVEL value in the following output is for example only, not valid number.
  - The WWNN value in the following figure will be valid if mode 484 is ON. If mode 484 is OFF, the WWNN value is example only, not valid number.
• If mode 484 is ON, the status of path as using the fibre channel interface will be displayed. If mode 484 is OFF, ESCON will be indicated for the path status.
• If the former type subsystem or the subsystem of TagmaStore USP microcode version 50-05-XX-XX or earlier is connected, mode 484 must be OFF.

Output Example: CQUERY

```
************** PPRC REMOTE COPY CQUERY - VOLUME **************
*                                          (PRIMARY)   (SECONDARY)
*                                          SSID CCA LSS SSID CCA LSS *
*DEVICE  LEVEL  STATE   PATH STATUS  SERIAL#  SERIAL#  *
*-------  -------  ------  -----------  ---------  ---------  *
* 2A10    PRIMARY.. PENDING... ACTIVE..  4300 10 00  4300 11 00 *
* CRIT(NO).... CGRPLB(NO). 00A7FS0V0000 00000000000 *
* PATHS SAID DEST STATUS: DESCRIPTION *
* -------  -------  ------  -------------------  *
* 1  aabb ccdd 00  PATH ESTABLISHED... *
* -------  ------  00    NO PATH............ *
* -------  ------  00    NO PATH............ *
* -------  ------  00    NO PATH............ *
* IF STATE = PENDING/SUSPEND: TRAIC KS OUT OF SYNC = 47277 *
*                             TRACKS ON VOLUME = 50085 *
*                             PERCENT OF COPY COMPLETE = 6% *
* SUBSYSTEM  WNNN  LIC LEVEL *
* -----------  -------------  -----------  *
* PRIMARY.... 0000000000000000 3.8.05.0000 *
*********************************************************************
```

Table 45  CQUERY output for serial and Fibre Channel

<table>
<thead>
<tr>
<th>LINK</th>
<th>Serial (ESCON) Interface</th>
<th>Fibre Channel Interface Mode 484 OFF</th>
<th>Fibre Channel Interface Mode 484 ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>aa</td>
<td>FREEZE option</td>
<td>Bit 0-3: RCU controller ID</td>
<td>SAID of MCU</td>
</tr>
<tr>
<td></td>
<td>0x00: keep the status</td>
<td>x2xF: Number stands for RCU</td>
<td>(‘00’ and the port number)</td>
</tr>
<tr>
<td></td>
<td>0x01: Enabled</td>
<td>controller ID.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0x02: Disabled</td>
<td>Bit 4-7: FREEZE option</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>x0: keep the status</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>x1: Enabled</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>x2: Disabled</td>
<td></td>
</tr>
<tr>
<td>bb</td>
<td>MCU port number (0x00-0x1f)</td>
<td>MCU port number (0x00-0xff)</td>
<td></td>
</tr>
<tr>
<td>cc</td>
<td>Link Addr (0x00-0xff)</td>
<td>RCU port number (0x00-0xff)</td>
<td>SAID of RCU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(‘00’ and the port number)</td>
<td></td>
</tr>
<tr>
<td>dd</td>
<td>CU number (0x00-0x1f)</td>
<td>CU number (0x00-0xff)</td>
<td></td>
</tr>
</tbody>
</table>

CGROUP (FREEZE/RUN) Support

The TC390 feature supports the CGROUP (FREEZE/RUN) TSO command for PPRC, which is also used in IBM’s Geographically Dispersed Parallel Sysplex (GDPS) environment. The CGROUP TSO command is used to control I/O operations for TC390 Synchronous pairs on a specific MCU-RCU pair. The CGROUP command is supported for the XP1024/XP128/XP12000/XP10000 (and other XP disk arrays) functioning as TC390 MCUs. The XP disk arrays provides all required host reporting for CGROUP operations (for example, IEA494I with extended long busy (ELB) state), which is a key component of GDPS operations. For disaster recovery implementations, you must use the XP1024/XP128/XP12000/XP10000 at both sites because the RCU will become MCUs in the event of a disaster.
The CGROUP command has two parameters, FREEZE and RUN. The CGROUP/FREEZE command stops all host I/O operations to the specified TC390 M-VOLs as well as all TC390 update copy operations to their associated R-VOLs. The CGROUP/RUN command changes the pair status to suspended and allows the M-VOLs to start accepting host I/Os.

**NOTE:** For 2105 controller emulation, do not use the FREEZE option. Use the CGROUP option of the CESTPATH command (see “CESTPATH” on page 156).

**CAUTION:** The XP1024/XP128/XP12000/XP10000 executes the CGROUP command on TC390 Synchronous pairs. TC390A does not support the CGROUP TSO command. If CGROUP is issued to a TC390A volume, the XP1024/XP128/XP12000/XP10000 will reject the command. CGROUP (FREEZE/RUN) operations on TC390 Synchronous pairs do not affect TC390A pairs in any way.

### Requirements

The CGROUP command can be issued only to a TC390 Synchronous M-VOL or a simplex volume in the MCU. If CGROUP is issued to a TC390 R-VOL, the RCU will reject the CGROUP command (F/M=0F, TC390 error code=58). The CGROUP command must be issued to each logical CU image of the MCU, unless the XP1024/XP128/XP12000/XP10000’s mode 64 (see description below) is enabled.

The requirements for CGROUP (FREEZE/RUN) support are:

- **MCU:** The MCUs to which the CGROUP command will be issued must be XP1024/XP128/XP12000/XP10000s (all-mainframe and multiplatform disk arrays are both supported). For disaster recovery implementations, you must use the XP1024/XP128/XP12000/XP10000 at both sites because the RCU will become MCUs in the event of a disaster.
- **PPRC:** The host systems at the main and remote sites must have IBM PPRC support as well as the PPRC ERP PTF installed. ICKDSF does not support the CGROUP command.
- **SSIDs:** The MCUs to which the CGROUP command will be issued must have consecutive SSIDs. The HP representative configures the SSIDs on the XP1024/XP128/XP12000/XP10000 SVP.

**CAUTION:** MVS requires that the disk array be offline during SSID changes. Reconfiguring SSIDs is therefore a disruptive event that must be carefully planned.

- **FREEZE Option (3990 only):** The FREEZE option must be enabled on the MCUs to which the CGROUP command will be issued. If not enabled, the MCU will reject the CGROUP TSO command. The FREEZE option is enabled using the Command View XP management station or XP Remote Web Console (RCU Option window). Enable the FREEZE option only after adding all MCU-RCU paths.

**NOTE:** Mode 104 (see below) changes the default FREEZE option from disabled to enabled. Mode 104 is invalid for 2105 emulation. For 2105 controller emulation, do not use the FREEZE option. Use the CGROUP option of the CESTPATH command (see “CESTPATH” on page 156).

The definition of the **LINK Parameter for the CESTPATH command** will be expanded to specify the FREEZE option on an **LCU pair basis**. The FREEZE option set by the CESTPATH command is effective until another CESTPATH command that specifies the same LCU pair but a different FREEZE Option is issued. The command syntax and parameter definitions are as follows (3990 only):

```
CESTPATH PRIM(x’ssid’ serial#) SEC(x’ssid’ serial#) LINK(x’pppllc’, ‘pppllc’,…) DEVN(x’1234’)
```

where:
\( pppp \) = Fibre Channel port ID of the primary CU (MCU) from which the TC390 paths should be established and the FREEZE option for the LCU pair. Note that the first two digits (FREEZE option) must be the same in a series of link parameters.

For ESCON cable:

<table>
<thead>
<tr>
<th>Value</th>
<th>Port ID</th>
<th>Freeze Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>X’0000’-X’001F’</td>
<td>Interface 1A-2R</td>
<td>Default</td>
</tr>
<tr>
<td>X’0100’-X’011F’</td>
<td>Interface 1A-2R</td>
<td>Enabled</td>
</tr>
<tr>
<td>X’0200’-X’021</td>
<td>Interface 1A-2R</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

For Fibre Channel cable:

<table>
<thead>
<tr>
<th>Value</th>
<th>Port ID</th>
<th>Freeze Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>X’4000’-X’40FF’</td>
<td>Interface 1A-GR</td>
<td>Default</td>
</tr>
<tr>
<td>X’4100’-X’41FF’</td>
<td>Interface 1A-GR</td>
<td>Enabled</td>
</tr>
<tr>
<td>X’4200’-X’42FF’</td>
<td>Interface 1A-GR</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

\( ll \) = Fibre-channel port ID of the secondary CU (RCU) from which the paths of the TCz should be established.

For Fibre Channel cable: Fibre Channel port ID of the secondary CU (RCU) from which the paths of the TC390 should be established.

\( cc \) = LCU number of the secondary CU (RCU).

The parameters may be described in the GDPS DASD configuration list. The required link parameter values must be written into the list or must be given to RCMF input.

- **Mode 59 (HXRC only):** Mode 59 must be ON for HXRC (activates variable RECSET size to provide performance improvement).
- **Mode 64 (optional):** Mode 64 extends the range of the CGROUP command to the entire MCU instead of just one logical CU image. When mode 64 is enabled, one CGROUP command to any M-VOL or simplex volume in the MCU is executed across all MCU-RCU paths and on all TC390 M-VOLs in the specified MCU, including all CU images (CU0-CU3). When mode 64 is disabled, you must issue a separate CGROUP command to an M-VOL (or simplex volume) in each logical CU image of the MCU. Although this mode can be enabled nondisruptively (that is, existing TC390 pairs do not have to be deleted), mode 64 should be enabled at the same time that mode 49 is enabled.

\[\text{NOTE: For operations in a GDPS environment, mode 64 must be OFF.}\]

- **Mode 104 (3990 only):** Mode 104 changes the default FREEZE option to \textit{enabled}. This mode should be enabled when CGROUP is being used in the GDPS environment. When mode 104 is enabled, the FREEZE option will remain enabled after the XP1024/XP128/XP12000/XP10000 is powered off and then back on (for example, due to some disaster). When mode 104 is not enabled, the FREEZE option will revert to the default value of \textit{disabled} after the XP1024/XP128/XP12000/XP10000 is powered off and back on.

\[\text{NOTE: For operations in a GDPS environment, mode 104 must be ON.}\]

Mode 104 is invalid for 2105 emulation.

For more information on XP1024/XP128/XP12000/XP10000 SVP modes related to TC390 (and HXRC) operations, refer to Table 4 on page 20.

**CGROUP (FREEZE/RUN) Command**

The CGROUP TSO command specifies all of the following:
• The device (LDEV ID of TC390 M-VOL or simplex volume) (DEVN parameter).
• The MCU (S/N and lowest SSID in CU image) (PRIM parameter).
• The RCU (S/N and lowest SSID in CU image) (SEC parameter).

The CGROUP TSO command has the following two options:

- **FREEZE** *(3990 only)*: When CGROUP is issued with the FREEZE option, the MCU:
  - Blocks the logical path(s) between the specified MCU CU image and RCU CU image to stop all TC390 update copy operations to the R-VOLs in the specified RCU.
  - Presents state change pending (SCP) with extended long busy status to host I/O requests, which causes the host to queue I/Os for the M-VOLs. SCP is indicated until the CGROUP/RUN command is issued or until the SCP delay time expires.

  **NOTE:** After all logical MCU-RCU paths are established, make sure to specify the SCP delay time (0-600 seconds) for the MCU using the RCU Option window. To register the SCP delay time, select **OK** to close the RCU Option window, even if you did not make any changes.

  If the specified MCU does not have any TC390 M-VOLs, the FREEZE command is executed without performing any operations (paths are not blocked, SCP is not indicated).

  For 2105 emulation, use the CESTPATH CGROUP option to control freeze.

- **RUN**: When CGROUP is issued with the RUN option, the MCU:
  - Suspends all TC390 pairs with M-VOLs on the specified MCU CU image.
  - Presents a state-change-interrupt (SCI) to the host(s) so that the host(s) re-issue the I/Os that were waiting while the M-VOLs were in the SCP state.
  - Changes the TC390 M-VOL fence level to **Never** (PPRC CRIT=NO) so that the suspended M-VOLs accept host write I/O operations.

The following table shows the TC390 pair status for TC390 M-VOLs and R-VOLs during CGROUP (FREEZE/RUN) operations.

**Table 46**  TrueCopy pair status during CGROUP (FREEZE/RUN) operations

<table>
<thead>
<tr>
<th>TC390 Pair Status</th>
<th>Before CGROUP (FREEZE/RUN)</th>
<th>After CGROUP/FREEZE</th>
<th>After CGROUP/RUN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M-VOL</td>
<td>R-VOL</td>
<td>M-VOL</td>
</tr>
<tr>
<td>Simplex</td>
<td>---</td>
<td>---</td>
<td>Simplex</td>
</tr>
<tr>
<td>Pending</td>
<td>Pending</td>
<td>Pending</td>
<td>Pending</td>
</tr>
<tr>
<td>Duplex</td>
<td>Duplex</td>
<td>Duplex</td>
<td>Duplex</td>
</tr>
<tr>
<td>Suspended</td>
<td>Suspended</td>
<td>Suspended</td>
<td>Suspended</td>
</tr>
</tbody>
</table>

**Using the CGROUP Command**

The following figure shows a simplified operational example of the CGROUP (FREEZE/RUN) command implemented in a GDPS environment. The CGROUP (FREEZE/RUN) TSO command can be issued by the user or through automation (such as GDPS) to perform the following sequence of actions:

1. Suspend host updates to all TC390 M-VOLs on the specified MCU.
2. Block the specified MCU-RCU path to stop update copy operations to the R-VOLs.
3. Change all TC390 M-VOLs on the specified MCU to suspended.
4. Resume host updates to the suspended M-VOLs.
5. The add RCU operation (CESTPATH) must be performed to re-establish the blocked logical paths. After the MCU-RCU path is re-established, the resume pair operation (CESTPAIR/RESYNC) must be performed to resume the suspended pairs.

For the following figure:
1. Read/write I/Os are issued from the host.
2. A failure occurs on a TC390 M-VOL and the MCU suspends the pair.
3. Suspend and extended long busy state are reported to the host.
4. Host reports IEA494I with extended long busy state.
5. CGROUP/FREEZE commands are issued to groups.
6. SCP sense bytes are reported if an I/O is issued to a frozen volume.
7. I/Os are queued at the host.
8. Switch to remote (secondary) site.

Figure 72  Overview of GDPS operations

Using PPRC TSO Commands with CGROUP Support

CESTPATH. You can use the CESTPATH command to recover a blocked MCU-RCU path. Make sure to use the same parameters as when the path was established.

CESTPAIR. After you re-establish the MCU-RCU path that was blocked, you can use the CESTPAIR/RESYNC command to resume the TC390 pairs suspended by the CGROUP/RUN command.

CDELPairs. After you re-establish the MCU-RCU path that was blocked, you can use the CDELPairs command to delete the TC390 pairs suspended by the CGROUP/RUN command. If CDELPairs is issued to a TC390 pair whose MCU-RCU path is still blocked, the MCU rejects the command (F/M=0F, TC390 error code=5A).

CRECOVER. You can use the CRECOVER command to change a suspended R-VOL to simplex. This command is issued to the R-VOL and does not affect the suspended M-VOL.

CQUERY/PATHS. The following example shows the output of the CQUERY command issued to a TC390 MCU to which the CGROUP/FREEZE command has been issued.
The following example shows the output of the CQUERY command issued to the TC390 RCU that has a blocked path due to the CGROUP/FREEZE command.

**CQUERY Output Example: M-VOL/Paths/Format**

```
* PRIMARY UNIT: SERIAL#= 000000090217 SSID= 00F8 *
* FIRST SECOND THIRD FOURTH *
* SECONDARY SECONDARY SECONDARY SECONDARY *
* SERIAL NO: 000000090217 ................ ........... *
* SSID: 00F8 0000 0000 0000 *
* PATHS: 1 0 0 0 *
* SAID DEST S* SAID DEST S* SAID DEST S* SAID DEST S* *
* -------------- -------------- -------------- -------------- *
* 1: 0020 FF04 10 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* 2: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* 3: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* 4: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* S* = PATH STATUS: *
* 00=NO PATH 01=ESTABLISHED 02=INIT FAILED *
* 03=TIME OUT 04=NO RESOURCES AT PRI 05=NO RESOURCES AT SEC *
* 06=SERIAL# MISMATCH 07=(RESERVED) 08=(RESERVED) *
* 09=(RESERVED) 10=CONFIGURATION ERROR *
```

**CQUERY Output Example: R-VOL/Paths/Format**

```
* PRIMARY UNIT: SERIAL#= ............ SSID= 0000 *
* FIRST SECOND THIRD FOURTH *
* SECONDARY SECONDARY SECONDARY SECONDARY *
* SERIAL NO: 000000090217 ........... ........... ........... *
* SSID: 00F8 0000 0000 0000 *
* PATHS: 1 0 0 0 *
* SAID DEST S* SAID DEST S* SAID DEST S* SAID DEST S* *
* -------------- -------------- -------------- -------------- *
* 1: 0020 FF04 10 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* 2: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* 3: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* 4: ---- ---- 00 ---- ---- 00 ---- ---- 00 ---- ---- 00 *
* S* = PATH STATUS: *
* 00=NO PATH 01=ESTABLISHED 02=INIT FAILED *
* 03=TIME OUT 04=NO RESOURCES AT PRI 05=NO RESOURCES AT SEC *
* 06=SERIAL# MISMATCH 07=(RESERVED) 08=(RESERVED) *
* 09=(RESERVED) 10=CONFIGURATION ERROR *
```

**CQUERY/VOLUME.** The following example shows the output of the CQUERY command issued to a TC390 M-VOL that has been suspended by the CGROUP/RUN command. As shown in the example, CQUERY issued to an M-VOL also indicates the status of the FREEZE option: CGRPLB(YES) = enabled, CGRPLB(NO) = disabled.
The following example shows the output of the CQUERY command issued to a TC390 R-VOL whose M-VOL has been suspended by the CGROUP/RUN command. The pair status and path status at the RCU are not changed.

### CQUERY Output Example: M-VOL/Volume/Format

<table>
<thead>
<tr>
<th>RCU Option</th>
<th>Path Status</th>
<th>Paths SAID/DEST Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREEZE</td>
<td>INACTIVE</td>
<td>CONFIGURATION ERROR</td>
<td></td>
</tr>
</tbody>
</table>

### CQUERY Output Example: R-VOL/Volume/Format

<table>
<thead>
<tr>
<th>RCU Option</th>
<th>Path Status</th>
<th>Paths SAID/DEST Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREEZE</td>
<td>INACTIVE</td>
<td>CONFIGURATION ERROR</td>
<td></td>
</tr>
</tbody>
</table>

### IEA494I and IEA491E Console Messages

When a TC390 pair is suspended, whether user-requested or due to failure, the MCU generates sense information to notify the host(s). If the PPRC ERP PTF is installed and **PPRC Support = Yes** is selected on the RCU option window, this notification results in an IEA494I system console message as well as an IEA491E message. The IEA491E message indicates the reason for suspension. The IEA494I and IEA491E messages are generated by the zSeries and S/390 host based upon SSBs (sense bytes) from the disk array and not SIMs from the disk array. Therefore, SIMs reported by the disk array to the host are not used by the GDPS scripting.

The IEA494I message is recommended as a trigger for automation over the IEA491E message. The IEA491E message is reported to only one host system, whereas the IEA494I message is reported to all attached MVS hosts each time the M-VOL pair status changes. GDPS uses the IEA494I message with extended long busy as a trigger for CGROUP (FREEZE/RUN).
NOTE: If PPRC Support = No is selected on the RCU Option window, the host generates the system console message that includes the SIM instead of the IEA494I or IEA491E message.

IEA494I Message

Whenever a TC390 pair status changes, with the exception of the TC390A transition states suspending and deleting, the MCU reports state-change-interrupt (SCI) to all hosts. In response to the SCI, the IEA494I system console message is generated (if supported by the host). The XP1024/XP128/XP12000/XP10000 reports SCI for both online and offline devices, but the host system does not generate console messages for offline devices. Therefore, the IEA494I message is never generated with a TC390 R-VOL device address.

The following figure shows an example of an IEA494I message.

• The XP1024/XP128/XP12000/XP10000 MCU reports SCI for all TC390A pairs whose status has changed, regardless of the Group/Volume option of the suspend or delete pair operation (if the status change was user-requested).
• The XP1024/XP128/XP12000/XP10000 MCU reports SCI for all TC390 M-VOLs (synchronous only) that are in the SCP state due to the CGROUP/FREEZE command. As shown in the following figure, this IEA494I message indicates the extended long busy state.
• The XP1024/XP128/XP12000/XP10000 MCU reports SCI for all TC390 M-VOLs (synchronous only) that are suspended due to the CGROUP/RUN command. This IEA494I message indicates the extended long busy state.
• When the FREEZE option is enabled, the XP1024/XP128/XP12000/XP10000 MCU reports SCI for a TC390 pair that is suspended due to a failure. When the host supports GDPS, this IEA494I message with extended long busy triggers the CGROUP (FREEZE/RUN) command.

Output Example: IEA494I Message with Extended Long Busy State

IEA494I 0FC3,RD0FC3,PPRC PAIR SUSPENDING,SSID=0FC0,CCA=03,EXTENDED LONG BUSY STATE

IEA491E Message

When a TC390 pair is suspended due to a failure, the XP1024/XP128/XP12000/XP10000 MCU reports SCI as well as unit check status and sense bytes with F/M = FB. In response to the F/M=FB sense bytes, the IEA491E system console message is generated (if supported by the host). The following figure shows an example of an IEA491E message.

NOTE: If the host supports GDPS and the FREEZE option is enabled, the IEA494I system console message with extended long busy, which was generated in response to the SCI, triggers the CGROUP (FREEZE/RUN) command.

Output Example: IEA491E Message

IEA491E DSLFC0,PPRC SUSPENDED,SECONDARY NOT READY,INTERVENTION_REQUIRED,(PRI)SER=0113-90797,CCA=00 (SEC)SER=0113-90217,CCA=

XP1024/XP128/XP12000/XP10000 Response Characteristics to Failure Conditions

The XP1024/XP128/XP12000/XP10000 supports the CGROUP command in the GDPS environment by performing PPRC-compatible actions and returning PPRC-compatible messages to failure conditions. The following figure shows the failure conditions and the following table describes the response characteristics of the XP1024/XP128/XP12000/XP10000 to these failure conditions.
NOTE: The PPRC Support=Yes option must be selected on the RCU option window (see “Registering an RCU (Add RCU)” on page 87). If not, the host processor generates the system console message that includes the SIM instead of the IEA494I or IEA491E message.

Figure 73 Failure conditions (described in Table 47)

Table 47 XP1024/XP128/XP12000/XP10000 response characteristics to failure conditions

<table>
<thead>
<tr>
<th>Failure Condition</th>
<th>TC390 Pairs Suspended?</th>
<th>Expected Messages</th>
<th>FREEZE Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure of all channel interfaces on the MCU</td>
<td>No</td>
<td>No IEA480, IEA491, or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>Failure of a disk on the MCU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Failure of one physical device in a parity group</td>
<td>No</td>
<td>1. IEA480 message (SIM for physical device blocked or port of physical device blocked) is displayed when the next I/O is issued to any logical volume in the parity group. 2. No IEA491 or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>b. Failure of two physical devices in a parity group</td>
<td>No</td>
<td>1. IEA480 message (SIM for LDEV blocked) is displayed when the next I/O is issued to any logical volume in the parity group. 2. No IEA491 or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>Failure Condition</td>
<td>TC390 Pairs Suspended?</td>
<td>Expected Messages</td>
<td>FREEZE Function</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| Failure of a link between the MCU and RCU                                         | No                     | 1. IEA480 message (SIM for TC390 path blocked) is reported when the next I/O to any device in this MCU is issued.  
  2. No IEA491 or IEA494 messages are displayed.                                   | Not activated     |
| Failure of NVS on the MCU; Failure of MCU read cache                              |                        |                                                                                   |                 |
| a. One side of MCU cache blocked due to failure                                   | No                     | 1. IEA480 (SIM for cache blocked) is reported when the next I/O to any device in this MCU is issued.  
  2. No IEA491 or IEA494 messages are displayed.                                   | Not activated     |
| b. One side of MCU cache blocked due to maintenance                                | No                     | No IEA480, IEA491, or IEA494 messages are displayed.                               | Not activated   |
| c. One side of MCU cache blocked by SET CACHE OFF                                  | No                     | No IEA480, IEA491, or IEA494 messages are displayed.                               | Not activated   |
| f Both sides of MCU cache blocked due to failure                                   | No                     | No IEA480, IEA491, or IEA494 messages are displayed.                               | Not activated   |
| Failure of a disk on the RCU                                                       |                        |                                                                                   |                 |
| a. Failure of one physical device in a parity group                                | No                     | 1. The RCU reports IEA480 message (SIM for physical device blocked or port of physical device blocked) to either the MCU or the host processor (whichever issues the next I/O first) when the next I/O is issued to any logical volume in the parity group. If MCU receives the SIM, it passes the SIM to the attached host processor, and the IEA480 message is reported when the next I/O to this MCU is issued to any main (primary) volume paired with the logical volume in the parity group.  
  2. No IEA491 or IEA494 messages are displayed.                                   | Not activated     |
| b. Failure of two physical devices in a parity group                                | Yes                    | 1. The RCU reports IEA480 message (SIM for LDEV blocked) to either the MCU or the host processor (whichever issues the next I/O first) when the next I/O is issued to any logical volume in the parity group. If MCU receives the SIM, it passes the SIM to the attached host processor, and the IEA480 message is reported when the next I/O to this MCU is issued to any main volume paired with the logical volume in the parity group.  
  2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed.     | Activated if the FREEZE option is enabled for the affected LCU pairs.          |
**Table 47** XP1024/XP128/XP12000/XP10000 response characteristics to failure conditions (continued)

<table>
<thead>
<tr>
<th>Failure Condition</th>
<th>TC390 Pairs Suspended?</th>
<th>Expected Messages</th>
<th>FREEZE Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. One side of RCU cache blocked due to failure</td>
<td>No</td>
<td>1. The RCU reports IEA480 message (SIM for cache blocked) to either the MCU or the host processor (whichever issues the next I/O first). If MCU receives the SIM, it passes the SIM to the attached host processor. Therefore, IEA480 is reported when the next I/O to any device in this MCU issued. 2. No IEA491 or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>b. One side of RCU cache blocked due to maintenance</td>
<td>No</td>
<td>No IEA480, IEA491, or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>c. One side of RCU cache blocked by SET CACHE OFF</td>
<td>No</td>
<td>No IEA480, IEA491, or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>« Both sides of RCU cache blocked due to failure</td>
<td>Yes</td>
<td>1. No IEA480 (SIM of cache blocked) is displayed. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed. 4. If CGROUP FREEZE and RUN are issued, IEA494 messages showing PAIR SUSPENDED are displayed when the MCU accepts CGROUP-RUN. These messages are from the TC390 pairs for which FREEZE option is enabled and from main volumes that did not already report IEA491/IEA494 at (3).</td>
<td>Activated if the FREEZE option is enabled for the affected LCU pairs.</td>
</tr>
<tr>
<td>» Failure of all links between the MCU and RCU</td>
<td>Yes</td>
<td>1. IEA480 (SIM for TC390 path blocked) message is reported when the next I/O to any device in this MCU is issued. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed.</td>
<td>Activated if the FREEZE option is enabled for the affected LCU pairs.</td>
</tr>
<tr>
<td>… Power failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. On the MCU</td>
<td>No</td>
<td>No IEA480, IEA491, or IEA494 messages are displayed.</td>
<td>Not activated</td>
</tr>
<tr>
<td>b. On the RCU</td>
<td>Yes</td>
<td>1. IEA480 (SIM of TC390 path blocked) message is reported when the next I/O to any device in this MCU is issued. 2. One (or more) IEA494 messages showing EXTENDED LONG BUSY are displayed. 3. One (or more) IEA491 and IEA494 messages showing PAIR SUSPENDED are displayed.</td>
<td>Activated if the FREEZE option is enabled for the affected LCU pairs.</td>
</tr>
</tbody>
</table>

1. When one side of the MCU cache is blocked, duplex TC390 pairs are not affected, but pending duplex TC390 pairs are suspended. Suspending TC390 pairs with pending duplex status provides additional protection in the unlikely event of a cache failure.
GDPS-TC390-HXRC Matrix

The following table compares IBM 3990-6E GDPS support to XP disk array GDPS support, and also provides a comparison of TC390 and HXRC to PPRC and XRC.

NOTE: The information shown in the following table was current at the time of publication of this document but is expected to change over time. Contact your HP account support representative for the latest GDPS-TC390-HXRC matrix information.

### Table 48  GDPS-TC390-HXRC matrix

<table>
<thead>
<tr>
<th>zSeries and S/390 Feature</th>
<th>IBM 3990-6E</th>
<th>XP1024/XP128/XP12000/XP10000</th>
<th>XP48/XP512</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDPS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned outage</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Unplanned outage</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>through IEA494I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IEA494I Long Busy message</td>
<td>Default time of 120 seconds for FREEZE after IEA494I message is issued.</td>
<td>Default time for FREEZE is 120 seconds, optional user-defined from 0 to 600 seconds after IEA494I message is issued.</td>
<td>Default time for FREEZE is 120 seconds, optional user-defined from 0 to 600 seconds after IEA494I message is issued.</td>
</tr>
<tr>
<td>Peer-to-Peer Remote Copy</td>
<td>PPRC</td>
<td>TC390, TC390A</td>
<td>CA</td>
</tr>
<tr>
<td>disk array-disk array</td>
<td>ESCON – maximum of 43 km</td>
<td>Communication via switch and extender using fibre-channel and fibre-channel cable</td>
<td>ESCON – maximum of 43 km</td>
</tr>
<tr>
<td>interface</td>
<td>Communication through channel extenders</td>
<td>Communication through channel extenders</td>
<td>Communication through channel extenders</td>
</tr>
<tr>
<td>Copy modes supported</td>
<td>Synchronous</td>
<td>Synchronous, asynchronous The default for IBM software commands is synchronous.</td>
<td>Synchronous, semi-synchronous, asynchronous Semi-synchronous can be specified only by Remote Console PC (or SVP). The default for IBM software commands is synchronous.</td>
</tr>
<tr>
<td>Dual Copy combination</td>
<td>Supported</td>
<td>Not Supported. Dual Copy is not supported by disk array.</td>
<td>Not Supported. Dual Copy is not supported by disk array.</td>
</tr>
<tr>
<td>Feature</td>
<td>IBM 3990-6E</td>
<td>XP1024/XP128/XP12000/XP10000</td>
<td>XP48/XP512</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>-----------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td><strong>TSO command Support</strong></td>
<td>Supported</td>
<td>Supported. Some additional options only available through the Command View XP management station or XP Remote Web Console (or SVP).</td>
<td>Supported. Some additional options only available through the Remote Console PC (or SVP).</td>
</tr>
<tr>
<td><strong>ICKDSF command support</strong></td>
<td>Supported</td>
<td>Supported. Some additional options only available through the Command View XP management station or XP Remote Web Console (or SVP).</td>
<td>Supported. Some additional options only available through the Remote Console PC (or SVP).</td>
</tr>
<tr>
<td><strong>P/DAS support</strong></td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Maximum pairs</strong></td>
<td>64</td>
<td>8,192</td>
<td>4,096</td>
</tr>
<tr>
<td><strong>Maximum paths between disk arrays</strong></td>
<td>4</td>
<td>8 per logical control unit</td>
<td>8 per logical control unit</td>
</tr>
<tr>
<td><strong>Number of copy operations on initial copy</strong></td>
<td>4</td>
<td>1 to 4, default is 4 per LCU. Requires Command View XP management station or XP Remote Web Console (or SVP) to change default.</td>
<td>1 to 4, default is 4 per LCU. Requires Remote Console PC (or SVP) to change default.</td>
</tr>
<tr>
<td><strong>Dedicated interface between disk arrays</strong></td>
<td>No</td>
<td>Requires main disk array port to be set to Target by Command View XP management station or XP Remote Web Console (or SVP) or automatically in response to establish and delete path commands.</td>
<td>Requires main disk array port to be set to LCP or Target by Remote Console PC (or SVP) or automatically in response to establish and delete path commands.</td>
</tr>
<tr>
<td><strong>PACE parameter initial copy option</strong></td>
<td>1-255, default is 15 (setting of 1 copies a maximum of 3 tracks at a time, 2,255 copies a maximum of 15 tracks at a time)</td>
<td>3 or 15, default = 15 tracks</td>
<td>3 or 15, default = 15 tracks</td>
</tr>
<tr>
<td><strong>CRITICAL pair error options (Fence Level parameter)</strong></td>
<td>Yes</td>
<td>RVOL Data</td>
<td>RVOL Data</td>
</tr>
<tr>
<td></td>
<td>No – Default</td>
<td>Never – Default</td>
<td>Never – Default</td>
</tr>
<tr>
<td></td>
<td>RVOL Status</td>
<td>RVOL Status</td>
<td>RVOL Status</td>
</tr>
<tr>
<td><strong>CGROUP</strong></td>
<td>FREEZE/RUN by logical controller SSID pair</td>
<td>FREEZE/RUN by logical controller SSID pair, or optionally by entire disk array using mode 64.</td>
<td>FREEZE/RUN by logical controller SSID pair, or optionally by entire disk array using mode 64.</td>
</tr>
<tr>
<td><strong>CQUERY</strong></td>
<td>Supported</td>
<td>Supported. When the connected control unit is an XP48/XP512, Mode 49 must be ON to report on all the 256 LDEVs in each logical control unit.</td>
<td>Supported.</td>
</tr>
</tbody>
</table>

Table 48  GDPS-TC390-HXRC matrix (continued)
<table>
<thead>
<tr>
<th>zSeries and S/390 Feature</th>
<th>IBM 3990-6E</th>
<th>XP1024/XP128/XP12000/XP10000</th>
<th>XP48/XP512</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-Unique Features (specified through the Command View XP management station, XP Remote Web Console, or SVP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RCU Options</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum paths</td>
<td>Not supported</td>
<td>Default = 1. If the minimum number of MCU-RCU active paths falls below this value, all pairs will be suspended based on the Fence Level option in effect.</td>
<td>Default = 1. If the minimum number of MCU-RCU active paths falls below this value, all pairs will be suspended based on the Fence Level option in effect.</td>
</tr>
<tr>
<td>PPRC support by host</td>
<td>Host must support PPRC</td>
<td>Default = YES - PPRC supported, optional capability to allow host support for non PPRC capable operating systems.</td>
<td>Default = YES - PPRC supported, optional capability to allow host support for non PPRC capable operating systems.</td>
</tr>
<tr>
<td>RCU-to-MCU SIM reporting</td>
<td>Not supported per the IBM document, <em>Planning for IBM Remote Copy</em> (SG24-2594-009 p.184)</td>
<td>To any host or only to RCU host</td>
<td>To any host or only to RCU host</td>
</tr>
<tr>
<td>RCU to MCU service SIM reporting</td>
<td>Not supported per the IBM document, <em>Planning for IBM Remote Copy</em> (SG24-2594-009 p.184)</td>
<td>Default = Not report; Table 49 on page 184 and Table 50 on page 185 list remote copy service SIMs. Designed for non-MVS operating systems that do not support SIM reporting.</td>
<td>Default = Not report; Table 49 on page 184 and Table 50 on page 185 list remote-copy service SIMs. Designed for non-MVS operating systems that do not support SIM reporting.</td>
</tr>
<tr>
<td><strong>Pair Options</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cache fast write data</td>
<td>Not supported</td>
<td>Optional to R-VOL, default = M-VOL</td>
<td>Optional to R-VOL, default = M-VOL</td>
</tr>
<tr>
<td><strong>Extended Remote Copy</strong></td>
<td>XRC</td>
<td>HXRC*</td>
<td>HXRC</td>
</tr>
<tr>
<td>SMS 1.3 - SDM ver. 1</td>
<td>Not supported</td>
<td>Not supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>SMS 1.3 + PTFs - SDM ver. 2</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>SMS 1.4 – SDM ver. 2</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>SMS 1.4+ PTFs – SDM ver. 2</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>SMS 1.5 – SDM ver. 2</td>
<td>Supported</td>
<td>Not supported, in QA test</td>
<td>Not supported, in QA test</td>
</tr>
<tr>
<td>Max. sessions</td>
<td>4 per disk array</td>
<td>4 per CU image, 128 total</td>
<td>4 per CU image, 64 total</td>
</tr>
<tr>
<td>Max. volumes</td>
<td>256 per disk array</td>
<td>256 per CU image, 8,192 total</td>
<td>256 per CU image, 4,096 total</td>
</tr>
<tr>
<td>Utility volumes with Multi Reader Support #OW30183</td>
<td>Multiple supported</td>
<td>Multiple supported</td>
<td>Multiple supported</td>
</tr>
<tr>
<td>SIM/error messages</td>
<td>Per the IBM document</td>
<td>Per the IBM document</td>
<td>Per the IBM document</td>
</tr>
</tbody>
</table>
NOTE: For more information on HXRC device blocking and load balancing control, refer to “HXRC Device Blocking and Load Balancing” on page 212.

Pinned Track Recovery for TrueCopy Volumes

If a pinned track occurs on a TC390 M-VOL or R-VOL, the MCU will suspend the pair (SIM reference code = D41x, D42x, DB1x, DB2x). 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 TCz pair that contains the volume with the pinned track, and select the correct CU image.
2. Delete the TCz pair that contains the volume with the pinned track.

   NOTE: If you delete the TCz pair containing the volume with the pinned track, delete only the pair containing the volume with the pinned track. To delete only the TCz Asynchronous volume pair containing the volume with the pinned track, select Volume for Asynchronous Parameters and Delete Range.

3. If the volume is offline (for example, R-VOL has pinned track)), vary the volume online.
4. Perform your usual procedure for recovering data from a pinned track. Refer to the pinned track recovery procedures for your operating system. Contact your HP account support representative to inform them of the pinned track.
5. If the volume was previously offline (for example, R-VOL), make sure to vary the volume offline again.
6. Restart the volume pair using the Add Pair window, making sure to use the Entire initial copy option.

   NOTE: Be sure to specify the volume pair for which the pinned track recovery operation was performed.

SIM Reporting

The XP1024/XP128/XP12000/XP10000 reports a service information message (SIM) to the host when it is necessary to notify the user of a possible service requirement for the disk array. The SIMs are classified according to severity for reporting and logging purposes: service, moderate, serious, or acute. The SVP reports all SIMs related to TC390 operations and all SIMs are stored on the SVP for use by HP personnel. The SIMs reported to the zSeries and S/390 host are logged in the SYS1.LOGREC dataset of the host operating system. Each time a SIM is generated, the amber Message LED on the XP1024/XP128/XP12000/XP10000 control window (under the Ready and Alarm LEDs) turns on as an
additional alert for the user. The XP1024/XP128/XP12000/XP10000 also reports SIMs to the Command View XP management station or XP Remote Web Console to provide an additional source of notification for the user.

During TC390 operations, the MCU and RCU will generate a service SIM each time the pair status of the M-VOL or R-VOL changes for any reason, including normal status transitions (for example, pending duplex to duplex). For TC390A transition states (suspending and deleting), a SIM is generated when the status changes to the transition state and again when the transition is complete. SIMs generated by the MCU will include the M-VOL device ID (byte 13) and SIMs generated by the RCU will include the R-VOL device ID (byte 13). Use the RCU Option window (see “Registering an RCU (Add RCU)” on page 87) to configure each MCU to report or not report service-level SIMs to the attached host(s).

The following figure shows a typical 32-byte SIM from the XP1024/XP128/XP12000/XP10000. SIMs are displayed on the host console by reference code (RC) and severity. The six-digit RC (composed of bytes 22, 23, and 13) identifies the possible error and determines the severity. The SIM type (byte 28) indicates the component that experienced the error. When byte 22 = 21, the SIM is a control unit SIM. When byte 22 = Dx, the SIM is a device SIM. When byte 22 = (D5-D7, DB), the specified pair is TC390A. When byte 22 = (D8 - DC), the pair is TC390 Synchronous. The SIM reference codes DB6x, DB7x, and DB8x indicate a TC390A pair suspended by the RCU.

![Figure 74 Typical XP1024/XP128/XP12000/XP10000 SIM showing reference code and SIM type](image)

The following table lists and describes the control unit SIMs (byte 28 = F1) related to TC390 operations. Table 50 on page 185 lists and describes the device SIMs (byte 28 = FE) related to TC390 operations. Both of these tables also specify the severity, host reporting, and SVP log file for each SIM.

**NOTE:** The SIM information for the XP1024/XP128/XP12000/XP10000 changes as new features and functions are added and supported. Contact your HP account support representative or HP technical support for the latest SIM information for the XP1024/XP128/XP12000/XP10000.

<table>
<thead>
<tr>
<th>Ref. Code</th>
<th>Severity</th>
<th>Description</th>
<th>Reported to Host</th>
<th>SVP Log File</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 23</td>
<td>Moderate</td>
<td>The logical path(s) on the remote copy connection(s) was logically blocked due to an error condition.</td>
<td>Yes</td>
<td>SIM Log</td>
</tr>
<tr>
<td>21 80</td>
<td>Service</td>
<td>The logical path on the remote copy connection has recovered from the blocked condition.</td>
<td>Yes*</td>
<td>SSB Log</td>
</tr>
<tr>
<td>21 82</td>
<td>Moderate</td>
<td>MCU received notification of an error detection for communication line from the extender.</td>
<td>Yes</td>
<td>SIM Log</td>
</tr>
</tbody>
</table>
This SIM is not reported to the host system when the **Service SIM=Not Report** RCU option is selected.

### Table 50  TrueCopy device SIMs

<table>
<thead>
<tr>
<th>Ref. Code</th>
<th>Severity</th>
<th>Description</th>
<th>Reported to Host</th>
<th>Generated by</th>
<th>Log File</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 23</td>
<td></td>
<td><strong>D0 0x Service</strong> TC390 started the initial copy for this volume, or was out of sync for this volume.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D0 1x Service</strong> TC390 completed the initial copy for this volume.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D0 2x Service</strong> TC390 for this volume was deleted as requested by the Command View XP management station, XP Remote Web Console, SVP, or host.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D0 3x Service</strong> The MCU changed the volume pair status as requested by the Command View XP management station, XP Remote Web Console, SVP, or host.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D1 sx Service</strong> Status of the R-VOL has changed as requested by the MCU. The third digit of the reference code “s” indicates change of states as follows: 0: from simplex to pending 1: from simplex to duplex 2: from pending to duplex 3: from pending to suspended 4: from duplex to suspended 5: from duplex to simplex 6: from pending to simplex 7: from suspended to simplex 8: from suspended to pending.</td>
<td>Yes¹ Once</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D2 0x Service</strong> The RCU changed the RVOL status to <strong>suspended</strong> as requested by Command View XP management station, XP Remote Web Console, SVP, or host.</td>
<td>No</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D2 1x Service</strong> The R-VOL status changed from <strong>suspended</strong> to <strong>simplex</strong> as requested by Command View XP management station, XP Remote Web Console, SVP, or host.</td>
<td>No</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D2 2x Service</strong> The R-VOL status has changed from <strong>duplex</strong> to <strong>simplex</strong>.</td>
<td>No</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D2 3x Service</strong> The TC390 R-VOL status has changed from <strong>pending duplex</strong> to <strong>simplex</strong>.</td>
<td>No</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D4 0x Serious</strong> TC390 for this volume was suspended due to a failure on the remote copy connection.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D4 1x Serious</strong> TC390 for this volume was suspended due to a failure on the M-VOL or remote copy.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>D4 2x Serious</strong> TC390 for this volume was suspended due to a failure on the R-VOL.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>Ref. Code</td>
<td>Severity</td>
<td>Description</td>
<td>Reported to Host</td>
<td>Generated by</td>
<td>Log File</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>-------------</td>
<td>------------------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>D4 3x</td>
<td>Serious</td>
<td>TC390 for this volume was suspended because DFW to the R-VOL was blocked.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>D4 4x</td>
<td>Serious</td>
<td>TC390 for this volume was suspended due to an internal error condition detected by the RCU.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>D4 5x</td>
<td>Serious</td>
<td>TC390 for this volume was suspended because the operator deleted the volume pair from the RCU.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>D4 Cx</td>
<td>Service</td>
<td>The MCU detected a service-level SIM at the RCU.</td>
<td>Yes¹ Once</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D4 Dx</td>
<td>Moderate</td>
<td>The MCU detected a moderate-level SIM at the RCU.</td>
<td>Yes¹ Repeat</td>
<td>RCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>D4 Ex</td>
<td>Serious</td>
<td>The MCU detected an acute- or serious-level SIM at the RCU.</td>
<td>Yes¹ Repeat</td>
<td>RCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>D4 Fx</td>
<td>Serious</td>
<td>The status of the M-VOL is not consistent with the status of the R-VOL.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM Log</td>
</tr>
<tr>
<td>D5 0x</td>
<td>Service</td>
<td>TC390 started the initial copy for this volume, or was out of sync for this volume.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D5 1x</td>
<td>Service</td>
<td>TC390 completed the initial copy for this volume.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D5 2x</td>
<td>Service</td>
<td>The volume pair accepted Delete Pair operation.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D5 3x</td>
<td>Service</td>
<td>The volume pair accepted Suspend Pair operation.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D5 4x</td>
<td>Service</td>
<td>Delete Pair operation for this volume pair has completed.</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D5 5x</td>
<td>Service</td>
<td>Suspend Pair operation for this volume pair has completed</td>
<td>Yes¹ Once</td>
<td>MCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>D6 sx</td>
<td>Service</td>
<td>The R-VOL status has changed as requested by the MCU. The third digit of the reference code &quot;s&quot; indicates change of states as follows: 0: from simplex to pending 1: from simplex to duplex 2: from pending to duplex 3: from pending to suspended 4: from duplex to suspended 5: from duplex to simplex 6: from pending to simplex 7: from suspended to simplex 8: from suspended to pending</td>
<td>Yes¹ Once</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
</tbody>
</table>

Table 50  TrueCopy device SIMs (continued)
### TrueCopy Scripting

#### Overview of Scripting

An added benefit of the TC390 feature is its support for scripting operations. This capability provides the user with additional flexibility in managing their TC390 environment. A TC390 script file contains a list of macros (commands) that describes a series of TC390 pair operations. The TC390 scripting macros are defined in a text file, and Command View XP or XP Remote Web Console reads the text file and executes the specified TC390 pair operations.

---

<table>
<thead>
<tr>
<th>Ref. Code</th>
<th>Severity</th>
<th>Description</th>
<th>Reported to Host</th>
<th>Generated by</th>
<th>Log File</th>
</tr>
</thead>
<tbody>
<tr>
<td>D7 sx</td>
<td>Service</td>
<td>The RVOL has accepted/completed state change as requested by operation. The third digit of the reference code “s” indicates the events as follows: 0: Accepted Suspend Pair operation. 1: Accepted Delete Pair operation. RVOL is suspended. 2: Accepted Delete Pair operation. RVOL is duplex. 3: Accepted Delete Pair operation. RVOL is pending. 4: Completed Suspend Pair operation. 5: Completed Delete Pair operation.</td>
<td>No</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>DB 0x</td>
<td>Serious</td>
<td>The volume pair was suspended due to a failure on the remote copy connections.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 1x</td>
<td>Serious</td>
<td>The volume pair was suspended due to a failure on the M-VOL or remote copy.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 2x</td>
<td>Serious</td>
<td>The volume pair was suspended due to a failure on the R-VOL.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 3x</td>
<td>Serious</td>
<td>The volume pair was suspended because DPW to the R-VOL was blocked.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 4x</td>
<td>Serious</td>
<td>The M-VOL has changed to suspended state due to an internal error condition detected by the RCU.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 5x</td>
<td>Serious</td>
<td>The M-VOL has changed to suspended state because the operator deleted the volume pair from the RCU.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 6x</td>
<td>Serious</td>
<td>The RCU has suspended all RVOLs in the consistency group due to time out failure defined by the maximum copy delay time.</td>
<td>Yes² Repeat</td>
<td>RCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 7x</td>
<td>Serious</td>
<td>The RCU has suspended all RVOLs in the consistency group due to the internal logic error.</td>
<td>Yes² Repeat</td>
<td>RCU</td>
<td>SIM log</td>
</tr>
<tr>
<td>DB 8x</td>
<td>Service</td>
<td>The RVOL was suspended due to MCU power-off event.</td>
<td>Yes¹ Once</td>
<td>RCU</td>
<td>SSB Log</td>
</tr>
<tr>
<td>DB Fx</td>
<td>Serious</td>
<td>The status of the M-VOL is not consistent with the status of the RVOL.</td>
<td>Yes² Repeat</td>
<td>MCU</td>
<td>SIM log</td>
</tr>
</tbody>
</table>

1. These SIMs are reported to the host only if the Service SIM=Report and PPRC Support=No RCU options are both selected.
2. These SIMs are reported to the host system only if the PPRC Support=No RCU option is selected.
NOTE: This section assumes that the user is familiar with batch files and does not provide instructions for writing or editing batch files. The macro commands and parameters listed in this section are the only commands recognized by the TC390 scripting function.

CAUTION: The user is responsible for testing the TC390 scripting function before running any TC390 scripts. If a TC390 script is run without prior testing and the script ends abnormally, data loss could occur. Before testing a TC390 script, back up the data and vary the volumes offline. If the volumes must remain online, back up the data and confirm that the target volume pair defined in the TC390 script is correct. The results of a TC390 script can be confirmed by checking the latest TC390 pair status update (Last Updated box on TC390 Pair Status window).

Table 51 on page 188 lists the TC390 pair macro commands. Table 52 on page 189 lists the internal macro commands for TC390 scripting. The following TC390 operations cannot be performed using TC390 scripting:

- Configure serial/fibre ports (“Configuring the Host Interface Ports” on page 83).
- Monitor remote copy activity (“Usage Monitor Window” on page 77).
- Clear remote copy SIMs (“Other Operations” on page 113).
- Add/delete RCU (“Registering an RCU (Add RCU)” on page 87 and “Deleting an RCU (Delete RCU)” on page 97).
- Change RCU options (“Modifying RCU Options (Change RCU Option)” on page 92).
- Add/delete path/SSID (“Adding and Deleting Logical Paths for an RCU (Add Path and Delete Path)” on page 97 and “Adding and Deleting SSIDs for an RCU (Add SSID and Delete SSID)” on page 100).
- View RCU status (“Viewing RCU Status (RCU Status)” on page 85).
- Change async options (“Asynchronous Copy Option” on page 108).
- Add/delete group (“Adding Consistency Groups (Add CT Group)” on page 105 and “Deleting Consistency Groups (Delete CT Group)” on page 107).
- Change group options (“Modifying Consistency Group Options (CT Group Option)” on page 106).
- View group status (“Viewing Consistency Group Status (CT Group Status)” on page 103).

NOTE: The scripting command names did not change between CA and TC390. Your existing CA scripting files can be used for TC390 operations.

Table 51 Functional macro commands for TrueCopy scripting

<table>
<thead>
<tr>
<th>TC390 Scripting Macro</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CreateHrcPair</td>
<td>Registers a TC390 pair or pairs. (StartHrcPair is used to start the initial copy operation.)</td>
</tr>
<tr>
<td>SuspendHrcPair</td>
<td>Suspends a TC390 pair or pairs.</td>
</tr>
<tr>
<td>DeleteHrcPair</td>
<td>Deletes a TC390 pair or TC390 pairs.</td>
</tr>
<tr>
<td>ResumeHrcPair</td>
<td>Resumes a TC390 pair or TC390 pairs. Use with StartHrcPair.</td>
</tr>
<tr>
<td>ChangeHrcOption</td>
<td>Changes the pair options for a TC390 pair or TC390 pairs.</td>
</tr>
<tr>
<td>StartHrcPair</td>
<td>Starts remote copy operations for the new pairs and/or resumed pairs specified in the preceding scripting commands.</td>
</tr>
<tr>
<td>GetHrcStatus</td>
<td>Displays the status of a TC390 pair or TC390 pairs.</td>
</tr>
<tr>
<td>SelectHrcDevice</td>
<td>Searches TC390 paired devices.</td>
</tr>
</tbody>
</table>
Syntax for Scripting

Syntax Overview

A TC390 script file can be written using any text editor (for example, WordPad or Notepad). A script file consists of an unlimited number of statements that consist of macros (commands), work variables, and comments (see “Operation Macro Commands” on page 191 and “Internal Macro Commands” on page 199). The first executable statement in a TC390 script file must be the Start macro and the last statement must be the End macro. Each line in a TC390 script file cannot exceed 320 bytes. A leading blank is ignored and a leading tab character (0x09) is converted to a space (0x20). A tab character (0x09) within a string is not converted to a space.

Each script file should contain all five script statements (see Table 53 on page 190 and Table 54 on page 190):

- A comment statement, including a short preface for the script: purpose, author, usage, description, operation, creation date, update date, and any reminder notes to the author. The comment statement is a non-execution statement. A comment statement begins with “//” and contains text (any character string) without any commands. Do not use the “//” symbol anywhere else in a script file, only at the beginning of a comment statement.
- A macro statement (see “Operation Macro Commands” on page 191 and “Internal Macro Commands” on page 199). The macro statement is an execution statement. Only one macro instruction can be set per line and a macro can span more than one line.
- A work variable statement (see “Work Variables” on page 201). The work variable statement is also an execution statement. Only one work variable statement can be set per line and a work variable statement cannot span more than one line.
- A blank statement (see Table 53). The blank statement is a non-execution statement.

<table>
<thead>
<tr>
<th>Type</th>
<th>Macro</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>For lists</td>
<td>SetList</td>
<td>Set (define) a list of items.</td>
</tr>
<tr>
<td></td>
<td>AddList</td>
<td>Add items to a list.</td>
</tr>
<tr>
<td>For non-lists</td>
<td>Start</td>
<td>Declares the beginning of a script.</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>Declares the end of a script.</td>
</tr>
<tr>
<td></td>
<td>Delay</td>
<td>Suspends script execution for the specified length of time.</td>
</tr>
<tr>
<td></td>
<td>If</td>
<td>Executes a script conditionally.</td>
</tr>
<tr>
<td></td>
<td>EndIf</td>
<td>Terminates a script conditionally.</td>
</tr>
<tr>
<td></td>
<td>MakeString</td>
<td>Makes strings; converts numeric value to character string.</td>
</tr>
</tbody>
</table>
• An empty statement (see Table 53). The empty statement is a non-execution statement.

**Table 53**  Syntax description

<table>
<thead>
<tr>
<th>Statement Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank statement</td>
<td>Space or Tab with a return</td>
</tr>
<tr>
<td>Comment statement</td>
<td>One line beginning with //</td>
</tr>
<tr>
<td>Empty statement</td>
<td>Return only</td>
</tr>
<tr>
<td>Execution statement</td>
<td>Work variable statement (non-list type work variable = constant)</td>
</tr>
<tr>
<td>Macro statement</td>
<td>Macro name [parameter list]</td>
</tr>
<tr>
<td></td>
<td>Refer to “Operation Macro Commands” on page 191 and “Internal Macro Commands” on page 199 for macro information.</td>
</tr>
</tbody>
</table>

**Table 54**  Script components

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro name</td>
<td>Either an internal macro or a functional macro.</td>
</tr>
<tr>
<td>Parameter list</td>
<td>Parameter identification name (defined in each macro format) = non-list type expression.</td>
</tr>
<tr>
<td>Expression</td>
<td>List, constant, and work variable.</td>
</tr>
<tr>
<td>List</td>
<td>In a list description, a constant is enclosed in braces “[]”. A comma “,” is inserted between constants. Example: {1, 2, 3, 4}, or {“ABC”, “qw”}. Lists and work variables cannot be described in a list.</td>
</tr>
<tr>
<td>Constant</td>
<td>String or a numeric value.</td>
</tr>
<tr>
<td>String</td>
<td>The string covers the following lists. Enclose a list with a double-quotation mark (“’”). Letters (uppercase and lowercase), numbers, symbols.</td>
</tr>
<tr>
<td></td>
<td>• Numeric list: List that consists of (0, 1, 2, 3, 4, 5, 6, 7, 8, 9)</td>
</tr>
<tr>
<td></td>
<td>• Hexadecimal number list: List that begins with 0x/0X of (A, B, C, D, E, F, a, b, c, d, e, f)</td>
</tr>
<tr>
<td>Reserved variables</td>
<td>Reserved variables can be referenced in a script only. Setting a value is not possible.</td>
</tr>
</tbody>
</table>

**Script File Requirements**

The following table lists the requirements for the components of a script file.

**Table 55**  Script file requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum length of one line of a script</td>
<td>320 bytes</td>
</tr>
<tr>
<td>Maximum number of items of one list type identification name</td>
<td>1,024</td>
</tr>
<tr>
<td>Maximum length of one item of a list type work variable string</td>
<td>16 bytes</td>
</tr>
<tr>
<td>Maximum length of one item of a non-list type string</td>
<td>150 bytes</td>
</tr>
<tr>
<td>Maximum number of items of macro trace storage</td>
<td>33,000</td>
</tr>
<tr>
<td>Maximum number of items of error trace</td>
<td>33,000</td>
</tr>
<tr>
<td>Maximum length of a script file</td>
<td>8 megabytes</td>
</tr>
</tbody>
</table>
### Script Symbols

Symbols can be used in a script to enhance or limit the power of each script command. The following table lists and describes the symbols that can be used in a script.

**Table 56  Script symbols**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quotation mark</td>
<td>Used to define the character constant by enclosing with it quotation marks.</td>
</tr>
<tr>
<td>Space</td>
<td>Used to delimit the before and after phrases.</td>
</tr>
<tr>
<td>Comma</td>
<td>Used to delimit the before and after phrases. This symbol must be placed by following each macro description rule.</td>
</tr>
<tr>
<td>Brace</td>
<td>Used to describe a list.</td>
</tr>
<tr>
<td>Parenthesis</td>
<td>Only used to describe a condition in the If statement.</td>
</tr>
<tr>
<td>Exclamation mark</td>
<td>Used as an operator in the If statement by placing the equal sign next to it. This symbol is not useful when used alone.</td>
</tr>
<tr>
<td>Unequal sign</td>
<td>Used as an operator in the If statement when used alone. When the equal sign follows, nothing changes.</td>
</tr>
<tr>
<td>Equal sign</td>
<td>Used as a substitute sign when used alone. When the equal sign follows, it becomes an operator in the If statement.</td>
</tr>
</tbody>
</table>

1. The before and after phrases are split by the above symbols. Each symbol is recognized as a single word.

### Operation Macro Commands

The functional macros are the script equivalents of the following TC390 pair operations:

- Create pairs (see page 191)
- Delete pairs (see page 193)
- Suspend pairs (see page 194)
- Resume pairs (see page 195)
- Change pair options (see page 196)
- Start pairs (see page 197)
- Get pair status (see page 197)
- Select pair devices (see page 197)

### Create Pairs

Use the CreateHrcPair command to establish new TC390 volume pairs.

**NOTE:** The CreateHrcPair command only creates the pair. You must run the StartHrcPair command after establishing the pair to start the remote copy process.

The CreateHrcPair parameters are:

- M-VOL device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within CU.
- Serial number list (string): RCU serial number (serial number is five digits decimal 0-9). Do not specify more than 12 RCUs.
- SSID number list (numeric): RCU SSID (four digits hexadecimal 0-F).
- R-VOL device list (numeric): C x 0x100 + VV, where C=CU#, VV=vol# within CU.
- Initial copy pace list (string): “CP_MIDDLE” = 3 tracks; “CP_FAST” = 15 tracks; default = CP_FAST.
- Initial copy mode list (string): “E” = entire; “N” = none; default = E.
- Sync level list (string): “S0” or “Synchronous0” = sync, “S2” or “Synchronous2” = async; default = S0. S0 and S2 cannot be specified at the same time.
- CT group list (numeric): consistency group number (0x00 - 0x7F). For async pairs you must specify this parameter. For sync pairs you must omit this parameter.
- Priority list (numeric): priority of initial copy operation (1-256); default = 32.
- Fence level list (string): “N” or “Never”, “S” or “Status” “D”, or “Data” = default = “Never”. For async pairs you must either specify N (never) or omit this parameter.
- CFW flag list (numeric): 0 = copy CFW data to R-VOL; 1 = only M-VOL; default = 1.
- DFW flag list (numeric): 0 = DFW not required; 1 = DFW required; default = 0. Must be omitted for async pairs.
- Error level list (string): “G” = group; “V” = volume; default = G. For sync pairs you must omit this parameter.
- Time-Saving Mode flag: “Yes” = The Use Time-Saving Mode option is enabled; “No” = The Use Time-Saving Mode option is disabled; default = “Yes”. This parameter is a non-list type and only one value can be specified.
- Differential management measurement flag list (string): The differential between the volumes is managed in Cylinder (“Cylinder” or “C”) or in Track (“Track” or “T”). When “Auto” or “A” is specified, the disk array selects the differential management measurement (cylinder or track) automatically. The default is Auto. If the disk array does not support the “Auto” option, “Track” is specified as the default.

The following CreateHrcPair command output shows an example of the pair macro commands needed to create the specified pairs with the parameters listed in the following table.

△ CAUTION: When using the CreateHrcPair command to create more than one pair, make sure to keep each line within the maximum line length (320 bytes). For script command restrictions and parameters, refer to “Script File Requirements” on page 190.

### Table 57  Example of CreateHrcPair parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-VOL</td>
<td>_ilDevA</td>
<td>CT group</td>
<td>[omit – N/A]</td>
</tr>
<tr>
<td>Serial number  (RCU)</td>
<td>_slWorkA</td>
<td>Priority</td>
<td>_iWorkA</td>
</tr>
<tr>
<td>SSID (RCU)</td>
<td>11</td>
<td>Fence level</td>
<td>Never</td>
</tr>
<tr>
<td>R-VOL</td>
<td>_ilDevB</td>
<td>CFW flag</td>
<td>0</td>
</tr>
<tr>
<td>Initial copy pace</td>
<td>_slWorkB</td>
<td>DFW flag</td>
<td>1</td>
</tr>
<tr>
<td>Initial copy mode</td>
<td>E</td>
<td>Error level</td>
<td>[omit – N/A]</td>
</tr>
<tr>
<td>Sync level</td>
<td>S0, S0, S0</td>
<td>Time-Saving Mode</td>
<td>[omit – default]</td>
</tr>
</tbody>
</table>
Example: CreateHrcPair Command

```plaintext
Start $Script="HRC", $Svr="CU-Name"

// $Dev
SetList $D = _ilDevA, $S = {0x0100,0x0101,0x0102,0x0103,0x0104,0x0105,0x0106,0x0107}
AddList $D = _ilDevA, $S = {0x0108,0x0109,0x010A,0x010B,0x010C,0x010D,0x010E,0x010F}

// $Rdev
SetList $D = _ilDevB, $S = {0x01F00,0x01F01,0x01F02,0x01F03,0x01F04,0x01F05,0x01F06,0x01F07}
AddList $D = _ilDevB, $S = {0x01F08,0x01F09,0x01F0A,0x01F0B,0x01F0C,0x01F0D,0x01F0E,0x01F0F}

// $Priority
SetList $D = _ilWorkA, $S = (1,2,3,4,16,32)

// $Fence
SetList $D = _slWorkB, $S = {"D","S","S","N"}

CreateHrcPair $Dev = _ilDevA, $RcuSn = "12345", $RcuSsid = 4, $Rdev = _ilDevB, $Priority = _ilWorkA, $Fence = _slWorkB
StartHrcPair

// $Dev
SetList $D = _ilDevA, $S = {0x0B80,0x0B81,0x0B82}
AddList $D = _ilDevA, $S = {0x0C2A,0x0C2B,0x0C2C}

// $Rdev
SetList $D = _ilDevB, $S = {0x1045,0x1047,0x105E}
AddList $D = _ilDevB, $S = {0x1130,0x1139,0x113D}

// $RcuSn
SetList $D = _slWorkD, $S = {"32072","32072","32072","28439","28439","28439"}
// $RcuSsid
SetList $D = _ilWorkC, $S = {33,33,33,0xA74C,0xA74C,0xA74C}
// $CTG
SetList $D = _ilWorkB, $S = {0x7F,0x7F,0x7F,10,10,10}

StartHrcPair
End
```

Delete Pairs

The DeleteHrcPair command deletes TC390 pairs. The DeleteHrcPair parameters include:

- **Device list (numeric):** $C \times 0x100 + VV$, where $C=CU\#$, $VV=\text{vol}\#$ within the CU.
- **Delete mode list (numeric):** $0$ (0x00) = normal, $1$ (0x01) = delete by force; default = 0. You must specify 0 (normal) when deleting two or more async pairs.
- **Delete range list (string):** “G” or “Group” = group; “V” or “Volume” = volume; “C” or “C/T” = consistency time. For sync pairs you must omit this parameter.
  - When two or more volumes are specified, the default = V. If you want to delete two or more specific async pairs, you can specify V or omit this parameter.
  - When one volume is specified, the default = G under these conditions:
    - Volume is an M-VOL and delete mode = 0 (normal) (any pair status); or
    - Volume is an R-VOL, delete mode = 0, and pair status = suspending or deleting.
    - If you want to delete an entire group by force (delete mode = 1), you must specify G.
  - When one volume is specified, the default = C/T under these conditions:
    - Volume is an R-VOL, delete mode = 0, and pair status is not suspending or deleting.
- **Time-Saving Mode flag:** “Yes” = The Use Time-Saving Mode option is enabled; “No” = The Use Time-Saving Mode option is disabled; default = “Yes”. This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to delete the specified pair with delete mode = normal.
The SuspendHrcPair command suspends TC390 pairs. The SuspendHrcPair parameters include:

- **Device list (numeric):** C x 0x100 + VV, where C=CU#, VV=vol# within the CU.
- **Suspend mode list (string):** “M” or “M-Vol” = M-VOL failure, “R” or “R-Vol” = R-VOL; default = R-VOL. You must specify R or omit this parameter when suspending async pairs.
- **Flag list (numeric):** suspend report flag: 0 = reports; 1 = no reports; default = 1.
- **Suspend range list (string):** “G” or “Group” = group; “V” or “Volume” = volume. For sync pairs you must omit this parameter.
  - When one volume is specified, the default = G. If you want to suspend only one async pair, you must specify V.
  - When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.
- **Pending data flag list (string):** “D” or “Drain” = drain; “P” or “Purge” = purge; default = D. For sync pairs you must omit this parameter.
- **Time-Saving Mode flag:** “Yes” = The **Use Time-Saving Mode** option is enabled; “No” = The **Use Time-Saving Mode** option is disabled; default = “Yes”. This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to suspend the specified pair with suspend mode = R-VOL and the default flag of no reports.

```plaintext
Example: DeleteHrcPair Command

Start $Script="HRC",$Svr="CU-Name"

// $Dev
SetList $D = _ilDevA, $S = {0x0800, 0x0901, 0x0A02}
AddList $D = _ilDevA, $S = {0x0B03, 0x0C04, 0x0D05, 0x0E06}

// $DelMode
SetList $D = _ilWorkA, $S = {0, 1, 0}
DeleteHrcPair $Dev = _ilDevA, $DelMode = _ilWorkA
DeleteHrcPair $Dev = 0x124C, $DelRange = "Group"

End
```

**Suspend Pairs**

The SuspendHrcPair command suspends TC390 pairs. The SuspendHrcPair parameters include:

- **Device list (numeric):** C x 0x100 + VV, where C=CU#, VV=vol# within the CU.
- **Suspend mode list (string):** “M” or “M-Vol” = M-VOL failure, “R” or “R-Vol” = R-VOL; default = R-VOL. You must specify R or omit this parameter when suspending async pairs.
- **Flag list (numeric):** suspend report flag: 0 = reports; 1 = no reports; default = 1.
- **Suspend range list (string):** “G” or “Group” = group; “V” or “Volume” = volume. For sync pairs you must omit this parameter.
  - When one volume is specified, the default = G. If you want to suspend only one async pair, you must specify V.
  - When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.
- **Pending data flag list (string):** “D” or “Drain” = drain; “P” or “Purge” = purge; default = D. For sync pairs you must omit this parameter.
- **Time-Saving Mode flag:** “Yes” = The **Use Time-Saving Mode** option is enabled; “No” = The **Use Time-Saving Mode** option is disabled; default = “Yes”. This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to suspend the specified pair with suspend mode = R-VOL and the default flag of no reports.
Resume Pairs

The ResumeHrcPair command resumes TC390 pairs. The ResumeHrcPair parameters include:

- M-VOL device list (numeric): \( C \times 0x100 + VV \), where \( C=CU# \), \( VV=vol# \) within CU.
- Priority list (numeric): priority of initial copy operation (numeric 0-256); default = 32.
- Fence level list (string): “N” or “Never” = never, “S” or “Status” = status, “D” or “Data” = data, default = current value. For async pairs you must either specify N (never) or omit this parameter.
- Sync level list (string): “S0” or “Synchronous0” = sync, “S2” or “Synchronous2” = async; default = current value.
- Error level list (string): “G” or “Group” = group; “V” or “Volume” = volume; default = current value. For sync pairs you must omit this parameter.
- Resume range list (string): “G” = group; “V” = volume. For sync pairs you must omit this parameter.
  - When one volume is specified, the default = G. If you want to resume only one async pair, you must specify V.
  - When two or more volumes are specified, the default = V. When two or more volumes are specified, you must either specify V or omit this parameter.
- Time-Saving Mode flag: “Yes” = The Use Time-Saving Mode option is enabled; “No” = The Use Time-Saving Mode option is disabled; default = “Yes”. This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to resume the specified pair in synchronous mode with fence level = never and priority = 1.

\[
\text{NOTE: After resuming pairs, you must run the StartHrcPair command to begin remote copy activity.}
\]
Example: ResumeHrcPair Command

```
Start $Script="HRC","$Svr="CU-Name"

// $Dev
SetList $D =_ilDevA, $S = {0x0100,0x0101,0x0102,259}
// $Priority
SetList $D =_ilWorkC, $S = {24,32,0x13,8}

ResumeHrcPair $Dev = _ilDevA, $Priority = _ilWorkC
StartHrcPair

// $Dev
SetList $D =_ilDevB, $S = {0x0200,0x0201,0x0202,0x0203}
AddList $D =_ilDevB, $S = {0x0904,0x0905,0x0906,0x0907}

ResumeHrcPair $Dev = _ilDevB, $OptRsmRange = "Volume"
StartHrcPair
End
```

Change Pair Options

Use the ChangeHrcOption command to change the pair options for TC390 pairs. The ChangeHrcOption parameters include:

- M-VOL device list (numeric): \( C \times 0x100 + VV \), where \( C=CU\# \), \( VV=vol\# \) within CU.
- Fence level list (string): “N” or “Never” = never, “S” or “Status” = status; “D” or “Data” = data; default = current value. For async pairs you must either specify N or omit this parameter.
- CFW flag list (numeric): 0 = copy CFW data to R-VOL; 1 = only M-VOL; default = current value.
- DFW flag list (numeric): DFW flag list is only left to maintain the compatibility of the format. The specification is not available.
- Error level list (string): “G” = group; “V” = volume; default = current value. For sync pairs you must omit this parameter.
- Time-Saving Mode flag: “Yes” = The Use Time-Saving Mode option is enabled; “No” = The Use Time-Saving Mode option is disabled; default = “Yes”. This parameter is a non-list type and only one value can be specified.

The following provides an example of the pair macro commands needed to change the pair options for the pair with LDEV ID 0x4a as follows: set fence level option to Never and set CFW option to M-VOL only.
Example: ChangeHrcOption Command

```
Start $Script="HRC",$Svr="CU-Name"

// $Dev
SetList $D=_ilDevA, $S = (0x0100,0x0101,0x0102,0x0103,0x0104)
AddList $D=_ilDevA, $S = (0x0117,0x0118,0x0119)

// $OptCfw
SetList $D=_ilDevA, $S = (1,1,0)

// $Fence
SetList $D=_slWorkA, $S = ("D", "S", "N", "Data", "Status")

ChangeHrcOption $Dev=_ilDevA, $Fence=_slWorkA, $OptCfw=_ilWorkA

// $Dev
SetList $D=_ilDevB, $S = (0x0A00,0x0A01,0x0A02,0x0A03,0x0A04)

// $OptErrLv
SetList $D=_slWorkB, $S = ("G", "V", "Volume", "Group")

ChangeHrcOption $Dev=_ilDevB, $OptErrLv=_slWorkB

End
```

Starting a Pair

The `StartHrcPair` command starts the remote copy process for all new and resumed TC390 pairs (CreateHrcPair and ResumeHrcPair commands). The `StartHrcPair` command does not have any arguments or parameters. After you have created and/or resumed all needed TC390 pairs, add the `StartHrcPair` command to the script to begin remote copy activity for all preceding new and resumed pairs. The following provides an example of the `StartHrcPair` command as it is displayed within a script file.

Example: StartHrcPair Command

```
:;
:StartHrcPair
```

Getting Pair Status

The `GetHrcStatus` macro command obtains the status of a specific TC390 pair. The `GetHrcStatus` argument is:

- Device (numeric constant, non-list-type and numeric-type work variable): VOL = C x 0x100 + VV, where C=CU#, VV=vol# within the CU.

The `GetHrcStatus` command obtains the status of the pair from the XP1024/XP128/XP12000/XP10000 and displays the status as a reserved variable “_HrcStatus” (see Table 65 on page 203). The following provides an example of the `GetHrcStatus` command for the pair with LDEV ID 0x4a.

Example: GetHrcStatus Command

```
GetHrcStatus $Dev=0x4a
    _sMsgB=_HrcStatus_Fence
    _sMsgC=_HrcStatus.Sync
    _sMsgD=_HrcStatus.Ssid
    _iNumB=_HrcStatus_DeviceR
```

Selecting Devices

The `SelectHrcDevice` command searches for TC390 pairs whose status matches the specified parameters. The `SelectHrcDevice` argument is:
The SelectHrcDevice parameters include:

- **Output list (list-type and numeric work variable)**
- **Device list (numeric):** list of devices to be searched: C x 0x100 + VV, where C=CU#, VV=vol# within CU. Default = all possible target devices that can be specified. The maximum number of the device is 1,024. When you search for more than 1,024 devices, use this command for several times.
- **Serial number list (string):** RCU serial number. Default = not specific.
- **SSID number list (numeric):** RCU SSID. Default = not specific.
- **Fence level list (string):** “N” or “Never” = never; “S” or “Status” = status; “D” or “Data” = data. Default = not specific.
- **Sync level list (string):** “S0” or “Synchronous0” = sync, “S2” or “Synchronous2” = async. Default = not specific.
- **Pair status list (string):** “Simplex”, “Pending”, “Duplex”, “Suspended0” (suspended during initial copy), “Suspended1” (suspended after initial copy), “Suspended” (all suspend types), “Suspending”, “Deleting”, “Undefined”. Default = not specific.
- **Device attribute list (string):** “M” or “M-Vol”, “R” or “R-Vol”. Default = not specific.
- **Error level list (string):** “G” or “Group”; “V” or “Volume”. Default = not specific.
- **CT group list (numeric):** consistency group number (0x00 - 0x7F). Default = not specific.
- **SEQCHK flag list (string):** “Yes” = SEQCHK on; “No” = SEQCHK off. Default = not specific.

The following SelectHrcDevice command output provides an example of the SelectHrcDevice command to find the pairs with the parameters listed in the following table.

**Table 58  Select device parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output list</td>
<td>_ilDevA</td>
</tr>
<tr>
<td>Device list</td>
<td>_ilDevB</td>
</tr>
<tr>
<td>RCU serial number</td>
<td>_slWorkA</td>
</tr>
<tr>
<td>RCU SSID</td>
<td>_ilWorkA</td>
</tr>
<tr>
<td>Fence level</td>
<td>N</td>
</tr>
<tr>
<td>Copy mode</td>
<td>S0, S0, S0</td>
</tr>
<tr>
<td>Pair status</td>
<td>Suspended0</td>
</tr>
<tr>
<td>Device attribute</td>
<td>M</td>
</tr>
</tbody>
</table>

**Example: SelectHrcDevice Command**

```
Start $Script="HRC",$Svr="CU-Name"
    // $Dev
    SetList $D = _ilDevB, $S = {0x0F00,0x0F01,0x0F02,0x0F03,0x0F04,0x0F05,0x0F06,0x0F07}
    AddList $D = _ilDevB, $S = {0x0F10,0x0F11,0x0F12,0x0F13,0x0F14,0x0F15,0x0F16,0x0F17}
    AddList $D = _ilDevB, $S = {0x0F20,0x0F21,0x0F22,0x0F23,0x0F24,0x0F25,0x0F26,0x0F27}
    AddList $D = _ilDevB, $S = {0x0F30,0x0F31,0x0F32,0x0F33,0x0F34,0x0F35,0x0F36,0x0F37}
    AddList $D = _ilDevB, $S = {0x0F40,0x0F41,0x0F42,0x0F43,0x0F44,0x0F45,0x0F46,0x0F47}
    AddList $D = _ilDevB, $S = {0x0F50,0x0F51,0x0F52,0x0F53,0x0F54,0x0F55,0x0F56,0x0F57}
    SelectHrcDevice $DevList = _ilDevA, $Dev = _ilDevB, $Sync = "Synchronous2", $PairStatus = "Suspend"
    DeleteHrcPair $Dev = _ilDevA
End
```
Internal Macro Commands

The internal macro commands are the connection agents that connect the functional macros together and produces a complete and functioning script. The internal macros are divided into two groups as shown in the following table: list types and non-list types.

Table 59 Internal macro commands

<table>
<thead>
<tr>
<th>Type</th>
<th>Macro</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>For lists</td>
<td>SetList</td>
<td>Set (define) a list of items.</td>
</tr>
<tr>
<td></td>
<td>AddList</td>
<td>Add items to a list.</td>
</tr>
<tr>
<td>For non-lists</td>
<td>Start</td>
<td>Declares the beginning of a script.</td>
</tr>
<tr>
<td></td>
<td>End</td>
<td>Declares the end of a script.</td>
</tr>
<tr>
<td></td>
<td>Delay</td>
<td>Suspends script execution for the specified length of time.</td>
</tr>
<tr>
<td></td>
<td>If</td>
<td>Executes a script conditionally.</td>
</tr>
<tr>
<td></td>
<td>EndIf</td>
<td>Terminates a script conditionally.</td>
</tr>
<tr>
<td></td>
<td>MakeString</td>
<td>Makes strings; converts numeric value to character string.</td>
</tr>
</tbody>
</table>

The Start and End commands are used together to begin and end the functions of a script. Every script must have a Start and End command. The If/EndIf commands are also used concurrently to string two or more functional commands together. The If/EndIf commands must be used together. For every If command in a script there must be an EndIf command. Use the Delay command to delay a script for up to an hour. Use the MakeString command to assign several values to a string statement. The MakeString command can convert numeric values to sting values. The SetList command creates a list (for example, all the searchable ports in the XP1024/XP128/XP12000/XP10000, all the searchable LDEVs in the XP1024/XP128/XP12000/XP10000) and the AddList command expands the parameters of a list created with the SetList command.

Internal Macro Command Definitions

AddList

The AddList command adds a specified value to a specific list type. If you add a value to a list that exceeds the maximum number of items for that output list, the excess values will be ignored. The format for the AddList command is: AddList $D= the output list to which you want to add a value, $S= the expressions or values to be added to the output list with a numeric range of 0x0000 to 0xffff. For example, to add these values (0, 1, 2, 3, 0x1e, and 0x1f) to the Dev (Device) B list, the AddList command would be:

AddList $D=iDevB,$S={0,1,2,3,0x1e,0x1f}

Delay

Use the Delay command to delay a script for a specified length of time. The script delay time is set in seconds (0 - 3600). The format for the Delay command is: Delay $Time= the length of time you want to delay the script. For example, to delay a script by 60 seconds, the Delay command would be:

Delay $Time=60

End

Use the End command to declare the end of a script. The End command also terminates the execution of a script. At least one End statement must be described in the trailing line of the script statement. The format for the End statement is:

End

If/EndIf

The If/EndIf statements are used together to verify the conditions of an expression. If the If/EndIf statement is successfully completed, succeeding statements will be processed. If the If/EndIf statement is not successfully completed, the script will abort and the succeeding statements will not be completed. When If/EndIf statements are used, several conditions must be met. You must end an If statement with an EndIf
statement. The execution statement cannot be defined on the same line as the If statement. The If statement must contain one conditional decision statement within parentheses. The string values must be compared as ASCII character codes (see Table 60). The format for an If/EndIf statement is:

**If** expression one compared with expression two (see Table 60 for comparison expressions) **EndIf**

For example, to start a TC390 pair only if the pair was created successfully (result value of CreateHrcPair command is not 0), use the following If/EndIf command:

```plaintext
If (_Result!=0)
    StartHrcPair
EndIf
```

**Table 60**  ASCII character codes

<table>
<thead>
<tr>
<th>Character</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0x30</td>
</tr>
<tr>
<td>1</td>
<td>0x31</td>
</tr>
<tr>
<td>9</td>
<td>0x39</td>
</tr>
<tr>
<td>A</td>
<td>0x41</td>
</tr>
<tr>
<td>Z</td>
<td>0x5a</td>
</tr>
<tr>
<td>a</td>
<td>0x61</td>
</tr>
<tr>
<td>z</td>
<td>0x7a</td>
</tr>
</tbody>
</table>

**Table 61**  If/EndIf comparison symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>==</code></td>
<td>Expression 1 is equal to Expression 2.</td>
</tr>
<tr>
<td><code>&lt;</code></td>
<td>Expression 1 is less than Expression 2.</td>
</tr>
<tr>
<td><code>&lt;=</code></td>
<td>Expression 1 is less than or equal to Expression 2.</td>
</tr>
<tr>
<td><code>&gt;</code></td>
<td>Expression 1 is greater than Expression 2.</td>
</tr>
<tr>
<td><code>&gt;=</code></td>
<td>Expression 1 is greater than or equal to Expression 2.</td>
</tr>
<tr>
<td><code>!=</code></td>
<td>Expression 1 is not equal to Expression 2.</td>
</tr>
</tbody>
</table>

**MakeString**

Use the **MakeString** command to edit a string and/or convert numeric values to string characters. When using the **MakeString** statement several conditions must be met. For each format control string statement there must be an $Item statement. The format control string of expression 1 must be enclosed in quotation marks (""'). If you set a value exceeding the maximum length of a string, the extraneous portion of the value will be not set. The following table defines the two expression statement in the **MakeString** command. The
format for the **MakeString** command is:

```
MakeString $D= output buffer, $Fmt= expression 1, $Item= expression 2
```

Table 62  MakeString expression definitions

<table>
<thead>
<tr>
<th>Expression 1</th>
<th>Expression 2</th>
</tr>
</thead>
</table>
| Expression 1 is one of three format control strings ($Fmt):
  
  %d  Converts a 16-bit numeric expression to a decimal number (0 - 65535).
  
  %x  Converts a 16-bit numeric expression to a hexadecimal number (0 - 0xffff).
  
  %s  Sets a string as it is. |
| Expression 2 is any expression not containing a list reserved variable (must be constant or work variable). |

For example, to create a **MakeString** statement that will convert the 16-bit numeric expression to a hexadecimal number (0 - 0xffff) and set the string as it is, with an output buffer of `_sMsg`, the command would be:

```
MakeString $D=_sMsgB
, $Fmt="EndCode=(0x%x):%s"
, $Item=_Result,_sMsgA
```

For the **MakeString** command listed above: `_sMsgB = “EndCode=(0x110f):Error Occurred”`

**SetList**

Use the **SetList** command to assign specific items to a list. The format of the **SetList** command is: **SetList $D= output list, $S= expression(attribute of the items to be assigned to the list with a numeric range of 0x0000 to 0xffff)**. For example, to set 0, 1, 2, 0x1e, and 0x1f to be displayed in the Dev (Device) B list the command would be:

```
SetList $D=ilDevB, $S={0,1,2,0x1e,0x1f}
```

**Start**

Use the **Start** command to declare the beginning of a script and check to verify that the controller name matched the connected controller. When using the **Start** command, several conditions must be met. The **Start** command must be described on the first line of the script. The **Start** statement cannot include a comment statement, an empty statement or a blank statement. The **Start** statement must be displayed at the beginning of every script. If the controller name does not match the connected controller, an error will occur and the script will be aborted. The format of the **Start** command is: **Start $Script=“HRC”, $Svr= controller name**. For example, to start a script for a controller named Training XP1024 the command would be:

```
Start $Script=“HRC”, $Svr=“Training XP1024”
```

**NOTE:** The controller name check is not available for this version. Therefore, the contents of the $Svr does not affect the script file execution.

**Work Variables**

There are two types of work variables: list type and non-list type. All work variables are initialized before a script is executed.

- Numeric work variables may have a value between 0x0000 and 0xffff. Numeric work variables are initialized with 0.
- A non-list string work variable may have a string with length up to 150 bytes. A list string work variable may have strings with length up to 16 bytes each. String work variables are initialized with a null string whose length is 0.
- A list work variable may have up to 1,024 items. A non-list work variable is a constant. List work variables are initialized as empty (no items).
The work variable is part of an execution statement in a script. The following table provides a description and the storage type of each work variable statement for list and non-list types.

**Table 63  Work variables**

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Description and Storage Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>List Type</td>
<td></td>
</tr>
<tr>
<td>_ilDEV</td>
<td>Numeric Stores the device number list. Expression: _ilDevA, _ilDevB, _ilDevC</td>
</tr>
<tr>
<td>_ilPriority</td>
<td>Numeric Stores the priority number list. Expression: _ilPriorityA, _ilPriorityB, _ilPriorityC</td>
</tr>
<tr>
<td>Non-List Type</td>
<td></td>
</tr>
<tr>
<td>_iNum</td>
<td>Numeric Stores any 16-bit numeric value. Expression: _iNumA, _iNumB, _iNumC, _iNumD, _iNumE, _iNumF</td>
</tr>
<tr>
<td>_sMsg</td>
<td>String Stores any string. Expression: _sMsgA, _sMsgB, _sMsgC, _sMsgD, _sMsgE, _sMsgF</td>
</tr>
</tbody>
</table>

**Reserved Variables**

Reserved variables include result variables (that is, result of macro execution) and status variables (that is, pair status of specified volume). The reserved variables are for reference use only.

**Reserved Result Variables**

When a functional macro is executed (for example, CreateHrcPair), a result value (Result) is issued. The following figure illustrates the result statement format, and the following table lists and defines the valid result values. When a new macro is initiated, the result value automatically resets to 0x0000. The functional macro executes on the specified number of devices. If the macro does not satisfy the execution condition, a conditional error occurs. If a conditional error is found, the result value is OR’ed with 0x1000, and the macro is logged in the error and macro trace files (see "Script Operations Window" on page 78). If the return value of the API (application program interface) is not 0, an API error occurs. If an API error occurs, the result value is OR’ed with 0x0100, and the macro is logged in the error and macro trace files.

![Figure 75 Result statement format](image)

**Table 64  Reserved result variables**

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
<td>Stores the execution results of a macro. 0 = normal end. Other values depend on the macro.</td>
</tr>
</tbody>
</table>
Reserved Status Variables

When a GetHrcStatus command is issued, the Command View XP management station or XP Remote Web Console obtains the status of the specified TC390 pair(s) from the XP1024/XP128/XP12000/XP10000. The results of this query are displayed in the reserved status variables. The following table lists and describes the valid reserved status variables.

Table 65  Reserved status variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| _MsgResult   | Numeric| Stores the execution results of a Message (internal) macro.  
1 = OK, 6 = Yes, 7 = No.                                           |
| _SelectResult| Numeric| Stores the number of devices found by SelectHrcDevice macro.  
0 = no devices found.                                           |
| _HrcStatus _CopyType | String | Stores the copy type:  
“RDC” = remote copy mode;  
“RMC’ = migration mode;  
“---” = other than the above modes.                                   |
| _HrcStatus _DeviceAttr | String | Stores the device attribute:  
“M-Vol” = M-VOL;  
“R-Vol” = R-VOL;  
“---” = other than the above modes.                                  |
| _HrcStatus _DeviceM | Numeric| Stores the M-VOL device number.                                             |
| _HrcStatus _DeviceR | Numeric| Stores the R-VOL device number.                                             |
| _HrcStatus _Sn  | String | Stores the serial number of the controller for the remote copy pairs.     |
| _HrcStatus _Ssid | Numeric| Stores the storage subsystem ID (SSID) of the controller for the remote copy pairs. |
| _HrcStatus _PairStatus | String | Stores the copy pair status:  
“Simplex” = simplex;  
“Duplex” = duplex;  
“Pending” = initial copy in progress;  
“Suspended0” = copy abort in initial copy;  
“Suspended1” = copy abort other than initial copy;  
“Suspending” = TC390A suspend in progress;  
“Deleting” = TC390A delete in progress;  
“Undefined” = undefined.                                              |
| _HrcStatus _Fence | String | Stores the M-VOL fence level:  
“Never” = no fence;  
“Status” = fence due to an RVOL status change failure;  
“Data” = fence due to a data error;  
“Undefined” = undefined.                                              |
### Optional Script Parameters

The parameters outlined in the following table are optional parameters that can be added to a script at the script creator’s discretion. If any of these parameters are included in a script, the XP1024/XP128/XP12000/XP10000 will perform a syntactical check of the script to ensure that the syntax requirements for the parameter have been met. If no optional parameters are included, the XP1024/XP128/XP12000/XP10000 will not check any part of the script. The XP1024/XP128/XP12000/XP10000 will run the script commands based only on what has been

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| _HrcStatus_Sync      | String | Stores the synchronous level:  
|                       |        | “Synchronous0” = sync;  
|                       |        | “Synchronous2” = async;  
|                       |        | “Undefined” = undefined. |
| _HrcStatus_TimeOfUpdate | String | Stores the pair status update time:  
| _HrcStatus_TimeOfEstablish | String | Stores the pair creation update time:  
| _HrcStatus_CopyRatio | Numeric | Stores the copy progress ratio (0 – 100). |
| _HrcStatus_InternalStatus | Numeric | Stores the internal status code. |
| _HrcStatusTypeOfICT | String | Stores the timer type of the consistency group:  
|                       |        | “System” = system timer;  
|                       |        | “Local” = local (SVP) timer;  
|                       |        | “None” = no timer;  
|                       |        | “Undefined” = undefined. |
| _HrcStatus_CTG | Numeric | Stores the consistency group number: 0x00-0x7F. |
| _HrcStatus_SuspendBy | String | Stores the async suspension status:  
|                       |        | “Group” = consistency time of suspended volume matches consistency time of group;  
|                       |        | “Volume” = consistency time of suspended volume does not match the group consistency time;  
|                       |        | “Undefined” = undefined. |
| _HrcStatus_ErrLv | String | Stores the error level (async) pair option:  
|                       |        | “Group” = all volumes in the group will be suspended if this volume is suspended;  
|                       |        | “Volume” = this volume will be suspended individually;  
|                       |        | “Undefined” = undefined. |
specified in the text of the script. The following table describes the syntax requirements that will be evaluated.

Table 66 Syntax requirements for optional parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Syntax Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>Check that each line does not exceed the maximum length for a script statement.</td>
</tr>
<tr>
<td>Phrases in a script statement</td>
<td>A phrase is enclosed by the quotation symbols. Use of the parentheses is correct and the number of parentheses is exact. A statement does not terminate with an equal sign. The parameter identification name (phrase beginning with “$”) is always defined. The work variable and reserved variable (phrase beginning with “_”) are always defined.</td>
</tr>
<tr>
<td>Script statement</td>
<td>The first line begins with (Start) as an execution statement. The lead of one line in the execution statement always begins with a macro name or an identification name for non-list type work variable.</td>
</tr>
<tr>
<td>Substitute statement</td>
<td>The number of phrases is correct. The equal sign is described exactly between the right side and the left side. The right side of the substitute statement is correct.</td>
</tr>
<tr>
<td>Setlist, Addlist</td>
<td>The number of phrases is not less than the minimum count. Duplicate parameter identification names are not specified. The required parameter identification name is defined. The equal sign is described between the right side and $D. Specifying the right side is correct. The equal sign is described between the right side and $S. Specifying the right side is correct. The parameter identification name is described immediately after the macro. The parameter identification names are delimited by a comma (,). An illegal phrase is not included in any statement.</td>
</tr>
<tr>
<td>Start</td>
<td>The number of phrases is not fewer than the minimum count. Duplicate parameter identification names are not specified. The required parameter identification name is defined. The equal sign is described between the right side and $Script. Specifying the right side is correct. The equal sign is described between the right side and $Svr. Specifying the right side is correct. The parameter identification name is described immediately after the macro. The parameter identification names are delimited by a comma (,). An illegal phrase is not included in one statement.</td>
</tr>
<tr>
<td>End</td>
<td>Check that the number of phrases matches.</td>
</tr>
<tr>
<td>Delay</td>
<td>The number of phrases matches. The required parameter identification name is defined. The equal sign is described between the right side and $Time. Specifying the right side is correct.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Syntax Requirements</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>If</td>
<td>The number of phrases matches.</td>
</tr>
<tr>
<td></td>
<td>The parentheses are described in the correct location.</td>
</tr>
<tr>
<td></td>
<td>Expressions 1 and 2 are correctly described.</td>
</tr>
<tr>
<td></td>
<td>The attribute of expressions 1 and 2 matches.</td>
</tr>
<tr>
<td></td>
<td>Specifying the right side is correct.</td>
</tr>
<tr>
<td></td>
<td>The comparison operator is correctly described.</td>
</tr>
<tr>
<td>EndIf</td>
<td>The number of phrases matches.</td>
</tr>
<tr>
<td></td>
<td>The macro is describe with the related If statement.</td>
</tr>
<tr>
<td>MakeString</td>
<td>Duplicate parameter identification names are not specified.</td>
</tr>
<tr>
<td></td>
<td>The required parameter identification name is defined.</td>
</tr>
<tr>
<td></td>
<td>The equal sign is described between the right side and one of $D$, $Fmt$ and $Item$.</td>
</tr>
<tr>
<td></td>
<td>Specifying the right side is correct.</td>
</tr>
<tr>
<td></td>
<td>The items are split by a comma (,) if multiple items are specified in $Item$.</td>
</tr>
<tr>
<td></td>
<td>The parameter identification name is described immediately after the macro.</td>
</tr>
<tr>
<td></td>
<td>The parameter identification names are delimited by a comma (,).</td>
</tr>
<tr>
<td></td>
<td>The matching between the specification of the control string and the description of the item is correct.</td>
</tr>
<tr>
<td></td>
<td>An illegal phrase is not included in any statement.</td>
</tr>
<tr>
<td>Message</td>
<td>The number of phrases is not less than the minimum count.</td>
</tr>
<tr>
<td></td>
<td>Duplicate parameter identification names are not specified.</td>
</tr>
<tr>
<td></td>
<td>The required parameter for the identification name is defined.</td>
</tr>
<tr>
<td></td>
<td>The equal sign is described between the right side and $Msg$.</td>
</tr>
<tr>
<td></td>
<td>Specifying the right side is correct.</td>
</tr>
<tr>
<td></td>
<td>The equal sign is described between the right side and $OptMsg$.</td>
</tr>
<tr>
<td></td>
<td>Specifying the right side is correct.</td>
</tr>
<tr>
<td></td>
<td>The parameter identification name is described immediately after the macro.</td>
</tr>
<tr>
<td></td>
<td>The parameter identification names are delimited by a comma (,).</td>
</tr>
<tr>
<td></td>
<td>An illegal phrase is not included in one statement.</td>
</tr>
<tr>
<td>Functional macro (except for StartHrcPair)</td>
<td>The number of phrases is not less than the minimum count.</td>
</tr>
<tr>
<td></td>
<td>Duplicate parameter identification name is prohibited.</td>
</tr>
<tr>
<td></td>
<td>The required parameter for the identification name is defined.</td>
</tr>
<tr>
<td></td>
<td>The equal sign is described between the right side and the parameter identification name.</td>
</tr>
<tr>
<td></td>
<td>Specifying the right side is correct.</td>
</tr>
<tr>
<td></td>
<td>The parameter identification name is described immediately after the macro.</td>
</tr>
<tr>
<td></td>
<td>The parameters for the identification names are delimited by a comma (,).</td>
</tr>
<tr>
<td></td>
<td>An illegal phrase is not included in any statement.</td>
</tr>
<tr>
<td>StartHrcPair</td>
<td>Check that the number of phrases matches.</td>
</tr>
<tr>
<td>Entire check</td>
<td>Check that the (If) has a matching (EndIf).</td>
</tr>
<tr>
<td></td>
<td>Check that the last line in the execution statement terminates at (END.)</td>
</tr>
</tbody>
</table>
Error Reporting

The TC390 scripting error codes are slightly different from the general TC390 error codes. The following figure shows the format of the scripting error codes. The following table describes the TC390 scripting error messages. Table 68 on page 207 lists the TC390 scripting error codes. The message ID is the four-digit number displayed on the error message. The internal code is the four-digit number displayed in the fifth column of the error trace file (refer to “Script Operations Window” on page 78). For additional TC390 troubleshooting information, refer to “Troubleshooting” on page 147.

![Figure 76 Scripting error code format](image)

<table>
<thead>
<tr>
<th>Table 67 Error messages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Error Message</strong></td>
</tr>
<tr>
<td>Syntax error</td>
</tr>
<tr>
<td>Parameter error</td>
</tr>
<tr>
<td>Rejection</td>
</tr>
<tr>
<td>Skip if not executable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 68 TrueCopy scripting error codes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message ID</strong></td>
</tr>
<tr>
<td>2338</td>
</tr>
<tr>
<td>2339</td>
</tr>
</tbody>
</table>
Table 68  TrueCopy scripting error codes (continued)

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Internal Code</th>
<th>Error Message</th>
<th>Error Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2340</td>
<td>1103, 1104</td>
<td>Invalid command line parameter.</td>
<td>An error is found in the startup parameter of the script monitor. The installation process may not have been complete.</td>
</tr>
<tr>
<td>2340</td>
<td>1105</td>
<td>Invalid command line parameter (1st parameter).</td>
<td>Start parameter (the 1st parameter) is invalid.</td>
</tr>
<tr>
<td>2340</td>
<td>1106</td>
<td>Invalid command line parameter (2nd parameter).</td>
<td>Start parameter (the 2nd parameter) is invalid.</td>
</tr>
<tr>
<td>2340</td>
<td>1107</td>
<td>Invalid command line parameter (3rd parameter).</td>
<td>Start parameter (the 3rd parameter) is invalid.</td>
</tr>
<tr>
<td>2340</td>
<td>1108</td>
<td>Invalid command line parameter (4th parameter).</td>
<td>Start parameter (the 4th parameter) is invalid.</td>
</tr>
<tr>
<td>2340</td>
<td>1109</td>
<td>Invalid command line parameter (5th parameter).</td>
<td>Start parameter (the 5th parameter) is invalid.</td>
</tr>
<tr>
<td>2340</td>
<td>110A</td>
<td>Invalid command line parameter (6th parameter).</td>
<td>Start parameter (the 6th parameter) is invalid.</td>
</tr>
<tr>
<td>2340</td>
<td>110B</td>
<td>Invalid command line parameter (Too short).</td>
<td>Start parameter is not enough</td>
</tr>
<tr>
<td>2340</td>
<td>1200</td>
<td>Memory allocation error.</td>
<td>Failed to allocate the memory.</td>
</tr>
<tr>
<td>2340</td>
<td>1201</td>
<td>Memory lock error.</td>
<td>Failed to lock the memory.</td>
</tr>
<tr>
<td>2341</td>
<td>1101, 1102</td>
<td>File I/O error (parameter).</td>
<td>The parameter file cannot be opened. The installation process may not have been complete.</td>
</tr>
<tr>
<td>2341</td>
<td>2101, 2102</td>
<td>File I/O error (script).</td>
<td>The specified file may be corrupt.</td>
</tr>
<tr>
<td>2341</td>
<td>2103-2105, 4101, 4102</td>
<td>File I/O error (temporary).</td>
<td>The work middle file is abnormal. The disk capacity may be insufficient or the file may be corrupt.</td>
</tr>
<tr>
<td>2341</td>
<td>6101-6105</td>
<td>File I/O error (trace).</td>
<td>The macro trace file cannot be opened. The disk capacity may be insufficient or the file may be corrupt.</td>
</tr>
<tr>
<td>2341</td>
<td>6111-6115</td>
<td>File I/O error (trace).</td>
<td>The error trace file cannot be opened. The disk capacity may be insufficient or the file may be corrupt.</td>
</tr>
<tr>
<td>2342</td>
<td>2101</td>
<td>Too long line. Line = nnnn</td>
<td>A script line exceeds the maximum character length (240), where nnnn is the script line number.</td>
</tr>
<tr>
<td>2343</td>
<td>2201, 2203</td>
<td>Illegal ‘If’ and ‘EndIf’ pair. Line = nnnn</td>
<td>‘If’ and ‘EndIf’ script commands do not match, in script line nnnn</td>
</tr>
<tr>
<td>2344</td>
<td>2202</td>
<td>‘End’ is required. Line = nnnn</td>
<td>‘End’ does not exist at the end of the script line nnnn.</td>
</tr>
<tr>
<td>2345</td>
<td>2204</td>
<td>‘Start’ is required. Line = nnnn</td>
<td>The script line nnnn does not begin with ‘Start.’</td>
</tr>
<tr>
<td>2346</td>
<td>2205</td>
<td>Illegal word is found. Line = nnnn</td>
<td>An illegal word was found in script line nnnn.</td>
</tr>
<tr>
<td>2347</td>
<td>2206</td>
<td>List type variable is unexpected. Line = nnnn</td>
<td>The list type variable is incorrect in script line nnnn.</td>
</tr>
<tr>
<td>2348</td>
<td>2207</td>
<td>Illegal quotation. Line = nnnn</td>
<td>A quotation mark is not found at the end of a string in script line nnnn.</td>
</tr>
</tbody>
</table>
Table 68  TrueCopy scripting error codes (continued)

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Internal Code</th>
<th>Error Message</th>
<th>Error Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2349</td>
<td>2208</td>
<td>Required value is not found. Line = nnnn</td>
<td>The end of line nnnn is “=”.</td>
</tr>
<tr>
<td>2350</td>
<td>2209, 220a</td>
<td>Illegal ‘(‘and’)’ pair. Line = nnnn</td>
<td>The parentheses are not matched in script line nnnn.</td>
</tr>
<tr>
<td>2351</td>
<td>220b, 2303</td>
<td>Syntax error. Line = nnnn</td>
<td>An illegal word is included in script line nnnn.</td>
</tr>
<tr>
<td>2351</td>
<td>27xx</td>
<td>Syntax error. Line = nnnn</td>
<td>The syntax in the parameter description for script line nnnn is invalid.</td>
</tr>
<tr>
<td>2351</td>
<td>274A</td>
<td>Syntax error.</td>
<td>Syntax error for the $Diff parameter line.</td>
</tr>
<tr>
<td>2351</td>
<td>274B</td>
<td>Syntax error.</td>
<td>Syntax error for the $TimeSave parameter line.</td>
</tr>
<tr>
<td>2351</td>
<td>29xx</td>
<td>Syntax error. Line = nnnn</td>
<td>The macro description for script line nnnn is invalid.</td>
</tr>
<tr>
<td>2351</td>
<td>2axx</td>
<td>Syntax error. Line = nnnn</td>
<td>An invalid comma is used in script line nnnn.</td>
</tr>
<tr>
<td>2351</td>
<td>2A4B</td>
<td>Syntax error.</td>
<td>A comma is required after the $Diff parameter.</td>
</tr>
<tr>
<td>2351</td>
<td>2A4C</td>
<td>Syntax error.</td>
<td>A comma is required after the $TimeSave parameter.</td>
</tr>
<tr>
<td>2352</td>
<td>220e</td>
<td>Illegal expression. Line = nnnn</td>
<td>An unavailable operator is defined in the if statement of script line nnnn.</td>
</tr>
<tr>
<td>2353</td>
<td>220f</td>
<td>Illegal parameter. Line = nnnn</td>
<td>The list of the format control string and the value of the expression specified by $Item do not match in the Make String command. Or, the format control string and the expression do not match the attributes in script line nnnn.</td>
</tr>
<tr>
<td>2353</td>
<td>24xx</td>
<td>Illegal parameter. Line = nnnn</td>
<td>The parameters of script line nnnn are invalid.</td>
</tr>
<tr>
<td>2354</td>
<td>2301</td>
<td>Unknown parameter. Line = nnnn</td>
<td>An undefined parameter is used in script line nnnn.</td>
</tr>
<tr>
<td>2355</td>
<td>2355</td>
<td>Unknown identifier. Line = nnnn</td>
<td>An undefined word is used to define the parameters in script line nnnn.</td>
</tr>
<tr>
<td>2356</td>
<td>25xx</td>
<td>Same parameter appears again. Line = nnnn</td>
<td>A duplicate parameter was found in script line nnnn.</td>
</tr>
<tr>
<td>2356</td>
<td>254A</td>
<td>Same parameter appears again.</td>
<td>Same parameter ($Diff) is used more than once.</td>
</tr>
<tr>
<td>2356</td>
<td>254B</td>
<td>Same parameter appears again.</td>
<td>Same parameter ($TimeSave) is used more than once.</td>
</tr>
<tr>
<td>2357</td>
<td>26xx</td>
<td>Required parameter is not found. Line = nnnn</td>
<td>A required parameter for script line nnnn was not found.</td>
</tr>
<tr>
<td>2358</td>
<td>28xx</td>
<td>Value type mismatch. Line = nnnn</td>
<td>The type of the value assigned to the parameter in script line nnnn is invalid.</td>
</tr>
<tr>
<td>2358</td>
<td>285C</td>
<td>Value type mismatch.</td>
<td>The value type for the $Diff parameter are not compatible.</td>
</tr>
<tr>
<td>2358</td>
<td>285D</td>
<td>Value type mismatch.</td>
<td>The value type for the $TimeSave parameter are not compatible.</td>
</tr>
<tr>
<td>2359</td>
<td>1001, 4111, 4112</td>
<td>Internal error.</td>
<td>An internal program error has occurred. The program installation may not have been complete.</td>
</tr>
<tr>
<td>2360</td>
<td>4181</td>
<td>Mismatch script type.</td>
<td>The script types specified by the Start macro and by the execution environment file are different.</td>
</tr>
<tr>
<td>Message ID</td>
<td>Internal Code</td>
<td>Error Message</td>
<td>Error Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------------</td>
<td>---------------</td>
<td>------------------</td>
</tr>
<tr>
<td>2361</td>
<td>4182</td>
<td>Mismatch controller name.</td>
<td>The device names specified by the Start macro and by the execution environment file are different.</td>
</tr>
<tr>
<td>2362</td>
<td>5101</td>
<td>Parameter value error ($Dev).</td>
<td>A functional macro parameter error was found. Check the setting value in the $Dev parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5102</td>
<td>Parameter value error ($Priority).</td>
<td>A functional macro parameter error was found in setting $Priority.</td>
</tr>
<tr>
<td>2362</td>
<td>5103</td>
<td>Parameter value error ($Fence).</td>
<td>A functional macro parameter error was found in setting $Fence.</td>
</tr>
<tr>
<td>2362</td>
<td>5104</td>
<td>Parameter value error ($Sync).</td>
<td>A functional macro parameter error was found in setting $Sync.</td>
</tr>
<tr>
<td>2362</td>
<td>5105</td>
<td>Parameter value error ($SusMode).</td>
<td>A functional macro parameter error was found in setting $SusMode.</td>
</tr>
<tr>
<td>2362</td>
<td>5106</td>
<td>Parameter value error ($SusReport).</td>
<td>A functional macro parameter error was found in setting $SusReport.</td>
</tr>
<tr>
<td>2362</td>
<td>5107</td>
<td>Parameter value error ($DelMode).</td>
<td>A functional macro parameter error is found in the setting $DelMode.</td>
</tr>
<tr>
<td>2362</td>
<td>5108</td>
<td>Parameter value error ($OptCfw).</td>
<td>A functional macro parameter error is found in the setting $OptCfw.</td>
</tr>
<tr>
<td>2362</td>
<td>5109</td>
<td>Parameter value error ($OptSusDfwBlk).</td>
<td>A functional macro parameter error is found in the setting $OptSusDfwBlk.</td>
</tr>
<tr>
<td>2362</td>
<td>5110</td>
<td>Parameter value error ($RcuSn).</td>
<td>A functional macro parameter error was found in setting $RcuSn.</td>
</tr>
<tr>
<td>2362</td>
<td>5111</td>
<td>Parameter value error ($RcuSsid).</td>
<td>A functional macro parameter error was found in the setting $RcuSsid.</td>
</tr>
<tr>
<td>2362</td>
<td>5112</td>
<td>Parameter value error ($Rdev).</td>
<td>A functional macro parameter error was found in the setting $Rdev.</td>
</tr>
<tr>
<td>2362</td>
<td>5113</td>
<td>Parameter value error ($CopyPace).</td>
<td>A functional macro parameter error was found in the setting $CopyPace.</td>
</tr>
<tr>
<td>2362</td>
<td>5114</td>
<td>Parameter value error ($CopyMode).</td>
<td>A functional macro parameter error was found in the setting $CopyMode.</td>
</tr>
<tr>
<td>2362</td>
<td>5115</td>
<td>Parameter value error ($PairStatus).</td>
<td>A functional macro parameter error was found in the setting $PairStatus.</td>
</tr>
<tr>
<td>2362</td>
<td>5116</td>
<td>Parameter value error ($DevAttr).</td>
<td>A functional macro parameter error was found in the setting $DevAttr.</td>
</tr>
<tr>
<td>2362</td>
<td>5117</td>
<td>Parameter value error ($OptMsg).</td>
<td>A functional macro parameter error was found in the setting $OptMsg.</td>
</tr>
<tr>
<td>2362</td>
<td>5118</td>
<td>Parameter value error ($Unit).</td>
<td>A functional macro parameter error was found in the setting $Unit.</td>
</tr>
<tr>
<td>2362</td>
<td>5121</td>
<td>Parameter value error ($RcuSn!=$Dev).</td>
<td>A functional macro parameter error was found in the $RcuSn!=$Dev setting.</td>
</tr>
<tr>
<td>2362</td>
<td>5122</td>
<td>Parameter value error ($RcuSsid!=$Dev).</td>
<td>A functional macro parameter error was found in the $RcuSsid!=$Dev settings.</td>
</tr>
<tr>
<td>2362</td>
<td>5123</td>
<td>Parameter value error ($Rdev!=$Dev).</td>
<td>A functional macro parameter error was found in the $Rdev!=$Dev settings.</td>
</tr>
</tbody>
</table>
Table 68  TrueCopy scripting error codes (continued)

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Internal Code</th>
<th>Error Message</th>
<th>Error Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2362</td>
<td>5124</td>
<td>Parameter value error ($CopyMode!=$Sync).</td>
<td>A functional macro parameter error is found in the $CopyMode!=Sync settings.</td>
</tr>
<tr>
<td>2362</td>
<td>5132</td>
<td>Parameter value error ($CTG).</td>
<td>A functional macro parameter error is found. Set the correct CT group number in the $CTG parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5133</td>
<td>Parameter value error ($OptErrLv).</td>
<td>A functional macro parameter error is found. Set the correct error level in the $OptErrLv parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5134</td>
<td>Parameter value error ($SusRange).</td>
<td>A functional macro parameter error is found. Set the correct suspend range in the $SusRange parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5135</td>
<td>Parameter value error ($PendData).</td>
<td>A functional macro parameter error is found. Set the correct pending data flag in the $PendData parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5136</td>
<td>Parameter value error ($DelRange).</td>
<td>A functional macro parameter error is found. Set the correct delete range in the $DelRange parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5137</td>
<td>Parameter value error ($OptRsmRange).</td>
<td>A functional macro parameter error is found. Set the correct resume range in the $OptRsmRange parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5138</td>
<td>Parameter value error ($Seqchk).</td>
<td>A functional macro parameter error is found. Set the correct SEQCHK flag in the $Seqchk parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>5139</td>
<td>Parameter value error ($SusComplete).</td>
<td>A functional macro parameter error is found. Set the correct time-saving mode flag in the $SusComplete parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>513A</td>
<td>Parameter value error ($TimeSave).</td>
<td>A functional macro parameter error is found in the $TimeSave parameter.</td>
</tr>
<tr>
<td>2362</td>
<td>513B</td>
<td>Parameter value error ($Diff).</td>
<td>A functional macro parameter error is found in the $Diff parameter.</td>
</tr>
<tr>
<td>2995</td>
<td>5201</td>
<td>Illegal combination ($$Sync and $$OptSusDfwBlk).</td>
<td>A functional macro parameter combination error is found. ($$Sync and $$OptSusDfwBlk.)</td>
</tr>
<tr>
<td>2995</td>
<td>5203</td>
<td>Illegal combination ($$Sync and $$CTG).</td>
<td>A functional macro parameter combination error is found. ($$Sync and $$CTG.)</td>
</tr>
<tr>
<td>2995</td>
<td>5204</td>
<td>Illegal combination ($$Sync and $$OptErrLv).</td>
<td>A functional macro parameter combination error is found. ($$Sync and $$OptErrLv.)</td>
</tr>
<tr>
<td>2996</td>
<td>5301</td>
<td>$CTG not found.</td>
<td>$CTG is not described when asynchronous copy pair creation.</td>
</tr>
<tr>
<td>-</td>
<td>4001</td>
<td>Non device error.</td>
<td>The specified device is not mounted.</td>
</tr>
<tr>
<td>-</td>
<td>4002</td>
<td>Pair status error.</td>
<td>The specified command cannot be performed under this pair status.</td>
</tr>
<tr>
<td>-</td>
<td>4003</td>
<td>Volume type error.</td>
<td>The specified command cannot be performed with this volume type.</td>
</tr>
<tr>
<td>-</td>
<td>4004</td>
<td>Device list empty.</td>
<td>The description is not found in the device list of macro</td>
</tr>
<tr>
<td>-</td>
<td>5001</td>
<td>API error(GetEquipInfoEx).</td>
<td>An error occurred during the acquisition of the volume mounting status.</td>
</tr>
<tr>
<td>-</td>
<td>5002</td>
<td>API error(GetPairStatus2561), ErrorCode=6005 xxxx</td>
<td>An error occurred during the getting pair status operation.</td>
</tr>
<tr>
<td>-</td>
<td>5003</td>
<td>API error(GetPairStatus), ErrorCode=6005 xxxx</td>
<td>An error occurred during the getting pair status operation.</td>
</tr>
</tbody>
</table>
NOTE: ErrorCode-6005 xxxx corresponds to the Command View XP or XP Remote Web Console error codes.

HXRC Device Blocking and Load Balancing

The XP1024/XP128/XP12000/XP10000 supports the IBM-compatible specifications for XRC device blocking and load balancing control. In addition, the XP1024/XP128/XP12000/XP10000 provides more flexible tuning methods for load balancing control under HXRC environments as shown below.

Device Blocking Function

The XP1024/XP128/XP12000/XP10000 HXRC function supports the new TSO command specifications for the XRC device blocking function.

- **DONOTBLOCK option.** DONOTBLOCK is a new option parameter that is specified by the XADDPAIR command.
  - **DONOTBLOCK**: The amount of write data for application programs are blocked by the threshold specified by SDM. Default value is “500” HEX RECSETs.
  - **Specified**: When the DONOTBLOCK option is specified to a logical device, the amount of write data of application programs for the logical device is not blocked.
  - **XQUERY**: The number of RECSET and the current threshold value corresponding to a logical device will be displayed by the XQUERY command.

△ **CAUTION:** If you specify the DONOTBLOCK option for too many devices, a sidefile puncture condition will occur. Use caution when determining the appropriate tuning (devices with DONOTBLOCK option, SVP modes) for your operational environment.
Load Balancing Control

Current Load Balancing Control

The XP1024/XP128/XP12000/XP10000 has three fixed thresholds and three levels of load balancing for varying amounts of sidefile cache as follows: Threshold 1/2/3 = 40/50/60%.

- **Level 1**: Sidefile capacity is 40% -50% of the total cache capacity. Write I/Os are blocked by “Sleep”-“Wait” logic. The following modes are set on the XP1024/XP128/XP12000/XP10000 SVP:
  - **Mode 45**: “Sleep”-“Wait” suppression option
    - **OFF** (Default): Disk array performs “Sleep”-“Wait” command retry per one write I/O to block write I/O until the amount of sidefile is less than 40% of total cache.
    - **ON**: Disk array does not perform “Sleep”-“Wait” command retry.
  - **Mode 97**: “Wait” timer control
    - **OFF** (Default): When the amount of sidefile is over 40% of total cache capacity, the XP1024/XP128/XP12000/XP10000 waits 100 ms as “Sleep”-“Wait” timer for write I/O.
    - **ON**: When the amount of sidefile is over 40% of total cache capacity, the XP1024/XP128/XP12000/XP10000 waits 10 ms as “Sleep”-“Wait” timer for write I/O.

- **Level 2**: Sidefile capacity is over 50% -60% of the total cache capacity. Write I/Os are blocked by “SCP”-“SCI” logic. The following modes are set on the XP1024/XP128/XP12000/XP10000 SVP:
  - **Mode 98**: “SCP” reporting suppression option
    - **OFF** (Default): When the amount of sidefile is over 50% of total cache capacity, the XP1024/XP128/XP12000/XP10000 reports SCP status for write I/O. Operating system cannot issue the write I/O until SCI status is received. The XP1024/XP128/XP12000/XP10000 reports SCI when the amount of sidefile is less than 50% of the total cache capacity.
    - **ON**: The XP1024/XP128/XP12000/XP10000 does not perform “SCP” reporting for write I/O.

- **Level 3**: Sidefile capacity exceeds 60% in the total cache capacity. Sidefile puncture occurs. The session that has the largest amount stored in sidefile cache is canceled.

**NOTE**: The XP1024/XP128/XP12000/XP10000 SVP mode settings are preserved, even during microprogram exchange or disk array power-off.

---

New Load Balancing Control

The following conditions are required to activate the new DONOTBLOCK option for the XADDPAIR TSO command:

![Figure 77 Current load balancing control](image-url)
• The operating system must support the new DONOTBLOCK option.
• Mode 61 must be ON.
  If Mode 61 is OFF (default), the XP1024/XP128/XP12000/XP10000 performs current load
  balancing control. If the operating system does not support the DONOTBLOCK option, set Mode 61 =
  OFF.

**DONOTBLOCK option**

The XP1024/XP128/XP12000/XP10000 does not block write I/Os for the
specify logical device, to avoid performance impact for application programs.

⚠️ **CAUTION:** If you specify the DONOTBLOCK option for too many devices, a sidefile puncture condition
will occur. Use caution when determining the appropriate tuning (devices with DONOTBLOCK option, SVP
modes) for your operational environment.

---

**Load balancing control for sidefile**

When the DONOTBLOCK option is not specified, the
XP1024/XP128/XP12000/XP10000 has four levels of load balancing for amount of sidefile. Level 0
control is new for load balancing control.

• Level 0: Sidefile capacity is less than threshold 1 in the total cache capacity.
  MODE 45 = ON: Write I/Os for logical devices are blocked (”Sleep”.”Wait” logic) by the threshold
  (500 HEX RECSETS) specified by SDM.
  MODE 45 = OFF: Write I/Os are not blocked.
• Level 1: Sidefile capacity is over threshold 1 - threshold 2 of the total cache capacity.
  MODE 97: ”Wait” timer control. Same as level 1 in current load balancing control.
• Level 2: Sidefile capacity is over threshold 2 - threshold 3 of the total cache capacity.
  MODE 98: ”SCP” reporting suppression option. Same as level 2 in current load balancing control.
• Level 3: Sidefile capacity exceeds threshold 3 of the total cache capacity. Sidefile puncture occurs.
  Same as level 3 in current load balancing control.

**Variable sidefile threshold.** Two new system options are assigned as variable sidefile threshold as follows.
These options are effective whether Mode 61 = ON or OFF.

• MODE 85, 86
  • Combination 1: MODE 85,86 = ON,OFF – Threshold 1/2/3=30/40/50%
  • Combination 2: MODE 85,86 = OFF,OFF – Threshold 1/2/3=40/50/60% Default
  • Combination 3: MODE 85,86 = OFF,ON – Threshold 1/2/3=50/60/70%
• Combination 4: MODE 85,86 = ON,ON – Threshold 1/2/3 = 60/70/80%

Figure 78  Combination 1: MODE 85,86 = ON,OFF; Threshold 1/2/3 = 30/40/50%

Figure 79  Combination 2 (Default): MODE 85,86 = OFF,OFF; Threshold 1/2/3 = 40/50/60%
Figure 80  Combination 3: MODE 85,86 = OFF,ON – Threshold 1/2/3 = 50/60/70%

Figure 81  Combination 4: MODE 85,86 = ON,ON – Threshold 1/2/3 = 60/70/80%
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