



































































































































































































- Command Usage

Since volumes described in the configuration definition file (HORCM\_CONF) are targets for the protection function, the following commands are also targets for the protection function (with the exception of `pairstisplay`).

- The **horctakeover**, **pairsturchk**, **pairstcreate**, **pairstsplit**, **pairstresync**, **pairstvolchk**, **pairstsyncwait**, and **pairstevtwait** commands are the target commands. Command operation during protection mode rejects volumes (EX\_ENPERM) that are not permitted.
- The **pairstdisplay** command displays volumes without LDEV-attached information, and displays LDEV# \*\*\*\* (for -CLI, -).

**Example:**

```
# pairstdisplay -g oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradevl (L)  (CL1-A , 3,    0-0 ) 91210061 ****.---- ----,----- ---- -
oradb   oradevl (R)  (CL1-A , 3,    1-0 ) 91210061 ****.---- ----,----- ---- -
```

- The **raidscan** command is not affected by the HORCM\_DEV and HORCM\_INST section in the configuration definition file. The **raidscan** command is not the target of the protection function.

You can see the correspondence of the permitted volumes and the DEVICE\_FILE by using the **raidscan -find** command. In the configuration definition file, describing UID, PORT, TARG, and VOL of the volume specified by the `-find` option usually does not reject volumes as EX\_PERM.

**Example** (for HP-UX):

```
# ioscan -fun | grep rdsd | raidscan -find
DEVICE_FILE      UID  S/F PORT   TARG  LUN   SERIAL  LDEV  PRODUCT_ID
/dev/rdsd/c0t3d0  0    S  CL1-A    3     0  91210061  17   DF600F
/dev/rdsd/c0t3d1  0    S  CL1-A    3     1  91210061  18   DF600F
```

- Registering Permitted Volumes

The protection mode enables CCI to check whether the volumes described in the configuration definition file matches all the volumes recognized from the host when CCI is activated. Permitted volumes are registered in HORCM. The permitted volumes are registered in `/etc/horcmgr` in the following steps.

**If the permitted file (\$HORCMPERM) exists:** CCI issues the following to the target volumes described in this file (e.g. To permit only the LVM within your host, describe LVM volume in \$HORCMPERM):

- **For HP-UX:** The default file name is `/etc/horcmperm.conf` or `/etc/horcmperm*.conf` (\* as an instance number). CCI automatically executes `cat $HORCMPERM | /HORCM/usr/bin/raidscan -find inst`

**Example:**

```
# The following are an example to permit the LVM Volume groups.
# For MU# 0
vg00 /dev/rdsd/c0t3d0 /dev/rdsd/c0t3d1
vg00 /dev/rdsd/c0t3d2 /dev/rdsd/c0t3d3
```

**Confirming vg01 groups:** The following is an example for confirming whether the LVM volume group vg01 is correctly mapped to the group described in the configuration definition file.

**Example:**

```
# export HORCC_MRCF=1
# cat /etc/horcmperm.conf | grep vg01 | raidscan -find verify 1 -fd
```

**OR**

```
# vgdisplay -v /dev/vg01|grep dsk|sed 's/\/\*/\/\dsk\/\//g'|raidscan -find verify 1 -fd
```

DEVICE_FILE	Group	PairVol	Device_File	M	SERIAL	LDEV
/dev/rdisk/c0t3d0	oradb1	oradev1	c0t3d0	1	91210061	17
/dev/rdisk/c0t3d1	oradb1	oradev2	c0t3d1	1	91210061	18
/dev/rdisk/c0t3d2	oradb	oradev3	c0t3d2	1	91210061	19
/dev/rdisk/c0t3d3	-	-	-	1	91210061	20

As shown in the example, the device file /dev/rdisk/c0t3d2 is mapped to the other group, and the /dev/rdisk/c0t3d3 is not described in the configuration definition file.

- **For Windows Server:** The default file name is \WINDOWS\horcmperm.conf or \WINDOWS\horcmperm\*.conf (\* as an instance number). CCI automatically issues:  
type \$HORCMPerm | x:\HORCM\etc\raidscan.exe -find inst

**Example:**

```
# The following are an example to permit the DB Volumes.
# Note: a numerical value is interpreted as Harddisk#.
# DB0 For MU# 0
Hd0-10
harddisk12 harddisk13 harddisk17
```

**Example (Confirming DB1 groups):**

```
set HORCC_MRCF=1
echo hd20-23 | raidscan -find verify 1 -fd
```

DEVICE_FILE	Group	PairVol	Device_File	M	SERIAL	LDEV
Harddisk20	oradb1	oradev1	Harddisk20	1	91210061	17
Harddisk21	oradb1	oradev2	Harddisk21	1	91210061	18
Harddisk22	oradb	oradev3	Harddisk22	1	91210061	19
Harddisk23	-	-	-	1	91210061	20

As shown in the example, Harddisk22 is mapped to the other group, and Harddisk23 is not described in the configuration definition file.

**If the permitted file (\$HORCMPerm) does not exist:** CCI targets the volumes of your own host, and performs the following:

**For HP-UX:**

```
'ioscan -fun | grep -e rdisk -e rsk | /HORCM/usr/bin/raidscan -find inst'
```

**For Solaris:**

```
'echo /dev/rdsk/* | /HORCM/usr/bin/raidscan -find inst'
```

**For AIX:**

```
'lsdev -C -c disk | grep hdisk | /HORCM/usr/bin/raidscan -find inst'
```

**For Linux:**

```
'echo /dev/sd* | /HORCM/usr/bin/raidscan -find inst'
```

**For Tru64 UNIX:**

```
'echo /dev/rdisk/dsk* | /HORCM/usr/bin/raidscan -find inst'
```

**For IRIX:**

```
'echo /dev/rdisk/*vol /dev/rdisk/*/*vol/* | /HORCM/usr/bin/raidscan -find inst '
```

**For Windows Server:**

```
'echo hd0-999 | x:\HORCM\etc\raidscan.exe -find inst'
```

**Note:** The default target number for scanning is 1,000. Since CCI automatically registers device files when CCI is activated, starting up may take time. To perform startup more quickly by using the non-protection mode, create an empty HORCMPerm file (with no size) as a dummy to prohibit scanning. The file name displayed by the -fd option will be Unknown. To display the file name using the -fd option, issue raidscan -find inst manually.

## CCI software files

The CCI software product consists of application and support files, internally generated log files, and user generated files. These files are stored on the local disk in the host. [Table 4-15](#) lists the CCI files that are provided for UNIX-based systems. [Table 4-16](#) lists the CCI files for Windows systems.



**Note:** The commands in \HORCM\etc\ are used when you issue commands from the console window. If these commands are performed without an argument, the interactive mode will start up. The commands in \HORCM\usr\bin have no console window, and can therefore be used when you issue commands from the user application.

**Table 4-15 CCI files for UNIX-based Systems**

No.	Title	File name	Command name	Mode	User*	Group
01	HORCM	/etc/horcmgr	<b>horcmd*</b>	0544	root	sys
02	HORCM_CONF	/HORCM/etc/horcm.conf	-	0444	root	sys
03	Takeover	/usr/bin/horctakeover	<b>horctakeover*</b>	0544	root	sys
04	Accessibility check	/usr/bin/paircurchk	<b>paircurchk*</b>	0544	root	sys
05	Pair creation	/usr/bin/paircreate	<b>paircreate</b>	0544	root	sys
06	Pair splitting	/usr/bin/pairsplit	<b>pairsplit</b>	0544	root	sys
07	Pair resynchronization	/usr/bin/pairresync	<b>pairresync</b>	0544	root	sys
08	Event waiting	/usr/bin/pairevtwait	<b>pairevtwait</b>	0544	root	sys
09	Error notification	/usr/bin/pairmon	<b>pairmon</b>	0544	root	sys
10	Volume check	/usr/bin/pairvolchk	<b>pairvolchk</b>	0544	root	sys
11	Pair configuration confirmation	/usr/bin/pairdisplay	<b>pairdisplay</b>	0544	root	sys
12	RAID scanning	/usr/bin/raidscan	<b>raidscan</b>	0544	root	sys
13	RAID activity reporting	/usr/bin/raidar	<b>raidar</b>	0544	root	sys
14	Connection confirming	/usr/bin/raidqry	<b>raidqry</b>	0544	root	sys
15	Trace control	/usr/bin/horcctl	<b>horcctl</b>	0544	root	sys
16	HORCM activation script	/usr/bin/horcmstart.sh	<b>horcmstart.sh</b>	0544	root	sys
17	HORCM shutdown script	/usr/bin/horcmshutdown.sh	<b>horcmshutdown.sh</b>	0544	root	sys
18	Connection confirming. <b>Note:</b> Provided only for HP-UX and Solaris.	/HORCM/usr/bin/inqraid	<b>inqraid</b>	0544	root	sys
19	Configuration file creating	/HORCM/usr/bin/mkconf.sh	<b>mkconf</b>	0544	root	sys

No.	Title	File name	Command name	Mode	User*	Group
20	Synchronous waiting	/usr/bin/pairsyncwait	<b>pairsyncwait*</b>	0544	root	sys
21	Oracle Validation setting	/usr/bin/raidvchkset	<b>raidvchkset</b>	0544	root	sys
22	Oracle Validation displaying	/usr/bin/raidvchkdsp	<b>raidvchkdsp</b>	0544	root	sys
23	Oracle Validation scanning	/usr/bin/raidvchkscan	<b>raidvchkscan</b>	0544	root	sys
24	VMware SRM/SRA	/HORCM/usr/bin/rmsra	<b>rmsra</b>	0544	root	sys
25	RAID configuration setting/confirmation	/HORCM/usr/bin/raidcfg	<b>raidcfg</b>	0544	root	sys
*ShadowImage/SnapShot does not support the <b>horcmd</b> , <b>horctakeover</b> , <b>paircurchk</b> , and <b>pairsyncwait</b> command. TrueCopy/TCE supports the <b>horctakeover</b> and the <b>paircurchk</b> command. TrueCopy/TCE does not support the <b>horcmd</b> command. TCE supports the <b>pairsyncwait</b> command.						

**Table 4-16 CCI files for Windows**

No.	Title	File name	Command name
01	HORCM	\HORCM\etc\horcmgr.exe	<b>horcmd*</b>
02	HORCM_CONF	\HORCM\etc\horcm.conf	--
03	Takeover	\HORCM\etc\horctakeover.exe	<b>horctakeover*</b>
04	Accessibility check	\HORCM\etc\paircurchk.exe	<b>paircurchk*</b>
05	Pair creation	\HORCM\etc\paircreate.exe	<b>paircreate</b>
06	Pair splitting	\HORCM\etc\pairsplit.exe	<b>pairsplit</b>
07	Pair resynchronization	\HORCM\etc\pairresync.exe	<b>pairresync</b>
08	Event waiting	\HORCM\etc\pairevtwait.exe	<b>pairevtwait</b>
09	Error notification	\HORCM\etc\pairmon.exe	<b>pairmon</b>
10	Volume check	\HORCM\etc\pairvolchk.exe	<b>pairvolchk</b>
11	Pair configuration confirmation	\HORCM\etc\pairdisplay.exe	<b>pairdisplay</b>
12	RAID scanning	\HORCM\etc\raidscan.exe	<b>raidscan</b>
13	RAID activity reporting	\HORCM\etc\raidar.exe	<b>raidar</b>
14	Connection confirmation	\HORCM\etc\raidqry.exe	<b>raidqry</b>
15	Trace control	\HORCM\etc\horcctl.exe	<b>horcctl</b>
16	HORCM activation script	\HORCM\etc\horcmstart.exe	<b>horcmstart</b>
17	HORCM shutdown script	\HORCM\etc\horcmshutdown.exe	<b>horcmshutdown</b>
18	Synchronous waiting	\HORCM\etc\pairsyncwait.exe	<b>pairsyncwait*</b>
19	Connection confirming	\HORCM\usr\inqraid	<b>inqraid</b>
20	Configuration file creating	\HORC\Tool\mkconf.sh	<b>mkconf</b>
21	Oracle Validation setting	\HORCM\usr\raidvchkset	<b>raidvchkset</b>

No.	Title	File name	Command name
22	Oracle Validation displaying	\HORCM\usr\raidvchkdsp	<b>raidvchkdsp</b>
23	Oracle Validation scanning	\HORCM\usr\raidvchkscan	<b>raidvchkscan</b>
24	Tool	\HORCM\Tool\svcx.exe	<b>svcx</b>
25	Sample script for svcx	HORCM\Tool\HORCM0_run.txt	--
26	VMware SRM/SRA	\HORCM\etc\rmsra.exe	<b>rmsra</b>
27	RAID configuration setting/confirmation	\HORCM\etc\raidcfg.exe	<b>raidcfg</b>
28	Takeover	\HORCM\usr\bin\horctakeover.exe	<b>horctakeover*</b>
29	Accessibility check	\HORCM\usr\bin\paircurchk.exe	<b>paircurchk*</b>
30	Pair creation	\HORCM\usr\bin\paircreate.exe	<b>paircreate</b>
31	Pair splitting	\HORCM\usr\bin\pairsplit.exe	<b>pairsplit</b>
32	Pair resynchronization	\HORCM\usr\bin\pairresync.exe	<b>pairresync</b>
33	Event waiting	\HORCM\usr\bin\pairevtwait.exe	<b>pairevtwait</b>
34	Volume check	\HORCM\usr\bin\pairvolchk.exe	<b>pairvolchk</b>
35	Pair configuration confirmation	\HORCM\usr\bin\pairdisplay.exe	<b>pairdisplay</b>
36	RAID scanning	\HORCM\usr\bin\raidscan.exe	<b>raidscan</b>
37	RAID connection confirmation	\HORCM\usr\bin\raidqry.exe	<b>raidqry</b>
38	Synchronous waiting	\HORCM\usr\bin\pairsyncwait.exe	<b>pairsyncwait*</b>
39	Oracle Validation setting	\HORCM\usr\bin\raidvchkset	<b>raidvchkset</b>
40	Oracle Validation displaying	\HORCM\usr\bin\raidvchkdsp	<b>raidvchkdsp</b>
41	Oracle Validation scanning	\HORCM\usr\bin\raidvchkscan	<b>raidvchkscan</b>
42	RAID configuration setting/confirmation	\HORCM\usr\bin\raidcfg.exe	<b>raidcfg</b>
*ShadowImage/SnapShot does not support the <b>horcmd</b> , <b>horctakeover</b> , <b>paircurchk</b> , and <b>pairsyncwait</b> command. TrueCopy/TCE supports the <b>horctakeover</b> and the <b>paircurchk</b> command. TrueCopy/TCE does not support the <b>horcmd</b> command. TCE supports the <b>pairsyncwait</b> command.			

## Log and trace files

The CCI software (HORCM) and ShadowImage/SnapShot/TrueCopy/TCE commands maintain start-up log files, execution log files, and trace files which can be used to identify the cause of errors and maintain status transition history records of the paired volumes.

## User-created files

**Script Files.** CCI supports scripting to provide automated and unattended copy operations. A CCI script contains a list of CCI commands, which describes a series of ShadowImage, SnapShot, TrueCopy, and/or TCE operations. The scripted commands for UNIX-based platforms are defined in a shell script file. The scripted commands for Windows-based platforms are defined in a text file. The host reads the script file and sends the commands to the disk array command device to perform the ShadowImage/SnapShot/TrueCopy/TCE operations automatically. The CCI scripts are:

- **HORCM startup script** (horcmstart.sh, horcmstart.exe): A script that starts HORCM (/etc/horcmgr), sets environmental variables as needed (for example, HORCM\_CONF, HORCM\_LOG, HORCM\_LOGS), and starts HORCM.
- **HORCM shutdown script** (horcmshutdown.sh, horcmshutdown.exe): A script for stopping the HORCM (/etc/horcmgr).
- **HA control script:** A script for executing takeover processing automatically when the cluster manager (CM) detects a host error.

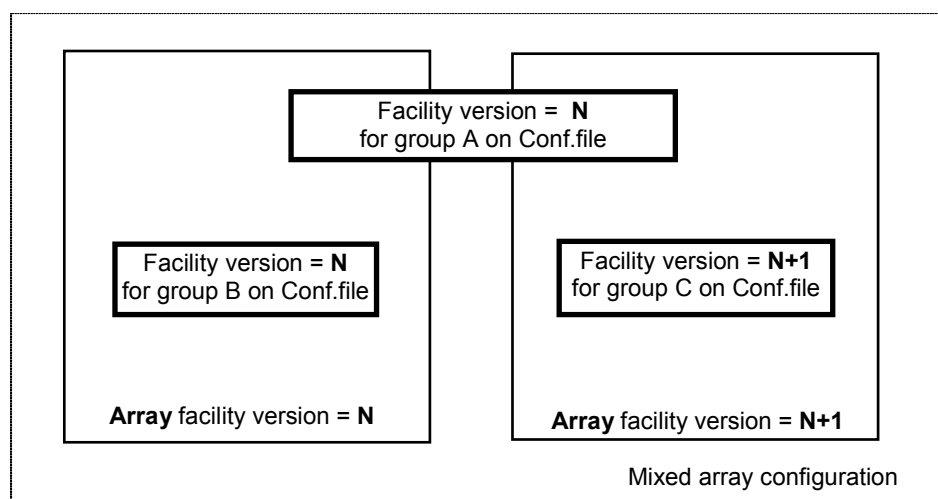
When constructing the HORCM environment, the system administrator should make a copy of the **HORCM\_CONF** file. The copied file should be set according to the system environment and registered as the following file (\* is the instance number):

- UNIX-based systems: **/etc/horcm.conf** or **/etc/horcm\*.conf**
- Windows Server systems: **\WINDOWS\horcm.conf** or **\WINDOWS\horcm\*.conf**

## Group version control

Before executing each option of a command, CCI checks the facility version of the Hitachi array internally to verify that the same version is installed on mixed array configuration. If the configuration includes older array systems, this method may not meet the requirements for the mixed array system environment, because the older array system limits the availability enhancements in later facility versions. If the facility versions of the array systems are different, the user will not be able to use disk array-specific facility, because CCI applies the minimum version to all array systems. To expand the capability for mixed array system configurations and avoid problems such as this, CCI supports the following “group version control” to manage a version for each group.

- CCI (HORCM daemon) makes a facility version for each group based on a configuration file at the start-up of HORCM.
- In a mixed array system configuration, if the facility version of the array systems is different on a group, CCI will apply the minimum version for each group.



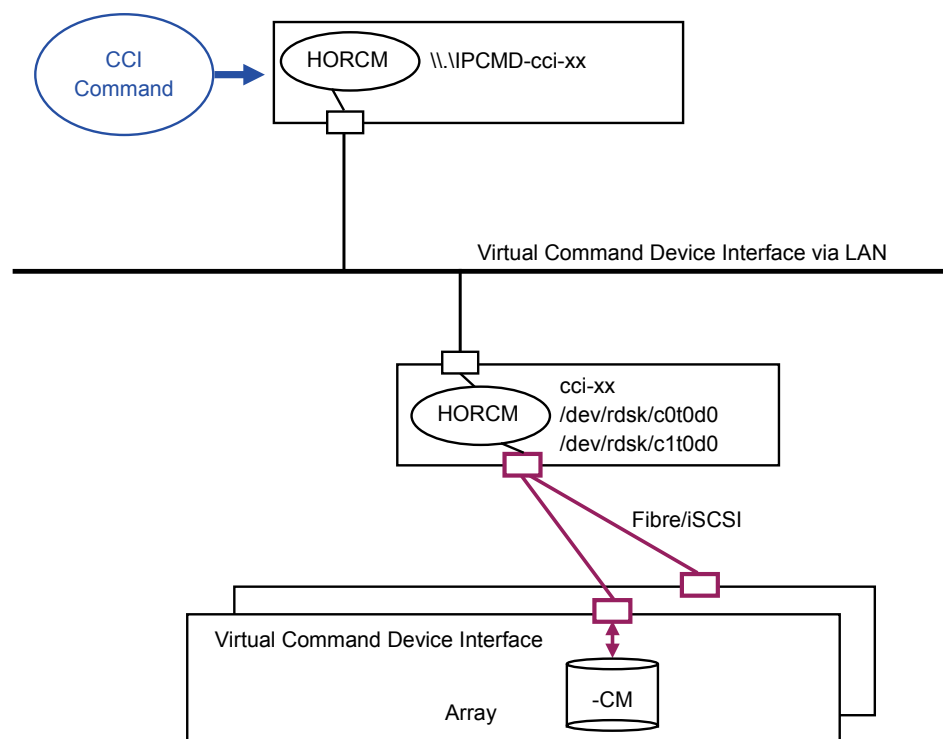
**Figure 4-31 Definition of the group version**

## Virtual command devices

### About virtual command devices

The command line such as a pair operation of the array can be issued using the command device connected to the host HBA and the CCI server. When executing the shell scrip from the client PC which does not have the host HBA, it was required to log into the CCI server using Telnet, SSH, or others and write the remote shell script to be performed. The Virtual Command Device is a function to provide the CCI server port to the client as a command device. By using this port as a command device, the script on the client PC can be performed as well as the command device connected to the HBA.

The conventional script can be used as is in the client PC environment.



**Figure 4-32 Structure of virtual command device**

## Specifying virtual command devices

### (1) Format for specifying Virtual Command Device

CCI supports the following naming format specifying IP address a port number (services) as notation of the command device for all CCI supported platforms.

**\\.\IPCMD-IPaddr-Port[-unitid] or IPCMD-IPaddr-Port[-unitid]**

**IPaddr:** IP address of HORCM host

**Port:** Port number of HORCM

**unitid:** Unit number of the array in the multiple-unit connection configuration

#### (a) Configuration file example for IPv4:

```
HORCM_CMD
#dev_name      dev_name      dev_name
\\.\IPCMD-158.214.135.113-31001
```

#### (b) Configuration file example for IPv6:

```
HORCM_CMD
#dev_name      dev_name      dev_name
\\.\IPCMD-fe80::209:6bff:febe:3c17-31001
```

#### (c) Configuration file example for mixing with a device file:

```
HORCM_CMD
#dev_name      dev_name      dev_name
\\.\IPCMD-91200026:/dev/rdisk/*
\\.\IPCMD-158.214.135.113-31001
```

#### (d) Configuration file example for alternating with a device file and IP command device:

```
HORCM_CMD
#dev_name      dev_name
\\.\IPCMD-91200026:/dev/rdisk/*      \\.\IPCMD-158.214.135.113-31001
```

```
HORCM_CMD
#dev_name      dev_name
\\.\IPCMD-158.214.135.113-31001      \\.\IPCMD-91200026:/dev/rdisk/*
```

#### (e) Configuration file example for multiple array configuration:

```
HORCM_CMD
#dev_name      dev_name      dev_name
\\.\IPCMD-158.214.135.113-31001
\\.\IPCMD-158.214.135.114-31001
\\.\IPCMD-158.214.135.115-31001
```



**Note:** The IP address and the port number can be specified the host name and service name which is registered on its host.

## (2) Requirement for supporting

CCI uses SCSI Path-through driver for implementing Virtual Command Device, and it is accomplished by converting from IP SCSI interface to Fibre SCSI interface.

Whether CCI can perform completely or not will be depended on OS, and it has some restriction in case of IP SCSI (Virtual CMDDEV) Command device target. Therefore CCI using Virtual Command Device should be used within the following restrictions.

- Virtual Command Device server

The environment where it is CCI supported platform other than Tru64 UNIX and the SCSI Path-through driver is usable is required. In the inappropriate environment, CCI start is rejected and fails. Set "ip\_address" of "HORCM\_MON" of the configuration definition file to be other than "localhost".

## (3) UDP/IP port for the initiator

CCI uses the following port number as default.

For nine specified instance: "34000+0"

For instance X: "34000+X+1"

If the default will be needed to change, this value can be changed by setting "HORCM\_IPSCPORT=<services>" environment variable.

<services> can be specified port number or service name.



**Note:** When an initiator port number and a port number to be assigned to a communication path of HORCM are the same, the operation by CCI may not operate normally. Set different values for the initiator port number and the port number to be assigned to the communication path of HORCM.

---

## (4) Controlling IO traffic for relaying port

CCI handles IOs for the Virtual Command Device using synchronized IO as performing of default. In Virtual Command Device router node, if HORCM will receive a many IO request from another HORCM client (command device initiator), it may be caused a performance decrement. Hence CCI supports asynchronous IO for relaying IOs to next node by setting the following environment variable.

**\$ HORCM\_IPSCPAIO=1**

A user will be able to start CCI client (command device initiator) by specifying remote HORCM instance connected to HBA port as **\\.\IPCMD-IPaddr-Port[-unitid]**.

The diagram illustrates the Virtual Command Device Interface (VCDI) architecture. It shows a host environment (top) and a storage array (bottom) connected via a VCDI interface (middle). The host environment contains a stack of virtual command devices (VCDs). The top VCD is labeled "HORCM" and "¥¥.¥IPCMD-cci-xx". Below it, the VCDI interface is shown as a horizontal line. The storage array (bottom) contains a component labeled "-CM" and "Array". The VCDI interface connects the host's VCDs to the storage array. A blue arrow labeled "Attach" points from the host's VCD stack to the storage array, indicating the attachment process. The VCDI interface also shows two red "X" marks, indicating a connection or error state.

Therefore CCI has a mechanism using the following format for allowing the specified IP address and port list only when CCI client (command device initiator) attaches to this instance.

```
HORCM_ALLOW_INST
#ip_address    service
158.214.135.113    34000
158.214.135.114    34000
```

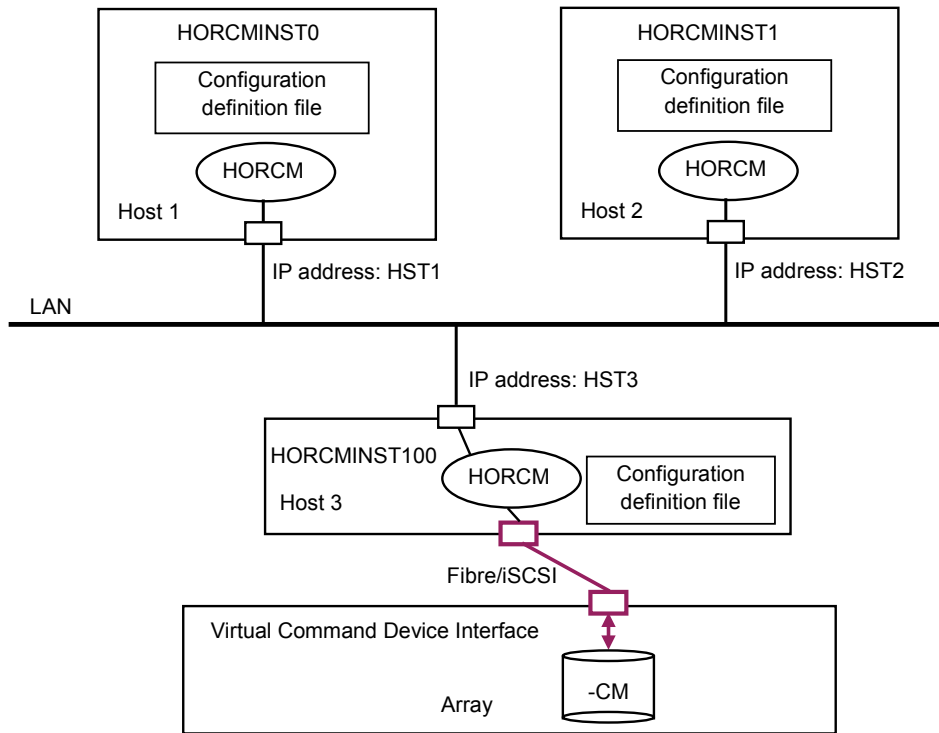
```
HORCM_ALLOW_INST
#ip_address    service
fe80::209:6bff:febe:3c17    34000
```

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## Setting virtual command devices

When starting an instance by specifying a virtual command device, it is required that CCI instance at the reference destination is started. Furthermore, when shutting down the instance, shut down from the instance which is using the virtual command device.

[Figure 4-34](#) shows an example of setting the configuration definition file when using a virtual command device in ShadowImage or SnapShot.



**Figure 4-34 Example of array-host configuration using virtual command device**

■ Configuration definition file for HORCMINST0 (horcm0.conf)

```

HORCM_MON
#ip_address      service    poll(10ms)    timeout(10ms)
HST1             30010      18000        3000

HORCM_CMD
#dev_name
  \\. \IPCMD-HST3-20010

HORCM_DEV
#dev_group  dev_name  port#  TargetID  LU#  MU#
  Oradb      oradev1  CL1-A    1      1
  Oradb      oradev2  CL1-A    1      2

HORCM_INST
#dev_group  ip_address      service
Oradb       HST2           30011

```

■ Configuration definition file for HORCMINST1 (horcm1.conf)

```

HORCM_MON
#ip_address      service    poll(10ms)    timeout(10ms)
HST2             30011      18000        3000

HORCM_CMD
#dev_name
  \\. \IPCMD-HST3-20010

HORCM_DEV
#dev_group  dev_name  port#  TargetID  LU#  MU#
  Oradb      oradev1  CL1-B    1      3
  Oradb      oradev2  CL1-B    1      4

HORCM_INST
#dev_group  ip_address      service
Oradb       HST1           30010

```

■ Configuration definition file for HORCMINST100 (horcm100.conf)

```

HORCM_MON
#ip_address      service    poll(10ms)    timeout(10ms)
HST3             20010      18000        3000

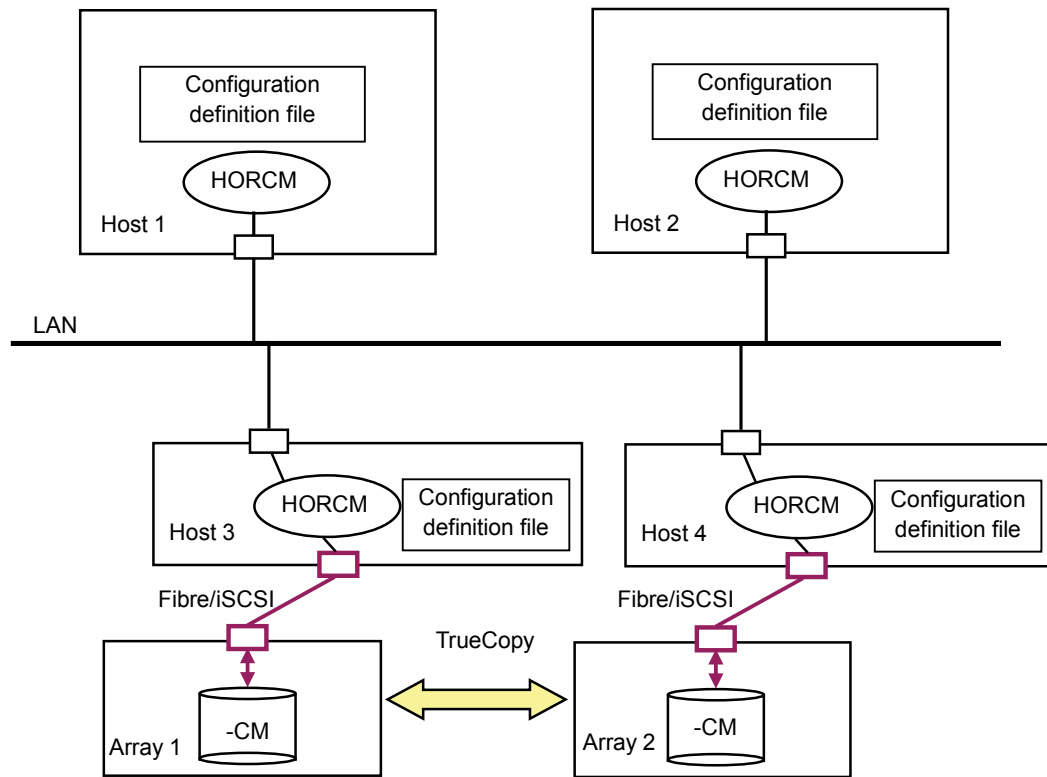
HORCM_CMD
#dev_name
  /dev/xxx

HORCM_DEV
#dev_group  dev_name  port#  TargetID  LU#  MU#

HORCM_INST
#dev_group  ip_address      service

```

When using TrueCopy or TCE in combination with the configuration of two hosts and two instances, two hosts are required to recognize the command device.



**Figure 4-35 Example of array-host configuration using virtual command device**

## Configuration file examples

[Figure 4-36](#) to [Figure 4-45](#) show examples of CCI configurations, the configuration definition files for each configuration, and examples of CCI command use for each configuration.

### Configuring two hosts and two instances

The command device is defined using the system raw device name (character-type device file name). For example, the command devices for [Figure 4-36](#) to [Figure 4-38](#) would be:

- HP-UX:

**HORCM\_CMD of HOSTA = /dev/rdisk/c0t0d0**

**HORCM\_CMD of HOSTB = /dev/rdisk/c1t0d0**

- Solaris:

**HORCM\_CMD of HOSTA = /dev/rdisk/c0t0d0s2**

**HORCM\_CMD of HOSTB = /dev/rdisk/c1t0d0s2**

You can use the command device without a label in the format command.

- AIX:

**HORCM\_CMD of HOSTA = /dev/rhdiskX**

**HORCM\_CMD of HOSTB = /dev/rhdiskX**

Where **X** = device number created automatically by AIX.

- Tru64 UNIX:

**HORCM\_CMD of HOSTA = /dev/rdisk/dskXc**

**HORCM\_CMD of HOSTB = /dev/rdisk/dskXc**

Where **X** = device number assigned by Tru64 UNIX.

- Linux:

**HORCM\_CMD of HOSTA = /dev/sdX**

**HORCM\_CMD of HOSTB = /dev/sdX**

Where **X** = device number assigned by Linux.

- IRIX:

**HORCM\_CMD of HOSTA = /dev/rdisk/dksXdXlXvol**

OR

**HORCM\_CMD of HOSTA = /dev/rdisk/node\_wwn/lunXvol/cXpX**

**HORCM\_CMD of HOSTB = /dev/rdisk/dksXdXlXvol**

OR

**HORCM\_CMD of HOSTB = /dev/rdisk/node\_wwn/lunXvol/cXpX**

Where **X** = device number assigned by IRIX.

- Windows Server:

HORCM\_CMD of HOSTA = **\\.\PhysicalDriveX**

OR

HORCM\_CMD of HOSTA = **\\.\Volume{guid}**

OR

HORCM\_CMD of HOSTA = **\\.\CMD-Ser#-Idev#-Port#**

HORCM\_CMD of HOSTB = **\\.\PhysicalDriveX**

OR

HORCM\_CMD of HOSTB = **\\.\Volume{guid}**

OR

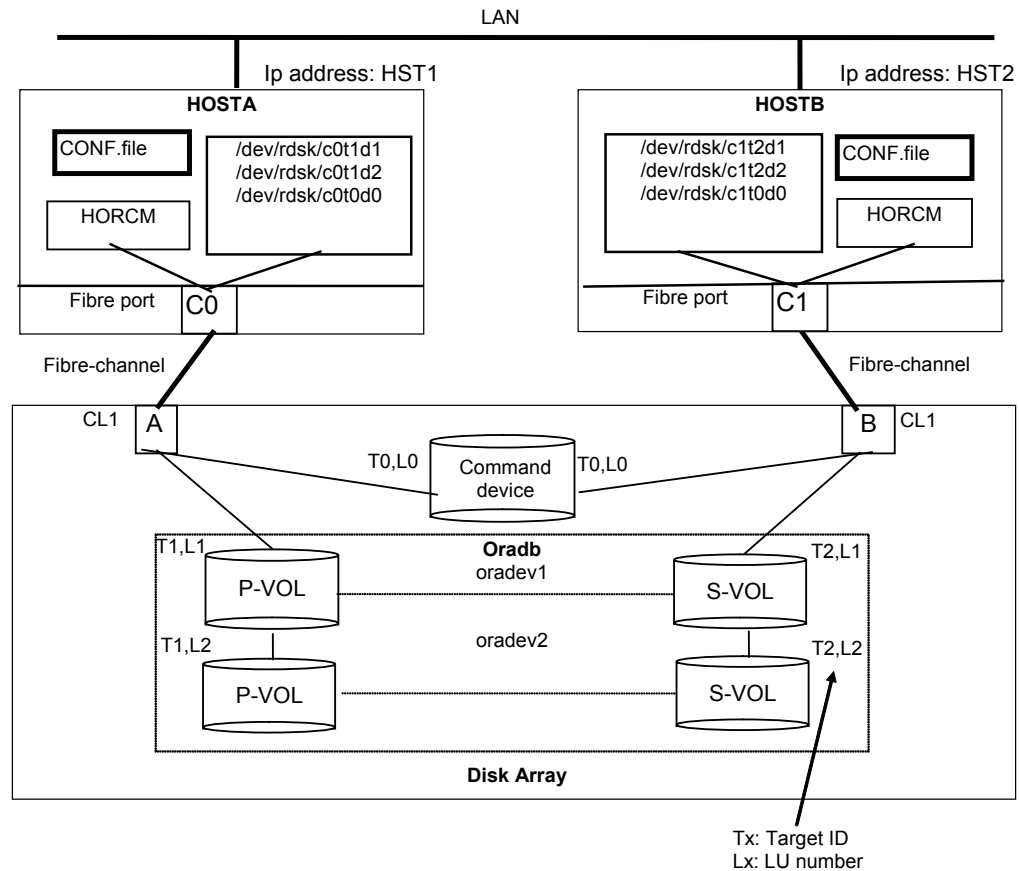
HORCM\_CMD of HOSTB = **\\.\CMD-Ser#-Idev#-Port#**

Where **X** = device number assigned by Windows Server.

The PhysicalDrive number may change at every reboot. If the number changes, use **\\.\CMD-Ser#-Idev#-Port#** or **Volume{guid}** for which the same name is kept.

If **\\.\CMD-Ser#-Idev#-Port#** or **\\.\Volume{guid}** is specified, CCI changes it to **\\.\PhysicalDrive?** to be corresponded. For MSCS, it is recommended to use **\\.\CMD-Ser#-Idev#-Port#** instead of **\\.\Volume{GUID}** because **\\.\Volume{GUID}** may not be maintained. Using **\\.\CMD-Ser#-Idev#-Port#** does not require creating any partition on a volume. **Volume{guid}** is created when you make a partition by using the Windows' Disk Management. You can find **Volume{guid}** by using the **inqraid \$Volume -CLI -fv** or **raidscan -x findcmddev0.?** commands.

- Regarding a command device for CCI, do not set two or more paths for a single host. (Windows Server may change the **guid** when a volume with an identical **guid** is found.)
- For Windows Server, when a path detachment, which is caused by a controller detachment or interface failure, continues for longer than one minute, the command device may be unable to be recognized at the time when recovery from the path detachment is made. To make the recovery, perform the re-scanning of the disks of Windows. When Windows cannot access the command device although CCI becomes able to recognize the command device, restart CCI.



Configuration file for HOSTA (/etc/horcm.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1 0
Oradb oradev2 CL1-A 1 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST2 horcm
```

Configuration file for HOSTB (/etc/horcm.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST2 horcm 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/yyy [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1 0
Oradb oradev2 CL1-B 2 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm
```

**Note 1:** To calculate the value for poll(10ms), see Configuration Definition File.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other applications (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. If setting two command devices, add second command device in the HORCM\_CMD section.

**Figure 4-36 ShadowImage example with two hosts and two instances**

### Example of CCI commands with HOSTA (group Oradb): ShadowImage

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb) and a local host P-VOL a case.

```
# paircreate -g Oradb -vl
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

- Designate a volume name (oradev1) and a local host P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vl
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-A , 1,   1-0 )91210061   18.P-VOL COPY,91210061   20 -
Oradb   oradev1 (R)  (CL1-B , 2,   1-0 )91210061   20.S-VOL COPY,-----   18 -
Oradb   oradev2 (L)  (CL1-A , 1,   2-0 )91210061   19.P-VOL COPY,91210061   21 -
Oradb   oradev2 (R)  (CL1-B , 2,   2-0 )91210061   21.S-VOL COPY,-----   19 -
```

### **Example of CCI commands with HOSTB (group Oradb): ShadowImage**

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name and a remote host P-VOL a case.

```
# paircreate -g Oradb -vr
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

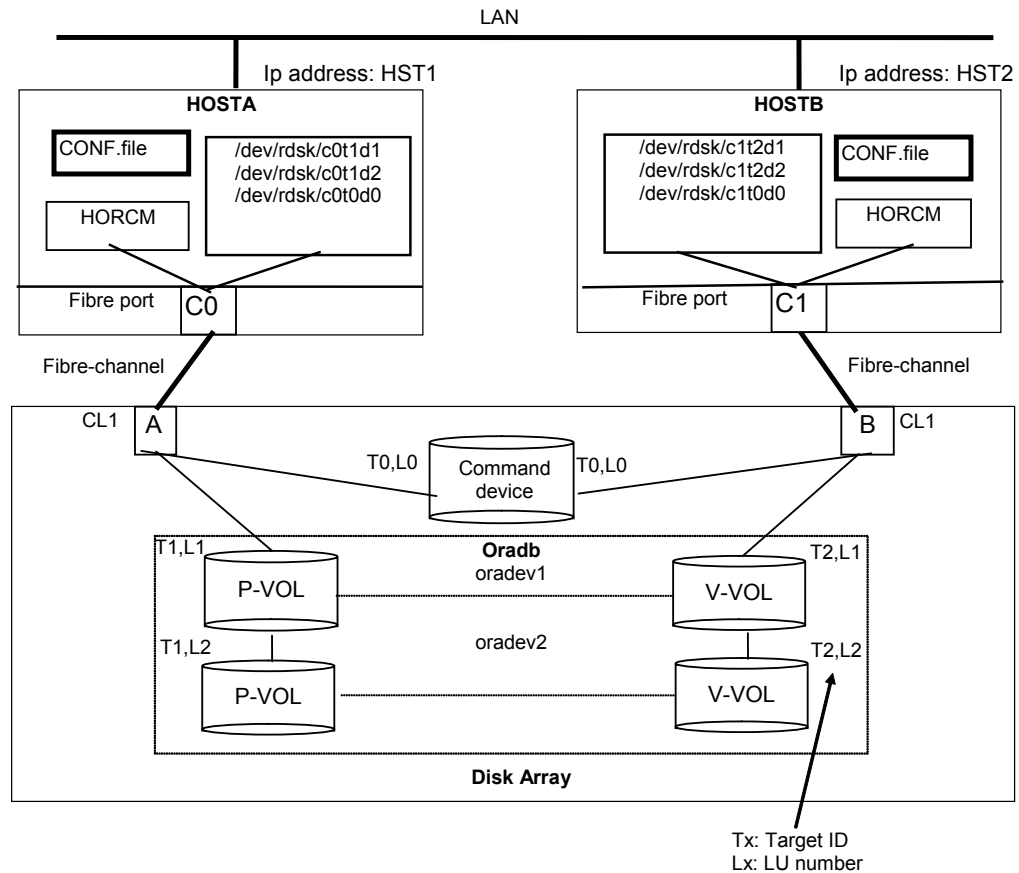
- Designate a volume name (oradev1) and a remote host P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vr
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-B , 2,   1-0 )91210061   20.S-VOL COPY,----- 18 -
Oradb   oradev1 (R)  (CL1-A , 1,   1-0 )91210061   18.P-VOL COPY,91210061 20 -
Oradb   oradev2 (L)  (CL1-B , 2,   2-0 )91210061   21.S-VOL COPY,----- 19 -
Oradb   oradev2 (R)  (CL1-A , 1,   2-0 )91210061   19.P-VOL COPY,91210061 21 -
```



Configuration file for HOSTA (/etc/horcm.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1 0
Oradb oradev2 CL1-A 1 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST2 horcm
```

Configuration file for HOSTB (/etc/horcm.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST2 horcm 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/yyy [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1 0
Oradb oradev2 CL1-B 2 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm
```

**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other applications (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. If setting two command devices, add second command device in the HORCM\_CMD section.

**Figure 4-37 SnapShot example with two hosts and two instances**

## Example of CCI commands with HOSTA (group Oradb): SnapShot

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb) and a local host P-VOL a case.

```
# paircreate -g Oradb -vl -split
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

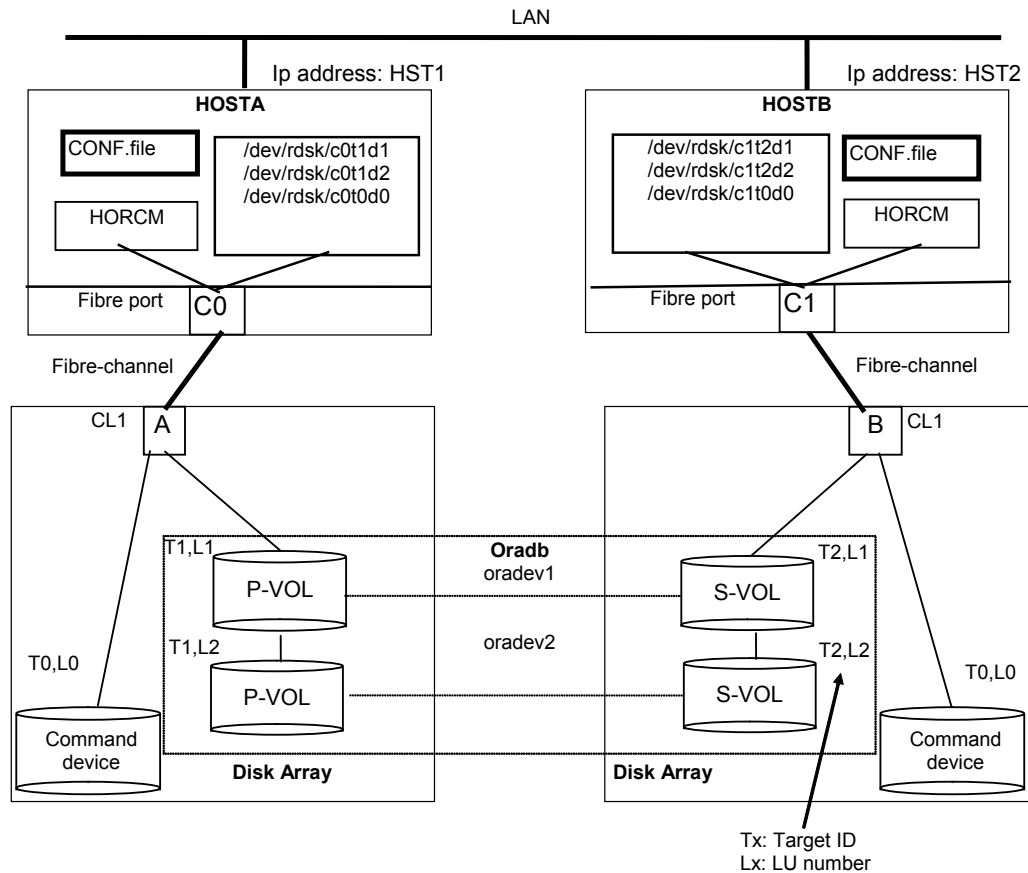
- Designate a volume name (oradev1) and a local host P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vl -split
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradev1 (L)  (CL1-A , 1, 1-0 )91210061 18.P-VOL PSUS,91210061 20 -
oradb   oradev1 (R)  (CL1-B , 2, 1-0 )91210061 20.S-VOL SSUS,----- 18 -
oradb   oradev2 (L)  (CL1-A , 1, 2-0 )91210061 19.P-VOL PSUS,91210061 21 -
oradb   oradev2 (R)  (CL1-B , 2, 2-0 )91210061 21.S-VOL SSUS,----- 19 -
```



Configuration file for HOSTA (/etc/horcm.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1
Oradb oradev2 CL1-A 1 2

HORCM_INST
#dev_group ip_address service
Oradb HST2 horcm
```

Configuration file for HOSTB (/etc/horcm.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST2 horcm 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/yyy [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1
Oradb oradev2 CL1-B 2 2

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm
```

**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other applications (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. If setting two command devices, add second command device in the HORCM\_CMD section.

**Figure 4-38 Two hosts and two instances example TrueCopy/TCE**

## Example of CCI commands with HOSTA (group Oradb): TrueCopy

For TCE, a fence level of **async** must be specified.

- Designate a group name (Oradb) and a local host P-VOL a case.

```
# paircreate -g Oradb -f never -vl
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file (two pairs for the configuration in [Figure 4-38](#)).

- Designate a volume name (oradev1) and a local host P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -f never -vl
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file (CL1-A, T1, L1 and CL1-B, T2, L1 for the configuration in [Figure 4-38](#)).

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL) ,Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-A , 1, 1 )91210061 18.P-VOL COPY NEVER ,91210062 20 -
Oradb   oradev1 (R)  (CL1-B , 2, 1 )91210062 20.S-VOL COPY NEVER , ----- 18 -
Oradb   oradev2 (L)  (CL1-A , 1, 2 )91210061 19.P-VOL COPY NEVER ,91210062 21 -
Oradb   oradev2 (R)  (CL1-B , 2, 2 )91210062 21.S-VOL COPY NEVER , ----- 19 -
```

## Example of CCI commands with HOSTB (group Oradb): TrueCopy

- Designate a group name and a remote host P-VOL a case.

```
# paircreate -g Oradb -f never -vr
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file (two pairs for the configuration in [Figure 4-38](#)).

- Designate a volume name (oradev1) and a remote host P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -f never -vr
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file (CL1-A, T1, L1 and CL1-B, T2, L1 for the configuration in [Figure 4-38](#)).

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL) ,Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-B , 2, 1 )91210062 20.S-VOL COPY NEVER , ----- 18 -
Oradb   oradev1 (R)  (CL1-A , 1, 1 )91210061 18.P-VOL COPY NEVER ,91210062 20 -
Oradb   oradev2 (L)  (CL1-B , 2, 2 )91210062 21.S-VOL COPY NEVER , ----- 19 -
Oradb   oradev2 (R)  (CL1-A , 1, 2 )91210061 19.P-VOL COPY NEVER ,91210062 21 -
```

## Configuring one host and two instances

The command device is defined using the system raw device name (character-type device file name). The command device defined in the configuration definition file must be established in a way to be following either every instance. If one command device is used between different instances on the same port, the number of instances is up to 16 per command device. If this restriction is exceeded, use a different path for each instance. For example, the command devices for [Figure 4-39](#) to [Figure 4-41](#) would be:

- HP-UX:  
HORCM\_CMD of HOSTA = **/dev/rdisk/c0t0d0**  
HORCM\_CMD of HOSTB = **/dev/rdisk/c1t0d0**
- Solaris:  
HORCM\_CMD of HOSTA = **/dev/rdisk/c0t0d0s2**  
HORCM\_CMD of HOSTB = **/dev/rdisk/c1t0d0s2**  
You can use the command device without a label in the format command.
- AIX:  
HORCM\_CMD of HOSTA = **/dev/rhdiskX**  
HORCM\_CMD of HOSTB = **/dev/rhdiskX**  
Where **X** = device number created automatically by AIX.
- Tru64 UNIX:  
HORCM\_CMD of HOSTA = **/dev/rdisk/dskXc**  
HORCM\_CMD of HOSTB = **/dev/rdisk/dskXc**  
Where **X** = device number assigned by Tru64 UNIX.
- Linux:  
HORCM\_CMD of HOSTA = **/dev/sdX**  
HORCM\_CMD of HOSTB = **/dev/sdX**  
Where **X** = device number assigned by Linux.
- IRIX:  
HORCM\_CMD of HOSTA = **/dev/rdisk/dksXdXlXvol**  
OR  
HORCM\_CMD of HOSTA = **/dev/rdisk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD of HOSTB = **/dev/rdisk/dksXdXlXvol**  
OR  
HORCM\_CMD of HOSTB = **/dev/rdisk/node\_wwn/lunXvol/cXpX**  
Where **X** = device number assigned by IRIX.

- Windows Server:

HORCM\_CMD of HOSTA = **\\.\PhysicalDriveX**

OR

HORCM\_CMD of HOSTA = **\\.\Volume{guid}**

OR

HORCM\_CMD of HOSTA = **\\.\CMD-Ser#-Idev#-Port#**

HORCM\_CMD of HOSTB = **\\.\PhysicalDriveX**

OR

HORCM\_CMD of HOSTB = **\\.\Volume{guid}**

OR

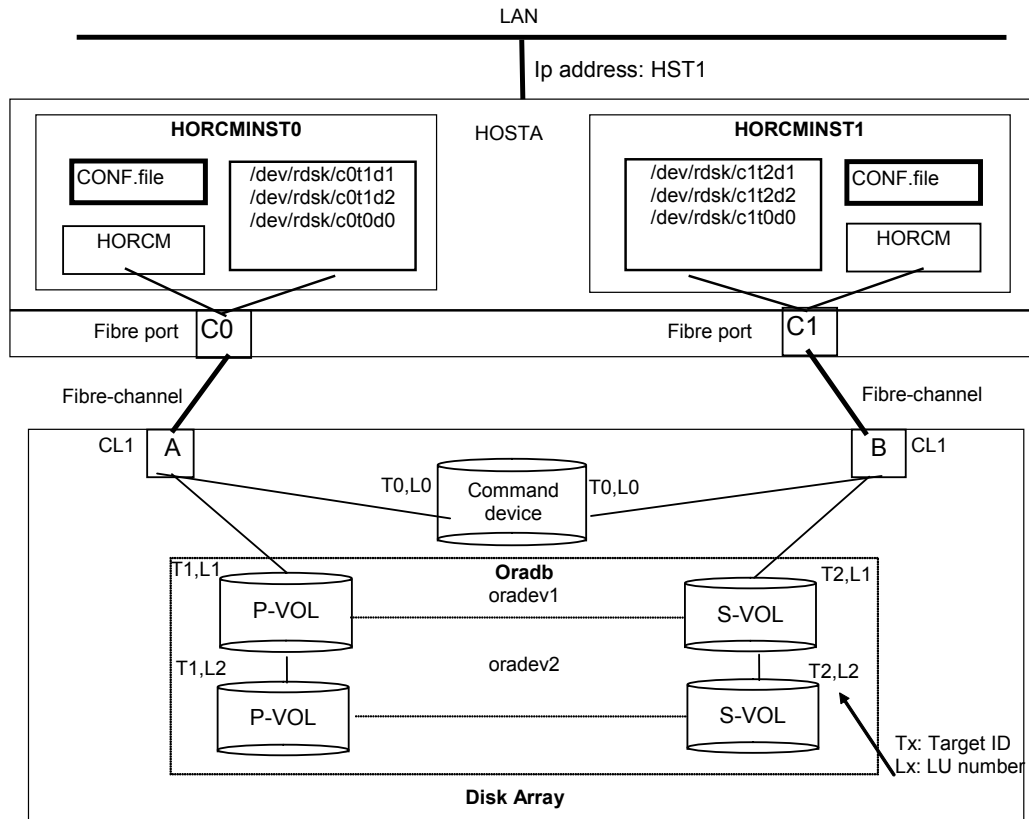
HORCM\_CMD of HOSTB = **\\.\CMD-Ser#-Idev#-Port#**

Where X = device number assigned by Windows Server.

The PhysicalDrive number may change at every reboot. If the number changes, use **\\.\CMD-Ser#-Idev#-Port#** or **Volume{guid}** for which the same name is kept.

If **\\.\CMD-Ser#-Idev#-Port#** or **\\.\Volume{guid}** is specified, CCI changes it to **\\.\PhysicalDrive?** to be corresponded. For MSCS, it is recommended to use **\\.\CMD-Ser#-Idev#-Port#** instead of **\\.\Volume{GUID}** because it may not be maintained. Using **\\.\CMD-Ser#-Idev#-Port#** does not require creating any partition on a volume. **Volume{guid}** is created when you make a partition by using the Windows' Disk Management. You can find **Volume{guid}** by using the **inqraid \$Volume -CLI -fv** or **raidscan -x findcmddev0.?** commands.

- Regarding a command device for CCI, do not set two or more paths for a single host. (Windows Server may change the **guid** when a volume with an identical **guid** is found.
- For Windows Server, when a path detachment, which is caused by a controller detachment or interface failure, continues for longer than one minute, the command device may be unable to be recognized at the time when recovery from the path detachment is made. To make the recovery, perform the re-scanning of the disks of Windows. When Windows cannot access the command device although CCI becomes able to recognize the command device, restart CCI.



Configuration file for HORCMINST0 (horcm0.conf)

```

HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm0 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1 0
Oradb oradev2 CL1-A 1 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm1

```

Configuration file for HORCMINST1 (horcm1.conf)

```

HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm1 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1 0
Oradb oradev2 CL1-B 2 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm0

```

**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other application (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. When setting two command devices, add second command device in the HORCM\_CMD section.

In the same line, you can also add a command device specified by a different path so that the host can use the same command device when one of the paths cannot be used.

**Figure 4-39 ShadowImage example with one host and two instances**

## Example of CCI commands with instance-0 on HOSTA: ShadowImage

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 0
```

For Windows:

```
set HORCMINST=0
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb) and a local instance P-VOL a case.

```
# paircreate -g Oradb -vl
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

- Designate a volume name (oradev1) and a local instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vl
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-A , 1, 1-0 )91210061 18.P-VOL COPY,91210061 19 -
Oradb   oradev1 (R)  (CL1-B , 2, 1-0 )91210061 19.S-VOL COPY,----- 18 -
Oradb   oradev2 (L)  (CL1-A , 1, 2-0 )91210061 20.P-VOL COPY,91210061 21 -
Oradb   oradev2 (R)  (CL1-B , 2, 2-0 )91210061 21.S-VOL COPY,----- 20 -
```

### Example of CCI commands with instance-1 on HOSTA: ShadowImage

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 1
```

For Windows:

```
set HORCMINST=1
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name and a remote instance P-VOL a case.

```
# paircreate -g Oradb -vr
```

This command creates pairs for all volumes designated as **Oradb** in the configuration definition file.

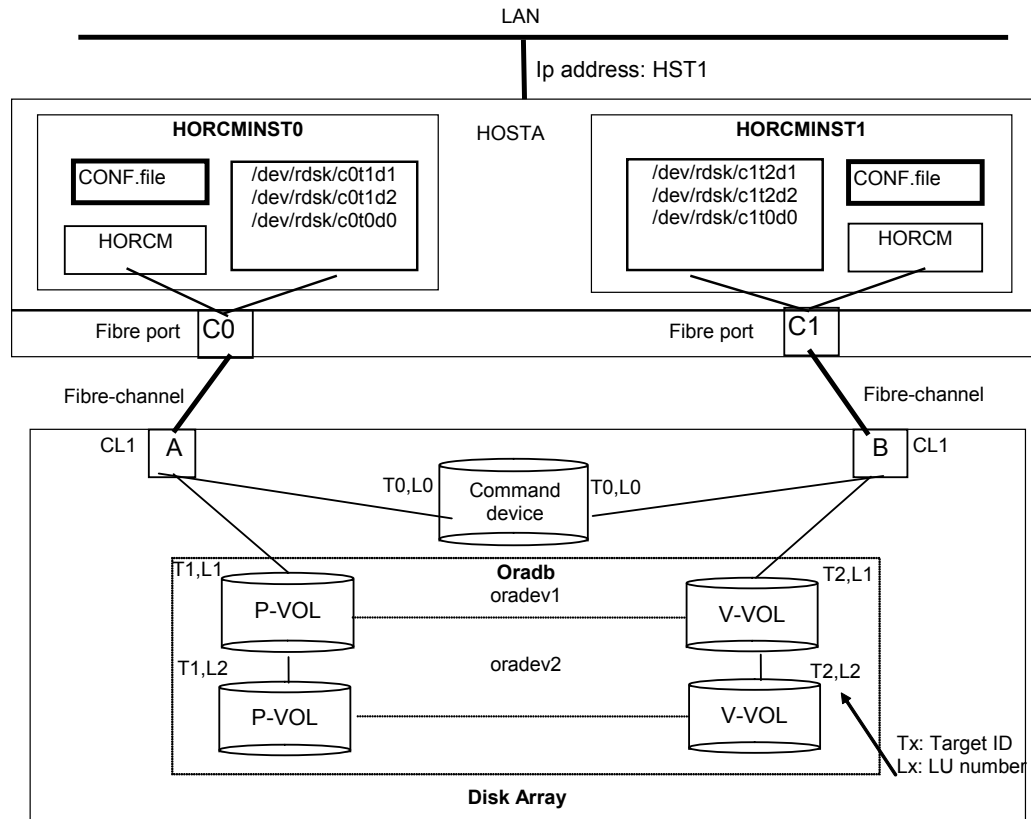
- Designate a volume name (oradev1) and a remote instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vr
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-B , 2, 1-0 )91210061 19.S-VOL COPY,----- 18 -
Oradb   oradev1 (R) (CL1-A , 1, 1-0 )91210061 18.P-VOL COPY,91210061 19 -
Oradb   oradev2 (L) (CL1-B , 2, 2-0 )91210061 21.S-VOL COPY,----- 20 -
Oradb   oradev2 (R) (CL1-A , 1, 2-0 )91210061 20.P-VOL COPY,91210061 21 -
```



Configuration file for HORCMINST0 (horcm0.conf)

```

HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm0 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1 0
Oradb oradev2 CL1-A 1 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm1

```

Configuration file for HORCMINST1 (horcm1.conf)

```

HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm1 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1 0
Oradb oradev2 CL1-B 2 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm0

```

**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other application (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. When setting two command devices, add second command device in the HORCM\_CMD section.

In the same line, you can also add a command device specified by a different path so that the host can use the same command device when one of the paths cannot be used.

**Figure 4-40 SnapShot example with one host and two instances**

## Example of CCI commands with instance-0 on HOSTA: SnapShot

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 0
```

For Windows:

```
set HORCMINST=0
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb) and a local instance P-VOL a case.

```
# paircreate -g Oradb -vl -split
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

- Designate a volume name (oradev1) and a local instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vl -split
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1-0 )91210061 18.P-VOL PSUS,91210061 19 -
Oradb   oradev1 (R) (CL1-B , 2, 1-0 )91210061 19.S-VOL SSUS,----- 18 -
Oradb   oradev2 (L) (CL1-A , 1, 2-0 )91210061 20.P-VOL PSUS,91210061 21 -
Oradb   oradev2 (R) (CL1-B , 2, 2-0 )91210061 21.S-VOL SSUS,----- 20 -
```

### Example of CCI commands with instance-1 on HOSTA: SnapShot

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 1
```

For Windows:

```
set HORCMINST=1
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name and a remote instance P-VOL a case.

```
# paircreate -g Oradb -vr -split
```

This command creates pairs for all volumes designated as **Oradb** in the configuration definition file.

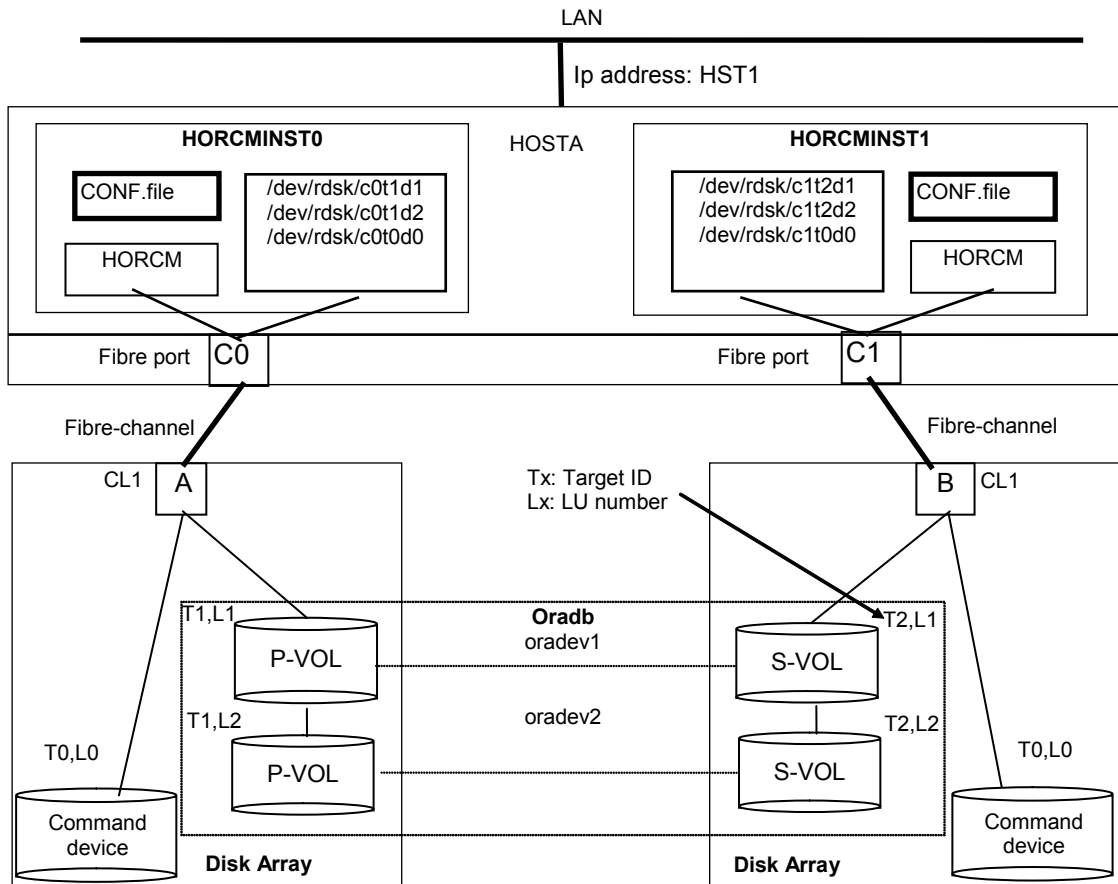
- Designate a volume name (oradev1) and a remote instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vr -split
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-B , 2,    1-0 )91210061    19.S-VOL SSUS,----- 18 -
Oradb   oradev1 (R)  (CL1-A , 1,    1-0 )91210061    18.P-VOL PSUS,91210061 19 -
Oradb   oradev2 (L)  (CL1-B , 2,    2-0 )91210061    21.S-VOL SSUS,----- 20 -
Oradb   oradev2 (R)  (CL1-A , 1,    2-0 )91210061    20.P-VOL PSUS,91210061 21 -
```



Configuration file for HORCMINST0 (horcm0.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm0 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1
Oradb oradev2 CL1-A 1 2

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm1
```

Configuration file for HORCMINST1 (horcm1.conf)

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm1 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/yyy [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1
Oradb oradev2 CL1-B 2 2

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm0
```

**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other applications (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. If setting two command devices, add second command device in the HORCM\_CMD section.

In the same line, you can also add a command device specified by different path, so that the host can use the same command device incase when one of the path cannot be used.

**Figure 4-41 One host and two instances example using TrueCopy/TCE**

## Example of CCI commands with instance-0 on HOSTA: TrueCopy

For TCE, a fence level of "async" must be specified.

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 0
```

For Windows:

```
set HORCMINST=0
```

- Designate a group name (Oradb) and a local instance P-VOL a case.

```
# paircreate -g Oradb -f never -vl
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file (two pairs for the configuration in [Figure 4-41](#)).

- Designate a volume name (oradev1) and a local instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -f never -vl
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file (CL1-A, T1, L1 and CL1-B, T2, L1 for the configuration in [Figure 4-41](#)).

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL) ,Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1 ) 91210061 18.P-VOL COPY NEVER ,91210062 19 -
Oradb   oradev1 (R) (CL1-B , 2, 1 ) 91210062 19.S-VOL COPY NEVER , ----- 18 -
Oradb   oradev2 (L) (CL1-A , 1, 2 ) 91210061 20.P-VOL COPY NEVER ,91210062 21 -
Oradb   oradev2 (R) (CL1-B , 2, 2 ) 91210062 21.S-VOL COPY NEVER , ----- 20 -
```

## Example of CCI commands with instance-1 on HOSTA: TrueCopy

For TCE, a fence level of **async** must be specified.

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 1
```

For Windows:

```
set HORCMINST=1
```

- Designate a group name and a remote instance P-VOL a case.

```
# paircreate -g Oradb -f never -vr
```

This command creates pairs for all volumes designated as **Oradb** in the configuration definition file (two pairs for the configuration in [Figure 4-41](#)).

- Designate a volume name (oradev1) and a remote instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -f never -vr
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file (CL1-A, T1, L1 and CL1-B, T2, L1 for the configuration in [Figure 4-41](#)).

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL) ,Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-B , 2, 1 )91210062 19.S-VOL COPY NEVER , ----- 18 -
Oradb   oradev1 (R)  (CL1-A , 1, 1 )91210061 18.P-VOL COPY NEVER ,91210062 19 -
Oradb   oradev2 (L)  (CL1-B , 2, 2 )91210062 21.S-VOL COPY NEVER , ----- 20 -
Oradb   oradev2 (R)  (CL1-A , 1, 2 )91210061 20.P-VOL COPY NEVER ,91210062 21 -
```

## Setting two command devices

Setting two command devices enables you to use the alternate command device function.

The command device is defined by using the system raw device name (character-type device file name). The command device defined in the configuration definition file must be established to follow either every instance. If one command device is used between different instances on the same port, the number of instances is up to 16 per command device. If this restriction is exceeded, use a different path for each instance. For example, the command devices [Figure 4-42](#) to [Figure 4-44](#) would be:

- HP-UX:

```
HORCM_CMD for HORCMINST0 = /dev/rdisk/c0t0d0
HORCM_CMD for HORCMINST0 = /dev/rdisk/c1t0d1
HORCM_CMD for HORCMINST1 = /dev/rdisk/c1t0d0
HORCM_CMD for HORCMINST1 = /dev/rdisk/c1t0d1
```

You can use the command device without a label in the format command.

- Solaris:

```
HORCM_CMD for HORCMINST0 = /dev/rdisk/c0t0d0s2
HORCM_CMD for HORCMINST0 = /dev/rdisk/c1t0d1s2
HORCM_CMD for HORCMINST1 = /dev/rdisk/c1t0d0s2
HORCM_CMD for HORCMINST1 = /dev/rdisk/c1t0d1s2
```

- AIX:

```
HORCM_CMD for HORCMINST0 = /dev/rhdiskX
HORCM_CMD for HORCMINST0 = /dev/rhdiskY
HORCM_CMD for HORCMINST1 = /dev/rhdiskX
HORCM_CMD for HORCMINST1 = /dev/rhdiskY
```

Where **X** and **Y** = device number created automatically by AIX.

- Tru64 UNIX:

```
HORCM_CMD for HORCMINST0 = /dev/rdisk/dskXc
HORCM_CMD for HORCMINST0 = /dev/rdisk/dskYc
HORCM_CMD for HORCMINST1 = /dev/rhdisk/dskXc
HORCM_CMD for HORCMINST1 = /dev/rhdisk/dskYc
```

Where **X** and **Y** = device number assigned by Tru64 UNIX.

- Linux:

```
HORCM_CMD for HORCMINST0 = /dev/sdX
HORCM_CMD for HORCMINST0 = /dev/sdY
HORCM_CMD for HORCMINST1 = /dev/sdX
HORCM_CMD for HORCMINST1 = /dev/sdY
```

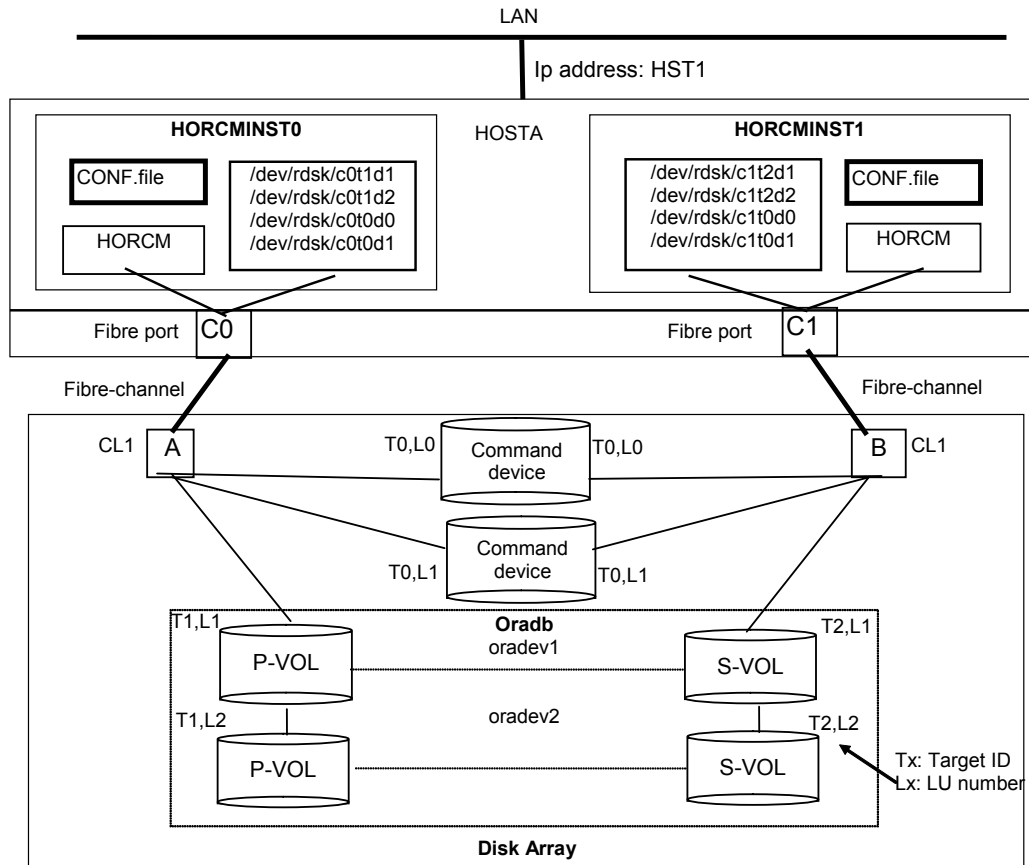
Where **X** and **Y** = device number assigned by Linux.

- IRIX:  
HORCM\_CMD for HORCMINST0 = **/dev/rdisk/dksXdXlXvol**  
OR  
HORCM\_CMD for HORCMINST0 = **/dev/rdisk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD for HORCMINST0 = **/dev/rdisk/dksYdYlYXvol**  
OR  
HORCM\_CMD for HORCMINST0 = **/dev/rdisk/node\_wwn/lunYvol/cYpY**  
HORCM\_CMD for HORCMINST1 = **/dev/rdisk/dksXdXlXvol**  
OR  
HORCM\_CMD for HORCMINST1 = **/dev/rdisk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD for HORCMINST1 = **/dev/rdisk/dksYdYlYvol**  
OR  
HORCM\_CMD for HORCMINST1 = **/dev/rdisk/node\_wwn/lunYvol/cYpY**  
Where **X** and **Y** = device number assigned by IRIX.
- Windows Server:  
HORCM\_CMD of HORCMINST0 = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HORCMINST0 = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HORCMINST0 = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HORCMINST0 = **\\.\PhysicalDriveY**  
OR  
HORCM\_CMD of HORCMINST0 = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HORCMINST0 = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HORCMINST1 = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HORCMINST1 = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HORCMINST1 = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HORCMINST1 = **\\.\PhysicalDriveY**  
OR  
HORCM\_CMD of HORCMINST1 = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HORCMINST1 = **\\.\CMD-Ser#-ldev#-Port#**  
Where **X** and **Y** = device number assigned by Windows Server.  
The PhysicalDrive number may change at every reboot. If the number changes, use **\\.\CMD-Ser#-ldev#-Port#** or **Volume{guid}** for which the same name is kept.

If **\\.\CMD-Ser#-ldev#-Port#** or **\\.\Volume{guid}** is specified, CCI changes it to **\\.\PhysicalDrive?** to be corresponded. For MSCS, it is recommended to use **\\.\CMD-Ser#-ldev#-Port#** instead of **\\.\Volume{GUID}** because it may not be maintained. Using **\\.\CMD-Ser#-ldev#-Port#** does not require creating any partition on a volume. **Volume{guid}** is created when you make a partition by using the Windows' Disk Management. You can find **Volume{guid}** by using the **inraid \$Volume -CLI -fv** or **raidscan -x findcmddev0.?** commands.

Regarding a command device for CCI, do not set two or more paths for a single host. (Windows Server may change the **guid** when a volume with an identical **guid** is found.

For Windows Server, when a path detachment, which is caused by a controller detachment or interface failure, continues for longer than one minute, the command device may be unable to be recognized at the time when recovery from the path detachment is made. To make the recovery, perform the re-scanning of the disks of Windows. When Windows cannot access the command device although CCI becomes able to recognize the command device, restart CCI.



Configuration file for HORCMINST0 (horcm0.conf)

```

HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm0 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx /dev/yyy [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-A 1 1 0
Oradb oradev2 CL1-A 1 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm1

```

Configuration file for HORCMINST1 (horcm1.conf)

```

HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1 horcm1 12000 [Note 1] 3000

HORCM_CMD
#dev_name
/dev/xxx /dev/yyy [Note 2]

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
Oradb oradev1 CL1-B 2 1 0
Oradb oradev2 CL1-B 2 2 0

HORCM_INST
#dev_group ip_address service
Oradb HST1 horcm0

```

**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other application (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. When setting two command devices, add second command device in the HORCM\_CMD section.

In the same line, you can also add a command device specified by a different path so that the host can use the same command device when one of the paths cannot be used.

**Figure 4-42 ShadowImage example with two command devices**

## Example of CCI commands with Instance-0 on HOSTA: ShadowImage

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 0
```

For Windows:

```
set HORCMINST=0
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb) and a local instance P-VOL a case.

```
# paircreate -g Oradb -vl
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

- Designate a volume name (oradev1) and a local instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vl
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1-0 )91210061 18.P-VOL COPY,91210061 19 -
Oradb   oradev1 (R) (CL1-B , 2, 1-0 )91210061 19.S-VOL COPY,----- 18 -
Oradb   oradev2 (L) (CL1-A , 1, 2-0 )91210061 20.P-VOL COPY,91210061 21 -
Oradb   oradev2 (R) (CL1-B , 2, 2-0 )91210061 21.S-VOL COPY,----- 20 -
```

## Example of CCI commands with Instance-1 on HOSTA: ShadowImage

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 1
```

For Windows:

```
set HORCMINST=1
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name and a remote instance P-VOL a case.

```
# paircreate -g Oradb -vr
```

This command creates pairs for all volumes designated as **Oradb** in the configuration definition file.

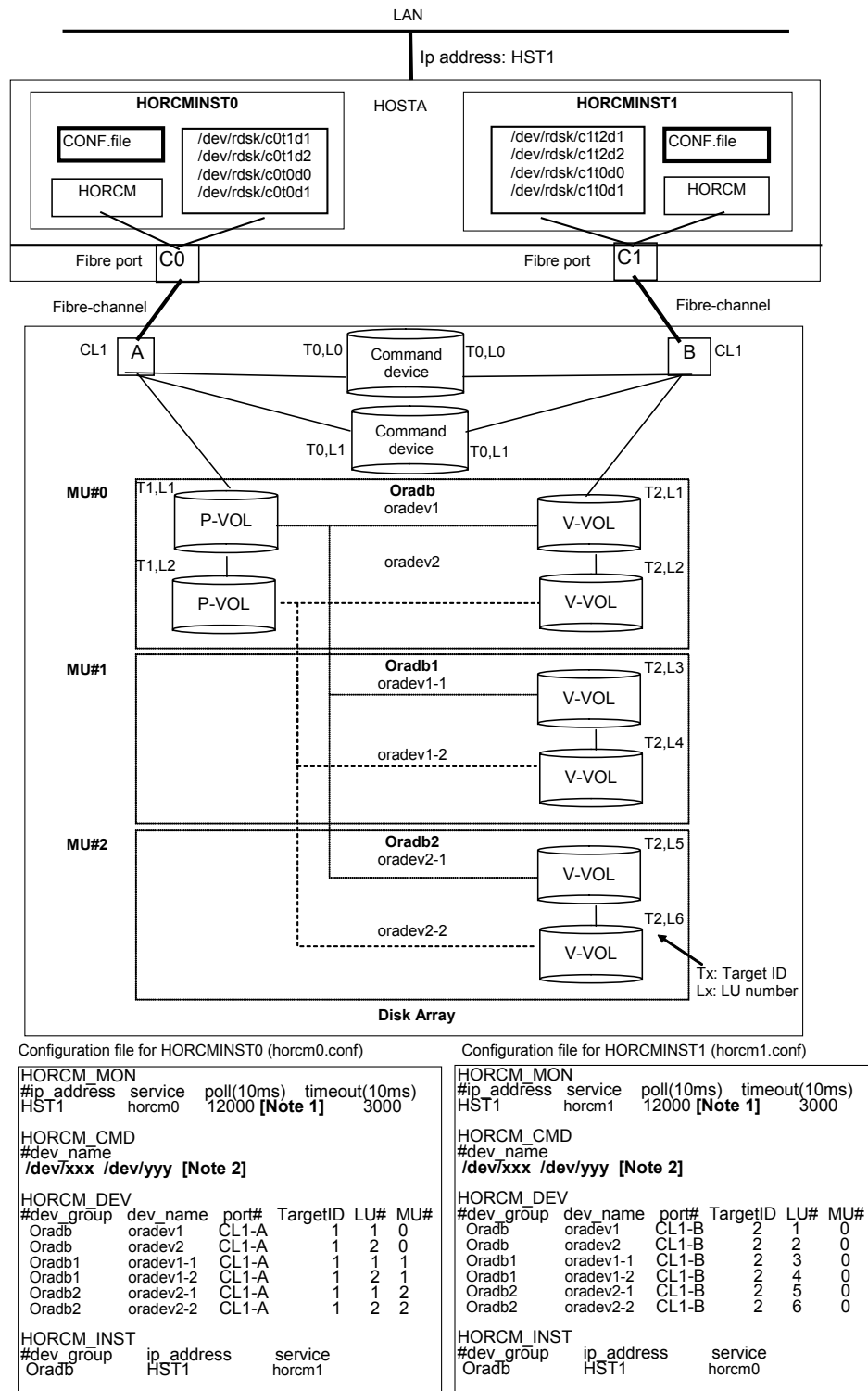
- Designate a volume name (oradev1) and a remote instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vr
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-B , 2, 1-0 )91210061 19.S-VOL COPY,----- 18 -
Oradb   oradev1 (R) (CL1-A , 1, 1-0 )91210061 18.P-VOL COPY,91210061 19 -
Oradb   oradev2 (L) (CL1-B , 2, 2-0 )91210061 21.S-VOL COPY,----- 20 -
Oradb   oradev2 (R) (CL1-A , 1, 2-0 )91210061 20.P-VOL COPY,91210061 21 -
```



**Figure 4-43 SnapShot example with two command devices**

## Example of CCI commands with Instance-0 on HOSTA: SnapShot

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 0
```

For Windows:

```
set HORCMINST=0
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb) and a local instance P-VOL a case.

```
# paircreate -g Oradb -vl -split
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file.

- Designate a volume name (oradev1) and a local instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vl -split
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1-0 )91210061 18.P-VOL PSUS,91210061 19 -
Oradb   oradev1 (R) (CL1-B , 2, 1-0 )91210061 19.S-VOL SSUS,----- 18 -
Oradb   oradev2 (L) (CL1-A , 1, 2-0 )91210061 20.P-VOL PSUS,91210061 21 -
Oradb   oradev2 (R) (CL1-B , 2, 2-0 )91210061 21.S-VOL SSUS,----- 20 -
```

### Example of CCI commands with Instance-1 on HOSTA: SnapShot

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 1
```

For Windows:

```
set HORCMINST=1
```

- When the command execution environment is not set, set HORCC\_MRCF to the environment variable.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name and a remote instance P-VOL a case.

```
# paircreate -g Oradb -vr -split
```

This command creates pairs for all volumes designated as **Oradb** in the configuration definition file.

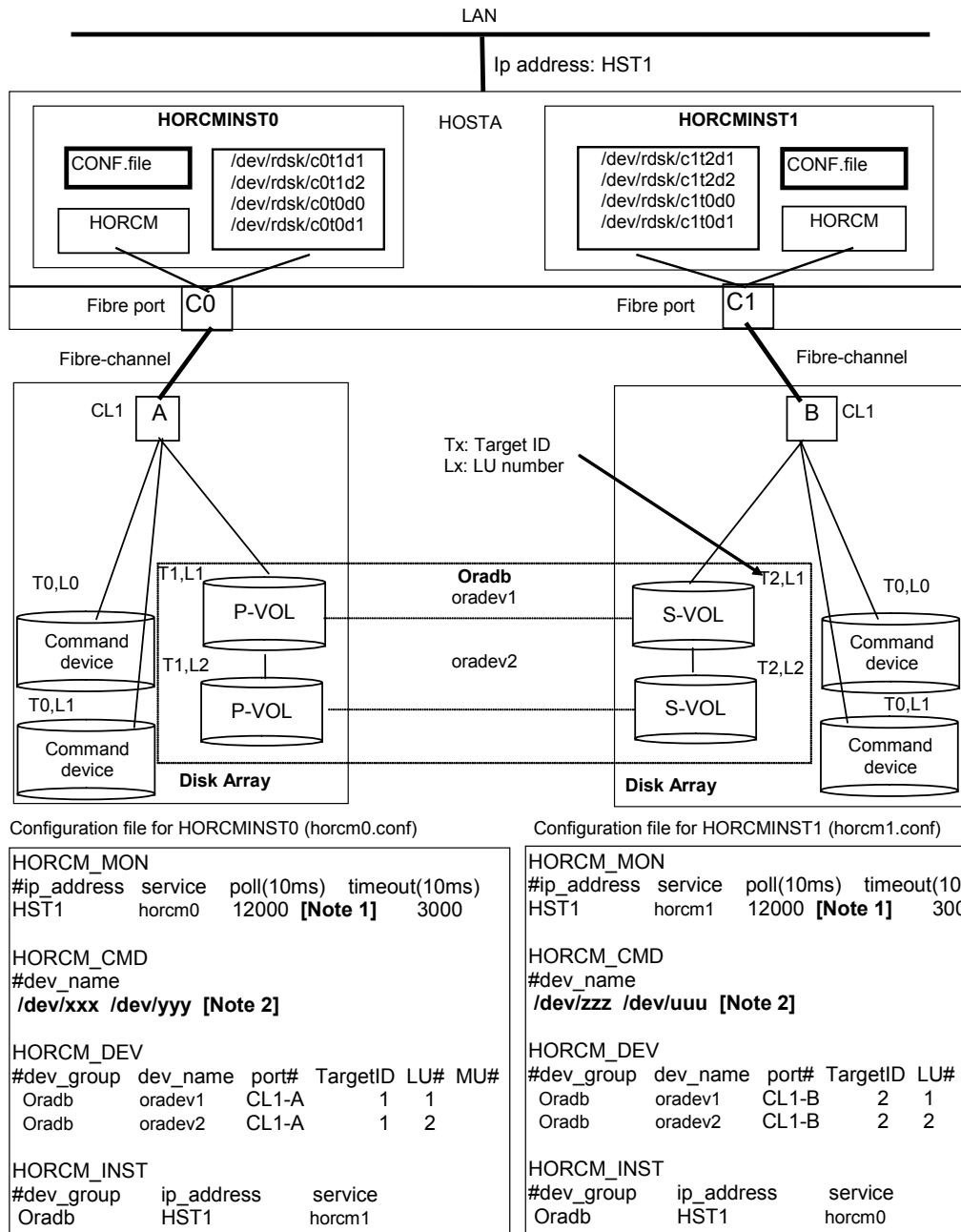
- Designate a volume name (**oradev1**) and a remote instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -vr -split
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file.

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-B , 2,   1-0 )91210061   19.S-VOL SSUS,----- 18 -
Oradb   oradev1 (R)  (CL1-A , 1,   1-0 )91210061   18.P-VOL PSUS,91210061 19 -
Oradb   oradev2 (L)  (CL1-B , 2,   2-0 )91210061   21.S-VOL SSUS,----- 20 -
Oradb   oradev2 (R)  (CL1-A , 1,   2-0 )91210061   20.P-VOL PSUS,91210061 21 -
```



**Note 1:** To calculate the value for poll(10ms), see section 2.5.3.

**Note 2:** The command device is dedicated to CCI communications and cannot be used by any other applications (neither the user). Command devices must be set using Hitachi Storage Navigator Modular 2. If setting two command devices, add second command device in the HORCM\_CMD section.  
In the same line, you can also add a command device specified by different path, so that the host can use the same command device incase when one of the path cannot be used.

**Figure 4-44 Two command devices using TrueCopy/TCE**

## Example of CCI commands with Instance-0 on HOSTA: TrueCopy

For TCE, a fence level of **async** must be specified.

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 0
```

For Windows:

```
set HORCMINST=0
```

- Designate a group name (Oradb) and a local instance P-VOL a case.

```
# paircreate -g Oradb -f never -vl
```

This command creates pairs for all volumes assigned to group **Oradb** in the configuration definition file (two pairs for the configuration in [Figure 4-44](#)).

- Designate a volume name (oradev1) and a local instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -f never -vl
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file (CL1-A, T1, L1 and CL1-B, T2, L1 for the configuration in [Figure 4-44](#)).

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL) ,Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1 ) 91210061 18.P-VOL COPY NEVER ,91210062 19 -
Oradb   oradev1 (R) (CL1-B , 2, 1 ) 91210062 19.S-VOL COPY NEVER , ----- 18 -
Oradb   oradev2 (L) (CL1-A , 1, 2 ) 91210061 20.P-VOL COPY NEVER ,91210062 21 -
Oradb   oradev2 (R) (CL1-B , 2, 2 ) 91210062 21.S-VOL COPY NEVER , ----- 20 -
```

## Example of CCI commands with Instance-1 on HOSTA: TrueCopy

For TCE, a fence level of async must be specified.

- When the command execution environment is not set, set an instance number.

For C shell:

```
# setenv HORCMINST 1
```

For Windows:

```
set HORCMINST=1
```

- Designate a group name and a remote instance P-VOL a case.

```
# paircreate -g Oradb -f never -vr
```

This command creates pairs for all volumes designated as **Oradb** in the configuration definition file (two pairs for the configuration in [Figure 4-44](#)).

- Designate a volume name (oradev1) and a remote instance P-VOL a case.

```
# paircreate -g Oradb -d oradev1 -f never -vr
```

This command creates pairs for all volumes designated as **oradev1** in the configuration definition file (CL1-A, T1, L1 and CL1-B, T2, L1 for the configuration in [Figure 4-44](#)).

- Designate a group name and display pair status.

```
# pairdisplay -g Oradb
Group   PairVol (L/R) (Port#,TID, VOL) ,Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M
Oradb   oradev1 (L)  (CL1-B , 2, 1 )91210062 19.S-VOL COPY NEVER , ----- 18 -
Oradb   oradev1 (R)  (CL1-A , 1, 1 )91210061 18.P-VOL COPY NEVER ,91210062 19 -
Oradb   oradev2 (L)  (CL1-B , 2, 2 )91210062 21.S-VOL COPY NEVER , ----- 20 -
Oradb   oradev2 (R)  (CL1-A , 1, 2 )91210061 20.P-VOL COPY NEVER ,91210062 21 -
```

## Configuring TrueCopy/ShadowImage with cascade pairs

The command device is defined using the system raw device name (character-type device file name). The command device defined in the configuration definition file must be established in a way to be following either every instance. If one command device is used between different instances on the same port, the number of instances is up to 16 per command device. If this restriction is exceeded, use a different path for each instance. For example, the command devices for would be as follows:

- HP-UX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rdisk/c0t0d1**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rdisk/c1t0d1**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rdisk/c1t0d1**
- Solaris:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rdisk/c0t0d1s2**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rdisk/c1t0d1s2**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rdisk/c1t0d1s2**  
The command device can be used without a label in the format command.
- AIX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rhdiskX**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rhdiskX**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rhdiskX**  
where **X** = device number assigned by AIX
- Tru64 UNIX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rhdisk/dskXc**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rhdisk/dskXc**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rhdisk/dskXc**  
where **X** = device number assigned by Tru64 UNIX
- Linux:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/sdX**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/sdX**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/sdX**  
where **X** = device number assigned by Linux

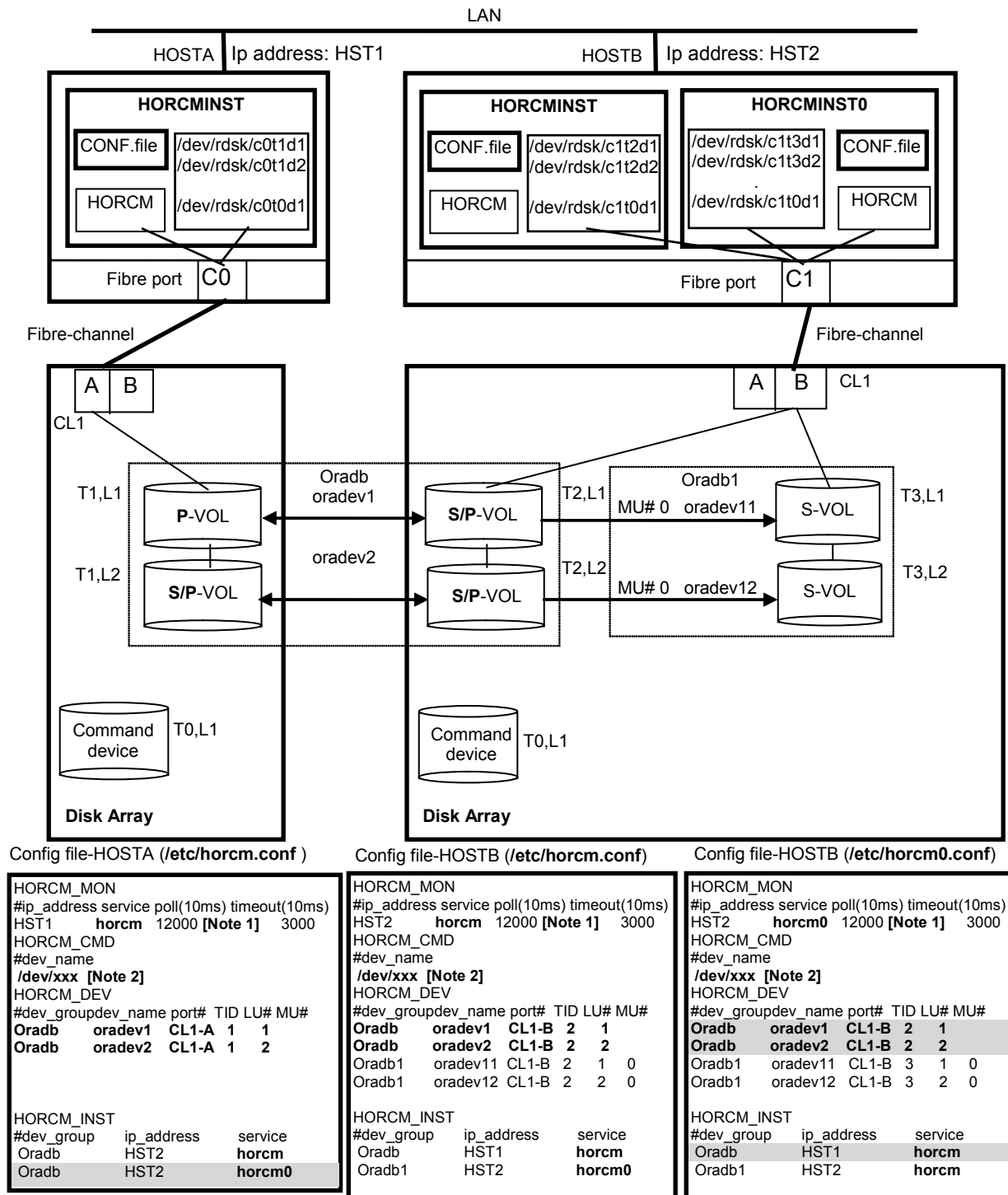
- IRIX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rdisk/dksXdXlXvol**  
OR  
HORCM\_CMD of HOSTA (/etc/horcm.conf) =  
**/dev/rdisk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rdisk/dksXdXlXvol**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm.conf) =  
**/dev/rdisk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rdisk/dksXdYlXvol**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) =  
**/dev/rdisk/node\_wwn/lunXvol/cYpX**  
where **X** = device number assigned by IRIX

- Windows Server:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **\\.\CMD-Ser#-ldev#-Port#**  
where **X** = device number assigned by Windows Server.  
The PhysicalDrive number may change at every reboot. If the number changes, use **\\.\CMD-Ser#-ldev#-Port#** or **Volume{guid}** for which the same name is kept.

If **\\.\CMD-Ser#-ldev#-Port#** or **\\.\Volume{guid}** is specified, CCI changes it to **\\.\PhysicalDrive?** to be corresponded. For MSCS, it is recommended to use **\\.\CMD-Ser#-ldev#-Port#** instead of **\\.\Volume{GUID}** because it may not be maintained. Using **\\.\CMD-Ser#-ldev#-Port#** does not require to create any partition on a volume. **Volume{guid}** is created when you make a partition by using the Windows' Disk Management. You can find **Volume{guid}** by using the **inraid \$Volume -CLI -fv** or **raidscan -x findcmddev0.?** commands.

Regarding a command device for CCI, do not set two or more paths for a single host. (Windows Server may change the **guid** when a volume with an identical **guid** is found.

For Windows Server, when a path detachment, which is caused by a controller detachment or interface failure, continues for longer than one minute, the command device may be unable to be recognized at the time when recovery from the path detachment is made. To make the recovery, perform the re-scanning of the disks of Windows. When Windows cannot access the command device although CCI becomes able to recognize the command device, restart CCI.



**Figure 4-45 TrueCopy/ShadowImage configuration example with cascade pairs**

### Example of CCI commands with HOSTA and HOSTB:

- Designate a group name (Oradb) on TrueCopy environment of HOSTA.

```
# paircreate -g Oradb -f never -vl
```

- When the command execution environment is not set, set HORCC\_MRCF.  
For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb1) on ShadowImage environment of HOSTB.

```
# paircreate -g Oradb1 -vl
```

These commands create pairs for all volumes assigned to groups **Oradb** and **Oradb1** in the configuration definition file (four pairs for the configuration in [Figure 4-45](#)).

- Designate a group name and display pair status on HOSTA.

```
# pairdisplay -g oradb -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1-0 ) 91210061 26.SMPL ----,----- ---- -
Oradb   oradev1 (L) (CL1-A , 1, 1 ) 91210061 26.P-VOL COPY,91210062 28 -
Oradb1  oradev11 (R) (CL1-B , 2, 1-0 ) 91210062 28.P-VOL COPY,91210062 30 -
Oradb   oradev1 (R) (CL1-B , 2, 1 ) 91210062 28.S-VOL COPY,----- 26 -
Oradb   oradev2 (L) (CL1-A , 1, 2-0 ) 91210061 27.SMPL ----,----- ---- -
Oradb   oradev2 (L) (CL1-A , 1, 2 ) 91210061 27.P-VOL COPY,91210062 29 -
Oradb1  oradev12 (R) (CL1-B , 2, 2-0 ) 91210062 29.P-VOL COPY,91210062 31 -
Oradb   oradev2 (R) (CL1-B , 2, 2 ) 91210062 29.S-VOL COPY,----- 27 -
```

## Example of CCI commands with HOSTB:

- Designate a group name (**oradb**) on TrueCopy environment of HOSTB.

```
# paircreate -g Oradb -f never -vr
```

- When the command execution environment is not set, set **HORCC\_MRCF**.  
For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Designate a group name (Oradb1) on ShadowImage environment of HOSTB.

```
# paircreate -g Oradb1 -vl
```

This command creates pairs for all volumes assigned to group **Oradb1** in the configuration definition file (four pairs for the configuration in [Figure 4-45](#)).

- Designate a group name and display pair status on TrueCopy environment of HOSTB.

```
# pairdisplay -g oradb -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb1  oradev11 (L) (CL1-B , 2, 1-0 )91210062 28.P-VOL PAIR,91210062 30 -
Oradb   oradev1 (L) (CL1-B , 2, 1 )91210062 28.S-VOL PAIR,----- 26 -
Oradb   oradev1 (R) (CL1-A , 1, 1-0 )91210061 26.SMPL ----,----- ---- -
Oradb   oradev1 (R) (CL1-A , 1, 1 )91210061 26.P-VOL PAIR,91210062 28 -
Oradb1  oradev12 (L) (CL1-B , 2, 2-0 )91210062 29.P-VOL PAIR,91210062 31 -
Oradb   oradev2 (L) (CL1-B , 2, 2 )91210062 29.S-VOL PAIR,----- 27 -
Oradb   oradev2 (R) (CL1-A , 1, 2-0 )91210061 27.SMPL ----,----- ---- -
Oradb   oradev2 (R) (CL1-A , 1, 2 )91210061 27.P-VOL PAIR,91210062 29 -
```

- Designate a group name and display pair status on ShadowImage environment of HOSTB.

```
# pairdisplay -g oradb1 -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb1  oradev11 (L) (CL1-B , 2, 1-0 )91210062 28.P-VOL PAIR,91210062 30 -
Oradb   oradev1 (L) (CL1-B , 2, 1 )91210062 28.S-VOL PAIR,----- 26 -
Oradb1  oradev11 (R) (CL1-B , 3, 1-0 )91210062 30.S-VOL PAIR,----- 28 -
Oradb1  oradev12 (L) (CL1-B , 2, 2-0 )91210062 29.P-VOL PAIR,91210062 31 -
Oradb   oradev2 (L) (CL1-B , 2, 2 )91210062 29.S-VOL PAIR,----- 27 -
Oradb1  oradev12 (R) (CL1-B , 3, 2-0 )91210062 31.S-VOL PAIR,----- 29 -
```

- Designate a group name and display pair status on ShadowImage environment of HOSTB (**HORCMINSTO**).

```
# pairdisplay -g oradb1 -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb1  oradev11 (L) (CL1-B , 3, 1-0 )91210062 30.S-VOL PAIR,----- 28 -
Oradb1  oradev11 (R) (CL1-B , 2, 1-0 )91210062 28.P-VOL PAIR,91210062 30 -
Oradb   oradev1 (R) (CL1-B , 2, 1 )91210062 28.S-VOL PAIR,----- 26 -
Oradb1  oradev12 (L) (CL1-B , 3, 2-0 )91210062 31.S-VOL PAIR,----- 29 -
Oradb1  oradev12 (R) (CL1-B , 2, 2-0 )91210062 29.P-VOL PAIR,91210062 31 -
Oradb   oradev2 (R) (CL1-B , 2, 2 )91210062 29.S-VOL PAIR,----- 27 -
```

## Configuring TCE/SnapShot with cascade pairs

The command device is defined using the system raw device name (character-type device file name). The command device defined in the configuration definition file must be established in a way to be following either every instance. If one command device is used between different instances on the same port, the number of instances is up to 16 per command device. If this restriction is exceeded, use a different path for each instance. For example, the command devices for would be as follows:

- HP-UX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rdisk/c0t0d1**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rdisk/c1t0d1**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rdisk/c1t0d1**
- Solaris:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rdisk/c0t0d1s2**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rdisk/c1t0d1s2**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rdisk/c1t0d1s2**  
The command device can be used without a label in the format command.
- AIX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rhdiskX**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rhdiskX**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rhdiskX**  
where **X** = device number assigned by AIX
- Tru64 UNIX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rhdisk/dskXc**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rhdisk/dskXc**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rhdisk/dskXc**  
where **X** = device number assigned by Tru64 UNIX
- Linux:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/sdX**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/sdX**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/sdX**  
where **X** = device number assigned by Linux

- IRIX:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **/dev/rdsk/dksXdXlXvol**  
OR  
HORCM\_CMD of HOSTA (/etc/horcm.conf) =  
**/dev/rdsk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **/dev/rdsk/dksXdXlXvol**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm.conf) =  
**/dev/rdsk/node\_wwn/lunXvol/cXpX**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **/dev/rdsk/dksXdYlXvol**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) =  
**/dev/rdsk/node\_wwn/lunXvol/cYpX**  
where **X** = device number assigned by IRIX

- Windows Server:  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HOSTA (/etc/horcm.conf) = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm.conf) = **\\.\CMD-Ser#-ldev#-Port#**  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **\\.\PhysicalDriveX**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **\\.\Volume{guid}**  
OR  
HORCM\_CMD of HOSTB (/etc/horcm0.conf) = **\\.\CMD-Ser#-ldev#-Port#**

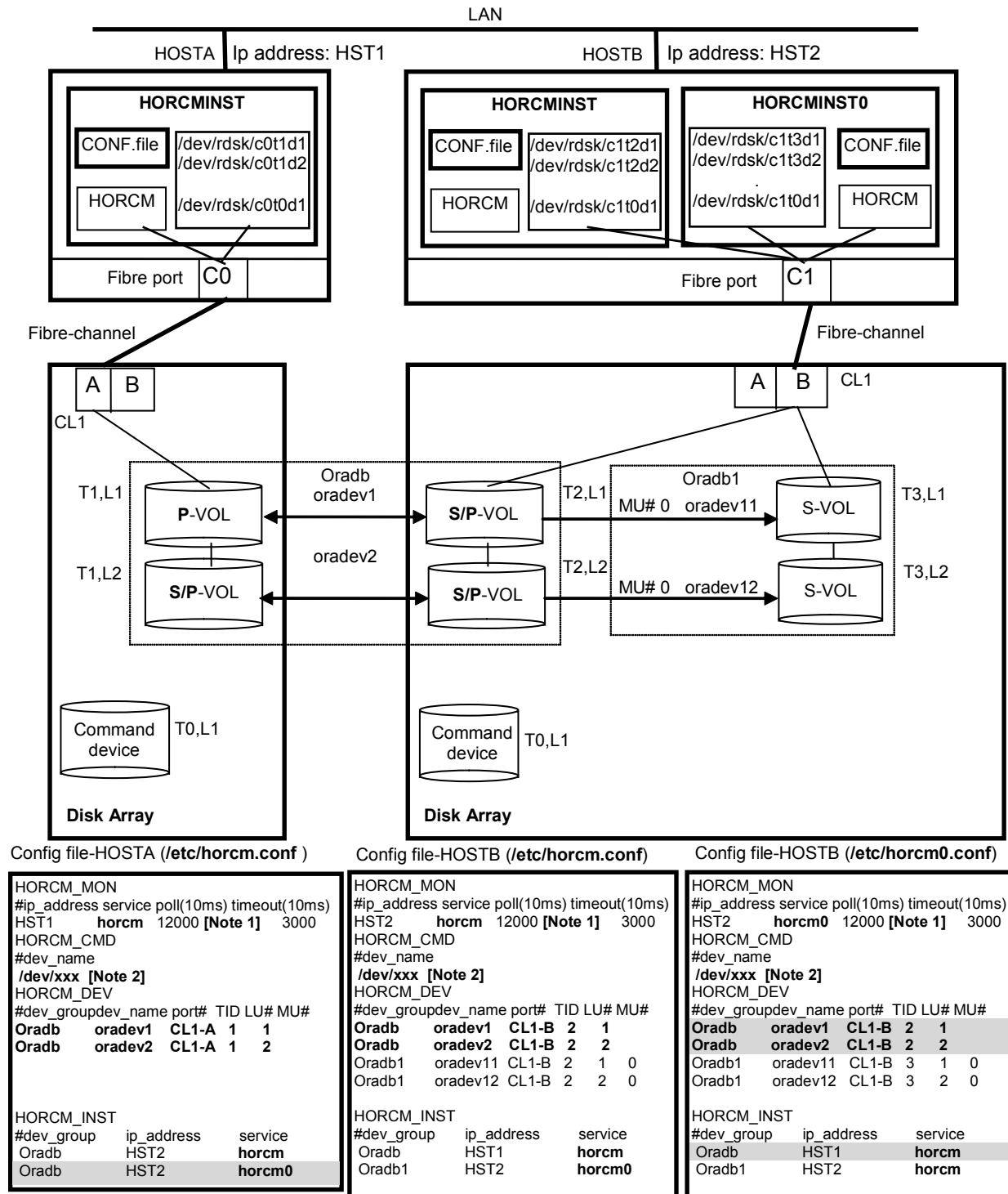
where **X** = device number assigned by Windows Server.

The PhysicalDrive number may change at every reboot. If the number changes, use **\\.\CMD-Ser#-ldev#-Port#** or **Volume{guid}** for which the same name is kept.

If **\\.\CMD-Ser#-ldev#-Port#** or **\\.\Volume{guid}** is specified, CCI changes it to **\\.\PhysicalDrive?** to be corresponded. For MSCS, it is recommended to use **\\.\CMD-Ser#-ldev#-Port#** instead of **\\.\Volume{GUID}** because it may not be maintained. Using **\\.\CMD-Ser#-ldev#-Port#** does not require to create any partition on a volume. **Volume{guid}** is created when you make a partition by using the Windows' Disk Management. You can find **Volume{guid}** by using the **inraid \$Volume -CLI -fv** or **raidscan -x findcmddev0.?** commands.

Regarding a command device for CCI, do not set two or more paths for a single host. (Windows Server may change the **guid** when a volume with an identical **guid** is found.

For Windows Server, when a path detachment, which is caused by a controller detachment or interface failure, continues for longer than one minute, the command device may be unable to be recognized at the time when recovery from the path detachment is made. To make the recovery, perform the re-scanning of the disks of Windows. When Windows cannot access the command device although CCI becomes able to recognize the command device, restart CCI.



**Figure 4-46 TCE/SnapShot configuration example with cascade pairs**

## Example of CCI commands with HOSTA and HOSTB:

- Designate a group name (**Oradb**) on TCE environment of HOSTA.

```
# paircreate -g Oradb -f async -vl
```

- When the command execution environment is not set, set **HORCC\_MRCF** of HOSTB.

For C shell:

```
# setenv HORCC_MRCF 1
```

For Windows:

```
set HORCC_MRCF=1
```

- Cascade the P-VOL of SnapShot with the S-VOL of TCE specifying a group in the SnapShot environment of HOSTB.

```
# paircreate -g Oradb1 -vl
```

These commands create pairs for all volumes assigned to groups **Oradb** and **Oradb1** in the configuration definition file (four pairs for the configuration in [Figure 4-46](#)).

- Designate a group name and display pair status on HOSTA.

```
# pairdisplay -g oradb -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
Oradb   oradev1 (L) (CL1-A , 1, 1-0 ) 91203052 26.SMPL ----,----- ---- -
Oradb   oradev1 (L) (CL1-A , 1, 1 ) 91203052 26.P-VOL COPY,91203053 28 -
Oradb1  oradev11 (R) (CL1-B , 2, 1-0 ) 91203053 28.P-VOL COPY,91203053 30 -
Oradb   oradev1 (R) (CL1-B , 2, 1 ) 91203053 28.S-VOL COPY,----- 26 -
Oradb   oradev2 (L) (CL1-A , 1, 2-0 ) 91203052 27.SMPL ----,----- ---- -
Oradb   oradev2 (L) (CL1-A , 1, 2 ) 91203052 27.P-VOL COPY,91203053 29 -
Oradb1  oradev12 (R) (CL1-B , 2, 2-0 ) 91203053 29.P-VOL COPY,91203053 31 -
Oradb   oradev2 (R) (CL1-B , 2, 2 ) 91203053 29.S-VOL COPY,----- 27 -
```

- Make the Host A specify the cascaded SnapShot pair and split the pair. The command is issued to the group of TCE, however, what is actually split is the cascaded SnapShot pair.

```
# pairsplit -g Oradb -mcas 123456 0
```

The V-VOL (Mu#:0) of the SnapShot pair, Oradev11, which was specified as Oradb in the configuration definition file and cascaded with a pair in the group of TCE, is split.

- When the status of the volume, which was produced by the splitting of a cascaded SnapShot pair, is displayed specifying a group in the SnapShot environment of the Host B, the following is displayed.

```
# pairdisplay -g Oradb1 -d Oradev11 -v smk
Group   PairVol (L/R) Serial# LDEV# P/S Status UTC-TIME -----Split-Marker-----
Oradb1  oradev11 (L) 91203053 30.S-VOL SSUS,- -
Oradb1  oradev11 (R) 91203053 28.P-VOL PSUS,123456ef 123456
```

## Confirming configurations

HORCM supports error monitoring and configuration confirmation commands for linkage with the system operation management of the UNIX/PC host.

## Monitoring paired volume errors

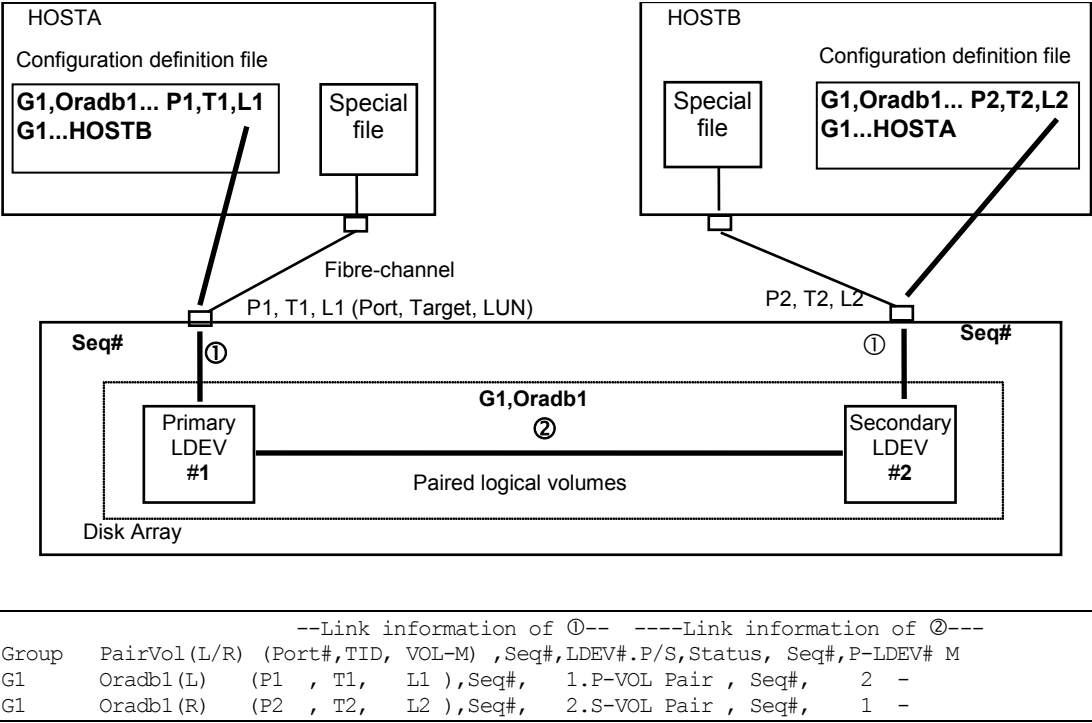
The HORC Manager (HORCM) monitors all volumes defined in the configuration definition file at a certain interval regardless of the ShadowImage/SnapShot/TrueCopy/TCE commands.

- **Objects and scope of monitoring:** The HORCM operates as a daemon process on the host and monitors all the paired volumes defined in the configuration definition file, not the volume groups. The HORC Manager's monitoring applies to the primary volumes only (since the primary volumes control the status). The HORC Manager monitors the changes in the pair status of these volumes. Only when the PAIR status changes to the PSUS status and that change is caused by an error (such as P-VOL error or S-VOL's SUS), does the HORC Manager regard the change as an error.
- **Monitoring time and interval:** This command always issues I/O instructions to the array in order to obtain information for monitoring. It is possible to specify the monitoring interval in the configuration definition file to adjust the daemon load.
- **Error notification by HORCM:** Since the operation management of the UNIX host checks Syslog to find system errors in many cases, ShadowImage/SnapShot/TrueCopy/TCE error messages are output to Syslog for linkage with the system operation management.
- **Error notification command:** The CCI supports the error notification function using commands in order to allow the UNIX host/client to monitor errors. This command is connected to the HORCM (daemon) to obtain the transition of the pairing status and report it. When an error is detected, this command outputs an error message. This command waits until an error occurs or reports that no error occurs if it finds no errors in pairing status transition queue of the HORCM's pairing monitor. Operations can be specified using certain options. If the command finds the status transition data in the status transition queue, it displays the data of all volumes. Specifying the option of this command can erase data in the HORCM's status transition queue.

# Confirming pair status

The configuration definition file combines physical volumes in the disk array used independently by the hosts. Therefore, be certain that the host volumes are combined as intended by the host system administrator.

The **pairedisplay** command displays the pairing status to enable you to verify the completion of pair creation or pair resynchronization (see [Figure 4-47](#)). This command is also used to confirm the configuration of the paired volume connection path (physical link of paired volumes among the hosts).

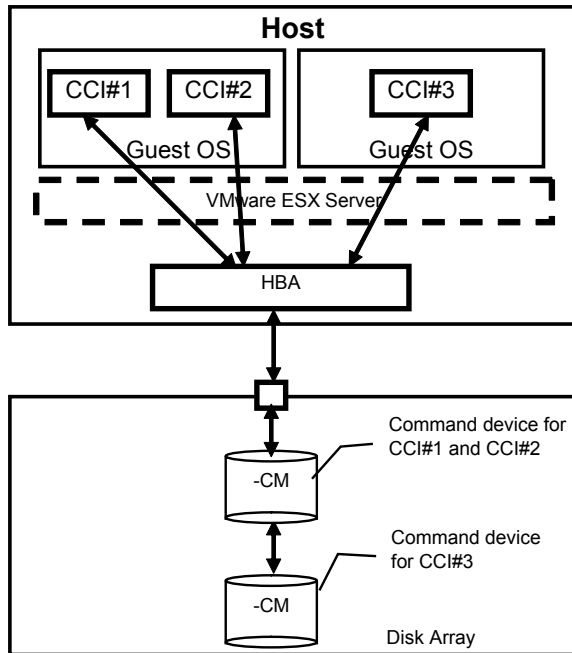


**Figure 4-47 Pair configuration confirmation (Pairedisplay)**

The **raidscan** command displays the fibre or iSCSI port, target ID, LDEVs mapped to VOLs, and status of those LDEVs, regardless of the configuration definition file. When a port number is specified, this command displays information about all target IDs and VOLs of that port.

## About VMware

Operation procedures and restrictions when using CCI installed in a guest OS of VMware are explained below.



**Figure 4-48 CCI configuration on VMware**

## Restrictions

- Guest OS

To make CCI operate on the guest OS, it is required that both CCI and VMware support the OS to be used as a guest OS. For the details, refer to "Applicable Platforms" described at the beginning of this manual.

- Command device

CCI uses the SCSI through interface in order to access a command device. Therefore, map the command device using the method of **Raw Device Mapping** with Physical Compatibility Mode.

When starting the CCI instance on two or more guest OS, you can assign the same command device to each guest OS. However, when you use the common command device, you cannot use the same instance number even if between the different guest OS.

- Assigned volume

The volume of guest OS assigned to the pair must be mapped as **Raw Device Mapping** using Physical Compatibility Mode. However, it is possible to acquire the backup of the system disk or data disk in the VMFS format by shutting down the guest OS.

- Cautions about volumes assigned to guest OS

It is required that the volumes assigned to guest OS must be visible at the time of VMware (host OS) will be started. If the S-VOLs used by VSS are in invisible status at the time of VMware (host OS) will be started, VMware (host OS) may not be able to start.

- Restrictions about volume share between guest OS and VMware (host OS)

Sharing of volumes, such as a command device, is not permitted between guest OS and VMware (host OS).

- Restrictions related to the linkage with VSS

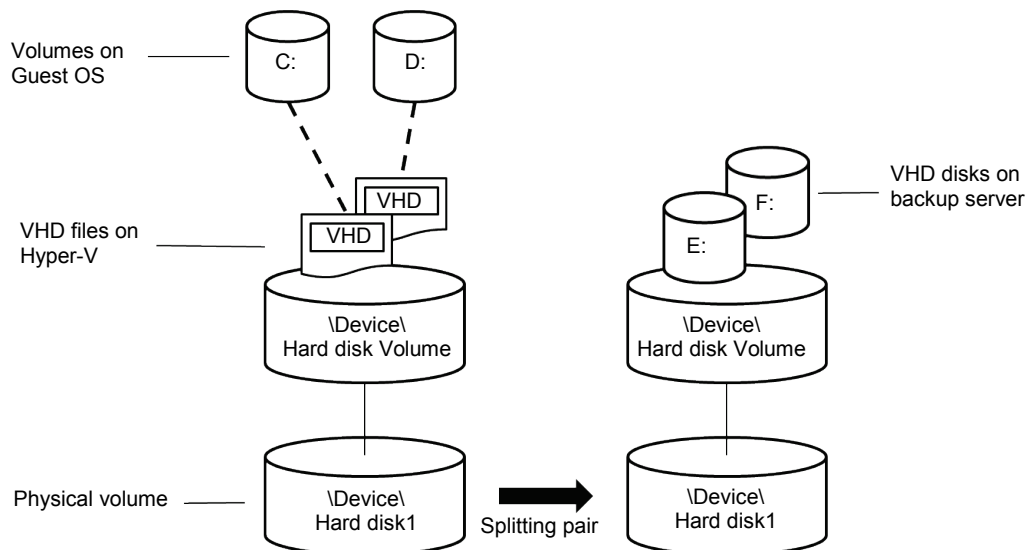
When acquiring the backup of the data disk on the guest OS using VSS, use the physical server for the backup host. When using the guest OS for the backup host, the backup cannot be acquired by utilizing VSS.

- Restrictions related to the discovery of the volume in which Raw Device Mapping was performed

The **inqraid** command uses the SCSI Inquiry command and displays the physical information (P/S/s, RAID groups, and etc) of the volume in which Raw Device Mapping was performed in the guest OS. However, since it is cached in VMware ESX 4.x, the current information is not displayed. Rebooting is required to display the updated information. Or for referring to the pair information, use the CCI commands (**raidscan**, **pairedisplay**, and others).

## Mounting VHD Disk on Windows 2008 R2/Windows 2012 Hyper-V

It is not possible to mount a VHD disk from the Guest OS on the Host OS in Windows 2008 Hyper-V. Because of this, before referencing the VHD disk on the S-VOL as a backup, it is necessary to import the VHD disk into Hyper-V and then run the Guest OS. In Hyper-V for Windows 2008 R2 and Windows 2012, you can map the VHD disk to the Host OS as a physical drive. This allows you to hold a backup by mounting a VHD disk without running a Guest OS.



You can hold a backup in the following procedure using -x mount and -x unmount commands of CCI when you map a VHD disk from the guest OS to the host OS as a physical drive.

### (1) Search for S-VOL

It is assumed that the S-VOL containing a VHD file is mounted as drive D.

```
C:\HORCM\etc>inqraid $LETALL -CLI
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
C:\Vol2\Dsk0 - - - - - Virtual disk
D:\Vol3\Dsk1 CL1-A 91200017 0 - s/S/ss 0000 A:00-00 DF600F
```

### (2) Attaching VHD file as a physical drive (Virtual Disk)

You attach a VHD file ("D:\VHD\win2k3dym.vhd, D:\VHD\win2k3fix.vhd") on the S-VOL as a physical drive (Virtual Disk).

```

DISKPART> select vdisk file="D:\VHD\win2k3dym.vhd"
DiskPart successfully selected the virtual disk file.
DISKPART> attach vdisk
100 percent completed
DiskPart successfully attached the virtual disk file.
DISKPART> select vdisk file="D:\VHD\win2k3fix.vhd"
DiskPart successfully selected the virtual disk file.
DISKPART> attach vdisk
100 percent completed
DiskPart successfully attached the virtual disk file.
DISKPART>

```

### (3) Search for virtual disk on S-VOL

The VHD disk appears as a "Virtual Disk". In the example below, the "Virtual Disks" appear as Physical Drive 2 and 3.

```

C:\HORCM\etc>inqraid $Phys -CLI
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
Harddisk0 - - - - - Virtual disk
Harddisk1 CL1-A 91200017 0 - s/S/ss 0000 A:00-00 DF600F
Harddisk2 - - - - - Virtual Disk
Harddisk3 - - - - - Virtual Disk

C:\HORCM\etc>inqraid $Vol -CLI
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
\Vol1\Dsk0 - - - - - Virtual disk
\Vol2\Dsk0 - - - - - Virtual disk

\Vol3\Dsk1 CL1-A 91200017 0 - s/S/ss 0000 A:00-00 DF600F
\Vol14\Dsk2 - - - - - Virtual Disk
\Vol15\Dsk3 - - - - - Virtual Disk

```

### (4) Mounting VHD disk

You mount the "Virtual disks" as drive E and F.

```

C:\HORCM\etc>raidscan -x mount E:\ \Vol14
E:\ <+> HarddiskVolume14

C:\HORCM\etc>raidscan -x mount F:\ \Vol15
F:\ <+> HarddiskVolume15

```

```

C:\HORCM\etc>inqraid $LETALL -CLI
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
C:\Vol2\Dsk0 - - - - - Virtual disk
D:\Vol3\Dsk1 CL1-A 91200017 0 - s/S/ss 0000 A:00-00 DF600F
E:\Vol14\Dsk2 - - - - - Virtual Disk
F:\Vol15\Dsk3 - - - - - Virtual Disk

```

(5) Unmounting and detaching VHD disk

```

C:\HORCM\etc>raidscan -x umount E:\
E:\ <-> HarddiskVolume14

```

```

C:\HORCM\etc>raidscan -x umount F:\
F:\ <-> HarddiskVolume15

```

```

DISKPART> select vdisk file="D:\VHD\win2k3dym.vhd"
DiskPart successfully selected the virtual disk file.
DISKPART> detach vdisk
DiskPart successfully detached the virtual disk file.
DISKPART> select vdisk file="D:\VHD\win2k3fix.vhd"
DiskPart successfully selected the virtual disk file.
DISKPART> detach vdisk
DiskPart successfully detached the virtual disk file.

```

```

C:\HORCM\etc>inqraid $Phys -CLI
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
Harddisk0 - - - - - Virtual disk
Harddisk1 CL1-A 91200017 0 - s/S/ss 0000 A:00-00 DF600F

```

```

C:\HORCM\etc>inqraid $Vol -CLI
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
\Vol1\Dsk0 - - - - - Virtual disk
\Vol2\Dsk0 - - - - - Virtual disk
\Vol3\Dsk1 CL1-A 91200017 0 - s/S/ss 0000 A:00-00 DF600F

```

## Creating and resynchronizing pairs

Procedures are explained below for the cases of the pair creation and the pair resynchronization referring to an operation example in which a pair is usually placed in the PSUS status and the P-VOL is resynchronized with the S-VOL when the backup is necessary.

To create a pair:

1. Issue a **paircreate** command.
2. Wait for the volumes to be paired.
3. Un-mount the P-VOL.
4. Issue a **pairsplit** command.
5. Mount the P-VOL.
6. Rescan the HBA by clicking the **Rescan** button on the **Configure** tab in the VMware operation window.
7. Reboot the guest OS.



**Note:** After the **paircreate** command or rescanning of the disks on the host OS is performed, it is required to reboot the guest OS in order to enable it to recognize the S-VOL.

---

8. Mount the S-VOL.

To resynchronize a pair:

1. Un-mount the S-VOL.
2. Issue a **pairresync** command.
3. Wait for the volumes to be paired.
4. Un-mount the P-VOL.
5. Issue a **pairsplit** command.
6. Mount the P-VOL.
7. Rescan the HBA by clicking the **Rescan** button on the **Configure** tab in the VMware operation window.
8. Check if the guest OS has recognized the S-VOL. If it has not recognized the S-VOL, reboot the guest OS.
9. Mount the S-VOL.

## About Hyper-V

Operation restrictions when using CCI installed in a guest OS of Hyper-V are explained below.

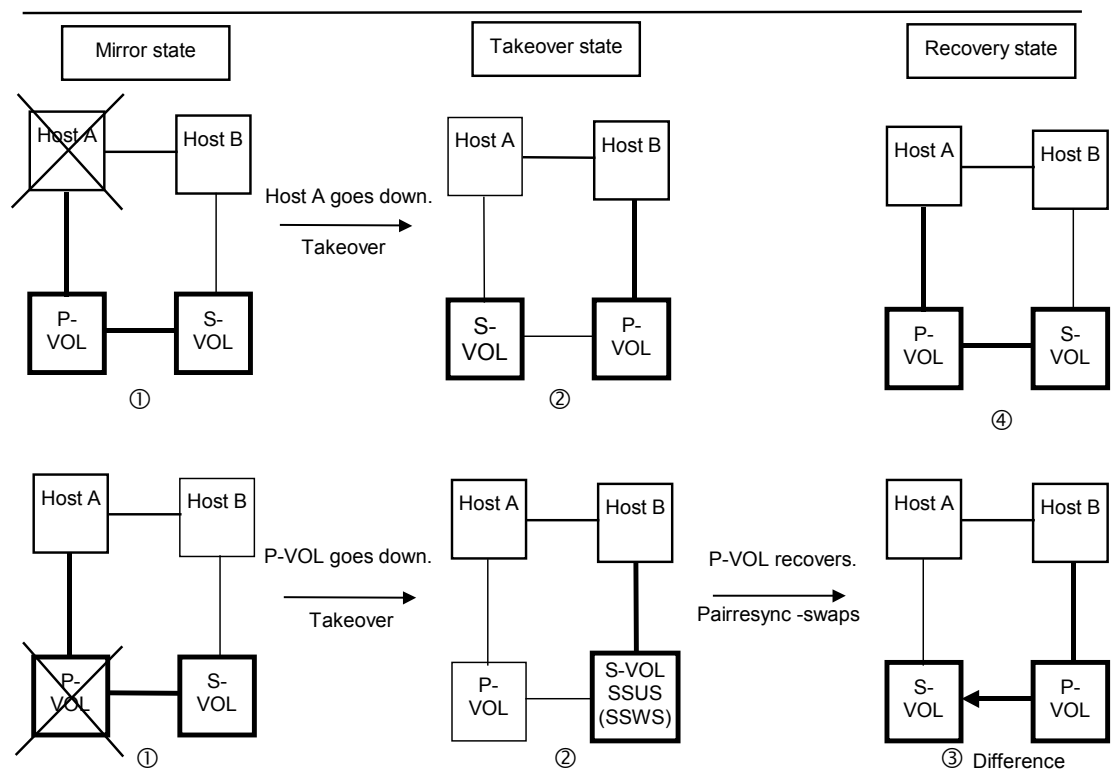
### Restrictions

- Notes on the guest OS  
To make CCI operate on the guest OS, it is required that both CCI and Hyper-V support the OS to be used as a guest OS. For the details, refer to "Applicable Platforms" described at the beginning of this manual.
- Notes on the command device  
Map the command device using the method of path through disk. CCI uses the SCSI through interface in order to access a command device.  
When starting CCI Instance on two or more guest OS, assign the command device for each guest OS.  
One hundred and twenty-eight command devices can be created per array. Therefore, the maximum number of acceptable guest OS is 128 for each array.
- Restrictions on the volume assigned to the pair  
The volume assigned to the pair must be mapped as path through disk. The disk which mapped VHD does not become a pair target.
- Cautions about volumes assigned to guest OS  
It is required that the volumes assigned to guest OS must be visible at the time of Hyper-V (management OS) will be started.
- Restrictions about volume share between guest OS and Hyper-V (management OS)  
Sharing of volumes, such as a command device, is not permitted between guest OS and Hyper-V (management OS).
- Restrictions about the cluster shared volume  
The command device cannot be used as a cluster shared volume (CSV) is unsupported in CCI.  
A P-VOL can be used as a CSV. The S-VOL can connect to a backup server for a backup of the P-VOL.

## Recovery procedures for HA

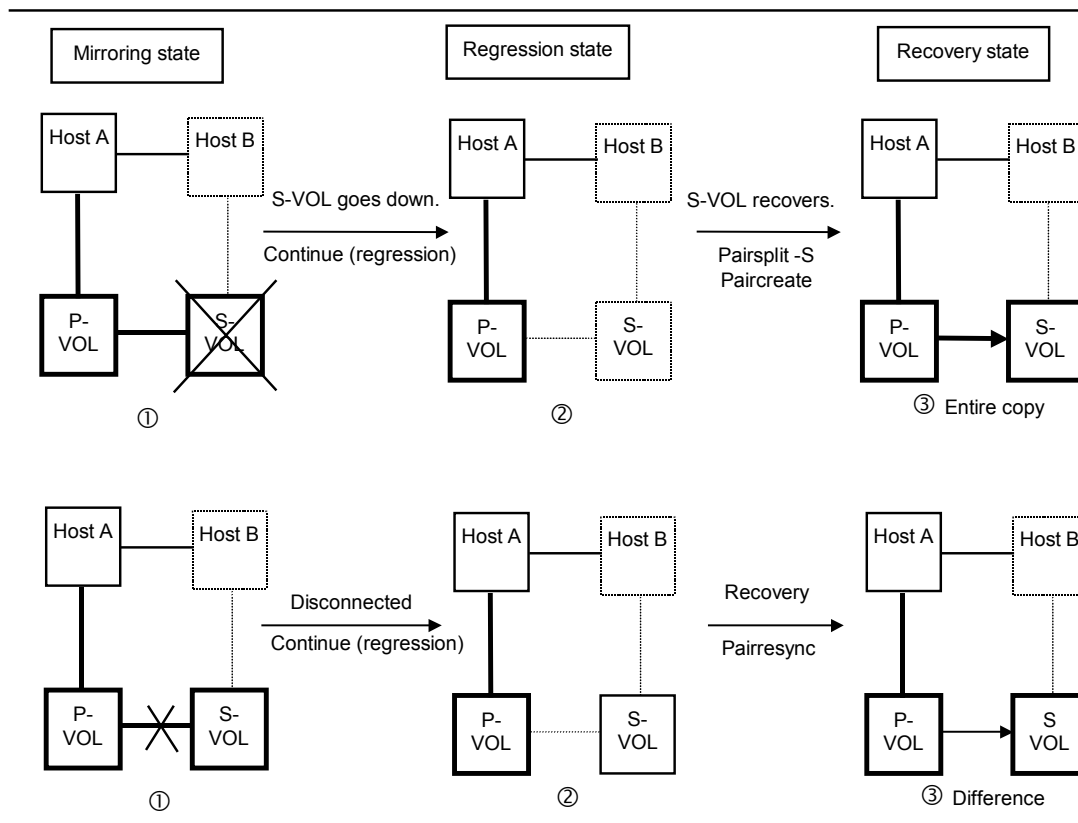
After configuring and starting CCI operations, the system administrator should conduct operational tests for possible failures in the system. In normal operation, service personnel obtain information for identifying the failure cause on the HITRACK and SNMP Agent or Web. However, a motive for the action above should be given by the CCI operation command.

[Figure 4-49](#) shows the system failover and recovery procedure. [Figure 4-50](#) shows the regression and TrueCopy recovery procedure.



- ① A failure occurs in the host A server (1-top) or in the P-VOL (1-bottom).
- ② Host B detects the failure of host A or the P-VOL and issues a takeover command to make the S-VOL usable. Host B takes over processing from host A. In the case of host A failure (1-top), the **Swap-takeover** command will be issued. In the case of P-VOL failure (1-bottom), the **SVOL-SSUS-takeover** command will be issued.
- ③ While host B continues processing, P-VOL and S-VOL are swapped (**pairresync -swaps**), and the delta data (BITMAP) updated by host B is fed back to host A.
- ④ After host A or the P-VOL has recovered, host A can take over processing from host B by executing the **Swap-takeover (horctakeover)** command.

**Figure 4-49 System failover and recovery**



- ① The P-VOL detects a failure in the S-VOL and causes suspension of the duplicated writing. (The fence level determines whether host A continues processing or host B takes over the processing from host A.)
- ② The P-VOL changes the paired volume status to PSUE and keeps track of the difference data. The HORCM detects the status change and outputs a message to syslog. If the client of host A has initiated the monitoring command, the message concerned is displayed on the screen of the client.
- ③ The S-VOL recovers from the failure. The host A issues the **pairsplit -S**, **paircreate -vl**, or **pairresync** command to update the P-VOL data by copying entire data or copying differential data only. The updated data is fed back to the S-VOL.

**Figure 4-50 Degeneracy and recovery in case of system error**

## IPv6 support in CCI

Supported level of IPv6 feature depends on the platform and OS version. In such OS platform, CCI will not be able to performed IPv6 communication completely. So CCI logs the results of whether OS is supporting IPv6 feature or not.

/HORCM/log\*/curlog/horcm\_localhost.log

```
*****
- HORCM STARTUP LOG - Thu Jun 05 15:47:19 2008
*****
15:47:19-0f230-01720- horcmgr started on Thu Jun 05 15:47:19 2008
::
15:47:19-1e848-01172- ***** starts Loading library for IPv6 *****
[ AF_INET6 = 26, AI_PASSIVE = 1 ]
15:47:19ca1-02188- dlsym() : Symb1 = 'getaddrinfo' : dlsym: symbol "getaddrinfo"
not found in "/etc/horcmgr"
getaddrinfo() : Unlinked on itself
inet_pton() : Linked on itself
inet_ntop() : Linked on itself
15:47:19-5ab3e-02188- ***** finished Loading library *****
:
HORCM set to IPv6 ( INET6 value = 26)
:
```

If platform does not support IPv6 library, CCI uses own internal function correspond to "inet\_pton(), inet\_ntop()", in that case, IPv6 address will not be allowed to describe hostname.

The following table shows the supported IPv6 platforms.

**Table 4-17 Supported IPv6 platforms**

Vendor	Operating System	IPv6 (Note)	IPv4 Mapped IPv6
HP	HP-UX 11i V2.0 (PA-RISC)		
	HP-UX 11i V3.0 (PA-RISC)		
	HP-UX 11i V2.0 (IPF)		
	HP-UX 11i V3.0 (IPF)		
SUN	Solaris 8 (SPARC)		
	Solaris 9 (SPARC)		
	Solaris 10 (SPARC)		
	Solaris 10 (x86)		
	Solaris 10 (x64)		
IBM	AIX 5.1		
	AIX 5.2		
	AIX 5.3		
	AIX 6.1		

Vendor	Operating System	IPv6 (Note)	IPv4 Mapped IPv6
Microsoft	Windows Server 2003 + IPv6 install (IA32)		N/A
	Windows Server 2008 (IA32)		N/A
	Windows Server 2003 + IPv6 install (x64)		N/A
	Windows Server 2008 (x64)		N/A
	Windows Server 2003 + IPv6 install (IA64)		N/A
	Windows Server 2008 (IA64)		N/A
Red Hat	Red Hat Linux AS/ES 2.1 (IA32)		
	Red Hat Linux AS/ES 3.0 (IA32)		
	Red Hat Linux AS/ES 4.0 (IA32)		
	Red Hat Linux AS/ES 5.0 (IA32)		
	Red Hat Linux AS/ES 3.0 (AMD64/EM64T)		
	Red Hat Linux AS/ES 4.0 (AMD64/EM64T)		
	Red Hat Linux AS/ES 5.0 (AMD64/EM64T)		
	Red Hat Linux AS/ES 6.0 (AMD64/EM64T)		
	Red Hat Linux AS/ES 3.0 (IA64)		
	Red Hat Linux AS/ES 4.0 (IA64)		

**Note:** For more details about IPv6 support, see section 2.11 of the *Hitachi DF850 Command Control Interface (CCI) User's Guide* manual.

## Windows Power Shell

Like UNIX's shell, Windows Power Shell translates "\$" as a character or a variable, you can not use an object with "\$" like \$Physical, \$LETALL or \$Volume.

The following command will hang up.

```
PS C:\> .\inraid -CLI $Phys
```

In order to avoid this issue, set the environment variable CHG\_DVOBJ\_CH as CHG\_DVOBJ\_CH=1, which translates "\$" to "%".

```
PS C:\> $env:CHG_DVOBJ_CH = 1
PS C:\> .\inraid -CLI %Phys
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
Harddisk0 - - - - - LOGICAL VOLUME
PS C:\>
PS C:\> $env:CHG_DVOBJ_CH
1
```



## Fibre-to-SCSI address conversion

- [SCSI TIDs](#)
- [Examples of Fibre address conversion](#)
- [Fibre address conversion tables](#)

## SCSI TIDs

Fibre channel physical addresses are converted to SCSI target Ids (TIDs) using a conversion table. [Table 5-1](#) displays the current limits for SCSI TIDs on various operating systems.

**Table 5-1 Limits for target IDs**

Port	HP-UX and other Systems		Solaris Systems		Windows Systems	
	TID	VOL	TID	VOL	TID	VOL
Fibre	0 to 15	0 to 511	0 to 125	0 to 511	0 to 31	0 to 511

## Examples of Fibre address conversion

[Figure 5-1](#) displays an example of using the **raidscan** command to display the TID and VOL of Harddisk6 (HP system).



**Note:** You must start HORCM without descriptions of HORCM\_DEV or HORCM\_INST in the configuration definition file because of the unknown target IDs and VOLs.

```
C:\>raidscan -pd hd6 -x drivescan hd6
Harddisk 6... Port[ 2] PhId[ 4] TId[ 3] Lun[ 5] [HITACHI      ] [DF600F      ]
               Port[CL1-A] Ser#[91203005] LDEV#[ 14(0x00E)]
               HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
               RAID5[Group 1- 0] SSID = 0x0000
PORT# /ALPA/C,TID#,VOL#.Num(LDEV#....) ...P/S, Status,Fence,LDEV#,P-Seq#,P-LDEV#
CL1-A / e2/ 4, 29, 0.1(9).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 4, 29, 1.1(10).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 4, 29, 2.1(11).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 4, 29, 3.1(12).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 4, 29, 4.1(13).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 4, 29, 5.1(14).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 4, 29, 6.1(15).....SMPL ---- - - - - - - - -, ---- - - - -
Specified device is LDEV# 0014
```

**Figure 5-1 Using raidscan to display TID and VOL for FC devices**

In this case, the target ID indicated by the **raidscan** command must be used in the configuration definition file. This can be done using either of the following two methods:

- **Using default conversion table.** The TID# and VOL# indicated by the **raidscan** command are used in the HORCM configuration definition file.
- **Changing default conversion table.** The HORCMFCTBL environmental variable enables you to change the default conversion table ([Figure 5-2](#)).

```
C:\> set HORCMFCTBL=X      'X' is fibre conversion table number.
C:\> horcmstart ...       Start of HORCM.
:
:
Result of "set HORCMFCTBL=X" command:
C:\>raidscan -pd hd6 -x drivescan hd6
Harddisk 6... Port[ 2] PhId[ 4] TId[ 3] Lun[ 5] [HITACHI      ] [DF600F      ]
               Port[CL1-A] Ser#[91203005] LDEV#[ 14(0x00E)]
               HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
               RAID5[Group 1- 0] SSID = 0x0000
PORT# /ALPA/C,TID#,VOL#.Num(LDEV#....) ...P/S,Status,Fence,LDEV#,P-Seq#,P-LDEV#
CL1-A / e2/ 0, 3, 0.1(9).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 0, 3, 1.1(10).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 0, 3, 2.1(11).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 0, 3, 3.1(12).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 0, 3, 4.1(13).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 0, 3, 5.1(14).....SMPL ---- - - - - - - - -, ---- - - - -
CL1-A / e2/ 0, 3, 6.1(15).....SMPL ---- - - - - - - - -, ---- - - - -
Specified device is LDEV# 0014
```

**Figure 5-2 Using HORCMFCTBL to change default Fibre conversion table**

## Fibre address conversion tables

Table 5-2, [Table 5-3](#), and [Table 5-4](#) show the fibre address conversion tables.

- AL-PA is an abbreviation for arbitrated loop physical address, and indicates the physical address for Fibre. TID indicates the target ID.
- If the TID displayed on the system is different than the TID indicated in the fibre address conversion table, you must use the TID and VOL# returned by the **raidscan** command to specify the devices.
- The conversion table for Windows Server is based on the Emulex driver. If a different adapter is used, the target ID indicated by the **raidscan** command may be different than the target ID indicated by Windows Server system. In such case, for the configuration definition file, use the target ID that is displayed (obtained) by the **raidscan -find** command.
- The conversion table for Native Fibre is used when the FC\_AL conversion for the host is unknown, or when the FC\_AL conversion is the device file displayed in VOL as Fabric mode. Only VOL is displayed and the target ID (displayed as zero) will not be used. Therefore, there is no table for Native Fibre since there is no conversion to target ID.

## Fibre address conversion tables

**Table 5-2 Fibre address conversion table for HP-UX systems**

C0		C1		C2		C3		C4		C5		C6		C7	
AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID
EF	0	CD	0	B2	0	98	0	72	0	55	0	3A	0	25	0
E8	E8	1	CC	1	B1	1	97	1	71	1	54	1	39	1	23
E4	E4	2	CB	2	AE	2	90	2	6E	2	53	2	36	2	1F
E2	E2	3	CA	3	AD	3	8F	3	6D	3	52	3	35	3	1E
E1	E1	4	C9	4	AC	4	88	4	6C	4	51	4	34	4	1D
E0	E0	5	C7	5	AB	5	84	5	6B	5	4E	5	33	5	1B
DC	DC	6	C6	6	AA	6	82	6	6A	6	4D	6	32	6	18
DA	DA	7	C5	7	A9	7	81	7	69	7	4C	7	31	7	17
D9	D9	8	C3	8	A7	8	80	8	67	8	4B	8	2E	8	10
D6	D6	9	BC	9	A6	9	7C	9	66	9	4A	9	2D	9	0F
D5	D5	10	BA	10	A5	10	7A	10	65	10	49	10	2C	10	08
D4	D4	11	B9	11	A3	11	79	11	63	11	47	11	2B	11	04
D3	D3	12	B6	12	9F	12	76	12	5C	12	46	12	2A	12	02
D2	D2	13	B5	13	9E	13	75	13	5A	13	45	13	29	13	01
D1	D1	14	B4	14	9D	14	74	14	59	14	43	14	27	14	
CE	CE	15	B3	15	9B	15	73	15	56	15	3C	15	26	15	

**Table 5-3 Fibre address conversion table for Solaris and IRIX systems**

C0		C1		C2		C3		C4		C5		C6		C7	
AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID
EF	0	CD	16	B2	32	98	48	72	64	55	80	3A	96	25	112
E8	1	CC	17	B1	33	97	49	71	65	54	81	39	97	23	113
E4	2	CB	18	AE	34	90	50	6E	66	53	82	36	98	1F	114
E2	3	CA	19	AD	35	8F	51	6D	67	52	83	35	99	1E	115
E1	4	C9	20	AC	36	88	52	6C	68	51	84	34	100	1D	116
E0	5	C7	21	AB	37	84	53	6B	69	4E	85	33	101	1B	117
DC	6	C6	22	AA	38	82	54	6A	70	4D	86	32	101	18	118
DA	7	C5	23	A9	39	81	55	69	71	4C	87	31	103	17	119
D9	8	C3	24	A7	40	80	56	67	72	4B	88	2E	104	10	120
D6	9	BC	25	A6	41	7C	57	66	73	4A	89	2D	105	0F	121
D5	10	BA	26	A5	42	7A	58	65	74	49	90	2C	106	08	122
D4	11	B9	27	A3	43	79	59	63	75	47	91	2B	107	04	123
D3	12	B6	28	9F	44	76	60	5C	76	46	92	2A	108	02	124
D2	13	B5	29	9E	45	75	61	5A	77	45	93	29	109	01	125
D1	14	B4	30	9D	46	74	62	59	78	43	94	27	110		
CE	15	B3	31	9B	47	73	63	56	79	3C	95	26	111		

**Table 5-4 Fibre Address conversion table for Windows Server (Table 2)**

C5(PhId5)				C4(PhId4)				C3(PhId3)				C2(PhId2)				C1(PhId1)			
AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID	AL-PA	TID
						CC	15			98	15			56	15			27	15
				E4	30	CB	14	B1	30	97	14	72	30	55	14	3C	30	26	14
				E2	29	CA	13	AE	29	90	13	71	29	54	13	3A	29	25	13
				E1	28	C9	12	AD	28	8F	12	6E	28	53	12	39	28	23	12
				E0	27	C7	11	AC	27	88	11	6D	27	52	11	36	27	1F	11
				DC	26	C6	10	AB	26	84	10	6C	26	51	10	35	26	1E	10
				DA	25	C5	9	AA	25	82	9	6B	25	4E	9	34	25	1D	9
				D9	24	C3	8	A9	24	81	8	6A	24	4D	8	33	24	1B	8
				D6	23	BC	7	A7	23	80	7	69	23	4C	7	32	23	18	7
				D5	22	BA	6	A6	22	7C	6	67	22	4B	6	31	22	17	6
				D4	21	B9	5	A5	21	7A	5	66	21	4A	5	2E	21	10	5
				D3	20	B6	4	A3	20	79	4	65	20	49	4	2D	20	0F	4
				D2	19	B5	3	9F	19	76	3	63	19	47	3	2C	19	08	3
				D1	18	B4	2	9E	18	75	2	5C	18	46	2	2B	18	04	2
		EF	1	CE	17	B3	1	9D	17	74	1	5A	17	45	1	2A	17	02	1
		E8	0	CD	16	B2	0	9B	16	73	0	59	16	43	0	29	16	01	0

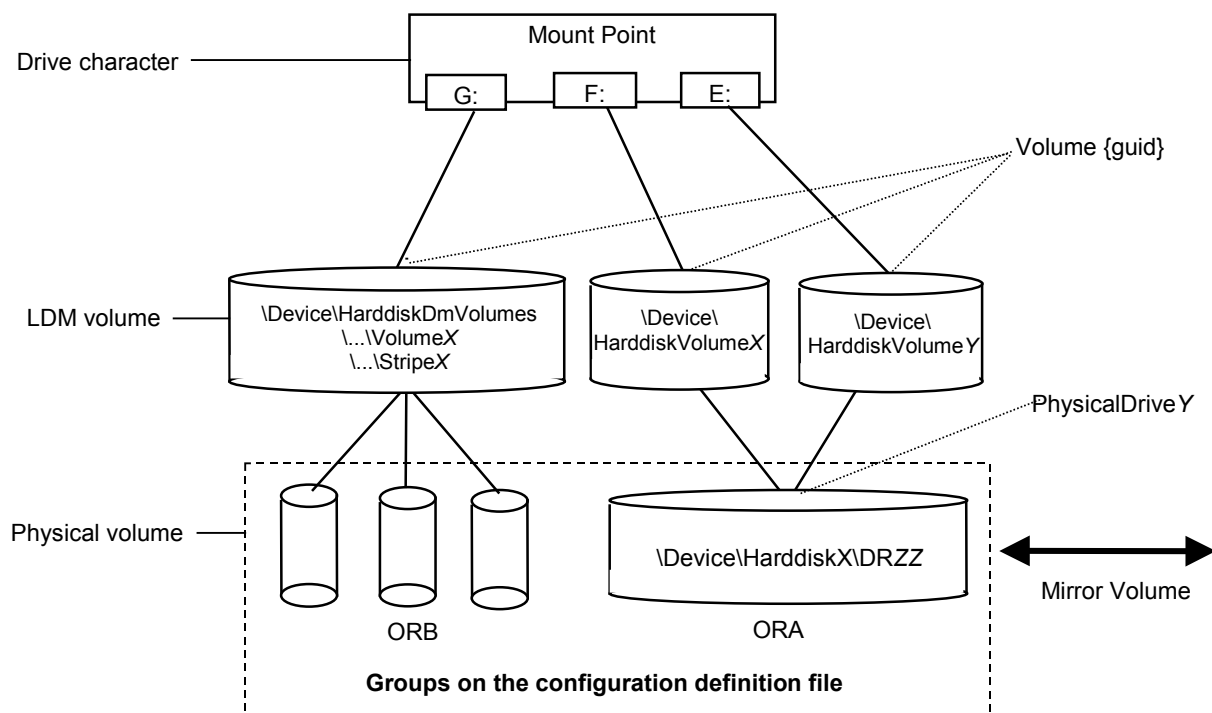
## CCI operations on Windows systems

This chapter covers the following topics:

- [About LDM volume search](#)
- [About dynamic disk and copy](#)

## About LDM volume search

Windows Server supports a logical device manager called LDM. A logical drive is usually linked to LDM volumes (e.g. \Device\HarddiskVolumeX). Therefore, it is not easy to link the physical volume in the disk array with LDM volume. Linking physical volumes in the disk array with LDM volume is necessary when creating the configuration definition file, as shown in [Figure 6-1](#).



**Figure 6-1 LDM volume configuration**

## Searching LDM volumes

CCI provides you with a search function that shows the relationship between the physical volumes in the disk array and the LDM volumes. There are three types of volume searches:

- Physical  
Using `$Physical` as a search condition, the CCI displays the relation between the physical drive and the LDEV configuration of the disk array.
- LDM Volume  
Using `$Volume` as a search condition, the CCI displays the relation between the LDM volume/physical drive and the LDEV configuration of the disk array.
- Logical Device (drive character)  
Using `$LETALL` as a search condition, the CCI displays the relation between the logical device and directory-mounted volume/LDM volume/physical drive and the LDEV configuration of the disk array.



**Note:** The search condition (`$Physical`, `#Volume`, `#LETALL`) can be used for **raidscan - find** command, **inqraid** command, and **mkconf** command.

---

Also, the search condition (**`$LETALL`**) for searching the directory-mounted volumes can be used for **raidscan -find** command and **mkconf** command.

In Windows Server systems, the DOS devices (e.g. C: Volume{guid}) are related to the device object name (`\Device\...`). The CCI changes the long name of these device objects to a shorter name shown below.

- **For Windows Server**
  - LDM device object name for Windows Server:  
`\Device\HarddiskVolumeX` (partition volume) → `\VolX\DskY`  
DskY indicates that VolX is configured by HarddiskY.  
`\Device\HarddiskDmVolumes\...\Volume` (span volume) → `\DmsX\DskYs`  
`\Device\HarddiskDmVolumes\...\StripeX` (stripe volume) → `\DmtX\DskYs`  
`\Device\HarddiskDmVolumes\...\RaidX` (RAID 5 volume) → `\DmtX\DskYs`  
DskYs indicates that DmsX (DmtX, DmrX) is configured by several HarddiskY1, Y2....
  - Device object name for Windows Server physical drive:  
`\Device\HarddiskX\DRZZ` → `HarddiskX`

Use the search condition (**`&Physical`**, **`$Volume`**, **`$LETALL`**) for the **inqraid** command, as shown below. You can see the relation between the logical device and directory-mounted volume/LDM volume/physical drive and the LDEV configuration of the disk array.



```

raidscan -pi $LETALL -find
DEVICE FILE      UID  S/F  PORT  TARG  LUN   SERIAL  LDEV  PRODUCT_ID
E:\Vol44\Dsk0    0    F    CL2-A  7     2     91206145  7     DF600F
F:\Vol45\Dsk0    0    F    CL2-A  7     2     91206145  7     DF600F
G:\Dmt1\Dsk1     0    F    CL2-A  7     4     91206145  8     DF600F
G:\Dmt1\Dsk2     0    F    CL2-A  7     5     91206145  9     DF600F
G:\Dmt1\Dsk3     0    F    CL2-A  7     5     91206145 10     DF600F

```

**Figure 6-6 Raidscan -find Command using \$LETALL for Search Condition**

The following is an example of LDM volume that is mounted by using a directory (hd1, hd2) that exists in D drive.

```

D:\HORCM\etc>inqraid $LETALL -CLI
DEVICE FILE      PORT  SERIAL  LDEV  CTG  H/M/12  SSID R:Group  PRODUCT_ID
D:\Vol2\Dsk7     -      -        -      -      -        -      -      DDRS-34560D
D:\hd1\Vol8\Dsk0 CL2-B   91206145  48    -    s/s/ss  0000 1:01-00 DF600F
D:\hd2\Vol9\Dsk1 CL2-B   91206145  49    -    s/s/ss  0000 1:01-00 DF600F
G:\Dms1\Dsk2     CL2-A   91206145  56    -    s/s/ss  0000 1:01-00 DF600F
G:\Dms1\Dsk3     CL2-A   91206145  57    -    s/s/ss  0000 1:01-00 DF600F
G:\Dms1\Dsk4     CL2-A   91206145  58    -    s/s/ss  0000 1:01-00 DF600F

```

**Figure 6-7 Inqraid Command using \$LETALL for Search Condition (Windows Server)**

The directory-mounted volume can be operated using **-x sync** subcommand, **-x mount** subcommand, and **-x umount** subcommand that are embedded in CCI commands.

```

pairsplit -x mount D:\hd1 \Vol6
D:\hd1 <+> HarddiskVolume6
pairsplit -x mount F:\ \Vol7
F:\ <+> HarddiskVolume7
pairsplit -x umount D:\hd1
D:\hd1 <-> HarddiskVolume6
pairsplit -x umount F:\
F:\ <-> HarddiskVolume7

```

**Figure 6-8 Directory mount command example (Windows Server)**

## Using the mountvol command on Windows

The **mountvol /D** command attached on Windows Server does not flush the NT file system buffer to the corresponding specified drive. Therefore, you cannot flush an unwritten data to P-VOL nor browse S-VOL by using this command. Do not mount the volume by the **mountvol** command if the volume was un-mounted by the **-x umount** command. Do not use the **mountvol** command to un-mount the volume if the volume was mounted using the **-x mount** command.

The **mountvol** command displays the mounted volume in \\?\Volume{XXXX}\ format.

```
mountvol
Creates, deletes, or lists a volume mount point.
.
.
MOUNTVOL [drive:]path VolumeName
MOUNTVOL [drive:]path /D
MOUNTVOL [drive:]path /L

    \\?\Volume{56e4954a-28d5-4824-a408-3ff9a6521e5d}\
        G:\
    \\?\Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}\
        F:\
```

**Figure 6-9 Mountvol command displaying mounted volumes**

You can use the **inqraid** command or the **raidscan** command to see the relationship between the device object name and the physical drive of the \\?\Volume{XXXX}\.

```
inqraid $Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e} -CLI
DEVICE_FILE      PORT      SERIAL  LDEV CTG  H/M/12  SSID R:Group  PRODUCT_ID
\Vol146\Dsk1     CL2-A     91206145  6      -      S/s/ss  0000 1:01-00  DF600F
```

**Figure 6-10 Inqraid command displaying mounted volumes**

```
raidscan -pi $Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e} -find
DEVICE_FILE      UID  S/F PORT  TARG  LUN      SERIAL  LDEV  PRODUCT_ID
\Vol146\Dsk1     0    F  CL2-A   7     1      91206145  6     DF600F
```

**Figure 6-11 Raidscan command displaying mounted volumes**

## About dynamic disk and copy

In an environment of Windows Server, you cannot use pair volumes as dynamic disk. The reason for this restriction is because in this case if you restart Windows or use the **Rescan Disks** command after creating or re-synchronizing a pair, there are cases where the S-VOL (V-VOL) is displayed as **Foreign** in Disk Management and becomes inaccessible.

## Mounting P-VOL and S-VOL on the same host

When you recognize the P-VOL and S-VOLs on Windows Server™ 2008/Windows Server 2012 at the same time, an alert (Event ID: 58) may be notified in the event log. This issue comes from the same disk signature that the P-VOL and S-VOLs retain when pair creation, pair resynchronization or restore is performed. When this issue happens, the target volume may go offline and become inaccessible.

Windows reconfirms the disk signature during Rescan Disks or reboot. When you mount the P-VOL and S-VOLs to the same host at the same time, rewrite the disk signature according to the following procedure, so that they have different disk signatures

# RM Shadow Copy provider for VSS

This chapter covers the following topics:

- [About VSS](#)
- [Configuring VSS](#)
- [Restrictions on VSS configurations](#)
- [About backup software and configurations](#)
- [Installing backup software](#)
- [Uninstalling backup software](#)
- [Starting VSS](#)
- [Notes on VSS](#)
- [Known VSS problems and concerns](#)
- [About event log error messages](#)

## About VSS

Windows Server supported the VSS that provides an infrastructure for creating point-in-time images known as shadow copies. VSS is able to produce high fidelity shadow copies through its coordination with business applications, backup applications, and RAID.

VSS is a service that coordinates backup software (requestors), the writers (for example, Database application), and hardware providers that provides vendor-unique shadow copy functions.

A shadow copy volume is a copy of a volume that is used by an application at a specific time. An RM shadow copy provider is a component that creates a shadow copy volume with controlling RAID via VSS.

Install Windows Enterprise Server™ and use it under the following conditions.

**Table 7-1 Relationship between RM Shadow Copy provider and Windows Enterprise Server versions**

RM Shadow Copy Provider Version	Windows Enterprise Server 2003 (Build#3790)	Windows Enterprise Server 2003 (Build#3790) +HotFix#833167 +(831112)	Windows Enterprise Server 2003 SP1 +HotFix#891957 +(903081)	Windows Enterprise Server 2008	Windows Enterprise Server 2012
01-04-03/00 or later	Available	Available	Available	Available	Available

Enable the following services for the Volume Shadow Copy Service (VSS) hardware provider installation on Windows Enterprise Server 2003.

**Table 7-2 Conditions for RM Shadow Copy provider installation**

Service Name	Display Name	Startup Type
RpcSs	Remote Procedure Call (RPC)	Automatic
EventLog	Event Log	Automatic
DcomLaunch	DCOM Server Process Launcher	Automatic
SamSs	Security Accounts Manager	Automatic
winmgmt	Windows Management Instrumentation	Automatic
EventSystem	COM+ Event System	Manual
MSIServer	Windows Installer	Manual
VSS	Volume Shadow Copy	Manual
COMSysApp	COM+ System Application	Manual
MSDTC	Distributed Transaction Coordinator	Manual

## Relation of RM Shadow Copy Provider and the disk array firmware

[Table 7-3](#) shows relationship of the RM Shadow Copy Provider attached to CCI delivered with firmware of the disk array.

**Table 7-3      Related version of RM Shadow Copy Provider attached to CCI versus firmware**

RM Shadow Copy Provider Version	CCI Version	HUS110	HUS130	HUS150
01-04-03/00	01-21-03/06 or later	0910/B or later	0910/B or later	0910/B or later

It is highly recommended to install RM Shadow Copy Provider before configuring Windows Server 2003 MSCS or Windows Server 2008/2012 MSFC. When a cluster has already been configured, follow the procedure below to install RM Shadow Copy Provider.

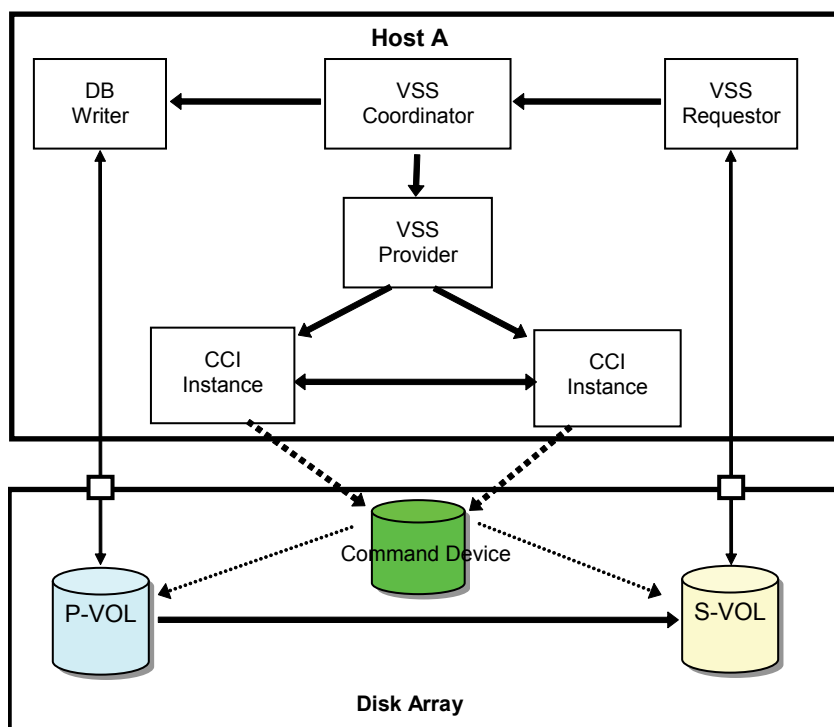
- For Windows Server 2003 MSCS, create and register MSDTC resources.
- Install RM Shadow Copy Provider.

## Configuring VSS

CCI provides the RM shadow copy provider as a Hardware Provider for VSS. The RM shadow copy provider supports any disks that are defined in CCI configuration files. If any disks for a backup application are not defined in CCI configuration files, VSS will select the provider using the following default hierarchy:

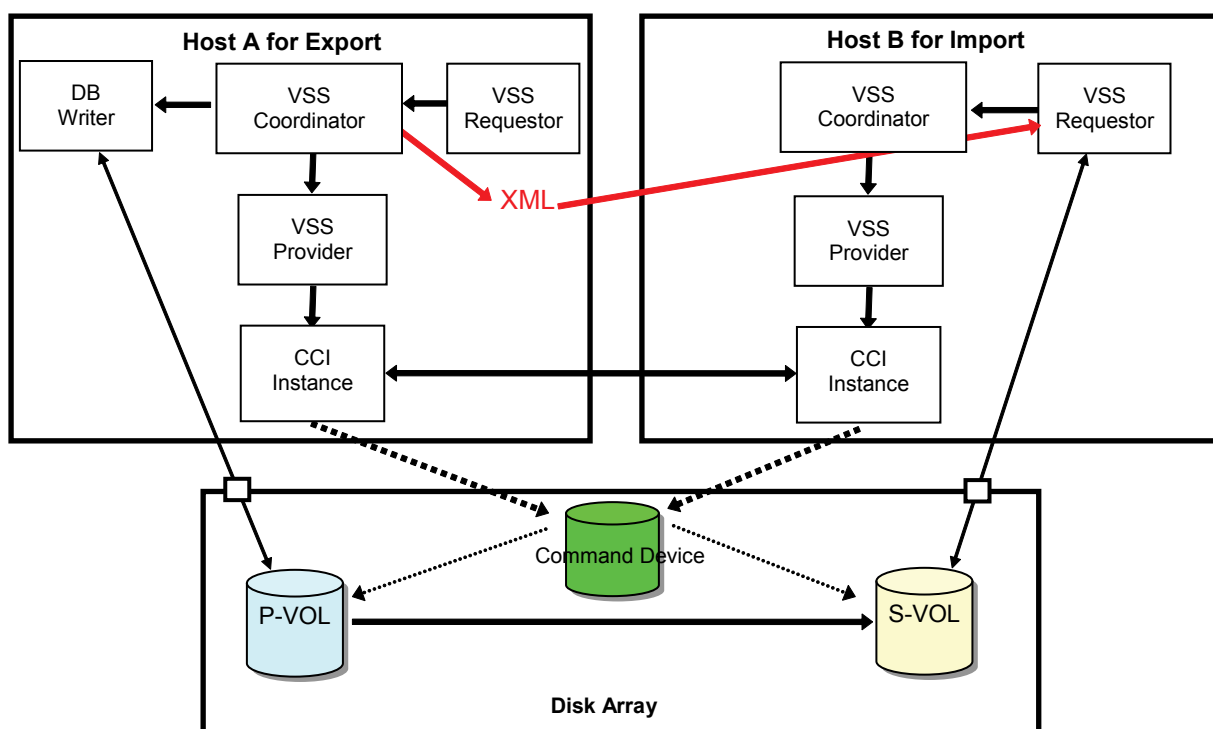
Hardware provider (RM shadow copy provider) → Software provider → System software provider, and will create a snapshot volume by using the default System software provider.

## Configuring single hosts



**Figure 7-1** Single host configuration for VSS

## Exporting and importing host configurations



**Figure 7-2 Export and import host configuration for VSS**

## Coordinating Shadow Copy creation

The various roles of the requestor, writer, and provider are placed into context in this section, which lists the steps that need to be taken to create a shadow copy. Coordination of the requestor, writer, and provider is under VSS control.

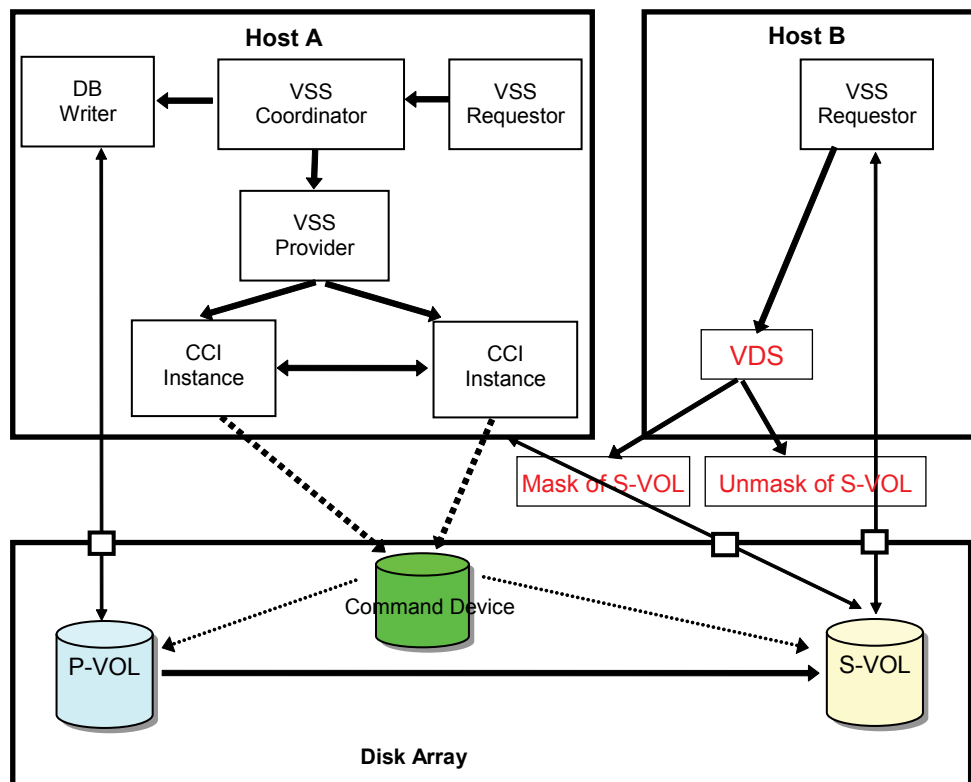
1. A backup application notifies to prepare a volume that will be backed up to the VSS coordinator service.
2. The VSS coordinator notifies the application-specific writer to prepare its data for making a shadow copy.
3. The VSS coordinator relays the message to the requestor, and the requestor initiates the commit snapshot phase. The VSS coordinator temporarily halts (quiesces) application I/O write requests (I/O read requests are still possible) for the several seconds required to create the shadow copy of the volume or volumes.

4. The VSS coordinator chooses a provider that matches to the volume. If any disks for a backup application are not defined in CCI configuration files, VSS selects the provider using the default hierarchy (Software provider → System software provider).
5. The writer prepares the data appropriately for that application (ex: completing all open transactions, rolling transaction logs, and flushing caches). When the data is prepared for shadow copy creation, the writer notifies to the VSS coordinator.
6. RM Shadow Copy Provider splits a pair of a designated disk and a snapshot disk in order to create the shadow copy (a maximum of 10 seconds).
7. After the shadow copy is created, the VSS coordinator releases the writer from its temporary quiescent phase. VSS queries the writers to confirm that write I/Os were successfully held during shadow copy creation. If the writes were not successfully held (the shadow copy data is potentially inconsistent), the shadow copy is deleted and the requestor is notified. The requestor can retry the process (loop back to 1) or notify the administrator to retry at a later time.
8. RM Shadow Copy Provider notifies the snapshot disks that match a designated disk to the VSS coordinator.
9. The VSS coordinator creates the XML document file describing the snapshot set in order to export the transportable snapshot volume.
10. The RM Shadow Copy Provider performs to map (Unmask) the designated disk by the VSS coordinator to the VOL.
11. The VSS coordinator discovers the new VOL, and notifies the snapshot volume mapped to an VOL to a backup application.



**Note:** In Export and Import configuration, Step 10 through 11 above will be performed on Import host, but a backup requestor should support this configuration.

## Using transportable configurations



**Figure 7-3 Transportable Configuration for VSS**

This configuration will be required when the setting functions of VDS (**Diskraid** command) are supported by VDS provider. This should be supported by a backup requestor.

## Restrictions on VSS configurations

The VSS and RM shadow copy provider must be used under the following conditions:

- **Property of the Shadow Copy Volume**  
The Shadow Copy volume (S-VOL) must be created as property of the hidden and read-only when detected by Windows Server. The drive letters and/or mount points are not automatically assigned.
- **Snapshots Containing Dynamic Disks**  
The native support for dynamic disks cannot accommodate VOLs with duplicate signatures and configuration database contents. The snapshot VOLs must be transported to a different host; VSS enforces this.  
When transporting dynamic disk VOLs to a new host, at least one dynamic disk should exist on the receiving host. This ensures that the disk group identifiers will be unique to both machines.
- **Hardware Snapshots not Supported on MSCS**  
MSCS cannot accommodate VOLs with duplicate signatures and partition layout. The snapshot VOLs must be transported to a host outside the cluster.
- **Using VSS under the I/O Path Manager**  
The I/O Path Manager must support the Shadow Copy volume as the PnP device, and must support all of DeviceIocontrol functions used on the Shadow Copy volume.
- **Note that HDLM (JP1/HiCommand Dynamic Link Manager) supported the DeviceIocontrol functions that will be using by VSS. Therefore VSS can be used on the I/O Path Manager.**

## About backup software and configurations

Table 7-4 displays the related support between the backup software and applicable configurations.

The RM Shadow Copy Provider must be used within scope of the following supported backup software.

**Table 7-4 Backup software with RM Shadow Copy provider**

Software Vendor	Software Name	Applicable Configurations		
		Single Host	Export/Import Host	Transportable
Microsoft	NTBackup	Supported	Not supported	Not supported
Veritas	Backup Exec (BEWS)	Supported	BEWS10.0	

## Installing backup software

This product provides the following three files:

No.	Title	File Name	Installation Place
1	RM Shadow Copy Provider	\HORCM\Tool\RMVSSPRV.exe	DIR\HITACHI\VSS Provider\RMVSSPRV.dll
2	RM Shadow Copy Provider for IA64	\HORCM\Tool\RMVSSPRV64.exe	DIR\HITACHI\VSS Provider\RMVSSPRV.dll
3	RM Shadow Copy Provider for x64 (EM64T)	\HORCM\Tool\RMVSSPRV_X64.exe	DIR\HITACHI\VSS Provider\RMVSSPRV.dll
<b>Note:</b> DIR stands for the installation directory, and the default directory is \Program Files.			

## Installing new backup software

1. Verify that MSDTC and COMSysApp services are enabled in the RM Shadow Copy Provider host. Also confirm the services listed in [Table 7-2](#) are present by using **Administrative Tools** → **Services**.

```
C:\>sc qc MSDTC
[SC] GetServiceConfig SUCCESS

SERVICE_NAME: MSDTC
        TYPE               : 10  WIN32_OWN_PROCESS
        START_TYPE           : 3   DEMAND_START
        ERROR_CONTROL         : 1   NORMAL
        BINARY_PATH_NAME      : C:\WINDOWS\System32\msdtc.exe
        LOAD_ORDER_GROUP      : MS Transactions
        TAG                   : 0
        DISPLAY_NAME          : Distributed Transaction Coordinator
        DEPENDENCIES          : RPCSS
                           : SamSS
        SERVICE_START_NAME    : LocalSystem

C:\>sc qc COMSysApp
[SC] GetServiceConfig SUCCESS

SERVICE_NAME: COMSysApp
        TYPE               : 10  WIN32_OWN_PROCESS
        START_TYPE           : 3   DEMAND_START
        ERROR_CONTROL         : 1   NORMAL
        BINARY_PATH_NAME      : C:\WINDOWS\System32\dllhost.exe /Processid:{02D4B3F
1-FD88-11D1-960D-00805FC79235}
        LOAD_ORDER_GROUP      :
        TAG                   : 0
        DISPLAY_NAME          : COM+ System Application
        DEPENDENCIES          : rpcss
        SERVICE_START_NAME    : LocalSystem
```

2. If the MSDTC and COMSysApp services have not started, set them to the automatic start or manual start using the Computer Management option, and install RM Shadow Copy Provider using the following procedure, after the services are started.

```
C:\>sc config MSDTC start= demand
[SC] ChangeServiceConfig SUCCESS

C:\>sc config COMSysApp start= demand
[SC] ChangeServiceConfig SUCCESS
```

3. Stop Microsoft Volume Shadow Copy Service by using the following command.

For Windows Server 2003:

```
C:\>net STOP Volume Shadow Copy
```

For Windows Server 2008/Windows Server 2012

```
C:\>net STOP VSS
```

If starting:

```
The Volume Shadow Copy service is stopping.
The Volume Shadow Copy service was stopped successfully.
```

If stopping:

```
The Volume Shadow Copy service is not started.
```

4. Change the current directory to \HORCM\Tool\ where CCI has been installed.
5. Perform the appropriate RMVSSPRV.exe setup program:
  - For a 32-bit system, run the RMVSSPRV.exe.
  - For an IA64 system, run the RMVSSPRV64.exe.
6. Restarts Microsoft Volume Shadow Copy Service by using the following command if VSS will not be started.

For Windows Server 2003:

```
C:\>net START Volume Shadow Copy
The Volume Shadow Copy service is starting.
The Volume Shadow Copy service was started successfully.
```

For Windows Server 2008/Windows Server 2012

```
C:\>net START VSS
The Volume Shadow Copy service is starting.
The Volume Shadow Copy service was started successfully.
```

## Upgrading backup software

1. Stop Microsoft Volume Shadow Copy Service by using the following command.

For Windows Server 2003:

```
C:\>net STOP Volume Shadow Copy
```

For Windows Server 2008/ Windows Server 2012

```
C:\>net STOP VSS
```

If starting:

```
The Volume Shadow Copy service is stopping.  
The Volume Shadow Copy service was stopped successfully.
```

If stopping:

```
The Volume Shadow Copy service is not started.
```

2. Delete the installed RM Shadow Copy Provider using **Addition and deletion of application** on the control panel.
3. Change the current directory to \HORCM\Tool\ where CCI has been installed.
4. Perform the appropriate RMVSSPRV.exe setup program:
  - For a 32-bit system, run the RMVSSPRV.exe.
  - For an IA64 system, run the RMVSSPRV64.exe.
5. Restarts Microsoft Volume Shadow Copy Service by using the following command if VSS will not be started.

For Windows Server 2003:

```
C:\>net START Volume Shadow Copy  
The Volume Shadow Copy service is starting.  
The Volume Shadow Copy service was started successfully.
```

For Windows Server 2008/ Windows Server 2012

```
C:\>net START VSS  
The Volume Shadow Copy service is starting.  
The Volume Shadow Copy service was started successfully.
```

## Confirming backup software versions

After a new installation or update, verify the version information (Version) by using the following command:

### **Example**

```
C:\vssadmin list providers
vssadmin 1.1 - Volume Shadow Copy Service administrative command-line tool
(C) Copyright 2001 Microsoft Corp.

Provider name: 'RM Shadow Copy Provider'
  Provider type: Hardware
  Provider Id: {748babd3-8c62-4b3d-b6b7-430b5f858c74}
  Version: 01-02-03/06

Provider name: 'Microsoft Software Shadow Copy provider 1.0'
  Provider type: System
  Provider Id: {b5946137-7b9f-4925-af80-51abd60b20d5}
  Version: 1.0.0.7
```

## Checking backup software service registration

Check that RM Shadow Copy Provider has been registered as a service using the following command.

```
C:\>sc qc "RM Shadow Copy Provider"
SERVICE_NAME: RM Shadow Copy Provider
        TYPE               : 10  WIN32_OWN_PROCESS
        START_TYPE          : 3   DEMAND_START
        ERROR_CONTROL       : 1   NORMAL
        BINARY_PATH_NAME   : C:\WINDOWS\System32\dllhost.exe /Processid:{08BD82A
3-CF60-4B6E-80A2-55A13611D951}
        LOAD_ORDER_GROUP   :
        TAG                 : 0
        DISPLAY_NAME       : RM Shadow Copy Provider
        DEPENDENCIES        : rpcss
        SERVICE_START_NAME : LocalSystem
```

## Uninstalling backup software

1. Stop Microsoft Volume Shadow Copy Service by using the following command.

For Windows Server 2003:

```
C:\net STOP Volume Shadow Copy
```

For Windows Server 2008/ Windows Server 2012:

```
C:\net STOP VSS
```

If starting:

```
The Volume Shadow Copy service is stopping.  
The Volume Shadow Copy service was stopped successfully.
```

If stopping:

```
The Volume Shadow Copy service is not started.
```

2. Delete the installed RM Shadow Copy Provider using **Addition and deletion of application** on the control panel.
3. Restart Microsoft Volume Shadow Copy Service with the following command if VSS will not be started.

For Windows Server 2003:

```
C:\net START Volume Shadow Copy  
The Volume Shadow Copy service is starting.  
The Volume Shadow Copy service was started successfully.
```

For Windows Server 2008/ Windows Server 2012:

```
C:\net START VSS  
The Volume Shadow Copy service is starting.  
The Volume Shadow Copy service was started successfully.
```

## Starting VSS

### Setting CCI system environment variables

1. Define the system environment variables as follows:

Variable	Value
VSHTCHORCMINST_LOCAL	Specifies the CCI Instance number for P-VOL side.
VSHTCHORCMINST_REMOTE	Specifies the CCI Instance number for S-VOL side.
VSHTCHOMRCF_MUN	Specifies the MUN specified to P-VOL on CCI configuration file.
VSHTCRMDRV	Specifies the drive in which CCI software was installed. Specify this variable when CCI was installed on a drive other than the system drive.

2. Reboot the Windows system. The VSS service will start automatically.

### Setting the CCI environment

This example assumes the instance number and the target volume for backup as below.

```
VSHTCHORCMINST_LOCAL=50
VSHTCHORCMINST_REMOTE=51
VSHTCHOMRCF_MUN=2
```

The target volume for buck-up is mounted as E: drive on Harddisk1.

Use Ntbackup.exe as back-up program.

1. Discover and describe the command device for %windir%\horcm50.conf.  
CCI uses the command device; discover the command device (xxxx-CM).

```
C:\HORCM\etc>ingraid -CLI $Phy
DEVICE FILE   PORT   SERIAL  LDEV CTG  H/M/12  SSID R:Group  PRODUCT_ID
Harddisk0     CL2-A   91202496  16   -   -       -       -       DF600F-CM
Harddisk1     CL2-A   91202496  18   -   s/s/ss  0000 6:01-04 DF600F
Harddisk2     CL2-A   91202496  19   -   s/s/ss  0000 6:01-04 DF600F
Harddisk3     -       -         -    -   -       -       -       L040L2
```

```
C:\HORCM\etc>ingraid -CLI $LETALL
DEVICE FILE   PORT   SERIAL  LDEV CTG  H/M/12  SSID R:Group  PRODUCT_ID
E:\Vol2\Dsk1  CL2-A   91202496  18   -   s/s/ss  0000 6:01-04 DF600F
D:\Vol1\Dsk3  -       -         -    -   -       -       -       L040L2
```

%windir%\horcm50.conf:

```
HORCM_MON
#ip_address    service      poll(10ms)    timeout(10ms)
127.0.0.1      52050        12000         3000

HORCM_CMD
#dev_name      dev_name     dev_name
\\.\CMD-91202496
```

## 2. Perform a horcmstart 50 as background.

```
C:\HORCM\etc>horcmstart 50
starting HORCM inst 50
HORCM inst 50 starts successfully.
```

## 3. Verify a physical mapping.

```
C:\HORCM\etc>set HORCMINST=50
C:\HORCM\etc>raidscan -pi $Phys -find
```

DEVICE_FILE	UID	S/F	PORT	TARG	LUN	SERIAL	LDEV	PRODUCT_ID
Harddisk0	0	F	CL2-A	25	16	91202496	16	DF600F-CM
Harddisk1	0	F	CL2-A	25	18	91202496	18	DF600F
Harddisk2	0	F	CL2-A	25	19	91202496	19	DF600F

## 4. Shut down a horcmstart 50.

```
C:\HORCM\etc>horcmshutdown 50
inst 50:
HORCM Shutdown inst 50 !!!
```

## 5. Describe the Known HORCM\_DEV on %windir%\horcm50.conf.

%windir%\horcm50.conf for P-VOL

```
HORCM_MON
#ip_address      service      poll(10ms)      timeout(10ms)
127.0.0.1        52050        12000           3000

HORCM_CMD
#dev_name        dev_name        dev_name
\\.\CMD-91202496

HORCM_LDEV
#dev_group       dev_name        Serial#         LDEV#          MU#
snap             snapdev1        91202496        18             0

HORCM_INST
#dev_group       ip_address      service
snap             127.0.0.1      52051
```

%windir%\horcm51.conf for S-VOL

```
HORCM_MON
#ip_address      service      poll(10ms)      timeout(10ms)
127.0.0.1        52051        12000           3000

HORCM_CMD
#dev_name        dev_name        dev_name
\\.\CMD-91202496

HORCM_LDEV
#dev_group       dev_name        Serial#         LDEV#          MU#
snap             snapdev1        91202496        19             0

HORCM_INST
#dev_group       ip_address      service
snap             127.0.0.1      52050
```

## 6. Start horcmstart 50 51.

```
C:\HORCM\etc>horcmstart 50 51
starting HORCM inst 50
HORCM inst 50 starts successfully.
starting HORCM inst 51
HORCM inst 51 starts successfully.

C:\HORCM\etc>set HORCMINST=51
C:\HORCM\etc>set HORCC_MRCF=1

C:\HORCM\etc>pairstat -g snap -fdc
Group   PairVol(L/R) Device_File      ,Seq#,LDEV#.P/S,Status,   %,P-LDEV# M
snap    snapdev(L/R)  Harddisk2          91202496  19.SMPL  ----,-----  -
snap    snapdev(L/R)  Harddisk1          91202496  18.SMPL  ----,-----  -
```

## 7. Hide and create invisible S-VOL.

The **-vg idb** option is an option only for VSS. Be sure to specify.

```
C:\HORCM\etc>raidvchkset -g snap -vg idb
C:\HORCM\etc>pairstat -g snap

C:\HORCM\etc>pairstat -g snap
Group   PairVol(L/R) (Port#,TID,VOL-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
snap    snapdev1(L)  (CL2-A ,25, 19-0)91202496  19.S-VOL PAIR,-----  18  -
snap    snapdev1(R)  (CL2-A ,25, 18-0)91202496  18.P-VOL PAIR,91202496  19  N
```

## 8. Perform Rescan disk.

VSS needs to make the hidden volumes for S-VOL, so you must perform the Rescan disk by using the **diskpart** command.

```
C:\HORCM\etc>diskpart
:
DISKPART>rescan
Please wait while DiskPart scans your configuration...
DiskPart has finished scanning your configuration.
```

## 9. Start horcmstart 50 51.

```
C:\HORCM\etc>horcmstart 50 51
starting HORCM inst 50
HORCM inst 50 starts successfully.
starting HORCM inst 51
HORCM inst 51 starts successfully
```

- The steps (1) - (8), for the CCI Environment, will need to be done for each changes of the horcm\*.conf file. VSS coordinator will activates the RM Shadow Copy provider automatically, and then RM Shadow Copy provider will perform the commands of CCI when Back-up program will be performed. Therefore CCI must be started prior to performing the Back-up program.
- In case of the export and import host configuration, VSHTCHORCMINST\_LOCAL variable must be set on P-VOL side (export) host, and VSHTCHORCMINST\_REMOTE variable must be set on S-VOL side (import) host. P-VOL side host must be started by horcmstart 50, and has to set HORCMINST=50 variable. Also S-VOL side host similarly must be started by horcmstart 51 and has to set HORCMINST=51 variable. P-VOL side host must be connected only P-VOLs, and S-VOL side host must be connected only S-VOLs.

## Performing a backup

You are able to perform the back-up program by specifying the target volume for backup after setting the CCI Environment.

When using the GUI:

1. Perform the back-up program.

Perform the NTbackup (%SystemRoot%\system32\Ntbackup.exe) by specifying E: drive on the P-VOL.

2. Verify that RM Shadow Copy Provider is working (if needed).

You can verify that RM Shadow Copy Provider is working by the Status field of CCI command (**pairedisplay -g snap**) or not.

When NTbackup has been starting, the **pairedisplay** state will be PVOL\_PSUS and SVOL\_COPY or PVOL\_PSUS and SVOL\_SSUS.

When NTbackup has been deleting the snap (OnLunEmpty() in H/W provider is called by VSS), the **pairedisplay** state will be PVOL\_COPY and SVOL\_COPY or PVOL\_PAIR and SVOL\_PAIR.

When using the CLI:

1. Execute the diskshadow.exe by specifying "E: drive" on the P-VOL.

```
C:\Windows>diskshadow
Microsoft DiskShadow version 1.0
:
DISKSHADOW> begin backup
DISKSHADOW> set context persistent
DISKSHADOW> add volume E:
DISKSHADOW> create
Alias VSS_SHADOW_1 for shadow ID {bfeelee0-b0af-4eef-8a00-768083ebc418} set as
environment variable.
Alias VSS_SHADOW_SET for shadow set ID {a8c8e0f0-2f06-4c87-8d79-29f7d6edfc12} set as
environment variable.

Querying all shadow copies with the shadow copy set ID {a8c8e0f0-2f06-4c87-8d79-
29f7d6edfc12}
    * Shadow copy ID = {bfeelee0-b0af-4eef-8a00-768083ebc418}
%VSS_SHADOW_1%
    - Shadow copy set: {a8c8e0f0-2f06-4c87-8d79-29f7d6edfc12}
%VSS_SHADOW_SET%
    - Original count of shadow copies = 1
    - Original volume name: \\?\Volume{064c2128-5b7a-11dc-9438-
806e6f6e6963}\ [E:\]
    - Creation time: 9/20/2007 2:09:12 PM
    - Shadow copy device name: \\?\Volume{63535314-5d14-11dc-abd1-
00c0a87bb335}
    - Originating machine: WIN-AK0K6OCBJSW
    - Service machine: WIN-AK0K6OCBJSW
    - Not exposed
    - Provider ID: {748babd3-8c62-4b3d-b6b7-430b5f858c74}
    - Attributes: No_Auto_Release Persistent Hardware
Number of shadow copies listed: 1

DISKSHADOW> expose %VSS_SHADOW_1% S:
-> %VSS_SHADOW_1% = {bfeelee0-b0af-4eef-8a00-768083ebc418}
The shadow copy was successfully exposed as mount point S:\.
```

## 2. Perform back-up operation on S: drive.

```
DISKSHADOW> unexposed S:
Shadow copy ID {bfeelee0-b0af-4eef-8a00-768083ebc418} is no longer exposed.

DISKSHADOW> delete shadows ID %VSS_SHADOW_1%
-> %VSS_SHADOW_1% = {bfeelee0-b0af-4eef-8a00-768083ebc418}
Deleting shadow copy {bfeelee0-b0af-4eef-8a00-768083ebc418}...

1 shadow copy deleted.

DISKSHADOW> end backup:
```

## 3. Verify that RM Shadow Copy Provider is working (if needed).

You can verify that RM Shadow Copy Provider is working by the Status field of CCI command (**pairedisplay -g snap**) or not.

When NTbackup has been starting, the `pairedisplay` state will be PVOL\_PSUS and SVOL\_COPY or PVOL\_PSUS and SVOL\_SSUS.

When NTbackup has been deleting the snap (OnLunEmpty() in H/W provider is called by VSS), the `pairedisplay` state will be PVOL\_COPY and SVOL\_COPY or PVOL\_PAIR and SVOL\_PAIR.

## Notes on VSS

- S-VOL (V-VOL) that is no longer used as a VSS  
For a volume that is hidden by the `raidvchkset -vg idb`, deleting and formatting, etc. are restricted. For a volume that is no longer used as a dynamic disk, eliminate hiding by using the **`raidvchkset -vg`** command.
- Starting CCI  
The CCI must be started with the privilege for administrator, when the user will start the CCI as a service.  
If the CCI is started with the System privilege, CCI commands via command prompt will be unable to attach to the CCI.
- Independent VDS  
Note that RM Shadow Copy Provider and CCI does not use VDS interface.  
RM Shadow Copy Provider and CCI can support two host configurations for the OFF HOST Backup (one is export host, another is import host), but these configurations must be supported via the back-up requestor by transporting the XML file between export and import host.
- Do not use RM Shadow Copy Provider to perform a backup operation with disks from other vendors. Otherwise, RM Shadow Copy Provider checks the disks from the other vendor and leaves the warning [EV\_ENOUSUP] in the log to indicate the disks are not supported.

## Known VSS problems and concerns

- **NTBackup cannot cancel a snapshot**
  - Problem: NTbackup does not cancel after the Cancel button is pushed.
  - Solution: This as a bug in VSS that occurs when you try to delete (cancel) a snapshot while importing it. This bug will be corrected with Windows Server 2003 SP1.
- **VSS cannot work with LDM (Disk Manager Tool)**
  - Problem: VSS cannot work with LDM tool correctly, because VSS depends on PnP.
  - Solution: This would be the problem between VSS and LDM tool, so do not use the LDM tool while VSS has been working.
- **Event log increases at every backup**
  - Problem: A warning message is recorded to the event log at time every backup, because VSS uses PnP for mounting the copied S-VOL that has the same signature to P-VOL.
  - Solution: The rewriting of the signature occurs when S-VOL is imported by the re-scan operation of VSS. The administrator should regularly remove this log.
- **VOL#0 cannot use S-VOL**
  - Problem: VSS cannot recognize VOLs over VOL#1; if VOL#0 is set S-VOL for VSS, VSS requires the hidden volume as S-VOL.
  - Solution: Some HBA driver did not scan all VOLs on a port, if VOL#0 is hidden as S-VOL. Therefore, do not use VOL#0 as S-VOL for HBA drivers.
- **BreakSnapShot() after importing fails with ERROR 0x80042306**
  - Problem: The behavior VSS is expecting is that a device object (Volume\?\GlobalRoot\Device\HarddiskVolumeX) is not changed via any RESCAN until the imported device object is deleted. If the PhysicalDriveX is changed by HBA driver via next RESCAN, a device object will be changed. So VSS coordinator will use old device object, and then VSS encounters an **ERROR\_FILE\_NOT\_FOUND** when it deletes a SnapShot volume.
  - Solution: The Full Port driver for the Emulex should not be used. You need to use **StorPort** drivers including **HotFix#838894** for importing the SnapShot.
- **raidscan -find does not show any volumes**
  - Problem: `inqraid $Phys -CLI` shows the details for the PhysicalDrive, but `raidscan -pi $Phys -find` does not show any device.
  - Solution: You need to use **StorPort** drivers including **HotFix#883646**.

- **RM Shadow Copy Provider does not exist as a service**

- Problem: When RM Shadow Copy Provider is installed in the status where MSDTC and COMSysApp have not started as a service, VSS cannot register the Hardware Provider as a service. Therefore, the VSS outputs the following event and the backup fails.

```
-----  
Event Type:      Error  
Event Source:    VSS  
:  
Computer:  
Description:  
Volume Shadow Copy Service error: A critical component required by the Volume  
Shadow Copy service is not registered.  
:  
The error returned from CoCreateInstance on class with CLSID  
{9e8bcdbd-ff46-48eb-8f09-23b00344a6ac} and Name HWPRV is [0x80040154].  
-----
```

- Solution: Reinstall RM Shadow Copy Provider in the following procedure:
  1. Set MSDTC and COMSysApp to either automatic start or manual start using the **Computer Management**. Confirm the services in [Table 7-2](#).
  2. Uninstall and then reinstall RM Shadow Copy Provider.

## About event log error messages

**Table 7-5 RM Shadow Copy provider error messages**

Message ID	Error Message	Condition	Recommended Action
EV_ERPERM	Permission denied with the VSS hardware provider.	RM Shadow Copy Provider is activated except for the Local System account.	Confirm the start up account of RM Shadow Copy Provider.
EV_ENOMEM	The memory become insufficient.	Couldn't retain the memory for executing a RM Shadow Copy Provider.	Increase the capacity of virtual memory of the whole system, or terminate unnecessary programs or daemon processes running simultaneously.
EV_INVSTP	Invalid pair status.	The pair status of a target volume isn't appropriate.	Confirm volume status with the <b>pairedisplay</b> command.
EV_ATTHOR	Can't attached to a HORCM daemon.	The HORCM daemon is not working.	Confirm if the HORCM daemon is working.
EV_CMDIOE	Control command I/O error.	Control command I/O error, or rejected.	Remove a cause of an error after confirming with system error code.
EV_CMDERR	VSS has caught an error of RAID Manager command.	RAID Manager command returns an error.	Remove a cause of an error after confirming with system error code of CCI.
EV_EGETEV	An error occurred in GetEnvironmentVariable().	The system environment variable could not be got on GetEnvironmentVariable() system call.	Confirm if the system environment variable is defined. Remove a cause of an error after confirming with system error code.
EV_ENOSUP	No supported device.	The specified device is a command device or unsupported disk.	Confirm if a target disk is the supported disk.
EV_ENOINQ	No such inquiry.	An error occurred in the inquiry to the specified device.	Remove a cause of an error after confirming it with system error code. Confirm the connection with the device.
EV_ENOOBJ	Not found object.	The SnapshotSetID which provider specified is invalid.	Remove a cause of an error after confirming with event log if an error about Shadow Copy Service is written in it.
EV_ENOSER	No such serial number.	A serial number could not be acquired from the specified device information.	Remove a cause of an error after confirming it with event log if an error about Shadow Copy Service is written in it.
EV_ENRMEN	A RAID Manager command binary file is not found	An operation misses, and so on removed the file of CCI command.	Install CCI again.
EV_ENRMEN	RAID Manager was not found in the "\\HORCM\ETC" directory in C-Z drives.	An operation misses, and so on removes the directory "\\HORCM\ETC".	Install CCI again.

Message ID	Error Message	Condition	Recommended Action
EV_ESETEV	The system environment variable could not be set.	The system environment variable could not be set on SetEnvironmentVariable() system call.	Remove a cause of an error after confirming it with event log if system is unstable with event log.
EV_EXCEPT	An exception occurred.	An Exception occurred during a process of RM Shadow Copy Provider.	Remove a cause of an error after confirming it with event log if system is unstable with event log.
EV_INVARG	Invalid argument.	The argument, which a coordinator specified, is invalid.	Remove a cause of an error after confirming it with event log if an error about Shadow Copy Service is written in it.
EV_INVSEQ	Invalid sequence.	The order specified from a coordinator is invalid.	Remove a cause of an error after confirming it with event log if an error about Shadow Copy Service is written in it.
EV_EOPDEV	Cannot open a device.	Opening the specified device special file failed.	Remove a cause of an error after confirming it with system error code.
EV_INCMUN	Inconsistent MUN in a SnapShot Set.	The MUN of a volume within a Snapshot Set isn't identical to the others in the Snapshot Set.	Confirm the MUN in Snapshot Set using the <b>pairedisplay</b> command.



# VMware vCenter Site Recovery Manager

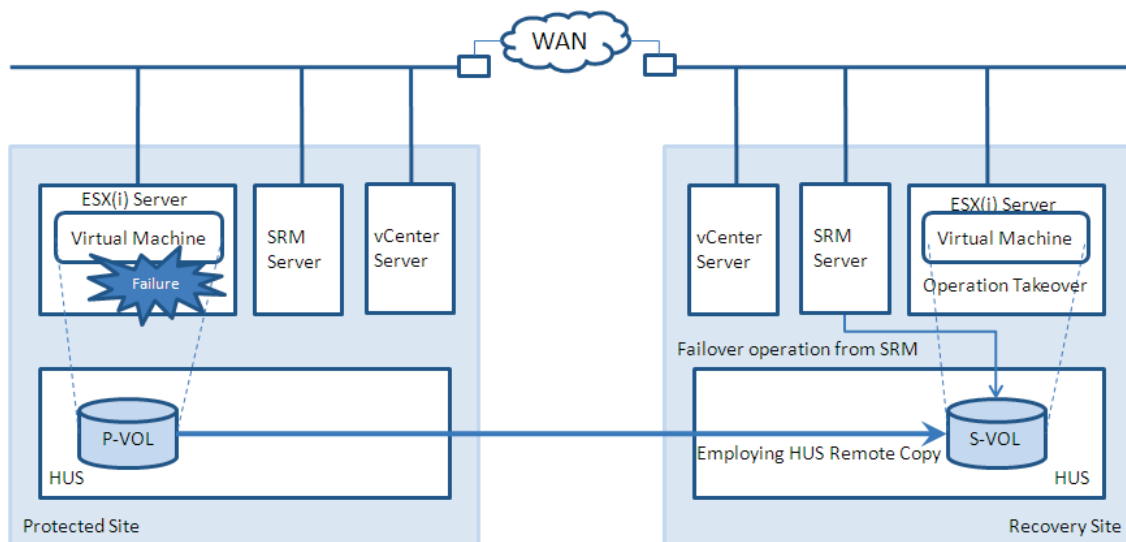
- ☐ [Overview of VMware vCenter Site Recovery Manager](#)
- ☐ [Integration between SRM and Copy Functions](#)
- ☐ [Configurations Integrating SRM with Copy Functions](#)
- ☐ [SRM Operations](#)
- ☐ [Requirements](#)
- ☐ [Configuring environment](#)
- ☐ [Setting SRM](#)
- ☐ [Considerations](#)
- ☐ [Troubleshooting](#)

## Overview of VMware vCenter Site Recovery Manager

VMware vCenter Site Recovery Manager (hereafter called SRM) is disaster recovery software for ESX(i) servers provided by VMware, Inc. SRM continues operations by handing virtual machine environments at the protected site (local site) over to the recovery site (remote site) when an ESX(i) server stops due to a disaster, etc. It also provides the testing function of this failover function, the reversing function that hands operations at the recovery site over to the protected site again after failover.

In data control between the protected site and the recovery site performed by SRM, TrueCopy and TCE can be used, which are remote copy functions of HUS. By using remote copy functions of HUS, you can offload remote copy functions to HUS that would otherwise be performed by SRM. You can also integrate ShadowImage and/or SnapShot with the testing function of the failover function.

**Figure 8.1 Integration between SRM and HUS Remote Copy Functions**



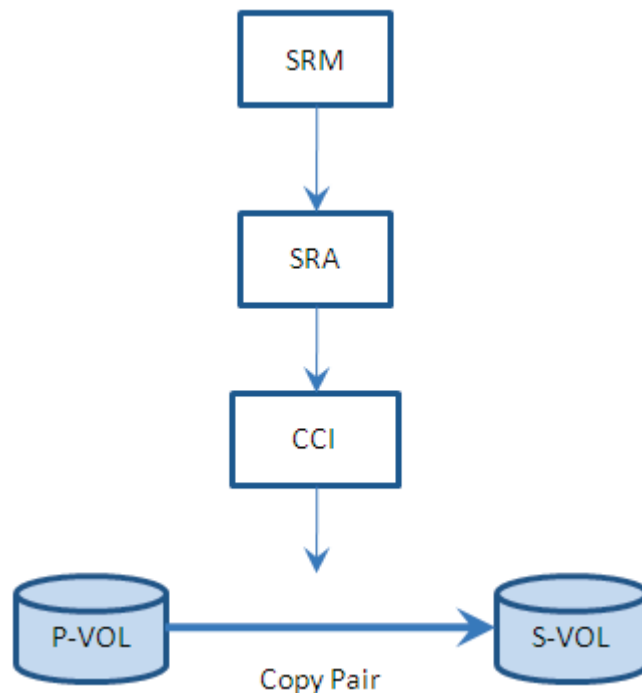
## Integration between SRM and Copy Functions

This section describes the configuration where SRM and the HUS copy functions work together.

When SRM works with the HUS copy functions, operations performed in SRM are eventually passed to HUS copy pairs as pair operations.

SRM operations performed by users such as failover, etc. are first passed to Storage Replication Adapter (hereafter called SRA). SRA is an interface that passes operations from SRM to copy pairs in arrays as pair operations and it is provided by each storage vendor. Hitachi provides it as Hitachi RAID Manager Storage Replication Adapter. Pair operations are passed from SRA to Command Control Interface (CCI), and eventually passed to copy pairs in HUS.

**Figure 8.2 Integration between SRM and Copy Functions**



## Configurations Integrating SRM with Copy Functions

This section describes examples of the configurations where SRM and the HUS copy functions work together.

To integrate SRM with the copy functions, the following servers are required for both the protected site and the recovery site in addition to HUS.

**Table 8.1 Servers Required for SRM**

No.	Server	In This Server,	Required OS
1	ESX(i) server	SRM-managed virtual machines run.	VMware ESX(i)
2	vCenter server	vCenter is installed. SRM operations are performed after logging in a vCenter server via a vCenter server or a vSphere Client.	Windows Server
3	SRM server ( <b>Note</b> )	SRM and SRA are installed.	Windows Server
4	CCI server ( <b>Note</b> )	CCI is installed.	Linux, HP-UX, AIX, Solaris, etc.

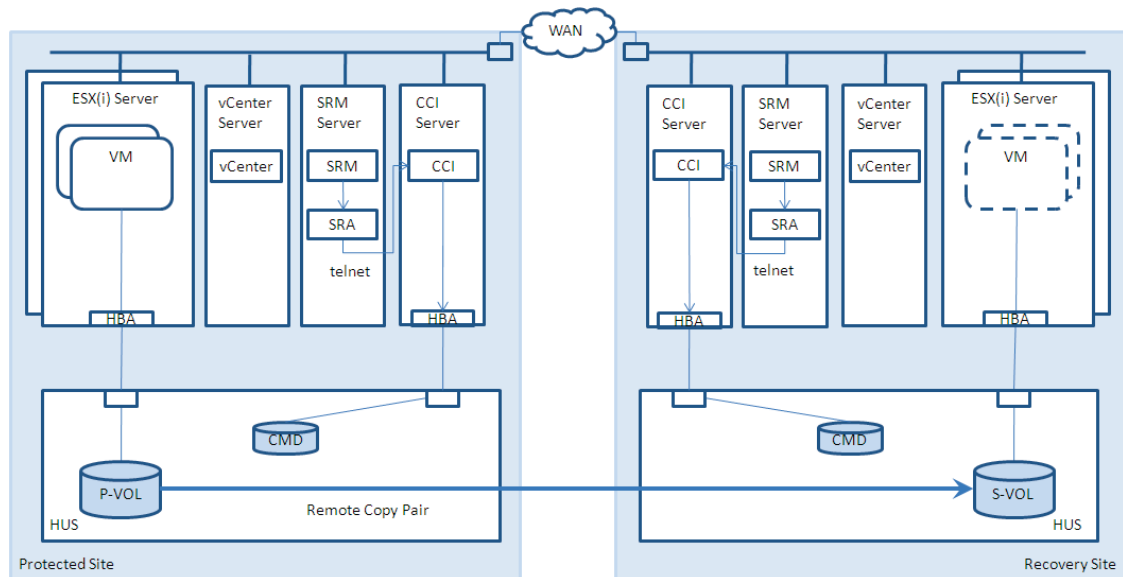
**Note:** If you install SRM and CCI together in a vCenter server, you do not necessarily need to prepare CCI and CCI server separately.

Here are five examples of the configurations where SRM, SRA, and CCI are installed in different servers.

## Configuration A

Each of vCenter, SRM, and CCI is installed in a different server. SRA passes instructions from SRM to CCI via telnet.

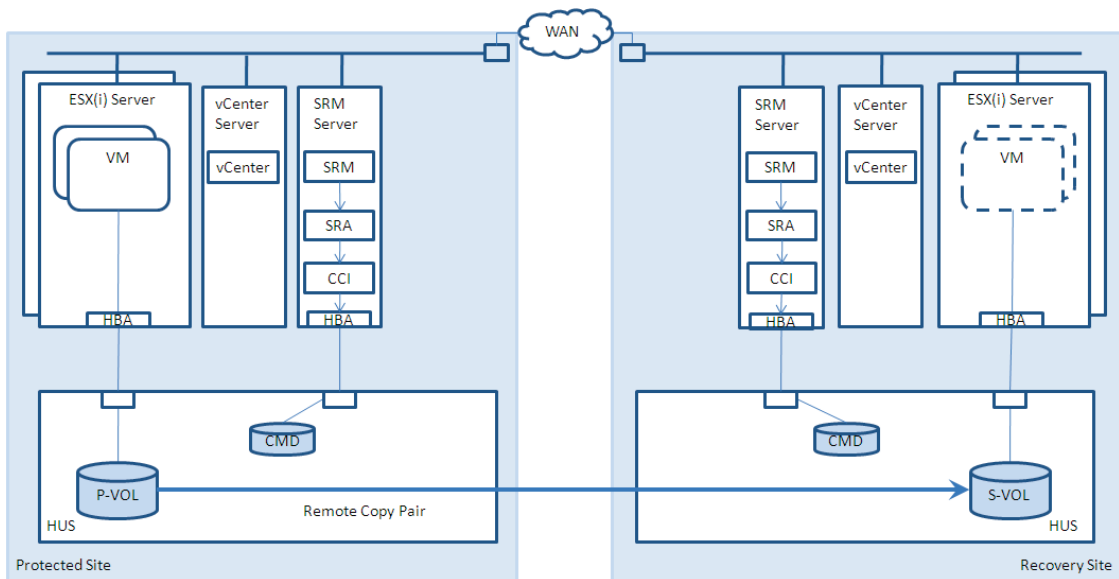
**Figure 8.3 Example of Configuration where vCenter, SRM, and CCI are in Different Servers**



## Configuration B

SRM and CCI are installed in the same server. A physical server for CCI can be eliminated. Telnet is not required because SRA and CCI reside in the same server.

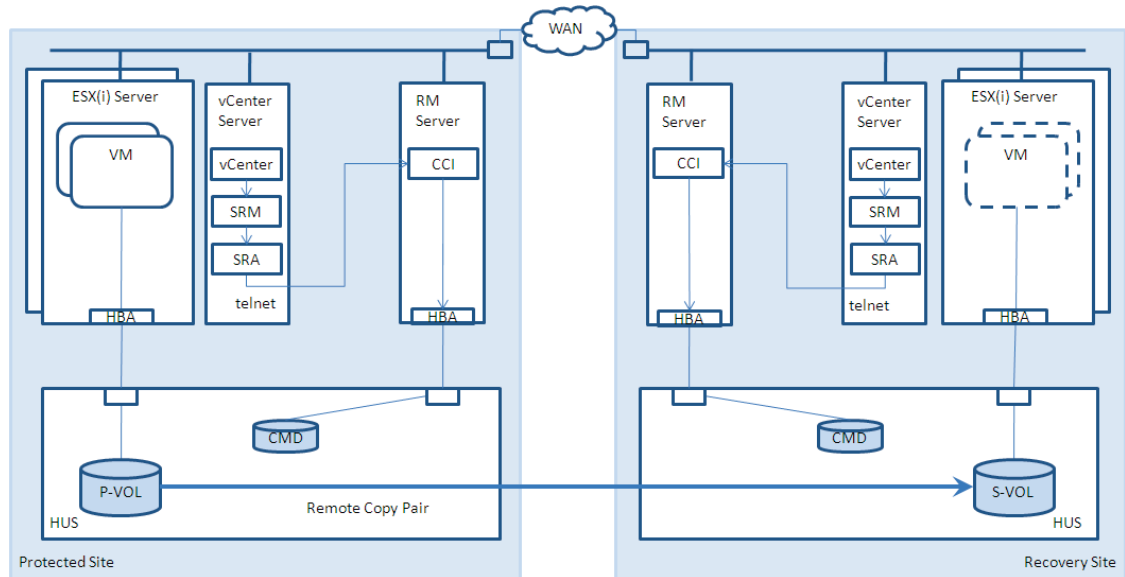
**Figure 8.4** Example of Configuration where SRM and CCI are in the Same Server



## Configuration C

vCenter and SRM are installed in the same server. A physical server for SRM can be eliminated. SRA passes instructions from SRM to CCI via telnet.

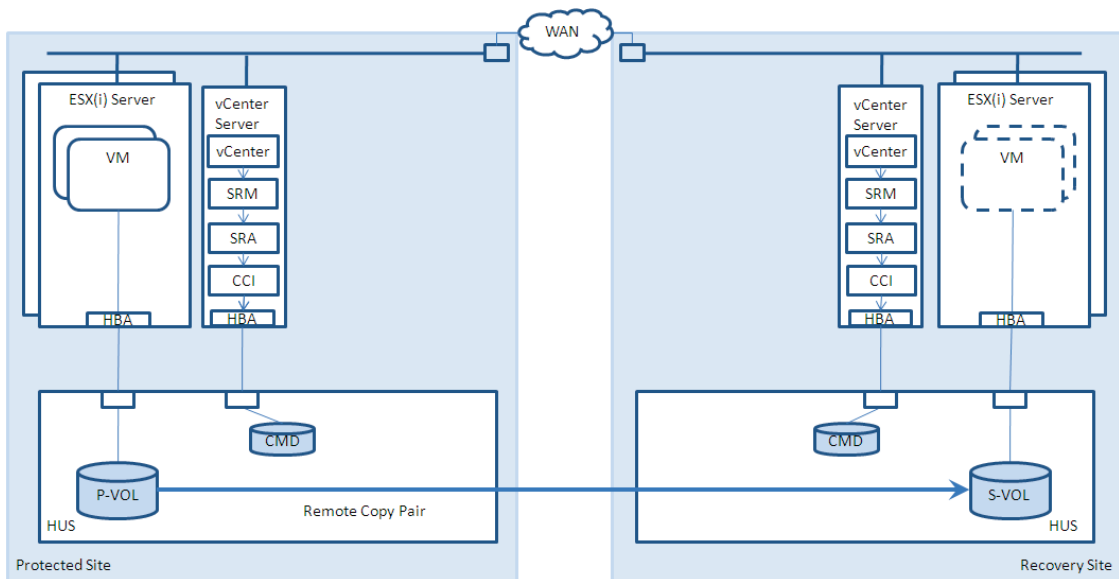
**Figure 8.5** Example of Configuration where vCenter and SRM are in the Same Server



## Configuration D

vCenter, SRM, and CCI are installed in the same server. Physical servers for SRM and CCI can be eliminated. Telnet is not required because CCI resides in the same server.

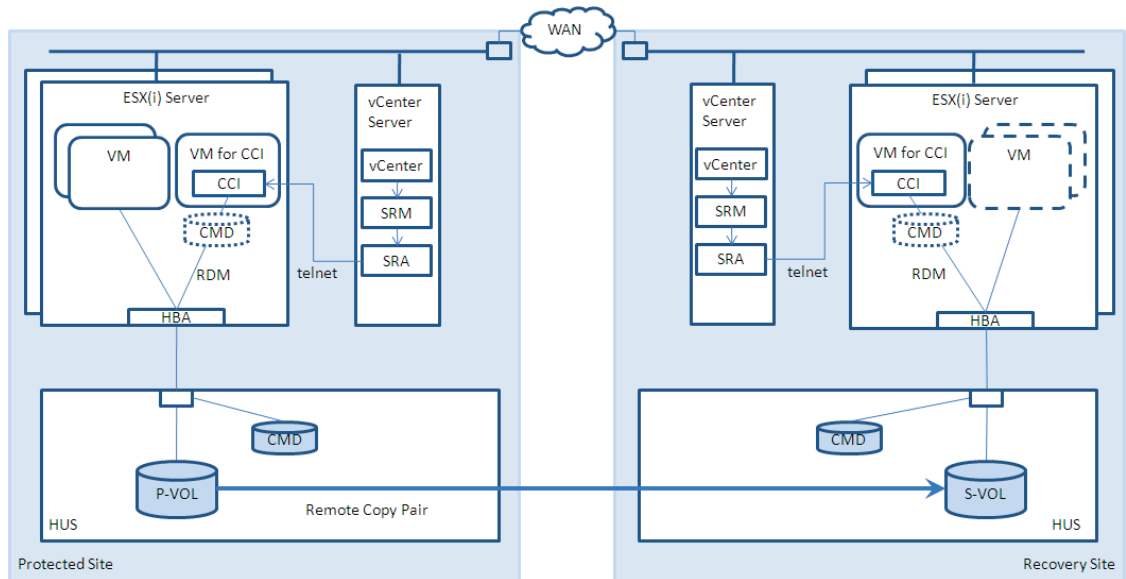
**Figure 8.6** Example of Configuration where vCenter, SRM, and CCI are in the Same Server



## Configuration E

CCI is installed in a VM on an ESX(i) server. An additional physical server exclusively dedicated for CCI is not required. SRA passes instructions from SRM to CCI via telnet.

**Figure 8.7 Example of Configuration where CCI is in VM**



## SRM Operations

This section describes an overview of operations that can be performed in SRM such as failover, etc. and how HUS copy functions work according to the operations.

In SRM, you can perform the following five operations.

**Table 8.2 SRM Operations**

No.	Operation	Description
1	Test ("test failover" in this guide)	Checks if failover function operates normally in an environment. Target can be remote copy or local copy.
2	Cleanup	Recovers the environment before test failover after performing it.
3	Recovery	Performs failover from protected site to recovery site. Planned Migration and Disaster Recovery are available.
4	Reprotect	Protects the operating recovery site after recovery. After reprotecting, recovery can be performed at the recovery site.
5	Cancel	Cancels an operation being performed.

The following table shows copy functions and available SRM operations for each copy function.

Test failover to a local copy can be performed only if S-VOL of a remote copy and P-VOL of a local copy are in the cascade configuration. SRM operations other than test failover can be performed in any configuration.

**Table 8.3 SRM Operations Supported by Copy Functions**

SRM Operation	Supported Copy Function				
	TrueCopy only	TrueCopy(S) + ShadowImage(P)	TrueCopy(S) + SnapShot(P)	TCE only	TCE(S) + SnapShot(P)
Test failover and cleanup to remote copy	Available	Available	Available	Available	Available
Test failover and cleanup to local copy	Not available	Available	Available	Not available	Available
Recovery	Available	Available	Available	Available	Available
Reprotect	Available	Available	Available	Available	Available
Cancel	Available	Available	Available	Available	Available

TrueCopy(S)+ShadowImage(P): TrueCopy S-VOL and ShadowImage P-VOL share a volume in the cascade configuration

TrueCopy(S)+SnapShot(P): TrueCopy S-VOL and SnapShot P-VOL share a volume in the cascade configuration

TCE(S)+SnapShot(P): TCE S-VOL and SnapShot P-VOL share a volume in the cascade configuration

## Details of Each Operation

### Test (test failover)

This operation checks if the failover function operates normally in an environment.

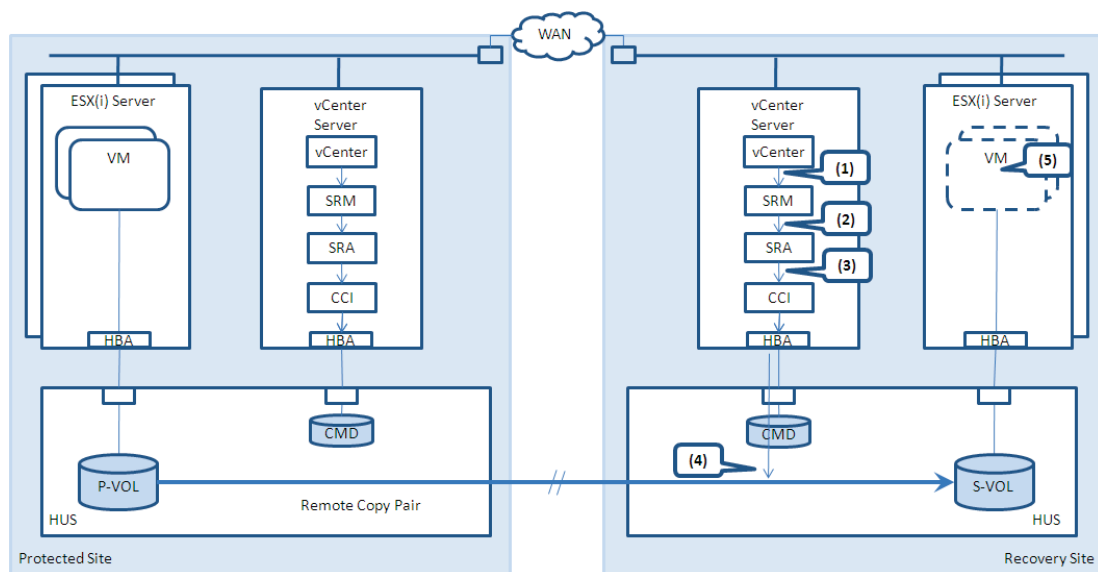
Test failover starts up virtual machines at the recovery site without shutting down virtual machines at the protected site. This action enables confirmation of failover function feasibility in an environment that you build without affecting virtual machines in a production environment. At this time, pair split is performed to the copy pair in the array and the statuses of P-VOL and S-VOL become PSUS and SSUS respectively.

Test failover can be performed to both remote copy pairs and local copy pairs. However, if a local copy pair becomes the target, a remote copy pair and a local copy pair at the recovery site need to be configured in cascade. In this case, you can switch the target of test failover between remote copy pair and local copy pair by changing the SplitReplication environment variable. For details, see [Setting environment variables](#) on page 8-32.

### When the target is a remote copy pair

Pair split is performed to a remote copy pair and a virtual machine starts up in S-VOL of the remote copy pair.

**Figure 8.8 Test Failover Operation (with Remote Copy)**

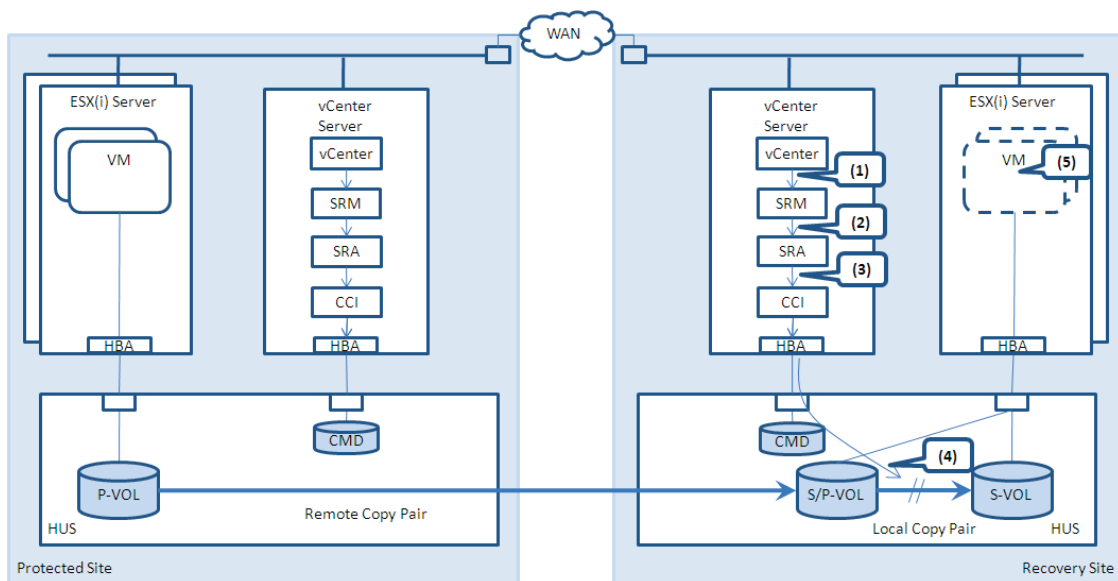


1. Perform test (test failover) from SRM to a remote copy pair.
2. SRM instructs SRA to start test failover.
3. SRA instructs CCI to start test failover.
4. CCI instructs a remote copy pair to be split.
5. A virtual machine (VM) starts up in S-VOL of the remote copy pair.

## When the target is a local copy pair

Pair split is performed to a local copy pair and a virtual machine starts up in S-VOL of the local copy pair.

**Figure 8.9 Test Failover Operation (with Local Copy)**



1. Perform test (test failover) from SRM to a local copy pair.
2. SRM instructs SRA to start test failover.
3. SRA instructs CCI to start test failover.
4. CCI instructs a local copy pair to be split.
5. A virtual machine (VM) starts up in S-VOL of the local copy pair.

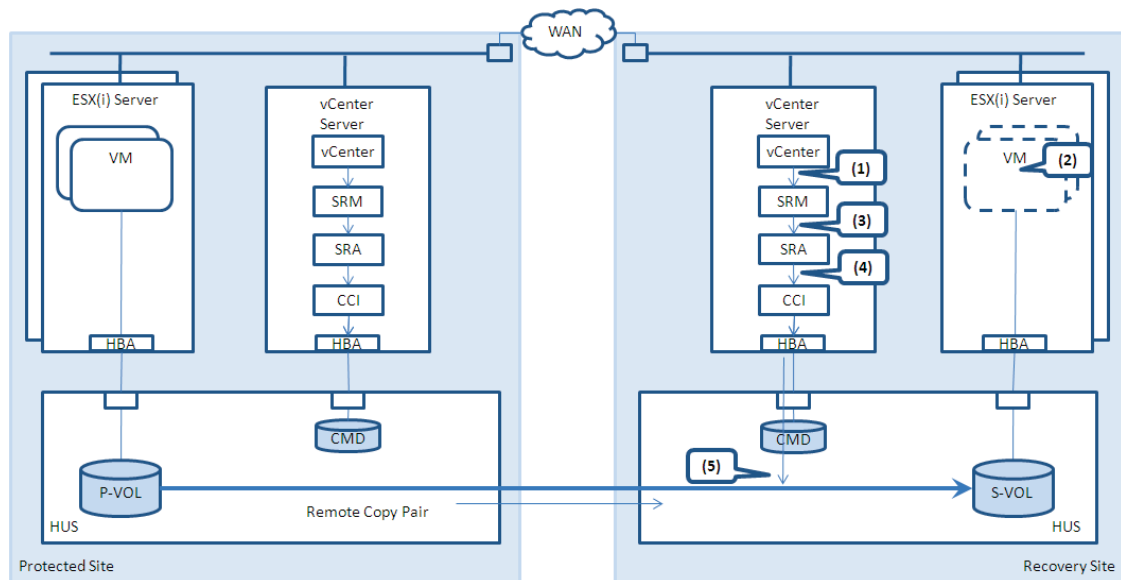
## Cleanup

This operation recovers the environment before test failover after it is performed. It shuts down the virtual machine for testing that started up at the recovery site after test failover. After that, pair resync is performed to a remote copy pair or a local copy pair that was performed test failover to synchronize data again in P-VOL and S-VOL of the copy pair. The pair status becomes PAIR.

### When remote copy is used

This operation shuts down the virtual machine that started up at the recovery site after test failover and performs pair resync to a remote copy pair.

**Figure 8.10 Cleanup Operation (with Remote Copy)**

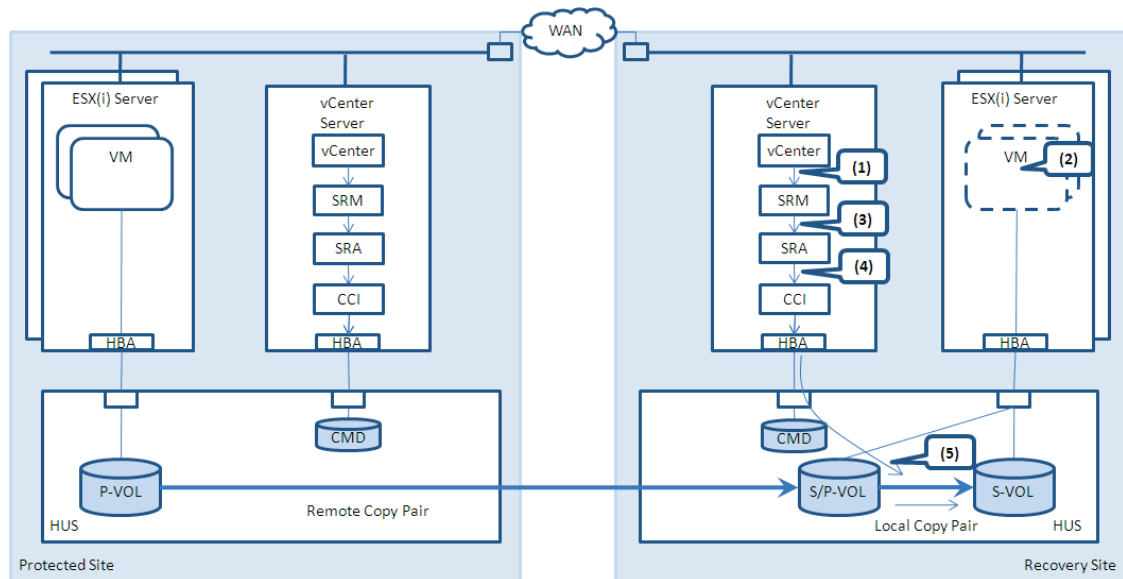


1. SRM performs cleanup to a remote copy pair.
2. The virtual machine for testing that is running at the recovery site is shut down.
3. SRM instructs SRA to terminate test failover.
4. SRA instructs CCI to terminate test failover.
5. CCI instructs a remote copy pair to be to be resynced.

## When a local copy is used

A virtual machine that started up after test failover is shut down and pair resync is performed to a local copy pair.

**Figure 8.11 Cleanup Operation (with Local Copy)**



1. SRM performs cleanup to a local copy pair.
2. A virtual machine for testing that is running at the recovery site is shut down.
3. SRM instructs SRA to terminate test failover.
4. SRA instructs CCI to terminate test failover.
5. CCI instructs a local copy pair to be resynced.

## Recovery

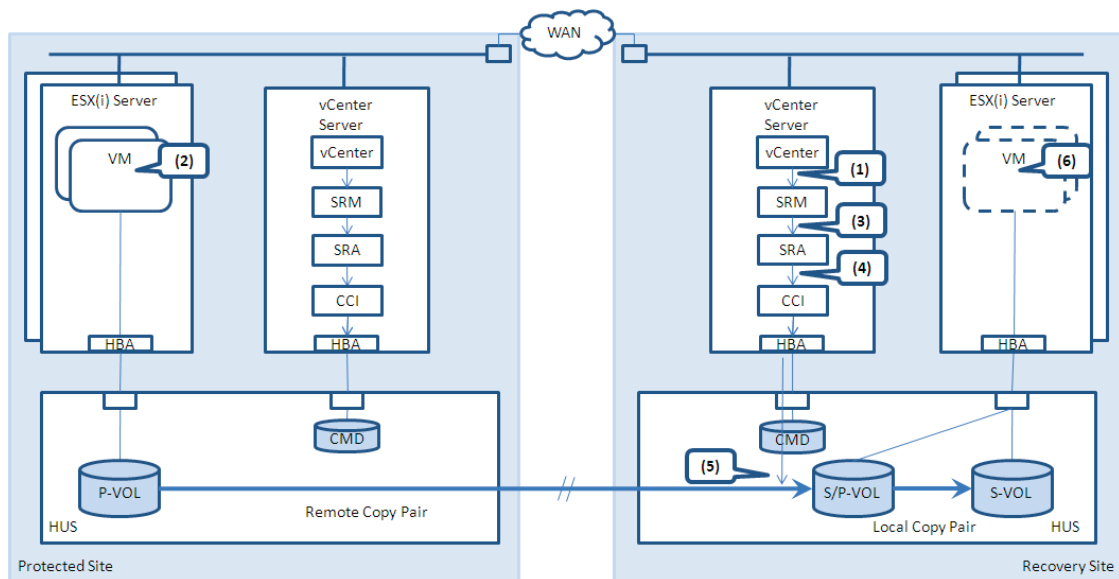
This operation performs failover from protected site to recovery site. Even if a virtual machine running at the protected site becomes unable to operate due to a failure, etc., you can continue operations by handing its environment over to the recovery site (performing recovery). At this time, takeover is performed to S-VOL of a remote copy pair and its pair status becomes SSWS in the array. The pair status of P-VOL remains PAIR, or becomes PSUE if P-VOL receives I/O.

The following two operation modes are available and selected from at the time of recovery.

### Planned Migration

After a virtual machine running normally at the protected site is shut down, the virtual machine environment at the protected site is transferred to a virtual machine at the recovery site. If errors occur during this operation, it stops because it aims at failover without data loss. This is used when you migrate virtual machine operations from protected site to recovery site in normal operation, restore the reversed protection target, etc.

**Figure 8.12 Planned Migration Operation**



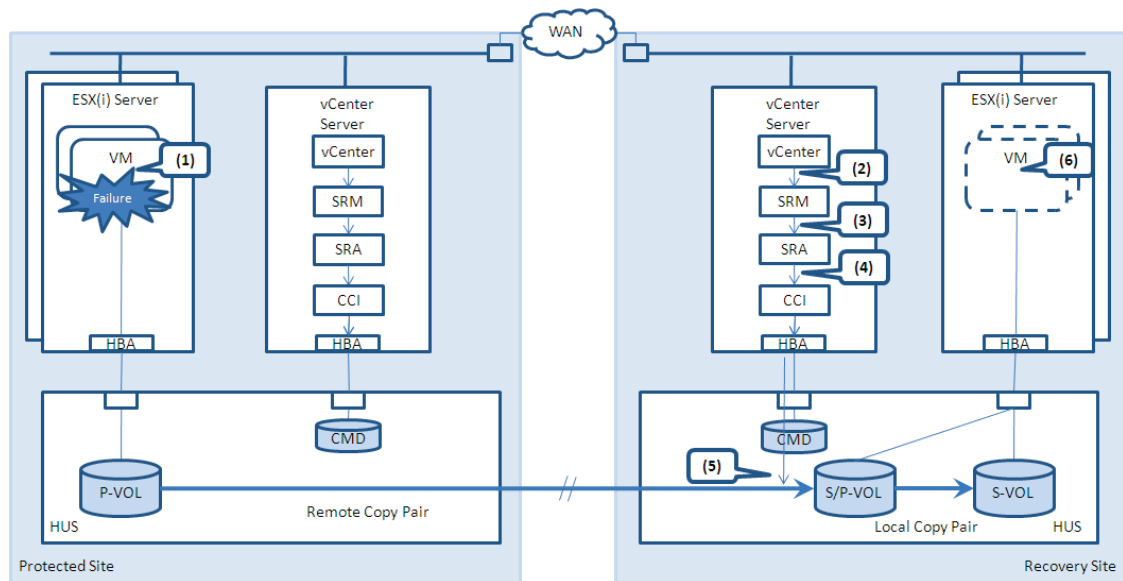
1. SRM performs planned migration.
2. The virtual machine at the protected site is shut down.
3. SRM instructs SRA to start failover.
4. SRA instructs CCI to start failover.

5. CCI instructs S-VOL of a remote copy pair to take over.
6. A virtual machine starts up in S-VOL of the remote copy pair.

## Disaster Recovery

If the protected site has a problem and the virtual machine becomes unable to be accessed, the virtual machine at the recovery site is started up with the latest environment available there. This operation continues failover even if errors occur during the operation. This is used when you continue operations at the recovery site after the protected site has a problem and the virtual machine becomes unable to be accessed.

**Figure 8.13 Disaster Recovery Operation**

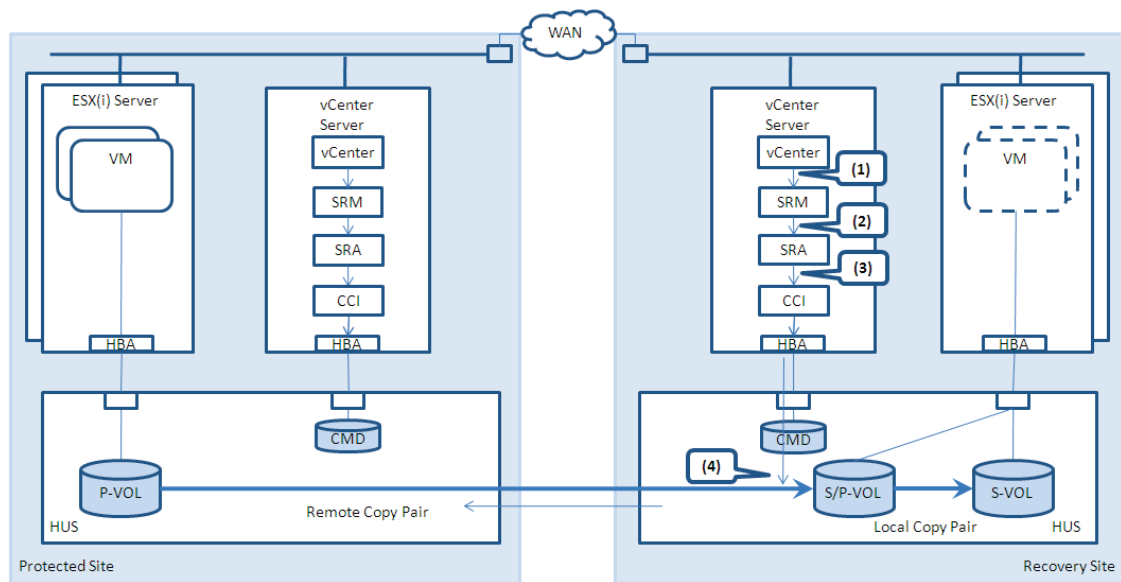


1. The virtual machine becomes unable to be accessed due to a failure at the protected site.
2. SRM performs disaster recovery.
3. SRM instructs SRA to start failover.
4. SRA instructs CCI to start failover.
5. CCI instructs S-VOL of a remote copy pair to take over.
6. A virtual machine starts up in S-VOL of the remote copy pair.

## Reprotect

This operation protects the virtual machine running at the recovery site after recovery. This enables recovery of the virtual machine at the recovery site. At this time, P-VOL and S-VOL of a remote copy pair are swapped and pair resync is performed from P-VOL to S-VOL at the recovery site. The pair status becomes PAIR.

**Figure 8.14 Reprotect Operation**



1. SRM performs reprotect.
2. SRM instructs SRA to start reverse copy.
3. SRA instructs CCI to start reverse copy.
4. CCI instructs a remote copy pair to swap.

## Cancel

This operation cancels each operation of SRM. If the pair status of a copy pair has already changed at the time of cancel, it does not go back to that before the SRM operation is performed.

## Requirements

[Table 8.4](#) shows the requirements of SRM.

**Table 8.4 Requirements**

Component	Requirement
Array	HUS110/130/150
Array firmware	<ul style="list-style-type: none"><li>▪ 0925/A or later when local copy is used for test failover and cleanup in TCE(S)+SnapShot(P)</li><li>▪ 0916/A or later in the cases other than the above</li></ul>
Front interface	Fibre Channel/iSCSI
User interface	CCI (Required) ( <b>Note1</b> )
VMware-related software	ESXi: VMware ESX(i) 5.0 or later vCenter: VMware vCenter Server 5.0 or later SRM: VMware vCenter Site Recovery Manager 5.0 or later SRA: Hitachi RAID Manager Storage Replication Adapter 02.01.03 or later
Supported copy function	TureCopy, TCE, ShadowImage, and SnapShot ( <b>Note2</b> )

**Note 1:** Hitachi Storage Navigator Modular 2 can be used only for confirming pair status, etc.

**Note 2:** For ShadowImage and SnapShot, configuring them in cascade enables only test failover and cleanup.

## Configuring environment

This section describes how to configure an environment where SRM can be used. The following tasks are needed to configure an SRM environment.

**Table 8.5 Requirements Tasks**

No.	Task	Description
1	Set array	Create a volume to be copy pair and map it to ESX(i) server
2	Build ESX(i) server	Install ESX(i) in Windows Server
3	Build vCenter server	Install vCenter in Windows Server
4	Build SRM server ( <b>Note</b> )	Install SRM and SRA in Windows Server
5	Build CCI server ( <b>Note</b> )	Install SRM in Linux server. Set configuration definition file and environment variables.

**Note:** If you install SRM and CCI together in a vCenter server, you do not necessarily need to prepare CCI and CCI server separately.

### Setting array

Perform the following in the array.

- Create a volume for copy pair and map it to the ESX(i) server
- Create a volume for copy pair and map it to the ESX(i) server
- Create a volume for a placeholder datastore and map it to the ESX(i) server
- Create a command device and map it to the vCenter server (or CCI server)

### Building ESX(i) server

SRM-managed virtual machines run on an ESX(i) server.

Install ESX(i) in a physical server. For installing ESX(i), see the documents provided by VMware, Inc.

## Building v server

SRM-managed virtual machines run on an ESX(i) server.

Install ESX(i) in a physical server. For installing ESX(i), see the documents provided by VMware, Inc.

## Building vCenter server

In a vCenter server, you manage ESX(i) servers and virtual machines, and perform SRM operations.

Install vCenter in Windows Server. For installing vCenter, see the documents provided by VMware, Inc.

- Create a virtual machine to be managed by SRM.
- Create a datastore on a volume in the array mapped to an ESX(i) server.
- Create a virtual machine on the datastore created.
- Create a datastore also on a volume created for a placeholder datastore.

For details, see the documents provided by VMware, Inc

## Building SRM Server

An SRM server passes SRM operations from vCenter server to SRA.

Install SRM and SRA in Windows Server. For installing SRM, see the documents provided by VMware, Inc.

If you do not prepare an SRM server separately, install SRM and SRA in the vCenter server.

## Installing SRA

To install SRA, perform the following steps.

Install it at both the protected site and the recovery site. Download an installer of SRA at a Web page of VMware.

Verify that the following SRM-related services are running. If not, start them.

**Table 8.6 SRM-related Services**

No.	Service	Display Name	Startup Type
1	vpxd	VMware VirtualCenter Server	Automatic
2	vmware-dr	VMware vCenter Site Recovery Manager Server	Automatic
3	EventLog	Windows Event Log	Automatic

1. Click RMHTCSRA-xx.xx.x.exe.
2. Read **License Agreement**, and click **I accept the terms of the license agreement**.
3. Either accept or change the default installation path. The default location is C:\Program Files\VMware\VMware vCenter Site Recover Manger. Click **Next**.
4. Click **Install** and proceed through the wizard.
5. Click **Finish**.

SRA installation is now complete.

## Updating SRA

To update SRA, perform the following steps. It needs to be performed at both the protected site and the recovery site.

1. Delete Hitachi Storage Replication Adapter by using Add or Remove Programs in Control Panel.
2. Install SRA according to [Installing SRA](#) on page [8-22](#).
3. Start the SRM-related services according to [Table 8.6](#).

## Uninstalling SRA

To uninstall SRA, perform the following steps.

1. Delete Hitachi Storage Replication Adapter by using Add or Remove Programs in Control Panel.
2. Start the SRM-related services according to [Table 6.6](#).

## Building CCI Server

A CCI server instructs pair operations to copy pairs in an array according to the instructions issued by SRA in an SRM server.

Install CCI in Linux, HP-UX, AIX, or Solaris. Transfer the rmsra20 command to a CCI server. The rmsra20 command passes instructions from SRA in SRM server to CCI server via telnet.

If you do not prepare a CCI server separately, install CCI in a vCenter server or an SRM server.

## Installing CCI

Install CCI according to [CCI system requirements](#) on page [1-2](#).

## Transferring rmsra20 Command

If you prepare a CCI server separately, transfer the rmsra20 command in an SRM server to a CCI server. The following table shows the directories for each OS in a CCI server from which the rmsra20 command is transferred and the destination directory.

**Table 8.7 rmsra20 Command Location**

OS	From (Note)	To
Linux	DIR\rmsra20.linux	/HORCM/usr/bin/rmsra20
Solaris	DIR\rmsra20.solaris	
xSolaris	DIR\rmsra20.xsolaris	
HP-UX	DIR\rmsra20.hp	
AIX	DIR\rmsra20.aix	

**Note:** DIR in the From column corresponds to "C:\Program Files (x86)\VMware\VMware vCenter Site Recovery Manager\storage\sra\RMHTC", in which SRA is installed.

## Creating HORCM configuration definition file

In SRM, pair operations are passed from SRA to copy pairs via HORCM. You need to create a configuration definition file for HORCM.

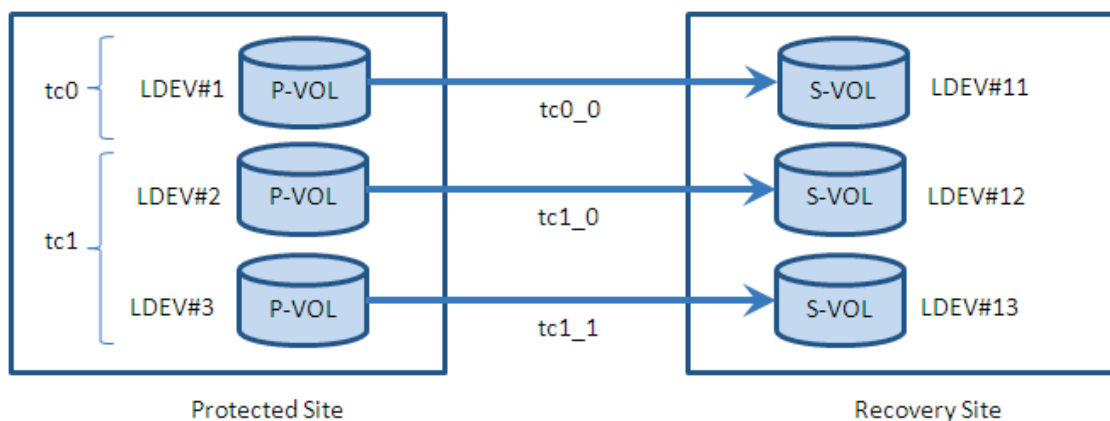
**Note 1:** If you perform test failover to a local copy pair, set an instance number based on the following rule. Ensure that the instance number of S-VOL of a local copy pair is X+1 where the instance number of P-VOL of the local copy pair is X (configuration definition file name is horcmX.conf). For an example, see [Figure 8.15](#).

**Note 2:** Do not set MU# to a remote copy pair.

**Note 3:** If you do not specify MU# to a local copy pair, MU# is set to 0 by default.

The following are examples of configuration definition files for remote copy pairs and local copy pairs used by SRM (Windows Server is used here).

## When only remote copy pairs are used



**Figure 8.15 Example of Configuration Definition File for Remote Copy Only Configuration**

Protected Site – P-VOL of Remote Copy Pair

Example for Configuration Definition File name: horcm0.conf

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.233 5020 1000 3000

HORCM_CMD
##.CMD-93000018-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
tc0 tc0_0 93000018 1
tc1 tc1_0 93000018 2
tc1 tc1_1 93000018 3

HORCM_INST
#dev_group ip_address service
tc0 123.1.1.234 5021
tc1 123.1.1.234 5021
```

Recovery Site – S-VOL of Remote Copy Pair

Example for Configuration Definition File name: horcm1.conf

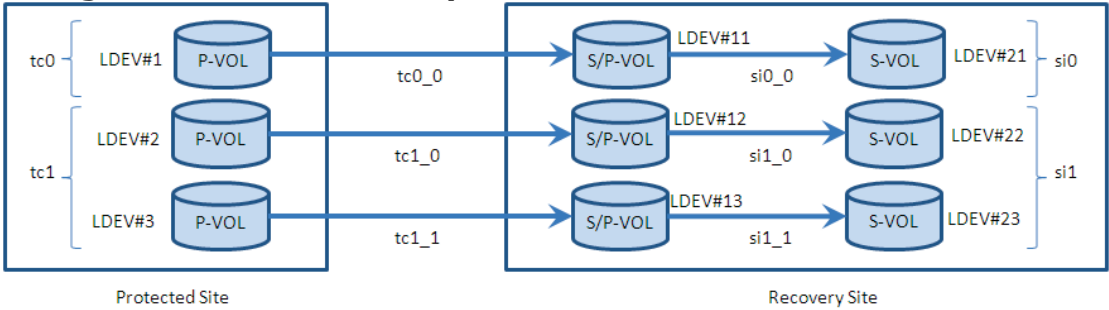
```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.234 5021 1000 3000

HORCM_CMD
##.CMD-91200017-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
tc0 tc0_0 91200017 11
tc1 tc1_0 91200017 12
tc1 tc1_1 91200017 13

HORCM_INST
#dev_group ip_address service
tc0 123.1.1.233 5020
tc1 123.1.1.233 5020
```

**When remote copy pairs and local copy pairs are in the cascade configuration at the recovery site**



**Figure 8.16 Example of Configuration Definition File for Remote Copy Pair and Local Copy Pair Cascade Configuration**

Protected Site – P-VOL of Remote Copy Pair  
Example for Configuration Definition File name: horcm0.conf

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.233 5020 1000 3000

HORCM_CMD
%%.CMD-93000018-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
tc0 tc0_0 93000018 1
tc1 tc1_0 93000018 2
tc1 tc1_1 93000018 3

HORCM_INST
#dev_group ip_address service
tc0 123.1.1.234 5021
tc1 123.1.1.234 5021
```

Recovery Site – S-VOL of Remote Copy Pair and P-VOL of Local Copy Pair  
Example for Configuration Definition File name: horcm1.conf

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.234 5021 1000 3000

HORCM_CMD
%%.CMD-91200017-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
tc0 tc0_0 91200017 11
tc1 tc1_0 91200017 12
tc1 tc1_1 91200017 13

si0 si0_0 91200017 11 0
si1 si1_0 91200017 12 0
si1 si1_1 91200017 13 0

HORCM_INST
#dev_group ip_address service
tc0 123.1.1.233 5020
tc1 123.1.1.233 5020

si0 123.1.1.234 5022
si1 123.1.1.234 5022
```

Recovery Site – S-VOL of Local Copy Pair  
Example for Configuration Definition File name: horcm2.conf

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.234 5022 1000 3000

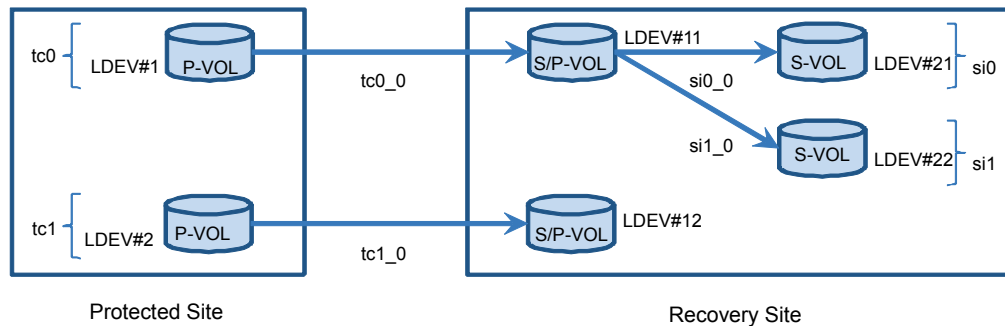
HORCM_CMD
%%.CMD-91200017-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
si0 si0_0 91200017 21
si1 si1_0 91200017 22
si1 si1_1 91200017 23

HORCM_INST
#dev_group ip_address service
si0 123.1.1.234 5021
si1 123.1.1.234 5021
```

## When copy pairs for other purposes than the SRM are used with a single instance

You can put copy pairs for both SRM operations and other types of operations in a single configuration definition file. For example, if you have a local copy pair with multiple S-VOLs and use some of them for other purposes than test failover such as for local backup purposes, you can put all the S-VOLs in a single configuration definition file. For this, you have to set the MU# of the S-VOL used for test failover to the environment variable "RMSRATMU".



tc0\_0: Remote copy pair for SRM

tc1\_0: Remote copy pair for other purposes than SRM

si0\_0: Local copy pair for SRM (test failover)

si1\_0: Local copy pair for other purposes than SRM

**Figure 8.17 Example of Configuration Definition File Including Copy Pairs used for Other Purposes than SRM**

**Protected Site ? P-VOL of Remote Copy Pair**  
**Example for Configuration Definition File name: horcm0.conf**

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.233 5020 1000 3000

HORCM_CMD
**.*CMD-93000018-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
tc0 tc0_0 93000018 1
tc1 tc1_0 93000018 2

HORCM_INST
#dev_group ip_address service
tc0 123.1.1.234 5021
tc1 123.1.1.234 5021
```

**Recovery Site -- S-VOL of Remote Copy pair and P-VOL of Local Copy Pair**  
**Example for Configuration Definition File name: horcm1.conf**

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.234 5021 1000 3000

HORCM_CMD
**.*CMD-91200017-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
tc0 tc0_0 91200017 11
tc1 tc1_0 91200017 12

si0 si0_0 91200017 11 0
si1 si1_0 91200017 11 1

HORCM_INST
#dev_group ip_address service
tc0 123.1.1.233 5020
tc1 123.1.1.233 5020

si0 123.1.1.234 5022
si1 123.1.1.234 5022
```

**Recovery Site ? S-VOL of Local Copy Pair**  
**Example for Configuration Definition File name: horcm2.conf**

```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
123.1.1.234 5022 1000 3000

HORCM_CMD
**.*CMD-91200017-0

HORCM_LDEV
#dev_group dev_name Serial# LDEV# MU#
si0 si0_0 91200017 21
si1 si1_0 91200017 22

HORCM_INST
#dev_group ip_address service
si0 123.1.1.234 5021
si1 123.1.1.234 5021
```

## Starting HORCM

Start HORCM used in SRM.

If CCI is installed in Windows Server, HORCM can be automatically started as a service at Windows Server startup.

## Creating copy pair

You need to create a copy pair where a virtual machine is stored before performing SRM operations.

Use CCI to create a remote copy pair and verify that the pair status is PAIR.

If you use a local copy pair for test failover, create a local copy pair and make the cascade configuration with a remote copy pair. Verify that the status of the local copy pair is PAIR.

## Setting environment variables

You can select remote copy or local copy as the target of test failover by changing environment variables in Windows on the server where CCI is installed.

Available environment variables are as follows.

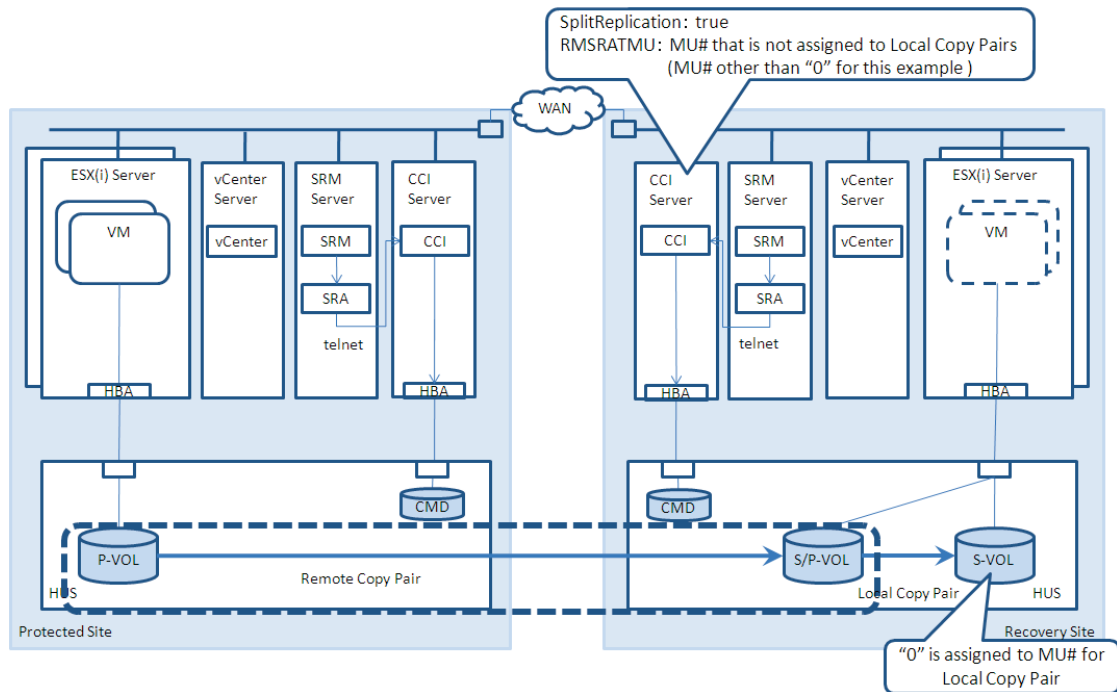
**Table 8.8 Environment Variables**

No.	Environment Variable	Description
1	SplitReplication	"true" specifies that remote copy pair is test failover target. "false" specifies that local copy pair is test failover target.
2	RMSRATMU	Specifies MU# of S-VOL of local copy pair. S-VOL of local copy pair that has the specified MU# becomes test failover target. If you specify remote copy as test failover target, specify MU# that is not used in local copy pairs.
3	HORCMROOT	Specifies the directory where CCI is installed. This environment variable needs to be set both at protected site and recovery site.
4	RMSRATOV	Specifies timeout period of failover. Default value is 60 seconds.

The following are examples of settings of SplitReplication and RMSRATMU when the target of test failover is a remote copy and a local copy.

## When a remote copy becomes the test failover target

**Figure 8.18 When a Remote Copy Becomes the Test Failover Target**

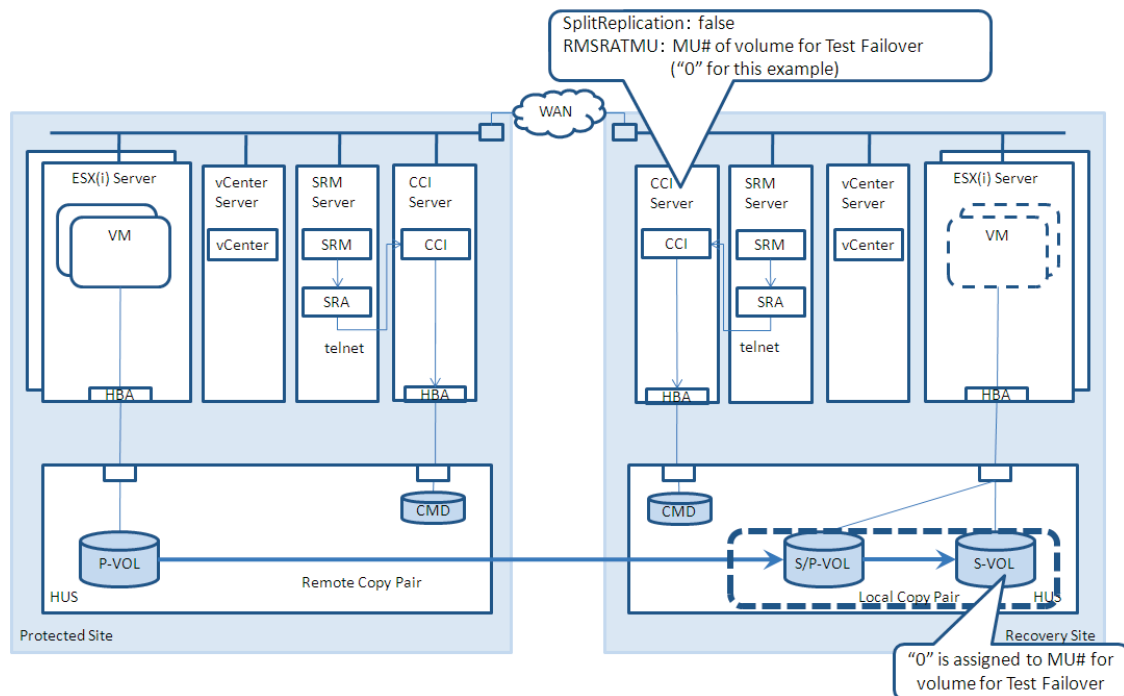


**Table 8.9 Environment Variables when a Remote Copy Becomes the Test Failover Target**

No.	Environment Variable	Value
1	SplitReplication	true
2	RMSRATMU	MU# that is not used (other than "0" in this example)

## When a local copy becomes the test failover target

**Figure 8.19 When a Local Copy Becomes the Test Failover Target**



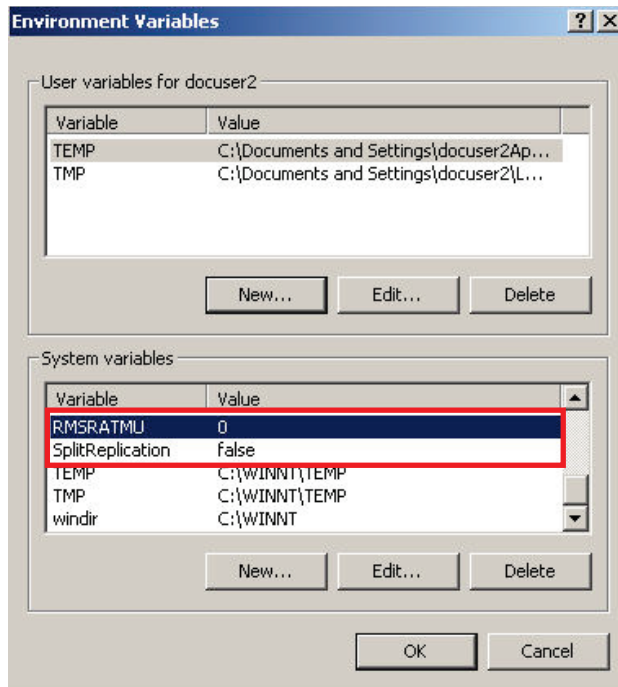
**Table 8.10 Environment Variables when Local Copy Becomes Test Failover Target**

No.	Environment Variable	Value
1	SplitReplication	false
2	RMSRATMU	MU# of S-VOL of the test failover target ("0" in this example)

### To set environment variables when CCI is installed in Windows

Set them at the site where a local copy pair is in the cascade configuration with a remote copy pair.

1. Change the values in the Environment Variables dialog box in Control Panel.



2. After changing the values, restart the server.

**To set environment variables when CCI is installed in the systems other than Windows (when you prepare a CCI server separately)**

**Note:** Do not set the RMSRATMU environment variable in Windows. If you do this, the environment variable in the CCI server is disabled.

1. Set the environment variables in CLI.

```
Export RMSRATMU=0
Export SplitReplication=true
```

2. After setting these, restart the server.

## Setting SRM

To set SRM, perform the following steps.

**Table 8.11 SRM Setting Tasks**

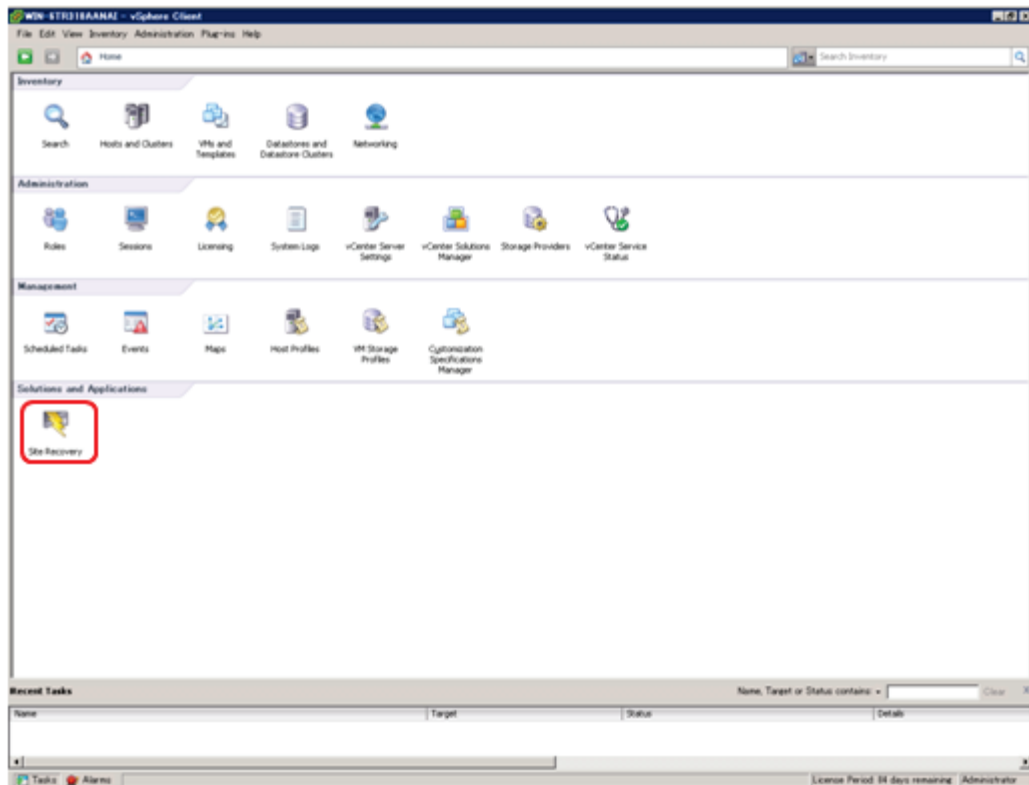
No.	Task	Description
1	Connect protected site and recovery site	Authenticate and connect SRM-managed protected site and recovery site each other. See the documents provided by VMware, Inc.
2	Set array manager	Use the array manager to associate SRM with SRA.
3	Set inventory mapping	Set the mapping of resources between protected site and recovery site, virtual machine folders, and network. See the documents provided by VMware, Inc.
4	Set place holder datastore	Specify datastore where configuration information of protection target virtual machine is stored. See the documents provided by VMware, Inc.
5	Create protection group	Create virtual machine group where SRM operations are performed simultaneously. See the documents provided by VMware, Inc.
6	Create recovery plan	Specify which recovery step is performed when SRM operations are instructed. See the documents provided by VMware, Inc.

## Configuring protected and recovery site array managers

Configure an array manager to associate SRM with SRA. By doing this, copy pairs operated by SRM are recognized. To configure an array manager, perform the following steps. You can do it at the protected site or the recovery site, and the settings are automatically transferred to its counterpart.

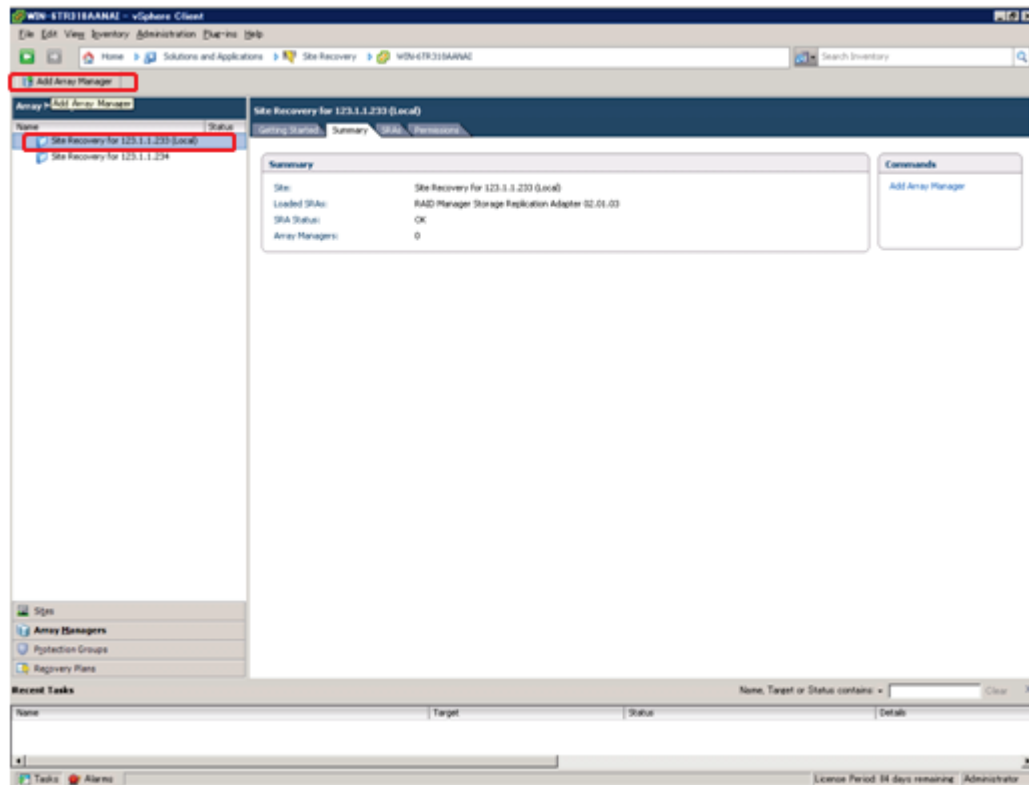
1. Log in to SRM.

Use a vSphere Client to log in to vCenter server at the protected site or the recovery site. On the Home page, click Site Recovery, and enter the user name and password to log in to SRM.



## 2. Adding array manager

Click Array Managers to move to the setting page of array manager.  
Select a protected site displayed, and click Add Array Manager in the upper corner of the screen.

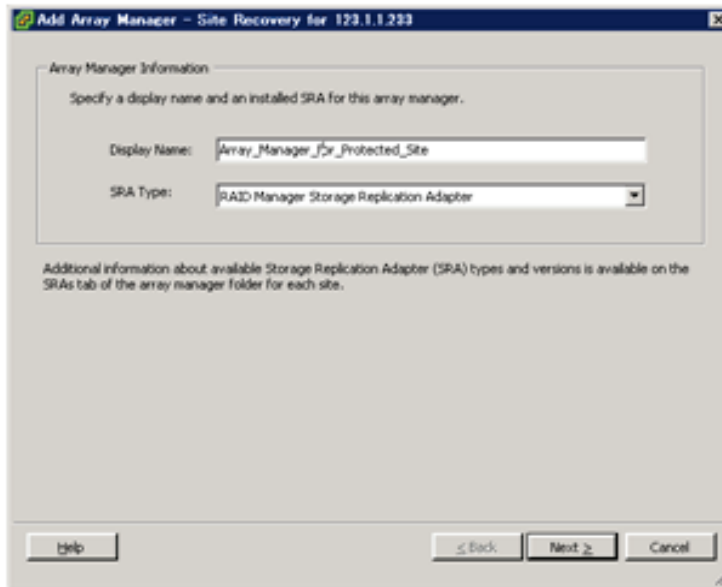


### 3. Setting array manger information

Enter the following array manager information, and click Next.

**Display Name:** Enter the display name of an array manager to be added.

**SRA Type:** Select an SRA in the list. If an SRA has already been installed, select RAID Manager Storage Replication Adapter, which will appear in the list.



#### 4. Setting SRA connection information

Set the following information on HORCM, which is connected by SRA.

**HORCMINST and AP Address of HORCM (CCI) Server:** Enter the instance number of HORCM, which is connected by SRA. You may need to enter additional information as follows, depending on the conditions where CCI is installed in the vCenter server or the CCI server is connected to the vCenter server via Telnet.

##### **When CCI is installed in the vCenter server:**

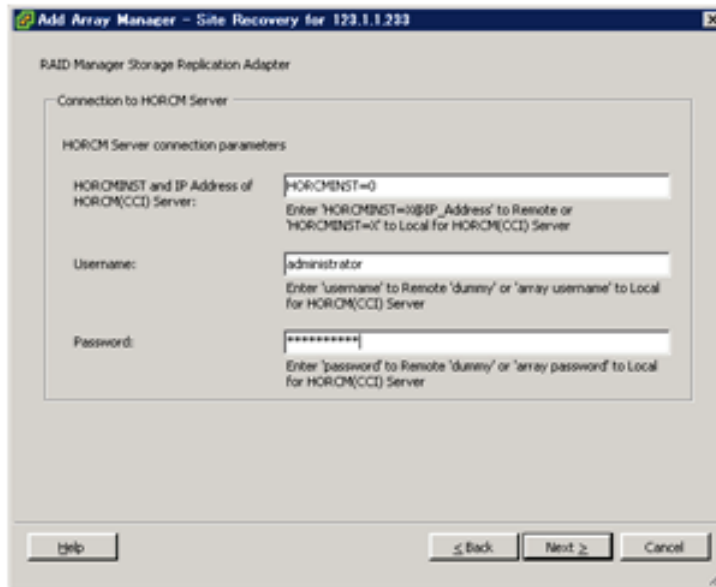
HORCMINST=<instance number>

##### **When the CCI server is connected to the vCenter server via Telnet:**

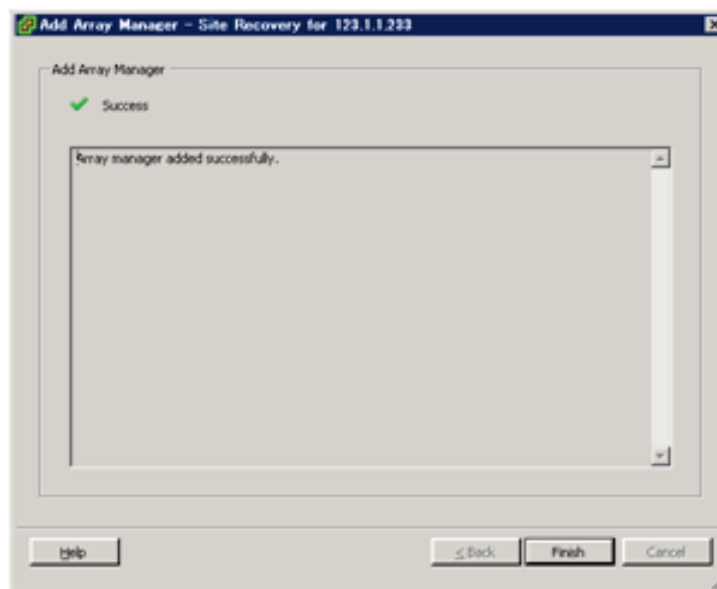
HORCMINST=<instance number>@<IP Address of the HORCM (CCI) Server>

**Username:** Enter the username for logging in to the server where CCI is installed.

**Password:** Enter the password for logging in to the server where CCI is installed.

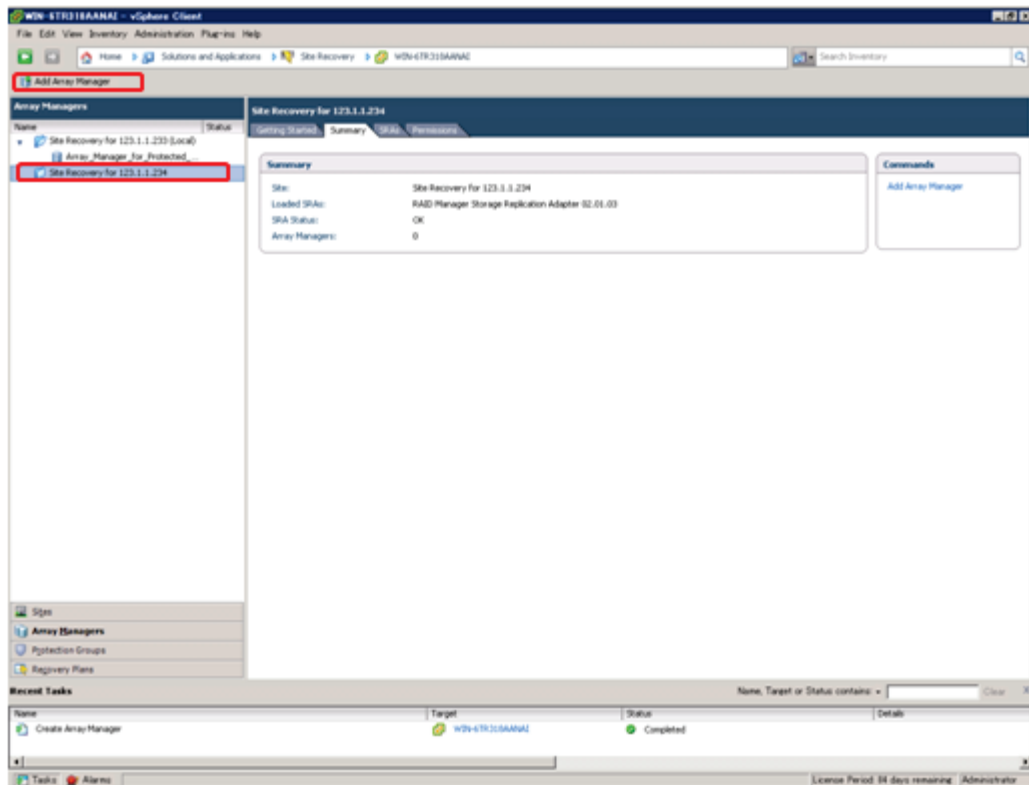


5. Confirming addition of an array manager
6. Verify that an array manager is added successfully, and then click **Finish**.



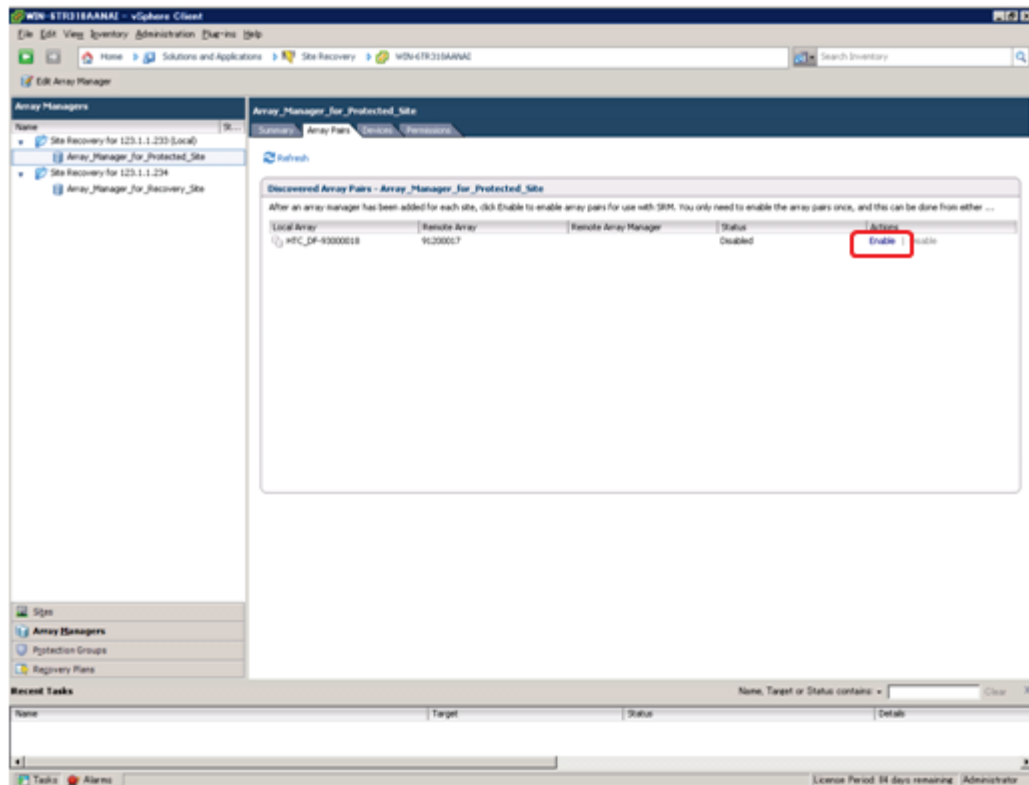
7. Adding an array manager at the other site

Add an array manager at the site other than the one where you added an array manager. Repeat step 2 through step 6. In the corresponding step 6, select the other site, and then click Add Array Manager.



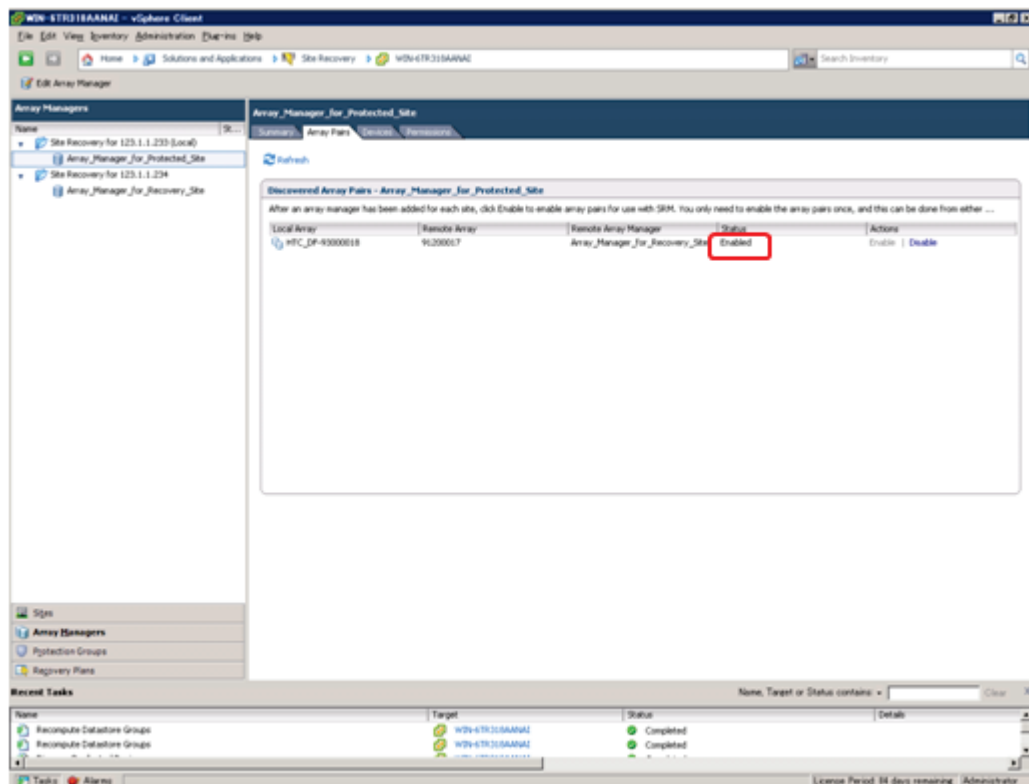
## 8. Enabling a copy pair

After adding array managers in both sites, SRM detects copy pairs and displays them. The detected copy pairs are displayed in the Array Pairs tab. Click Enable.



## 9. Confirming copy pair status

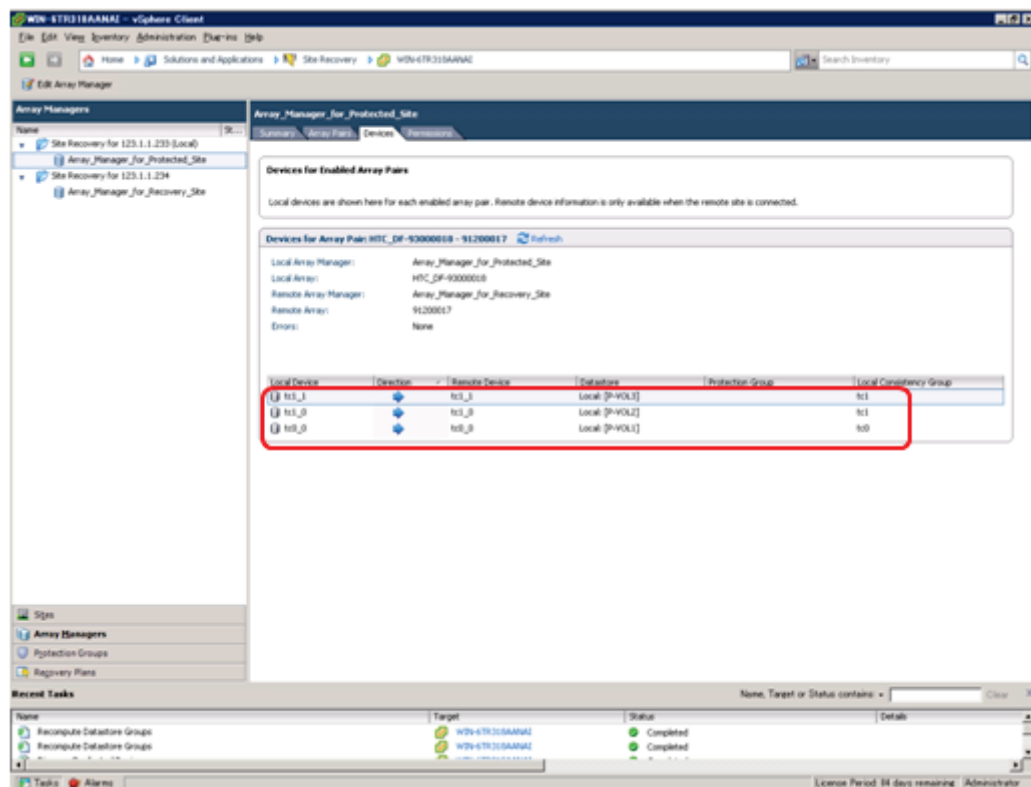
Verify that the status of a detected copy pair is "Enabled".



## 10. Confirming devices of a copy pair

After a copy pair is enabled, devices of the copy pair are displayed in the Devices tab. Verify that:

- Local device and remote device have dev\_name that is specified in a configuration definition file.
- Correct copy direction is set to each copy pair.
- Each datastore is at the local site.

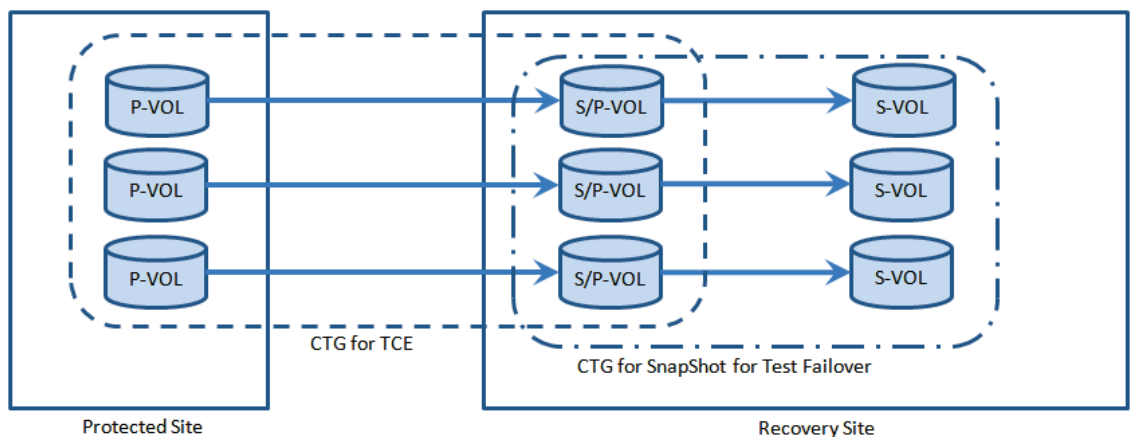


The setting of array managers is now complete.

## Considerations

The following are other considerations.

- If you change the contents of a configuration definition file, you need to delete the settings in the array manager. For this reason, you need to delete the recovery plan and the protection group, and recreate them.
- When creating a protection group, you specify a data store group that includes data stores you add into the protection group. All data stores created on the copy pairs in a single CTG go into a single data store group.
- To use SnapShot pairs cascading with TCE pairs for the test failover operation, you have to make both TCE pairs and SnapShot pairs belong to CTGs. When you cascade TCE pairs in a CTG with SnapShot pairs for the test failover operation, you have to make all those SnapShot pairs belong to a single CTG. Otherwise, the test failover operation will fail.



## Troubleshooting

See the Troubleshooting section in *Hitachi Storage Replication Adapter 2.0 for VMware vCenter Site Recovery Manager 5.0/5.1 Deployment Guide*, MK-09RM6745, for how to handle issues you may face with using SRM with the array.



## Differences between groups

- ☐ [About groups](#)
- ☐ [Consistency groups](#)

## About groups

Multiple pairs are managed as a group. A configuration file of CCI defines a group as a set of pairs. Disk array also manages and operates a set of pairs as a consistency group. The differences between two types of groups are explained by using [Figure 9-1](#).

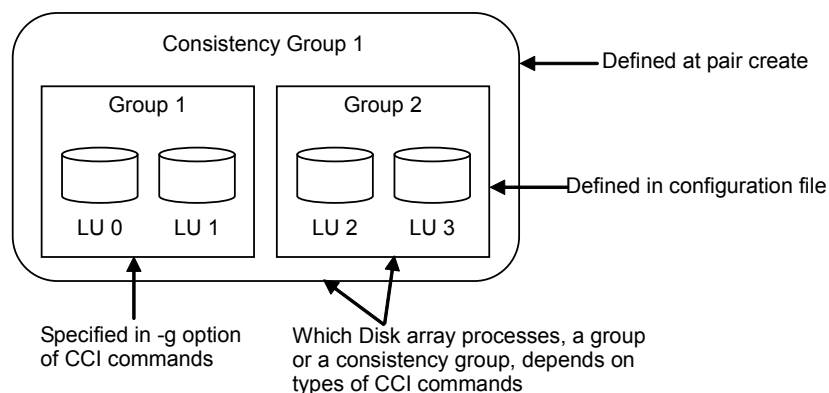
A group described in a configuration file (a group in short) can have one or more pairs. A group specified by -g option of CCI commands indicates a group defined in a configuration file. By using a group, an operation to multiple pairs is done at a time.

A CTG is a group managed by disk array and a CTG can have one or more pairs. If data consistency across multiple pairs is required, such pairs must be operated as a consistency group by disk array. A group cannot belong to multiple CTGs. Pairs in a group cannot belong to multiple CTGs.

While two or more groups can belong to one CTG, it is strongly recommended to give each group a different CTG.

CTG number cannot be specified in CCI commands except for **paircreate** command. Only a group can be specified in the CCI commands. Operations like **pairsplit** require operating pairs in a CTG at a time so CCI and disk array interpret an operation request for a group as a request for a CTG to which the specified group belongs.

## Consistency groups



**Figure 9-1 Group and consistency groups**

[Table 9-1](#) shows which disk array processes, a group or a consistency group, when -g option is specified in each major CCI command.

For example, a **pairdisplay** command displays pair statuses of a specified group. In a case of [Figure 9-1](#), specifying the group 1 in a **pairdisplay** command shows only information about the group 1.

On the other hand, a **pairsplit** command splits all pairs in all groups belonging to a CTG to which a specified group belongs. In a case of [Figure 9-1](#), specifying the group 1 in a **pairsplit** command splits not only the group 1 but also the group 2.

If multiple groups belong to a CTG, operating only the specific group within the CTG is impossible. In a case of [Figure 9-1](#) example, splitting only the group 1 but keeping the group 2 be PAIR is impossible. When splitting the specific group, it is required to split all pairs in the group one by one.



**Note:** Splitting each pair does not guarantee data consistency across the split pairs. Only one pair per a CTG is processed at a time.

**Table 9-1 The CCI -g option and target**

Command Name or Status	ShadowImage	Snapshot	TrueCopy	TCE
<b>pairvolchk</b>	Group	Group	Group	Group
<b>paircurchk</b>	-	-	Group	Group
<b>pairdisplay</b>	Group	Group	Group	Group
<b>pairevtwait</b>	Group	Group	Group	Group
<b>pairsyncwait</b>	-	-	-	CTG

<b>paircreate</b>	Group	Group	Group	Group
<b>pairsplit</b>	CTG	CTG	Group	CTG
<b>pairresync</b>	Group	Group	Group	CTG
<b>horctakeover</b>	-	-	Group	CTG
<b>PSUE (Failure Occurred)</b>	Pair	Pair	Pair	CTG
<b>PFUS (Pool Empty)</b>	-	CTL	-	CTG&CTL
<p>CTG: All pairs in a CTG</p> <p>Group: All pairs in a group</p> <p>Pair: Only the specified pair</p> <p>CTL: All pairs that are using a pool owned by a failed controller</p> <p>CTG&amp;CTL: All pairs that are using a pool owned by a failed controller and all pairs that belong to CTGs to which the former pairs belong</p>				

## Performing CCI operations

This chapter includes the following:

- ❑ [Important CCI notice](#)
- ❑ [About CCI environment variables](#)
- ❑ [Splitting pairs](#)
- ❑ [Resynchronizing pairs](#)
- ❑ [Confirming pairs](#)
- ❑ [Monitoring pairs](#)
- ❑ [Checking pair attribute and status](#)
- ❑ [Displaying pair status](#)
- ❑ [Checking TrueCopy/TCE pair currency](#)
- ❑ [Performing TrueCopy/TCE takeover](#)
- ❑ [Displaying configuration information](#)
- ❑ [Protecting volume data](#)
- ❑ [Controlling CCI activity](#)
- ❑ [About Windows Server subcommands](#)
- ❑ [CCI command tools](#)
- ❑ [Controlling host groups](#)
- ❑ [Migrating volumes](#)
- ❑ [About the synchronous waiting command for TCE](#)
- ❑ [Using the raidcom command](#)

## Important CCI notice

Note the following when performing CCI operations:

- Remember to change the default value for the poll(10ms) parameter in the configuration definition file.
- When an internal process conflict occurs between the CCI and the disk array, the processing of the disk array is temporarily suspended. If the conflict continues, internal processing may not proceed. Therefore, when monitoring (polling) the status of the disk array (by creating a script using the CCI commands) set the display-information-based commands (e.g. **pairdisplay**, **raidscan**, **raidar**, and **raidqry**) to be issued more than or equal to a minute.
- Commands that change the status of pairs (**paircreate**, **pairsplit**, **pairresync**) cannot be performed while changing the firmware online.
- Do not change the firmware online while executing commands that change the status of pairs (**paircreate**, **pairsplit**, **pairresync**). The execution time for the copying process varies; changing the firmware online suspends the copying operation temporarily.

The processing time for changing the firmware online is 4 min./CTL (the copying process will be suspended for 4 minutes per CTL). The waiting process in the batch file may end abnormally when executing a copy (using a batch file) by designating a specific time.

- Commands that change the status of pairs (**paircreate**, **pairsplit**, **pairresync**) of TrueCopy/TCE cannot be performed while the host re-starting in TrueCopy/TCE environment. The command may end abnormally when executing a command while the host re-starting.
- It is essential that both P-VOL and V-VOL should be defined in advance from Hitachi Storage Navigator Modular 2. Also, the secondary volume (S-VOL) used and assigned by the CCI is the same as the SnapShot image created by Hitachi Storage Navigator Modular 2.
- In the case of Windows, do not use the **diskpart** command for a mounting and unmounting of a volume.
- When use host I/O and CCI simultaneously, the completion of CCI commands may be late by the performance and load of the host.
- All command options displayed in help do not perform.

The options that can perform are limited to the options described in this manual.

- The host machines must run on the operating system (OS) of the same architecture and the same CCI version because the host machine may be incapable of recognizing the paired volume of another host. However, it is possible to prepare only one server at a secondary site by supporting CCI communications (32-bit, 64-bit (Tru64)) among different OSs (HP-UX, Solaris, AIX, Linux, and Windows).

## About CCI environment variables

When activating HORCM or initiating a command, users can specify any of the environment variables shown in [Table 10-1](#).

**Table 10-1 Environment Variables**

Variable	Functions
HORCM (/etc/horcmgr) environment variables	<p><b>\$HORCM_CONF</b>: Names the HORCM configuration file, default = /etc/horcm.conf.</p> <p><b>\$HORCM_LOG</b>: Names the HORCM log directory, default = /HORCM/log/curlog.</p> <p><b>\$HORCM_TRCSZ</b>: Specifies the size of the HORCM trace file in kB, default = 1 MB. The trace file size cannot be changed using the <b>horcctl</b> command.</p> <p><b>\$HORCM_TRCLVL</b>: Specifies the HORCM trace level (0 - 15), default = 4. If a negative value is specified, trace mode is canceled. The trace level can be changed using the <b>horcctl -c -l</b> command.</p> <p><b>\$HORCM_TRCBUF</b>: Specifies the HORCM trace mode. If this variable is specified, data is written in the trace file in the non-buffer mode. If not, data is written in the buffer mode. The trace mode can be changed using the <b>horcctl -c -b</b> command.</p> <p><b>\$HORCM_TRCENV</b>: Specifies whether or not to succeed the trace control parameters (TRCLVL and TRCBUF) as they are when a command is issued. When this variable is specified, the HORCM default trace control parameters are used to the trace control parameters of HORCM as global parameters. If not, the default trace control parameters for HORCM commands are used and tracing level = 4, trace mode = buffer mode.</p> <p><b>\$HORCMFCTBL</b>: Changes the fibre address conversion table number, used when the target ID indicated by the raidscan command is different than the TID on the system.</p> <p><b>\$HORCMPROMOD</b>: Sets HORCM forcibly to protection mode. Command devices in non-protection mode can be used as protection mode also.</p> <p><b>\$HORCMPERM</b>: Specifies the file name for the protected volumes. When this variable is not specified, the default name is as follows (* as an instance number): For UNIX systems: /etc/horcmperm.conf or /etc/horcmperm*.conf For Windows Server systems: \WINDOWS\horcmperm.conf or \WINNT\horcmperm*.conf When the variable is set HORCMPERM = MGFNOINST, the built-in command will not be performed. Set this variable when you want to issue any command from the user shell script.</p>
CCI command environment variables	<p><b>\$HORCC_LOG</b>: Specifies the command log directory name, default = /HORCM/log* (* = instance number). When a magic character STDERROUT is set for this variable, the log output changes to standard error output. Use this character when you want to issue commands from the script file knowing that the error would occur, in order to inhibit log output.</p> <p><b>\$HORCC_TRCSZ</b>: Specifies the size of the command trace file in kB, default = HORCM trace file size. The default HORCM trace file size can be changed using <b>horcctl -d -s</b>.</p> <p><b>\$HORCC_TRCLVL</b>: Specifies the command trace level (0 = 15), default = 4 or the specified HORCM trace level. If a negative value is specified, trace mode is canceled. The default trace level for HORCM commands can be changed using the <b>horcctl -d -l</b>.</p> <p><b>\$HORCC_TRCBUF</b>: Specifies the command trace mode. If specified, data is written in the trace file in the non-buffer mode. If not, the HORCM trace mode is used. The default trace mode for HORCM commands can be changed using the <b>horcctl -d -b</b>.</p> <p><b>\$HORCC_LOGSZ</b>: This variable is used to specify a maximum size (in units of kB) and normal logging for the current command. "/HORCM/log*/horcc_HOST.log" file is moved to "/HORCM/log*/horcc_HOST.oldlog" file when reaching in the specified maximum size. If this variable is not specified or specified as '0', it is same as the current logging for only command error.</p>
CCI instance environment variable	<p><b>\$HORCMINST</b>: Specifies the instance number when using two or more CCI instances on the same host. The command execution environment and the HORCM activation environment require an instance number to be specified. Set the configuration definition file (HORCM_CONF) and log directories (HORCM_LOG and HORCC_LOG) for each instance.</p>

Variable	Functions
ShadowImage/ SnapShot command environment variables	<p><b>\$HORCC_MRCF:</b> Sets the command execution environment of the ShadowImage/SnapShot commands. The selection whether the command functions as that of the TrueCopy/TCE or the ShadowImage/SnapShot is made according to this variable. The HORCM is not affected by this variable. When issuing a TrueCopy/TCE command, do not set the HORCC_MRCF variable for the execution environment of the command. When issuing a ShadowImage/SnapShot command, set the environmental variable HORCC_MRCF=1 for the execution environment of the command.</p> <p>Besides, when returning the command execution environment of ShadowImage/SnapShot to that of TrueCopy/TCE, set HORCC_MRCF=.</p> <p>The following environment variables can be set of ShadowImage pair operation.</p> <p><b>\$HORCC_SPLT:</b></p> <p>NORMAL: The <b>pairsplit</b> and <b>paircreate -split</b> will be performed as Non quick mode.</p> <p>QUICK: The <b>pairsplit</b> and <b>paircreate -split</b> will be performed as Quick Split.</p> <p><b>\$ HORCC_RSYN:</b></p> <p>NORMAL: The <b>pairresync</b> will be performed as Non quick mode.</p> <p>QUICK: The <b>pairresync</b> will be performed as Quick Resync.</p>

## Specifying CCI options

Normally, the CCI command performs it using a number set for the environmental variable of **\$HORCMINST** as an instance number. The command operates in the TrueCopy/TCE execution environment when the environmental variable of **\$HORCC\_MRCF** is not set or in the ShadowImage/SnapShot/Data Retention execution environment when the valuable is set as 1. When the option for specifying the instance number is used, the instance number can be specified irrespective of the environmental variable of **\$HORCMINST** only in the command execution in which the option is used. Besides, when the option for specifying the execution environment is used, the execution environment can be changed irrespective of the environmental variable of **\$HORCC\_MRCF** only in the command execution in which the option is used.

- A way to specify options

**-I[instance#]**

This option specifies the instance number.

Example:

Issue the **pairedisplay** command setting the instance number as 5.

```
# pairedisplay -g<group> -I5 ...
```

Issue the **pairedisplay** command setting the instance number as no instance number.

```
# pairedisplay -g<group> -I ...
```

**-IH[instance#] or -ITC[instance#]**

This option selects the TrueCopy/TCE execution environment and specifies the instance number.

Example:

Issue the **pairedisplay** command in the TrueCopy/TCE execution environment setting the instance number as no instance number.

```
# pairedisplay -g<group> -IH ...
```

Issue the **pairedisplay** command in the TrueCopy/TCE execution environment setting the instance number as 5.

```
# pairedisplay -g<group> -IH5 ...
```

### **-IM[instance#] or -ISI[instance#]**

This option selects the ShadowImage/SnapShot/Data Retention execution environment and specifies the instance number.

Example:

Issue the **pairedisplay** command in the ShadowImage/SnapShot/Data Retention execution environment setting the instance number as no instance number.

```
# pairedisplay -g<group> -IM ...
```

Issue the **pairedisplay** command in the ShadowImage/SnapShot/Data Retention execution environment setting the instance number as 5.

```
# pairedisplay -g<group> -IM5 ...
```



**Note:** In the interactive mode (specified with the **-z** or **-zx** option), a change of the instance number is rejected because the instance number has been fixed.

- Relationship between environment variables and options

When neither the instance number nor the option for specifying the command execution environment is used, the instance number and the command execution environment depend on the setting of **\$HORCMINST** and **\$HORCC\_MRCF**. The relation between the instance number and the command execution environment is as shown below.

**Table 10-2 The instance for the connection**

<b>-I[instance#] Option</b>	<b>\$HORCMINST</b>	<b>Instance</b>
<b>-I</b>	Don't care	No instance number
<b>-IX</b>		Instance number=X
Not specified	HORCMINST=X	Instance number=X
	Not specified	No instance number
<b>X:</b> Instance number		

**Table 10-3 Command environment variables**

<b>-IH, -IM or -ITC, -ISI Option</b>	<b>\$HORCMINST</b>	<b>Command Environment</b>
<b>-IH or -ITC</b>	Don't care	TrueCopy/TCE
<b>-IM or -ISI</b>		ShadowImage/SnapShot/Data Retention
Not specified	HORCC_MRCF=1	ShadowImage/SnapShot/Data Retention
	Not specified	TrueCopy/TCE

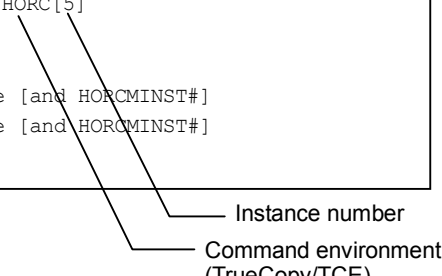
## Verifying instance numbers

- A way to verify instance number and command environment

The instance number and the command execution environment at the time of the command execution are displayed as shown below.

Example:

```
C:\HORCM\etc>pairstdisplay -h
Model : RAID-Manager/WindowsNT
Ver&Rev: 01-25-03/05
Usage : pairstdisplay [options] for HORC[5]
-h      Help/Usage
-I[#]   Set to HORCMINST#
-IH[#] or -ITC[#] Set to HORC mode [and HORCMINST#]
-IM[#] or -ISI[#] Set to MRCF mode [and HORCMINST#]
:
```

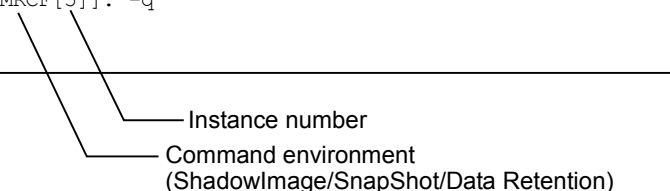


Instance number

Command environment  
(TrueCopy/TCE)

Example with interactive mode:

```
C:\HORCM\etc>pairstdisplay -z
pairstdisplay[HOMRCF[5]]: -IM
pairstdisplay[HOMRCF[5]]: -q
:
```



Instance number

Command environment  
(ShadowImage/SnapShot/Data Retention)

## Creating pairs

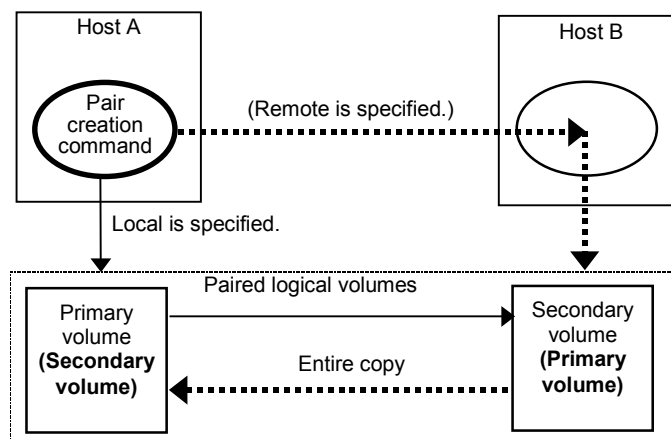


**Warning:** Use the **paircreate** command with caution. The **paircreate** command starts the initial copy operation, which overwrites all data on the secondary volume. If the primary and secondary volumes are not identified correctly, or if the wrong options are specified (for example, **-vl (-pvol)** instead of **-vr (-svol)**), data will be transferred in the wrong direction.

The **paircreate** command creates a new volume pair from two unpaired volumes. The **paircreate** command can create either a paired logical volume or a group of paired volumes.

The **paircreate** command allows you to specify the direction (local or remote) of the pair creation (see Figure 10-1). If local (**-vl (-pvol)** option) is specified, the host issuing the **paircreate** command has the primary volume. If remote (**-vr (-svol)** option) is specified, the remote host has the primary volume (ShadowImage/TrueCopy/TCE).

The **-split** option of the **paircreate** command (ShadowImage/SnapShot) allows you to simultaneously create and split pairs using a single CCI command. When **-split** is used, the pair status changes from COPY to PSUS (instead of PAIR) when the initial copy operation is complete. Table 10-4 lists and describes the **paircreate** command parameters and returned values.



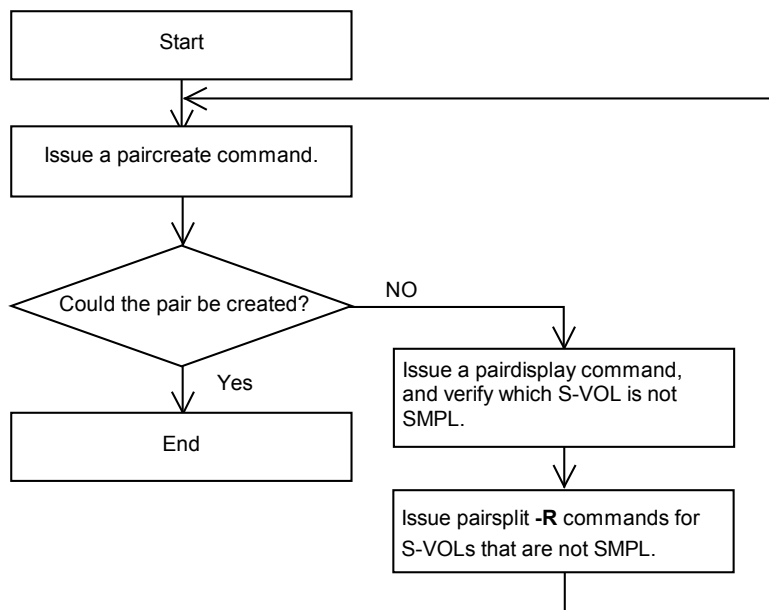
**Figure 10-1** Pair creation

Before issuing the **paircreate** command, verify that the secondary volume is not mounted on any system. If the secondary volume is mounted after paircreate, delete the pair (pairsplit -S), unmount the secondary volume, and reissue the **paircreate** command.



**Note:** The **paircreate** command terminates before the initial copy operation is complete (except when the **-nocopy** option is specified). Use the pair event waiting or **pairdisplay** to verify that the initial copy operation completed successfully (status changes from COPY to PAIR, or from COPY to PSUS if the **-split** option was specified). The execution log file also shows completion of the initial copy operation.

Figure 10-2 shows how pairs are created.



**Figure 10-2 Pair creation**

**Table 10-4 Paircreate command parameters**

Parameter	Value
Command Name	<b>paircreate</b>
Format	<b>paircreate { -h   -q   -z   -x   -xh   -I [H   M] [instance#]   -g &lt;group&gt;   -d &lt;pair Vol&gt;   -d [g] &lt;raw_device&gt; [MU#]   -d [g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#] -f &lt;fence&gt; [CTGID]   -fg &lt;fence&gt; [CTGID]   -v   -c &lt;size&gt;   -nocopy   -nomsg   -split [[Split-Marker]]   [-m &lt;mode&gt;]   -jp &lt;PID&gt; -js &lt;PID&gt;   -pid &lt;PID&gt;   -fq &lt;mode&gt;   -p [s] vol}</b>
Options	<b>-h:</b> Displays Help/Usage and version information.
	<b>-q:</b> Terminates the interactive mode and exits the command.
	<b>-z</b> or <b>-zx:</b> Makes the paircreate command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.

Parameter	Value
	<p><b>-x:</b> Specifies the sub-command of Windows.</p> <p><b>-xh:</b> Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#] or -I[TC   SI][instance#]:</b> Specifies the instance number and the command execution environment.</p> <p><b>-g &lt;group&gt;:</b> Specifies a group name defined in the configuration definition file. The command is executed for the specified group unless the -d &lt;pair Vol&gt; option is specified.</p> <p><b>-d &lt;pair Vol&gt;:</b> Specifies paired logical volume name defined in the configuration definition file. When this option is specified, the command is issued for the specified paired logical volume.</p> <p><b>-d[g] &lt;raw_device&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is performed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified raw_device is contained in two or more groups, the command is performed on the first group.</p> <p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is performed on the first group. The &lt;seq #&gt; &lt;LDEV #&gt; values can be specified in hexadecimal (by addition of "0x ") or decimal notation.</p> <p><b>-f &lt;fence&gt; [CTGID] or -fg&lt;fence&gt; [CTGID]</b> (TrueCopy/TCE only): Specifies the level for assuring the consistency of paired volume data. For TrueCopy, a fence level of "never" or "data" must be specified. For TCE, a fence level of "async" must be specified. This option is required for TrueCopy/TCE. In case of TrueCopy, use the -f option when the CTG is not used and use the -fg option when the CTG is used. For TCE, use the -f option. Be sure to use the CTG for TCE. In the -f option, when other than "async" is specified to the fence level, CTGID (CT group ID) is disregarded. If the "CTGID" option is not specified, the pair is automatically assigned to a new group. When the CTGID is not specified, the CTG is the group specified in the configuration definition file. Each pair in the same group cannot be assigned to separate CTGs in the configuration definition file. If "CTGID" is not specified and maximum CT groups already exist, an EX_ENOCTG error will be returned. The CTGID option is used to make paired volumes of specified group forcibly by given CTGID of another group.</p> <p><b>Restriction:</b> When pairs to be operated are specified with a group name in case where two or more groups of CCI are included in the same CTGID, all the pairs in the same CTGID are operated at the same time. CCI registers the group in the configuration file mapping them in the CTGID managed by the array at the time of pair creation. The number of CTGs that can be registered in the array is up to 256 (CTGID: 0 to 255) for TrueCopy or up to 64 (CTGID: 0 to 255) for TCE.</p> <p><b>Examples:</b></p> <p>When the CTG is not used in TrueCopy  # paircreate -g VG01 -vl -f never</p> <p>When the CTG is used in TrueCopy (The CTGID is assigned automatically.)  # paircreate -g VG01 -vl -fg never</p> <p>When the CTG is used in TrueCopy (The CTGID is specified expressly.)  # paircreate -g VG01 -vl -fg never 1</p> <p>When the CTGID is assigned automatically in TCE  # paircreate -g VG01 -vl -f async</p> <p>When the CTGID is specified expressly in TCE  # paircreate -g VG01 -vl -f async 1</p> <p><b>-vl (-pvol) or -vr (-svol):</b> Specifies the data flow direction and must always be specified. The <b>-vl (-pvol)</b> option specifies "local" and the host which issues the command possesses the primary volume. The <b>-vr (-svol)</b> option specifies "remote" and the remote host possesses the primary volume while the local host possesses the secondary volume.</p> <p><b>-c &lt;size&gt;:</b> You can use this option to specify the copying pace (1 - 15) to be used for the initial data copy. You can shorten the copy time by specifying a large number. (1 to 5: slow, 6 to 10: normal, 11 to 15: prior)</p>

Parameter	Value
	<p><b>-nocopy</b> (TrueCopy/TCE): Creates paired volumes without copying data in the case in which the data consistency of simplex volumes is assured by the user.</p> <p><b>-nomsg</b>: Suppresses messages to be displayed when this command is performed. It is used to perform this command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p> <p><b>-split [Split-Marker]</b> (ShadowImage/SnapShot only): Splits the paired volume after the initial copy operation is complete. Besides, an optional character string (with ASCII 31 characters), which is specified by a user, can be added to the V-VOL as a <b>&lt;Split-Marker&gt;</b>.</p> <p><b>-m &lt;mode&gt;</b> (ShadowImage only): For mode, you can specify the following option:  <b>noread</b>: Specifies the noread mode for hiding the secondary volume. The secondary volume becomes read-disabled when this mode option is specified. The secondary volume is read-enabled when this mode option is omitted. <b>Note</b>: The primary volume becomes read-disabled only during a reverse resync operation (<b>restore</b> option of pairresync command).  <b>mode=grp [CTGID]</b> (SnapShot/ShadowImage only) Makes a group for splitting all SnapShot/ShadowImage pairs specified in a group. SnapShot/ShadowImage guarantees data consistency among multiple VOLs in a group at a single point in time when doing a split using the <b>pairsplit -g &lt;group&gt;</b> command (except <b>-S</b> or <b>-E</b> option).  A CTGID is assigned automatically if you do not specify the <b>CTGID</b> option in this command. If CTGID is not specified and maximum CT groups already exists, an EX_ENOCTG error will be returned. Therefore, the CTGID option can forcibly assign a volume group to an existing CTGID.  <b>Note</b>: This option cannot be specified with <b>-split</b> option in the same command. A plurality of pairs can be created to one P-VOL. But, the number of pair that can be set in one group is one pair per one P-VOL.  <b>mode=cc</b> (Volume Migration only): This option instructs the copying of the volume migration to be made.  The <b>-vl (-pvol)</b> specifies the local instruction, that is, an instruction to copy a local instance volume (P-VOL) to a remote instance volume (S-VOL) and to maps a copying destination volume (a volume of the remote instance) to the local instance volume (P-VOL).  The <b>-vr (-svol)</b> specifies the remote instruction, and copies data from a remote instance volume (P-VOL) to a local instance volume (S-VOL) and maps a copy destination volume (a volume of the local instance) to the remote instance volume (P-VOL).  <b>Note</b>: This option cannot be specified with <b>-split</b> option in the same command.</p> <p><b>-jp &lt;PID&gt; -js &lt;PID&gt;</b>: This can be specified by TCE only. The number (DP pool ID) of a DP pool used by a P-VOL is specified with the <b>-jp</b> option and that used by an S-VOL is specified with the <b>-js</b> option. The same DP pool is used for the local replication data DP pool and the local management area DP pool. The different DP pools cannot be specified respectively. Remote side is same as above.  <b>Note</b>: The <b>-jp</b> and <b>-js</b> options are enabled when the fence level is specified as <b>async</b>. When the <b>-jp</b> and <b>-js</b> options are omitted, 0 is used as a DP pool ID.</p> <p><b>-pid &lt;PID&gt;</b> (SnapShot only): This option specifies the DP pool number (DP pool ID) which the pair to create uses. When one P-VOL configures a pair with two or more V-VOLs, the pair configured by the same P-VOL needs to use a common DP pool. If this option is omitted, 0 is used as a DP pool ID. The same DP pool is used for the replication data DP pool and the management area DP pool. The different DP pools cannot be specified respectively.</p> <p><b>-fq &lt;mode&gt;</b> (ShadowImage only): This option is used to specify the mode whether <b>-split</b> is performed or not as "QUICK".  <b>mode = normal</b> The <b>paircreate -split</b> will be performed as non-quick mode regardless of setting of \$HORCC_SPLT environment variable.  <b>mode = quick</b> The <b>paircreate -split</b> will be performed as Quick Split regardless of setting of \$HORCC_SPLT environment variable.</p>
Returned values	<p>Normal termination: 0. When creating groups, 0 = normal termination for all pairs.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p>

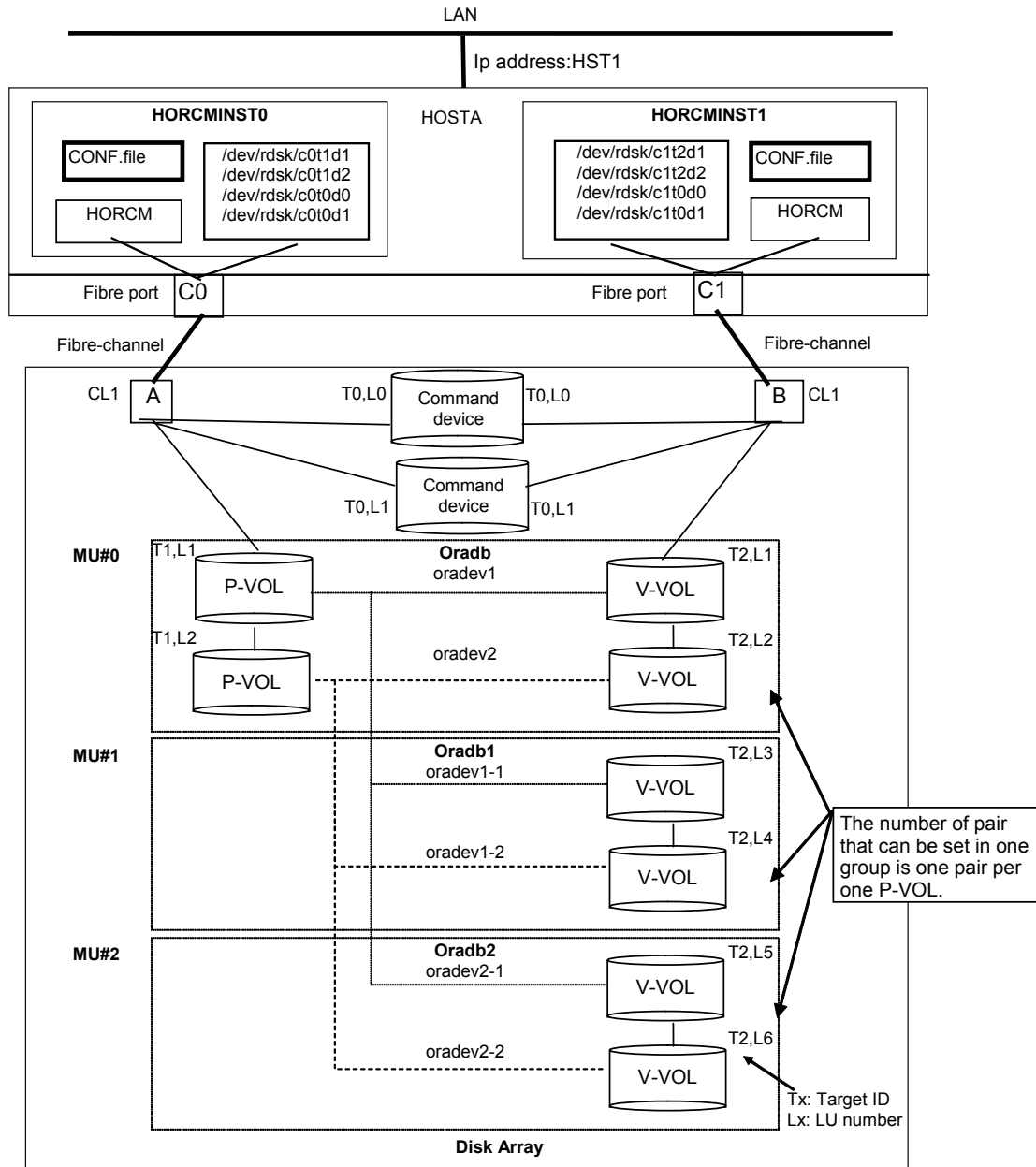


**Note:** During TrueCopy/TCE pair operation, there are cases where pair operation fail when high volume host I/O or frequent change of pair status is occurring on both local and remote array. If pair operation fails and state transition is not done, retry the pair operation (pairvolchk command can be used to check the state transition). If pair operation fails partially when doing pair operation by groups, then pair operation needs to be done per each pair logical volume within that group.

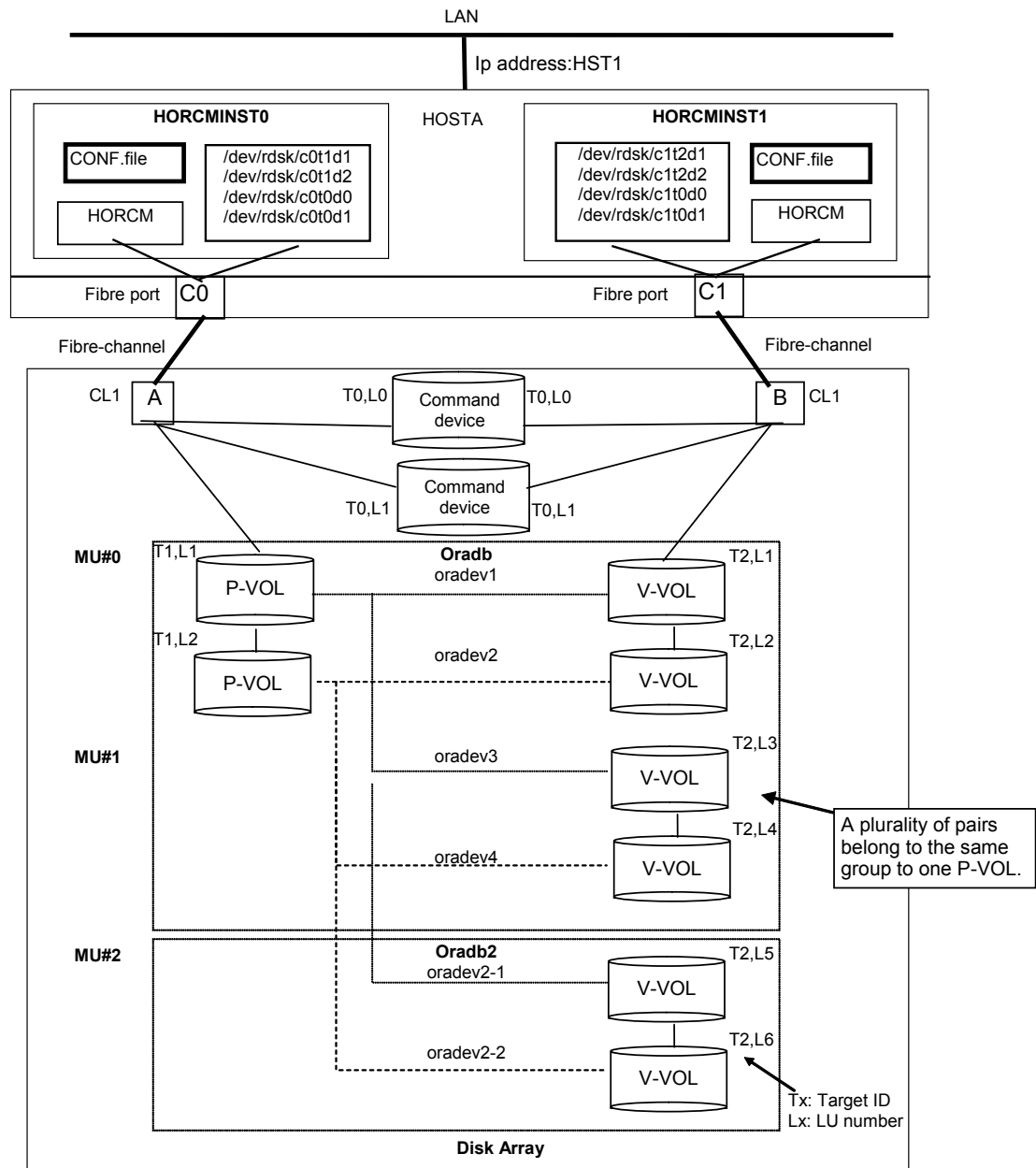
```
C:\HORCM\etc>paircreate -g VG01 -vl -c 15
C:\HORCM\etc>pairevtwait -g VG01 -s pair -t 300 10
pairevtwait : Wait status done.

C:\HORCM\etc>pairdisplay -g VG01
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
VG01    oradb1 (L)  (CL1-A , 1,   1-0 )91200174      1.P-VOL PAIR,91200174      2 -
VG01    oradb1 (R)  (CL1-A , 1,   2-0 )91200174      2.S-VOL PAIR,-----      1 -
```

**Figure 10-3 Paircreate command**



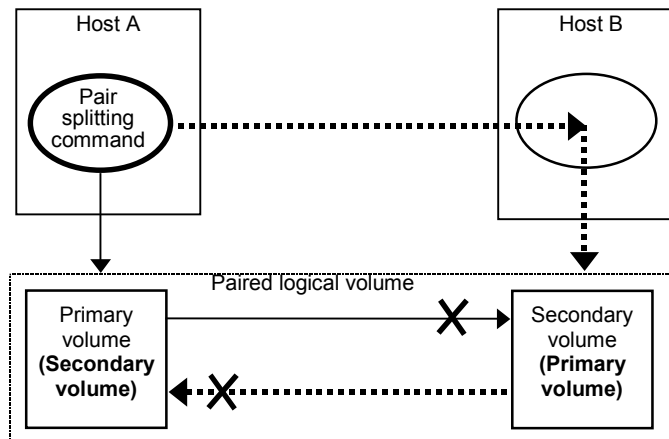
**Figure 10-4 Paircreate command -m option**



**Figure 10-5 Paircreate command -m option (inappropriate example)**

## Splitting pairs

The **pairsplit** command stops updates to the secondary volume of a pair (see [Figure 10-6](#)). The pairsplit command allows read/write access to the secondary volume. The pairsplit command can be applied to a paired logical volume or to a group of paired volumes. [Table 10-5](#) lists and describes the pairsplit command parameters and returned values.



**Figure 10-6 Pair splitting**

The pairsplit command allows read/write access to the secondary volume, depending on the selected options (-r, -rw, -S, -R, -E, -ms, -mscal, -RB, -RS). The primary volume's host is automatically detected by the pairsplit command, so the host does not need to be specified in the pairsplit command parameters. If the -S option (simplex) is used, the volume pair is deleted, the volumes are returned to the simplex state, and the primary and secondary volume status is lost. Paired volumes are split as soon as the pairsplit command is issued. To synchronize the volumes, the pairsplit command must be issued after write I/Os to the paired volume have been completed.

When splitting a pair, whether you can change the pair status of the S-VOL or not, changing the pair status of the P-VOL to SMPL takes priority. Therefore, if the pair status of the S-VOL cannot be changed to SMPL, the pair status of the P-VOL might not correspond with that of the S-VOL.

When a path failure has occurred or when S-VOL is not used temporarily (for example, while formatting), the pair status of S-VOL cannot be changed to SMPL.

When you want to change the status of P-VOL and S-VOL to SMPL, a pairdisplay command is issued and a pairsplit **-R** command is issued for S-VOL that is not SMPL. (This can be specified for TrueCopy/TCE).

When the pairsplit **-R** is issued for S-VOL in paired state, a pairsplit **-S** is issued for P-VOL to change the status of P-VOL to SMPL.

When the S-VOL of the TCE pair is placed in the SMPL status through an issue of a command for the pair splitting (pairsplit -R) to the TCE pair, the S-VOL data may become unsettled data that is being copied. Therefore, to use the data as the settled one on which the P-VOL data has been reflected, change the volume status to SSWS by issuing the command for the takeover (horctakeover) beforehand, and issue the command for the pair splitting (pairsplit -R).



**Note:** During the period until the response of the command is returned after the pair status change command such as pairsplit is performed, the pairdisplay command cannot be performed in the same screen. Therefore, start another screen and issue pairdisplay to check the pair status.

**Table 10-5 Pairsplit command parameters**

Parameter	Value
Command Name	pairsplit
Format	pairsplit {-h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -FHORC   -FMRCF [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -r   -rw   -S   -R[B][S]   -P   -I   -nomsg   -C <size>   -E   -ms<Split-Marker>   -mscas<Split-Marker> [MU#]   -fq <mode>   -t <time>}
Options	<p><b>-h:</b> Displays Help/Usage and version information.</p> <p><b>-q:</b> Terminates the interactive mode and exits this command.</p> <p><b>-z</b> or <b>-zx:</b> Makes the pairsplit command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x:</b> Specifies the sub-command of Windows.</p> <p><b>-xh:</b> Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]:</b> Specifies the instance number and the command execution environment.</p> <p><b>-g &lt;group&gt;:</b> Specifies a group name defined in the configuration definition file. This option must always be specified. The command is executed for the specified group unless the -d &lt;pair Vol&gt; option is specified.</p> <p><b>-d &lt;pair Vol&gt;:</b> Specifies the paired logical volume name defined in the configuration definition file. When this option is specified, the command is issued for the specified paired logical volumes.</p> <p><b>-d[g] &lt;raw_device&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified the raw_device is contained in two or more groups, the command is performed on the first group.</p> <p><b>-FHORC</b> or <b>-FCA:</b> Forcibly specifies a cascading TrueCopy/TCE volume for specified pair logical volumes on a ShadowImage/SnapShot environment (see example in <a href="#">Figure 10-7</a>). If the <b>-I</b> option is specified, this option splits a cascading TrueCopy/TCE volume on a local host (near site). If no <b>-I</b> option is specified, this option splits a cascading TrueCopy/TCE volume on a remote host (far site). The target TrueCopy/TCE volume must be a P-VOL and the <b>-R</b> option cannot be specified. Only the P-VOL of SnapShot can be cascaded with the TCE. In the case where the P-VOL of SnapShot is cascaded with the S-VOL of TCE, an instruction to split the SnapShot pair cannot be issued directly when the both pairs are in the PAIR status.</p>

Parameter	Value
	<p><b>-FMRCF [MU#] or -FBC [MU#]:</b> Forcibly specifies a cascading ShadowImage/SnapShot volume for specified pair logical volumes on a TrueCopy/TCE environment (see example in <a href="#">Figure 10-8</a>). If the <b>-I</b> option is specified, this option splits a cascading ShadowImage/SnapShot volume on a local host (near site). If no <b>-I</b> option is specified, this option splits a cascading ShadowImage/SnapShot volume on a remote host (far site). The target ShadowImage/SnapShot volume must be a P-VOL and the <b>-E</b> option cannot be specified.</p>
	<p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is in the group, the target volume is performed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is performed on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x") or decimal notation.</p>
	<p><b>-r or -rw</b> (for TrueCopy/TCE): Specifies a mode of access to the S-VOL after paired volumes are split. The <b>-r</b> option (default) allows read-only from the S-VOL. The <b>-rw</b> option enables read and write access for the S-VOL.</p>
	<p><b>-S:</b> Selects simplex mode (releases the pair). When the pairing direction is reversed among the hosts (for example, disaster recovery), this mode is established once, and the paircreate command is issued. To re-establish a pair which has been released, you must use the paircreate command (not pairresync).</p>
	<p><b>-R</b> (for TrueCopy/TCE): Brings the secondary volume into the simplex mode forcibly. It is issued by the secondary host, if the host possessing the primary volume is down or has failed.</p>
	<p><b>-RS</b> (for TrueCopy/TCE): Brings the secondary volume forcibly into SSWS mode.</p>
	<p><b>-RB</b> (for TrueCopy/TCE): Backs the secondary volume forcibly from SSWS into PSUS (PSUE) (SSUS) mode. This makes to be able to back to the primary volume if the user wants to back from the secondary host in SSWS state on Link failure to the primary host.</p>
	<p><b>-P</b> (for TrueCopy): This option is used to bring the primary volume forcibly into write disabled mode like PSUE with "fence=data". It is issued by the secondary host to disable P-VOL data changes by the host possessing the primary volume.</p>
	<p><b>-I:</b> When this command cannot utilize the remote host for host down, this option enables a pairsplit operation by local host only. The target volume of local host can be P-VOL or S-VOL.</p>
	<p><b>-nomsg:</b> Suppresses messages to be displayed when this command is executed. It is used to issue a command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p>
	<p><b>-C &lt;size&gt;:</b> This option does not affect on operation even if it specified or omitted.</p>
	<p><b>-E (ShadowImage only):</b> Suspends a paired volume forcibly when a failure occurs. Not normally used.</p>
	<p><b>-ms &lt;Split-Marker&gt;</b> (for ShadowImage/SnapShot only): This option adds the optional character strings (ASCII code of 31 characters) specified by the user to the S-VOL or the V-VOL as &lt;Split-Marker&gt;.</p>
	<p><b>-mscas &lt;Split-Marker&gt; [MU#] (TCE only):</b> This option splits the V-VOL of the SnapShot pair cascaded with the S-VOL of the TCE pair by issuing an instruction (only the group can be specified) to TCE. As to the TCE pair targeted, its S-VOL must be cascaded with a SnapShot pair with the same "MU#." All the TCE pairs concerned must be in the PAIR status. All the SnapShot pairs must be in the PSUS or PAIR status. All the TCE pairs (in the PAIR status) in the CTG that includes the specified group are to be processed. The pairs (in the CTG) to be processed must be in the PAIR status only. Besides, an optional character string (with ASCII 31 characters), which is specified by a user, can be added to the V-VOL as a &lt;Split-Marker&gt;. Incidentally, this option cannot be used together with the option of -d.</p>

Parameter	Value
	<p><b>-fq &lt;mode&gt;</b> (ShadowImage only): This option is used to specify the mode whether "pairsplit" is performed or not as "QUICK".</p> <p><b>mode = normal</b> The "pairsplit" will be performed as non-quick mode regardless of setting of \$HORCC_SPLT environment variable.</p> <p><b>mode = quick</b> The "pairsplit" will be performed as Quick Split regardless of setting of \$HORCC_SPLT environment variable.</p> <p><b>t &lt;time&gt;</b> : This option is used to specify the time before a pairsplit command is timed out (on the second time scale).</p>
Returned values	<p>Normal termination: 0. When creating groups, 0 = normal termination for all pairs.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p>

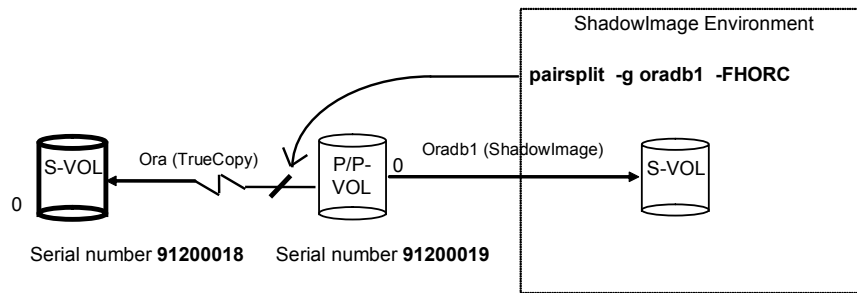
During TrueCopy/TCE pair operation, there are cases where pair operation fail when high volume host I/O or frequent change of pair status is occurring on both local and remote array. If pair operation fails and state transition is not done, retry the pair operation (pairvolchk command can be used to check the state transition). If pair operation fails partially when doing pair operation by groups, then pair operation needs to be done per each pair logical volume within that group.

When two or more groups, which are specified in the configuration definition file, exist in the CTG, an instruction to split the pairs issued to a group specified in the configuration definition file is issued for the entire CTG.

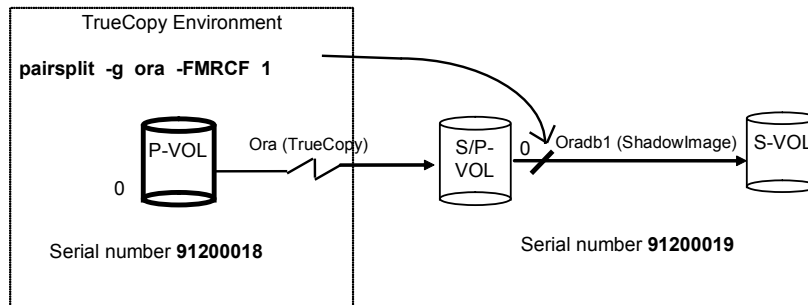
When TCE issues the pairsplit command, the response time differs depending on the options.

- pairsplit, pairsplit -S:  
When the status is PAIR, the response is delayed depending on the amount of the differential data.
- pairsplit -R, pairsplit -mscas:  
The response is made immediately after the command is issued.

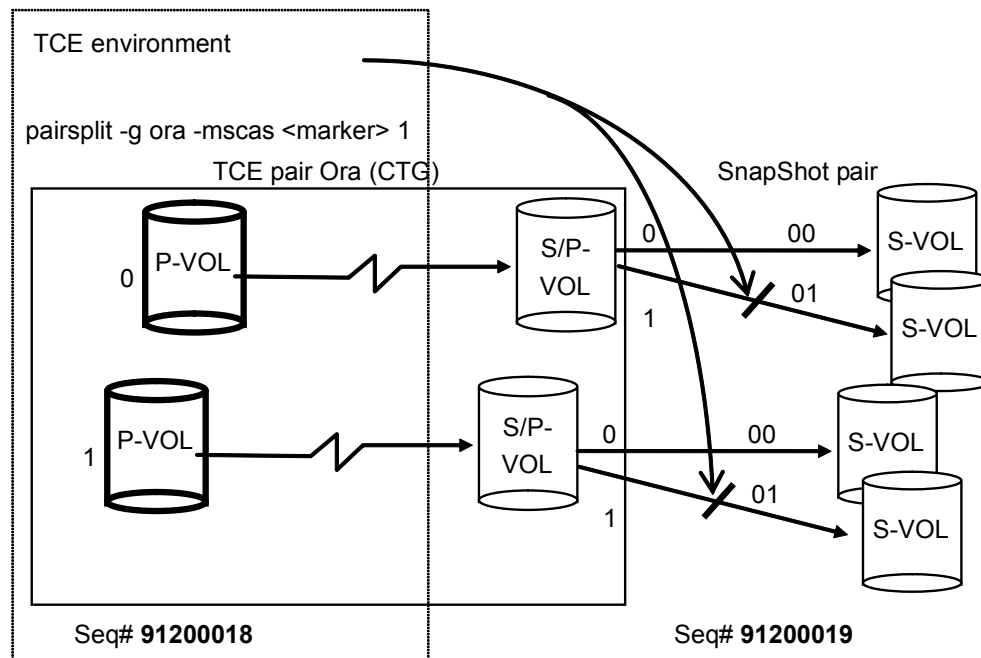
When the -d option is specified for the pairsplit -R command in the case of TCE, only an S-VOL of the target pair is placed in the SMPL status. Besides, at this time, all other pairs in the same CTG are not kept paired. When a P-VOL was in the PAIR status before the command was accepted, it is placed in the PSUE status because the pair created of it and an S-VOL is split forcibly. On the other hand, statuses of the other S-VOLs in the CTG are not changed and kept as PAIR because the communication from the primary array is cut off.



**Figure 10-7 Example of -FHORC option for pairsplit**



**Figure 10-8 Example of -FMRCF option for Pairsplit**



**Figure 10-9 Example of -mscas option for pairsplit**

```
C:\HORCM\etc>pairsplit -g VG01

C:\HORCM\etc>pairstat -g VG01
Group  PairVol(L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
VG01   oradb1(L)   (CL1-A , 1, 1-0 )91200174 1.P-VOL PSUS,91200174 2 -
```

VG01	oradb1 (R)	(CL1-A , 1, 2-0 )	91200174	2.S-VOL SSUS,-----	1 -
------	------------	-------------------	----------	--------------------	-----

**Figure 10-10 Pair split command**

```
C:\HORCM\etc>pairsplit -g VG01 -E

C:\HORCM\etc>pairdisplay -g VG01
Group  PairVol(L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
VG01   oradb1 (L)   (CL1-A , 1, 1-0 ) 91200174      1.P-VOL PSUE,91200174      2 -
VG01   oradb1 (R)   (CL1-A , 1, 2-0 ) 91200174      2.S-VOL PSUE,-----      1 -
```

**Figure 10-11 Pair split command -e option**

```
C:\HORCM\etc>pairsplit -g VG01 -S

C:\HORCM\etc>pairdisplay -g VG01
Group  PairVol(L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
VG01   oradb1 (L)   (CL1-A , 1, 1-0 ) 91200174      1.SMPL ----,-----      2 -
VG01   oradb1 (R)   (CL1-A , 1, 2-0 ) 91200174      2.SMPL ----,-----      1 -
```

**Figure 10-12 Pair split command -s option**

## Using the pairsplit command

Since a pair is split at the time when the pairsplit command is issued, verify that writing onto pair volumes is fixed before issuing the command.

- Instantaneous offline backup of the UNIX file system:
  - Unmount the primary volume, and split the volume pair.
  - Mount the primary volume (**mount**).
  - Verify that the pairsplit is complete, and mount the secondary volume (**mount -r**).
  - Perform the backup.
  - Restore the volumes to their previous state, and resynchronize the volume pair (ShadowImage/TrueCopy).
- Online backup of the UNIX file system:
  - Issue the **sync** command to a mounted primary volume to flush the file system buffer, and split the volume pair in Read/Write mode.
  - Verify that the pairsplit is complete, and use the **fsck** command to check the consistency of the secondary volume file system.
  - Mount (**mount**) the secondary volume.
  - Perform the backup.
  - Restore the volumes to their previous state and resynchronize the volume pair (ShadowImage/TrueCopy).
- Instantaneous offline backup of Windows Server file system:
  - Issue **-x umount** of the primary volume, split the volume pair.
  - Issue **-x mount** of the primary volume.
  - Verify that the pairsplit is complete, then issue **-x mount** of the secondary volume.
  - Perform the backup.
  - Restore the volumes to their previous state, and resynchronize the volume pair (ShadowImage/TrueCopy).
- Online backup of Windows Server file system:
  - Issue the **-x sync** command to a mounted primary volume to flush the file system buffer, then split the volume pair in Read/Write mode.
  - Verify that the pairsplit is complete, and use **-x mount** of the secondary volume.
  - Perform the backup.
  - Restore the volumes to their previous state and resynchronize the volume pair (ShadowImage/TrueCopy).

If the primary volume is divided by LVM or partition, the control information of LVM or partition on the primary volume is also copied to the secondary volume. When executing the backup from the secondary volume, import this control information and issue pairsplit when activating the secondary volume.

TCE takes some time for the pair splitting in order to reflect the P-VOL data on the S-VOL.

TCE can split V-VOL of the SnapShot pair cascaded with the secondary volume through the instruction issued from the primary host leaving the pair status as PAIR. From the above, backup data can be collected online more smoothly.

## Resynchronizing pairs

The **pairresync** command re-establishes a split pair, and restarts the update copy operations to the secondary volume (see [Figure 10-13](#)). The **pairresync** command can resynchronize either a paired logical volume or a group of paired volumes. The normal direction of resynchronization is from the primary volume to the secondary volume. If the **-restore** option is specified (ShadowImage only), the pair is resynchronized in the reverse direction (i.e., secondary volume to primary volume). [Figure 10-14](#) shows the normal and restore resync operations. The primary volume is read and write accessible during **pairresync**. The secondary volume becomes write-disabled when the **pairresync** command is issued.

[Table 10-6](#) lists and describes the **pairresync** command parameters and returned values. The primary volume's host is automatically detected by the **pairresync** command, so the host does not need to be specified in the **pairresync** command parameters.

The **pairresync** command terminates before resynchronization of the secondary (or primary) volume is complete. Use the **pair event waiting** or **pair display** command to verify that the resync operation completed successfully (status changes from COPY to PAIR). The execution log file also shows completion of the resync operation. The status transition of the paired volume is judged by the status of the primary volume.

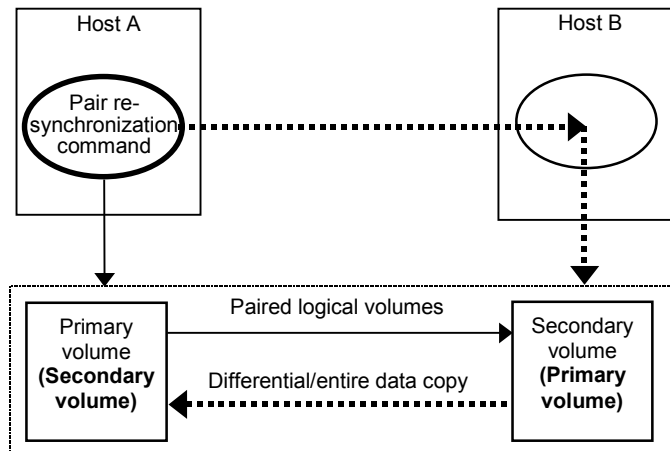
If no data was written to the secondary volume while the pair was split, the differential data on the primary volume is copied. If data was written to the secondary volume, the differential data on the primary volume and secondary volume is copied to the secondary volume. This process is reversed when the ShadowImage **-restore** option is specified.

Before issuing the **pairresync** command (normal or reverse direction), make sure that the secondary volume is not mounted on any UNIX system. Before issuing a reverse **pairresync** command, make sure that the primary volume is not mounted on any UNIX system.

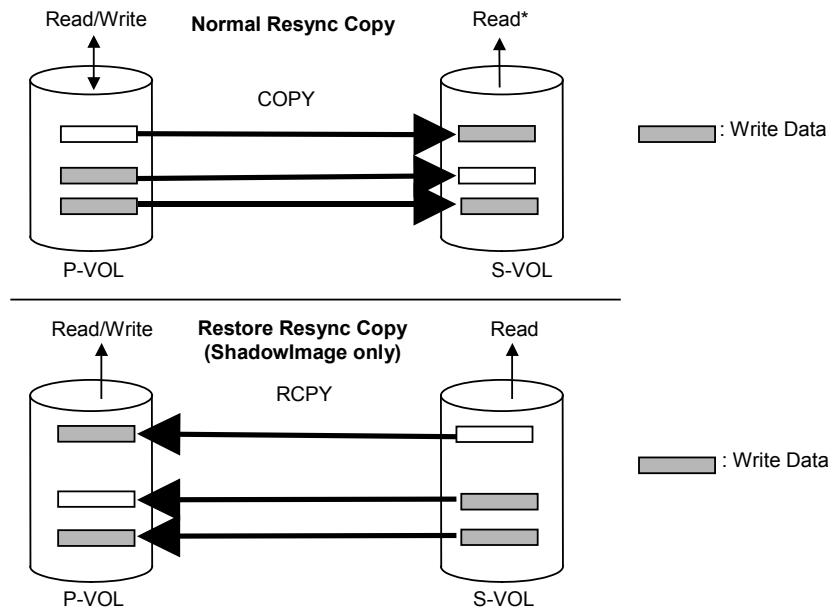


**Note:** Commands that change the status of pairs (**paircreate**, **pairsplit**, **pairresync**) cannot be issued while the host is being restarted in a TrueCopy/TCE environment. Processing may end abruptly when a command is issued while the host is being restarted.

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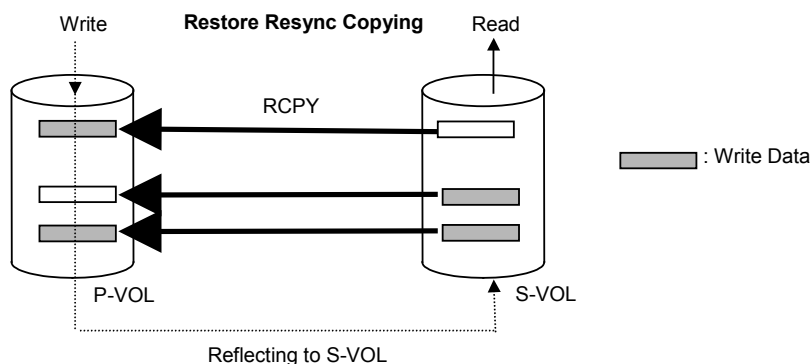


**Figure 10-13 Pair resynchronization**



Read\*: Read disabled when the paircreate -m noread option is specified.

**Figure 10-14 Normal resync and ShadowImage restore resync**



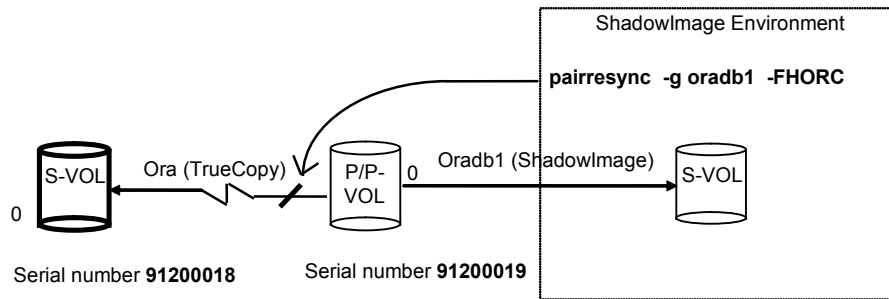
**Figure 10-15 Reflecting write data to P-VOL during ShadowImage restore resync copy**

**Table 10-6 Pairresync Command Parameters**

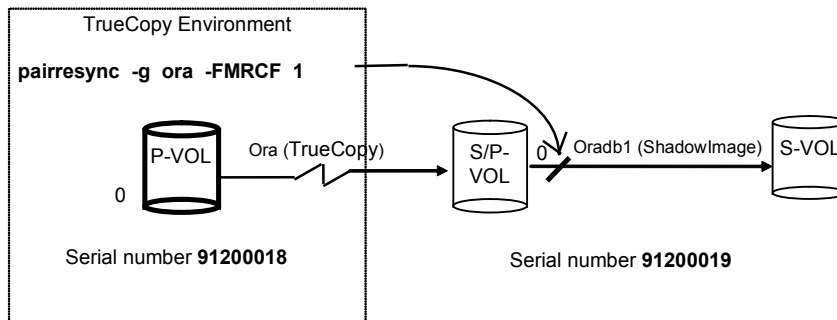
Parameter	Value
Command Name	pairresync
Format	pairresync { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -FHORC   -FMRCF [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -c <size>   -nomsg   -l   -restore   -swaps   -swapp   -fq <mode> }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits this command.
	<b>-z</b> or <b>-zx</b> : Makes the pairresync command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows.
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-g &lt;group&gt;</b> : This option is used to specify a group name defined in the configuration definition file. This option must always be specified. The command is issued for the specified group unless the <b>-d &lt;pair Vol&gt;</b> option is specified.
	<b>-d &lt;pair Vol&gt;</b> : Specifies a paired logical volume name defined in the configuration definition file. When this option is specified, the command is issued for the specified paired logical volumes.
	<b>-d[g] &lt;raw_device&gt; [MU#]</b> : Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g <group>" option. If the specified the raw_device is contained in two or more groups, the command is issued on the first group.
	<b>-FHORC</b> or <b>-FCA</b> : Forcibly specifies a cascading TrueCopy/TCE volume for specified pair logical volumes on a ShadowImage/SnapShot environment (see example in <a href="#">Figure 10-16</a> ). If the <b>-l</b> option is specified, this option resyncs a cascading TrueCopy/TCE volume on a local host (near site). If no <b>-l</b> option is specified, this option resyncs a cascading TrueCopy/TCE volume on a remote host (far site). The target TrueCopy/TCE volume must be a P-VOL.

Parameter	Value
	<p><b>-FMRCF [MU#] or -FBC [MU#]:</b> Forcibly specifies a cascading ShadowImage/SnapShot volume for specified pair logical volumes on a TrueCopy/TCE environment (see example in <a href="#">Figure 10-17</a>). If the <b>-I</b> option is specified, this option resyncs a cascading ShadowImage/SnapShot volume on a local host (near site). If no <b>-I</b> option is specified, this option resyncs a cascading ShadowImage/SnapShot volume on a remote host (far site). The target ShadowImage/SnapShot volume must be a P-VOL.</p>
	<p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specification of the "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is issued on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x") or decimal notation.</p> <p><b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x ") or decimal notation.</p>
	<p><b>-c &lt;size&gt;:</b> You can use this option to specify the copying pace for the resync operation (range = 1 to 15). If omitted, the value used for paircreate or at previous pairresync will be used. (1 to 5: slow, 6 to 10: normal, 11 to 15: prior)</p>
	<p><b>-nomsg:</b> Suppresses messages to be displayed when this command is issued. It is used to issue this command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p>
	<p><b>-I:</b> When this command cannot utilize the remote host for host down, this option enables a pairresync operation by the local host only. The target volume of the local host can be P-VOL or S-VOL.</p>
	<p><b>-restore:</b> Performs reverse resync (from secondary volume to primary volume).</p>
	<p><b>-swaps</b> (TrueCopy/TCE only): Issued from the S-VOL side when there is no host on the P-VOL side to help. Typically issued in PSUS state to facilitate "fast failback" without requiring a full copy. In <a href="#">Figure 10-18</a>, the left side shows T0 for both the P-VOL and S-VOL (before command execution), and the right side shows T1, after the command has issued. For both -swaps and -swapp, the delta data from the original S-VOL becomes dominant and is copied to the original P-VOL, then the S/P-VOL designations are swapped.</p>
	<p><b>-swapp</b> (TrueCopy/TCE only): Issues the equivalent of a -swaps from the original P-VOL side. Unlike -swaps, -swapp does require the cooperation of hosts at both sides.</p>
	<p><b>-fq &lt;mode&gt;</b> (ShadowImage only): This option is used to specify the mode whether "pairresync" is performed or not as "QUICK".</p> <p><b>mode = normal</b> The "pairresync" will be performed as non-quick mode regardless of setting of \$HORCC_RSYN environment variable.</p> <p><b>mode = quick</b> The "pairresync" will be performed as Quick Resync regardless of setting of \$HORCC_RSYN environment variable.</p>
Returned Values	<p>Normal termination: 0. When resynchronizing groups, 0 = normal termination for all pairs.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p>

During TrueCopy/TCE pair operation, there are cases where pair operation fail when high volume host I/O or frequent change of pair status is occurring on both local and remote array. If pair operation fails and state transition is not done, retry the pair operation (pairvolchk command can be used to check the state transition). If pair operation fails partially when doing pair operation by groups, then pair operation needs to be done per each pair logical volume within that group.



**Figure 10-16 Example of -FHORC option for pairresync**



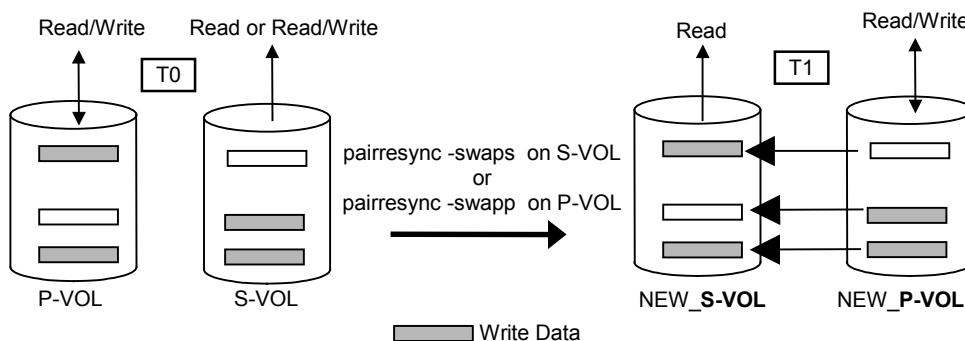
**Figure 10-17 Example of -FMRCF option for pairresync**

```
C:\HORCM\etc>pairresync -g VG01 -c 15

C:\HORCM\etc>pairevtwait -g VG01 -s pair -t 300 10
pairevtwait : Wait status done.

C:\HORCM\etc>pairdisplay -g VG01
Group  PairVol(L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
VG01   oradb1(L)   (CL1-A , 1, 1-0 )91200174 1.P-VOL PAIR,91200174 2 -
VG01   oradb1(R)   (CL1-A , 1, 2-0 )91200174 2.S-VOL PAIR,----- 1 -
```

**Figure 10-18 Pairresync command**

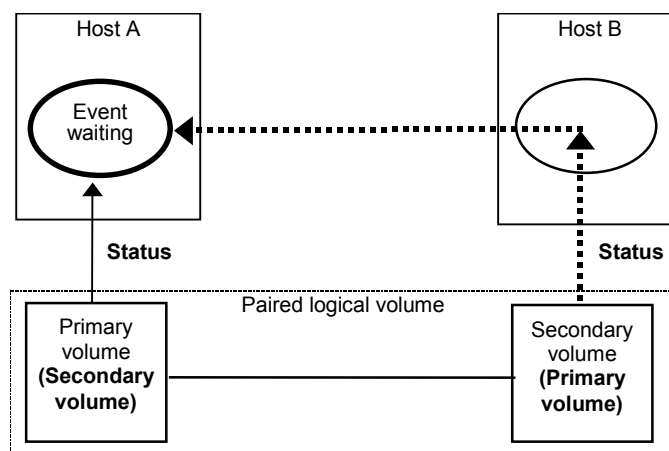


**Figure 10-19 Swap operation**

## Confirming pairs

The pair event waiting (**pairevtwait**) command is used to wait for completion of pair creation and pair resynchronization and to check status (see [Figure 10-20](#)). It waits ("sleeps") until the paired volume status becomes identical to a specified status, then completes. The pairevtwait command can be used for a paired logical volume or a group of paired volumes. The primary volume's host is automatically detected by the pair event waiting command, so the host does not need to be specified in the pair event waiting command parameters.

[Table 10-7](#) lists and describes the pair event waiting command parameters and returned values. The pair event waiting command waits until the specified status is established, and terminates abnormally if an abnormal status is detected. The transition of the paired volume status is judged by the status of the primary volume. If the event waiting command is issued for a group, the command waits until the status of each volume in the group becomes identical to the specified status. When the event waiting command with the **-nowait** option is issued for a group, the status is returned if the status of each volume in the group is identical. This command must be used to confirm a pair status transition.



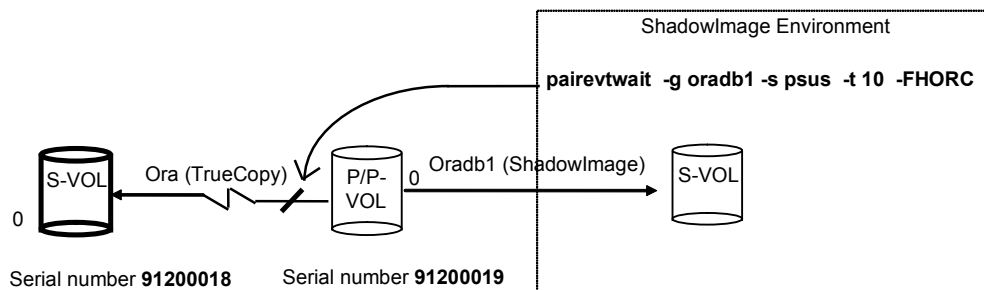
**Figure 10-20 Pair event waiting**

**Table 10-7 Pairevtwait command parameters**

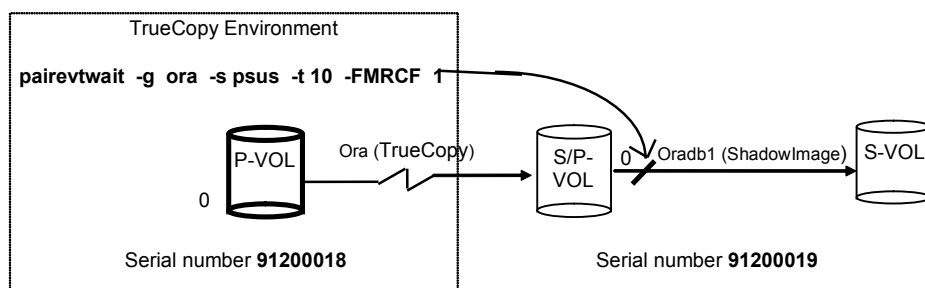
Parameter	Value
Command Name	pairevtwait
Format	pairevtwait { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -FHORC   -FMRCF [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -s[s] <status> ...   -t <timeout>[interval]   -nowait[s]   -l   -nomsg }
Options	<b>-h</b> : Displays Help/Usage and version information. <b>-q</b> : Terminates the interactive mode and exits this command.

Parameter	Value
	<p><b>-z</b> or <b>-zx</b>: Makes the pairevtwait command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p>
	<p><b>-x</b>: Specifies the sub-command of Windows.</p>
	<p><b>-xh</b>: Displays Help/Usage the sub-command of Windows.</p>
	<p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b>: Specifies the instance number and the command execution environment.</p>
	<p><b>-g &lt;group&gt;</b>: Specifies a group name defined in the configuration definition file. This option must always be specified. The command is issued for the specified group unless the <b>-d &lt;pair Vol&gt;</b> option is specified.</p>
	<p><b>-d &lt;pair Vol&gt;</b>: Specifies a paired logical volume name defined in the configuration definition file. When this option is specified, the command is issued for the specified paired logical volumes.</p>
	<p><b>-d[g] &lt;raw_device&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specifying the "-g &lt;group&gt;" option. If the specified raw_device is contained in two or more groups, the command is issued on the first group.</p>
	<p><b>-FHORC</b> or <b>-FCA</b>: Forcibly specifies a cascading TrueCopy/TCE volume for specified pair logical volumes on a ShadowImage/SnapShot environment (see example in <a href="#">Figure 10-21</a>). If the <b>-I</b> option is specified, this option tests status of a cascading TrueCopy/TCE volume on a local host (near site). If no <b>-I</b> option is specified, this option tests status of a cascading TrueCopy/TCE volume on a remote host (far site). The target TrueCopy/TCE volume must be P-VOL or SMPL.</p>
	<p><b>-FMRCF [MU#]</b> or <b>-FBC [MU#]</b>: Forcibly specifies a cascading ShadowImage/SnapShot volume for specified pair logical volumes on a TrueCopy/TCE environment (see example in <a href="#">Figure 10-22</a>). If the <b>-I</b> option is specified, this option tests status of a cascading ShadowImage/SnapShot volume on a local host (near site). If no <b>-I</b> option is specified, this option tests status of a cascading ShadowImage/SnapShot volume on a remote host (far site). The target ShadowImage/SnapShot volume must be P-VOL or SMPL.</p>
	<p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specifying the "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is issued on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x") or decimal notation.</p>
	<p><b>-s &lt;status&gt; ...</b>: Specifies the waiting status, which is "smpl", "copy/rcpy", "pair", "psus", or "psue". If two or more statuses are specified following -s, waiting is done according to the logical OR of the specified statuses. This option is valid when the -nowait option is not specified.</p>
	<p><b>-ss &lt;status&gt; ...</b>: Specifies the waiting status, which is "smpl", "copy/rcpy", "pair", "ssus", or "psue" on S-VOL. If two or more statuses are specified following -ss, waiting is done according to the logical OR of the specified statuses. This option is valid when the -nowaits option is not specified.</p>
	<p><b>-t &lt;timeout&gt; [interval]</b>: Specifies the interval of monitoring a status specified using the -s option and the time-out period in units of 1 sec. Unless [interval] is specified, the default value is used. This option is valid when the -nowait option is not specified. When a value, 2,000,000 or more is specified for the &lt;timeout&gt;, a warning message is displayed.</p>
	<p><b>-nowait</b>: When this option is specified, the pair status at that time is reported without waiting. The pair status is set as a returned value for this command. When this option is specified, the -t and -s options are not needed.</p>
	<p><b>-nowaits</b>: When this option is specified, the pair status on S-VOL at that time is reported without waiting. The pair status is set as a returned value for this command. When this option is specified, the -t and -ss options are not needed.</p>
	<p><b>-I</b>: When this command cannot utilize a remote host for host down, this option issues this command by a local host only. The target volume of the local host can be P-VOL or S-VOL.</p>

Parameter	Value
	<p><b>-nomsg</b>: Suppresses messages to be displayed when this command is issued. It is used to issue a command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p>
Returned values	<p>When the <b>-nowait</b> option is specified:</p> <p>Normal termination:</p> <ol style="list-style-type: none"> <li>1: The status is <b>SMPL</b>.</li> <li>2: The status is <b>COPY</b> or <b>RCPY</b>.</li> <li>3: The status is <b>PAIR</b>.</li> <li>4: The status is <b>PSUS</b>.</li> <li>5: The status is <b>PSUE</b>.</li> </ol> <p>When monitoring groups, 1/2/3/4/5 = normal termination for all pairs.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p> <p>When the <b>-nowaits</b> option is specified:</p> <p>Normal termination:</p> <ol style="list-style-type: none"> <li>1: The status is <b>SMPL</b>.</li> <li>2: The status is <b>COPY</b> or <b>RCPY</b>.</li> <li>3: The status is <b>PAIR</b>.</li> <li>4: The status is <b>SSUS</b>. (SVOL_PSUS will be displayed as SSUS)</li> <li>5: The status is <b>PSUE</b>.</li> </ol> <p>When monitoring groups, 1/2/3/4/5 = normal termination for all pairs.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p> <p>When the <b>-nowait</b> or <b>-nowaits</b> option is not specified:</p> <p>Normal termination: 0. When monitoring groups, 0 = normal termination for all pairs.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p>



**Figure 10-21 Example of -FHORC option for pairevtwait**



**Figure 10-22 Example of -FMRCF Option for pairevtwait**

```
C:\HORCM\etc>paircreate -g VG01 -vl -c 15
C:\HORCM\etc>pairevtwait -g VG01 -s pair -t 300 10
pairevtwait : Wait status done.
```

**Figure 10-23 Pairevtwait command**

## Monitoring pairs

The **pairmon** command, connected to the HORCM daemon, obtains the pair status transition of each volume pair and reports it. If the pair status changes (due to an error or a user-specified command), the pairmon command issues a message. [Table 10-8](#) lists and describes the pairmon command parameters. [Figure 10-24](#) shows an example of the pairmon command and its output. [Table 10-9](#) lists the results of the command options.

The pair status transition events exist in the HORCM pair status transition queue. The **-resevt** option (reset event) deletes one/all events from the HORCM pair status transition queue. If reset event is not specified, the pair status transition queue is maintained. If the **-s** option is not specified, pairmon displays all events for which it receives information from HORCM. If the **-s** option is specified, only the specified status transitions are displayed.

It may take time to reflect the pair status change to the output result of the pairmon command. You can calculate the maximum value of this time in the following formula.

The maximum time to reflect the pair status to the output result: Interval time × number of all pairs defined in the configuration definition file (Value of poll in the configuration definition file).

Calculating the value for poll(10ms): 6000 × the number of all CCI instances that control the array, which its host is connected to the disk array.

**Table 10-8 Pairmon command parameters**

Parameter	Value
Command Name	pairmon

Parameter	Value
Format	pairmon { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -D   -allsnd   -resevt   -nowait   -s <status> ... }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits this command.
	<b>-z</b> or <b>-zx</b> : Makes the pairmon command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows.
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-D</b> : Selects the default report mode. In the default mode, if there is pair status transition information to be reported, one event is reported and the event is reset. If there is no pair status transition information to be reported, the command waits. The report mode consists of the three flags: -allsnd, -resevt, and -nowait options.
	<b>-allsnd</b> : Reports all events if there is pair status transition information.
	<b>-resevt</b> : Reports events if there is pair status transition information, then resets all events.
	<b>-nowait</b> : When this option is specified, the command does not wait when there is no pair status transition information.
	<b>-s &lt;status&gt; ...</b> : Specifies the pair status transition to be reported: smpl, copy (includes rcpy), pair, psus, psue. If two or more statuses are specified following -s, masking is done according to the logical OR of the specified statuses. If this option is not specified, pairmon displays all events which received information from HORCM.



**Note:** In TrueCopy/TCE operation, do not specify the MU# to TrueCopy/TCE pair.

```
# pairmon -allsnd -nowait
Group Pair vol Port targ# lun# LDEV#... Oldstat code -> Newstat code
oradb oradb1 CL1-A 1 5 5... SMPL 0x00 -> COPY 0x01
oradb oradb2 CL1-A 1 6 6... PAIR 0x02 -> PSUS 0x04
```

**Figure 10-24 Pairmon command**

The output of the pairmon command includes:

- **Group**: Shows the group name (dev\_group) described in the configuration definition file.
- **Pair vol**: Shows the paired volume name (dev\_name) in the specified group which is described in the configuration definition file.
- **Port targ# lun#**: Shows the port ID, TID, and VOL described in the configuration definition file.
- **LDEV#**: Shows the array LDEV ID for the specified device. LDEV indicates volume.

- **Oldstat:** Shows the old pair status when the status of the volume is changed.
- **Newstat:** Shows the new pair status when the status of the volume is changed.
- **Code:** Shows the array-internal code for the specified status.

**Table 10-9 Results of pairmon command options**

-D	-nowait	-resevt	-allsnd	Actions
-D				When HORCM does not have an event, this option waits until an event occurs. If one or more events exist, it reports one event and resets the event which it reported.
Invalid			-allsnd	When HORCM does not have an event, this option waits until an event occurs. If one or more events exist, it reports all events.
Invalid		-resevt		When HORCM does not have an event, this option waits until an event occurs. If one or more events exist, it reports one event and resets all events.
Invalid		-resevt	-allsnd	When HORCM does not have an event, this option waits until an event occurs. If one or more events exist, it reports all events and resets all events.
Invalid	-nowait			When HORCM does not have an event, this option reports event nothing. If one or more events exist, it reports one event and resets the event which it reported.
Invalid	-nowait		-allsnd	When HORCM does not have an event, this option reports event nothing. If one or more events exist, it reports all events.
Invalid	-nowait	-resevt		When HORCM does not have an event, this option reports event nothing. If one or more events exist, it reports one event and resets all events.
Invalid	-nowait	-resevt	-allsnd	When HORCM does not have an event, this option reports event nothing. If one or more events exist, it reports all events and resets all events.

## Checking pair attribute and status

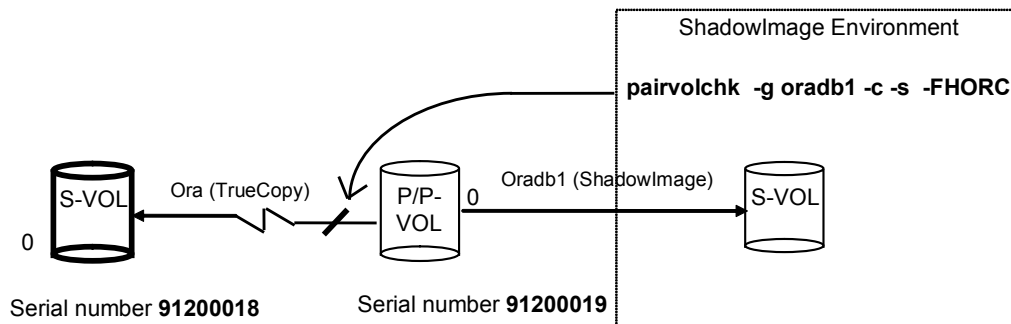
The **pairvolchk** command acquires and reports the attribute of a volume or group connected to the local host (issuing the command) or remote host. The volume attribute is SMPL (simplex), P-VOL (primary volume), or S-VOL (secondary volume). The **-s[s]** option reports the pair status in addition to the attribute. [Table 10-10](#) lists and describes the pairvolchk command parameters and returned values. [Figure 10-27](#) shows an example of the pairvolchk command and its output. [Table 10-11](#) shows the truth table for pairvolchk group status display.

**Table 10-10 Pairvolchk command parameters**

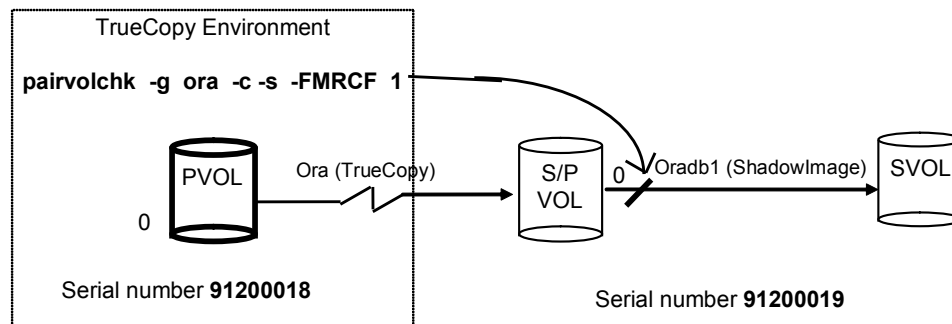
Parameter	Value
Command Name	pairvolchk
Format	pairvolchk { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -FHORC   -FMRCF [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -c   -ss   -nomsg }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits the pair volume check command.
	<b>-z</b> or <b>-zx</b> : Makes the pairvolchk command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows.
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-g &lt;group&gt;</b> : Specifies the group name defined in the configuration definition file. This option must always be specified. The command is issued for the specified group unless the <b>-d &lt;pair Vol&gt;</b> option is specified.
	<b>-d &lt;pair Vol&gt;</b> : This option is used to specify the paired logical volume name defined in the configuration definition file. When this option is specified, the command is issued for the specified paired logical volumes.
	<b>-d[g] &lt;raw_device&gt; [MU#]</b> : Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specifying the "-g <group>" option. If the specified the raw_device is contained in two or more groups, the command is issued on the first group.
	<b>-FHORC</b> or <b>-FCA</b> : Forcibly specifies a cascading TrueCopy/TCE volume for specified pair logical volumes on a ShadowImage/SnapShot environment (see example in <a href="#">Figure 10-25</a> ). If no <b>-c</b> option is specified, this option acquires the attributes of a cascading TrueCopy/TCE volume on a local host (near site). If the <b>-c</b> option is specified, this option acquires the attributes of a cascading TrueCopy/TCE volume on a remote host (far site).
	<b>-FMRCF [MU#]</b> or <b>-FBC [MU#]</b> : Forcibly specifies a cascading ShadowImage/SnapShot volume for specified pair logical volumes on a TrueCopy/TCE environment (see example in <a href="#">Figure 10-26</a> ). If no <b>-c</b> option is specified, this option acquires the attributes of a cascading ShadowImage/SnapShot volume on a local host (near site). If the <b>-c</b> option is specified, this option acquires the attributes of a cascading ShadowImage/SnapShot volume on a remote host (far site).

Parameter	Value
	<p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is issued as the paired logical volume (-d) or group (-dg). This option is effective without specifying the "-g &lt;group&gt; " option. If the specified LDEV is contained in two or more groups, the command is issued on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x") or decimal notation.</p>
	<p><b>-c:</b> Checks the conformability of the paired volumes of the local and remote hosts and reports the volume attribute of the remote host. If this option is not specified, the volume attribute of the local host is reported.</p>
	<p><b>-ss:</b> Used to acquire the pair status of a volume in addition to the volume attribute. If this option is not specified, only the volume attribute is reported.</p> <p><b>-nomsg:</b> Suppresses messages to be displayed when this command is issued. It is used to issue a command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p>

Parameter	Value
Returned values	<p>When the <b>-ss</b> option is not specified:</p> <p>Normal termination:</p> <p>1: The volume attribute is SMPL.  2: The volume attribute is P-VOL.  3: The volume attribute is S-VOL.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command.  For details on error codes, see Chapter 10.</p> <p>When the <b>-ss</b> option is specified:</p> <p>Normal termination:</p> <p>11: The status is SMPL.</p> <p><b>For SnapShot:</b></p> <p>22: The status is PVOL_COPY or PVOL_RCPY.  23: The status is PVOL_PAIR.  24: The status is PVOL_PSUS.  25: The status is PVOL_PSUE.  28: The status is PVOL_PFUS.  32: The status is SVOL_COPY or SVOL_RCPY.  33: The status is SVOL_PAIR.  34: The status is SVOL_PSUS.  35: The status is SVOL_PSUE.  38: The status is SVOL_PFUS.  39: The status is SVOL_PFUS or SVOL_PSUS.</p> <p><b>For TrueCopy and ShadowImage:</b></p> <p>22: The status is PVOL_COPY or PVOL_RCPY.  23: The status is PVOL_PAIR.  24: The status is PVOL_PSUS.  25: The status is PVOL_PSUE.  32: The status is SVOL_COPY or SVOL_RCPY.  33: The status is SVOL_PAIR.  34: The status is SVOL_PSUS.  35: The status is SVOL_PSUE.</p> <p><b>For TCE:</b></p> <p>42: The status is PVOL_COPY.  43: The status is PVOL_PAIR.  44: The status is PVOL_PSUS.  45: The status is PVOL_PSUE.  48: The status is PVOL_PFUS.  52: The status is SVOL_COPY.  53: The status is SVOL_PAIR.  54: The status is SVOL_PSUS.  55: The status is SVOL_PSUE.  58: The status is SVOL_PFUS.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command.  For details on error codes, see Chapter 10.</p>



**Figure 10-25 Example of -FHORC option for pairvolchk**



**Figure 10-26 Example of -FMRCF option for pairvolchk**

```
# pairvolchk -g ora
Pairvolchk : Volstat is S-VOL.[status = PAIR fence = ASYNC CTGID = 5 MINAP = 2 ]
```

**Figure 10-27 Pairvolchk command**

The output of the pairvolchk command includes:

- **status:** Shows the status of paired volume. For the pair status in the case of specifying a group, refer to [Table 10-11](#).
- **fence:** Shows fence level.
- **CTGID:** Shows CTGID.
- **MINAP:** The number of active link paths of TrueCopy/TCE is shown on the P-VOL.

**Table 10-11 Truth table for pairvolchk group status display**

Option	Status of Each Volume in the Group					Group Status
	COPY*	PSUE	PFUS	PSUS	PAIR	
Note*	TRUE	-	-	-	-	COPY*
	false	TRUE	-	-	-	PSUE
	false	false	TRUE	-	-	PFUS
	false	false	false	TRUE	-	PSUS
	false	false	false	false	TRUE	PAIR
-ss	TRUE	-	-	-	-	COPY*
	false	TRUE	-	-	-	PSUE
	false	false	-	-	TRUE	PAIR
	false	false	TRUE	false	false	PFUS
	false	false	false	TRUE	false	PSUS
COPY* = COPY or RCPY - = true or false (does not matter). <b>Note*:</b> A case where the pairvolchk -s command is issued with the setting of the environmental variable of USE_OLD_VCHK.						

## Displaying pair status

The **pairdisplay** command displays the pair status; this allows you to verify that pair operations are complete (for example, paircreate, pairresync). The pairdisplay command is also used to confirm the configuration of the pair connection path (the physical link of paired volumes and hosts). The pairdisplay command can be used for a paired volume or a group of paired volumes. [Table 10-12](#) lists and describes the pairdisplay command parameters and returned values. [Figure 10-28](#) shows examples of the pairdisplay command and its output.



**Note:** During the period until the response of the command is returned after the pair status change command such as pairsplit is executed, the pairdisplay command cannot be executed in the same screen. Therefore, start another screen and execute pairdisplay to check the pair status.

**Table 10-12 Pairdisplay command parameters**

Parameter	Value
Command Name	pairdisplay
Format	pairdisplay { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -FHORC   -FMRCF [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -c   -l   [-f[xcdew]]   -CLI   -v smk   -v pid   -m <mode> }
Options	<p><b>-h:</b> Displays Help/Usage and version information.</p> <p><b>-q:</b> Terminates the interactive mode and exits the pair volume check command.</p> <p><b>-z</b> or <b>-zx:</b> Makes the pairdisplay command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x:</b> Specifies the sub-command of Windows.</p> <p><b>-xh:</b> Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]:</b> Specifies the instance number and the command execution environment.</p> <p><b>-g &lt;group&gt;:</b> Specifies the group name defined in the configuration definition file. This option must always be specified. The command is executed for the specified group unless the -d &lt;pair Vol&gt; option is specified.</p> <p><b>-d &lt;pair Vol&gt;:</b> This option is used to specify the paired logical volume name defined in the configuration definition file. When this option is specified, the command is executed for the specified paired logical volumes.</p> <p><b>-d[g] &lt;raw_device&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified the raw_device is contained in two or more groups, the command is executed on the first group.</p> <p><b>-FHORC</b> or <b>-FCA:</b> Forcibly specifies a cascading TrueCopy/TCE volume for specified pair logical volumes on a ShadowImage/SnapShot environment. If the <b>-l</b> option is specified, this option displays status of a cascading TrueCopy/TCE volume on a local host (near site). If no <b>-l</b> option is specified, this option displays status of a cascading TrueCopy/TCE volume on a remote host (far site). This option cannot be specified with <b>-m &lt;mode&gt;</b> option on the same command line.</p>

Parameter	Value
	<p><b>-FMRCF [MU#] or -FBC [MU#]:</b> Forcibly specifies a cascading ShadowImage/SnapShot volume for specified pair logical volumes on a TrueCopy/TCE environment. If the <b>-I</b> option is specified, this option displays status of a cascading ShadowImage/SnapShot volume on a local host (near site). If no <b>-I</b> option is specified, this option displays status of a cascading ShadowImage/SnapShot volume on a remote host (far site). This option cannot be specified with <b>-m &lt;mode&gt;</b> option on the same command line.</p>
	<p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]:</b> Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is executed on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x") or decimal notation.</p>
	<p><b>-c:</b> Checks the configuration of the paired volume connection path (physical link of paired volume among the hosts) and displays illegal pair configurations. If this option is not specified, the status of the specified paired volume is displayed without checking the path configuration.</p>
	<p><b>-I:</b> Displays the paired volume status of the local host (which issues this command).</p>
	<p><b>-fc:</b> Displays the copy operation progress (or the pair consistency rate), and whether if the use rate of the DP pool has reached its threshold. This option also shows the PFUS status of the SnapShot pairs.</p>
	<p><b>-fx:</b> Displays the LDEV ID as a hexadecimal number.</p>
	<p><b>-fd:</b> Displays the group-based device file of the configuration file registered in HORCM and the relation between the groups. If Unknown is displayed in the DEVICE_FILE shown below, the pair operation (except for the local option) is rejected as protection mode because the volume is not registered.</p> <p><b>Example:</b></p> <pre># pairdisplay -g oradb -fd Group PairVol(L/R) Device_File M,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M oradb oradb1(L) Harddisk1 0 91205013 17.P-VOL COPY,91205013 18 - oradb oradb1(R) Unknown 0 91205013 ****,-----,-----,-----,-----</pre>
	<p><b>-fe:</b> Displays discrimination between a SnapShot volume and a ShadowImage volume and a number of active link paths, etc. by adding them as the last column. The 80-column format of 80 is neglected. This option will be invalid if the cascade options (-m all) are specified.</p>
	<p><b>-fw:</b> Used to display the WWN setting to the port instead of a port name. If this option is specified with "-fe" option at the same line, then "VOL WWN" is displayed as shown below. If WWN is not computed, then "Unknown" is displayed.</p> <p><b>Example:</b></p> <pre># pairdisplay -g oradb -fw Group PairVol(L/R)(WWN , VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M oradb oradev1(L)(50060e8010200650, 21-0 )91200101 21.P-VOL PSUS,91200101 20 W oradb oradev1(R)(50060e8010200654, 20-0 )91200101 20.S-VOL SSUS,----- 21 W # pairdisplay -g oradb -fwe Group PairVol(L/R)(WWN , VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M CTG CM EM E-Seq# E-LDEV# VOL-WWN oradb oradev1(L)(50060e8010200650, 21-0 )91200101 21.P-VOL PSUS,91200101 20 W - N - - 60060e80102006500510ffa500000014 oradb oradev1(R)(50060e8010200654, 20-0 )91200101 20.S-VOL SSUS,----- 21 W - N - - 60060e80102006500510ffa500000015</pre>
	<p><b>-CLI:</b> Used to specify display for command line interface (CLI). This option displays to the same position that defined number of columns, and displays one header. The delimiters between columns are displayed as spaces or hyphens (-). Display example:</p> <pre># pairdisplay -g homrcf1 -CLI Group PairVol L/R Port# TID VOL-M Seq# LDEV# P/S Status Seq# P-LDEV# M homrcf1 deva0 L CL1-A 3 5 0 91203005 5 P-VOL PAIR 91203005 3 - homrcf1 deva1 L CL1-A 3 5 0 91203005 5 SMPL - - - - homrcf1 deva2 L CL1-A 3 5 0 91203005 5 SMPL - - - -</pre>

Parameter	Value
	<p><b>-v smk</b> (for ShadowImage/SnapShot): This option displays Split-Marker (character string within 31 characters) added to the S-VOL (in case of ShadowImage) or the V-VOL (in case of SnapShot) and the time (UTC) which added Split-Marker. Split-Marker is added when pair split is executed by pairsplit -ms.</p> <p><b>-v pid</b> (for SnapShot only): This option displays the pair volume name or the information on the pool which the pair specified by &lt;raw_device&gt; uses. The information on the pool of the local side is displayed on the 1st line, and the information on the pool of the remote side is displayed on the 2nd line. If executing it to the SnapShot pair, the displays of the 1st line and the 2nd line become equal.  <b>Note:</b> This option displays nothing if the target volume is NOT SnapShot volume.</p> <p><b>-m &lt;mode&gt;</b>: Used to display a paired status of each mirror descriptors for the specified pair logical volume, and used for paired status indication of the cascading volume. <b>&lt;mode&gt;</b> option can be designated "all " (see <a href="#">Figure 10-29</a>):</p> <p>"all" option is used to display a paired status of all mirror descriptors (MU#).</p>
Returned values	<p>Normal termination: 0.</p> <p>Abnormal termination: Returns a common error code for this command. For details on error codes, see Chapter 2.</p>

```
# pairdisplay -g oradb
Group   PairVol(L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradb1(L)   (CL1-A , 1,   1-0 )91203005      1.P-VOL COPY,91203005      19 -
oradb   oradb1(R)   (CL1-A , 2,   1-0 )91203005      1.S-VOL COPY,-----      18 -
```

**Figure 10-28 Pairdisplay command**

The output of the pairdisplay command includes:

- **Group:** Shows the group name (dev\_group) described in the configuration definition file.
- **Pair Vol(L/R):** Shows the paired volume name (dev\_name) described in the configuration definition file. (L) indicates the local host; (R) indicates the remote host.
- **(Port#,TID,VOL) (TrueCopy/TCE):** Shows the port number, target ID and volume number as described in the configuration definition file.
- **(Port#,TID,VOL-M) (ShadowImage/SnapShot):** Shows the port number, target ID, volume number, and MU number as described in the configuration definition file.
- **Seq#:** Shows the serial number of the disk array.
- **LDEV#:** Shows the logical device number. LDEV indicates volume.
- **P/S:** Shows the volume attribute.
- **Status:** Shows the status of the paired volume.
- **Fence (for TrueCopy/TCE):** Shows fence level.

- **%**: Shows copy operation completion or percent pair synchronization.

State VOL.	TrueCopy			TCE			ShadowImage/SnapShot			
	COPY	PAIR	OTHER	COPY	PAIR	OTHER	COPY	PAIR	PVOL_PSUS SVOL_COPY	OTHER
P-VOL	CR	BMP	BMP	CR	UnBMP	BMP	CR	CR	BMP	CR
S-VOL	-	BMP	BMP	-	UnBMP	BMP	CR	CR	CR	CR

CR: Shows the copy operation rate (identical rate of a pair).  
 BMP: Shows the identical percentage of BITMAP both P-VOL and S-VOL.  
 UnBMP: Shows the inconsistent percentage of BITMAP both P-VOL and S-VOL.

When the paircreate or pairresync command is executed, the pair undergoes the full copy or differential copy in the COPY status, undergoes the cyclic copy once, and then placed in the PAIR status. When a new pair is added to a CTG, which is already placed in the PAIR status, by the paircreate or pairresync command, the copy operation halts until the time of the existing cyclic copy after the full copy or differential copy is completed. Further, it is not placed in the PAIR status until the first cyclic copy is completed after it begins to act in time to the cycle. Therefore, the pair synchronization rate displayed by Hitachi Storage Navigator Modular 2 or CCI may be 100% or not changed when the pair status is COPY.

- **P-LDEV#**: Shows the LDEV number of the partner volume of the pair.

- **M**

**M = W** (PSUS only): For P-VOLs, shows suspension with the S-VOL read/write enabled. For S-VOLs, shows that write I/Os were accepted at the S-VOL.

**M = N** (COPY, PAIR, PSUE, PSUS only): Shows that read access is disabled. At this time, make sure of the pair, which is displayed by Hitachi Storage Navigator Modular 2, status of which is PSUS (PSUS(N)), and no reading/writing from/to which is allowed.

[Figure 10-29](#) shows examples of the **-m** option of the pairdisplay command.

Display examples for **-m** all:

```
# pairdisplay -g oradb -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradev1(L) (CL1-A , 3, 0-0 )91203005 0.SMPL ----, ---- -
oradb   oradev1(L) (CL1-A , 3, 0-0 )91203005 0.P-VOL PAIR,91203005 26 -
oradb1  oradev11(R) (CL1-A , 3, 2-0 )91203005 2.P-VOL COPY,91203005 27 -
oradb   oradev1(R) (CL1-A , 3, 2-0 )91203005 2.S-VOL COPY, ---- 25 -

# pairdisplay -d Harddisk1 -l -m all
Group   PairVol (L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradev1(L) (CL1-A , 3, 0-0 )91203005 0.SMPL ----, ---- -
oradb   oradev1(L) (CL1-A , 3, 0-0 )91203005 0.P-VOL PAIR,91203005 26 -
```

**Figure 10-29 Pairdisplay command -m option**

[Figure 10-30](#) to [Figure 10-31](#) show examples of the **-fe** option of the **pairdisplay** command.

```
# pairdisplay -g vg01 -fe
Group   PairVol(L/R) (Port#,TID, VOL-M) ,Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M CTG CM EM
E-Seq# E-LDEV#
vg01    oradb1(L)   (CL1-A , 1, 5-0 )91200004 5.P-VOL PSUS,91200004 6 W - S
- - - - -
vg01    oradb1(R)   (CL1-A , 1, 6-0 )91200004 6.S-VOL PSUS,----- 5 - - S -
- - - - -
vg01    oradb2(L)   (CL1-A , 1, 2-0 )91200004 2.P-VOL PSUS,91200004 3 W - N
- - - - -
vg01    oradb2(R)   (CL1-A , 1, 3-0 )91200004 3.S-VOL PSUS,----- 2 - - N -
- - - - -
```

**Figure 10-30 Pairdisplay command -fe option (ShadowImage/SnapShot)**

```
# pairdisplay -g vg01 -fe
Group   PairVol(L/R) .... P-LDEV# M CTG JID AP EM E-Seq# E-LDEV# R/W
vg01    oradb1(L) .... 1 - - - 2 - - - -/-
vg01    oradb1(R) .... 1 - - - 2 - - - -/-
```

**Figure 10-31 Pairdisplay command -fe option (TrueCopy)**

```
# pairdisplay -g vg01 -fe
Group   PairVol(L/R) .... P-LDEV# M CTG JID AP EM E-Seq# E-LDEV# R/W
vg01    oradb1(L) .... 1 - 1 - 2 - - - -/-
vg01    oradb1(R) .... 1 - 1 - 2 - - - -/-
```

**Figure 10-32 Pairdisplay Command -fe Option (TCE)**

The output of the **pairdisplay** command includes:

- **CTG**: Shows the CTG ID.
- **JID**: Shows "-".
- **AP**: Shows the number of active link paths of TrueCopy/TCE on the P-VOL.
- **CM**: Shows copy mode.  
N: Non-snap shot volume (ShadowImage)  
S: Snap shot volume (SnapShot)
- **EM, E-Seq#, E-LDEV#**: Shows "-".
- **R/W**: Shows "-".

[Figure 10-33](#) shows examples of the **-v smk** option of the **pairdisplay** command.

```
# pairdisplay -g vg01 -v smk
Group   PairVol(L/R) Serial# LDEV# P/S Status UTC-TIME -----Split-Marker-----
vg01    oradb1(L)      91200004 5 P-VOL PSUS - -
vg01    oradb1(R)      91200004 6 S-VOL SSUS 123456ef QS_Check_12345678
```

### Figure 10-33 Pairedisplay command -v smk option (SnapShot)

The output of the paireddisplay command with -v smk includes:

- **UTC-TIME:** The UTC when the Split-Marker was added to the V-VOL is displayed.
- **Split-Marker:** The Split-Marker added to the V-VOL is displayed. When the pair concerned is the SnapShot pair that was split by the pairsplit -ms command, the Split-Marker is displayed as information on the V-VOL.

Figure 10-34 shows examples of the -v pid option of the paireddisplay command.

# paireddisplay -g vg01 -v pid										
PID	POLS	U(%)	SSCNT	Available(MB)	Capacity(MB)	Seq#	Num	LDEV#	H(%)	
127	POLN	0	6	3000	3000	91200004	2	200	80	
127	POLN	0	6	3000	3000	91200004	2	200	80	
# paireddisplay -g vg01 -v pid -l										
PID	POLS	U(%)	SSCNT	Available(MB)	Capacity(MB)	Seq#	Num	LDEV#	H(%)	
127	POLN	0	6	3000	3000	91200004	2	200	80	

### Figure 10-34 Pairedisplay command -v pid option

The output of the paireddisplay command with -v pid includes:

- **PID:** Shows the pool ID.
- **POLS:** The status of the pool:
  - POLN: Shows that the status of the pool is normal.
  - POLF: Shows that the usage rate of the pool exceeds the set threshold value.
- **U(%):** The whole capacity of the pool is made into 100%, and the usage rate is shown.
- **SSCNT:** Shows the number of SnapShot Volume (V-VOL) in the pool.
- **Available(MB):** Shows the available capacity for the volume data on the pool (in MB).
- **Capacity(MB):** Shows the total capacity in the pool (in MB).
- **Seq#:** Shows the serial number of the disk array.
- **Num:** Shows the number of volume configured the pool.
- **LDEV:** Shows the first number of volume configured the pool.
- **H(%):** Shows the threshold rate being set to the pool as High water mark. 'Unknown' will be shown as '-'.

## Checking TrueCopy/TCE pair currency

The TrueCopy/TCE paircurchk command checks the currency of the TrueCopy/TCE secondary volumes by evaluating the data consistency based on pair status and fence level. [Table 10-13](#) specifies the data consistency for each possible state of a TrueCopy/TCE volume. A paired volume or group can be specified as the target of the paircurchk command. The paircurchk command assumes that the target is an S-VOL. If the paircurchk command is specified for a group, the data consistency of each volume in the group is checked, and all inconsistent volumes are found in the execution log file and displayed. Paircurchk is also executed as part of the TrueCopy/TCE horctakeover command (see the next section).

TrueCopy/TCE supports the paircurchk command. The paircurchk command may be executed in the cases where it is performed by the user specification and the SVOL\_Takeover processing by the horctakeover command.

**Table 10-13 Data consistency displayed by the paircurchk command**

Object Volume			Paircurchk	
Attribute	Status	Fence	User Specification	SVOL_Takeover Processing
SMPL	–	–	To be confirmed	(Not executed)
P-VOL	–	–	To be confirmed	(Not executed)
S-VOL	COPY	Data	Inconsistent	Inconsistent
		Never		
		Async		
	PAIR	Data	OK	OK
		Never	To be analyzed	To be analyzed
		Async	To be analyzed	OK
	PSUS	Data	Suspected	Suspected
		Never		
		Async		
	PSUS(N)	Async	Suspected	Inconsistent
	PFUS	Async	Suspected	OK
	PSUE	Data	OK	OK
		Never	Suspected	Suspected
		Async		OK
	SSWS	Async	Suspected	(Not executed)

Object Volume			Paircurchk	
Attribute	Status	Fence	User Specification	SVOL_Takeover Processing
<b>Notes:</b> <ol style="list-style-type: none"> <li>1. To be confirmed = It is necessary to check the object volume, since it is not the secondary volume.</li> <li>2. Inconsistent = Data in the volume is inconsistent because it was being copied. Therefore the SVOL-takeover is not executed.</li> <li>3. To be analyzed = Whether S-VOL has a mirror consistency or not cannot be judged by the status of S-VOL. If the status of P-VOL is PAIR, the mirror consistency is OK. If the status of P-VOL is PSUS or PSUE, the mirror consistency is suspected.</li> <li>4. Suspected = S-VOL has no mirror consistency.</li> <li>5. OK = Mirroring consistency is assured in TrueCopy. Mirroring consistency is not assured in TCE.</li> </ol>				

**Table 10-14 Paircurchk command parameters**

Parameter	Value
Command Name	paircurchk
Format	paircurchk { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -nomsg }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits the pair volume check command.
	<b>-z</b> or <b>-zx</b> : Makes the pairvolchk command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows.
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-g &lt;group&gt;</b> : Specifies the group name defined in the configuration definition file. This option must always be specified. The command is executed for the specified group unless the -d <pair Vol> option is specified. In the case of TCE, the horctakeover command is executed for each CTG, however, the paircurchk command is executed for the specified group.
	<b>-d &lt;pair Vol&gt;</b> : This option is used to specify the paired logical volume name defined in the configuration definition file. When this option is specified, the command is executed for the specified paired logical volumes.
	<b>-d[g] &lt;raw_device&gt; [MU#]</b> : Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g <group>" option. If the specified the raw_device is contained in two or more groups, the command is executed on the first group.
	<b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]</b> : Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g <group>" option. If the specified LDEV is contained in two or more groups, the command is executed on the first group. The <b>&lt;seq #&gt;</b> <b>&lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x ") or decimal notation.
	<b>-nomsg</b> : Suppresses messages to be displayed when this command is executed. It is used to execute a command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.

Parameter	Value
Returned values	Normal termination: 0. Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.

```
# paircurchk -g oradb
paircurchk : Volume currency error.
Group Pair vol Port targ# lun# LDEV#...P/S Status Fence To be...
oradb oradb1 CL1-A 1 5 30...SMPL ... Confirmed
paircurchk: [EX_VOLCUR] S-Vol currency error
```

**Figure 10-35 Paircurchk command**

The output of the **paircurchk** command includes:

- **Group:** Shows the group name (dev\_group) described in the configuration definition file.
- **Pair Vol:** Shows the paired volume name (dev\_name) described in the configuration definition file.
- **Port#, targ#, lun#:** Shows the port number, target ID, and volume number as described in the configuration definition file.
- **LDEV#:** Shows the logical device number. LDEV indicates volume.
- **P/S:** Shows the volume attribute.
- **Status:** Shows the status of the paired volume.
- **Fence:** Shows the fence level.
- **To be...:** Evaluating the mirror consistency of S-VOL shows the currency of the volume.

## Performing TrueCopy/TCE takeover

When the array to be used is changed to the remote one by the horctakeover command, the local array is placed in the PSUE status, depending on the time when the change is made because of a collision with an I/O instruction issued by a host to the local array. This status transition occurs because the change is untimely. However, even if this occurs, reading/writing from/to an S-VOL of the remote array can be done because the horctakeover command keeps the S-VOL in the PSUS status (SSWS).

In the case of TrueCopy, when the horctakeover command is issued to the remote array, there may be a rare case where the SWAP-Takeover fails and terminates in the SVOL-Takeover status because of a load of the other CCI command on the local array added to a load of the horctakeover command. However, even if this occurs, the S-VOL is kept in the PSUS status (SSWS) and reading/writing from/to it can be done. Besides, a swap between a primary and secondary volume can be done when it is possible after statuses of the local and remote arrays are checked and the pairresync -swaps command is executed for the remote array.

When the -d option is specified in the case of TCE, only an S-VOL of the target pair is placed in the SSWS status. Besides, at this time, all the other pairs in the same CTG are not kept paired. When a P-VOL was in the PAIR status before the command was accepted, it is placed in the PSUE status because the pair created of it and an S-VOL is split forcibly. On the other hand, statuses of the other S-VOLs in the CTG are not changed and kept as PAIR because the communication from the primary array is cut off.

The horctakeover command is a scripted command for executing several HORC operations. The horctakeover command checks the specified volume's or group's attributes (paircurchk), decides the takeover function based on the attributes, executes the chosen takeover function, and returns the result. The four TrueCopy takeover functions designed for HA software operation are: takeover-switch, swap-takeover, PVOL-takeover, and SVOL-takeover. TCE takeover function designed for HA software operation is SVOL-takeover only. A paired volume or a group can be specified as the target of the TrueCopy/TCE horctakeover command. If TrueCopy/TCE SVOL-takeover is specified for a group, the data consistency check is executed for all volumes in the group, and all inconsistent volumes are found in the execution log file and displayed (same as paircurchk command).

The horctakeover command allows swapping of the primary and secondary volumes, so that if the primary or secondary volume is switched due to a server error or package transfer, duplex operations can be continued using the reversed volumes. When control is handed over to the current node, swapping the volumes again deletes the need to copy them. The horctakeover command also allows the secondary volume to be separated for disaster recovery operations.

[Table 10-15](#) lists and describes the TrueCopy/TCE horctakeover command parameters and returned values.

**Table 10-15 Horctakeover command parameters**

Parameter	Value
Command Name	horctakeover
Format	horctakeover { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol>   -d[g] <raw_device> [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -S   -I   -t<timeout>   -nomsg }
Options	<p><b>-h</b>: Displays Help/Usage and version information.</p> <p><b>-q</b>: Terminates the interactive mode and exits the pair volume check command.</p> <p><b>-z</b> or <b>-zx</b>: Makes the pairvolchk command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x</b>: Specifies the sub-command of Windows.</p> <p><b>-xh</b>: Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b>: Specifies the instance number and the command execution environment.</p> <p><b>-g &lt;group&gt;</b>: Specifies the group name defined in the configuration definition file. This option must always be specified. The command is executed for the specified group unless the -d &lt;pair Vol&gt; option is specified.</p> <p><b>-d &lt;pair Vol&gt;</b>: This option is used to specify the paired logical volume name defined in the configuration definition file. When this option is specified, the command is executed for the specified paired logical volumes.</p> <p><b>-d[g] &lt;raw_device&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified the raw_device is contained in two or more groups, the command is executed on the first group.</p> <p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is executed on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x ") or decimal notation.</p> <p><b>-S</b>: Selects and executes SVOL-takeover. The target volume of the local host must be an S-VOL. If this option is specified, then the following "-I" option is invalid.</p> <p><b>-I</b>: Enables read and write to the primary volumes by a local host only without a remote host, and executes PVOL-takeover when the primary volume cannot be used because it is fenced (fence = DATA, state = PSUE, or PSUE volume is contained in the group). If the primary volume can be accessed, nop- takeover is executed. The target volume of the local host must be a P-VOL.</p> <p><b>-t&lt;timeout&gt;</b>: Must be specified for async volumes only (TCE), ignored for sync. Specifies the maximum time to wait (in seconds) for swap-takeover and SVOL-takeover operation to synchronize the P-VOL and S-VOL. If this timeout occurs, the horctakeover command fails with EX_EWSTOT. To avoid timeout, set this value less than or equal to the start-up timeout value of the HA Control Script.</p> <p><b>-nomsg</b>: Suppresses messages to be displayed when this command is executed. It is used to execute a command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p>

Parameter	Value
Returned values	<p>Normal termination:</p> <ul style="list-style-type: none"> <li>0: Nop-takeover (no operation).</li> <li>1: Swap-takeover was successfully executed.</li> <li>2: SVOL-takeover was successfully executed.</li> <li>3: PVOL-SMPL-takeover was successfully executed.</li> <li>4: PVOL-PSUE-takeover was successfully executed.</li> <li>5: SVOL-SSUS-takeover was successfully executed.</li> </ul> <p>Abnormal termination: other than 0-5, Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p>

During TrueCopy/TCE pair operation, there are cases where pair operation fail when high volume host I/O or frequent change of pair status is occurring on both local and remote array. If pair operation fails and state transition is not done, then retry the pair operation (pairvolchk command can be used to check the state transition). When some of the pair operators fail, it is required to perform the pair operation for each logical volume pair in the group.

## Using the horctakeover command

ShadowImage and SnapShot do not support this command.

### Takeover

The control scripts activated by the HA software are used the same way by all nodes of a cluster; they do not discriminate between primary and secondary volumes. The horctakeover command, when activated by a control script, checks the combination of attributes of the local and remote volumes and determines the proper takeover action. [Table 10-16](#) lists the volume attributes and specifies the TrueCopy takeover action for each combination of attributes. [Table 10-17](#) lists the volume attributes and specifies the TCE takeover action for each combination of attributes.

**Table 10-16 Volume attributes and takeover actions (TrueCopy)**

Local Node (Takeover Node)		Remote Node		Takeover Action
Volume Attribute	Fence Level and Status	Volume Attribute	P-VOL Status	
SMPL	-	SMPL	-	NG <sup>[1]</sup>
		P-VOL	-	<b>Nop-Takeover</b> <sup>[2]</sup>
		S-VOL	-	Volumes not conform <sup>[3]</sup>
		Unknown <sup>[4]</sup>	-	NG
P-VOL (primary)	Fence = Data and Status = PSUE	SMPL	-	NG
		P-VOL	-	Volumes not conform
		S-VOL	-	<b>PVOL-Takeover</b>
		Unknown Status (e.g. LAN down)	-	<b>PVOL-Takeover</b>
	Fence = Never or Status = others	SMPL	-	NG
		P-VOL	-	Volumes not conform
		S-VOL	-	<b>Nop-Takeover</b>
		Unknown Status (e.g. LAN down)	-	<b>Nop-Takeover</b>
S-VOL (secondary)	Status = SSWS <sup>[5]</sup> After SVOL_SSUS-takeover	Any	-	<b>Nop-Takeover</b>
	Others	SMPL	-	Volumes not conform
		P-VOL	PAIR	<b>Swap-Takeover</b>
			Others	<b>SVOL-Takeover</b>
		S-VOL	-	Volumes not conform
		Unknown	-	<b>SVOL-Takeover</b>

**Table 10-17 Volume attributes and takeover actions (TCE)**

Local Node (Takeover Node)		Remote Node		Takeover Action
Volume Attribute	Fence Level and Status	Volume Attribute	P-VOL Status	
SMPL	-	SMPL	-	NG <sup>[1]</sup>
		P-VOL	-	<b>Nop-Takeover</b> <sup>[2]</sup>
		S-VOL	-	Volumes not conform <sup>[3]</sup>
		Unknown <sup>[4]</sup>	-	NG
P-VOL (primary)	Fence = Async	SMPL	-	NG
		P-VOL	-	Volumes not conform
		S-VOL	-	<b>Nop-Takeover</b>
		Unknown	-	<b>Nop-Takeover</b>
S-VOL (secondary)	Fence = Async and Status = SSWS	-	-	<b>Nop-Takeover</b>
	Fence = Async and Status = PSUS(N)	-	-	NG
	Fence = Async and Status = COPY	-	-	NG
	Others	SMPL	-	Volumes not conform
		P-VOL	PAIR	<b>SVOL-Takeover</b>
			Others	<b>SVOL-Takeover Note 2</b>
		S-VOL	-	Volumes not conform
		Unknown	-	<b>SVOL-Takeover Note 2</b>

**Note 1:**

1. NG = The horctakeover command is rejected, and the operation terminates abnormally.
2. Nop-Takeover = The horctakeover command is accepted, but no operation is performed.
3. Volumes not conform = The volumes are not in sync, and the horctakeover command terminates abnormally.
4. Unknown = The remote node attribute is unknown and cannot be identified. The remote node system is down or cannot communicate.
5. SSWS = Suspend for Swapping with S-VOL side only. The SSWS state is displayed as SSUS (SVOL\_PSUS) by ALL commands except the **-fc** option of the paireddisplay command.

**Note 2:** When the attribute of the self-node volume is SSUS, the target displays the NG message but the status changes to SSWS.

## Swap-takeover

When the P-VOL status of the remote node is PAIR and the S-VOL data is consistent, it is possible to swap the primary and secondary volumes. Therefore, when the P-VOL status of the remote node is PAIR, the swap-takeover function can be executed. The swap-takeover function is used by the HA control script when a package is manually moved to an alternate data center while all hardware is operational. Swap-takeover can be specified for a paired volume or a group.

The swap-takeover function internally executes the following commands to swap the primary and secondary volumes:

1. Execute **Suspend for Swapping** for the local volume (S-VOL). If this step fails, swap-takeover is disabled and an error is returned.
2. Execute **Resync for Swapping** to switch to the primary volume for which the local volume (S-VOL) is swapped as the NEW\_P-VOL. Re-synchronizes the NEW\_S-VOL based on the NEW\_P-VOL. As for copy pace, if the remote host is known, the command will use the value of P-VOL specified at paircreate time. If the remote host is unknown, the command will use the default number of pace (three). If this step fails, swap-takeover returns at **SVOL-SSUS-takeover**, and the local volume (S-VOL) is maintained in SSUS(PSUS) state which allows and keeps track of write I/Os using a bitmap for the S-VOL. This special state is displayed as **SSWS** using the **-fc** option of the pairdisplay command.



**Note:** The swap-takeover function does not use **SMPL** or **No Copy** mode for swapping to guarantee mirror consistence. This is included as a function of SVOL-takeover.

---

## SVOL-takeover

The SVOL-takeover function allows the takeover node to use the secondary volume (except in COPY state) in SSUS (PSUS) state (i.e., reading and writing are enabled), on the assumption that the remote node (possessing the primary volume) cannot be used. The data consistency of the TrueCopy S-VOL is evaluated by its pair status and fence level (same as paircurchk). If the primary and secondary volumes are not consistent, the SVOL-takeover function fails. If primary and secondary volumes are consistent, the SVOL-takeover function attempts to switch to the primary volume using **Resync for Swapping**. If successful, the SVOL-takeover function returns **Swap-takeover** as the return value of the horctakeover command. If not successful, the SVOL-takeover function returns **SVOL-SSUS-takeover** as the return value of the horctakeover command. In case of a host failure, **Swap-takeover** is returned. In case of P-VOL site failure, **SVOL-SSUS-takeover** is returned.

SVOL-takeover can be specified for a paired volume or a group. If the SVOL-takeover is specified for a group, a data consistency check is executed for all volumes in the group, and all inconsistent volumes are displayed (see [Table 10-13](#)).

## PVOL-takeover

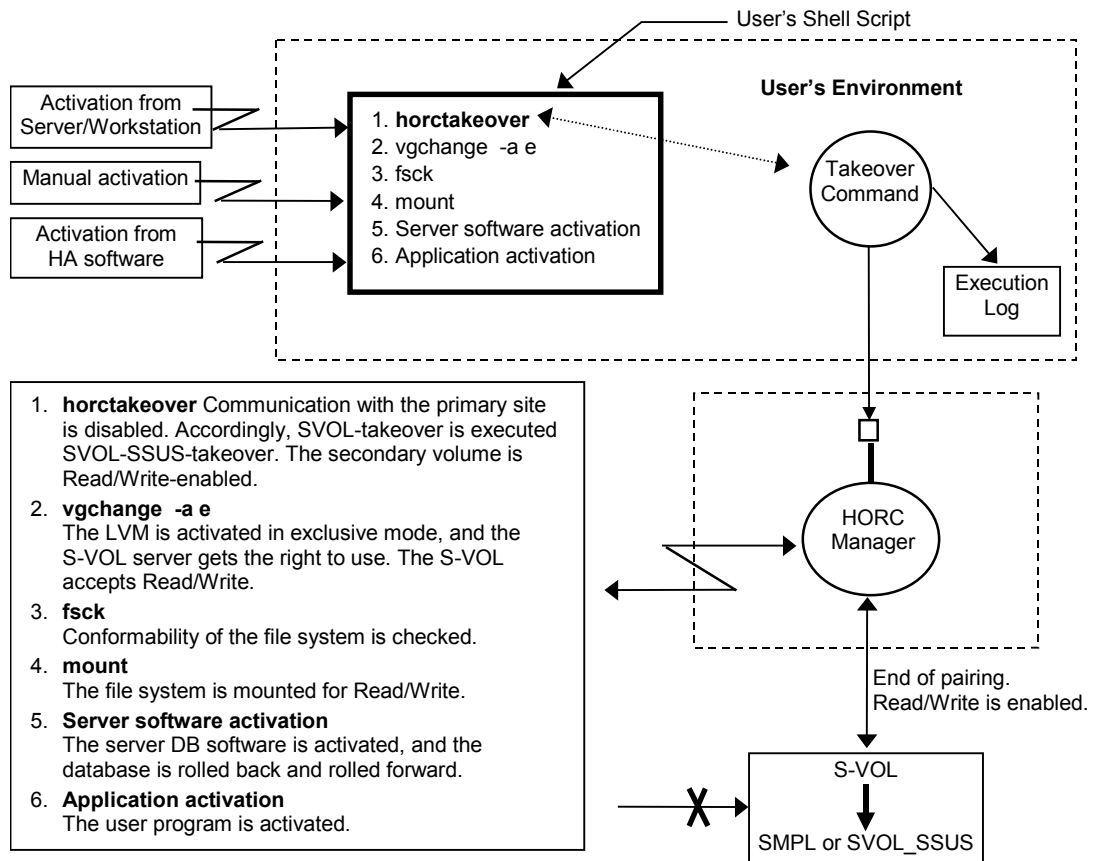
The PVOL-takeover function releases the pair state as a group, since that maintains the consistency of the secondary volume at having accepted horctakeover command when the primary volume is fenced ("data" and "PSUE" state, "PSUE" volume are contained in the group). This function allows the takeover node to use the primary volume (i.e., reading and writing are enabled), on the assumption that the remote node (possessing the secondary volume) cannot be used. PVOL-takeover can be specified for a paired volume or a group.

The PVOL-takeover function executes the following two commands:

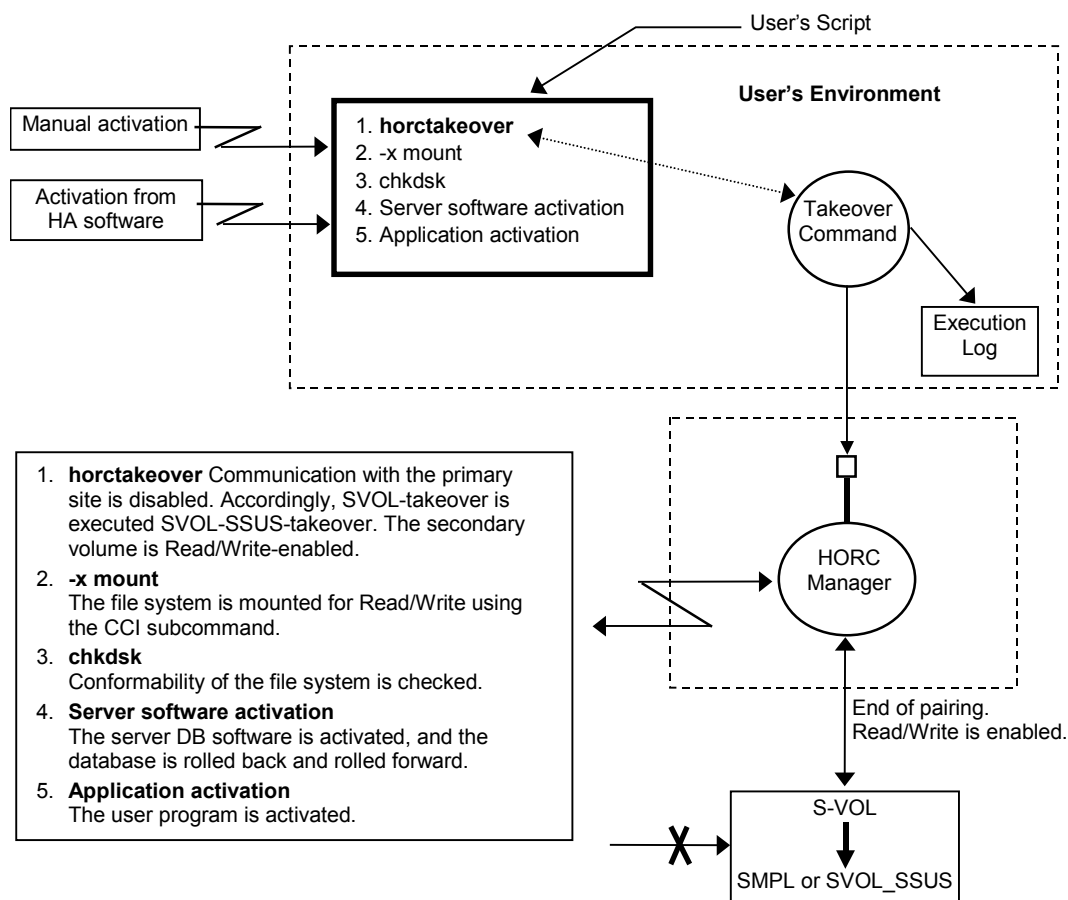
- **PVOL-PSUE-takeover:** Changes the primary volume to the suspend (PSUE, PSUS) state which enables write I/Os to all primary volumes of the group. The action of the PVOL-PSUE-Takeover causes PSUE and/or PSUS to be intermingled in the group. This intermingled pair status is PSUE as the group status; therefore, pairvolchk command returned gives priority to PSUE rather than PSUS as the group status. This special state turns back to the original state when the pairresync command is issued.
- **PVOL-SMPL-takeover:** Changes the primary volume to the simplex (SMPL) state. First, PVOL-takeover executes PVOL-PSUE-takeover further than PVOL-SMPL-takeover. If the PVOL-PSUE-takeover function fails, the PVOL-SMPL-takeover function is executed.

## Horctakeover command

The basic TrueCopy/TCE commands (takeover, pair creation, pair splitting, pair resynchronization, event waiting) can be combined to enable recovery from a disaster, backup of paired volumes, and many other operations (for example, restoration of paired volumes based on the secondary volume, swapping of the paired volumes). [Figure 10-36](#) shows the flow of starting operations on a UNIX server at the secondary site using the TrueCopy/TCE horctakeover command. [Figure 10-37](#) shows the flow of starting operations on Windows Server at the secondary site using the TrueCopy/TCE horctakeover command.



**Figure 10-36 Application/Example of TrueCopy/TCE Takeover (UNIX - based System)**



**Figure 10-37 Application/Example of TrueCopy/TCE Takeover (Windows - based System)**

# Displaying configuration information

## Using the raidscan command

The **raidscan** command displays configuration and status information for the specified disk array port/TIDs/devices. The information is acquired directly from the disk array (not the configuration definition file). [Table 10-18](#) lists and describes the raidscan command parameters. [Figure 10-38](#) to [Figure 10-44](#) list examples of the raidscan command and its output. Note that LDEV indicates volume.

**Table 10-18 Raidscan Command Parameters**

Parameter	Value
Command Name	raidscan
Format	raidscan { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -p <port> [hgrp]   -pd[g] <raw_device>   -s <Seq#>   -t <targ>   -l <lun>   [ -f[xfgde] ]   -CLI   -find[g] [op] [MU#] [-g group]   -pi <strings> -m<mun> }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits the command.
	<b>-z</b> or <b>-zx</b> : Makes the raidscan command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows.
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-p &lt;port&gt; [hgrp]</b> : Specifies the port ID of the array port to be scanned. Valid ports are CL1-A to CL1-H and CL2-A to CL2-H. This option must always be specified. <b>[hgrp]</b> is specified to display only the LDEVs mapped to a host group on a port for disk array.
	<b>-pd[g] &lt;raw_device&gt;</b> : Specifies the raw device name. This option finds Seq# and port_name of the array that the specified device can be connected, and scans the port of the disk array which corresponds with the unit ID that searches the unit ID from Seq#. This option must always be specified.
	<b>-pdg</b> option is specified to find host group and to display VOL.
	<b>-s &lt;Seq#&gt;</b> : Used to specify the Seq# of the disk array when this option can't specify the unit ID which is contained for "-p <port>" option. This option scans the port specified by "-p <port>" option of the disk array which corresponds with the unit ID that searches the unit ID from Seq#. If this option is specified, then the unit ID which is contained in "-p <port>" option is invalid.
	<b>-t &lt;targ&gt;</b> : Specifies a target ID (0 to 15) of the specified port. If this option is not specified, the command applies to all target IDs.
	<b>-l &lt;lun&gt;</b> : Specifies a VOL (0 to 7) of the specified target ID. If this option is not specified, the command applies to all VOLs. If this option is specified, the TID must also be specified.
	<b>-fx</b> : Displays the LDEV number in hexadecimal notation.
	<b>-f</b> or <b>-ff</b> : Specifies display of volume-type for a display column. If this option is specified, then the following <b>-fg</b> and <b>-fd</b> option is invalid.

Parameter	Value																																																
	<p><b>-fg</b>: Specifies display of group_name for a display column. This option searches a group on the configuration definition file (local CCI instance) from the scanned LDEV, and displays a group_name when the scanned LDEV is contained in the group. If this option is specified, the <b>-f[f]</b> option is excluded. If this option is specified, the <b>-fd</b> option is invalid.</p>																																																
	<p><b>-fd</b>: Displays the device file registered in HORCM. This option is invalid when the <b>-ff</b> or the <b>-fg</b> option is specified.</p>																																																
	<p><b>-fe</b>: This option displays a device serial number and a volume managing number of the other device to which external VOL is mapped. When no external VOL exists on the specified port, nothing is displayed. Display example:</p> <table><tr><th>Port#</th><th>/ALPA/C</th><th>TID#</th><th>VOL#</th><th>Seq#</th><th>Num</th><th>LDEV#</th><th>P/S</th><th>Status</th><th>Fence</th><th>E-Seq#</th><th>E-LDEV#</th></tr><tr><td>CL1-A</td><td>ef</td><td>0</td><td>0</td><td>48</td><td>91203005</td><td>2</td><td>256</td><td>SMPL</td><td>-</td><td>91203006</td><td>17</td></tr><tr><td>CL1-A</td><td>ef</td><td>0</td><td>0</td><td>49</td><td>91203005</td><td>2</td><td>272</td><td>SMPL</td><td>-</td><td>91203006</td><td>23</td></tr><tr><td>CL1-A</td><td>ef</td><td>0</td><td>0</td><td>50</td><td>91203005</td><td>1</td><td>288</td><td>SMPL</td><td>-</td><td>91203006</td><td>28</td></tr></table>	Port#	/ALPA/C	TID#	VOL#	Seq#	Num	LDEV#	P/S	Status	Fence	E-Seq#	E-LDEV#	CL1-A	ef	0	0	48	91203005	2	256	SMPL	-	91203006	17	CL1-A	ef	0	0	49	91203005	2	272	SMPL	-	91203006	23	CL1-A	ef	0	0	50	91203005	1	288	SMPL	-	91203006	28
Port#	/ALPA/C	TID#	VOL#	Seq#	Num	LDEV#	P/S	Status	Fence	E-Seq#	E-LDEV#																																						
CL1-A	ef	0	0	48	91203005	2	256	SMPL	-	91203006	17																																						
CL1-A	ef	0	0	49	91203005	2	272	SMPL	-	91203006	23																																						
CL1-A	ef	0	0	50	91203005	1	288	SMPL	-	91203006	28																																						
	<p><b>-CLI</b>: Specifies display for command line interface (CLI). This option displays to the same position that defined number of columns, and displays one header. The delimiters between columns are displayed as spaces or hyphens (-). Display example:</p> <table><tr><th>Port#</th><th>TargetID#</th><th>Lun#</th><th>Seq#</th><th>Num</th><th>LDEV#</th><th>P/S</th><th>Status</th><th>P-Seq#</th><th>P-LDEV#</th></tr><tr><td>CL1-A</td><td>1</td><td>0</td><td>91203005</td><td>1</td><td>0</td><td>SMPL</td><td>-</td><td>-</td><td>-</td></tr><tr><td>CL1-A</td><td>2</td><td>2</td><td>91203005</td><td>1</td><td>2</td><td>P-VOL</td><td>PAIR</td><td>91203005</td><td>26</td></tr><tr><td>CL1-A</td><td>2</td><td>3</td><td>91203005</td><td>1</td><td>3</td><td>P-VOL</td><td>PAIR</td><td>91203005</td><td>27</td></tr></table>	Port#	TargetID#	Lun#	Seq#	Num	LDEV#	P/S	Status	P-Seq#	P-LDEV#	CL1-A	1	0	91203005	1	0	SMPL	-	-	-	CL1-A	2	2	91203005	1	2	P-VOL	PAIR	91203005	26	CL1-A	2	3	91203005	1	3	P-VOL	PAIR	91203005	27								
Port#	TargetID#	Lun#	Seq#	Num	LDEV#	P/S	Status	P-Seq#	P-LDEV#																																								
CL1-A	1	0	91203005	1	0	SMPL	-	-	-																																								
CL1-A	2	2	91203005	1	2	P-VOL	PAIR	91203005	26																																								
CL1-A	2	3	91203005	1	3	P-VOL	PAIR	91203005	27																																								
	<p><b>-pi&lt;strings&gt;</b>: Used to change the STDIN of the -find option to argument input. If this option is specified, the STDIN becomes invalid. Specify <b>&lt;strings&gt;</b> in less than or equal to 255 characters.</p>																																																
	<p><b>-find [op] [MU#]</b>: Executes the operation specified in [op] using a special file (raw device file) provided via STDIN. If the -pi &lt;strings&gt; option is specified, the STDIN becomes invalid and changes to &lt;strings&gt;.</p> <p><b>Restriction:</b> Special files via STDIN are specified in the following ways:</p> <ul style="list-style-type: none"><li>HP-UX systems: /dev/rdsk/*, /dev/rdisk/disk*, /dev/rcdisk/disk*</li><li>Solaris systems: /dev/rdsk/*s2, c*s2</li><li>AIX systems: /dev/rhdisk*, /dev/hdisk*, hdisk*</li><li>Linux systems: /dev/sd*, /dev/rd*, /dev/raw/raw*</li><li>Tru64 UNIX systems: /dev/rdisk/dsk*c</li><li>IRIX systems: /dev/rdsk/*vol, /dev/rdsk/node_wwn/*vol/*, /dev/dsk/*vol, /dev/dsk/node_wwn/*vol/*</li><li>Windows systems: hd0-10, harddisk0, harddisk1... (numbers indicate the drive number)</li></ul> <p>\$LETALL, \$Volume, \$Phys, D:\Vol(Dms,Dmt, Dmr)X\DskY, \Vol(Dms,Dmt, Dmr)X\DskY</p> <p>For Windows LDM volumes, see Chapter 4 of the CCI User’s Guide.</p>																																																
	<p><b>-find[g]</b>: Displays the port, target ID, and VOL (disk array notation) which was mapped for LDEV using a special file (raw device file ) provided via STDIN (see <a href="#">Figure 10-38</a>). If <b>target ID and VOL are Unknown</b> for the target device file, the user must start HORCM without a description for HORCM_DEV and HORCM_INST, and should describe the shown Port, target ID, and VOL for HORCM_DEV. This option also uses the <b>-fx</b> option to display the LDEV numbers in hexadecimal. - <b>findg</b> option is specified to find host group and to display VOL.</p>																																																
	<p><b>-find inst</b>: Obtains the Ser# and LDEV# of the volume using a special file (raw device file) provided via STDIN, and then checks the consistency with the volume described in the configuration definition file. Then registers (permits) the special file name to HORCM, and displays the relation between the configuration definition file. This option is not usually used because it is automatically used by /etc/hormgr. This option also uses the <b>-fx</b> option to display the LDEV numbers in hexadecimal (see <a href="#">Figure 10-40</a>).</p> <p><b>Note:</b> When activating HORCM, the CCI automatically registers the device file by executing raidscan -find inst command. If this command is executed manually even if the device file has already been registered, a message “The registration has been canceled due to enough for HORCM.” Is displayed and the command will be rejected.</p>																																																

Parameter	Value
	<p><b>-find verify [MU#]:</b> Displays the relation between the volumes described in the configuration definition file after obtaining the Ser# and LDEV# of the volume using a special file (raw device file). This option also uses the <b>-fx</b> option to display the LDEV numbers in hexadecimal. This option is effected by the command execution environment (HORCC_MRCF).</p> <p><b>-find[g] conf [MU#] [-g &lt;group&gt;]:</b> Displays the image of the port, target ID, and VOL (disk array notation) which was mapped for LDEV using a special file (raw device file ) provided via STDIN. Before displaying the information, this option edits the information into an image that looks like the configuration definition file. If <b>target ID and VOL are Unknown</b> for the target device file, the user must start HORCM without a description for HORCM_DEV and HORCM_INST, and should describe the shown Port, target ID, and VOL for HORCM_DEV. This option also uses the <b>-fx</b> option to display the LDEV numbers in hexadecimal. The <b>-g group</b> option specifies the group name where the name should be described in the configuration definition file. If omitted, "VG" is used for the group name. <b>-findg</b> option is specified to find host group and to display VOL.</p> <p><b>-find sync [MU#] [-g &lt;group&gt;]:</b> This option reads the search conditions (\$Physical, \$Volume, \$LETALL) from the standard input, searches for a logical drive that corresponds to the group (&lt;group&gt;) defined in the configuration definition file, and then sends the unwritten data on the file system buffer to the logical drive (physical disk) to synchronize the pair (see <a href="#">Figure 10-43</a>). The <b>-g &lt;group&gt;</b> option specifies all the group names on the configuration definition file. If omitted, the <b>-find sync [MU#]</b> searches for a logical drive that corresponds to all groups in the CCI local instance, and sends the unwritten data on the file system buffer to the logical drive (physical disk) to synchronize the pair (see <a href="#">Figure 10-44</a>).</p> <p><b>Note:</b> The sync option executes the following procedures, depending on the execution condition.</p> <ul style="list-style-type: none"> <li>If the logical device that corresponds to the &lt;group&gt; described in the configuration definition file is closed from the application, the sync option flushes the system buffer and changes the logical device to "Dismount" status.</li> <li>If the logical device is opened from the application, the sync option flushes the system buffer only. In this case, [FLUSH] will be displayed.</li> </ul> <p>[FLUSH] : ORA ORA_000[-1] -&gt; \Vol44\Dsk0 : Volume{56e4954a-28d5-4824-a408-3ff9a6521e5d}</p> <p><b>Restrictions:</b></p> <ul style="list-style-type: none"> <li>All logical drives that correspond to the group defined in the configuration definition file must be closed from the application.</li> <li>This option cannot specify the device object name (shown below) for the search conditions: D:\Vol(Dms,Dmt, Dmr)X\DskY, \Vol(Dms,Dmt, Dmr)X\DskY</li> </ul> <p><b>-m &lt;mun&gt;:</b> Scanning information is displayed only for MU# specified by this option.</p>

When SnapShot is installed, the range searched with raidscan is extended to MU#=39 from MU#=0. Therefore, execution of raidscan takes several minutes. When you want to limit the searched range, please use the option that is displayed only for specified host group (**-p <port> [hgrp]**), or the option that is displayed only for specified MU# (**-m <mun>**). And when raidscan is executed, because only volume defined in the searched range is displayed, you may seem that the display is frozen during search of volumes that are not defined.

```
# raidscan -p cll1-a
PORT# /ALPA/C,TID#,VOL#.Num(LDEV#....)....P/S, Status,LDEV#,P-Seq#,P-LDEV#
CLL1-A / ef/ 5, 1, 0-0.1(0).....P-VOL ---- ----, ---- ----
CLL1-A / ef/ 5, 1, 1-0.1(1).....SMPL ---- ----, ---- ----
```

**Figure 10-38 Raidscan Command for Fibre-Channel Ports**

```
# echo $Phys | raidscan -find
DEVICE_FILE      UID  S/F PORT    TARG  LUN    SERIAL  LDEV  PRODUCT_ID
Harddisk0        0   F  CL1-A    0     4     91203116  4    DF600F-CM
Harddisk1        0   F  CL1-A    0     2     91203116  2    DF600F
Harddisk2        -   -  CL1-A    -     -     91203117  -    DF600F
```

**Figure 10-39 Raidscan Command -find Option**

The output of the raidscan command with the **-find** option includes:

- **UID:** Shows the unit ID for multiple array configurations. If UID is displayed as '-', the command device for HORCM\_CMD is not found.
- **S/F:** Shows whether the PORT is fibre.
- **PORT:** Shows the disk array port number.
- **TARG:** Shows the target ID (which was converted by the fibre conversion table).
- **VOL:** Shows the VOL (which was converted by the fibre conversion table).
- **SERIAL:** Shows the production (serial#) number of the disk array.
- **LDEV:** Shows the LDEV# within the disk array. LDEV indicates volume.
- **PRODUCT\_ID:** Shows the product-id field in the SCSI inquiry page.

```
# echo $Phys | raidscan -find inst
DEVICE_FILE      Group PairVol  PORT    TARG  LUN M  SERIAL  LDEV
Harddisk3        oradb oradev1  CL1-A    3     0 -  91203116  17
Harddisk3        oradb oradev1  CL1-A    3     0 0  91203116  17
```

**Figure 10-40 Raidscan Command -find inst Option**

If multiple device files were shared (linked) within the same LDEV, the first one founded would be registered as the device file name.

The output of the raidscan command with **-find inst** option includes:

- **Group:** Shows the group name (dev\_group) defined in the configuration definition file. If "-" is displayed, the device that corresponds to this group does not exist in the configuration definition file.
- **PairVol:** Shows the dev\_name defined in the configuration definition file.
- **Port:** Shows the port name defined in the configuration definition file.
- **TARG:** Shows the target ID defined in the configuration definition file.
- **VOL:** Shows the volume number defined in the configuration definition file.
- **M:** Shows the MU# defined in the configuration definition file.
- **SERIAL:** Shows the production (serial#) number of the disk array.
- **LDEV:** Shows the LDEV# within the disk array. LDEV indicates volume.

```
# echo $Phys | raidscan -find verify
DEVICE_FILE      Group PairVol  PORT    TARG  LUN M  SERIAL  LDEV
Harddisk0        oradb oradev1 CL1-A    3      0 0  91203501  17
Harddisk1        oradb oradev2 CL1-A    3      1 0  91203501  18
Harddisk3        -     -       -        -     - 0  91203501  19

# iocsan -fun | grep rdsd | raidscan -find verify 1 -fd
DEVICE_FILE      Group PairVol  Device_File M  SERIAL  LDEV
Harddisk0        oradb oradev1  C0t3d0    1  91203501  17
Harddisk1        oradb oradev2  Unknown   1  91203501  18
Harddisk2        -     -       -          1  91203501  19
```

**Figure 10-41 Raidscan Command -find verify Option**

If the contents displayed in `DEVICE_FILE` and `Device_File` is different, it indicates that the volumes are shared (linked) within the same LDEV. If "Unknown" is displayed in `Device_File`, this volume is not registered, so the pair operation (except for local options) is rejected in the protection mode.

The output of the `raidscan` command with **-find verify** option includes:

- **Group:** Shows the group name (`dev_group`) described in the configuration definition file. If "-" is displayed, the device that corresponds to this group does not exist in the configuration definition file.
- **PairVol:** Shows the `dev_name` described in the configuration definition file.
- **Device\_File:** Shows the device file registered in HORCM.
- **Port:** Shows the port name described in the configuration definition file.
- **TARG:** Shows the target ID described in the configuration definition file.
- **VOL:** Shows the volume number described in the configuration definition file.
- **M:** Shows the MU# described in the configuration definition file.
- **SERIAL:** Shows the production (serial#) number of the array.
- **LDEV:** Shows the LDEV# within the disk array. LDEV indicates volume.

```
# type hormperm.conf | raidscan -find conf 0 -g ORA
HORCM_DEV
#dev_group      dev_name  port#    TargetID    VOL#      MU#
Harddisk14      SER =91206145 LDEV =   2 [FIBRE FCTBL = 4]
ORA             ORA_000    CL2-A      0          0          0
Harddisk15      SER =91206145 LDEV =   3 [FIBRE FCTBL = 4]
ORA             ORA_001    CL2-A      0          1          0
Harddisk16      SER =91206145 LDEV =   4 [FIBRE FCTBL = 4]
ORA             ORA_002    CL2-A      0          2          0
Harddisk17      SER =91206145 LDEV =   5 [FIBRE FCTBL = 4]
ORA             ORA_003    CL2-A      0          3          0
#ERROR [CMDDEV] Harddisk0      SER =91206145 LDEV = 9 [DF600F-CM]
```

**Figure 10-42 Raidscan Command -find conf Option**

If a command device is included in the STDIN device, a comment is displayed as follows and the target device will not be included.

```
#ERROR [CMDDEV] Harddisk0      SER =91206145 LDEV = 9 [DF600F-CM]
```

- If an STDIN device is shared by multiple device files and is displayed as target device, a comment is displayed as follows and the target device will not be included.

```
#ERROR [LDEV LINK] Harddisk17    SER =91206145 LDEV = 5 [FIBRE FCTBL = 4]
```

- If the STDIN device does not have a proper MU#, a comment is displayed as follows and the target device will not be included.

```
#ERROR [INVALID MUN(2<1)] Harddisk17    SER =91206145 LDEV = 5 [DF600F ]
```

- If the STDIN device is mixed between the arrays that have different mirroring control, a comment is displayed as follows and the target device will be not be included.

```
#ERROR [MIXING RAID TYPE] Harddisk17    SER =91206145 LDEV = 5 [DF600F ]
```

The following is an example of synchronizing (flushing) the system buffer that corresponds to group ORB in the configuration definition file.

```
raidscan -pi $Volume -find sync -g ORB
[SYNC] : ORB ORB_000[-] -> \Dmt1\Dsk1 : Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}
[SYNC] : ORB ORB_001[-] -> \Dmt1\Dsk2 : Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}
[SYNC] : ORB ORB_002[-] -> \Dmt1\Dsk3 : Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}
```

**Figure 10-43 Raidscan Command -find sync Option Example (1)**

The following is an example of synchronizing (flushing) the system buffer that corresponds to all groups in the CCI local instance.

```
[SYNC] : ORA ORA_000[-] -> \Vol144\Dsk0: Volume{56e4954a-28d5-4824-a408-3ff9a6521e5d}
[SYNC] : ORA ORA_000[-] -> \Vol145\Dsk0: Volume{56e4954a-28d5-4824-a408-3ff9a6521e5e}
[SYNC] : ORB ORB_000[-] -> \Dmt1\Dsk1 : Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}
[SYNC] : ORB ORB_001[-] -> \Dmt1\Dsk2 : Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}
[SYNC] : ORB ORB_002[-] -> \Dmt1\Dsk3 : Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}
```

**Figure 10-44 Raidscan Command -find sync Option Example (2)**

## Using the raidar command

The **raidar** command displays configuration, status, and I/O activity information for the specified disk array port/TIDs/devices at the specified time interval. The configuration information is acquired directly from the disk array (not from the configuration definition file). [Table 10-19](#) lists and describes the raidar command parameters. [Figure 10-45](#) shows an example of the raidar command and its output.

- The I/O activity of a ShadowImage/SnapShot S-VOL in the COPY or PAIR state includes only host-requested I/Os. The I/O activity of a P-VOL or simplex volume includes only host-requested I/Os. If state changed into SMPL in S-VOL (COPY, PAIR) I/O actively, and then I/O activity of the between is reported in the SMPL state.
- The disk array has I/O activity information to be displayed for each controller. Therefore, To display the I/O information using this command, when creating the configuration definition file, you must set the command device that is specified by the controller that accepts the host I/O.

**Table 10-19 Raidar Command Parameters**

Parameter	Value
Command Name	raidar
Format	raidar { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -p <port> <targ> <lun> <mun>   -pd[g] <raw_device>   -s [interval] [count] }
Options	<p><b>-h</b>: Displays Help/Usage and version information.</p> <p><b>-q</b>: Terminates the interactive mode and exits the command.</p> <p><b>-z</b> or <b>-zx</b>: Makes the raidar command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x</b>: Specifies the sub-command of Windows.</p> <p><b>-xh</b>: Displays Help/Usage the sub-command of Windows</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b>: Specifies the instance number and the command execution environment.</p> <p><b>-p &lt;port&gt; &lt;targ&gt; &lt;lun&gt; &lt;mun&gt;....</b>: Monitors one or more (up to 16) devices at a time.  <b>&lt;port&gt;</b>: Specifies the port to be reported: CL1-A to CL1-H and CL2-A to CL2-H. This option must be specified.  <b>&lt;targ&gt;</b>: Specifies the SCSI/Fibre target ID (0 to 15) of the specified port.  <b>&lt;lun&gt;</b>: Specifies the VOL (0 to 7) on the specified TID.  <b>&lt;mun&gt;</b>: Specifies the MU number of the specified VOL.</p> <p><b>-pd[g] &lt;raw_device&gt;</b>: Allows designation of an LDEV by raw device file name. <b>-pdg</b> option is specified to find host group and to display VOL.</p> <p><b>-s [interval]</b> or <b>-sm [interval]</b>: Designates the time interval in seconds.  <b>-s</b>: Interprets the time interval as seconds.  <b>-sm</b>: Interprets the time interval as minutes.  <b>[ interval]</b>: Designates the time interval value (1 to 60). If the interval is not specified, the default interval (3) is used.  <b>[count]</b>: Designates number of repeats. When omitted, this command repeats until Cntl-C.</p>

Time interval  
↓

This line indicates no I/O activity for the specified port/TID(s)/LUN(s).  
↙

# raidar	-p	cll-a	15	6	-p	cll-b	14	5	-p	cll-a	12	3	-s	3
TIME[03]	PORT	T	L	VOL	STATUS	IOPS	HIT(%)	W(%)	IOCNT					
13:45:25	-	-	-	-	-	-	-	-	-					
13:45:28	CL1-A	1	6-0	SMPL	-	200.0	80.0	40.0	600					
	CL1-B	1	5-0	P-VOL	PAIR	133.3	35.0	13.4	400					
	CL1-A	1	3-0	P-VOL	PSUS	200.0	35.0	40.6	600					
	CL1-A	1	7-0	*** Can't report activity on this Vol. ***										

**Note:** When a device is not mapped to LU, the output status will display "\*\*\*\*Can't report activity on this Vol.\*\*\*\*". Verify that the device is mapped.

**Figure 10-45 Raidar Command Example**

The output of the raidar command includes:

- **TIME [ ]:** Shows the interval time.
- **PORT:** Shows the port name of the disk array.
- **T:** Shows the port ID.
- **L:** Shows the volume number in the target ID of the disk array.
- **VOL:** Shows the volume attribute (P-VOL, S-VOL, SMPL).
- **STATUS:** Shows the pair status of the paired volume.
- **IOPS:** Shows the number of I/Os (read/write) per second (total I/O rate).
- **HIT(%):** Shows the hit rate for read I/Os (read hit rate).
- **W(%):** Shows the ratio of write I/Os to total I/Os (percent writes).
- **IOCNT:** Shows the number of times of write and read.

## Using the raidqry command

The raidqry command (RAID query) displays the configuration of the connected host and disk array. [Table 10-20](#) lists and describes the raidqry command parameters. [Figure 10-46](#) shows an example of the raidqry command output.

**Table 10-20 Raidqry Command Parameters**

Parameter	Value
Command Name	raidqry
Format	raidqry { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -l   -r <group>   [ -f ]   -g }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits the command.
	<b>-z</b> or <b>-zx</b> : Makes the raidqry command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-l</b> : Displays the configuration information for the local host and the local disk array.
	<b>-r &lt;group&gt;</b> : Displays the configuration information for the remote host and the remote disk array that contains the specified group.
	<b>-f</b> : Displays the hostname (ip_address) as specified in the configuration definition file. Use this option if "floatable IP address" is used for the hostname (ip_address) in the configuration file.
	<b>-g</b> : Displays the all group name as specified in the configuration definition file.

```
# raidqry -l
No Group      Hostname      HORCM_ver  Uid  Serial#      Micro_ver  Cache(MB)
1 ---         HOSTA         01-25-03/05  0  91210061     09-10-A0/00  4096

# raidqry -r oradb
No Group      Hostname      HORCM_ver  Uid  Serial#      Micro_ver  Cache(MB)
1 oradb       HOSTB         01-25-03/05  0  91210062     09-10-A0/00  4096

# raidqry -l -f
No Group      Floatable Host  HORCM_ver  Uid  Serial#      Micro_ver  Cache(MB)
1 ---         xxx.xxx.xxx.xxx 01-25-03/05  0  91210061     09-10-A0/00  4096

# raidqry -g
Gno  Group      RAID_type  IV/H  IV/M  MUN/H  MUN/M
1    vg01      HTC_DF     8     6     1     14
```

**Figure 10-46 Raidqry Command**

The output of the raidqry command includes:

- **No:** Shows the order when the group name (dev\_group) described in the configuration definition file has multiple remote hosts.
- **Group:** When the **-r** or **-g** option is used, this column shows the group name (dev\_group) described in the configuration definition file.
- **Hostname:** When the **-l** option is used, this column shows the host name of the local host. When the **-r** option is used, this column shows the remote host name for the group (dev\_group) which is described in the configuration definition file. The host name with more than or equal to 30 characters cannot be displayed.
- **Floatable Host:** When the **-f** option is used, this column shows the host name (ip\_address) described in the configuration definition file. Up to 30 host names can be displayed. The **-f** option interprets the host name as utilizing floatable IP for a host.
- **HORCM\_ver:** Shows the version of the HORC Manager on the local or remote host. The **-l** option specifies local host. The **-r** option specifies remote host.
- **Uid Serial# Micro\_ver:** Shows the unitID, serial number, and firmware version of the disk array connected to the local or remote host. The **-l** option specifies local host. The **-r** option specifies remote host.
- **Cache(MB):** Shows the logical cache capacity (in MB) of the disk array connected to the local or remote host. The **-l** option specifies local host. The **-r** option specifies remote host.
- **Gno:** When the **-g** option is used, this column shows as order when the group name (dev\_group) described in the configuration definition file.
- **RAID\_type:** When the **-g** option is used, this column shows the type of RAID configured a group.
- **IV/H:** When the **-g** option is used, this column shows the interface version for TrueCopy/TCE that made the consistence in a group, this is used for the maintenance.
- **IV/M:** When the **-g** option is used, this column shows the interface version for ShadowImage/SnapShot that made the consistence in a group, this is used for the maintenance.
- **MUN/H:** When the **-g** option is used, this column shows the number of maximum MUs for TrueCopy/TCE that made the consistence in a group.
- **MUN/M:** When the **-g** option is used, this column shows the number of maximum MUs for ShadowImage/SnapShot that made the consistence in a group.

## Protecting volume data

The disk array supports parameters for data protection of each volume, and these parameters are set through the command device using CCI. CCI supports the following three commands in order to set and verify these parameters for data protection of each volume.

- **raidvchkset:** Sets the data protection parameter to the specified volumes.
- **raidvchkdsp:** Shows the data protection parameter on the specified volumes based on CCI configuration definition file.
- **raidvchkscan:** Shows the parameter for data protection on the specified ports based on the raidscan command.

CCI will report the following message to the syslog file as validation error when each statistical information counted an error will be updated:

```
[HORCM_103] Detected a validation check error on this volume(0000
unit#0,ldev#0) : CfEC=n, MNEC=n, SCEC=n, BNEC=n
```

When the volume concerned has been set as a protected volume using the `raidvchkset` command, the following restrictions are placed.

- The setting with the `raidvchkset -vg svd` or `raidvchkset -vg idb` can be performed without using the license key for Data Retention, but the setting cannot be released by Hitachi Storage Navigator Modular 2. In regard to a volume for which the setting has been made using the `raidvchkset -vg svd` or `raidvchkset -vg idb`, operations such as deleting and formatting of it are restricted. To release the setting, issue the `raidvchkset -vg` command.
- When setting the data protection for a UNIX file system volume, unmount the volume, and then mount it as a read-only volume to use it.  
For a Windows Server file system, you have to use “-x mount” and “-x umount” option of CCI commands with above procedures.
- When changing a configuration of the LVM including a protected volume, the volume concerned must be temporarily placed in the status in which the check on it is inhibited by the `raidvchkset -vg` command.  
Place the volume again in the status in which it is checked when the LVM configuration change is completed.
- There may be a case where a volume to which the data protection is applied cannot be used as a resource of the HA cluster software (such as the MSCS). This is because the HA cluster software (such as the MSCS) writes management information in the management area periodically in order to check propriety of the resource.
- When setting a volume being used by Windows Server as a protected volume, protection can be applied to a basic disk only. When the protection is applied to a dynamic disk, the volume is not recognized correctly.
- Some OS cannot be recognized VOLs over VOL#1, if VOL#0 will being set to the “inv” as the attribute of the data protection, the reason is that some HBA driver does not scan all VOLs on a port, if VOL#0 will be invisible.

## Using the raidvchkset command

The raidvchkset command sets the parameters for data protection of the specified volumes, and can also be used to turn off all data protection without specifying [type]. Unit of protection for data is based on the group of CCI configuration definition file.

[Table 10-21](#) lists and describes the raidvchkset command parameters.

**Table 10-21 Raidvchkset command parameters**

Parameter	Value
Command Name	raidvchkset
Format	raidvchkset { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol> -d[g] <raw_device> [MU#]   -d[g] <seq#> <LDEV#> [MU#]   -nomsg   -vg [type][rtime] }
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-q</b> : Terminates the interactive mode and exits the command.
	<b>-z</b> or <b>-zx</b> : Makes the raidvchkset command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.
	<b>-x</b> : Specifies the sub-command of Windows.
	<b>-xh</b> : Displays Help/Usage the sub-command of Windows.
	<b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b> : Specifies the instance number and the command execution environment.
	<b>-g &lt;group&gt;</b> : Specifies a group name written in the configuration definition file.
	<b>-d &lt;pair Vol&gt;</b> : Specifies paired logical volume name defined in the configuration definition file. When this option is specified, the command is executed for the specified paired logical volume.
	<b>-d[g] &lt;raw_device&gt; [MU#]</b> : Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g <group>" option. If the specified the raw_device is contained in two or more groups, the command is executed on the first group.
	<b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]</b> : Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g <group>" option. If the specified LDEV is contained in two or more groups, the command is executed on the first group. The <b>&lt;seq #&gt;</b> <b>&lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x ") or decimal notation.
	<b>-nomsg</b> : Suppresses messages to be displayed when this command is executed. It is used to execute this command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.

Parameter	Value
	<p><b>-vg [type]</b>: Specifies the following data type that assumes the target volumes as data protection. If <b>[type]</b> is not specified, then this option will disable all of the protection.</p> <p><b>Note</b>: When you specify <b>inv</b>, <b>sz0</b>, <b>rwd</b>, or <b>wtd</b> as the <b>-vg</b> option, specify <b>svd</b>.</p> <p><b>Inv</b>: The object volume is prohibited from reading/writing, the size zero in reply to the Read Capacity command, and is hidden from the Inquiry command.</p> <p><b>Sz0</b>: The object volume is prohibited from reading/writing, and the size zero in reply to the Read Capacity command.</p> <p><b>Rwd</b>: It is prohibited to read/write from/to the object volume.</p> <p><b>Wtd</b>: It is prohibited to write from/to the object volume.</p> <p><b>Svd</b>: It is inhibited to assign the object volume in the SMPL status to an S-VOL.</p> <p><b>Idb</b>: The object volume is hidden from the Inquiry command only.</p> <p><b>[rtime]</b>: Specifies the retention time, in units of day. If <b>[rtime]</b> is not specified, the default time defined by the disk array will be used. The default time is "zero". When specifying "infinite", specify it as "--".</p>
Returned values	<p>Normal termination: 0.</p> <p>Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.</p>

```
# raidvchkset -g vg01 -d oradb1 -vg wtd svd 365
```

**Figure 10-47 Raidvchkset command examples with -vg options**

## Using the raidvchkdsp command

The raidvchkdsp command displays the parameters for data protection of the specified volumes. Unit of protection for the data is based on the group of CCI configuration definition file. [Table 10-22](#) lists and describes the raidvchkdsp command parameters. [Figure 10-48](#) shows examples of the raidvchkdsp command.

**Table 10-22 Raidvchkdsp command parameters**

Parameter	Value
Command Name	raidvchkdsp
Format	raidvchkdsp { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g <group>   -d <pair Vol> -d[g] <raw_device> [MU#]   -d[g] <seq#> <LDEV#> [MU#]   [-f[xd]]   [-v gflag]   [-v pool]   -c }
Options	<p><b>-h</b>: Displays Help/Usage and version information.</p> <p><b>-q</b>: Terminates the interactive mode and exits the command.</p> <p><b>-z</b> or <b>-zx</b>: Makes the raidvchkdsp command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x</b>: Specifies the sub-command of Windows.</p> <p><b>-xh</b>: Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b>: Specifies the instance number and the command execution environment.</p> <p><b>-g &lt;group&gt;</b>: Specifies a group name written in the configuration definition file.</p> <p><b>-d &lt;pair Vol&gt;</b>: Specifies paired logical volume name defined in the configuration definition file. When this option is specified, the command is executed for the specified paired logical volume.</p> <p><b>-d[g] &lt;raw_device&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified the raw_device is contained in two or more groups, the command is executed on the first group.</p> <p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specification of "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is executed on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x ") or decimal notation.</p> <p><b>-fx</b>: Displays the LDEV number in hexadecimal.</p> <p><b>-fd</b>: Displays the relation between the Device_File and the paired Volumes, based on the Group (as defined in the local instance configuration definition file). If Device_File column shows "Unknown" to HOST (instance) (<a href="#">Figure 10-48</a>), then the volume is not recognized on own HOST, and raidvchkdsp command will be rejected in protection mode. Non-permitted volume is shown without LDEV# information (LDEV# is " - ").</p> <p><b>-v [op]</b>: Specifies the following operation that displays each parameter for data protection:  <b>gflag</b>: Displays all flags for protection regarding data block protection for target vols (see <a href="#">Figure 10-48</a>).  <b>pool</b>: This option shows the usage of the pool (see <a href="#">Figure 10-49</a>).</p> <p><b>-c</b>: When this option is specified, the command checks whether the relation between the connecting path of the volume described in the configuration definition file and the volume was changed or not and displays only the configurations changed illegally.</p>

Parameter	Value
Returned values	Normal termination: 0. Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.

# raidvchkdsp -g vg01 -fd -v gflag ← Example of -v gflag option.									
Group	PairVol	Device_File	Seq#	LDEV#	GI-C-R-W-S	PI-C-R-W-S	R-Time		
vg01	oradb1	Unknown	91200067	3	D D D D D	E E E D D	365		
vg01	oradb2	Unknown	91200067	4	E E E E E	E E E E E	-		

**Figure 10-48 Raidvchkdsp command examples with -fd and -v gflag options**

The output of the raidqvchkdsp command with **-v gflag** option includes:

- **Group:** Shows the group name (dev\_group) described in the configuration definition file.
- **Pair Vol:** Shows the paired volume name (dev\_name) described in the configuration definition file.
- **Device\_File:** Shows the device file registered in HORCM.
- **Seq#:** Shows the serial number of the disk array.
- **LDEV#:** Shows the logical device number. LDEV indicates volume.
- **GI-C-R-W-S:** This displays the flags for guarding as for the target volume.  
I=E: The volume is permitted to accept the Inquiry command.  
I=D: The volume is not permitted to accept the Inquiry command.  
C=E: The volume returns the formal volume size in reply.  
C=D: The volume returns the size zero in reply.  
R=E: It is permitted to read from/to the object volume.  
R=D: It is prohibited to read from/to the object volume.  
W=E: It is permitted to write from/to the object volume.  
W=D: It is prohibited to write from/to the object volume.  
S=E: The volume can be assigned to an S-VOL.  
S=D: The volume cannot be assigned to an S-VOL.
- **PI-C-R-W-S:** This displays the permission flags that shows whether each mode flags can be changed to enable or not.  
I=E: This shows that "I" flag can be changed to enable.  
I=D: This shows that "I" flag cannot be changed to enable.  
C=E: This shows that "C" flag can be changed to enable.  
C=D: This shows that "C" flag cannot be changed to enable.  
R=E: This shows that "R" flag can be changed to enable.  
R=D: This shows that "R" flag cannot be changed to enable.

W=E: This shows that “W” flag can be changed to enable.

W=D: This shows that “W” flag cannot be changed to enable.

S=E: This shows that “S” flag can be changed to enable.

S=D: This shows that “S” flag cannot be changed to enable.

- **R-Time:** The term of protection set for the volume is displayed with a number of days. When “-” is displayed, it means that the term is indefinite. Expiration Lock status is shown as the retention time plus 1000000. “R-Time + 1000000” shows the retention time with Expiration Lock status.

# raidvchkdsp -g vg01 -d oradb1 -v pool										← Example of -v pool option.
Group	PairVol	Port#	TID	VOL	Seq#	LDEV#	Bsize	Available	Capacity	
vg01	oradb1	CL1-A	1	2	91200015	2	2048	1024	3072	

**Figure 10-49 Raidvchkdsp Command Examples with -v pool Options**

The output of the raidvchkdsp command with **-v pool** option includes:

- **Group:** Shows the group name (dev\_group) described in the configuration definition file.
- **Pair Vol:** Shows the paired volume name (dev\_name) described in the configuration definition file.
- **Port#:** Shows the device file registered in HORCM.
- **TID:** Shows the target ID.
- **VOL:** Shows the volume number in the target ID of the disk array.
- **Seq#:** Shows the serial number of the disk array.
- **LDEV#:** Shows the logical device number. LDEV indicates volume.
- **Bsize:** The unit of Available and Capacity is shown by block (1 block = 512 bytes). The unit of Available and Capacity becomes 1 MB (= 2048 blocks) in the example of a display in [Figure 10-49](#).
- **Available:** Shows the available capacity for the volume data on the pool.
- **Capacity:** Shows the total capacity in the pool.

# raidvchkdsp -g vg01 -c									
Group	PairVol	Port#	TID	VOL	Seq#	LDEV#	LDEV# (conf)	-change->	LDEV#
vg01	oradb1	CL1-A	1	2	91200015	-	2 (conf)	-change->	NO LDEV

**Figure 10-50 Raidvchkdsp Command Examples with -c Options**

The output of the raidvchkdsp command with **-c** option includes:

- **Group:** Shows the group name (dev\_group) described in the configuration definition file.
- **Pair Vol:** Shows the paired volume name (dev\_name) described in the configuration definition file.

- **Port#**: Shows the device file registered in HORCM.
- **TID**: Shows the target ID.
- **VOL**: Shows the volume number in the target ID of the disk array.
- **Seq#**: Shows the serial number of the disk array.
- **LDEV#**: Shows the logical device number. LDEV indicates volume.
- **LDEV#(conf)**: Shows the volume number that was described in the configuration definition file at the time of the instance start.

## Using the raidvchkscan command

The raidvchkscan command displays the fibre or iSCSI port of the disk array, target ID, LDEV mapped for VOL# and the parameters for data protection, regardless of the configuration definition file. [Table 10-23](#) lists and describes the raidvchkscan command parameters. [Figure 10-51](#) shows examples of the raidvchkscan command.

**Table 10-23 Raidvchkscan Command Parameters**

Parameter	Value
Command Name	raidvchkscan
Format	raidvchkscan { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -p <port> [hgrp]   -pd[g] <raw_device>   -s <seq#>   -t <target>   -l <lun>   [ -f[x] ]   [-v gflag]   [-v pid] }
Options	<p><b>-h</b>: Displays Help/Usage and version information.</p> <p><b>-q</b>: Terminates the interactive mode and exits the command.</p> <p><b>-z</b> or <b>-zx</b>: Makes the raidscan command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x</b>: Specifies the sub-command of Windows.</p> <p><b>-xh</b>: Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b>: Specifies the instance number and the command execution environment.</p> <p><b>-p &lt;port&gt; [hgrp]</b>: Specifies the port ID of the disk array port to be scanned. Valid ports are CL1-A to CL1-H and CL2-A to CL2-H. This option must always be specified. <b>[hgrp]</b> is specified to display only the LDEVs mapped to a host group on a port for disk array.</p> <p><b>-pd[g] &lt;raw_device&gt;</b>: Specifies the raw device name. This option finds Seq# and port_name of the disk array that the specified device can be connected, and scans the port of the disk array which corresponds with the unit ID that searches the unit ID from Seq#. This option must always be specified.</p> <p><b>-pdg</b> option is specified to find host group and to display VOL.</p> <p><b>-s &lt;Seq#&gt;</b>: Used to specify the Seq# of the disk array when this option can't specify the unit ID which is contained for "-p &lt;port&gt;" option. This option scans the port specified by "-p &lt;port&gt;" option of the disk array which corresponds with the unit ID that searches the unit ID from Seq#. If this option is specified, then the unit ID which is contained in "-p &lt;port&gt;" option is invalid.</p> <p><b>-t &lt;targ&gt;</b>: Specifies a target ID (0 to 15) of the specified port. If this option is not specified, the command applies to all target IDs.</p>

Parameter	Value
	<b>-l &lt;lun&gt;</b> : Specifies a VOL (0 to 7) of the specified target ID. If this option is not specified, the command applies to all VOLs. If this option is specified, the TID must also be specified. <b>-fx</b> : Displays the LDEV number in hexadecimal notation. <b>-v [op]</b> : Specifies the following operation that displays each parameter for data protection: <b>gflag</b> : Displays all flags for data regarding data block protection for target vols (see <a href="#">Figure 10-51</a> ). <b>pid</b> : This option shows the usage of the pool. The displayed contents are same as the pairedisplay -v pid.
Returned values	Normal termination: 0. Abnormal termination: Returns a common error code and a unique error code for this command. For details on error codes, see Chapter 10.

```
# raidvchkscan -p CL1-A -v gflag
PORT# /ALPA/C TID# VOL# Seq# Num LDEV# GI-C-R-W-S PI-C-R-W-S R-Time
CL1-A /ef/ 0 0 2 91202332 1 2 D D D D D E E E D D 365
CL1-A /ef/ 0 0 3 91202332 1 3 E E E E E E E E E E -
```

**Figure 10-51 Raidvchkscan command example with -v gflag option**

The output of the raidqvchkscan command with **-v gflag** option includes:

- **Port#**: Shows the port name of the disk array.
- **ALPA/C**: For the fibre channel, shows the physical address of the Fibre channel in a port. For iSCSI, displayed "ef" always.
- **TID#**: Shows the target ID of the disk array.
- **VOL#**: Shows the volume number.
- **Seq#**: Shows the production (serial#) number of the disk array.
- **Num**: Shows the number of volumes that constitute volume# (one fixed).
- **LDEV#**: Shows the LDEV# within the disk array. LDEV indicates volume.
- **GI-C-R-W-S**: This displays the flags for guarding as for the target volume.  
I=E: The volume is permitted to accept the Inquiry command.  
I=D: The volume is not permitted to accept the Inquiry command.  
C=E: The volume returns the formal volume size in reply.  
C=D: The volume returns the size zero in reply.  
R=E: It is permitted to read from/to the object volume.  
R=D: It is prohibited to read from/to the object volume.  
W=E: It is permitted to write from/to the object volume.  
W=D: It is prohibited to write from/to the object volume.  
S=E: The volume can be assigned to an S-VOL.  
S=D: The volume cannot be assigned to an S-VOL.

- **PI-C-R-W-S:** This displays the permission flags that shows whether each mode flags can be changed to enable or not.  
I=E: This shows that "**I**" flag can be changed to enable.  
I=D: This shows that "**I**" flag cannot be changed to enable.  
C=E: This shows that "**C**" flag can be changed to enable.  
C=D: This shows that "**C**" flag cannot be changed to enable.  
R=E: This shows that "**R**" flag can be changed to enable.  
R=D: This shows that "**R**" flag cannot be changed to enable.  
W=E: This shows that "**W**" flag can be changed to enable.  
W=D: This shows that "**W**" flag cannot be changed to enable.  
S=E: This shows that "**S**" flag can be changed to enable.  
S=D: This shows that "**S**" flag cannot be changed to enable.
- **R-Time:** The term of protection set for the volume is displayed with a number of days. When "-" is displayed, it means that the term is indefinite.  
Expiration Lock status is shown as the retention time plus 1000000.  
"R-Time + 1000000" shows the retention time with Expiration Lock status.

# Controlling CCI activity

## Using the horcmstart command

The **horcmstart** command is a shell script that starts the HORCM application (/etc/horcmgr). This shell script also sets the environment variables for HORCM as needed (for example, HORCM\_CONF, HORCM\_LOG, HORCM\_LOGS). [Table 10-24](#) lists and describes the **horcmstart** command parameters.

**Table 10-24 Horcmstart command parameters**

Parameter	Value
Command Name	horcmstart
Format	horcmstart.sh { inst ... } horcmstart.exe { inst ... }
Options	<p><b>Inst:</b> Specifies the HORCM instance number (numerical value). When this option is specified, the horcmstart shell script sets the environment variables (HORCMINST, HORCM_CONF, HORCM_LOG, HORCM_LOGS) that correspond to the instance number, and starts the specified HORCM instance. (Environment variables set by the user become invalid.) When this option is not specified, the horcmstart shell script starts<sup>[1]</sup> HORCM and uses the environment variables set by the user. If you have designated full environment variables, you should use horcmstart.sh without any arguments. If you did not designate environment variables (HORCM_CONF, HORCM_LOG, HORCM_LOGS), then this shell script sets the environment variables as follows:</p> <p>For UNIX-based platforms:</p> <p>If HORCMINST is specified: HORCM_CONF = /etc/horcm*.conf (* is instance number) HORCM_LOG = /HORCM/log*/curlog HORCM_LOGS = /HORCM/log*/tmplog</p> <p>If no HORCMINST is specified: HORCM_CONF = /etc/horcm.conf HORCM_LOG = /HORCM/log/curlog HORCM_LOGS = /HORCM/log/tmplog</p> <p>For Windows Server platform:</p> <p>If HORCMINST is specified: HORCM_CONF = \WINDOWS\horcm*.conf (* is instance number) HORCM_LOG = \HORCM\log*\curlog HORCM_LOGS = \HORCM\log*\tmplog</p> <p>If no HORCMINST is specified: HORCM_CONF = \WINDOWS\horcm.conf HORCM_LOG = \HORCM\log\curlog HORCM_LOGS = \HORCM\log\tmplog</p>
<p><b>Note 1:</b> The <b>HORCM_LOGS</b> environment variable is used to specify the log file directory for automatic storing. When HORCM starts up, the log files created in the operation are stored automatically in the HORCM_LOGS directory. This log directory must give an equality class with HORCM_LOG.</p> <p><b>Note 2:</b> The <b>HORCMSTART_WAIT</b> environment variable waits until HORCM becomes ready for use setting an appropriate time. However, this time may take longer than it is required, depending on an operating system to be used, an HBA driver, or a command device. As a result, a time-out may occur exceeding this waiting time and the start may fail (the process exists in the status where HORCM is starting). In such a case, start HORCM setting the waiting time for the variable. The waiting time must be specified more than 5 seconds and multiple of 5 seconds.</p>	

When this command is started in the status where a file under the HORCM\_LOG and HORCM\_LOGS directory is opened in the case of Windows Server, the operation will terminate abnormally. In this case, take actions as shown below since a message, which informs that the file cannot be deleted or moved, is output.

- When a file under the HORCM\_LOG and HORCM\_LOGS directory is opened, close the file, and then start the command.
- Investigate whether the program, which traces the directories and the files in the drive, is operating in the background as a service (such as CL and DTC service). If it is possible that the program collides with the service, start the program by adjusting the time.

## Using the horcmshutdown command

The **horcmshutdown** command is a shell script for stopping the HORCM application (/etc/horcmgr). [Table 10-25](#) describes the shutdown command parameters.

**Table 10-25 Horcmshutdown command parameters**

Parameter	Value
Command Name	horcmshutdown
Format	horcmshutdown.sh {inst...} horcmshutdown.exe {inst...}
Option	<p><b>Inst:</b> Specifies the HORCM (CCI) instance number (numerical value). When this option is specified, the command stops the specified HORCM instance. When this option is not specified, the command refers to the instance (environment variable HORCMINST) of the execution environment of this shell script and stops the following the HORCM instance.</p> <p>When HORCMINST is specified, this command stops the HORCM instance of the execution environment of this shell script.</p> <p>When HORCMINST is not specified, this command stops the HORCM having no instance setting.</p> <p><b>Note:</b> This command instructs the HORCM instance to stop and receives a response immediately before the HORCM instance stops. Therefore, the response to this command does not mean that the HORCM instance has disappeared.</p>

## Using the horcctl command

The HORCM software has logs that identify the cause of software and/or hardware errors as well as a tracing function for investigating such errors. The location of the log files depends on the user's command execution environment and the HORC Manager's execution environment. The command trace file and core file reside together under the directory specified in the HORC Manager's execution environment.

The **horcctl** command can be used for both maintenance and troubleshooting. The horcctl command allows you to change and display the internal trace control parameters (for example, level, type, buffer size) of the HORC Manager commands. If a new value for a parameter is not specified, the current trace control parameter is displayed. [Table 10-26](#) lists and describes the horcctl command parameters.



**Caution:** Do not change the trace level unless directed to do so by a Hitachi representative. Level 4 is the normal trace level setting. Levels 0-3 are for troubleshooting. Setting a trace level other than 4 may impact problem resolution. If you request a change of the trace level using the **horcctl -l <level>** command, a warning message is displayed, and this command enters interactive mode.

**Table 10-26 Horcctl command parameters**

Parameter	Value
Command Name	horcctl
Format	horcctl { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -d   -c   -l <level>   -b <y/n>   -s <size(KB)>   -t <type>   -S   -D   -C   [-u <-unitid>   -ND   -NC   -g <group>}
Options	<p><b>-h:</b> Displays Help/Usage and version information.</p> <p><b>-q:</b> Terminates the interactive mode and exits the command.</p> <p><b>-z</b> or <b>-zx:</b> Makes the horcctl command enter the interactive mode. The <b>-zx</b> option guards performing of HORCM in interactive mode. When this option detects a HORCM shutdown, interactive mode terminates.</p> <p><b>-x:</b> Specifies the sub-command of Windows.</p> <p><b>-xh:</b> Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]:</b> Specifies the instance number and the command execution environment.</p> <p><b>-d:</b> Interprets the control options following this option (-l &lt;level&gt;, -b &lt;y/n&gt;, -s &lt;size(kB)&gt;, and -t &lt;type&gt;) as the parameters of the CCI commands.</p> <p><b>-c:</b> Interprets the control options following this option (-l &lt;level&gt;, -b &lt;y/n&gt; and -t &lt;type&gt;) as the parameters of the HORC Manager (HORCM).</p> <p><b>-l &lt;level&gt;:</b> Sets the trace level (range = 0 to 15). If a negative value is specified, the trace mode is canceled. A negative value "n" must be specified as "-n".</p> <p><b>Caution:</b> Do not change the trace level unless directed to do so by a Hitachi representative. Level 4 is the normal trace level setting. Levels 0-3 are for troubleshooting. Setting a trace level other than 4 may impact problem resolution. If you request a change of the trace level using the <b>horcctl -l &lt;level&gt;</b> command, a warning message is displayed, and this command enters interactive mode.</p> <p><b>-b &lt;y/n&gt;:</b> Sets the trace writing mode: Y = buffer mode, N = synchronous mode.</p>

Parameter	Value
	<b>-t &lt;type&gt;</b> : Sets the trace type (range = 0 to 511). When this option is used, only traces of the specified type are output. One or more values can be specified.
	<b>-s &lt;size(KB)&gt;</b> : Changes the default trace buffer size, which is 1 MB, in units of 1,024 bytes.
	<b>-S</b> : Shuts down HORCM.
	<b>-D</b> : Displays the command device name currently used by HORCM. If the command device is blocked due to online maintenance (firmware replacement) of the array, you can check the command device name in advance using this option.
	<b>-C</b> : Changes the command device name being used by HORCM and displays the new command device name. If the command device is blocked due to online maintenance of the disk array, you can change the command device in advance using this option.
	<b>-u &lt;unitid&gt;</b> : Used to specify the unit ID of a command device as the target. This option is effective when the <b>-D</b> or <b>-C</b> option is specified. If this option is not specified, the unit ID is 0.
	<b>-ND -g &lt;group&gt;</b> : Displays the network address and port name being used by HORCM. The <b>-g &lt;group&gt;</b> option is used to specify the group name defined in the configuration definition file.
	<b>-NC -g &lt;group&gt;</b> : Changes the network address and port name being used by HORCM and displays the new network address name. The <b>-g &lt;group&gt;</b> option specifies the group name defined in the configuration definition file.

The following is an example of changing the trace level to 15.

```
C:\HORCM\etc>horcctl -d -l 15
/***** WARNING *****/
/* This is an option for maintenance, and used for troubleshooting. */
/* When it is issued, the internal trace control parameters of the HORC */
/* manager and HORC commands are changed and displayed. */
/* These trace control parameters should not be changed unless directed */
/* by a CS&S service representative. */
/* For cancel -> Enter '-q' option */
/* For continue -> Re-enter '-c ...' or '-d ...' options */
/***** WARNING *****/
horcctl[HORCM]: -q
C:\HORCM\etc>
```

**Figure 10-52 Horcctl command -d -l option**

```
C:\HORCM\etc>horcctl -d
logdir = C:\HORCM\log1\curlog
[Client]:
trace = ON
level = 4
mode = Buffer
size = 1024 KB
type = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,17,18,19...Full
```

**Figure 10-53 Horcctl command -d option**

```
: \HORCM\etc>horcctl -c
logdir = C:\HORCM\log1\curlog
[HORCM]:
trace = ON
level = 4
mode = Buffer
size = 1024 KB
type = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,17,18,19...Full
```

**Figure 10-54 Horcctl command -c option**

## About Windows Server subcommands

The CCI software provides subcommands for Windows Server platforms which are executed as options (-x <command> <arg>) of another command. When you specify a subcommand as the only option of a command, you do not need to start HORCM. If another option of the command and the subcommand is specified on the same command line, place the other option after the subcommand.

### Using the findcmddev subcommand

The **findcmddev** subcommand (find command device) searches for command devices within the specified range of disk drive numbers. If it is found, the command device is displayed in the same format as in the configuration definition file. This subcommand is used when the command device name is not known. [Table 10-27](#) lists and describes the findcmddev subcommand parameters. [Figure 10-55](#) shows an example of the findcmddev subcommand used as an option of the raidscan command output.



**Caution:** The **findcmddev** subcommand must be used when HORCM is not running.

The **findcmddev** subcommand searches for the physical and logical devices associated with the command device. If the command device is indicated as a logical device, you must delete the drive letter assigned to the command device to prevent utilization by general users. The physical drive number may change at every reboot. If the number changes, use \\.\CMD-Ser#-ldev#-Port# or Volume{guid} for which the same name is kept. Volume{guid} is created when you make a partition by using the Windows' Disk Management. Do not format.

**Table 10-27 Findcmddev subcommand parameters**

Parameter	Value
Command Name	findcmddev
Format	-x findcmddev drive#(0-N)
Argument	<b>drive#(0-N):</b> Specifies the range of disk drive numbers on the Windows system.

```
C:\HORCM\etc>raidscan -x findcmddev hdisk0,20
cmddev of Ser#91203001 = \\.\PhysicalDrive0
cmddev of Ser#91203001 = \\.\E:
cmddev of Ser#91203001 = \\.\Volume{b9b31c79-240a-11d5-a37f-00c00d003b1e}
```

**Figure 10-55 Findcmddev subcommand**

This example searches for command devices in the range of disk drive numbers 0 to 20.

## Using the drivescan subcommand

The **drivescan** subcommand displays the relationship between the disk numbers assigned by Windows Server system and the LDEVs on the disk array, and also displays attribute and status information for each LDEV. [Table 10-28](#) lists and describes the drivescan subcommand parameters. [Figure 10-56](#) shows an example of the drivescan subcommand used as an option of the raidscan command and its output.

**Table 10-28 Drivescan subcommand parameters**

Parameter	Value
Command Name	drivescan
Format	-x drivescan drive#(0-N)
Argument	<b>drive#(0-N)</b> : Specifies the range of disk drive numbers on the Windows system.

```
C:\HORCM\etc>raidscan -x drivescan harddisk0,20
Harddisk 0... Port[ 1] PhId[ 0] TId[ 0] Lun[ 0] [HITACHI] [DK328H-43WS  ]
Harddisk 1... Port[ 2] PhId[ 4] TId[ 29] Lun[ 0] [HITACHI] [DF600F  ]
                Port[CL1-A] Ser#[91203005] LDEV#[ 9(0x009)]
                HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                RAID5[Group 2- 1] SSID = 0x0000
Harddisk 2... Port[ 2] PhId[ 4] TId[ 29] Lun[ 1] [HITACHI] [DF600F  ]
                Port[CL1-A] Ser#[91203005] LDEV#[ 10(0x00A)]
                HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                RAID5[Group 2- 1] SSID = 0x0000
Harddisk 3... Port[ 2] PhId[ 4] TId[ 29] Lun[ 6] [HITACHI] [DF600F-CM  ]
                Port[CL1-A] Ser#[91203005] LDEV#[ 15(0x00F)]
```

**Figure 10-56 Drivescan subcommand example**

This example displays the devices for the range of disk drive numbers from 0 to 20.

The output of the drivescan subcommand includes:

- **Harddisk #**: Shows the hard disk recognized by Windows Server system.
- **Port**: Shows the port number on the device adapter recognized by Windows Server system.
- **PhId**: Shows the bus number on the device adapter port recognized by Windows Server 2003 system.
- **Tid**: Shows the target ID of the hard disks on the specified port and bus.
- **VOL**: Shows the volume number of the hard disk on the specified port, bus, and TID.
- **Port[CLX-Y]**: Shows the port number on the disk array.
- **Ser#**: Shows the production number of the disk array.
- **LDEV#**: Shows the LDEV ID (hexadecimal) of the specified volume on the disk array. LDEV indicates volume.

- **HORC:** Shows the TrueCopy/TCE attribute (P-VOL, S-VOL, SMPL).
- **HOMRCF:** Shows the ShadowImage/SnapShot attribute (P-VOL, S-VOL, SMPL) and MU number of the specified volume.
- **RAIDX[Group ]:** Shows the physical location (frame number-parity group number) of the specified volume and the RAID level of this parity group.
- **SSID:** Shows the SSID of the specified volume.

## Using the portscan subcommand

The **portscan** subcommand displays the devices on the specified ports. lists and describes the portscan subcommand parameters. [Figure 10-57](#) shows an example of the portscan subcommand used as an option of the raidscan command and its output.

**Table 10-29 Portscan subcommand parameters**

Parameter	Value
Command Name	portscan
Format	-x portscan port#(0-N)
Argument	<b>port#(0-N):</b> Specifies the range of port numbers on the Windows system.

```
C:\HORCM\etc>raidscan -x portscan port0,20
PORT[ 0] IID [ 7] SCSI Devices
        PhId[ 0] TId[ 3] Lun[ 0] [MATSHIT] [CD-ROM CR-508 ] ...Claimed
        PhId[ 0] TId[ 4] Lun[ 0] [HP      ] [C1537A  ] ...Claimed
PORT[ 1] IID [ 7] SCSI Devices
        PhId[ 0] TId[ 0] Lun[ 0] [HITACHI ] [DK328H-43WS ] ...Claimed
PORT[ 2] IID [ 7] SCSI Devices
        PhId[ 0] TId[ 5] Lun[ 0] [HITACHI ] [DF600F      ] ...Claimed
        PhId[ 0] TId[ 5] Lun[ 1] [HITACHI ] [DF600F      ] ...Claimed
        PhId[ 0] TId[ 5] Lun[ 2] [HITACHI ] [DF600F      ] ...Claimed
        PhId[ 0] TId[ 6] Lun[ 0] [HITACHI ] [DF600F      ] ...Claimed
```

**Figure 10-57 Portscan subcommand**

This example displays the devices for the range of ports from 0 to 20.

The output of the portscan subcommand includes:

- **Port:** Shows the port number on the device adapter recognized by the Windows system.
- **IID:** Shows the initiator ID on the specified device adapter port.
- **PhId:** Shows the BUS number on the specified device adapter port.
- **Tid:** Shows the target ID of the hard disks on the specified adapter port and bus.
- **VOL:** Shows the volume number of each hard disk on the specified device adapter port/bus. This item shows LDEV# of the partner who becomes a pair in or among the disk array.

## Using the sync and syncd subcommands

The **sync** (synchronization) subcommand sends unwritten data remaining on Windows Server to the specified devices. The **syncd** (synchronization delay) subcommand waits the delayed I/O for dismount after issued “sync”.

[Table 10-30](#) lists and describes the sync and syncd subcommand parameters.

**Table 10-30 Sync and syncd subcommand parameters**

Parameter	Value
Command Name	sync syncd
Format	-x sync[d] A: B: C: ... -x sync[d] all -x sync[d] drive#(0-N) ... -x sync[d] Volume#(0-N) ... -x sync[d] D:\directory or \directory pattern ... (Windows Server systems only)
Argument	<p><b>A: B: C:[\directory or \directory pattern] ...</b> : Specifies the logical devices that you want to synchronize. The data is flushed to the specified logical device and to the physical device that corresponds to the specified logical device.</p> <p>If a directory-mounted volume exists in the specified logical device, the data will be flushed including the directory-mounted volume as follows:</p> <pre>pairsplit -x sync D: [SYNC] D: HarddiskVolume2 [SYNC] D: \hd1 HarddiskVolume8 [SYNC] D: \hd2 HarddiskVolume9</pre> <p><b>[\directory or \directory pattern] (Windows Server systems only)</b></p> <p>Specifies the directory or the directory pattern for searching the directory mount point in the logical device.</p> <p><b>If directory is specified:</b> The applicable directory-mounted volume will be flushed.</p> <pre>pairsplit -x sync D:\hd1 [SYNC] D:\hd1 HarddiskVolume8</pre> <p><b>If directory patter is specified:</b> The directory-mounted volume that matches the specified pattern will be flushed.</p> <pre>pairsplit -x sync D:\h [SYNC] D:\hd1 HarddiskVolume8 [SYNC] D:\hd2 HarddiskVolume9</pre> <p><b>all:</b> Synchronizes all logical devices. The logical device on which the CCI software is installed and the logical device containing Windows Server directory are excluded. If a directory-mounted volume exists in the specified logical device, the data will be flushed including the directory-mounted volume as follows:</p> <pre>pairsplit -x sync all [SYNC] C: HarddiskVolume1 [SYNC] D: \hd1 HarddiskVolume8 [SYNC] D: \hd2 HarddiskVolume9 [SYNC] G: HarddiskVolume10</pre> <p><b>drive#(0-N) ...:</b> Specifies the range of devices on Windows Server system.</p> <p><b>Volume#(0-N) ...:</b> Synchronizes the data to the specified LDM (logical device manager) volume. The LDM volume specifies the following device objects: \Vol#, \Dms#, \Dmt#, \Dmr#, or Volume{GUID}.</p>

Parameter	Value
Note	<p>The sync command executes the following procedures, depending on the execution condition.</p> <p>If the logical device is closed from the application, the system buffer is flushed and changes the logical device to "Dismount" status.</p> <p>If the logical device is opened from the application, the sync option flushes the system buffer only. In this case, [WARNING] will be displayed.</p> <pre>pairsplit -x sync -C: WARNING: Only flushed to [\\.\C] drive due to be opening. [SYNC] C: HarddiskVolume3</pre> <p>The syncd command executes the following procedures, depending on the execution condition.</p> <p>If the logical drives designated as the objects of the sync command will not be opened to any applications, then syncd flushes the system buffer to a drive and waits (30 sec) the delayed (paging) I/O for dismount after made the dismount state about the drive.</p> <p>This avoids a problem that NTFS on P-VOL will be split on inconsistent state because Windows Server delays the I/O for dismounting.</p>

The following examples show the sync subcommand used as an option of the pairsplit command. For the example in [Figure 10-58](#), the data remaining on logical devices C: and D: is written to disk, all pairs in the specified group are split (status = PSUS), and read/write access is enabled for all S-VOLs in the specified group.

```
pairsplit -x sync C: D: -g oradb
```

**Figure 10-58 Sync subcommand example 1**

For the example in [Figure 10-59](#), the data remaining on physical devices harddisk2 and harddisk3 is written to disk, all pairs in the specified group are deleted (status = SMPL), which enables read/write access for all secondary volumes.

```
pairsplit -x sync hdisk2 hdisk3 -g oradb -S
```

**Figure 10-59 Sync subcommand example 2**

## Using the mount subcommand

The **mount** subcommand mounts the specified drive to the specified partition on the specified hard disk drive. If the mount subcommand is executed without specifying an argument, all drives that are currently mounted are displayed. [Table 10-31](#) lists and describes the mount subcommand parameters. [Figure 10-60](#) shows example of the mount subcommand used as an option of the pairsplit command output.

For the directory mount, specify the mount point in the form of **F:\** or **D:\hdl** (with \).



**Caution:** The partition on the specified disk drive (Harddisk) must be recognized on Windows Server system. Note that when you want to not use directory mount, it will be unmounted forcibly by logging off of Windows Server system. You can avoid the Windows Server mount problems by setting USE\_MOUNTVOL\_P of the environment variable. You can avoid mount problems that is event ID1 occurrence by setting this environment variable.

**Table 10-31 Mount subcommand parameters**

Parameter	Value
Command Name	mount
Format	-x mount -x mount drive: Volume#(0-N) ... -x mount drive: [\directory] Volume#(0-N) ... (Windows Server systems only)
Arguments	<b>Drive: [\directory] Volume#:</b> For Windows Server. The drive specifies the logical device to be mounted. The hdisk# specifies the following device object names of the LDM volume to be mounted: hdisk#, \Vol#, \Dms#, \Dmt#, \Dmr#, or Volume{GUID} <b>[\directory]</b> Specifies the directory for specifying the directory mount point in the logical device. The character string of the directory cannot include space letters. pairsplit -x mount D:\hdl \Vol8 D:\hdl <+> HarddiskVolume8 pairsplit -x mount D:\hd2 \Vol9 D:\hd2 <+> HarddiskVolume9 If this command is executed without any argument, the device that is already mounted will be displayed.

When mounting it by using the mountvol command supplied with Windows Server, the character string of the specified directory can include space letters (however, do not use the mountvol command when mounting the volumes created in disk array). When the character string includes a space (example: aaa bbb), it is indicated by adding "\" to the first character string in the mount command as shown in the following example.

```
pairsplit -x mount
```

Drive	FS_name	VOL_name	Device	Partition	...	Port	PathID	Targ	Lun
D:	NTFS	Null	HarddiskVolume3		...	Harddisk2			
D:\aaa...	NTFS	Null	HarddiskVolume4		...	Harddisk3			

If the command is executed without an argument, a mounted device that contains the directory-mounted volume will be displayed. If the mounted volume is an LDM volume, the physical drive (hard disk) number that configures the LDM volume will be displayed also.

```

pairsplit -x mount F:\ hdisk2
pairsplit -x mount

```

Drive	FS_name	VOL_name	Device	Partition	...	Port	PathID	Targ	Lun
C:	NTFS	Null	Harddiskvolume1		...	Harddisk0			
F:	NTFS	Null	Harddiskvolume2		...	Harddisk1			
D:	NTFS	Null	Harddiskvolume3		...	Harddisk2			
D:\hd1	NTFS	Null	Harddiskvolume4		...	Harddisk3			
D:\hd2	NTFS	Null	Harddiskvolume5		...	Harddisk4			
G:	NTFS	Null	HarddiskDmVolumes\		...	\Volume1 ...			Harddisk5[3]

**Figure 10-60 Mount subcommand (Windows)**

This example executes mount from the pairsplit command option, mounting the F: drive to the harddiskvolume2, after the mounted devices are displayed.

The output of the mount subcommand includes:

- **Drive:** Shows the logical device recognized by Windows Server system.
- **FS\_name:** Shows the name of the file system formatted on the specified drive.
- **VOL\_name:** Shows the volume label name for the specified drive.
- **Device, Partition:** Shows the device name and partition for the specified drive.
- **Port, PathID, Targ, Lun:** Shows the port number, path ID (bus), target ID, and VOL for the specified drive.

For Windows Server system, if you specified both hdisk# and partition# arguments for the mount subcommand, the drive letters will not be displayed when the Disk Management is activated in the **Control Panel → Administrative Tools → Computer Management → Storage** folder. Even if this sub command is executed, a drive letter may not be assigned. In this case, the target volume may be used. Execute the command after making the target volume to unused status. Alternatively, a drive letter can be assigned by activating the Disk Management in the **Control Panel → Administrative Tools → Computer Management → Storage** folder.

When using Volume{guid} as argument for mount sub-command on Windows Server, the Volume{guid} of secondary volumes (S-VOL/V-VOL) of ShadowImage/SnapShot/TrueCopy/TCE is set by recognizing from OS by the Control Panel → Administrative Tools → Computer Management → Storage folder → Rescan Disks, while status is PSUS after pair create. Afterwards, the set Volume{guid} can be confirmed by "inraid.exe -CLI \$Vol -fv". However, if Volume{guid} is already set when partition is already created at SMPL status before pair create, then Volume{guid} after pair create may not be recognized even if "re-scan disk" is done at PSUS status after pair create. In case of using Volume{guid} with secondary volumes (S-VOL/V-VOL), be sure to create pair when partition is not created to the secondary volume (S-VOL/V-VOL) before pair creation.

When making a secondary volume (S-VOL or V-VOL) of ShadowImage, SnapShot, TrueCopy, or TCE recognized by a host on Windows Server, make it in a state in which the pair is placed in the PSUS status after the pair has been created. If the pair status is changed to PSUS after the pair has been recognized by a host while it has been in the PSUS status, the pair may not operate correctly thereafter because the pair status is changed to that of the primary volume (P-VOL). To recognizing from host by the Control Panel → Administrative Tools → Computer Management → Storage folder → Rescan Disks, or reboot a host.

## Using the umount subcommand

The **umount** subcommand unmounts the specified logical drive and deletes the drive letter. Before deleting the drive letter, this subcommand executes sync internally for the specified logical drive and flushes unwritten data.

[Table 10-32](#) lists and describes the umount subcommand parameters.

[Figure 10-61](#) shows an example of the umount subcommand used as an option of the pairsplit command.

For the directory mount, specify the mount point in the form of **F:\** or **D:\hdl** (with \).



**Caution:** The logical drive to be unmounted and the corresponding physical drive must be closed to all applications.

You can avoid the Windows Server mount problems by setting USE\_MOUNTVOL\_P of the environment variable. You can avoid mount problems that is event ID1 occurrence by setting this environment variable.

---

When Disk Management is started or the Rescan Disks is executed on Windows Server 2003, the Write command may be issued by Windows Server 2003. Besides, the Write command by Disk Management start or the Rescan Disks is also issued to a logical drive unmounted by the unmount sub-command. Therefore, when Disk Management is started or the Rescan Disk is executed in the status where a logical drive is not writable in the disk array, an error indicating a failure of writing to the logical drive may remain in the event log of Windows Server 2003 even though the logical drive in the write disabled status is unmounted. For example, because an S-VOL placed in the COPY or PAIR status by the pairresync is in the write disabled status, an error may remain in the event log of Windows Server 2003 when Disk Management is started or the Rescan Disks is executed even though the S-VOL is unmounted. The data has no problem even though an error remains in the event log of Windows Server 2003. If you do not want the error remained, execute the Rescan Disks before the logical drive is placed in the write disabled status by the pairresync command, etc. after unmounting the logical drive.

Procedure for the resync operation after unmounting the S-VOL:

1. Unmount the S-VOL by the unmount sub-command.
2. Execute the Rescan (that is equivalent to the Rescan Disks of Disk Management) of the diskpart command.
3. Wait for about 30 seconds.
4. Execute the **pairresync** command. (The S-VOL is changed to the write disabled status)

Windows Server may write for the un-mounted volume. If a pair is resynchronized while remaining the data to the S-VOL on the memory of the server, the compatible backup cannot be collected. Therefore, execute the sync command of CCI immediately before re-synchronizing the pair for the un-mounted S-VOL.

**Table 10-32 Umount subcommand parameters**

Parameter	Value
Command Name	umount
Format	-x umount drive: -x umount drive:[\directory] ... (Windows Server systems only)
Argument	drive: Specifies the mounted logical device. <b>Drive:[\directory]:</b> Specify the mounted logical device for <b>drive</b> . <b>[\directory]:</b> Specifies the directory for specifying the directory mount point in the logical device. pairsplit -x umount D:\hd1 D:\hd1 <-> HarddiskVolume8 pairsplit -x umount D:\hd2 D:\hd2 <-> HarddiskVolume9
Note	When the logical drive opened to applications, specified as following. pairsplit -x umount D:\hd1 ERROR: Couldn't unmount [\\.\D:\hd1] due to be opening.

pairsplit -x umount F:\ -x umount G:\ -g oradb pairsplit -x mount									
Drive	FS_name	VOL_name	Device	Partition	...	Port	PathID	Targ	Lun
C:	FAT	Null	Harddisk0	Partition1	...	1	0	0	0
Z:	Unknown	Unknown	CdRom0		...	Unknown			

**Figure 10-61 Umount subcommand**

This example unmounts the F: and G: drives, splits all pairs in the specified group (status = PSUS), enables read/write access to all secondary volumes in the specified group, and then displays all mounted drives.

The output of the umount subcommand includes:

- **Drive:** Shows the logical drive recognized by Windows Server system.
- **FS\_name:** Shows the name of the file system formatted on the specified drive.
- **VOL\_name:** Shows the volume label name for the specified drive.
- **Device, Partition:** Shows the device name and partition for the specified drive.
- **Port, PathID, Targ, Lun:** Shows the port number, path ID (bus), target ID, and VOL for the specified drive.

For Windows Server system, even if this sub command is executed, a drive letter may not be deleted. In this case, the target volume may be used. Execute the command after making the target volume to unused status. Alternatively, a drive letter can be deleted by activating the Disk Management in the Control Panel → Administrative Tools → Computer Management → Storage folder.

If you use the mount command with directory mount option on Windows Server, the umount command must be used with directory mount option.

**Example: correct**

```
pairsplit -x mount F:\ hdisk2  
pairsplit -x umount F:\
```

**Example: correct**

```
pairsplit -x mount F: hdisk2  
pairsplit -x umount F:
```

**Example: incorrect**

```
pairsplit -x mount F:\ hdisk2  
pairsplit -x umount F:
```

## Using environment variable subcommands

If no environment variables are set in the execution environment, the environment variable subcommand sets or cancels an environment variable within the CCI command. The `setenv` subcommand sets the specified environment variables. The `unsetenv` subcommand deletes the specified environment variables. The `env` subcommand displays the environment variables. The `sleep` subcommand causes CCI to wait for the specified time. [Table 10-33](#) lists and describes the environment variable subcommands and their parameters.



**Caution:** The environment variables must be set before connecting to HORCM, and must be specified during interactive mode (**-z** option). Changing an environment variable after a CCI command execution error is invalid.

**Table 10-33 Environment variable subcommand parameters**

Parameter	Value
Command Name	setenv unsetenv env sleep
Format	-x setenv varname value -x unsetenv varname -x env -x sleep time
Argument	<b>Varname:</b> Specifies the environment variable to be set or canceled. <b>Value:</b> Specifies the value or character string of the environment variable to be set. <b>Time:</b> Specifies the sleep time in seconds.

[Figure 10-62](#) shows an example of the `setenv` subcommand used as an option of the `raidscan` command. This example changes from "TrueCopy/TCE" to "ShadowImage/SnapShot" an execution environment of the `raidscan` command which makes a dialog mode, because of establishing "HORCC\_MRCF" as an environment variable.



**Important:** Always set HORCC\_MRCF 1 for the ShadowImage/SnapShot/Data Retention operation.

```
raidscan[HORC]: -x setenv HORCC_MRCF 1
raidscan[MRCF]:

raidscan[MRCF]: -x unsetenv HORCC_MRCF
raidscan[HORC]:
```

**Figure 10-62 Environment variable subcommand**

# CCI command tools

## Usng the inqraid command

The **inqraid** command tool confirms the drive connection between the disk array and the host system. The inqraid command displays the relation between special files on the HP-UX system and actual physical drive of the disk array. [Table 10-34](#) lists and describes the inqraid command and parameters. [Figure 10-63](#) to [Figure 10-78](#) show examples of using inqraid and system commands to display the connection between the STDIN special file and the actual physical drive of disk array.

**Table 10-34 Inqraid Command Parameters**

Parameter	Value
Command Name	inqraid
Format	/HORCM/usr/bin/inqraid [-h   quit   -inqdump   -fx[l][g][w]   -find[c]   <special file>   -CLI   -CLIWP   -CLIWN   sort   -CM ] \HORCM\etc\inqraid [-h   quit   -inqdump   -fx[l][g][w]   -find[c]   <special file>   -CLI   -CLIWP   -CLIWN   sort   -CM   -gvinf   -svinf ]
Options	<p><b>-h</b>: This option displays Help/Usage.</p> <p><b>quit</b>: This option terminates from waiting STDIN and exits this command.</p> <p><b>-inqdump</b>: This option displays information for standard inquiry with Dump Image of hexadecimal.</p> <p><b>-fx</b>: This option displays the LDEV number with hexadecimal.</p> <p><b>-fl</b>: Shows a data protection volume with "-CLI " option by appending an asterisk (*) to the device file name.</p> <p><b>-fg</b>: This option is specified to find host group and to display VOL.</p> <p><b>-fw</b>: This option extends the contents of display, and indicates the V-VOL information to the maximum of MU#. This option is used by combining with the option of <b>-CLI</b> (see <a href="#">Figure 10-78</a> also).</p> <p><b>-find [c]</b>: This option searches a group on the configuration definition file ( local instance) from &lt;special file&gt; of STDIN by using pairedisplay command, and uses the following options of the pairedisplay command to display its state.            The <b>-find</b> option executes the following command (see <a href="#">Figure 10-71</a> also).            pairedisplay -d &lt;Seq#&gt;&lt;LDEV&gt; 0 1 2 -l [-fx] [-CLI] 2&gt;/dev/null            The <b>-find[c]</b> option executes the following command and then displays the result edited to CLI format (see <a href="#">Figure 10-71</a> also).            pairedisplay -d &lt;Seq#&gt;&lt;LDEV&gt;&lt;MU#&gt; -fd -CLI 2&gt;/dev/null</p> <p><b>&lt;special file&gt;</b>: This option is used to specify the special file name as argument of command.  <b>If no argument</b>, this command makes mode that wait for STDIN without argument.</p> <p><b>-CLI</b>: Displays the CLI. This option displays the CLI using one header and divides the column with space or with "-" (see <a href="#">Figure 10-73</a> also).</p> <p><b>-CLIWP</b> and <b>-CLIWN</b>: For fibre channel, these options display the WWN of the host adaptor in CLI format. PWWN or NWWN will be displayed for WWN (see <a href="#">Figure 10-74</a> also). For iSCSI, "0000000000000000" will be always displayed for WWN.</p> <p><b>-sort [-CM]</b>: Sorts and displays the order of the disk array product number and the volume management number. The <b>[-CM]</b> option searches for command device from the specified special file (raw device file) provided via STDIN or argument input, and then displays only the command device in the image of the configuration definition file (see <a href="#">Figure 10-75</a> also).</p>

Parameter	Value
	<p><b>-gvinf:</b> For Windows Server 2003 systems only.</p> <p><b>-gvinfex:</b> For Windows Server 2003 GPT disk only. This option obtains the signature and the volume layout information from the device that is given by a standard input or by an argument, and saves (shelters) the information under the system device in the following format (see <a href="#">Figure 10-76</a> also).</p> <p>File format: \WindowsDirectory\VOLssss_\\lll.ini (ssss indicates the serial number of the array, and \\lll indicates the LDEV number)</p> <p>Usually, you do not need to be aware of this file, since the file is used by the Windows' Disk Management at the beginning when setting the S-VOL signature and the volume information.</p> <p><b>-svinf:</b> For Windows Server systems only.</p> <p><b>-svinfex:</b> For Windows Server GPT disk only. This option sets the saved (sheltered) signature and the system volume layout information of the system device into the device that is given by a standard input or by an argument. When setting the signature and the volume layout information to the device, the host issues the SCSI inquiry command, obtains the serial number of the array and the LDEV number, and then reads the applicable VOLssss_\\lll.ini file. Therefore, even if the hard disk number is changed due to changing the configuration, the signature and the volume layout information will be set correctly since it is managed by the array serial number and the LDEV number.</p> <p>For [=PTN], specify a pattern for selecting the character string that is given as a device by a standard input or by an argument (see <a href="#">Figure 10-77</a> also).</p> <p><b>-fv:</b> This option is used with "\$Volume specification". Volume{guid} of the appropriate volume is displayed in the wide format.</p> <p>Example:</p> <pre># inraid -CLI \$Vol -fv DEVICE_FILE   PORT   SERIAL  LDEV CTG  H/M/12  SSID R:Group PRODUCT_ID Volume{cec25efe-d3b8-11d4-aeaa-00c00d003b1e}\Vol3\Dsk0 CL1-B 91202496 56 - - - - DF600F-CM</pre>
Returned values	<p>The -svinf or -svinfex option returns the following values to distinguish the execution result from the user program:</p> <p>Normal termination: 0.</p> <p>Abnormal termination: 1 (when the execution to the specified device did not end normally).</p>
Restriction	<p>The special file of STDIN or Argument must be specified following name:</p> <p>HP-UX: /dev/rdisk/*, /dev/rdisk/disk*</p> <p>Solaris: /dev/rdisk/*s2, c*s2</p> <p>AIX: /dev/rhdisk*, /dev/hdisk*, hdisk*</p> <p>Linux: /dev/sd*, /dev/rd*, /dev/raw/raw*</p> <p>Tru64 UNIX: /dev/rdisk/dsk*c</p> <p>IRIX: /dev/rdisk/*vol, /dev/rdisk/node_wwn/*vol/*, /dev/dsk/*vol, /dev/dsk/node_wwn/*vol/*</p> <p>Windows Server 2003 systems: hd0-10, harddisk0, harddisk1... (numbers indicate the drive number)</p> <p>\$LETALL, \$Volume, \$Phys, D:\Vol(Dms,Dmt, Dmr)X\DskY, \Vol(Dms,Dmt, Dmr)X\DskY</p> <p>Example:</p> <pre>ls /dev/sd*   ./inraid echo /dev/sda /dev/sdb /dev/sdc   ./inraid</pre>

```
ioscan -fun | grep rdsk | ./inraid
/dev/rdisk/c0t2d1 -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
HARC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
RAID5[Group 2- 0] SSID = 0x0000
/dev/rdisk/c0t4d0 -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-63 Inraid command example (HP-UX)**

```
ls /dev/rdisk/* | ./inraid
/dev/rdisk/c0t2d1s2 -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
                        HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                        RAID5[Group 2- 0] SSID = 0x0000
/dev/rdisk/c0t4d0s2 -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-64 Inraid command (Solaris)**

```
lsdev -C -c disk | ./inraid
hdisk10 -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
                        HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                        RAID5[Group 2- 0] SSID = 0x0000
hdisk11 -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-65 Inraid command (AIX)**

```
ls /dev/sd* | inraid
/dev/sdh -> CHNO = 0 TID = 1 LUN = 7
           [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
           HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
           RAID5[Group 2- 0] SSID = 0x0000
/dev/sdi -> CHNO = 0 TID = 4 LUN = 0
           [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-66 Inraid command (Linux)**

```
ls /dev/rdisk/dsk* | ./inraid
/dev/rdisk/dsk10c -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
                        HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                        RAID5[Group 2- 0] SSID = 0x0000
/dev/rdisk/dsk11c -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-67 Inraid command (Tru64 UNIX)**

```
echo hd10-11 | .\inraid
Harddisk10 -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
                        HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                        RAID5[Group 2- 0] SSID = 0x0000
Harddisk11 -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-68 Inraid command (Windows)**

```
ls /dev/rdisk/*vol | ./inraid
/dev/rdisk/dks1d6vol -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ] [DF600F ]
                        HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                        RAID5[Group 2- 0] SSID = 0x0000
/dev/rdisk/dks1d7vol -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ] [DF600F-CM ]
```

**Figure 10-69 Inraid command (IRIX FC\_AL)**

```
ls /dev/rdisk/*/*vol/* | ./inraid
/dev/rdisk/50060e8000100262/lun3vol/c8p0 -> [ST] CL2-A Ser =91203005 LDEV = 9 [HITACHI ]
[DF600F ]
                        HORC = SMPL HOMRCF[MU#0 = SMPL MU#1 = NONE MU#2 = NONE]
                        RAID5[Group 2- 0] SSID = 0x0000
/dev/rdisk/50060e8000100262/lun4vol/c8p0 -> [ST] CL2-A Ser =91203005 LDEV = 14 [HITACHI ]
[DF600F-CM ]
```

**Figure 10-70 Inraid command (IRIX Fabric Fibre)**

The output of the `inqraid` command includes:

- **CLX-Y**: Shows the port number.
- **Ser**: Shows the serial number.
- **LDEV**: Shows the LDEV ID. LDEV indicates volume.
- **HORC**: Shows TrueCopy/TCE attributes (P-VOL/S-VOL/SMPL) of the volume.
- **HOMRCF**: Shows ShadowImage/SnapShot attributes (P-VOL/S-VOL/SMPL) of the volume for MU#. (**Note**)
- **Group**: Shows the array (parity) group ID (physical position of the volume in the array). LDEV indicates volume. (**Note**)
- **SSID**: Shows the array ID of the volume. LDEV indicates volume. (**Note**)
- **CHNO**: Channel number on the device adapter that recognizes the volume. Displayed only for Linux systems.
- **TID**: Target ID of the volume. Displayed only for Linux systems.
- **VOL**: Volume number of the volume. Displayed only for Linux systems.



**Note:** The display of **HOMRCF**, **Group**, and **SSID** depends on the disk array firmware level.

```
# echo /dev/rds/c23t0d0 /dev/rds/c23t2d3 | ./inqraid -find
Group PairVol (L/R) (Port#,TID,VOL-M), Seq#,LDEV#, P/S, Status, Seq#, P-LDEV# M
horcl dev00 (L) (CL2-A, 0, 0-0)91206145 0 S-VOL SSUS, ----- 9 -
->/dev/rds/c23t0d0
Group PairVol (L/R) (Port#,TID,VOL-M), Seq#,LDEV#, P/S, Status, Seq#, P-LDEV# M
horcl dev10 (L) (CL2-A, 2, 3-0)91206145 3 S-VOL SSUS, ----- 6 -
->/dev/rds/c23t2d3
```

**Figure 10-71 Inqraid command -find option (HP-UX)**

```
# echo /dev/rds/c23t0d0 /dev/rds/c23t2d3 | ./inqraid -findc
DEVICE_FILE M Group PairVol P/S Stat R_DEVICE M P/S Stat LK
C23t0d0 0 horcl dev00 S-VOL SSUS c23t0d1 0 P-VOL PSUS OK
/dev/rds/c23t0d0[1] -> No such on the group
/dev/rds/c23t0d0[2] -> No such on the group
DEVICE_FILE M Group PairVol P/S Stat R_DEVICE M P/S Stat LK
C23t2d3 0 horcl dev10 S-VOL SSUS c23t2d2 0 P-VOL PSUS OK
/dev/rds/c23t2d3[1] -> No such on the group
/dev/rds/c23t2d3[2] -> No such on the group

# echo /dev/rds/c23t0d0 /dev/rds/c23t2d3 | ./inqraid -findc -CLI
DEVICE_FILE M Group PairVol P/S Stat R_DEVICE M P/S Stat LK
C23t0d0 0 horcl dev00 S-VOL SSUS c23t0d1 0 P-VOL PSUS OK
C23t2d3 0 horcl dev10 S-VOL SSUS c23t2d2 0 P-VOL PSUS OK
```

**Figure 10-72 Inqraid command -findc option (HP-UX)**

The output of the inqraid command with -find (and -findc) includes:

- **DEVICE\_FILE:** Shows only the device file name.
- **M:** Shows the MU#.
- **Group:** Shows the group name (dev\_group) described in the configuration definition file.
- **PairVol:** Shows the paired volume name (dev\_name) of the group described in the configuration definition file.
- **P/S:** Shows the volume attribute (P-VOL, S-VOL, SMPL).
- **Stat:** Shows the status of the paired volume.
- **R\_DEVICE:** Shows the device file name of the remote site.
- **LK:** Shows the configuration check result for the paired volume connection path (physical link of the paired volumes between the hosts).

```
# ls /dev/sd* | ./inqraid -CLI
DEVICE_FILE  PORT  SERIAL  LDEV  H/M/12  SSID R:Group  PRODUCT_ID
sdh          CL2-B  91203005  23   -/P/--  0004 5:02-00  DF600F
sdi          CL2-B  91203005  14   -      -      -      DF600F-CM
sdj          -      -      -      -      -      -      -
```

**Figure 10-73 Inqraid command -cli option (Linux)**

The output of the inqraid command with -CLI includes:

- **DEVICE\_FILE:** Shows only the device file name.
- **PORT:** Shows the port name of the disk array.
- **SERIAL:** Shows the product number of the disk array.
- **LDEV:** Shows the volume management number in the disk array. LDEV indicates volume.
- **H/M/12:** Shows the volume attribute of ShadowImage/TrueCopy/TCE (P-VOL is indicated as P, S-VOL is indicated as S, and SMPL is indicated as s).
- **SSID:** Shows the array ID where LDEV is allocated. LDEV indicates volume.
- **R:Group:** Shows the position of the physical CCI group mapped in LDEV. LDEV indicates volume.
- **PRODUCT\_ID:** Shows the product ID in the standard inquiry page.

```
# echo /dev/rdisk/c23t0d0 /dev/rdisk/c23t0d1 | ./inqraid -CLIWP
DEVICE_FILE  PWWN          AL PORT  LUN  SERIAL  LDEV  PRODUCT_ID
c23t0d0      500060e802f01018 - CL2-A  -    91206145  12    DF600F
c23t0d1      500060e802f01018 - CL2-A  -    91206145  12    DF600F
```

**Figure 10-74 Inqraid command -CLIWP option example (HP-UX)**

The output of the `inraid` command with `-CLIWP` includes:

- **DEVICE\_FILE**: Shows only the device file name.
- **WWN (PWWN or NWWN)**: For fibre channel, if `-CLIWP` option is specified, this option shows the Port\_WWN of the host adaptor for the specified device. If `-CLIWN` option is specified, this option shows the Node\_WWN of the host adaptor. For iSCSI, "0000000000000000" will be always displayed.
- **AL** and **VOL**: Shows a hyphen (-) all the time.
- **PORT**: Shows the port name of the disk array.
- **SERIAL**: Shows the product number of the disk array.
- **LDEV**: Shows the volume management number in the disk array. LDEV indicates volume.
- **PRODUCT\_ID**: Shows the product ID in the standard inquiry page.

```
# ioscan -fun | grep rdsd | ./inraid -sort -CM -CLI
HORCM_CMD
# dev_name          dev_name          dev_name
#UnitID 0 (Serial# 91203001)
/dev/rdsd/c0t3d0    /dev/rdsd/clt2d1
#UnitID 1 (Serial# 91203002)
/dev/rdsd/c2t3d0
```

**Figure 10-75 Inraid command -sort[-CM] option (HP-UX)**

The unit ID is added in the order of the disk array's product number. If multiple command devices exist within the array, the device file that is used to share between the disk array port would be chosen in prior, and is used as alternate command device.

The following is an example of using the **-gvinf** option of the `inraid` command. The information in all physical drives will be saved (sheltered) by giving **\$Phy**.

```
D:\HORCM\etc>inraid $Phys -gvinf -CLI
\\.\PhysicalDrive0:
\ Harddisk0 -> [VOL91206145_448_DA7C0D91] [DF600F ]
\\.\PhysicalDrive1:
\ Harddisk1 -> [VOL91206145_449_DA7C0D92] [DF600F ]
\\.\PhysicalDrive2:
\ Harddisk2 -> [VOL12006145_450_DA7C0D93] [DF600F ]
```

Signature  
LDEV number  
Array serial number

**Figure 10-76 Inraid command -gvinf option example**

The following is an example of using the **-svinf** option of the **inqraid** command. The information is set to the hard disk number indicated by the **pairdisplay** command that is issued from S-VOL instance.

```
D:\HORCM\etc>pairdisplay -l -fd -g URA
Group   PairVol(L/R) Device File   M ,Seq#,LDEV#.P/S, Status, Seq#,P-LDEV# M
URA    URA_000(L)   Harddisk3    0 91206145 51.S-VOL SSUS,----- 48 -
URA    URA_001(L)   Harddisk4    0 91206145 52.S-VOL SSUS,----- 49 -
URA    URA_002(L)   Harddisk5    0 91206145 53.S-VOL SSUS,----- 50 -

D:\HORCM\etc>pairdisplay -l -fd -g URA | inqraid -svinf=Harddisk
[VOL91206145_51_5296A763] -> Harddisk3      [DF600F      ]
[VOL91206145_52_5296A760] -> Harddisk4      [DF600F      ]
[VOL91206145_53_5296A761] -> Harddisk5      [DF600F      ]
```

**Figure 10-77 Inqraid command -svinf option example**



**Note:** If you have created a pair using a **noread** option, the device object (**\Device\HarddiskVolume#**) and the **Volume{guid}** of the S-VOL will not be generated at the time when the Windows is booted in **Noread** status. However, executing the **pairsplit** command, and then executing the **inqraid -svinf** command results in generation of the device object (**\Device\HarddiskVolume#**) and the **Volume{guid}**.

The hard disk volume number of the device object is generated in the order of the command that the Windows issued. Therefore, the same number will be maintained unless the configuration is changed. However, if you want the hard disk volume number to be absolute, add the **-sort** option, as shown below, so that the serial number of the disk array and the LDEV number will be sorted in numbers.

#### Example:

```
D:\HORCM\etc>echo hd5 hd4 hd3 | inqraid -svinf -sort
[VOL91206145_51_5296A763] -> Harddisk3      [DF600F      ]
[VOL91206145_52_5296A760] -> Harddisk4      [DF600F      ]
[VOL91206145_53_5296A761] -> Harddisk5      [DF600F      ]
```

The following is an example of using the **-fw** option of the **inqraid** command.

```
C:\horcm\etc>inqraid $Phy -CLI -fw
DEVICE_FILE   PORT      SERIAL    LDEV CTG   H../M/..          SSID R:Group  PRODUCT_ID
Harddisk0     -         -         -    -    -         -             -   FIREBALL CR6
Harddisk1     -         -         -    -    -         -             -   PSEUDO LUN
Harddisk2     CL1-A    91200008   1    -    -         -             -   DF600F-CM
Harddisk3     CL1-A    91200008   2    -    s/P/PPssssssssP 0000 5:00-00 DF600F
```

**Figure 10-78 Inqraid command -fw option example (Windows)**

## Using the mkconf command

The **mkconf** command executes the following operation and creates a configuration definition file automatically from the special file via STDIN. The user must edit the created configuration definition file as needed.

1. The mkconf command executes **inqraid -sort -CM -CLI** and then creates a configuration definition file only for HORCM\_CMD.
2. The mkconf command starts the HORCM instance using the created definition file.
3. The mkconf command executes **raidscan -find conf** by using the special file via STDIN, and then creates the definition file that contains HORCM\_DEV and HORCM\_INST.
4. The mkconf command starts the HORCM instance again to verify the created definition file.
5. The mkconf command executes **raidscan -find verify** and displays the correspondence between the special files via STDIN with the definition file.

**Table 10-35 Mkconf Command Parameters**

Parameter	Value
Command Name	<b>mkconf</b>
Format	<b>/HORCM/usr/bin/mkconf.sh [-g[g] &lt;group&gt; [-m &lt;mu#&gt;] [-i &lt;inst#&gt;] [-s &lt;service&gt;] [-a] ]</b> <b>\HORCM\Tool\ mkconf.exe [-g[g] &lt;group&gt; [-m &lt;mu#&gt;] [-i &lt;inst#&gt;] [-s &lt;service&gt;] [-a] [-c &lt;drive&gt;]]</b>
Options	<p>If no argument, this command creates a mode that waits for STDIN without argument.</p> <p><b>-g[g] &lt;group&gt;</b>: This option specifies the group described in the configuration definition file. If omitted, "VG" is used for the group name. -gg option is specified to find host group and to display VOL.</p> <p><b>-m &lt;MU#&gt;</b>: This option specifies the mirror descriptor MU#.</p> <p><b>-i &lt;inst&gt;</b>: This option shows the instance number.</p> <p><b>-s &lt;service&gt;</b>: This option specifies the service name (port number) described in the configuration definition file. If omitted, "52323" is used for the port number.</p> <p><b>-a</b>: This option adds a group to an already created configuration definition file.</p> <p><b>-c &lt;drive&gt;</b>: This option specifies the range of the command device to be searched. If omitted, "\$PhysicalDrive" is used for &lt;drive&gt;.</p>
Note	The configuration definition file and the log file are created in the current directory as horcm*.conf or log* (* as an instance number). The user must edit the created configuration definition file as necessary (such as ip_addresses, and services).



**WARNING:** If you have created the configuration definition file using the mkconf command tool, remember to change the value of the poll(10ms) manually. Setting the value incorrectly may cause a conflict between the CCI and the disk array, which causes the internal process of the disk array to suspend temporary. The process may not proceed.

```

C:\HORCM>type C:\HORCM\usr\bin\horcm.conf | C:\HORCM\Tool\mkconf.exe -g ORA -i 9 -m 0
starting HORCM inst 9
HORCM inst 9 starts successfully.
HORCM Shutdown inst 9 !!!
A CONFIG file was successfully completed.
starting HORCM inst 9
HORCM inst 9 starts successfully.
DEVICE FILE          Group   PairVol   PORT   TARG   LUN M   SERIAL   LDEV
Harddisk1            ORA     ORA_000   CL2-A   0       0 0   91206145   0
Harddisk2            ORA     ORA_001   CL2-A   0       1 0   91206145   1
Harddisk3            ORA     ORA_002   CL2-A   0       2 0   91206145   2
Harddisk4            ORA     ORA_003   CL2-A   0       3 0   91206145   3
Harddisk5            ORA     ORA_004   CL2-A   0       4 0   91206145   4
Harddisk6            ORA     ORA_005   CL2-A   0       5 0   91206145   5
Harddisk6            -       -         -       -       - 0   91206145   -
HORCM Shutdown inst 9 !!!
Please check 'C:\HORCM\horcm9.conf', 'C:\HORCM\log9\curlog\horcm*_log.txt', and modify
ip_address & service'.

C:\HORCM>dir /b
horcm9.conf
log9
Tool
usr

C:\HORCM>type horcm9.conf
# Created by mkconf on Tue Sep 11 17:11:41

HORCM_MON
#ip_address          service          poll(10ms)          timeout(10ms)
localhost            52323              1000 [Note]          3000

HORCM_CMD
#dev_name            dev_name            dev_name
#UnitID 0 (Serial# 91206145)
\\.\PhysicalDrive6

HORCM_DEV
#dev_group           dev_name           port#           TargetID          VOL#           MU#
# Harddisk1          SER = 91206145 LDEV = 0 [ FIBRE FCTBL = 4 ]
ORA                  ORA_000            CL2-A           0                 0              0
# Harddisk2          SER = 91206145 LDEV = 1 [ FIBRE FCTBL = 4 ]
ORA                  ORA_001            CL2-A           0                 1              0
# Harddisk3          SER = 91206145 LDEV = 2 [ FIBRE FCTBL = 4 ]
ORA                  ORA_002            CL2-A           0                 2              0
# Harddisk4          SER = 91206145 LDEV = 3 [ FIBRE FCTBL = 4 ]
ORA                  ORA_006            CL2-A           0                 6              0
# ERROR [CMDDEV] Harddisk5 SER = 91206145 LDEV = 7 [ DF600F-CM
]

HORCM_INST
#dev_group           ip_address          service
ORA                  localhost           52323

```

**Figure 10-79 Mkconf command example (Windows)**



**Note:** Make sure to change the value of the poll (10ms) parameter using the equation.

- Unit IDs are added in the order of the array product number. If multiple command devices exist in the disk array, the device file that was shared between the ports of the array will be selected, and will be handled as an alternative command device.
- If the standard input device includes a command device, the target device will be displayed as the comment shown below and will be omitted.

**Example:**

```
# ERROR [CMDDEV] Harddisk5          SER = 91206145  LDEV = 7 [ DF600F-CM      ]
```

- If the standard input device is shared between several command devices and is already displayed as a target device, the target device will be displayed as the comment shown below and will be omitted.

**Example:**

```
# ERROR [LDEV LINK] Harddisk5      SER = 91206145  LDEV = 3 [ FIBRE FCTBL = 4]
```

- If the standard input device does not have an appropriate mirror descriptor (MU#), the target device will be displayed as the comment shown below and will be omitted.

**Example:**

```
# ERROR [LDEV MUN (2<1)] Harddisk5  SER = 91206145  LDEV = 3 [ DF600F  ]
```

- If the device from the standard input co-reside between arrays with different mirror control, the target device will be displayed as the comment shown below and will be omitted.

**Example:**

```
# ERROR [MIXING RAID TYPE] Harddisk5  SER = 91206145  LDEV = 3 [ DF600F  ]
```

## Controlling host groups

The disk array has the defined host group in the port and are able to allocate host volume every this host group. CCI does not use this host volume, and specifies by using absolute VOL in the port. Therefore, a user can become confused because VOL of the CCI notation does not correspond to VOL on the host view. Thus, CCI supports a way of specifying a host group and VOL on the host view.

## Specifying a host group

### (1) Defining the formats

The way what CCI has addition of argument for the host group to the raidscan command and the configuration file will not be able to maintain the compatibility with conventional CLI. Therefore, CCI adopts a way that supports in the form which specifies a host group in the port strings as follows.

- CL1-A-**GRP#** (GRP# are up to 127)
  - Specifying the host group for the raidscan command as follows:

```
raidscan -p CL1-A-5
```

- Specifying the host group for the configuration file

#dev_group	dev_name	port#	TargetID	VOL#	MU#
ORA	ORA_000	CL1-A-1	4	1	0
ORA	ORA_001	CL1-A-1	4	2	0

If the port including a host group is specified to the port name, then maximum of specifiable VOLs are up to 255.

### (2) Specifiable port strings

As the result, CCI supports four kinds of forms in the port name.

- Specifying the Port name without a host group  
CL1-A  
CL1-A**n**      where **n**: unit ID for multiple RAID
- Specifying the Port name with a host group  
CL1-A-**g**      where **g**: host group  
CL1-A**n-g**      where **n-g**: host group=**g** on CL1-A in unit ID=**n**

## Using host group commands

### (1) Specifiable command for host group

The following commands are able to specify a host group with the port strings:

- **raidscan -p <port>, raidar -p <port>, raidvchkscan -p <port>**

```
# raidscan -p CL2-D-1
PORT# /ALPA/C,TID#,VOL#.Num(LDEV#....)...P/S, Status,Fence,LDEV#,P-Seq#,P-LDEV#
CL1-A-1 /da/ 0, 4, 0.1(256).....SMPL ---- - - - - - , - - - - -
CL1-A-1 /da/ 0, 4, 1.1(257).....SMPL ---- - - - - - , - - - - -
CL1-A-1 /da/ 0, 4, 2.1(258).....SMPL ---- - - - - - , - - - - -
```

### (2) New option including a host group

CCI supports new option for the following commands in order to show a VOL on the host view by finding a host group via the specified device.

- **raidscan -pdg <device>, raidar -pdg <device>, raidvchkscan -pdg <device>**

```
# raidscan -pdg /dev/rdsk/c57t4d1
PORT# /ALPA/C,TID#,VOL#.Num(LDEV#....)...P/S, Status,Fence,LDEV#,P-Seq#,P-LDEV#
CL1-A-1 /da/ 0, 4, 0.1(256).....SMPL ---- - - - - - , - - - - -
CL1-A-1 /da/ 0, 4, 1.1(257).....SMPL ---- - - - - - , - - - - -
CL1-A-1 /da/ 0, 4, 2.1(258).....SMPL ---- - - - - - , - - - - -
Specified device(hgrp=1) is LDEV# 0257
```

- **raidscan -findg**

```
# ls /dev/rdsk/c57* | raidscan -findg
DEVICE FILE      UID  S/F PORT  TARG  LUN   SERIAL  LDEV  PRODUCT ID
/dev/rdsk/c57t4d0  0    F  CL1-A-1  4     0    91201000 256  DF600F-CM
/dev/rdsk/c57t4d1  0    F  CL1-A-1  4     1    91201000 257  DF600F
/dev/rdsk/c57t4d2  0    F  CL1-A-1  4     2    91201000 258  DF600F
```

- **raidscan -findg conf, mkconf -gg**

```
# ls /dev/rdsk/c57* | raidscan -findg conf 0 -g ORA
HORCM_DEV
#dev_group      dev_name      port#      TargetID      VOL#      MU#
# /dev/rdsk/c57t4d1 SER = 91201000 LDEV = 257 [ FIBRE FCTBL = 4 ]
ORA             ORA_000       CL1-A-1    4             1         0
# /dev/rdsk/c57t4d2 SER = 91201000 LDEV = 258 [ FIBRE FCTBL = 4 ]
ORA             ORA_001       CL1-A-1    4             2         0
```

- **inraid -fg**

```
# ls /dev/rdsk/c57* | ./inraid -CLI -fg
DEVICE FILE      PORT      SERIAL  LDEV CTG  H/M/12  SSID R:Group  PRODUCT ID
c57t4d0          CL1-A-1  91201000 256  -    -      -      -      - DF600F-CM
c57t4d1          CL1-A-1  91201000 257  -    s/P/ss 0000 1:01-02 DF600F
c57t4d2          CL1-A-1  91201000 258  -    s/P/ss 0000 1:01-02 DF600F
```

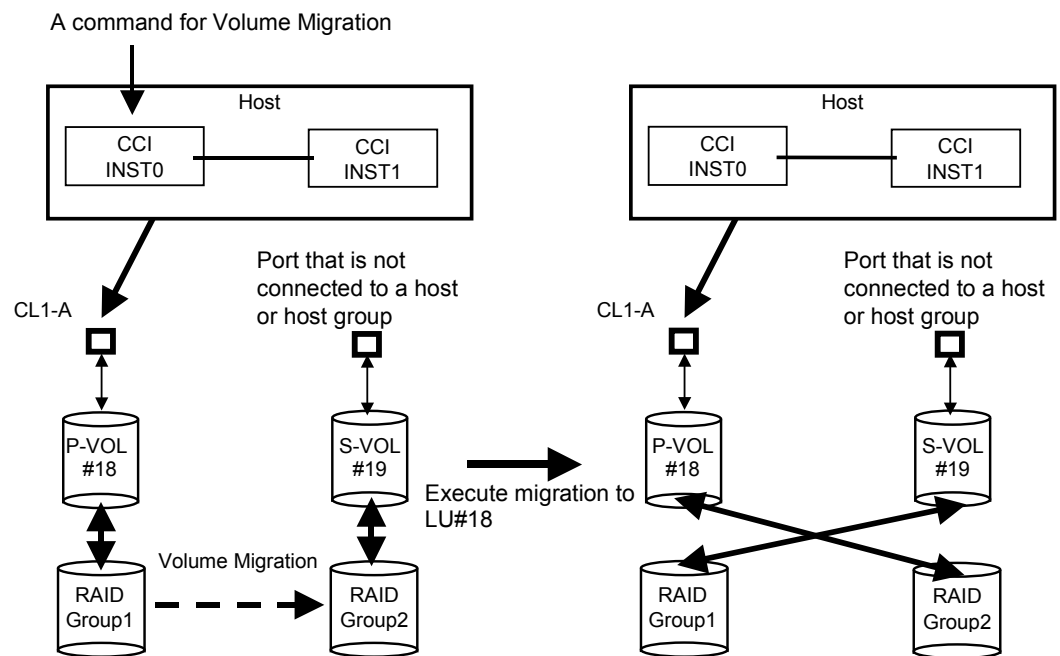
# Migrating volumes

## About volume migration

Volume Migration is a function to migrate a logical volume to the other RAID group in the disk array. CCI operates in cooperation with software on the host and Volume Migration of the disk array and provides a function to control Volume Migration by CLI commands.

## Specifications for volume migration

To make CCI execute the migration by operating Volume Migration, it is required to map the migration destination volume to a port or a host group that is not connected to a host beforehand. [Figure 10-80](#) is the execution example of the volume migration executed for LDEV#18.



**Figure 10-80 Volume migration configurations**

- Command specification

To operate Volume Migration using CCI, it is required to define the mapping of the migration source volume and the migration destination volume. The volumes are registered in the horcm\*.conf file of CCI in the same way as ShadowImage, etc. in order to define the mapping. When the remote instance is instructed to execute the migration by Volume Migration, the volume of the remote instance is interpreted as the migration source volume and a volume of the local instance is made to be the migration destination volume.

- Group operation

It is possible to perform an operation of Volume Migration for a group through a description in the horcm\*.conf file of CCI, but the data consistency of a group for which the command has been executed is not maintained. When a host crashes while the command is executed for the group, the command execution is interrupted halfway and volumes in statuses different from each other may exist.

- HORCM instance

It is possible to describe a volume to be operated by Volume Migration in the horcm\*.conf file, in which a volume to be operated by the other function such as ShadowImage is described, as the other group in duplicate. It is also possible to define a volume to be operated by Volume Migration in the other horcm\*.conf file than that for a volume to be operated by the other function such as ShadowImage and to operate it from the independent HORCM instance.

## Using volume migration commands

[Table 10-36](#) lists and describes the Volume Migration command parameters.

- Command for volume migration  
CCI supports the volume migration by adding an option (**-m cc**) to the paircreate command.

**Table 10-36 Command for volume migration**

Parameter	Value
Command Name	<b>paircreate</b>
Format	<b>paircreate -g &lt;group&gt; -d &lt;pair Vol&gt; -m cc -vl[r]   -p[s]vol -c &lt;size&gt;</b>
Options	<p><b>-m cc:</b> This option instructs the copying of the volume migration to be made.  <b>Note:</b> This option cannot be specified with "-split" option in the same command.</p> <p><b>-vl (-pvol) or -vr (-svol):</b> Specifies the data flow direction and must always be specified. The <b>-vl (-pvol)</b> specifies the local instruction, that is, an instruction to copy a local instance volume (P-VOL) to a remote instance volume (S-VOL) and to maps a copying destination volume (a volume of the remote instance) to the local instance volume (P-VOL). The <b>-vr (-svol)</b> specifies the remote instruction, and copies data from a remote instance volume (P-VOL) to a local instance volume (S-VOL) and maps a copy destination volume (a volume of the local instance) to the remote instance volume (P-VOL).</p> <p><b>-c &lt;size&gt;:</b> You can use this option to specify the copying pace (1 - 15) to be used for the initial data copy. You can shorten the copy time by specifying a large number. Do not use the default value of 3. (1 to 5: slow, 6 to 10: normal, 11 to 15: priority).  If a copying is made at the "normal" pace when the host I/O load is heavy, the host I/O performance may be deteriorated remarkably. When you want to prevent the host I/O performance being deteriorated, select the "slow" pace. Select the "prior" pace only when you want to give much priority to the time for the completion of the copy than the host I/O performance in a period of time when the P-VOL is rarely accessed.</p>

- Confirming the migration pair status  
You can check that the RAID group to which the volume that executed the migration belongs has been changed by referring to the RAID group to which the volume concerned belongs using the inqraid command.

```

C:\HORCM\etc>echo hd0 | inqraid
Harddisk0 -> [ST] CL1-A Ser =91200067 LDEV = 1 [HITACHI ] [DF600F ]
             HORC = SMPL HOMRCF[MU#0 = S-VOL MU#1 = SMPL MU#2 = SMPL]
             RAID5[Group 1- 0] SSID = 0x0000

C:\HORCM\etc>paircreate -g vg01 -m cc -vl

C:\HORCM\etc>echo hd0 | inqraid
Harddisk0 -> [ST] CL1-A Ser =91200067 LDEV = 1 [HITACHI ] [DF600F ]
             HORC = SMPL HOMRCF[MU#0 = S-VOL MU#1 = SMPL MU#2 = SMPL]
             RAID5[Group 2- 0] SSID = 0x0000

```

The volume has been migrated to the other RAID group.

**Figure 10-81 Inqraid command example**

## About cc command issues and status

The migration volumes can be handled by issuing the CCI commands (pair creation and pair splitting commands). The validity of the specified operation is checked according to the status of the paired volume (primary volume). [Table 10-37](#) shows the relations between the migration volume statuses and command acceptances.

**Table 10-37 Command issues and pairing status transition**

Command Command option Pair Status	paircreate	
	-m cc	-S
① SMPL	Accepted ②→③ ②→④	Acceptable
② COPY ↓	Acceptable	Accepted ①
③ PSUS ↓		Accepted ①
④ PSUE		Accepted ①

- **Accepted:** A command is accepted and executed. When the command execution succeeds, the status changes to that of the shown number.
- **Acceptable:** No operation is executed, though a command is accepted.
- **Shaded portions:** Command execution is rejected and the operation terminates abnormally.



**Note:**

- Other commands and option (for example, pairresync...) for operating a paired-volume are rejected.
- The "-m cc" option cannot be specified with "-split" option in the same command.

## About the synchronous waiting command for TCE

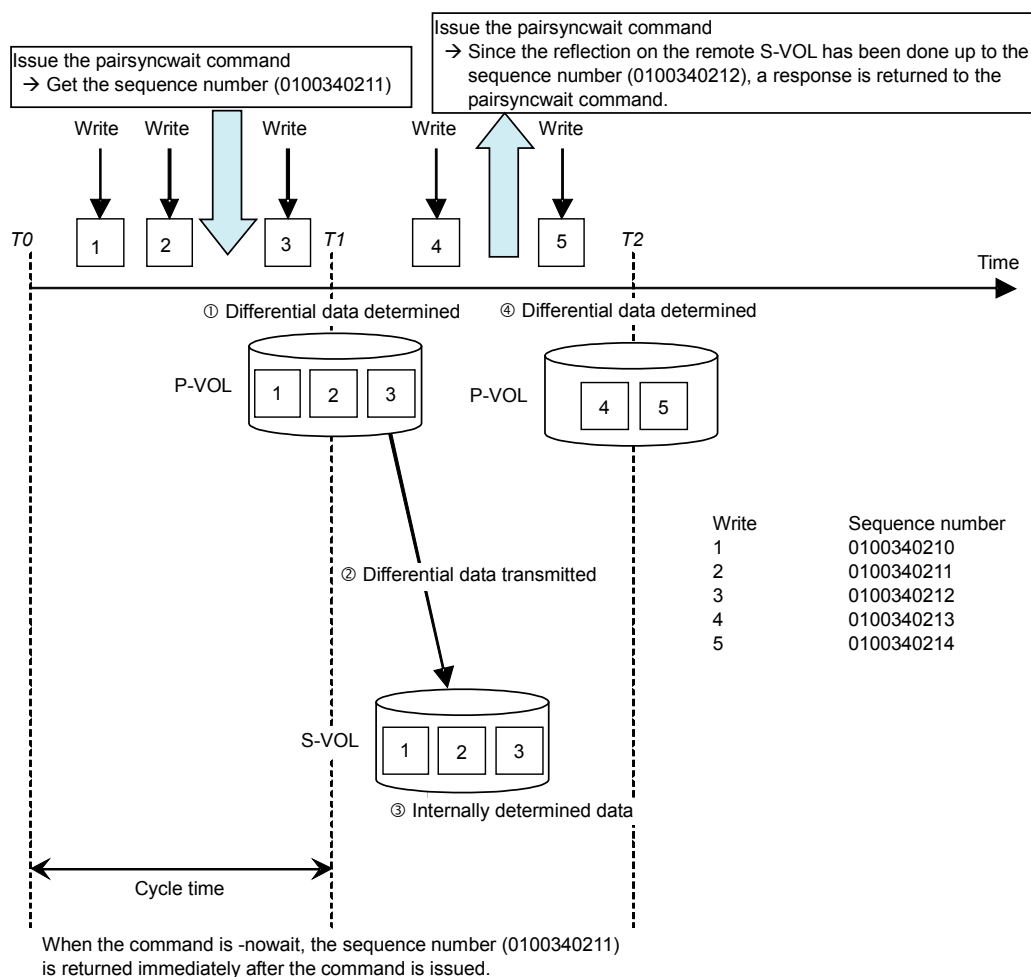
[Table 10-38](#) lists and describes the pair synchronization waiting command parameters and returned values. The pairsyncwait is a command exclusive for TCE. It is a command to check whether or not the data written immediately after the issue of the command is reflected on the S-VOL of the remote site. This command gets the latest sequence # of local array (P-VOL latest sequence # within the CT group) and the sequence # of remote array within the CT group which correspond to the <group> or <raw\_device> that is specified by pairsyncwait, and compares local array with remote array sequence # at that time and at regular interval. Because the sequence number is updated for each group, you can check whether the S-VOL data has been updated or not by executing the command specifying a group when all the pairs in the target group are in the PAIR status.

If remote array sequence # is over the value of local array sequence # within the term that was specified by pairsyncwait, this command reports the return code 0 with the meaning of completion of synchronization. The -nowait option shows the latest sequence # (Q-marker) of local array P-VOL and CTGID. The marker is shown in hexadecimal of ten characters.

**Table 10-38 Pairsyncwait command parameters**

Parameter	Value
Command Name	<b>pairsyncwait</b>
Format	<b>pairsyncwait { -h   -q   -z   -x   -xh   -I[H   M][instance#]   -g &lt;group&gt;   -d &lt;pair Vol&gt;   -d[g] &lt;raw_device&gt; [MU#]   -d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]   -t &lt;timeout&gt;   -nowait   [-m &lt;marker&gt;   -nomsg] }</b>
Options	<p><b>-h</b>: Displays Help/Usage and version information.</p> <p><b>-q</b>: Terminates the interactive mode and exits this command.</p> <p><b>-z</b> or <b>-zx</b>: Makes the pairsyncwait command enter the interactive mode. The <b>-zx</b> option guards performing of the HORCM in the interactive mode. When this option detects a HORCM shut down, interactive mode terminates.</p> <p><b>-x</b>: Specifies the sub-command of Windows.</p> <p><b>-xh</b>: Displays Help/Usage the sub-command of Windows.</p> <p><b>-I[H   M][instance#]</b> or <b>-I[TC   SI][instance#]</b>: Specifies the instance number and the command execution environment.</p> <p><b>-g &lt;group&gt;</b>: Specifies a group name defined in the configuration definition file. The command is executed for each CTG unless the -d &lt;pair Vol&gt; option is specified. The execution result of the pairsyncwait command for each option, see <a href="#">Table 10-39</a> and <a href="#">Table 10-40</a>.</p> <p><b>-d &lt;pair Vol&gt;</b>: Specifies a paired logical volume name defined in the configuration definition file. When this option is specified, the command is executed for the specified paired logical volumes.</p> <p><b>-d[g] &lt;raw_device&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified raw_device, and if the specified raw_device is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specifying the "-g &lt;group&gt;" option. If the specified the raw_device is contained in two or more groups, the command is executed on the first group.</p>

Parameter	Value
	<p><b>-d[g] &lt;seq#&gt; &lt;LDEV#&gt; [MU#]</b>: Searches a group on the configuration definition file (local instance) for the specified LDEV, and if the specified LDEV is contained in the group, the target volume is executed as the paired logical volume (-d) or group (-dg). This option is effective without specifying the "-g &lt;group&gt;" option. If the specified LDEV is contained in two or more groups, the command is executed on the first group. The <b>&lt;seq #&gt; &lt;LDEV #&gt;</b> values can be specified in hexadecimal (by addition of "0x") or decimal notation.</p> <p><b>-t &lt;timeout&gt;</b>: Specifies the timeout value to wait for the completion. The unit is 100 ms. Local array gets the latest sequence # from remote array at regular interval.</p> <p><b>-nowait</b>: Gets the latest sequence # of local array P-VOL and CTGID without waiting. When this option is specified, the latest sequence # of local array P-VOL is reported immediately, and -t &lt;timeout&gt; option is ignored.</p> <p><b>-nomsg</b>: Suppresses messages to be displayed when this command is executed. It is used to execute a command from a user program. This option must be specified at the beginning of a command argument. The command execution log is not affected by this option.</p> <p><b>-m &lt;marker&gt;</b>: Specifies the sequence # of local array P-VOL, called the Q-marker. If the application gets Q-marker as the result of execution of pairsyncwait because of timeout or "-nowait", the application can reconfirm the completion of asynchronous transfer by using pairsyncwait with Q-marker. If the application does not specify Q-marker, CCI uses the latest sequence # when CCI receives pairsyncwait. It is also possible to wait for the completion from S-VOL side with this option.</p> <p><b>Q-Marker format</b>: = iisssssss, where ii = incarnation # of pair volume, and sssssss = P-VOL serial #.</p>
Returned values	<p>When the <b>-nowait</b> option is specified:</p> <p>Normal termination: 0: The status is <b>NOWAIT</b>.</p> <p>Abnormal termination: other than 0 to 127, refer to the execution logs for error details.</p> <p>When the <b>-nowait</b> option is not specified:</p> <p>Normal termination: 0: The status is <b>DONE</b> (completion of synchronization).</p> <p>1: The status is <b>TIMEOUT</b> (timeout).</p> <p>2: The status is <b>BROKEN</b> (Q-marker synchronized process is rejected).</p> <p>3: The status is <b>CHANGED</b> (Q-marker is invalid due to resynchronize).</p> <p>Abnormal termination: other than 0 to 127, refer to the execution logs for error details.</p>



```
# pairsyncwait -g oradb -nowait
UnitID CTGID Q-Marker Status Q-Num
0 3 01003408ef NOWAIT 2
```

← -nowait is specified.

```
# pairsyncwait -g oradb -t 100
UnitID CTGID Q-Marker Status Q-Num
0 3 01003408ef DONE 2
```

← -nowait is not specified.

```
# pairsyncwait -g oradb -t 1
UnitID CTGID Q-Marker Status Q-Num
0 3 01003408ef TIMEOUT 3
```

```
# pairsyncwait -g oradb -t 100 -m 01003408ef
UnitID CTGID Q-Marker Status Q-Num
0 3 01003408ef DONE 0
```

```
# pairsyncwait -g oradb -t 100
UnitID CTGID Q-Marker Status Q-Num
0 3 01003408ef BROKEN 0
```

```
# pairsyncwait -g oradb -t 100 -m 01003408ef
UnitID CTGID Q-Marker Status Q-Num
0 3 01003408ef CHANGED 0
```

↖ Q Marker(01003408ef) is invalid when P-VOL was resynchronized while this command is executed.

**Figure 10-82 Pairsyncwait command examples**

The output of the pairsyncwait command is:

- **UnitID:** Unit ID in case of multiple array connection
- **CTGID:** CTGID within Unit ID
- **Q-Marker:** The latest sequence # of local array P-VOL (marker) when the command is received.
- **Status:** The status after the execution of command.
- **Q-Num:** The number of process queue to wait for synchronization within the CTGID.

Execute the pairsyncwait command only when the target pair statuses are all PAIR. It can also be executed when the target pair status is other than PAIR, but the output result becomes as it is shown in the table below.

**Table 10-39 Command is issued to the primary array in which a TCE pair has been created**

Options	Result
-g or -g -nowait	The command can be executed when a status of a pair, which is defined as the lead pair of the specified group in the configuration definition file, is PAIR.
-d or -d -nowait	The command can be executed when the status of the specified pair is PAIR.
-g, -m, or -d -m	The command can be executed even when a single pair in the PAIR status exists in the specified group.

**Table 10-40 Command is issued to the secondary array in which a TCE pair has been created**

Options	Result
-g, -d, -g -nowait, or -d -nowait	Cannot execute
-g -m, or -d -m	The command can be executed even when a single pair in the PAIR status exists in the specified group.

## Using the raidcom command

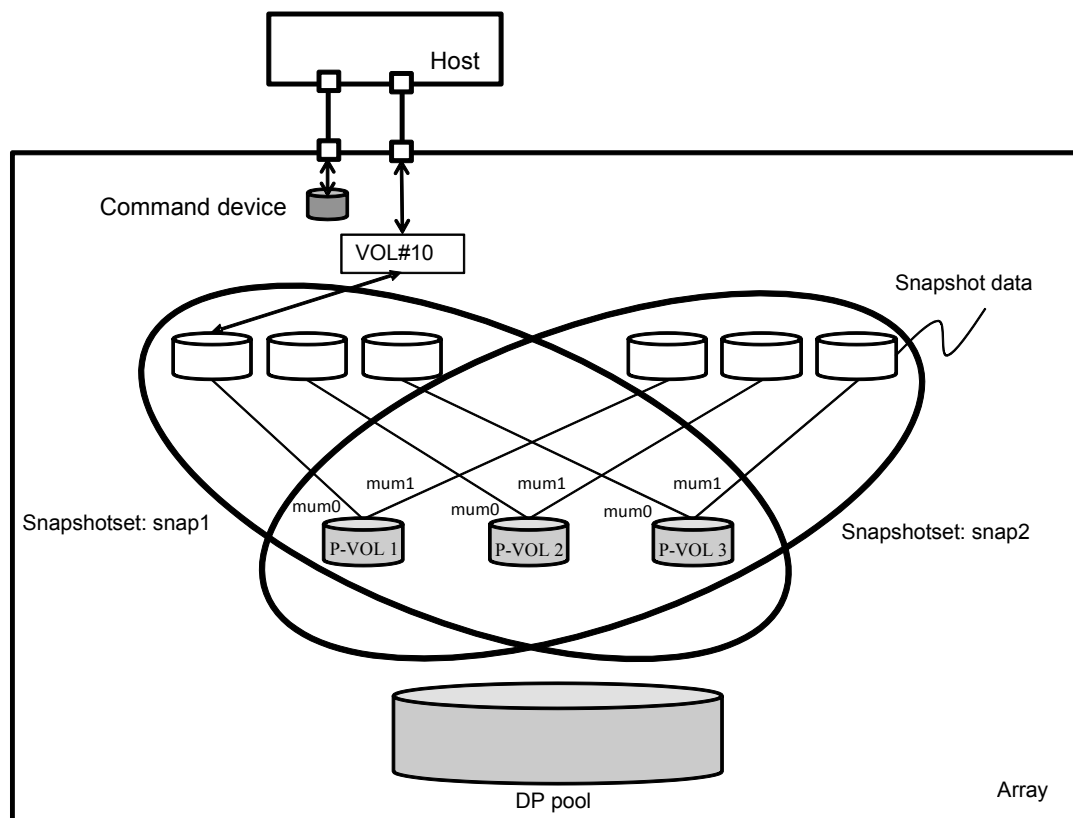
All command options displayed in help do not perform. The options that can perform are limited to the options described in this manual.

### About the raidcom command

The raidcom command can be mainly used for the SnapShot operation.

While one P-VOL can have up to 32 pairs with the paircreate command, using the raidcom command allows a P-VOL to have up to 1,024 pairs. Therefore, use the raidcom command when over 32 pairs per P-VOL are needed.

The concept of the SnapShot operation using the raidcom command is shown in the figure below.



**Figure 10-83** Concept of SnapShot operation using raidcom command

In the SnapShot operation using the raidcom command, the volume of the duplication target is called a P-VOL and its duplication is called snapshot data (**Note 1**). In the raidcom command, it is necessary to register the P-VOL to create the snapshot data and the DP pool to be used in the snapshotset (**Note 2**) before creating the snapshot data. After registering the P-VOL in the snapshotset, the snapshot data is created. The duplication of the P-VOL can be acquired for the first time by creating the snapshot data. Since multiple P-VOLs can be registered in the snapshotset and those snapshot data can be created, the snapshotset is called the aggregate of the snapshot data. By setting the snapshotset to the operation target of the raidcom command, all the snapshot data belonging to the relevant snapshotset can be operated at once. The operation per snapshot data is also possible by specifying the P-VOL at the same time.

Furthermore, specifying the P-VOL and mum# (MU#) can uniquely identify the snapshot data to be operated without specifying the snapshotset name (when multiple snapshot data exist in the same P-VOL in the snapshotset, mum# is enabled to uniquely identify the snapshot data to be operated). The mum# is assigned to the P-VOL automatically when creating the snapshot data.

Since the volume number is not assigned to the created snapshot data, when using it by making the host recognize it, use the raidcom map snapshot command and map the volume number to the snapshot data. The mapped volume number can be unmapped or change the assignment of the different snapshot data of the same P-VOL.

Furthermore, the snapshotset supports the CTG mode. When creating the snapshot data, the consistency of the data of the snapshot data belonging to the snapshotset whose CTG mode is enabled is guaranteed. The consistency of the data of the snapshot data belonging to the snapshotset whose CTG mode is disabled is not guaranteed.



**Note:**

- The snapshot data is equivalent to the V-VOL.
- The snapshotset is equivalent to the CTG of the SnapShot pair created by the paircreate command. The paircreate command can create a SnapShot pair not belonging to CTG, but the snapshot data created by the raidcom command must belong to the snapshotset.

## Differences between raidcom and paircreate commands

The paircreate command can also operate SnapShot. However, unless otherwise a special purpose such as maintenance, do not mix the pairs created by the raidcom command and the paircreate command.

[Table 10-41](#) shows the difference of the snapshot data or the V-VOL pair created by the raidcom command and the paircreate command.

**Table 10-41 Difference between raidcom and paircreate command**

Items	Raidcom	Paircreate
Configuration definition file	Only HORCM_CMD is described	HORCM_MON, HORCM_CMD, HORCM_DEV, HORCM_INST must be described
The number of pairs to be created per P-VOL	1024	32
CTG#	This is assigned automatically. However, it is not used in the operation of the raidcom command.	When using CTG, this is assigned manually or automatically.
CTG mode	Enabled/Disabled is specified manually.	When using CTG, this is always enabled.
mum#	A number from 1 to 1032 is assigned automatically. Furthermore, the number from 0 to 1032 can be displayed.	Up to 32 numbers from 0 to 39 are assigned manually in the configuration definition file. Furthermore, the number from 0 to 39 can be displayed.
Snapshot data or V-VOL without volume number	The snapshot data without the volume number can be created.	The V-VOL pair without the volume number cannot be created. It is necessary to prepare the V-VOL in Hitachi Storage Navigator Modular 2 in advance.

## Using raidcom command options

### Using common raidcom command options

This is the common option which can be used by each raidcom command.

**Table 10-42 Raidcom command common options**

Parameter	Value
Command Name	<b>raidcom</b>
Format	<b>raidcom { -h   &lt;action&gt; &lt;object&gt; [&lt;param&gt; &lt;value&gt;...] [-fx] [-nomsg] [-s &lt;seq#&gt;   -u &lt;unit#&gt;] }</b>
Options	<b>-h</b> : Displays Help/Usage and version information.
	<b>-s &lt;seq#&gt;</b> : The serial number of the array to which the command device used in the command device defined by HORCM_CMD in the configuration definition file belongs is specified.
	<b>-u &lt;unit#&gt;</b> : The unit ID to which the command device used in the command device defined by HORCM_CMD in the configuration definition file.
	<b>-fx</b> : Displays the volume number as a hexadecimal number.
	<b>-nomsg</b> : Suppresses messages to be displayed when this command is executed. <b>&lt;action&gt; &lt;object&gt; [&lt;param&gt; &lt;value&gt;...]</b> : The parameter and the value necessary for each command name and each operation are specified.

### Using the raidcom get snapshotset command

The information of the snapshotset and the snapshot data is displayed.

**Table 10-43 Raidcom get snapshotset command options**

Parameter	Value
Command Name	<b>raidcom get snapshotset</b>
Format	<b>raidcom get snapshotset [-ldev_id &lt;ldev#&gt;   -snapshot_name &lt;name&gt;] [{-check_status   -check_status_not} &lt;string&gt; [-time &lt;time&gt;]]</b>
Options	<b>-ldev_id &lt;ldev#&gt;</b> : The volume number of the P-VOL or snapshot data is specified. If the volume number of the P-VOL is specified, all the snapshot data of the relevant P-VOL is displayed.
	<b>-snapshot_name &lt;name&gt;</b> : The snapshot data belonging to the specified snapshotset is displayed.
	<b>-check_status &lt;string&gt; [-time &lt;time&gt;]</b> : Check that the specified snapshotset or the snapshot data is in the status displayed in <string>. Any of the characteristic strings displayed in STAT of the display items is specified for <string>. When the specified snapshotset or the snapshot data is in the specified status, it is completed normally. Furthermore, when -time is specified, check that it waits only for the specified time (seconds) and it is in the specified status.
	<b>-check_status_not &lt;string&gt; [-time &lt;time&gt;]</b> : Check that the specified snapshotset or the snapshot data is not in the status displayed in <string>. Any of the characteristic strings displayed in STAT of the display items is specified for <string>. When the specified snapshotset or the snapshot data is in not the specified status, it is completed normally. Furthermore, when -time is specified, check that it waits only for the specified time (seconds) and it is not in the specified status.

## Examples:

To display the snapshotset list:

```
C:\HORCM\etc>raidcom get snapshotset
```

SnapShot_name	P/S	STAT	Serial#	LDEV#	MU#	P-LDEV#	PID	%	MODE	SPLT-TIME
snap1	-	-	91200007	-	-	-	-	-	----	-
snap2	-	-	91200007	-	-	-	-	-	----	-
snap3	-	-	91200007	-	-	-	-	-	----	-

To display all the snapshot data of specified P-VOL (volume number 10):

```
C:\HORCM\etc>raidcom get snapshotset -ldev_id 10
```

SnapShot_name	P/S	STAT	Serial#	LDEV#	MU#	P-LDEV#	PID	%	MODE	SPLT-TIME
snap1	P-VOL	PAIR	91200007	10	1010	-	2	100	----	-
snap2	P-VOL	PAIR	91200007	10	1011	20	2	100	G---	-
snap3	P-VOL	PAIR	91200007	10	1012	-	2	100	----	-

To display the snapshot data of specified volume number (volume number 20):

```
C:\HORCM\etc>raidcom get snapshotset -ldev_id 20
```

SnapShot_name	P/S	STAT	Serial#	LDEV#	MU#	P-LDEV#	PID	%	MODE	SPLT-TIME
snap2	S-VOL	PAIR	91200007	20	1011	10	2	100	GN--	-

To display the snapshot data of specified belonging to the relevant snapshotset:

```
C:\HORCM\etc>raidcom get snapshotset -snapshot_name snap2
```

SnapShot_name	P/S	STAT	Serial#	LDEV#	MU#	P-LDEV#	PID	%	MODE	SPLT-TIME
snap2	P-VOL	PAIR	91200007	10	1011	20	2	100	G---	-
snap2	P-VOL	PAIR	91200007	11	1011	21	2	100	G---	-
snap2	P-VOL	PAIR	91200007	12	1011	22	2	100	G---	-

To confirm that STAT of the specified snapshotset is PAIR:

```
C:\HORCM\etc>raidcom get snapshotset -snapshot_name snap2 -check_status PAIR
```

```
C:\HORCM\etc>
```

The output of the raidcom get command includes:

- SnapShot\_name: Shows the snapshotset name defined in the array.
- P/S: Shows the target volume attribute. P-VOL shows the P-VOL and S-VOL shows the snapshot data. In case of the snapshot set list, "-" is displayed.
- STAT: Shows the each snapshot data status.
- Serial#: Shows the serial number of the disk array.
- LDEV#: Shows the volume number of the P-VOL related to the snapshotset.
- MU#: Shows the mum number (MU number).
- P-LDEV#: Shows the volume number of the volume (P-VOL or snapshot data) of the volume to be paired related to the snapshotset.
- PID: Shows the replication data DP pool number used by the snapshot data.
- %: Shows the identical rate of the P-VOL and the snapshot data.

- **MODE:** Shows the snapshotset mode.  
G: CTG mode
- **SPLT-TIME:** Shows the time that the snapshot data was created.

## Using the raidcom add snapshotset command

The specified P-VOL and the DP pool to be used are registered in the specified snapshotset. If the specified snapshotset does not exist, it is newly created.

**Table 10-44 Raidcom add snapshotset command options**

Parameter	Value
Command Name	<b>raidcom add snapshotset</b>
Format	<b>raidcom add snapshotset -ldev_id &lt;ldev#&gt; -pool &lt;pool ID#&gt; -snapshot_name &lt;name&gt; [-snap_mode &lt;mode&gt;] [-copy_size &lt;size&gt;]</b>
Options	<b>-ldev_id &lt;ldev#&gt;:</b> The volume number of the P-VOL to be registered in the snapshotset is specified.
	<b>-pool &lt;pool ID#&gt;:</b> The DP pool number used by the P-VOL to be registered in the snapshotset is specified. The same DP pool is used for the replication data DP pool and the management area DP pool.
	<b>-snapshot_name &lt;name&gt;:</b> The snapshotset name to be added to the snapshotset is specified.
	<b>-snap_mode &lt;mode&gt;:</b> The mode when creating the snapshot data is specified. <b>&lt;mode&gt; = CTG:</b> This is created in the CTG mode. CTG# is assigned automatically.
	<b>-copy_size &lt;size&gt;:</b> This option can specify the pace at the time of restoration in the range of 1 to 15. Specifying the large value can reduce the restoration time. (1 to 5: slow, 6 to 10: normal, 11 to 15: prior) If this option is omitted, default 3 is used as a pace.

### **Example:**

The P-VOL (10) and the DP pool (50) to be used are registered in the snapshotset (snap1).

```
C:\HORCM\etc>raidcom add snapshotset -ldev_id 10 -pool 50 -snapshot_name snap1
```

## Using the raidcom delete snapshotset command

The snapshotset is deleted. Once the P-VOL is specified, the snapshot data of the relevant P-VOL is deleted from the snapshotset.

The snapshot data in which the volume number is mapped and the snapshotset including such snapshot data cannot be deleted. Un-map the volume number from the snapshot data, and then delete them.

**Table 10-45 Raidcom delete snapshotset command options**

Parameter	Value
Command Name	raidcom delete snapshotset
Format	raidcom delete snapshotset {-snapshot_name <name>   -ldev_id <ldev#> {-mirror_id <mun#>   -snapshot_name <name>}}
Options	<b>-snapshot_name &lt;name&gt;</b> : The snapshotset name of the snapshotset to be deleted is specified. Once the snapshot set is deleted, all the snapshot data belonging to the relevant snapshotset is also deleted.
	<b>-ldev_id &lt;ldev#&gt;</b> : The volume number of the P-VOL of the snapshot data to be deleted is specified. Furthermore, the snapshot data to be deleted is identified by specifying the snapshotset name or mun#.
	<b>-mirror_id &lt;mun#&gt;</b> : mun# of the snapshot data to be deleted is specified.

### **Example:**

The snapshot data of the P-VOL (10) belonging to the snapshotset (snap1) is deleted.

```
C:\HORCM\etc>raidcom delete snapshotset -snapshot_name snap1 -ldev_id 10
```

## Using the raidcom modify snapshotset command

The snapshotset is operated. Once the P-VOL is specified, the snapshot data of the relevant P-VOL is operated.

**Table 10-46 Raidcom modify snapshotset command options**

Parameter	Value
Command Name	raidcom modify snapshotset
Format	raidcom modify snapshotset -ldev_id <ldev#> {-snapshot_name <name>   -mirror_id <mun#>} -snapshot_data <op> raidcom modify snapshotset -snapshot_name <name> -snapshot_data <op> raidcom modify snapshotset -ldev_id <ldev#> -mirror_id <mun#> -snapshot_name <name> -snapshot_data rename
Options	<p><b>-snapshot_name &lt;name&gt;</b>: The snapshotset name of the snapshotset to be operated is specified. Once the snapshotset is operated, all the snapshot data belonging to the relevant snapshotset becomes the operation target. When rename is specified for -snapshot_data, the snapshotset name after the change is specified.</p> <p><b>-ldev_id &lt;ldev#&gt;</b>: The volume number of the P-VOL of the snapshot data to be operated is specified. Furthermore, the snapshot data to be operated is identified by specifying the snapshotset name or mun#.</p> <p><b>-mirror_id &lt;mun#&gt;</b>: mun# of the snapshot data to be operated is specified.</p> <p><b>-snapshot_data &lt;op&gt;</b>: The operation performed for the specified snapshot data is specified. Select one from the following four parameters and specify the operation to be performed.</p> <p><b>create</b>: Create a snapshot data. (The pair status is changed from PAIR to PSUS. This is equivalent to pairsplit.)</p> <p><b>resync</b>: The created snapshot data is discarded. (The pair status is changed to PAIR. This is equivalent to pairresync.)</p> <p><b>restore</b>: Restore a snapshot data. (The pair status is changed from PSUS to RCPY. It is changed to PAIR after completing the restoration. This is equivalent to pairresync -restore.)</p> <p><b>rename</b>: The snapshotset name is changed. The volume number of the specified P-VOL and the name of the snapshotset to which the snapshot data identified by mun# belongs are changed.</p> <p><b>Note</b>: When two or more snapshot data exist in the same P-VOL in the snapshotset, even if the snapshotset name and the P-VOL are specified, the snapshot data of the operation target cannot be identified uniquely. In such case, an option among the snapshot data in the appropriate pair status for the operation to be executed becomes the operation target. If the snapshot data in the appropriate pair status does not exist, the operation is not executed.</p>

### Example:

The snapshot data of the P-VOL (10) registered in the snapshotset (snap1) is created.

```
C:\HORCM\etc>raidcom modify snapshotset -ldev_id 10 -snapshot_name snap1
-snapshot_data create
```

## Using the raidcom map snapshotset command

The volume number is mapped to the snapshot data.

**Table 10-47 Raidcom map snapshotset command options**

Parameter	Value
Command Name	<b>raidcom map snapshotset</b>
Format	<b>raidcom map snapshotset -ldev_id &lt;ldev#(P)&gt; &lt;ldev#(S)&gt; {-mirror_id &lt;mun#&gt;   -snapshot_name &lt;name&gt;}</b>
Options	<b>-ldev_id &lt;ldev#(P)&gt; &lt;ldev#(S)&gt;</b> : The volume number of the P-VOL of the snapshot data which maps the volume number to ldev#(P) is specified. The volume number to map the snapshot data to ldev#(S) is specified.
	<b>-snapshot_name &lt;name&gt;</b> : The snapshotset name of the snapshotset to which the snapshot data to be operated belongs is specified.
	<b>-mirror_id &lt;mun#&gt;</b> : mun# of the snapshot data to map the volume number is specified.

### **Example:**

The volume number (20) is mapped to the snapshot data of the P-VOL (10) registered in the snapshotset (snap1).

```
C:\HORCM\etc>raidcom map snapshotset -ldev_id 10 20 -snapshot_name snap1
```

## Using the p command

The mapped volume number is unmapped from the snapshot data.

**Table 10-48 Raidcom unmap snapshotset command options**

Parameter	Value
Command Name	<b>raidcom unmap snapshotset</b>
Format	<b>raidcom unmap snapshotset -ldev_id &lt;ldev#&gt; [-mirror_id &lt;mun#&gt;   -snapshot_name &lt;name&gt;]</b>
Options	<b>-ldev_id &lt;ldev#&gt;</b> : Specify the volume number to be unmapped. If the volume number of the P-VOL is specified, it is necessary to specify the snapshotset name or mun#.
	<b>-snapshot_name &lt;name&gt;</b> : The snapshotset name of the snapshotset to which the snapshot data to unmap the volume number belongs is specified.
	<b>-mirror_id &lt;mun#&gt;</b> : mun# of the snapshot data to operate the volume number is specified.

### **Example:**

The volume number (20) is unmapped from the snapshot data.

```
C:\HORCM\etc>raidcom unmap snapshotset -ldev_id 20
```

## Using the raidcom replace snapshotset command

The assignment of the volume number mapped to the snapshot data is changed to the different snapshot data of the same P-VOL.

**Table 10-49 Raidcom replace snapshotset command options**

Parameter	Value
Command Name	<b>raidcom replace snapshotset</b>
Format	<b>raidcom replace snapshotset -ldev_id &lt;ldev#&gt; {-mirror_id &lt;mun#&gt;   -snapshot_name &lt;name&gt;}</b>
Options	<b>-ldev_id &lt;ldev#&gt;</b> : The volume number of the snapshot data to change the assignment is specified.
	<b>-snapshot_name &lt;name&gt;</b> : The snapshotset name of the snapshotset to which the snapshot data of the assignment destination of the volume number belongs is specified.
	<b>-mirror_id &lt;mun#&gt;</b> : mun# of the snapshot data of the assignment destination of the volume number is specified.

### **Example:**

The assignment of the volume number (20) mapped to the snapshot data is changed to the snapshot data belonging to the snapshotset (snap3).

```
C:\HORCM\etc>raidcom replace snapshotset -ldev_id 20 -snapshot_name snap3
```

# Troubleshooting

This chapter covers the following topics:

- [Troubleshooting ShadowImage](#)
- [Troubleshooting SnapShot](#)
- [Troubleshooting TrueCopy](#)
- [Troubleshooting TCE](#)
- [Troubleshooting CCI](#)
- [About error reporting](#)
- [Recovering PSUE status using ShadowImage](#)
- [Recovering PSUE status using SnapShot](#)
- [Recovering PSUE status using TrueCopy/TCE](#)
- [Calling the Hitachi Data Systems Support Center](#)

## Troubleshooting ShadowImage

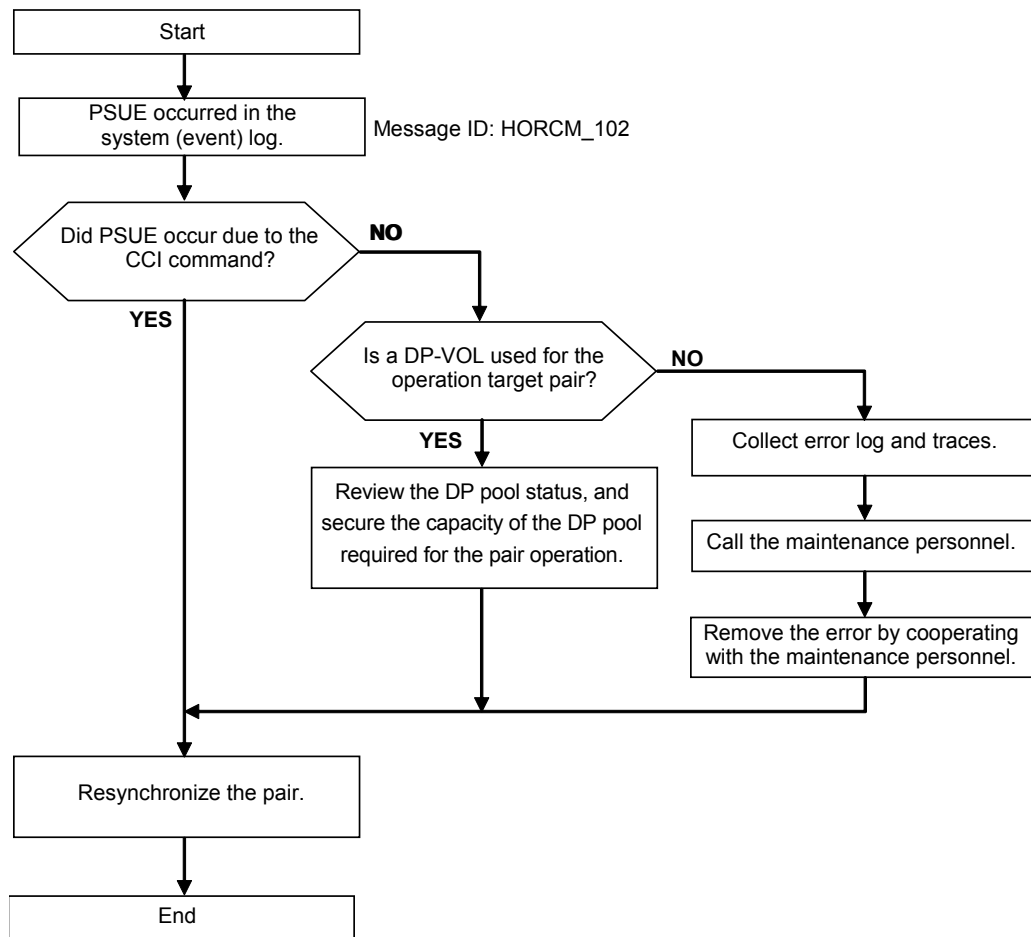
In the case of the ShadowImage pair, a pair failure may be caused by occurrence of a hardware failure, so that the work for restoring the pair status is required. When the operation of pair release is performed forcibly by a user, the pair status is changed to PSUE in the same way that a pair failure occurs, so that the work for restoring the pair status is required. Furthermore, when the DP-VOLs are used for the volumes configuring a pair, a pair failure may occur, depending on the consumed capacity of the DP pool and the pair status may become PSUE.

When the DP-VOL created in the DP pool is used for a ShadowImage pair, since the required area cannot be allocated, a pair failure may occur. If a failure occurs during the DP pool formatting, wait until the formatting of the DP pool for total capacity of the DP-VOLs created in the DP pool is completed. If a failure occurs due to the DP pool capacity depletion, for making the DP pool status normal, perform the DP pool capacity growing and DP pool optimization, and increase the DP pool free capacity.

If a hardware error occurs while you are operating ShadowImage, both of the following are necessary:

- A CCI user intervention
- Assistance from a Hitachi Customer Service representative

For example, when formatting is needed to resolve a volume error and that volume is used for ShadowImage, the pair must be released by the user (CCI operation by the user) before the volume can be formatted. Therefore, please contact Hitachi personnel because maintenance requires the user to issue CCI commands. Note that the Hitachi personnel can only remove errors which result from hardware. An operation such as recovering a ShadowImage pair status (e.g. resynchronizing) must be done by the user. [Figure 11-1](#) shows the flow of action when the PSUE error occurs. [Table 11-1](#) shows the share of action to be taken by the user.



**Figure 11-1 Pair status information example using ShadowImage**

**Table 11-1 Operational notes for ShadowImage**

Action	Action taken by whom
Confirm the message (syslog).	User
Verify that PSUE is caused by the user operation.	User
Verify the status of the array.	User
Call maintenance personnel when the array malfunctions.	User
For other reasons, call the Hitachi Data Systems Support Center.	User (only for users who are registered to receive support)
Hardware maintenance.	Hitachi Customer Service
Reconfigure and recover the pair.	User

## Troubleshooting SnapShot

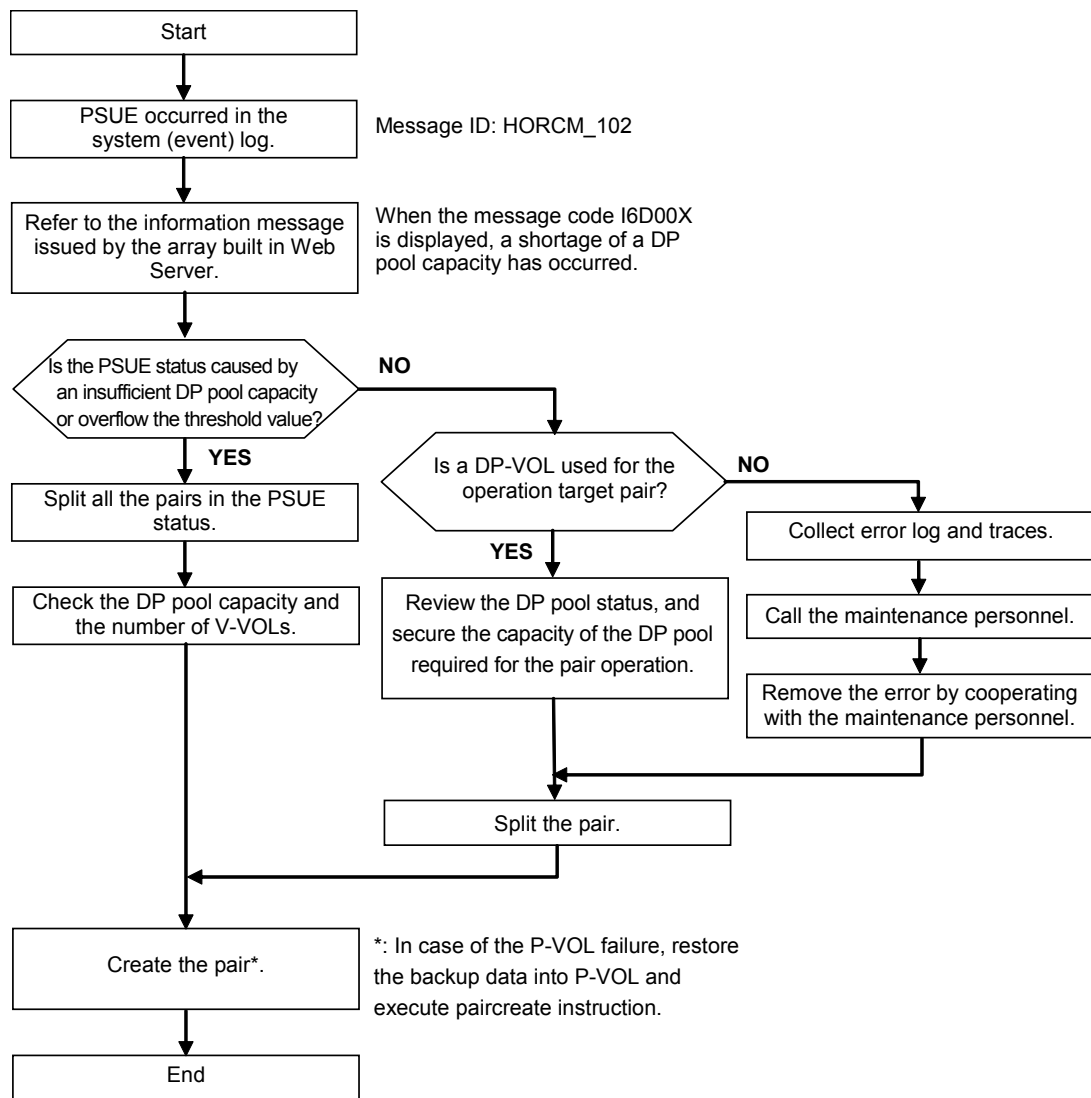
If a hardware error occurs while you are operating SnapShot, both of the following are necessary:

- A CCI user intervention
- Assistance from a Hitachi Customer Service representative

There are three causes of PSUE status induced during an operation of SnapShot: an insufficient DP pool capacity (full of the DP pool), DP pool capacity is depleted, and an occurrence of a logically abnormal status caused by a hardware failure. When the DP pool capacity is insufficient, split all pairs that have been placed in the PSUE status. After that, check if the configuration including the DP pool capacity and number of V-VOLs is appropriate because it is judged that the system configuration has a problem. After the check is finished, carry out an operation of SnapShot for recovering a pair status (such as paircreate). All those operations are to be done by a user.

When the DP-VOL created in the DP pool is used for a SnapShot pair, since the required area cannot be allocated, a pair failure may occur. If a failure occurs during the DP pool formatting, wait until the formatting of the DP pool for total capacity of the DP-VOLs created in the DP pool is completed. If a failure occurs due to the DP pool capacity depletion, for making the DP pool status normal, perform the DP pool capacity growing and DP pool optimization, and increase the DP pool free capacity.

For example, when formatting is needed to resolve a volume error and that volume is used for SnapShot, the pair must be released by the user (CCI operation by the user) before the volume can be formatted. Therefore, please contact Hitachi personnel because maintenance requires the user to issue CCI commands. Note that the Hitachi personnel can only remove errors which result from hardware. An operation such as recovering a SnapShot pair status (e.g. paircreate) must be done by the user. [Figure 11-2](#) shows the flow of action when the PSUE error occurs. [Table 11-2](#) shows the share of action to be taken by the user.



**Figure 11-2 Pair status information example using SnapShot**

**Table 11-2 Operational notes for SnapShot**

Action	Action taken by whom
Confirm the message (syslog).	User
Refer to the information message issued by the array built in Web Server (a shortage of a DP pool capacity).	User
Verify the status of the array.	User
Call maintenance personnel when the array malfunctions.	User
For other reasons, call the Hitachi Data Systems Support Center.	User (only for users who are registered to receive support)
Split the pair.	User
Hardware maintenance.	Hitachi Customer Service
Reconfigure and recover the pair.	User

## Troubleshooting TrueCopy

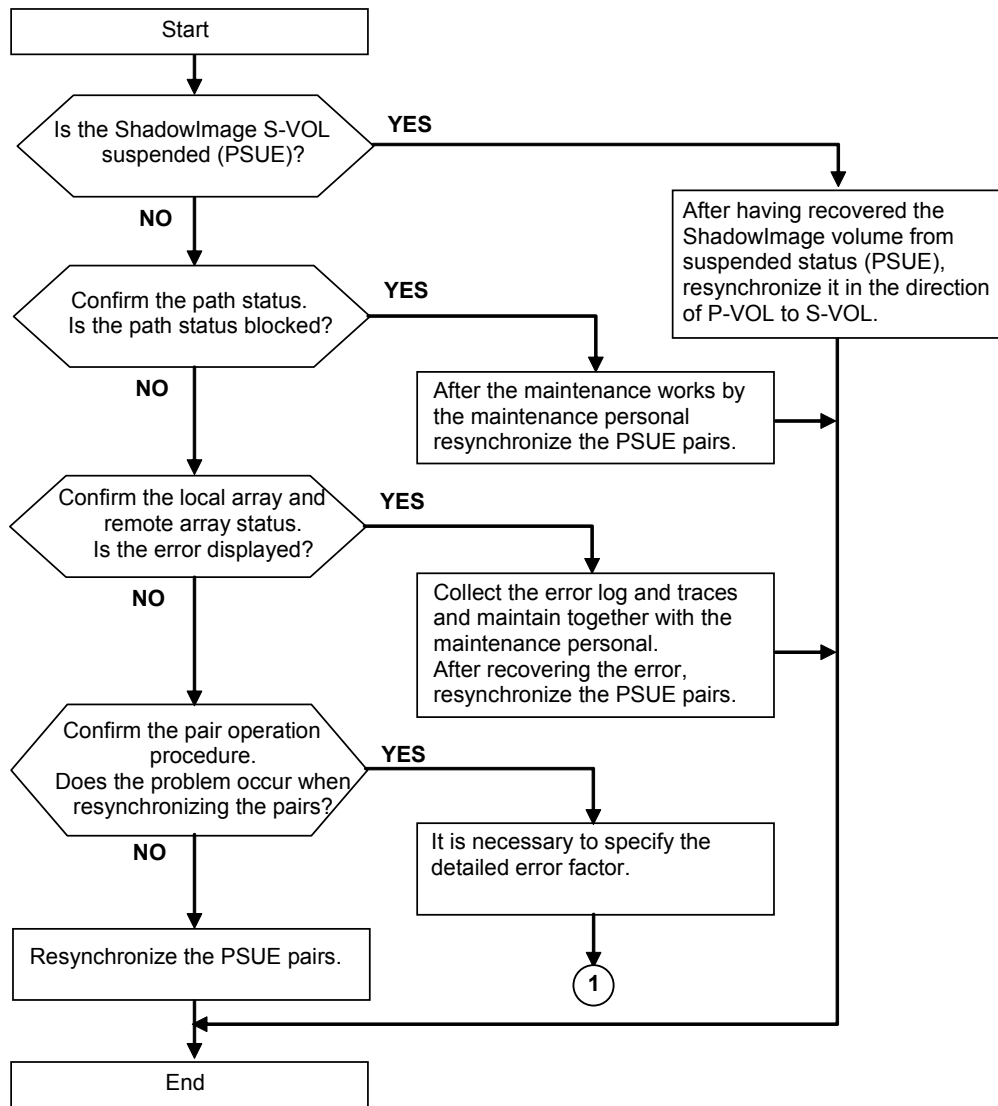
When the following problem occurs, the pair status is changed to PSUE:

- The path detached occurs
- A logical abnormal state occurs by the trouble of the array
- An abnormal state occurs by the causes other than the array

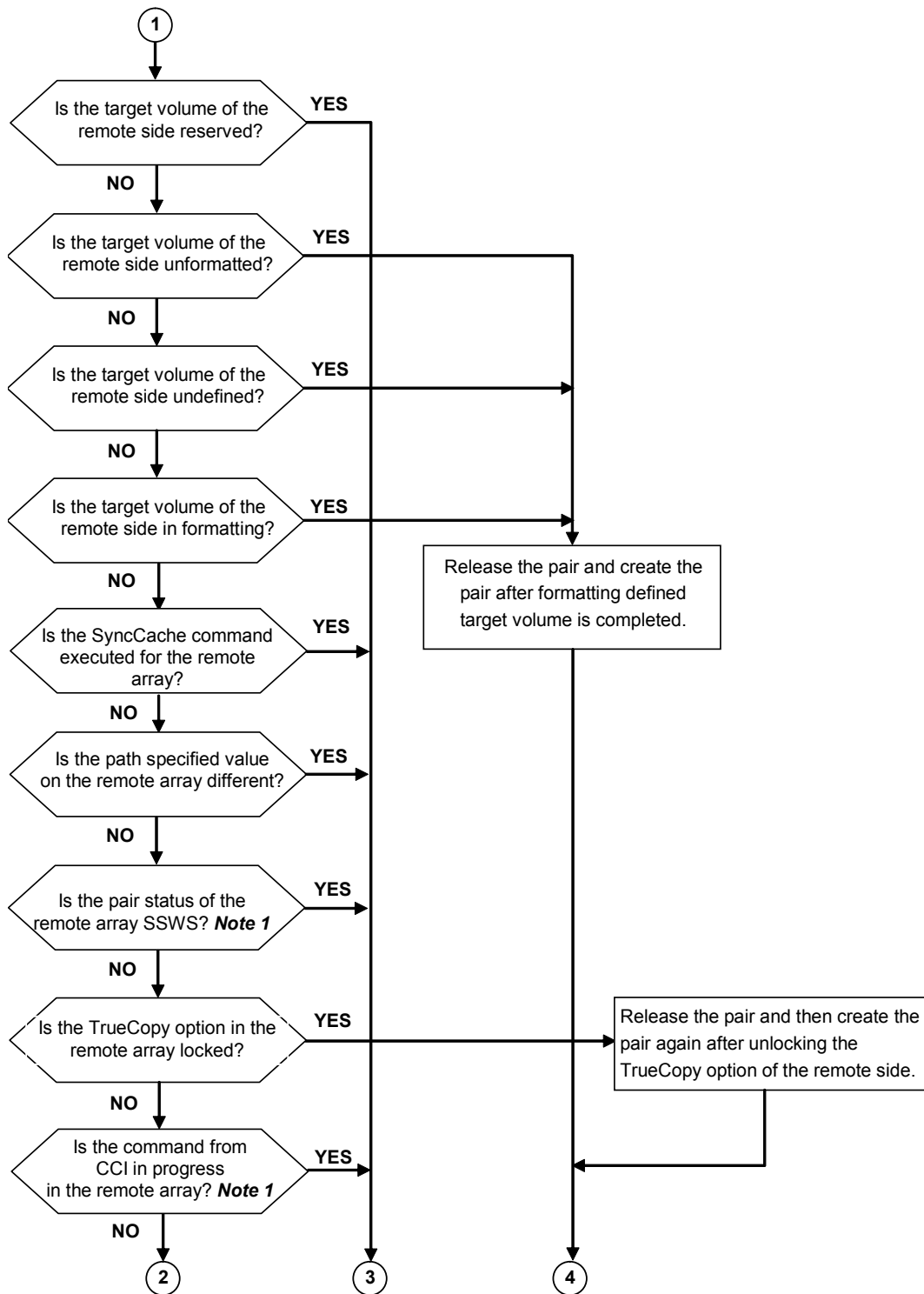
If a hardware or Fibre path error occurs while you are operating the TrueCopy, both of the following are necessary:

- A CCI user intervention
- Assistance from a Hitachi Customer Service representative

For example, when formatting is needed to resolve a volume error and that volume is used for TrueCopy, the pair must be released by the user (CCI operation by the user) before the volume can be formatted. Therefore, please contact Hitachi personnel because maintenance requires the user to issue CCI commands. Note that the Hitachi personnel can only remove errors which result from hardware. An operation such as recovering the TrueCopy pair status (e.g. resynchronizing) must be done by the user. [Figure 11-3](#) shows the flow of action when the PSUE error occurs. [Table 11-3](#) shows the share of action to be taken by the user.

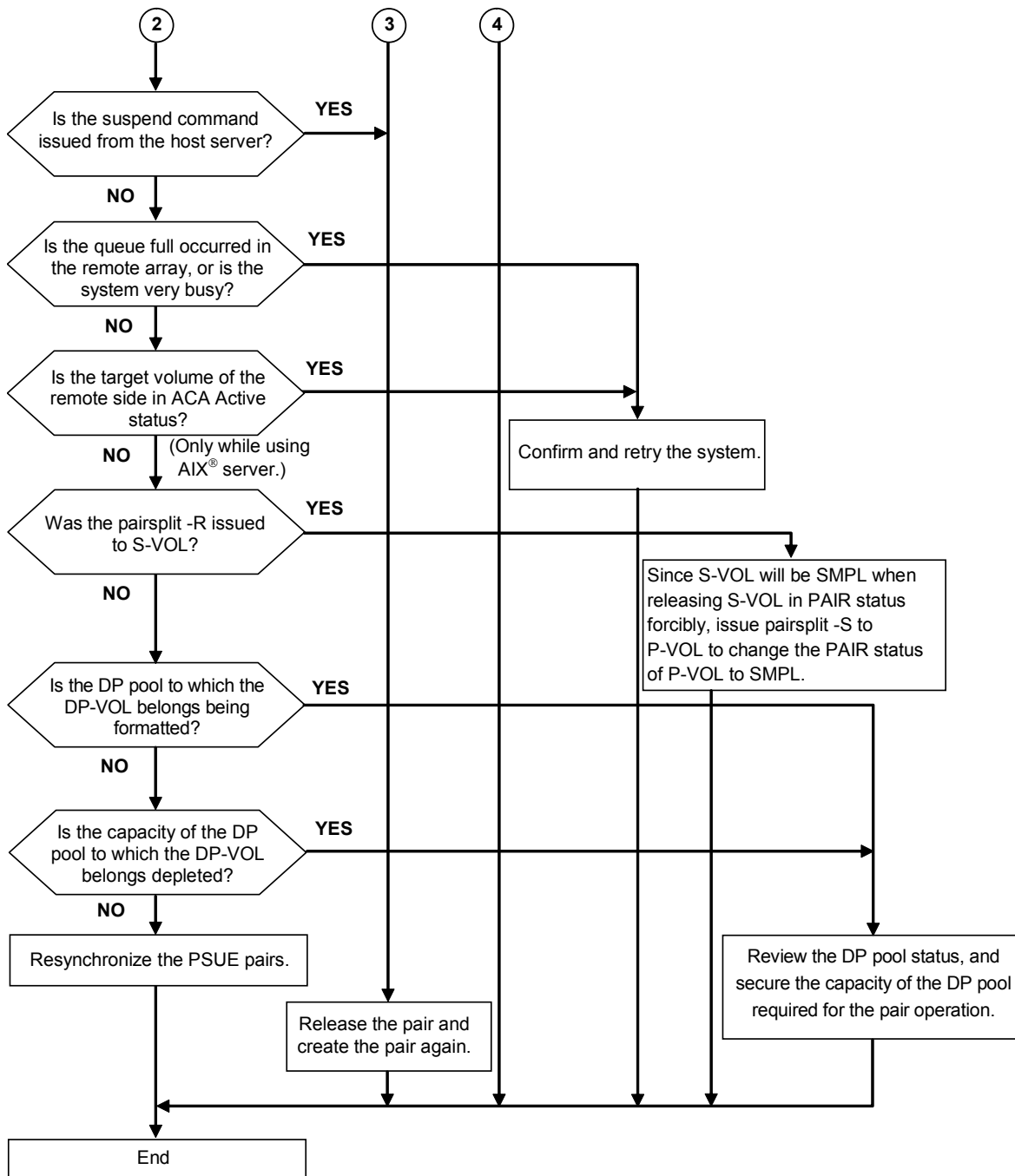


**Figure 11-3 Pair status information example using TrueCopy**



**Figure 11-3 Pair status information example using TrueCopy (cont.)**

**Note:** When swap is in progress from S-VOL to P-VOL, the pairs cannot be resynchronized from P-VOL to S-VOL.



**Figure 11-3 Pair status information example using TrueCopy (cont.)**

**Table 11-3 Operational notes for TrueCopy**

Action	Action taken by whom
Confirm the message (syslog).	User
Confirm whether PSUE is caused by the user operation.	User
Confirm the status of the array.	User
Call the maintenance personnel when the array malfunctions.	User
For other reasons, call the Hitachi Data Systems Support Center.	User (only for users who are registered to receive support)
Hardware maintenance (including path blockage).	Hitachi maintenance personnel
Reconfigure and recover the pair.	User

## Troubleshooting TCE

When the following problem occurs, the pair status is changed to PSUE:

- The amount of the data in the DP pool exceeds the capacity allowed to be used
- The path detached occurs
- A logical abnormal state occurs by the trouble of the array
- An abnormal state occurs by the causes other than the array

If a hardware or Fibre path error occurs while you are operating the TCE, both of the following are necessary:

- A CCI user intervention
- Assistance from a Hitachi Customer Service representative

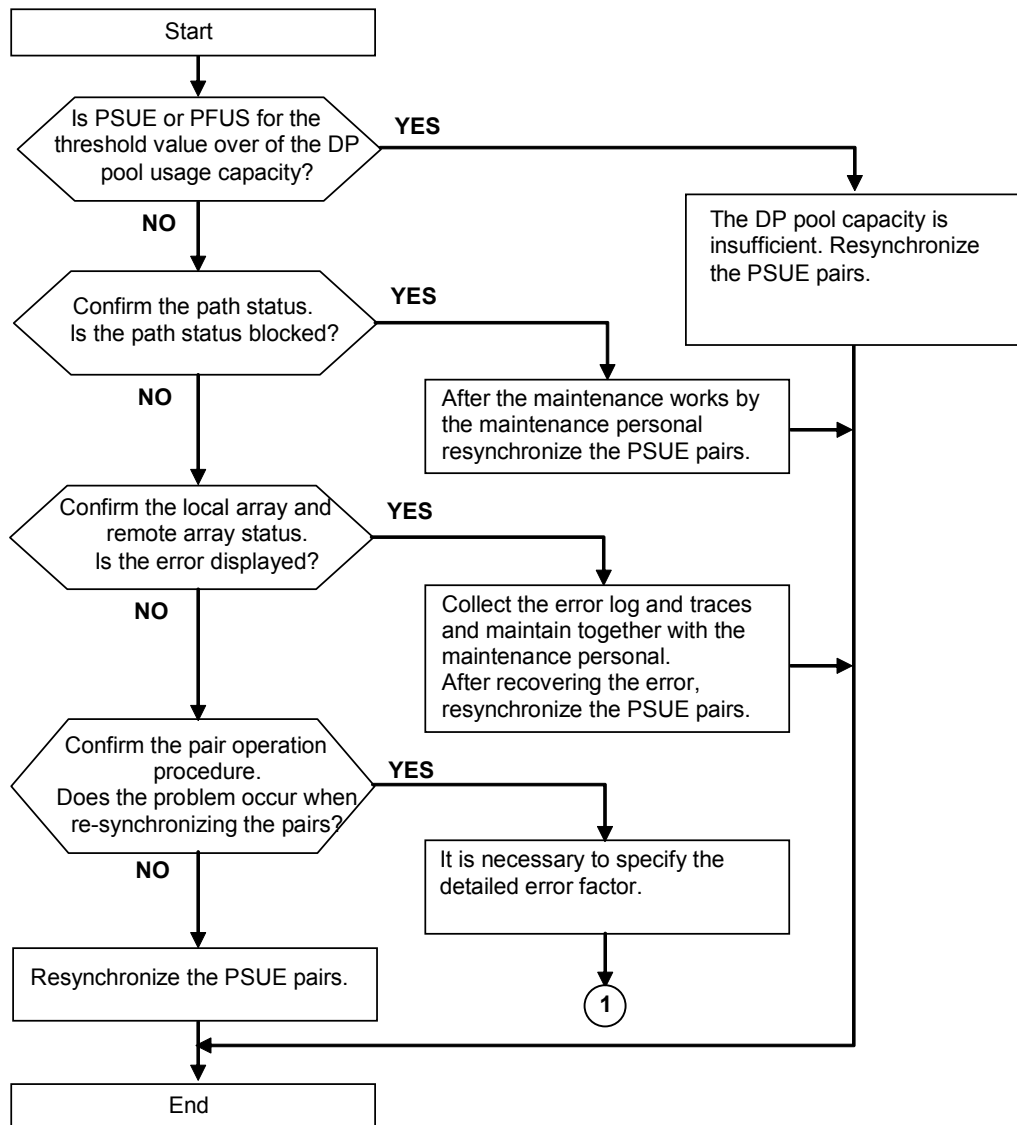
When the amount of the data in the DP pool exceeds the capacity allowed to be used, can be recover by resynchronizing all the pairs whose DP pools are placed in the PSUE or PFUS status. After that, check if the configuration including the DP pool capacity and number of V-VOLs (when concurrent use of SnapShot) is appropriate because it is judged that the system configuration has a problem. After the check is finished, carry out an operation of TCE for recovering a pair status (such as paircreate). All those operations are to be done by a user.

For example, when formatting is needed to resolve a volume error and that volume is used for TCE, the pair must be released by the user (CCI operation by the user) before the volume can be formatted. Therefore, please contact Hitachi personnel because maintenance requires the user to issue CCI commands. Note that the Hitachi personnel can only remove errors which result from hardware. An operation such as recovering the TCE pair status (e.g. resynchronizing) must be done by the user. [Figure 11-4](#) shows the flow of action when the PSUE error occurs. [Table 11-4](#) shows the share of action to be taken by the user.



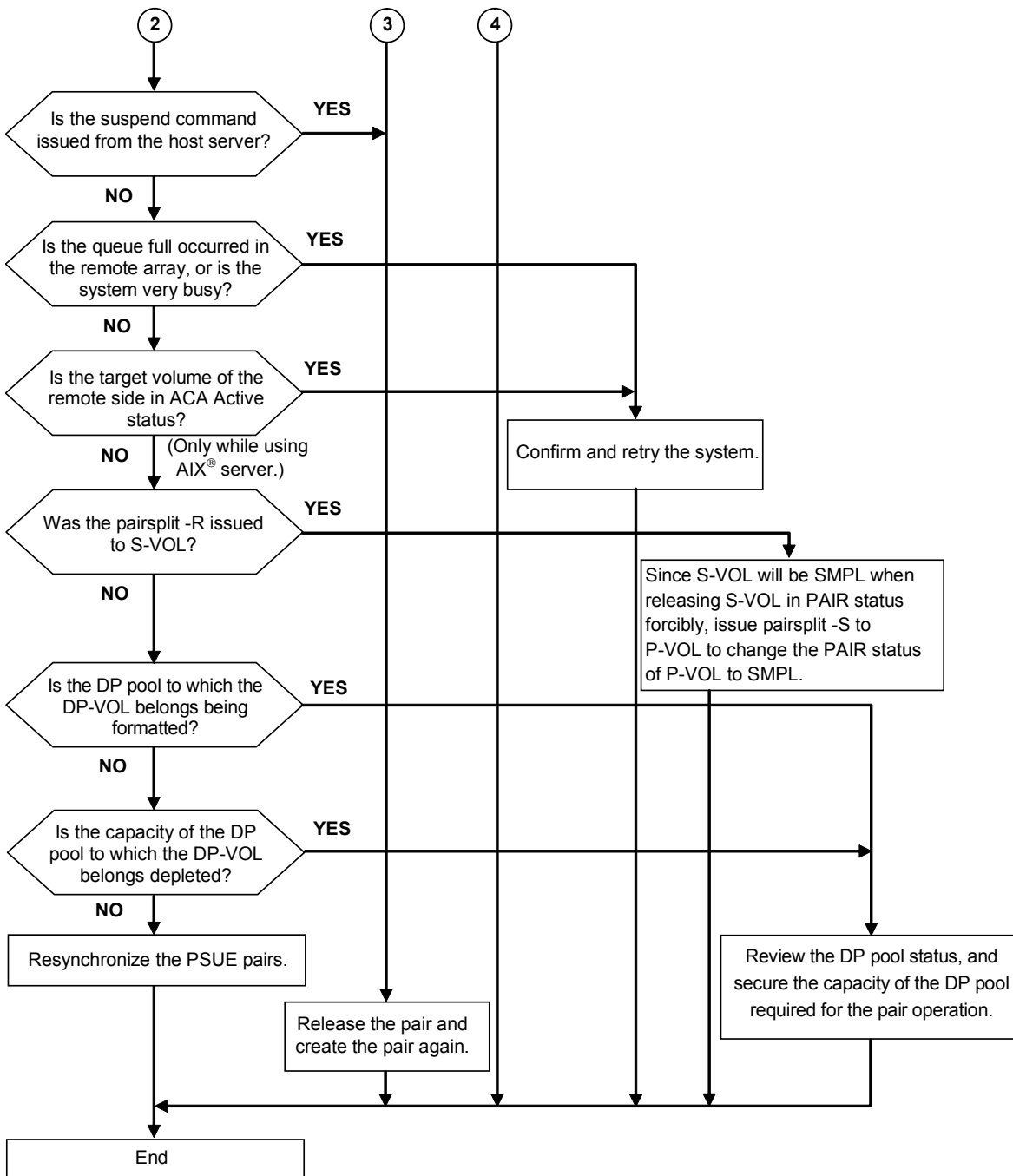
**Note:**

- In the case of TCE, even when one of the pairs belonging to the same CTG is placed in the PSUE status, all the pairs in the CTG are placed in the PSUE status because the change to the PSUE status is made in units of CTG. However, concerning the pair in the PSUS status, the status is not changed to PSUE but left as it is.
- In the case where the DP pool-over occurs in the secondary DP pool, it is reported to the P-VOL after the S-VOL status is changed to PFUS and the P-VOL status is changed to PSUE. On the other hand, when the DP pool-over occurs in the primary DP pool, only the P-VOL status is changed to PFUS and the change of the S-VOL status does not occur.



**Figure 11-4 Pair status information example using TCE**





**Figure 11-4 Pair status information example using TCE (continued)**

**Table 11-4 Operational notes for TCE**

Action	Action taken by whom
Confirm the message (syslog).	User
Checking the Information message sent from the Web built-in array (making sure of insufficiency of the DP pool capacity)	User
Confirm whether PSUE is caused by the user operation.	User
Confirm the status of the array.	User
Call the maintenance personnel when the array malfunctions.	User
For other reasons, call the Hitachi Data Systems Support Center.	User (only for users who are registered to receive support)
Hardware maintenance (including path blockage).	Hitachi maintenance personnel
Reconfigure and recover the pair.	User

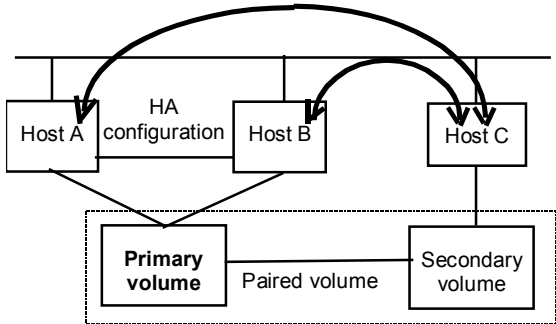
## Troubleshooting CCI

If you have a problem with the CCI software, first verify that the problem is not being caused by the UNIX/PC host hardware or software, and try restarting the host. [Table 11-5](#) provides operational notes and restrictions for CCI operations.

For maintenance of ShadowImage/SnapShot/TrueCopy/TCE volumes, if a failure occurs, it is important to find the failure in the paired volumes, recover the volumes, and continue operation in the original system.

**Table 11-5 Operational notes for CCI**

Condition	Recommended Action
Startup/shutdown restrictions	<p>When the host starts, the primary volume host may update the secondary volume. The secondary volume must not be mounted automatically in the startup sequence. If the secondary volume is used by the LVM, the volume group of the LVM must be deactivated. The secondary volume must be mounted in the split state or in the simplex mode.</p> <p>When the host starts, the secondary volume can be activated without confirmation, once it can be guaranteed that the secondary volume has been PSUS (Read/Write enable) or it is in the SMPL state during the host shutdown sequence.</p>
Hot standby operations	<p>CCI commands cannot execute hot standby operations between the primary and secondary volumes. Use the takeover command intended for the HA configuration to execute the hot standby operation. In hot standby operation, two hosts are used, and the active (primary) and standby (secondary) host programs are run alternately in each host in case one host fails. Follow these precautions:</p> <p><b>Operation across volumes.</b> Since each CCI command causes the host software to handle the volume by volume, a single volume should not be partitioned to prevent it from being used by selected hosts.</p> <p><b>Using LVM and paired volume together.</b> When constructing the LVM on the paired volume in the mutual hot standby configuration, the LVM logical volumes must be constructed in units of volume to prevent the volumes from being mounted by the LVM.</p>
Coexistence of LVM mirror and TrueCopy	<p>When the LVM mirror and TrueCopy volumes are used together, the LVM mirror handles write errors and changes the volumes. Thus, the fence level of the volumes used by the LVM mirror must be set to <b>data</b>.</p>
Using paired volume in a single host	<p>When constructing a paired volume in a single host, it is necessary to activate two or more CCI instances. To activate two or more CCI instances, instance numbers must be assigned using the environmental variable <b>HORCMINST</b>. The HORCM and CCI commands must possess this environmental variable. A configuration definition file and a log directory must be set for each instance.</p> <p>The command device described in the configuration definition file must be established to follow every instance. If using a command device between different instances on the same port, the maximum number of instances per command device is 16. If this number is exceeded, use a different path for each instance.</p>

Condition	Recommended Action
Sharing volumes in a hot standby configuration	<p>When a paired volume is used for the disk shared by the hosts in a hot standby configuration using HA software, use the primary volume as the shared disk and describe the corresponding hosts using the paired volume in the configuration definition file as shown below. In the HA configuration, if a CCI command issued by host C fails in host B (because host B has gone down and/or there is a command device IO_ERROR), host A is connected and command execution is retried.</p>  <pre> graph TD     HA[HA configuration] --- HostA[Host A]     HA --- HostB[Host B]     HostA --- PV[Primary volume]     HostB --- PV     HostB --- SV[Secondary volume]     HostC[Host C] --- SV     PV --- PV_PV[Paired volume] --- SV   </pre>
Linkage with HA software	<p>The HORCM must not be an object of the process monitored by the HA software (cluster manager), because HORCM should run at the same level as the cluster manager.</p> <p><b>Note:</b> Do not use the pair volume for the cluster lock disk that HA software uses for election.</p>
Maintenance	A HORCM restart is required if the disk array configuration is changed (for example, firmware exchange, cache memory install/uninstall).
Command device	Each CCI command is executed by issuing a command to the command device. This command is read or written from/into the specific block area of the command device. Therefore, the user cannot use the command device. In addition, this device must not belong to an LVM volume group. For Windows systems, do not assign a drive letter to the command device to prevent utilization by general users.
Alternate path restrictions	If the P-VOL and S-VOL are on the same host, an alternate path from P-VOL to S-VOL cannot be used. Use of alternate path to a volume pair is limited to primary (secondary) volumes.
HORCM failure to activate	After a new system has been constructed, failure to activate HORCM may occur due to an improper environmental setting and/or configuration definition by the user. Refer to the HORCM activation log, and correct the settings.
Changing IO way of the command device for AIX	<p>CCI tries to use <code>ioctl(DK_PASSTHRU)</code> or <code>SCSI_Path_thru</code> as much as possible, if it fails, changes to <code>RAW_IO</code> follows conventional ways. Even so, CCI may encounter to AIX FCP driver which does not support the <code>ioctl(DK_PASSTHRU)</code> fully in the customer site. After this consideration, CCI also supports by defining either following environment variable or <code>/HORCM/etc/USE_IOCTL</code> file (size=0) that uses the <code>RAW_IO</code> forcibly.</p> <p>Example:</p> <pre> export USE_OLD_IOCTL=1 horcmstart.sh 10  HORCM/etc: -rw-r--r--  1 root root      0 Nov 11 11:12 USE_OLD_IOCTL -r--r--r--  1 root sys  32651 Nov 10 20:02 horcm.conf -r-xr--r--  1 root sys  282713 Nov 10 20:02 horcmgr </pre>
Abnormal termination of command	Refer to the command log file and HORCM log file to identify the cause of the error. If a command terminates abnormally because of a remote host failure, recover the host from the failure, then re-execute the command. If HORCM has shut down, restart HORCM. If an unrecoverable error occurs, obtain the log files and contact the Hitachi Support Center.
The poll(10ms) parameter in the configuration definition file	Always set the poll(10ms) parameter with a value more than or equal to 6,000. If you have created the configuration definition file using the mkconf command tool, set this value manually. If the value is set incorrectly, it may cause a conflict between the CCI and the array, which causes the internal process of the array to suspend temporary. The process may not proceed.

Condition	Recommended Action
Internal process conflict between the CCI and the array.	When an internal process conflict occurs between the CCI and the array, the process of the array suspends temporarily. If the conflict continues, the internal process may not proceed. Therefore, when monitoring (polling) the status of the array (by creating a script using the CCI commands), set the information-display-based commands (e.g. pairedisplay, raidscan, raidar, and raidqry) to be issued to more than or equal to a minute.
Restriction for TrueCopy/TCE	Since S-VOL is reserved while using S-VOL of TrueCopy, the resources of MSCS, P-VOL cannot be copied to S-VOL. Therefore, S-VOL of TrueCopy must not be used as the resources of MSCS.

## About error reporting

[Table 11-6](#) lists and describes the HORCM system log messages and provides guidelines for resolving the error conditions.

[Table 11-7](#) lists and describes the command error messages and their return values and also provides guidelines for resolving the error conditions.

[Table 11-8](#) and [Table 11-9](#) list and describe the common error messages for each command. [Table 11-10](#) lists the unique error messages.

**Table 11-6 System log messages**

Message ID	Condition	Cause	Recommended Action
HORCM_001	The HORCM log file cannot be opened.	The file cannot be created in the HORCM directory.	Create space on the disk where the root directory resides.
HORCM_002	The HORCM trace file cannot be opened.	The file cannot be created in the HORCM directory.	Create space on the disk where the root directory resides.
HORCM_003	The HORCM daemon process cannot create a child process due to an error.	HORCM daemon attempted to create more processes than the maximum allowable number.	Terminate unnecessary programs or daemon processes running simultaneously.
HORCM_004	HORCM assertion failed, resulting in a fatal internal error in the HORCM.	An internal error occurred which could not be identified by the HORCM.	Restart the system, collect all HORCM log and trace information, and call the Hitachi Data Systems Support Center.
HORCM_005	The CCI software failed to create the end point for remote communication.	HORCM failed to create a socket, or an error exists in the HORCM configuration file (\$HORCM_CONF).	Refer to the HORCM startup log to identify the cause of the error and reset the parameters.
HORCM_006	HORCM memory allocation failed.	HORCM memory could not be secured.	Increase the system virtual memory, or close any unnecessary programs.
HORCM_007	An error exists in the HORCM setup file.	An error exists in the HORCM setup file.	Refer to the startup log and reset the parameters.
HORCM_008	HORCM configuration file parameters could not be read.	An error exists in the format or parameters of the HORCM configuration file (\$HORCM_CONF).	Refer to the HORCM startup log to identify the cause of the error.
HORCM_009	ShadowImage connection to the CCI software failed.	System devices are improperly connected, or an error exists in the HORCM configuration file.	Refer to the HORCM startup log to identify the cause of the error.
HORCM_101	ShadowImage and the CCI software communication fails.	A system I/O error occurred or an error exists in the HORCM configuration file (\$HORCM_CONF).	Refer to the HORCM startup log to identify the cause of the error.

Message ID	Condition	Cause	Recommended Action
HORCM_102	The volume is suspended in code 0006.	The pair status was suspended due to code 0006.	<p>(For ShadowImage) Determine how the pair was suspended. If the pair was forcibly suspended, resynchronize the pair. If the pair was not suspended forcibly, the pair was suspended due to an error in the array. Collect all HORCM log and trace information, and call the Hitachi Data Systems Support Center. After maintenance personnel has recovered the array, refer to the <a href="#">"Recovering PSUE status using ShadowImage"</a> to recover the data.</p> <p>(For SnapShot) Refer to the <a href="#">"Recovering PSUE status using SnapShot"</a> to recover the data.</p> <p>(For TrueCopy/TCE) Refer to the <a href="#">"Recovering PSUE status using TrueCopy/TCE"</a> to recover the data.</p>

**Table 11-7 Command error messages**

Message ID	Error Message	Condition	Recommended Action	Return Value
EX_COMERR	Can't be communicated with HORC Manager	This command failed to communicate with the CCI software.	Verify that HORCM is running by using UNIX commands [ps - ef   grep horcm].	255
EX_REQARG	Required Arg list	An option or arguments of an option are not sufficient.	Choose the correct option using the -h option.	254
EX_INVARG	Invalid argument	An option or arguments of an option are incorrect.	Choose the correct option using the -h option.	253
EX_UNWOPT	Unknown option	Designated an unknown option.	Choose the correct option using the -h option.	252
EX_ATTTHOR	Can't be attached to HORC Manager	Could not connect with HORCM.	<p>Verify that HORCM is running and/or that HORCMINST is set correctly.</p> <p><b>Note 1:</b> For Windows Server, when a path detachment, which is caused by a controller detachment or interface failure, continues for longer than one minute, the command device may be unable to be recognized at the time when recovery from the path detachment is made. To make the recovery, execute the "re-scanning of the disks" of Windows. When Windows cannot access the command device although HORCM becomes able to recognize the command device, restart HORCM.</p>	251
EX_ATTDBG	Can't be attached to a Debug layer	Failed to communicate with HORCM, or cannot make a log directory file.	Verify that HORCM is running by using UNIX commands [ps - ef   grep horcm].	250

Message ID	Error Message	Condition	Recommended Action	Return Value
EX_INVNAM	Invalid name of option	The name specified in an argument of an option is not appropriate.	Choose the correct option using the -h option.	249
EX_OPTINV	A specified option is invalid	Detected contradiction in information that RAID reported.	Call the Hitachi Support Center.	248
EX_ENOENT	No such device or group	The designated device or group name does not exist in the configuration file.	Verify the device or group name and add it to the configuration file of the remote and local hosts.	247
EX_ENODEV	No such device	The designated device name does not exist in the configuration file.	Verify the device name and add it to the configuration file of the remote and local hosts.	246
EX_ENOUNT	No such RAID unit	The designated RAID unit ID does not exist in the configuration file.	Verify the RAID unit ID and add it to the configuration file of the remote and local hosts.	219
EX_ENQSER	Unmatched Serial# vs RAID unitID	The group designated by ShadowImage/SnapShot paircreate does not have the same RAID unit, or the unitID is not identical to the unit ID in the same RAID serial#.	Verify the serial# (serial number) using the pairedisplay command, or confirm serial# of the RAID using the raidqry -r command	218
EX_ENOMEM	Not enough core	Insufficient memory exists.	Increase the virtual memory capacity of the system, or close any unnecessary programs and/or daemon processes.	245
EX_ERANGE	Result too large	Tried to use arguments for an option beyond the maximum allowed, or a result beyond the maximum was created.	Refer to the error message, and designate an appropriate value.	244
EX_ENAMLG	File name too long	Undefined error.	-	243
EX_ENORMT	No remote host alive for remote commands or Remote Raid Manager might be blocked(sleeping) on an existing I/O	A timeout occurred on remote communication, and HORC Manager failed to re-execute.	Confirm that the HORC Manager in the remote host is running, and then increase the value of the timeout in the configuration file.  To execute within the local host, execute the command that supports the local option (-l).	242
EX_INVMOD	Invalid RAID command mode	Detected a contradiction for a command.	Collect all HORCM log information, and call the Hitachi Support Center.	241
EX_INVCMD	Invalid RAID command	Detected a command error.	Collect all HORCM log information, and call the Hitachi Support Center.	240
EX_ENOGRP	No such group	The designated device or group name does not exist in the configuration file, or the network address for remote communication does not exist.	Verify the device or group name and add it to the configuration file of the remote and local hosts.	239
EX_UNWCOD	Unknown function code	Detected a command error.	Collect all HORCM log information, and call the Hitachi Support Center.	238

Message ID	Error Message	Condition	Recommended Action	Return Value
EX_CMDIOE	Control command I/O error	A read/write to the command device failed with an I/O error.	Refer to the host syslog file, and investigate the cause of the error. If the problem persists, collect all HORCM log information, and call the Hitachi Support Center.	237
EX_CMDRJE	An order to the control/command device was rejected	The request to the command device failed or was rejected. <b>Note:</b> This error code is sometimes caused by the operating system and reported as EX_CMDIOE instead of EX_CMDRJE (see next row).	Investigate the detailed factor of the error referring to the information on the syslog of the host or the HORCM log. Confirm the following items, and if the problem persists, collect all HORCM log information, and call the Hitachi Support Center.  Verify ShadowImage/SnapShot/TrueCopy/TCE functions are installed.  Verify that the target volume is available.	221
EX_CMDIOE	Control command I/O error, or rejected	A read/write to the command device failed with an I/O error or was rejected.	Investigate the detailed factor of the error referring to the information on the syslog of the host or the HORCM log. If the cause is "Illegal Request (0x05)" Sense Key, please confirm the following items. If the problem persists, collect all HORCM log information, and call the Hitachi Support Center.  Verify ShadowImage/SnapShot functions are installed.  Verify that the target volume is available.	237
EX_ENQVOL	Unmatched volume status within the group	The volume attribute or the fence level within a group is not identical.	Verify status using the pairdisplay command. Make sure all volumes in the group have the same fence level and volume attributes.	236
EX_EVOLCE	Pair Volume combination error	Combination of a volume is unsuitable between the remote and local host.	Verify volume status using the pairdisplay command, and change the combination of volumes properly.	235
EX_EWSUSE	Pair suspended at WAIT state	Detected a suspended status (PSUE) for the paired volume, before it achieves the designated status.	Determine how the pair was suspended.  If the pair was forcibly suspended, resynchronize the pair. If the pair was not suspended forcibly, the pair was suspended due to an error in the array. Collect all HORCM log and trace information, and call the Hitachi Data Systems Support Center.	234
EX_EWSTOT	Timeout waiting for specified status	Detected a timeout before it achieved the designated status.	Increase the value of the timeout using the -t option.	233
EX_EWSLTO	Timeout waiting for specified status on the local host	Timeout error because the remote did not note expected status.	Verify that HORC Manager on the remote host is running.	232
EX_ESTMON	HORCM Monitor stopped	HORC Manager monitoring was refused.	Verify the value of "poll" in the configuration file.	231

Message ID	Error Message	Condition	Recommended Action	Return Value
EX_UNWCMD	Unknown command	An unknown command was attempted.	Verify the command name.	230
EX_INCSTG	Inconsistent status in group	The pair status of a volume within a group is not identical to the status of the other volumes in the group.	Verify the pair status using the pairdisplay command.	229
EX_INVSTP	Invalid pair status	The pair status of the target volume is not appropriate.	Verify the pair status using the pairdisplay command.	228
EX_INVVOL	Invalid volume status	The volume status of the target volume is not appropriate.	Verify the pair status using the pairdisplay -l command.	222
EX_INVMUN	Invalid mu# with HORC or HOMRCF	The MU# of the volume to be operated is not appropriate.	Verify the MU# for the specified group using the pairdisplay command. Also verify whether the command execution environment is set as HORCC_MRCF 1.	220
EX_ENLDEV	No such LDEV within the RAID	A device defined in the configuration file does not have a mapping to a real VOL and Target ID within the RAID.	Please confirm that the Port, Target ID, VOL is defined correctly under HORCM_DEV in the configuration file.	227
EX_INVRCO	Invalid return code	Wrong return code.	Collect all HORCM log information, and call the Hitachi Support Center.	226
EX_VOLCUR	S-Vol currency error	Currency check error for S-VOL. Cannot guarantee identical data on S-VOL.	Check the volume list to see if an operation was directed to the wrong S-VOL.	225
EX_VOLCUE	Local Volumecurrency error	The volume specified with the SVOL-takeover command is not the same as the P-VOL.	Verify the pair status of the local volume.	224
EX_VOLCRE	Local and Remote Volumecurrency error	The combination of the volumes specified with Swap-takeover is unsuitable.	Verify the pair status of remote and local volumes using the pairdisplay command.	223
EX_UNWERR	Unknown Error code	Wrong error code.	Collect all HORCM log information, and call the Hitachi Support Center.	--
EX_ENOCTG	Not enough CTgroups in RAID	CTGID could not be registered due to being beyond the max number of CT groups (0-127) for a volume. Or the cycle time that has been set for the array is less than the minimum value to be set. Or the specified CT group can not be used because it has already been used.	Choose an existing CTGID (use pairvolchk to display CTGIDs). Use the '-f <CTGID>' option of the paircreate command to force the pair into a pre-existing CTGID. Or set an appropriate value to the cycle time. If the specified CT group has already been used, use an available CT group.	217
EX_EXTCTG	Extended CT group across RAIDs	A volume is defined in the configuration file (HORCM_CONF) as a group that extends across arrays.	Please confirm the serial # of the volumes by using the pairdisplay command to verify that the CT group is contained completely within one RAID array.	216
EX_ENXCTG	No CTgroups left for OPEN Vol use	An available CT group for volume does not exist.	-	215

Message ID	Error Message	Condition	Recommended Action	Return Value
EX_ENQCTG	Unmatched CTGID within the group	The CT group references within a group do not have an identical CTGID.	Please confirm the CTGID using the pairvolchk command and/or confirm that group references within the configuration file (HORCM_CONF) refer to the same CT group.	214
EX_ENPERM	Permission denied with the LDEV	The device described in the configuration definition file is not permitted for pair operation.	Execute the pairedisplay command or the raidscan - use the verify command to verify that the device is permitted for the pair operation.	213
EX_ENQSIZ	Unmatched volume size for pairing	1. The number or the size of the volume between the local and remote volume is not appropriate. 2. The product ID on the local array does not correspond with the product ID on the remote array.	1. Check the volume size of the target pair using raidscan -f option, and then set the same size for local and remote volumes for the target pair. 2. Set the identical product ID in the local and remote array.	212
EX_ERPERM	Permission denied with the RAID	The volume on the configuration file is a volume that is not permitted to operate a pair in the array.	Set HITACHI for the vendor ID.	211
EX_ESVOLD	SVOL denied due to be disabling	It is inhibited to assign the specified volume to be paired to an S-VOL.	Check whether the volume to be paired is not inhibited to be assigned to an S-VOL using the inquired -fl or raidvchkdsp -v gflag command.	209
EX_ENOSUP	Micro code not supported	The specified command option is not supported by the firmware of the array.	Make sure of a version of the firmware of the array using the raidgry -l command.	210
EX_EPRORT	Mode changes denied due to retention time	It is inhibited to change a mode of the specified volume during the term of protection.	Make sure of the term of protection for the object volume using the raidvchkdsp -v gflag command.	208

The following list includes common error messages for the **horctakeover**, **paircurchk**, **paircreate**, **pairsplit**, **pairresync**, **pairevtwait**, **pairvolchk**, **pairsyncwait**, and **pairedisplay** commands.

**Table 11-8 Common error messages (1)**

Type	Message ID	Error Message	Return Value
Syntax for Argument Unrecoverable	EX_REQARG	Required Arg list	254
	EX_INVARG	Invalid argument	253
	EX_INVNAM	Invalid name of option	249
	EX_UNWOPT	Unknown option	252
	EX_UNWCOD	Unknown function code	238
	EX_UNWCMD	Unknown command	230
	EX_ERANGE	Result too large	244
	EX_ENAMLG	File name too long	243
	EX_INVRCD	Invalid return code	226

Type	Message ID	Error Message	Return Value
Configuration Unrecoverable	EX_ENOGRP	No such group	239
	EX_ENOENT	No such device or group	247
	EX_ENODEV	No such device	246
	EX_ENLDEV	No such LDEV within the RAID	227
	EX_ENOUNT	No such RAID unit	219
	EX_INVMMUN	Invalid mu# with HORC or HOMRCF	220
	EX_ENQSER	Unmatched Serial# vs RAID unitID	218
	EX_EXTCTG	Extended CTgroup across RAIDs	216
	EX_ENQCTG	Unmatched CTGID within the group	214
	EX_ENPERM	Permission denied with the LDEV	213
	EX_ERPERM	Permission denied with the RAID	211
Command I/O to RAID Recoverable	EX_CMDRJE	An order to the control/command device was rejected	221
	EX_CMDIOE	Control command I/O error Control command I/O error, or rejected	237
	EX_OPTINV	A specified option is invalid	248
	EX_INVMOD	Invalid RAID command mode	241
	EX_INVCMD	Invalid RAID command	240
Communication for HORCM Recoverable	EX_ATTJOR	Can't be attached to HORC Manager	251
	EX_ATTDBG	Can't be attached to a Debug layer	250
	EX_COMERR	Can't be communicated with HORC Manager	255
	EX_ENORMT	No remote host alive for remote commands or Remote Raid Manager might be blocked (sleeping) on an existing I/O.	242
Resource Unrecoverable	EX_ENOMEM	Not enough core	245



**Note:** Unrecoverable indicates errors that cannot be recovered by executing the command again. Recoverable indicates errors that can be recovered by executing the command again.

The following list includes common error messages for the **raidscan**, **raidar**, **raidqry**, and **horcctl** commands.

**Table 11-9 Common error messages (2)**

Type	Message ID	Error Message	Return Value
Syntax for Argument Unrecoverable	EX_REQARG	Required Arg list	254
	EX_INVARG	Invalid argument	253
	EX_INVNAM	Invalid name of option	249
	EX_UNWOPT	Unknown option	252
	EX_UNWCOD	Unknown function code	238

Type	Message ID	Error Message	Return Value
	EX_UNWCMD	Unknown command	230
	EX_ERANGE	Result too large	244
	EX_ENAMLG	File name too long	243
	EX_INVRCD	Invalid return code	226
Configuration Unrecoverable	EX_ENLDEV	No such LDEV within the RAID	227
	EX_ENOUNT	No such RAID unit	219
	EX_INVNUM	Invalid mu# with HORC or HOMRCF	220
	EX_ERPERM	Permission denied with the RAID	211
	EX_ENOSUP	Micro code not supported	210
Command I/O to RAID Recoverable	EX_CMDIOE	Control command I/O error Control command I/O error, or rejected	237
	EX_OPTINV	A specified option is invalid	248
	EX_INVMOD	Invalid RAID command mode	241
	EX_INVCMD	Invalid RAID command	240
Communication for HORCM Recoverable	EX_ATTJOR	Can't be attached to HORC Manager	251
	EX_ATTDBG	Can't be attached to a Debug layer	250
	EX_COMERR	Can't be communicated with HORC Manager	255
Resource Unrecoverable	EX_ENOMEM	Not enough core	245



**Note:** Unrecoverable indicates errors that cannot be recovered by executing the command again. Recoverable indicates errors that can be recovered by executing the command again.

The following list includes unique error messages for the **horctakeover**, **paircurchk**, **paircreate**, **pairsplit**, **pairresync**, **pairevtwait**, **pairvolchk**, **pairsyncwait**, and **raidvchkset** commands.

**Table 11-10 Unique error messages**

Command	Type	Message ID	Error Message	Return Value
paircreate, pairsplit, pairresync, pairevtwait, pairvolchk, horctakeover	Volume status Unrecoverable	EX_ENQVOL	Unmatched volume status within the group	236
paircreate, pairsplit, pairresync, pairevtwait, horctakeover		EX_INCSTG	Inconsistent status in group	229
paircreate, pairsplit, pairresync, pairevtwait, pairsyncwait		EX_INVVOL	Invalid volume status	222
pairsplit, pairevtwait, pairvolchk, horctakeover		EX_EVOLCE	Pair Volume combination error	235

Command	Type	Message ID	Error Message	Return Value
paircreate, pairsplit, pairresync		EX_INVSTP	Invalid pair status	228
paircurchk, horctakeover		EX_VOLCUR	S-VOL currency error	225
horctakeover		EX_VOLCUE	Local Volume currency error	224
horctakeover		EX_VOLCRE	Local and Remote Volume currency error	223
pairsplit, pairevtwait		EX_EWSUSE	Pair suspended at WAIT state	234
paircreate		EX_ENQSIZ	Unmatched volume size for pairing	212
		EX_EWSTOT	SVOL denied due to be disabling	209
raidvchkset		EX_EWSLTO	Mode changes denied due to retention time	208
pairevtwait, horctakeover	Timer Recoverable	EX_EWSTOT	Timeout waiting for specified status	233
pairevtwait		EX_EWSLTO	Timeout waiting for specified status on the local host	232
paircreate	Resource Unrecoverable	EX_ENOCTG	Not enough CTgroups in RAID	217
paircreate		EX_ENXCTG	No CTgroups left for OPEN Vol use.	215

Unrecoverable indicates errors that cannot be recovered by executing the command again. Recoverable indicates errors that can be recovered by executing the command again. However, EX\_EWSTOT of the horctakeover command is excluded. When the command completed with an error, the error is recorded in the CCI command log (\$HORCC\_LOG).

## Recovering PSUE status using ShadowImage

When a pair was suspended (PSUE) due to a failure in the array, collect the CCI system log files and call the Hitachi maintenance personnel.

Maintenance personnel will remove the source of error in the array. After the source of the error has been removed, the system administrator must recover the pair using the CCI commands.

### Recovering the pair

Make sure that the system administrator has verified that the PSUE occurred while resynchronizing from S-VOL to P-VOL (pairresync -restore). [Table 11-11](#) shows data assurance and the method for recovering the pair.

**Table 11-11 Data assurance and the method for recovering the pair**

State before PSUE	Data Assurance	Action to be taken after PSUE
Other than RCPY	P-VOL: Assured S-VOL: Not assured	Resynchronize (pairresync) in the direction of P-VOL to S-VOL. Note that the pair may have been split due to a drive's double-malfunction in one or both volumes. In this case, confirm that the data exists in the P-VOL, and then create a pair (paircreate).
RCPY	P-VOL: Not assured S-VOL: Not assured	Split the pair (pairsplit -S), restore the backup data to P-VOL, and then create a pair (paircreate). Note that the pair may have been split due to a drive's double-malfunction in one or both volumes. In this case, confirm that the backup data restoration is complete to the P-VOL, and then create a pair.

## About internal volumes in an array

To verify the correspondence of the internal volume number in the array and the device name recognized by the host, use the `inraid` command tool or the `raidscan` command. The following example shows using the `inraid` command tool in the HP-UX system.

```
# ls /dev/rdisk/* | ./inraid -find
Group PairVol (L/R) (Port#,TID,LU-M), Seq#,LDEV#, P/S, Status, Seq#, P-LDEV# M
horcl dev00 (L) (CL2-A, 0, 0-0) 91206145 0 S-VOL SSUS, ----- 9 -
->/dev/rdisk/c23t0d0
Group PairVol (L/R) (Port#,TID,LU-M), Seq#,LDEV#, P/S, Status, Seq#, P-LDEV# M
horcl dev10 (L) (CL2-A, 2, 3-0) 91206145 3 S-VOL SSUS, ----- 6 -
<-> Hraddisk3
```

The device name recognized by the host.

The port number, target ID, volume number, and MU number registered in the configuration definition file.

The internal volume number in the array.

**Figure 11-5 Correspondence between the internal volume and the device recognized by the host**

For details on the `inraid` command tool, refer to the "[Using the inraid command](#)" section. For details on `raidscan` command, refer to the "[Using the raidscan command](#)" section.

# Notes on pair splitting

When the host cannot recognize a volume while the protection function is ON, the following message is displayed and operations to the pair of the unrecognized volume cannot be performed.

[EX\_ENPERM] Permission denied with the LDEV

**Figure 11-6** Message displayed when host cannot recognize a volume

Issue the pairdisplay command and verify the pair status. An example is shown below.

C:\horcm\etc>pairdisplay -g vg01 -fc											
Group	PairVol	(L/R)	(Port#,TID,	LU-M)	,Seq#,LDEV#.	P/S,	Status,	%	P-LDEV#	M	
vg01	oradb1	(L)	(CL1-A , 1,	1-0 )	91209876	1.	P-VOL	PSUE,	0	2	-
vg01	oradb1	(R)	(CL1-A , 1,	2-0 )	91209876	****.	----	----	----	----	-
vg01	oradb2	(L)	(CL1-A , 1,	3-0 )	91209876	3.	P-VOL	PSUE,	0	2	-
vg01	oradb2	(R)	(CL1-A , 1,	4-0 )	91209876	****.	----	----	----	----	-
vg01	oradb3	(L)	(CL1-A , 1,	5-0 )	91209876	5.	P-VOL	PSUE,	0	2	-
vg01	oradb3	(R)	(CL1-A , 1,	6-0 )	91209876	****.	----	----	----	----	-

Volumes not recognized by the host.

**Figure 11-7** Pair status verification

After the pair status is verified, turn the protection function OFF, restart HORCM, and then split the pair (to turn the protection function OFF, delete the environment variable \$HORCMPROMOD).

After splitting the pair and when the drive maintenance is done by the maintenance personnel, restore the backup data, make the host recognize the volume, and create the pair. And then turn the protection function ON and start HORCM.

## Recovering PSUE status using SnapShot

When a pair was suspended (PSUE) due to a failure in the array, collect the CCI system log files and then call the Hitachi maintenance personnel. The maintenance personnel will remove the error cause of the array. After the error cause has been removed, the system administrator must recover the pair using the CCI commands.

### Recovering the pair

The concrete pair recovery using SnapShot is that pair is split (with `pairsplit -S`) once and then create again (with `paircreate`). Recover the pair following the detailed recovery procedure shown in [Figure 11-2](#).

Make sure that the system administrator has verified that the PSUE occurred while restoring from V-VOL to P-VOL (`pairresync -restore`). [Table 11-12](#) shows data assurance and the method for recovering the pair.

**Table 11-12 Data assurance and the method for recovering the pair**

State before PSUE	Data Assurance	Action to be taken after PSUE
Other than COPY(RS-R)	P-VOL: Assured V-VOL: Not assured	Split the pair ( <code>pairsplit -S</code> ), and then create a pair ( <code>paircreate</code> ) again. Note that the pair may have been split due to the drive's double-malfunction in either or both volumes. In such case, confirm that the data exists in the P-VOL, and then create a pair ( <code>paircreate</code> ). Incidentally, the V-VOL data generated is not the one invalidated previously but the P-VOL data at the time when the pair was newly formed.
COPY(RS-R)	P-VOL: Not assured V-VOL: Not assured	Split the pair ( <code>pairsplit -S</code> ), restore the backup data to P-VOL, and then create a pair ( <code>paircreate</code> ). Note that the pair may have been split due to the drive's double-malfunction in either or both volumes. In such case, confirm that the backup data restoration has been completed to the P-VOL, and then create a pair. Incidentally, the V-VOL data generated is not the one invalidated previously but the P-VOL data at the time when the pair was newly formed.

## Recovering PSUE status using TrueCopy/TCE

When a pair was suspended (PSUE) due to a failure in the array, collect the CCI system log files and then call the Hitachi maintenance personnel. The maintenance personnel will remove the error cause of the array. After the error cause has been removed, the system administrator must recover the pair using the CCI commands.

### Recovering the pair

Resynchronization in the direction of P-VOL to S-VOL enables to recover a TrueCopy/TCE pair. (The resynchronization cannot be performed in the direction of S-VOL to P-VOL.) However, when a pair was suspended (status = PSUE) without a failure in the system, once release the pair and create the pair again. Please recover the pair following the procedure for the recovery in the flow of [Figure 11-3](#) or [Figure 11-4](#).

In the case of TCE, the resynchronization of the S-VOL with the P-VOL is required when the P-VOL status is changed to PFUS because the amount of the data in the primary DP pool exceeds the capacity allowed to be used or the S-VOL status is changed to PSUS(N) as well as the P-VOL status is changed to PSUE. The PSUS(N) means the PSUS status that the Read/Write operation cannot be performed; and it is a status in which the S-VOL data is not restored even when the SVOL-Takeover operation is performed.

## Calling the Hitachi Data Systems Support Center

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

- The circumstances surrounding the error or failure
- The exact content of any error messages displayed on the host systems
- The error codes displayed on Storage Navigator Modular 2

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, please log on to the Hitachi Data Systems Portal for contact information: <https://portal.hds.com>

# Maintenance logs and tracing functions

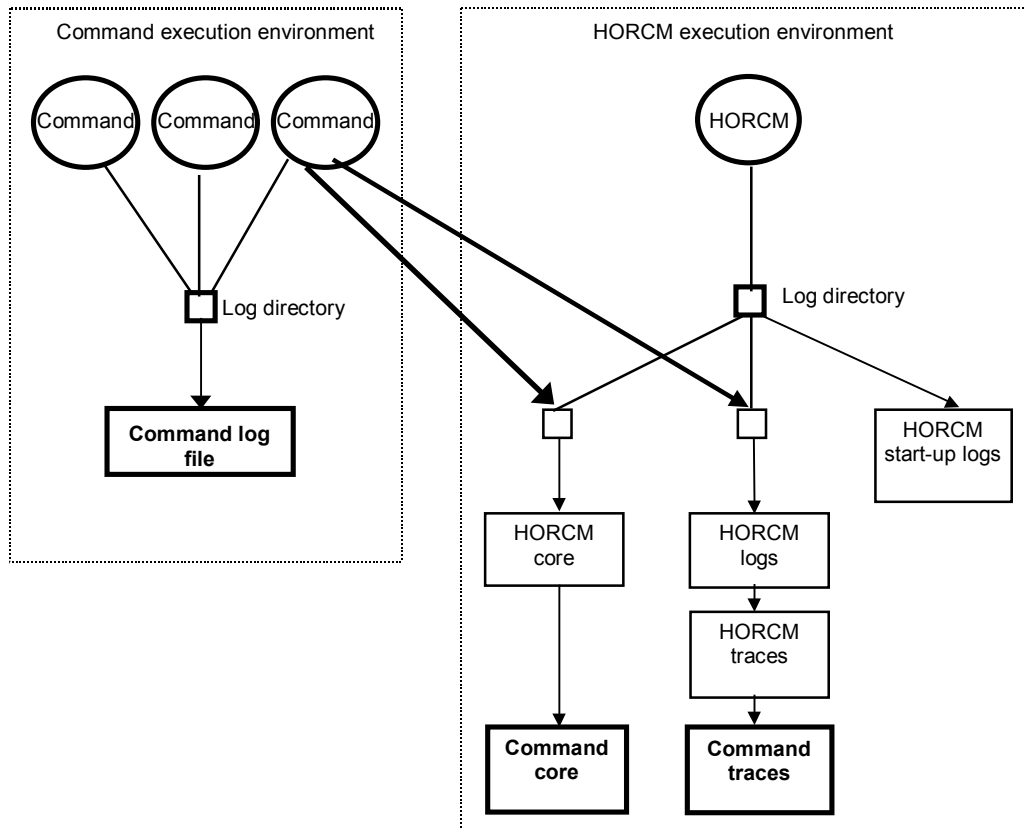
This chapter covers the following topics:

- [About log files](#)
- [About trace files](#)
- [Using the trace control command](#)
- [Reading error log codes](#)
- [Using logging commands](#)

## About log files

The CCI software (HORCM) and ShadowImage/SnapShot/TrueCopy/TCE commands maintain internal logs and traces which can be used to identify the source of errors and keep records of the status transition history of paired volumes. [Figure 12-1](#) displays the CCI logs and traces.

HORCM logs are classified into start-up logs and execution logs. The start-up logs contain data on errors that occur before the HORCM is ready to provide services. Thus, if the HORCM fails to start up due to improper environment settings, refer to the start-up logs to resolve the problem. The HORCM execution logs (error log, trace, and core files) contain data on errors that are caused by software or hardware problems. These logs contain internal error data, which does not apply to any user settings; therefore, users do not need to refer to the HORCM execution logs. When an error occurs during the execution of a command, data on the error is collected in the command log file. Users may refer to the command log file if a command execution error occurs.



**Figure 12-1** Logs and traces

The start-up log, error log, trace, and core files are stored as shown in [Table 12-1](#). Specify the directories for the HORCM and command log files using the HORCM\_LOG and HORCC\_LOG environmental variables as shown in [Table 12-2](#). If it is not possible to create the log files, or if an error occurs before the log files are created, the error logs are output in the system log file. If the HORCM activation fails, the system administrator should check the system log file, identify the error cause, and take the proper action. For details on message output to the system log file and the recommended actions for resolving the error conditions, see Chapter 11. The system log file for UNIX-based systems is the syslog file. The system log file for Windows-based systems is the event log file.

**Table 12-1 Log files**

File	UNIX-based Systems	Windows-based Systems
Start-up log	HORCM start-up log: \$HORCM_LOG/horcm_HOST.log Command log: \$HORCC_LOG/horcc_HOST.log	HORCM start-up log: \$HORCM_LOG\horcm_HOST_log.txt Command log: \$HORCC_LOG\horcc_HOST_log.txt
Error log	HORCM error log: \$HORCM_LOG/horcmlog_HOST/horcm.log	HORCM error log: \$HORCM_LOG\horcmlog_HOST\horcm_log.txt
Trace	HORCM trace: \$HORCM_LOG/horcmlog_HOST/horcm_PID.trc Command trace: \$HORCM_LOG/horcmlog_HOST/horcc_PID.trc	HORCM trace: \$HORCM_LOG\horcmlog_HOST\horcm_PID_trc.txt Command trace: \$HORCM_LOG\horcmlog_HOST\horcc_PID_trc.txt
Core	HORCM core: \$HORCM_LOG/core_HOST_PID/core Command core: \$HORCM_LOG/core_HOST_PID/core	HORCM core: \$HORCM_LOG\core_HOST_PID\core Command core: \$HORCM_LOG\core_HOST_PID\core



**Note:** Host denotes the host name of the corresponding machine. PID denotes the process ID of that machine.

The location of the directory that contains the log file depends on the user's command execution environment and the HORCM execution environment. The command trace file and core file reside together under the directory specified in the HORCM execution environment. A directory specified using the environmental variable HORCM\_LOG is used as the log directory in the HORCM execution environment. If no directory is specified, directory **/tmp** is used. A directory specified using the environmental variable HORCC\_LOG is used as the log directory in the command execution environment. If no directory is specified, the directory **/HORCM/log\*** is used (\* = instance number). A nonexistent directory may be specified as a log directory using the environmental variable.

**Table 12-2 Log directories**

Directory Name	Definition
\$HORCM LOG	A directory specified using the environmental variable <b>HORCM_LOG</b> . The HORCM log file, trace file, and core file as well as the command trace file and core file are stored in this directory. If no environmental variable is specified, <b>/HORCM/log/curlog</b> is used.
\$HORCC LOG	<p>A directory specified using the environmental variable <b>HORCC_LOG</b>. The command log file is stored in this directory. If no environmental variable is specified, the directory <b>/HORCM/log*</b> is used (* is the instance number). While the HORCM is running, the log files are stored in the <b>\$HORCM_LOG</b> directory shown in (a). When the HORCM starts up, the log files created in the operation are stored automatically in the <b>\$HORCM_LOGS</b> directory shown in (b).</p> <p>6. HORCM log file directory in operation \$HORCM_LOG = /HORCM/log*/curlog (* is instance number)</p> <p>7. HORCM log file directory for automatic storing \$HORCM_LOGS = /HORCM/log*/tmplog (* is instance number)</p>

## About trace files

The command trace file is used for maintenance troubleshooting maintenance. It is not created normally. If the source of an error cannot be identified by means of the log file, the environmental variables or trace control commands with trace control parameters are issued to start tracing and the trace file is created. The trace control parameters consist of the trace level, file size, mode, etc. Increasing the trace level enables more detailed tracing. Tracing is made in wraparound within the range of the file size. The HORCM creates the trace file according to the trace level specified in the HORCM start-up shell script set to activate the HORCM.

## Using the trace control command

The trace control command (one of the HORCM control commands) sets or changes the trace control parameters. This command is used for troubleshooting and maintenance. If no trace control parameters can be specified using the environmental variables in the user's command execution environment, it is possible to change the trace control parameters into the global parameters using this command. [Table 12-3](#) lists and describes the parameters of the trace control command.

**Table 12-3 Trace command parameters**

Parameter	Function
Trace level parameter	Specifies the trace level, range = 0 to 15.
Trace size parameter	Specifies the trace file size in kB.
Trace mode parameter	Specifies the buffer mode or non-buffer mode for writing data in the trace file.
Trace type parameter	Specifies the trace type defined internally.
Trace change instruction	Specifies either the command or the HORCM (CCI instance) for which the trace control parameters are changed.

## Reading error log codes

You can get detailed information on the error from an error message (EX\_CMDIOE and/or EX\_CMDRJE) collected in a command log by referring to a detailed code, sense code, and sub-code. Each code can be collected from an error message or error log displayed at the time of command execution. [Figure 12-2](#) shows an example of each code displayed in the error message. Refer to [Figure 12-3](#), [Figure 12-5](#), or [Figure 12-7](#) for each code displayed in the error log.

```
C:\HORCM\etc>paircreate -g si -d si-3 -vl -c 8
paircreate: [EX_CMDRJE] An order to the control/command device was rejected
Refer to the command log(C:\HORCM\log0\horcc_ylqo6quetvg70ri_log.txt) for details.
It was rejected due to SKEY=0x05, ASC=0x96, ASCO=0x1C, SSB=0x8400, 0x00D0 on
Serial#(91200018)
```

Sense code (961C)                      Sub-code (84)                      Detailed code (00D0)

**Figure 12-2** Error message example

Refer to [Table 12-5](#) for the detailed information of the error indicated by the collected detailed code, sense code and sub-code.

A command log is output to the side of an instance that has executed a command. An error log is output to an instance on the primary volume side or the secondary volume side, depending on the type of the command irrespective of whether the instance that has executed the command is on the primary volume side or the secondary volume side. When an error occurs during the execution of the command, examine the error cause by looking at the error logs of both local instance (an instance that has executed the command) and the remote instance. Examples of the decisions, to which of the local instance and the remote instance the error log corresponding to the command log is output, are shown in [Table 12-4](#).

**Table 12-4** Command log and error log destination

Command	Command Log	Error Log
paircreate -vr	Local instance	Remote instance
pairresync (Issuing the command from an instance on the primary volume side)	Local instance	Local instance
pairresync (Issuing the command from an instance on the secondary volume side)	Local instance	Remote instance

The error log corresponding to the command log can be found out using a time when an error occurs as a key.

## Solaris logs

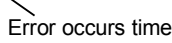
The command log is stored in the command log file in the start log directory listed in [Figure 12-1](#), "Log File List." The error log is stored in the HORCM error log file in the error log directory listed in the same [Figure 12-1](#), "Log File List." The following are locations for storing the command log and error log in the case where the directories are not specified using the environmental variable, HORCC\_LOG.

Command log: /HORCM/logINS/horcc\_HOST.log

Error log: /HORCM/logINS/curlog/horcmlog\_HOST/horcm.log

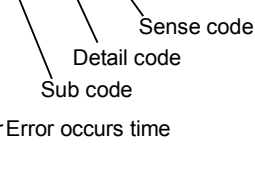
INS is an instance number and HOST is a host name of the computer concerned.

```
COMMAND ERROR : EUserId for HOMRCF : root (0) Tue Dec 2 18:18:07 2003
CMDLINE : paircreate -g SI -d SI_000 -vl -c 15
18:18:08-95274-03005- ERROR:cm_sndrcv[rc < 0 from HORCM]
18:18:08-9fe17-03005- [paircreate] L_CMD(CREATEPAIR) ERROR :rc = -35
18:18:08-aleaa-03005- [paircreate][exit(221)]
[EX_CMDRJE] An order to the control/command device was rejected
[Cause ]: An order to the command(control) device failed,or was rejected.
[Action]:Please confirm the following items.If this trouble doesn't resolve,then collect HORCM
error logs(HORCM_LOG=/HORCM/log0/curlog) and trace data,and send them to service personnel.
(1) Check if the 'HORC or HOMRCF function' is installed in the RAID.
(2) Check if the RCP and LCP are installed in the RAID.
(3) Check if the path between the RAID CUs is established by using the SVP.
(4) Check if the pair target volume is an appropriate status.
```



**Figure 12-3 Command log output example (Solaris)**

```
18:18:07-d9b1e-02746- SCSI : Check Condition.
18:18:07-dedfd-02746- ***** SCSI SENSE DATA *****
---ADDR--- -OFF- 0-1-2-3- 4-5-6-7- 8-9-A-B- C-D-E-F- -----CHAR-----
[0xffbeef14]0000: 70000500 00000038 84000039 95760000 p.....8...9.v..
[0xffbeef24]0010: 00001000
18:18:07-ef183-02746- SKEY = 0x05
18:18:07-f326b-02746- ASC = 0x95
[System Call Error]
SysCall: write
Errorno: 22 (Invalid argument)
ErrInfo: Internal Error
ErrTime: Tue Dec 2 18:18:08 2003
SrcFile: horcpprc.c
SrcLine: 1178
```



**Figure 12-4 Error log output example (Solaris)**

## Linux logs

In the same way as Solaris, the command log is stored in the command log file in the start log directory listed in [Figure 12-1](#), "Log File List." The error log is stored in the HORCM error log file in the error log directory listed in the same [Figure 12-1](#), "Log File List." The following are locations for storing the command log and error log in the case where the directories are not specified using the environmental variable, HORCC\_LOG.

Command log: /HORCM/logINS/horcc\_HOST.log

Error log: /HORCM/logINS/curlog/horcmlog\_HOST/horcm.log

INS is an instance number and HOST is a host name of the computer concerned.

```
COMMAND ERROR : EUserId for HORC : root (0) Mon Dec 8 10:28:12 2003
CMDLINE : pairsplit -g vg1 -d vg120 -S
10:28:13-3201d-05247- ERROR:cm_sndrcv[rc < 0 from HORCM]
10:28:13-3f438-05247- [pairsplit] L_CMD(ERASEPAIR) ERROR :rc = -35
10:28:13-43af5-05247- [pairsplit][exit(221)]
[EX_CMDRJE] An order to the control/command device was rejected
[Cause ]: An order to the command(control) device failed,or was rejected.
[Action]:Please confirm the following items.If this trouble doesn't resolve,then collect HORCM
error logs(HORCM_LOG=/HORCM/log2/curlog) and trace data,and send them to service personnel.
(1) Check if the 'HORC or HOMRCF function' is installed in the RAID.
(2) Check if the RCP and LCP are installed in the RAID.
(3) Check if the path between the RAID CUs is established by using the SVP.
(4) Check if the pair target volume is an appropriate status.
```

Error occurs time

**Figure 12-5 Command log output example (Linux)**

```
10:28:12-600f8-01422- SCSI : Check Condition.
10:28:12-6c792-01422- ***** SCSI SENSE DATA *****
---ADDR--- -OFF- 0-1-2-3- 4-5-6-7- 8-9-A-B- C-D-E-F- -----CHAR-----
[0xbffec628]0000: 70000500 00000038 84000039 95760000 p.....8...9.v..
10:28:12-79b71-01422- SKEY = 0x05
10:28:12-7e218-01422- ASC = 0x95
[System Call Error]
SysCall: write
Errorno: 22 (Invalid argument)
ErrInfo: Internal Error
ErrTime: Mon Dec 8 10:28:12 2003
SrcFile: horcprc.c
SrcLine: 1178
```

Sense code  
Detail code  
Sub code  
Error occurs time

**Figure 12-6 Error log output example (Linux)**

## Windows logs

In the same way as Solaris, the command log is stored in the command log file in the start log directory listed in [Figure 12-1](#), "Log File List." The error log is stored in the HORCM error log file in the error log directory listed in the same [Figure 12-1](#), "Log File List." The following are locations for storing the command log and error log in the case where the directories are not specified using the environmental variable, HORCC\_LOG.

Command log: \HORCM\logINS\horcc\_HOST\_log.txt

Error log: \HORCM\logINS\curlog\horcmlog\_HOST\horcm\_log.txt

INS is an instance number and HOST is a host name of the computer concerned.

```
COMMAND ERROR : EUserId for HOMRCF : Administrator (0) Thu Feb 19 05:11:14 2004
CMDLINE : pairresync -g vg01 -d oradb1
05:11:14-81a38-01860- ERROR:cm_sndrcv[rc < 0 from HORCM]
05:11:14-854d0-01860- [pairresync] L_CMD(CREATEPAIR) ERROR :rc = -35
05:11:14-854d0-01860- [pairresync][exit(221)]
[EX_CMDRJE] An order to the control/command device was rejected
[Cause ]: An order to the command(control) device failed,or was rejected.
[Action]:Please confirm the following items.If this trouble doesn't resolve,then collect HORCM
error logs(HORCM_LOG=C:\HORCM\log137\curlog) and trace data, and send them to service personnel.
(1) Check if the 'HORC or HOMRCF function' is installed in the RAID.
(2) Check if the RCP and LCP are installed in the RAID.
(3) Check if the path between the RAID CUs is established by using the SVP.
(4) Check if the pair target volume is an appropriate status.
```

Error occurs time

**Figure 12-7 Command log output example (Windows)**

```
05:11:14-81a38-01928- SCSI : Check Condition.
05:11:14-81a38-01928- ***** SCSI SENSE DATA *****
---ADDR--- -OFF- 0-1-2-3- 4-5-6-7- 8-9-A-B- C-D-E-F- -----CHAR-----
[0x0012f318]0000: 70000500 00000038 84000039 96080000 p.....8...9.v..
[0x0012f328]0010: 00001000 84000039 00000000 1fd00000 .....9.....
[0x0012f338]0020: 00000000 00000000 00000000 00000000 .....
[0x0012f348]0030: 00000000 00000000 00000000 00000000 .....
[0x0012f358]0040: 00000000 00000000 00000000 00000000 .....
[0x0012f368]0050: 00000000 00000000 00000000 00000000 .....
05:11:14-81a38-01928- SKEY = 0x05
05:11:14-81a38-01928- ASC = 0x96
05:11:14-81a38-01928- SSB = 0x8400,0039
[System Call Error]
SysCall: write
Errorno: 22 (Invalid argument)
ErrInfo: Internal Error
ErrTime: Thu Feb 19 05:11:14 2004
SrcFile: horccpprc.c
SrcLine: 1182
```

Sense code  
Detail code  
Sub code  
Error occurs time

**Figure 12-8 Error log output example (Windows)**

## Sense codes and detail codes

Table 12-5 shows sense codes and detailed codes. 0~A will be set in the x of detailed codes.

**Table 12-5 Sense codes and detailed codes**

Sense code	Detailed code	Sub code	Error contents	Recommended Action
2602			The primary sequence number is beyond the limits of supported.	Check the serial number.
2602			The secondary sequence number is beyond the limits of supported.	Check the serial number.
2602			The VOL of the P-VOL is beyond the limits of supported.	Check the specified VOL.
2602			The VOL of the S-VOL is beyond the limits of supported.	Check the specified VOL.
2602			The primary port number is beyond the limits of supported.	Check the specified port number.
2602			The secondary port number is beyond the limits of supported.	Check the specified port number.
2602			The object VOL is beyond the limits of supported.	Check the status of the VOL.
2602			The object VOL is undefined.	Check the status of the VOL.
2602			The environment has a problem.	Check the environment of CCI.
2602			The retention term is beyond the limits of validity.	Check that the specified value that has been set is 0 to 21900.
3180			The object VOL is unformatted.	Check the status of the VOL.
9501			A command was received during execution of the pseudo deliberate shutdown.	Retry after the pseudo deliberate shutdown is completed.
9510			A command was received during a performance of hot replacement of the firmware.	Retry after waiting for a while.
9531			The password protection is being logged in.	Retry after waiting for a while.
9536			The optional feature is invalid.	Install the optional feature.
9552			The object VOL is defined as a command device.	Check the attribute of the VOL.
9557			VOL capacities of the P-VOL and S-VOL are not the same.	Check the capacity of the VOL.
956B			The capacity is beyond the limits of supported.	Split the unnecessary pairs.
9576	0000	84	The pair status of the P-VOL is other than Normal or Regression.	Check the pair status of the VOL.
9576	0001	84	The status of the P-VOL is other than normal or regressive.	Check the status of the VOL.
9576	0002	84	The P-VOL is a Cache Residency VOL.	Check the status of the VOL.
9576	0003	84	The P-VOL is reserved as a Cache Residency VOL.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	0004	84	The P-VOL is a command device.	Check the status of the VOL.
9576	0005	84	The primary sequence number is different from the own Array ID.	Check the Array ID.
9576	0006	84	Both of the two paths are abnormal.	Check the status of the path.
9576	0007	84	The P-VOL has been defined as a SubLU of a unified VOL.	Check the status of the VOL.
9576	0009	84	There are maximum number of pairs already.	Delete the unnecessary pairs.
9576	000D	84	The P-VOL is in a status other than PSUS or PSUE.	Check the pair status of the VOL.
9576	000E	84	The status of the P-VOL is other than normal or regressive.	Check the pair attribute of the VOL.
9576	000F	84	The number of the VOL to be paired is different.	Check the specified VOL.
9576	0010	84	The primary sequence number is different from the own Array ID.	Check the Array ID.
9576	0011	84	Both of the two paths are abnormal.	Check the status of the path. Also, check the S-VOL status. When it is SSWS, the S-VOL is available for I/O.
9576	0012	84	The specified P-VOL is in a status other than COPY or PAIR.	Check the pair status of the VOL.
9576	0014	84	The current Array ID differs from the number that was set initially.	Check the Array ID.
9576	0016	84	The number of the VOL to be paired is different.	Check the specified VOL.
9576	0017	84	The primary sequence number is different from the own Array ID.	Check the Array ID.
9576	0018	84	The pairsplit -R command to a P-VOL or the pairsplit -S command to an S-VOL was received.	Check the pair status of the VOL.
9576	0020	84	The Asynchronous mode is turned on.	The Asynchronous mode is not supported.
9576	0021	84	The fence level is STATUS.	Make sure of the specified fence level.
9576	0023	84	The P-VOL is a volume of ShadowImage. It is in the PSUE status and cannot accept Read/Write instructions.	Check the pair status of the VOL.
9576	0024	84	The P-VOL is undergoing the restoration of ShadowImage pair.	Check the pair status of the VOL.
9576	0025	84	The P-VOL received an instruction to swap pair.	Check the pair status of the VOL.
9576	0026	84	The pair status is not SSWS.	Check the pair status of the VOL.
9576	0027	84	The S-VOL received an instruction to resynchronize pair.	Check the pair status of the VOL.
9576	0028	84	The volume is a P-VOL of ShadowImage. It is in the PSUE status and cannot accept Read/Write instructions.	Place the P-VOL concerned in the SMPL status and create the pair again.
9576	0029	84	The volume is a P-VOL of ShadowImage and undergoing a reverse copy.	Check the pair status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	002A	84	The P-VOL received an instruction to be taken over.	Check the pair status of the VOL.
9576	002B	84	It is in the SMPL or COPY status.	Check the pair status of the VOL.
9576	002C	84	The secondary sequence number is different from the Array ID.	Check the Array ID.
9576	002D	84	The S-VOL received an instruction to be taken over.	Check the pair status of the VOL.
9576	002E	84	The pair status of the P-VOL is SMPL or COPY.	Check the pair status of the VOL.
9576	002F	84	The primary sequence number is different from the Array ID.	Check the Array ID.
9576	0030	84	The S-VOL received the pairsplit -E (pair suspend) command.	Check the pair status of the VOL.
9576	0031	84	The capacity is beyond the limits of supported.	Split the unnecessary pairs.
9576	0032	84	The P-VOL is configured as RAID 0.	Check the RAID level of the specified VOL.
9576	0033	84	The specified VOL is an S-VOL of ShadowImage and it is in a pair status other than PSUS.	Check the pair status of the VOL.
9576	0035	84	The volume is an S-VOL of ShadowImage and it is in a pair status other than PSUS.	Check the pair status of the VOL.
9576	0036	84	The volume is a P-VOL of SnapShot and being restored.	Check the pair status of the VOL.
9576	0037	84	The volume is a P-VOL of SnapShot. It is in the PSUE status and cannot accept Read/Write instructions.	Change the statuses of all V-VOLs of the P-VOL concerned to SMPL, and create the pair again.
9576	0038	84	The volume is a P-VOL of SnapShot and the mate to it has already been paired by TrueCopy.	Check the pair status of the VOL.
9576	0039	84	The volume is a V-VOL of SnapShot and it is in a status other than PSUS of SnapShot.	Check the pair status of the VOL.
9576	003A	84	The volume is a V-VOL of SnapShot. The related P-VOL of SnapShot is being restored or has been placed in the PSUE status during a restoration.	Check the pair status of the VOL.
9576	003B	84	The specified VOL is comprised in a SnapShot pair and it has already been cascaded with a TrueCopy pair.	Check the pair status of the VOL.
9576	003C	84	The specified VOL is comprised in a SnapShot pair and it has already been cascaded with a TrueCopy pair.	Check the pair status of the VOL.
9576	003D	84	The volume is a P-VOL of SnapShot and being restored.	Check the pair status of the VOL.
9576	003E	84	The volume is a P-VOL of SnapShot. It is in the PSUE status and cannot accept Read/Write instructions.	Change the statuses of all V-VOLs of the P-VOL concerned to SMPL, and create the pair again.
9576	003F	84	The volume is a V-VOL of SnapShot and it is in a status other than PSUS of SnapShot.	Check the pair status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	0040	84	The volume is a P-VOL of SnapShot. It is being restored or in the PSUE status and cannot accept Read/Write instructions.	Check the pair status of the VOL.
9576	0041	84	The number of unified LUs is 17 or more.	Check the number of unified LUs of the volume corresponding to the specified VOL.
9576	0042	84	The RAID level differs between the MainLU and SubLU.	Check that the RAID level of the specified VOL is the same as that expected.
9576	0043	84	The number of data disks differs between the MainLU and SubLU.	Check that the number of data disks of the specified VOL is the same as that expected.
9576	0044	84	The specified VOL is a V-VOL of SnapShot. The P-VOL of the related SnapShot pair is a unified VOL and the number of unified LUs is 17 or more.	Check the number of unified LUs of the SnapShot P-VOL corresponding to the specified VOL.
9576	0045	84	The specified VOL is a V-VOL of SnapShot. The P-VOL of the related SnapShot pair is a unified VOL, whose MainLU and SubLU are different in RAID level.	Check that the RAID level of the SnapShot P-VOL corresponding to the specified VOL is the same as that expected.
9576	0046	84	The specified VOL is a V-VOL of SnapShot. The P-VOL of the related SnapShot pair is a unified VOL, whose MainLU and SubLU are different in number of data disks.	Check that the number of data disks of the SnapShot P-VOL corresponding to the specified VOL is the same as that expected.
9576	0047	84	Data of the TrueCopy P-VOL is partially destroyed.	Issue the SnapShot instruction (to change the status from PAIR to PSUS) to the SnapShot pair again, and then create the pair again.
9576	0048	84	Data of the TrueCopy P-VOL is partially destroyed.	Format the specified VOL after getting backup data of it. Then restore the backup data.
9576	0049	84	A problem occurred in the pair.	After splitting the pair, create a pair again.
9576	004A	84	A problem occurred in the pair.	After splitting the pair, create a pair again.
9576	004B	84	The specified P-VOL is in the PSUE (S-VOL Switch) status of ShadowImage.	Request the service personnel to replace drives that compose the P-VOL. Format them after the replacement, and then resynchronize them.
9576	004D	84	The DM-VOL is not set.	Retry after setting the DM-VOL.
9576	004E	84	The DM-VOL cannot be specified as P-VOL.	Check the status of the VOL.
9576	004F	84	Validity of the license expired.	Purchase the license.
9576	0052	84	The pairsplit -mscas was issued in the TrueCopy environment.	The pairsplit -mscas is not supported in the TrueCopy environment.
9576	0053	84	The specified P-VOL is the reserved VOL.	Check the status of the VOL.
9576	0054	84	The specified P-VOL is undergoing the migration.	Check the pair status of the VOL.
9576	0055	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
9576	0056	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	0057	84	The specified function is not supported in a remote array.	Check the remote array.
9576	0058	84	When creating pairs with CTG is specified, the specified CTG ID is beyond the limits of supported.	Check the specified CTG ID.
9576	0059	84	A pair was created with an S-VOL that was placed in the SMPL status by the pair cancellation instructions for only S-VOL and its pair status became PSUS(N).	Check the pair status of the specified S-VOL.
9576	005A	84	The command was received in unit of CTG at the time of resynchronization (including swap).	Check the specified value.
9576	005B	84	When the unit of CTG is specified, the specified S-VOL is not created pair with CTG.	Check the status of the VOL.
9576	005C	84	When the unit of CTG is specified, there is a P-VOL in the same CTG.	Check the CTG ID.
9576	005D	84	When the unit of CTG is specified, there is no pair, which is in the PAIR, PSUS, or PSUE status, in the same CTG.	Check the pair status of VOL in the CTG.
9576	005E	84	When the unit of CTG is specified, the specified P-VOL is not created pair with CTG.	Check the status of the VOL.
9576	005F	84	When the unit of CTG is specified, there is an S-VOL in the same CTG.	Check the CTG ID.
9576	0060	84	When the unit of CTG is specified, there is no pair, which is in the PAIR, PSUS, or PSUE status, in the same CTG.	Check the pair status of VOL in the CTG.
9576	0061	84	When the unit of CTG is specified, the specified P-VOL is not created pair with CTG.	Check the status of the VOL.
9576	0062	84	When the unit of CTG is specified, there is an S-VOL in the same CTG.	Check the CTG ID.
9576	0063	84	When the unit of CTG is specified, there is no pair, which is in the COPY or PAIR status, in the same CTG.	Check the pair status of VOL in the CTG.
9576	90F2	94	The remote array is reconstructing the memory or the target CTG is executing the cycle copy and receiving the cascaded SnapShot pair split.	Execute it again after waiting for a while. When the remote array performs the SnapShot split instruction, execute it again after completing the target CTG cascaded SnapShot pair split.
9576	9145	94	The target CTG is executing the cycle copy and receiving the cascaded SnapShot pair split.	Execute it again after completing the target CTG cascaded SnapShot pair split.
9576	0064	84	The pair cancellation instruction was executed for the range that was not supported.	Check the specified value.
9576	0065	84	When the unit of CTG is specified, the specified P-VOL is not created pair with CTG.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	0066	84	When the unit of CTG is specified, there is an S-VOL in the same CTG.	Check the CTG ID.
9576	0067	84	When the unit of CTG is specified, the specified S-VOL is not created pair with CTG.	Check the status of the VOL.
9576	0068	84	When the unit of CTG is specified, there is a P-VOL in the same CTG.	Check the CTG ID.
9576	0069	84	The specified secondary sequence number does not match with the array serial number.	Check the specified command device number.
9576	006A	84	The command cannot execute because the Auto Migration is undergoing.	Check the Migration status.
9576	006B	84	The command cannot execute because the Auto Migration is undergoing.	Check the Migration status.
9576	006C	84	The command cannot execute because the Auto Migration is undergoing.	Check the Migration status.
9576	006D	84	There are other pairs in the group, whose fence level is not the same as the one specified.	Confirm the fence level of the pair you are creating.
9576	006E	84	There are other pairs in the group, whose P-VOL and S-VOL are swapped.	Confirm the array on which you are executing the command.
9576	006F	84	The specified VOL is the P-VOL or S-VOL of a ShadowImage pair that the status is PSUS(SP) or PAIR(IS).	Check the status of the ShadowImage pair.
9576	0072	84	The RAID group to which the specified VOL belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9576	0073	84	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the data pool that is used by pairs in the specified group.	Retry after the RAID group status becomes Normal.
9576	0074	84	The specified CTG number has been used into other remote replication pair with the remote array.	Retry after specifying the number other than specified CTG number.
9576	0075	84	The specified local Edge array has created a remote replication pair with another array.	Check the pair status of the local array.
9576	0076	84	The local array can not execute create pair with the specified remote array because the maximum number of the connected arrays is beyond the limits.	Retry after deleting the all remote replication pair with the another remote array.
9576	0077	84	The VOL created in DP pool was specified as P-VOL.	Specify an VOL other than the VOL created in DP pool.
9576	0078	84	The VOL that was specified as P-VOL does not exist.	Check the specified VOL.
9576	0079	84	The specified P-VOL is a volume of ShadowImage pair that includes the VOL created in DP pool.	Confirm the ShadowImage pair that the specified P-VOL is part of.
9576	007A	84	The specified P-VOL is a volume of ShadowImage pair that includes the VOL created in DP pool.	Confirm the ShadowImage pair that the specified P-VOL is part of.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	007B	84	The specified P-VOL is an S-VOL of ShadowImage pair those P-VOL is part of another ShadowImage pair that S-VOL is the VOL created in DP pool.	Confirm all the S-VOL of ShadowImage pair that shares the P-VOL with the ShadowImage pair that specified P-VOL is part of.
9576	007C	84	Management information of Dynamic Provisioning is being updated.	Retry after waiting for a while.
9576	007D	84	The operation can not be performed due to insufficient capacity of the DP pool for the specified P-VOL.	Check the capacity of the DP pool.
9576	007E	84	The operation can not be performed due to insufficient capacity of the DP pool for the specified S-VOL.	Check the capacity of the DP pool.
9576	007F	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
9576	0080	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
9576	0081	84	The status of the specified S-VOL is SMPL, COPY, or PAIR.	Check the pair status.
9576	0082	84	There are no pairs in the specified group whose status is SSWS.	Check the pair status.
9576	0083	84	The copy operation cannot be performed because the capacity of the DM-VOL is depleted.	Grow the capacity of DM-VOL.
9576	0084	84	The internal transaction of the specified VOL is working now.	Retry after waiting for a while.
9576	0085	84	The DM-VOL status is invalid.	Check the DM-VOL status.
9576	0086	84	The copy operation cannot be performed because the DP pool to which the DM-VOL belongs is detached.	Recover the DP pool.
9576	0087	84	Pinned data exists in the DM-VOL.	Retry after eliminating pinned data.
9576	0088	84	The operation cannot be performed due to insufficient capacity of the DP pool for the DM-VOL.	Grow the capacity of DM-VOL.
9576	0089	84	The copy operation cannot be performed because the DM-VOL has unwritten data.	Delete the specified pair.
9576	008A	84	The copy operation cannot be performed because the DM-VOL has unwritten data.	Retry the operation per pair.
9576	008B	84	The copy operation cannot be performed because the DM-VOL has unwritten data.	Delete the ShadowImage pair that is cascaded with the P-VOL of the specified pair.
9676	008C	84	The specified P-VOL is the P-VOL of a TCE pair.	Check the pair status.
9576	008D	84	The specified VOL is comprised in a SnapShot pair and it has already been cascaded with a TCE pair.	Check the pair status of the VOL.
9576	008E	84	The snapshot pair of the specified V-VOL has already had its V-VOL being cascaded with the max number of remote replication pairs.	Check the pair configuration.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	905E	94	There is a SnapShot pair, which has an MU number specified for a SnapShot P-VOL, has not been placed in the PAIR or PSUS status, and whose S-VOL is one of the S-VOLs with the specified CTG numbers. Otherwise, the process of reconfigure memory is in progress on the remote array.	Check the pair status of the SnapShot. Otherwise, retry after the process of reconfigure memory is completed.
9576	905F	94	There is no pair, which is in the PAIR status, in the target CTG.	Check the pair status of the VOL.
9576	x005	94	The VOL of the remote array is being formatted.	Retry after waiting for a while.
9576	x006	94	The remote array is undergoing the pseudo deliberate shutdown.	Retry after the pseudo deliberate shutdown is completed.
9576	x007	94	The remote array has undergone the pseudo deliberate shutdown.	Retry after waiting for a while.
9576	x008	94	The S-VOL is undefined.	Check the status of the VOL.
9576	x009	94	The specified S-VOL or the target volume of remote array is already paired by a different array.	Check the pair information.
9576	x00B	94	The remote array is undergoing hot replacement of the firmware.	Retry after waiting for a while.
9576	x00C	94	A command error occurred.	Retry after waiting for a while.
9576	x00D	94	The optional feature of TrueCopy of the remote array is invalid.	Unlock and validate the optional feature.
9576	x00E	94	The status of the S-VOL cannot be changed.	Retry after waiting for a while.
9576	x011	94	The object VOL has already been organized into a TrueCopy or TCE pair. Besides, the serial number differs between the local and remote arrays.	Check the pair status of the VOL and serial number.
9576	x012	94	The number of TrueCopy or TCE pairs exceeded the maximum value that can be supported.	Check the number of TrueCopy or TCE pairs.
9576	x014	94	The current serial number differs from the number that was set initially.	Check the serial number.
9576	x015	94	The status of the object P-VOL or S-VOL is other than Normal and Regression or the specified S-VOL is an VOL created in DP pool or a volume of ShadowImage pair that includes the VOL created in DP pool.	Make the status of the P-VOL or S-VOL Normal or Regression and confirm the S-VOL and the ShadowImage pair that the specified S-VOL is part of.
9576	x017	94	The S-VOL is configured as RAID 0.	Check the RAID level of the specified VOL.
9576	x019	94	The capacity differs between the P-VOL and S-VOL.	Equalize the capacities of the P-VOL and S-VOL.
9576	x01A	94	The S-VOL is a Cache Residency VOL or has been set to the reserved Cache Residency VOL.	Check the status of the VOL.
9576	x01C	94	The object VOL is a command device.	Specify an VOL other than a command device.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	x01D	94	The change of the default owner controller is reserved for the object VOL.	Cancel the reservation for changing the default owner controller or specify the VOL for which the change of the default owner controller is not reserved.
9576	x01E	94	The status of the remote array is in an inappropriate condition to operate the TrueCopy or TCE pair.	The object VOL has been organized into a TrueCopy or TCE pair or the RAID group to which the object VOL belongs indicates a status other than Normal. Check the pair status of the VOL, and the RAID group status, the status of the DM-VOL, the capacity of the DM-VOL, and the status of the DP pool to which the DM-VOL belongs. Retry after the RAID group status becomes Normal in case that the RAID group indicate a status other than Normal. Recover the DM-VOL status if the DM-VOL is detached. Retry after the DP pool status to which the DM-VOL belongs becomes Normal in case that the DP pool indicate a status other than Normal. Retry after eliminating pinned data if pinned data exists in the DM-VOL. Delete the ShadowImage pair that is cascaded with the specified pair if the DM-VOL has unwritten data.
9576	x020	94	The object VOL of the remote array is being restored as a volume of ShadowImage or cannot accept Read/Write instructions.	Check the pair status of the VOL.
9576	x021	94	The object VOL has already been cascaded with a ShadowImage pair.	Check the pair status of the VOL and check that its pair attribute is P-VOL.
9576	x02A	94	The optional feature of TrueCopy of the remote array is invalid.	Unlock and validate the optional feature.
9576	x02B	94	Both of the two paths of the remote array were detached.	Check the status of the path.
9576	x030	94	The S-VOL is LU undefined.	Check the attribute of the LU.
9576	x031	94	The specified S-VOL or the target volume of remote array is already paired by a different array.	Check the pair information.
9576	x032	94	The remote array is receiving a command.	Retry after waiting for a while.
9576	x035	94	The optional feature of TrueCopy or TCE of the remote array is invalid.	Unlock and validate the optional feature.
9576	x038	94	Both of the two paths of the remote array were detached.	Check the status of the path.
9576	x03D	94	Pair status of corresponding VOL does not match.	Confirm the pair status of VOL and the other side's VOL.
9576	x03F	94	The VOL assigned to a TrueCopy pair has already been paired by ShadowImage.	Check the pair status of the VOL.
9576	x040	94	The object VOL of the remote array is a volume of ShadowImage that status is RCPY or cannot accept Read/Write instructions.	Check the pair status of the VOL.
9576	x041	94	The process is in progress.	Retry after waiting for a while.
9576	x045	94	The stripe size of the object VOL of the remote array is other than 64 kB.	Make the stripe size of the VOL of the remote array 64 kB.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	x046	94	The object VOL of the remote array is being restored as a volume of SnapShot or cannot accept Read/Write instructions.	Place the SnapShot pair, which comprises the VOL of the remote array, in the SMPL status once and then operate the pair.
9576	x047	94	The specified VOL is an S-VOL of ShadowImage.	Specify an VOL other than a ShadowImage S-VOL that comprises the VOL of the remote array (at the time of a swap).
9576	x048	94	The specified VOL is an S-VOL of ShadowImage.	Split the ShadowImage pair that comprises an VOL of the remote array.
9576	x049	94	The object VOL of the remote array is being quick formatted. Or management information of Dynamic Provisioning for the VOL specified as S-VOL in the remote array is being updated.	Create the pair again after the quick formatting is completed. Or retry after waiting a while.
9576	x04A	94	The S-VOL is in the S-VOL Disable mode.	Cancel the S-VOL Disable specified for the VOL of the remote array.
9576	x04B	94	The P-VOL is in the S-VOL Disable mode.	Cancel the S-VOL Disable specified for the VOL of the remote array (at the time of a swap).
9576	x050	94	The object VOL of the remote array has not undergone the forced restoration by means of parity or it is undergoing the restoration above.	Make the status, which concerns the forced restoration by means of parity, of the VOL of the remote array to Restored or Skip.
9576	x053	94	The number of unified LUs of the remote array is 17 or more.	Make the number of unified LUs of the remote array 16 or less.
9576	x054	94	The V-VOL, which is paired with a SnapShot P-VOL of the remote array has already been organized into a TrueCopy pair.	Split the TrueCopy pair comprising a SnapShot V-VOL that is an VOL of the remote array.
9576	x055	94	The object VOL of the remote array is a V-VOL of SnapShot (at the time of a pair creation).	Specify the VOL of the remote array to a volume other than a V-VOL of SnapShot.
9576	x056	94	The object VOL of the remote array is a V-VOL of SnapShot (at the time of a resynchronizing swap).	Specify the VOL of the remote array to a volume other than a V-VOL of SnapShot.
9576	x059	94	The license validity of the remote array is expired. Otherwise, the process of reconfigure memory is in progress on the remote array.	Purchase the license. Or retry after the process of reconfigure memory is completed.
9576	x05A	94	The DM-VOL is not set of the remote array or the DM-VOL was specified as S-VOL.	Retry after setting the DM-VOL or check the status of the VOL.
9576	x05D	94	The process is in progress.	Retry after waiting for a while.
9576	x089	94	The S-VOL of the remote array is in the status of S-VOL Disable.	Check the status of the remote array and cancel the access attribute.
9576	x08B	94	This operation cannot be executed due to lack of resources within the remote array. Try the operation again after deleting unnecessary pairs.	Check the pool VOL status of the remote array.
9576	x08C	94	This operation cannot be executed due to lack of resources within the remote array. Try the operation again after waiting for a while.	Check the pool VOL status of the remote array.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	x08D	94	The S-VOL of the remote array does not meet the conditions of cascading with a SnapShot pair.	Check the status of the VOL in the remote array.
9576	x090	94	The S-VOL of the remote array does not meet the conditions of cascading with a SnapShot pair.	Check the status of the VOL in the remote array.
9576	x091	94	The indicated Array ID is not same as the actual one for remote array.	Confirm the Array ID for the remote array.
9576	x095	94	The S-VOL in the remote array is undergoing the forced parity correction.	Check the status of the remote array and retry after waiting for a while.
9576	x097	94	The S-VOL in the remote array received an illegal command.	Check the status of the remote array.
9576	x09A	94	The VOL status of the S-VOL in the remote array is normal or other than regressed.	Check the VOL status of the remote array.
9576	x09F	94	The internal transaction which are splitting or deleting for SnapShot is working now.	Retry after waiting for a while.
9576	x0A0	94	The remote array has no DP pool.	Create a DP pool for the remote array.
9576	x0A2	94	The VOL status of the S-VOL in the remote array is Normal or other than Regresson.	Check the DP pool status of the remote array.
9576	x0A4	94	The S-VOL in the remote array exceeded the total allowable maximum number of TCE and SnapShot pairs.	Check the status of the remote array. In addition, delete unnecessary pairs of the remote array.
9576	x0A5	94	The TCE pair status of the S-VOL in the remote array is PSUE.	Check the TCE pair status of the remote array.
9576	x0A6	94	The TCE pair status of the S-VOL in the remote array is PFUS.	Check the TCE pair status of the remote array.
9576	x0A7	94	The TCE pair status of the S-VOL in the remote array is PSUS (no reading/writing allowed).	Check the TCE pair status of the remote array.
9576	x0A8	94	The TCE pair status of the S-VOL in the remote array is SSWS (including SSWS(R)).	Check the TCE pair status of the remote array.
9576	x0A9	94	The TCE pair status of the S-VOL in the remote array is SMPL.	Check the TCE pair status of the remote array.
9576	x0AA	94	The TCE pair status of the S-VOL in the remote array is PSUS.	Check the TCE pair status of the remote array.
9576	x0AB	94	The TCE pair status of the S-VOL in the remote array is not SMPL.	Check the TCE pair status of the remote array.
9576	x0B3	94	The specified S-VOL is a unified VOL including a SubLU with a capacity less than 1 GB.	Check whether the VOL with a capacity less than 1 GB is included in each VOL of the specified unified VOL.
9576	x0B4	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, the special processing cannot be continued.	Check the status of the remote array and retry after waiting for a while.
9576	x0B5	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, an ownership of VOL change for it has been started.	Check the status of the remote array and retry after waiting for a while.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	x0B6	94	The S-VOL in the remote array does not exist on the default owner controller and it has started an ownership of VOL change.	Check the status of the remote array and retry after waiting for a while.
9576	x0B7	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, an ownership of VOL to be changed is blocked.	Check the status of the remote array and retry after waiting for a while.
9576	x0B8	94	The S-VOL in the remote array cannot change an ownership of VOL and, at the same time, it is using the sequential buffer.	Check the status of the remote array and retry after waiting for a while.
9576	x0B9	94	The S-VOL in the remote array cannot change an ownership of VOL temporarily.	Retry after waiting for a while.
9576	x0BA	94	The S-VOL in the remote array cannot change an ownership of VOL and, at the same time, it has pinned data.	Contact the service personnel.
9576	x0BB	94	The S-VOL in the remote array cannot change an ownership of VOL temporarily.	Retry after waiting for a while.
9576	x0BC	94	The S-VOL in the remote array cannot change an ownership of VOL temporarily.	Retry after waiting for a while.
9576	x0BD	94	The S-VOL in the remote array cannot change an ownership of VOL and a time-out occurred.	Check the status of the remote array and retry after waiting for a while.
9576	x0BE	94	The S-VOL in the remote array cannot change an ownership of VOL and, at the same time, the group# is illegal.	Check the status of the remote array.
9576	x0C0	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, it is making the drive spun up.	Check the status of the remote array and retry after waiting for a while.
9576	x0C1	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, it is making the system copy.	Check the status of the remote array and retry after waiting for a while.
9576	x0C2	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, it is writing the takeover information.	Check the status of the remote array and retry after waiting for a while.
9576	x0C4	94	When a new pair of a CTG is created, the cycle time that has been set for the local and remote array is less than the minimum interval.	Check the cycle time that has been set for the local and remote array.
9576	x0C6	94	The specified S-VOL is undergoing the migration.	Re-execute the migration after splitting the pair.
9576	x0C7	94	The specified S-VOL is the reserved VOL.	Re-execute the migration specifying an VOL other than the reserved VOL for the S-VOL.
9576	x0CA	94	The specified S-VOL is undergoing the migration.	Re-execute the migration after splitting the pair.
9576	x0CB	94	The specified S-VOL is the reserved VOL.	Re-execute the migration specifying an VOL other than the reserved VOL for the S-VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	x0CF	94	The disk drives that configure a RAID group, to which a target VOL in the remote array belongs have been spun down.	Perform the operation again after spinning up the disk drives that configure the RAID group.
9576	x0D1	94	The disk drives that configure a RAID group, to which a target VOL in the remote array belongs have been spun down.	Perform the operation again after spinning up the disk drives that configure the RAID group.
9576	x0D2	94	The specified pool number in the remote array is not same as the one that is being used for SnapShot. Or the specified Replication Data DP pool or the Management Area DP pool for the remote array does not exist. Or the status of the specified Replication Data DP pool or the Management Area DP pool for the remote array is other than Normal or Regression. Or the specified Replication Data DP pool or Management Area DP pool for the remote array is different from the one that the specified S-VOL is currently using. Or the TCE pair deletion process is running on the Management Area DP pool for the remote array.	Confirm the indicated pool number in the remote array.
9576	x0D3	94	The license validity of the remote array is expired.	Purchase the license.
9576	x0D4	94	The S-VOL pair attribute in the remote array is P-VOL.	Check the VOL status of the remote array.
9576	x0D7	94	The indicated S-VOL is not PSUS status in the ShadowImage pair.	Execute again after having the ShadowImage pair status in the remote array be PSUS or SMPL.
9576	x0D8	94	The indicated S-VOL is not PSUS status in the SnapShot pair.	Execute again after having the SnapShot pair status in the remote array be PSUS or SMPL.
9576	x0D9	94	The Array ID of the remote array does not match, or TCE pairs whose status is other than COPY or PSUS, or ShadowImage or SnapShot pairs whose status is other than PSUS exist in the specified CTG.	Confirm the Array ID, pair status of ShadowImage, SnapShot, and TCE.
9576	x0DB	94	The partition or pair partition to which the target VOL belongs is incorrect.	Check the partition number.
9576	x0DD	94	The firmware internal error occurred.	Retry after waiting for a while. If an error occurred again, contact the service personnel.
9576	x0DE	94	Auto Migration is being executed in the remote array just now.	Execute again after the Migration is completed.
9576	x0E1	94	The operation to change VOL has become timeout while the remote array controller is recovering.	Retry the operation after the controller is recovered.
9576	x0E3	94	The RAID group to which the VOL that will be specified to S-VOL of the remote array belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9576	x0E9	94	The specified S-VOL is an VOL created in DP pool or a volume of ShadowImage pair that includes the VOL created in DP pool.	Confirm the S-VOL and the ShadowImage pair that the specified S-VOL is part of.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9576	x0F1	94	Management information of Dynamic Provisioning for the VOL specified as S-VOL in the remote array is being updated.	Retry after waiting a while.
9576	x0F2	94	The process of reconfigure memory is in progress on the remote array.	Retry after the process of reconfigure memory is completed.
9576	x0F5	94	The full capacity mode differs between the P-VOL and S-VOL. Or the full capacity mode is not supported.	Set both P-VOL and S-VOL the same value. Or check the firmware version of array.
9576	x101	94	The copy operation can not be performed because the capacity of the DM-VOL is depleted.	Grow the capacity of DM-VOL.
9576	x104	94	The internal transaction of the specified VOL is working now.	Retry after waiting for a while.
9576	x107	94	The copy operation can not be performed because the DM-VOL is detached.	Recover the DM-VOL status.
9576	x10A	94	The copy operation can not be performed because the DP pool to which the DM-VOL belongs is detached.	Recover the DP pool.
9576	x10D	94	Pinned data exists in the DM-VOL.	Retry after eliminating pinned data.
9576	x110	94	The operation can not be performed due to insufficient capacity of the DP Pool for the DM-VOL.	Grow the capacity of DP pool.
9576	x113	94	The copy operation can not be performed because the DM-VOL has unwritten data.	Delete the ShadowImage pair that is cascaded with the specified pair.
9576	x13A	94	There are the maximum number of groups for TCE on the remote array.	Check the number of groups for TCE.
9591			There exist maximum number of pairs already.	Split the unnecessary pairs.
9606			The P-VOL or S-VOL is an invalidated VOL.	Check the status of the VOL.
9607			The P-VOL or S-VOL is a P-VOL (other than SMPL, or the SMPL and a V-VOL that has been set) or a V-VOL of SnapShot.	Check the pair status.
9608	0000	84	In the operation to change an ownership of VOL, an VOL having pinned data was specified.	Retry after eliminating pinned data.
9608	0001	84	The controller that controls the VOL cannot be changed temporarily.	Retry after waiting for a while.
9608	0002	84	The operation to change an ownership of VOL is in progress.	Retry after waiting for a while.
9608	0003	84	There is no partition to which the current partition is to be changed.	Retry after waiting for a while.
9608	0004	84	The specified P-VOL or the specified S-VOL is the VOL, for which a change of the cache partitions had been reserved.	Retry after releasing the reserved status.
9608	0004	84	The P-VOL is in a status other than Normal and Regression.	Check the status of the VOL.
9608	0005	84	The operation to change an ownership of VOL is in progress.	Retry after waiting for a while.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	0005	84	The DP pool being used is in a status other than Normal and Regression.	Check the status of the DP pool.
9608	0006	84	The pair status of the P-VOL is other than SMPL, or a V-VOL does not exist.	Check the pair status of the VOL.
9608	0007	84	The pair status is other than SMPL.	Check the pair status of the VOL.
9608	0008	84	The specified P-VOL is a V-VOL.	Check the pair status of the VOL.
9608	0009	84	The specified V-VOL is a P-VOL.	Check the pair status of the VOL.
9608	000A	84	The specified VOL is not the same as the expected one.	Make sure of the specified VOL.
9608	000B	84	The group ID is out of appropriate ranges.	Make sure of the specified group ID number.
9608	000D	84	The same MU number was specified within the same P-VOL.	Make sure of the specified MU number.
9608	000E	84	The process is in progress.	Retry after waiting for a while.
9608	0010	84	The pair status is other than PSUS.	Check the pair status of the VOL.
9608	0011	84	The object VOL is not the same as the expected one.	Check the specified VOL.
9608	0012	84	The pairsplit -E command (instruction of forced suspension) was received.	Make sure of the command.
9608	0014	84	The P-VOL is in a status other than Normal or Regression.	Check the status of the VOL.
9608	0015	84	The DP pool being used is in a status other than Normal or Regression.	Check the status of the DP pool.
9608	0016	84	There is no V-VOL corresponding to the specified P-VOL.	Check the status of the VOL.
9608	0017	84	The pair attribute of the P-VOL is V-VOL.	Check the status of the VOL.
9608	0018	84	The pair attribute of the V-VOL is P-VOL.	Check the status of the VOL.
9608	0019	84	The object VOL is not the same as the expected one.	Check the specified VOL.
9608	001A	84	The same MU number was specified within the same P-VOL.	Make sure of the specified MU number.
9608	001B	84	The process is in progress.	Retry after waiting for a while.
9608	001D	84	The object VOL is not the same as the expected one.	Check the specified VOL.
9608	001E	84	The specified V-VOL is not specified to be grouped. (Group ID suspension)	Check the pair attribute of the VOL.
9608	001F	84	The V-VOL, which is an object of the batch suspension, is in a status other than PAIR. (Group ID suspension)	Check the pair status of the VOL.
9608	0020	84	The process is in progress.	Retry after waiting for a while.
9608	0021	84	The process is in progress.	Retry after waiting for a while.
9608	0022	84	The pair status of the V-VOL is illegal.	Check the pair status of the VOL.
9608	0023	84	The object VOL is not the same as the expected one.	Check the specified VOL.
9608	0028	84	The specified MU number is different from that of the specified V-VOL.	Make sure of the specified MU number.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	0029	84	The specified MU number is different from that of the specified V-VOL.	Make sure of the specified MU number.
9608	002A	84	The specified MU number is different from that of the specified V-VOL.	Make sure of the specified MU number.
9608	002B	84	The pair status was changed to PSUE because the process terminated abnormally.	Place the pair concerned in the SMPL status once, and then create the pair again.
9608	002C	84	The specified P-VOL has excess pinned data (at the time of a restoration only).	Retry after eliminating pinned data.
9608	002E	84	CCI was received by the control information on 8-byte form.	Check the environment of CCI.
9608	002F	84	There are 64 or more LUs being restored.	Retry after the restoration is completed.
9608	0030	84	The P-VOL is being restored.	Retry after the restoration is completed.
9608	0031	84	Data of the V-VOL is partially destroyed.	Make a backup from the S-VOL to a tape device, etc. and then restore the data to the P-VOL.
9608	0032	84	The process is in progress.	Retry after waiting for a while.
9608	0033	84	Because the process terminated abnormally, the pair status was changed to PSUE and the P-VOL became unable to accept Read/Write instructions.	Change the statuses of all V-VOLs of the P-VOL concerned to SMPL, and create the pair again.
9608	0034	84	Because the process terminated abnormally, the pair status was changed to PSUE and the P-VOL became unable to accept Read/Write instructions.	Change the statuses of all V-VOLs of the P-VOL concerned to SMPL, and create the pair again.
9608	0035	84	The MU number is other than 0 to 2.	Make sure of the specified MU number.
9608	0036	84	The MU number is other than 0 to 2.	Make sure of the specified MU number.
9608	0037	84	The MU number is other than 0.	Make sure of the specified MU number.
9608	0038	84	The V-VOL is a volume of TrueCopy and in a status other than SMPL.	Check the status of the TrueCopy pair.
9608	0039	84	The P-VOL of SnapShot is a P-VOL of TrueCopy. It is in the PSUS status and prohibited from accepting Write instructions.	Check the pair status and pair attribute.
9608	003A	84	The P-VOL of SnapShot is a P-VOL of TrueCopy. It is in the PSUS status and prohibited from accepting Write instructions.	Check the pair status and pair attribute.
9608	003B	84	The P-VOL of SnapShot is a volume of TrueCopy and it is in a status other than SMPL and PSUS.	Check the status of the TrueCopy pair.
9608	003C	84	Among the other S-VOLs of SnapShot, there are LUs of TrueCopy in a status other than PSUS and PSUE.	Check the status of the TrueCopy pair.
9608	003D	84	The V-VOL is a volume of TrueCopy and in a status other than PSUS and PSUE.	Check the status of the TrueCopy pair.
9608	003E	84	The V-VOL is a volume of TrueCopy and in a status other than SMPL.	Check the status of the TrueCopy pair.
9608	0044	84	The DM-VOL is not set.	Retry after setting the DM-VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	0045	84	The DM-VOL was specified as P-VOL.	Check the status of the VOL.
9608	0046	84	The DM-VOL was specified as V-VOL.	Check the status of the VOL.
9608	0047	84	The DM-VOL is not set.	Retry after setting the DM-VOL.
9608	0048	84	The DM-VOL was specified as P-VOL.	Check the status of the VOL.
9608	0049	84	The DM-VOL was specified as V-VOL.	Check the status of the VOL.
9608	004A	84	Validity of the license expired.	Purchase the license.
9608	004B	84	Validity of the license expired.	Purchase the license.
9608	0052	84	The specified P-VOL is a P-VOL of TCE and the status of the TCE pair is other than PSUS (at the time of restoration).	Check the status of the VOL.
9608	0053	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is PSUS and writing to the S-VOL is prohibited (at the time of restoration).	Check the status of the VOL.
9608	0054	84	The specified P-VOL is an S-VOL of TCE and the determined data at the end of the previous cycle is being restored to the S-VOL.	Retry after waiting for a while.
9608	0056	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is PSUS and reading/writing from/to the S-VOL is prohibited (at the time of restoration).	Check the status of the VOL.
9608	0057	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is other than SMPL or PSUS (at the time of restoration).	Check the status of the VOL.
9608	0058	84	The P-VOL of this SnapShot is the S-VOL of the TCE pair. It cannot be executed because the status of this TCE pair is COPY or PAIR.	Check the status of the VOL.
9608	0059	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is PSUS and reading/writing from/to the S-VOL is prohibited.	Check the status of the VOL.
9608	005A	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is COPY or PAIR.	Check the status of the VOL.
9608	005B	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is PSUS and reading/writing from/to the S-VOL is prohibited.	Check the status of the VOL.
9608	005C	84	The specified P-VOL is an S-VOL of TCE and the status of the TCE pair is PFUS (at the time of restoration).	Check the status of the VOL.
9608	005D	84	The specified P-VOL is the reserved VOL.	Check the status of the VOL.
9608	005E	84	The specified P-VOL is the reserved VOL.	Check the status of the VOL.
9608	005F	84	Though the specified P-VOL requires a change of an ownership of VOL, it has the pinned data.	Contact the service personnel.
9608	0060	84	The controller that controls the VOL that will be P-VOL cannot be changed.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	0061	84	The operation to change VOL is in progress.	Retry after waiting for a while.
9608	0062	84	There is no partition to which the current partition to be changed.	Retry after waiting for a while.
9608	0063	84	Though the specified P-VOL requires a change of an ownership of VOL, the directory structure is being changed.	Check the status of the VOL.
9608	0064	84	Though the specified P-VOL requires a change of an ownership of VOL, a time-out occurred in the ownership of VOL changed.	Check the status of the VOL.
9608	0065	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down (at the time of restoration).	Check the status of the RAID group.
9608	0066	84	The specified DP pool is beyond the limits of supported.	Check the specified DP pool ID.
9608	0067	84	There is no DP pool at the specified DP pool ID.	Check the specified DP pool ID.
9608	0068	84	The specified P-VOL is already paired with one or more V-VOLs, and the specified DP pool ID is different from the DP pool ID, which is already assigned.	Check the specified DP pool ID.
9608	0069	84	The RAID group, to which the specified P-VOL belongs, is RAID 0.	Check the RAID level of the specified VOL.
9608	006A	84	For the specified P-VOL, the V-VOL has already created the maximum number of pairs.	Check the number of V-VOLs which are paired with the P-VOLs.
9608	006B	84	The specified P-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
9608	006C	84	The specified P-VOL is a Volume Migration pair.	Check the status of the VOL.
9608	006D	84	The specified P-VOL is a ShadowImage pair.	Check the attribute of the VOL.
9608	006E	84	The specified P-VOL has been defined to the command device.	Check the attribute of the VOL.
9608	006F	84	The capacity of SnapShot pair is beyond the limits.	Confirm the capacity of all the SnapShot V-VOLs, all the P-VOLs and S-VOLs of TCE pairs, and DP pools is less than or equal to the supported capacity.
9608	0070	84	The process is in progress.	Retry after waiting for a while.
9608	0071	84	It is exceeded the total allowable maximum number of TCE and SnapShot pairs.	Delete the unnecessary pairs.
9608	0072	84	The specified P-VOL is a MainLU of a unified VOL, which includes an VOL with a capacity smaller than 1 GB.	Check the status of the VOL.
9608	0073	84	The specified P-VOL has been set to the current Cache Residency VOL.	Check the status of the VOL.
9608	0074	84	The specified P-VOL has been set to the reserved Cache Residency VOL.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	0075	84	The specified P-VOL is the VOL, for which a change of the cache partitions had been reserved to other directory.	Check the status of the VOL.
9608	0076	84	Differential bit map is insufficient.	Delete the unnecessary pairs.
9608	0077	84	When the specified P-VOL is a TCE pair, the specified DP pool ID and the used DP pool ID are not the same.	Check the specified DP pool ID.
9608	0078	84	VOL capacities of the P-VOL and V-VOL are different.	Check the capacity of the VOL.
9608	007B	84	An unsupported command option was received.	Check the specified value.
9608	007C	84	The specified DP pool ID is beyond the limits of supported.	Check the specified DP pool ID.
9608	007D	84	There is no DP pool at the specified DP pool ID.	Check the specified DP pool ID.
9608	007E	84	An instruction to create a pair was issued to a P-VOL, which has one or more pairs, specifying a pool ID different from that has been assigned.	Check the specified DP pool ID.
9608	007F	84	The RAID group, to which the specified P-VOL belongs, is RAID 0.	Check the RAID level of the specified VOL.
9608	0080	84	The V-VOL has already created the maximum number of pairs for the specified P-VOL.	Check the number of V-VOLs which have paired with the P-VOL.
9608	0081	84	The specified P-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
9608	0082	84	The specified P-VOL is a Volume Migration pair.	Check the attribute of the VOL.
9608	0083	84	The specified P-VOL is a ShadowImage pair.	Check the attribute of the VOL.
9608	0084	84	The specified P-VOL has been defined to the command device.	Check the attribute of the VOL.
9608	0085	84	The capacity of SnapShot pair is beyond the limits.	Confirm the capacity of all the SnapShot V-VOLs, all the P-VOLs and S-VOLs of TCE pairs, and DP pools is less than or equal to the supported capacity.
9608	0086	84	The process is in progress.	Retry after waiting for a while.
9608	0087	84	It is exceeded the total allowable maximum number of TCE and SnapShot pairs.	Delete the unnecessary pairs.
9608	0088	84	The specified P-VOL is a MainLU of a unified VOL, which includes an VOL with a capacity smaller than 1 GB.	Check the status of the VOL.
9608	0089	84	The specified P-VOL has been set to the current Cache Residency VOL.	Check the status of the VOL.
9608	008A	84	The specified P-VOL has been set to the reserved Cache Residency VOL.	Check the status of the VOL.
9608	008B	84	The specified P-VOL is the VOL, for which a change of the cache partitions had been reserved to other directory.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	008C	84	Differential bit map is insufficient.	Delete the unnecessary pairs.
9608	008D	84	When the specified P-VOL is a TCE pair, the specified DP pool ID and the used DP pool ID are not the same.	Check the specified DP pool ID.
9608	008E	84	VOL capacities of the P-VOL and V-VOL are different.	Check the capacity of the VOL.
9608	008F	84	When creating a pair specifying a group ID, the specified group ID is already used for a ShadowImage pair.	Check the specified group ID.
9608	0090	84	The partition or pair partition to which the target VOL belongs is incorrect.	Check the partition number.
9608	0091	84	The firmware internal error occurred.	Retry after waiting for a while. If an error occurred again, contact the service personnel.
9608	0092	84	The P-VOL is in a status other than Normal or Regression.	Check the status of the VOL.
9608	0093	84	The used DP pool is in the status other than Normal or Regression.	Check the status of the DP pool.
9608	0094	84	The Migration status is other than unexecuted.	Check the Migration status.
9608	0095	84	The Migration status is other than unexecuted.	Check the Migration status.
9608	0096	84	The Migration status is other than unexecuted.	Check the Migration status.
9608	0097	84	The Migration status is other than unexecuted.	Check the Migration status.
9608	0098	84	The Migration status is other than unexecuted.	Check the Migration status.
9608	0099	84	There exist maximum number of pairs already.	Delete the unnecessary pairs.
9608	009A	84	There exist maximum number of pairs already.	Delete the unnecessary pairs.
9608	009B	84	The operation to change VOL has become timeout while the controller is recovering.	Retry the operation after the controller is recovered.
9608	009C	84	The RAID group to which the specified VOL belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9608	009D	84	The VOL created in DP pool was specified as P-VOL.	Specify an VOL other than the VOL created in DP pool.
9608	009E	84	A P-VOL that belongs to the RAID group that indicates a status other than Normal is included in the specified group.	Retry after the RAID group status becomes Normal.
9608	009F	84	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the data pool that is used by pairs in the specified group.	Retry after the RAID group status becomes Normal.
9608	00A0	84	The RAID group to which the specified VOL belongs indicates a status other than Normal.	Retry after the status becomes Normal.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	00A1	81	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the data pool that is specified when the pair operation or used by specified pair.	Retry after the RAID group status becomes Normal.
9608	00A2	84	The VOL created in DP pool was specified as P-VOL.	Specify an VOL other than the VOL created in DP pool.
9608	00A3	84	The VOL that was specified as P-VOL does not exist.	Check the specified VOL.
9608	00A4	84	The VOL that was specified as P-VOL does not exist.	Check the specified VOL.
9608	00A5	84	An VOL whose DP optimization status is not Normal is included the pair and its cascade pairs.	Check the DP optimization status of the LUs which are included in the pairs.
9608	00A6	84	The operation can not be performed due to insufficient capacity of the DP pool for the specified P-VOL.	Check the capacity of the DP pool.
9608	00A7	84	The operation can not be performed due to insufficient capacity of the specified DP pool.	Check the capacity of the DP pool.
9608	00A8	84	Management information of Dynamic Provisioning is being updated.	Retry after waiting for a while.
9608	00A9	84	The operation can not be performed due to insufficient capacity of the DP pool for the P-VOL of a pair in the same group.	Check the capacity of the DP pool.
9608	00AA	84	The operation can not be performed due to insufficient capacity of the specified DP pool of a pair in the same group.	Check the capacity of the DP pool.
9608	00AB	84	The V-VOL of the specified pair is the P-VOL of a TrueCopy or TCE.	Retry after deleting the TrueCopy or TCE pair.
9608	00AC	84	Access attribute has been set to the V-VOL of the specified SnapShot pair.	Change the attribute to Read/Write and reset S-VOL Disable. If mode is set, reset it using CCI. Then, delete the pair.
9608	00AD	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
9608	00AE	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
9608	00B1	84	The status of the ShadowImage pair cascading with the specified SnapShot pair is invalid.	Check the status of the ShadowImage pair.
9608	00B2	84	The status of a ShadowImage pair cascading with the specified SnapShot pair is PSUE where the ShadowImage pair cannot accept Read/Write instructions.	Check the pair status.
9608	00B4	84	There is a ShadowImage pair in the specified group cascading with another pair.	Check the status of the ShadowImage pair.
9608	00B5	84	The specified MU# is invalid.	Check the MU#.
9608	00B6	84	The Point-in-Time of the specified group is disabled.	Check the group number.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	00B7	84	There are the maximum number of pairs in the specified group.	Check the number of pairs in the specified group.
9608	00B8	84	There are the maximum number of pairs that do not belong to any group.	Check the number of pairs that do not belong to any group.
9608	00B9	84	The Point-in-Time of the specified group is disabled.	Check the group number.
9608	00BA	84	The status of the specified Replication Data DP Pool or Management Area DP Pool is other than Normal or Regression. Or Replication Data Released Threshold for the DP pool is exceeded. Or the DP pool is depleted.	Check the status of the DP pool.
9608	00BB	84	SnapShot pairs are being deleted.	Retry after waiting for a while.
9608	00BC	84	The specified P-VOL is paired with the maximum number of pairs.	Check the number of pairs with the specified P-VOL.
9608	00BD	84	The P-VOL has not undergone forced parity correction.	Retry after executing forced parity correction.
9608	00BE	84	The specified Replication Data DP pool number or Management Area DP pool number is beyond the limit.	Check the DP pool number.
9608	00BF	84	The specified Replication Data DP pool or Management Area DP pool does not exist.	Check the status of the DP pool.
9608	00C0	84	The specified Replication Data DP pool or Management Area DP pool is different from the one that the P-VOL is currently using.	Check the specified DP pool number.
9608	00C1	84	Restore is running in the background.	Retry after waiting for a while.
9608	00C2	84	There is a P-VOL of SnapShot that is cascaded with an S-VOL of TCE whose pair status is COPY or PAIR.	Check the pair status of TCE.
9608	00C3	84	There is a P-VOL of SnapShot that is cascaded with an S-VOL of TCE whose pair status is SSUS and whose S-VOL can not accept read/write instructions.	Check the pair status of TCE.
9608	00C5	84	The processing is impossible because the specified group is receiving the pair split and the cascaded TCE is executing the cycle copy	Perform it again after completing the SnapShot pair split of the target group.
9608	00C6	84	The pair status of the P-VOL belonging to the specified group and the cascaded TCE is illegal.	Check the pair status of the LUs in the group.
9608	00C7	84	The configuration of the P-VOL belonging to the specified group and the cascaded TCE is illegal	Check the configuration of the LUs in the group and the cascaded TCE.
9608	00C8	84	The pair which shares the P-VOL exists in the pairs belonging to the specified group.	Check the pair configuration in the group.
9608	00C9	84	The remote array type of the LUs of the batch Split target and the cascaded TCE is out of the supported array.	Check the type of the TCE remote array.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	00CA	84	The group which performs the batch Split after TCE cycle transfer exists in the other group that shares the specified group and the P-VOL.	Perform it again after completing Split of the other group.
9608	00EF	84	The partition or pair partition to which the target VOL belongs is incorrect.	Check the partition number.
9608	00F0	84	The firmware internal error occurred.	Retry after waiting for a while. If an error occurred again, contact the service personnel.
9608	00FA	84	The operation to change VOL has become timeout while the controller is recovering.	Retry the operation after the controller is recovered.
9608	00FB	84	The RAID group to which the target VOL of changing ownership belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9608	FFE5	84	The specified P-VOL is the LU for which a change of the cache partitions had been reserved.	Retry after releasing the reserved status.
9608	FFE6	84	The specified SnapShot data has been mapped to a host group.	Retry after unmapping the specified SnapShot data from the host group.
9608	FFE7	84	The specified P-VOL is undergoing the execution of the ownership of LU change.	Retry after waiting for a while.
9608	FFE8	84	A SnapShot data with its CTG mode enabled is being created into a SnapShot set whose CTG mode is disabled.	Create a SnapShot data with its CTG mode disabled.
9608	FFE9	84	The specified volume is not the P-VOL of a SnapShot set.	Check the specified volume.
9608	FFEA	84	The specified SnapShot set already has the max number of SnapShot data.	Check the number of SnapShot data in the specified SnapShot set.
9608	FFEB	84	The max number of SnapShot sets have existed.	Check the number of SnapShot sets.
9608	FFEC	84	The SnapShot data with the specified LUN is not in a SnapShot set.	Check the SnapShot data with the specified LUN.
9608	FFED	84	The SnapShot data with the specified MU# is not in a SnapShot set.	Check the SnapShot data with the specified MU#.
9608	FFEE	84	The specified SnapShot set name is already in use.	Specify an available SnapShot set name.
9608	FFEF	84	Access attribute has been set to the specified SnapShot data.	Change the attribute to Read/Write and reset S-VOL Disable.
9608	FFF0	84	The specified SnapShot data has been cascaded with remote replication.	Retry after releasing the cascade with remote replication.
9608	FFF1	84	A LUN has not been mapped to the specified SnapShot data.	Check the specified SnapShot data.
9608	FFF2	84	The specified LUN is not a LUN for a SnapShot data but a P-VOL.	Specify the LUN of a SnapShot data.
9608	FFF3	84	The specified LUN is not mapped to a SnapShot data.	Check the specified LUN.
9608	FFF4	84	The specified LUN is beyond the limits of support.	Check the specified LUN.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9608	FFF5	84	A LUN has already been mapped to the specified SnapShot data.	Check the LUN of the SnapShot data.
9608	FFF6	84	The specified P-VOL does not have a SnapShot data with the specified MU#.	Check the specified P-VOL and MU#.
9608	FFF7	84	The specified P-VOL does not have a SnapShot data with the specified SnapShot set name.	Check the specified P-VOL and SnapShot set name.
9608	FFF8	84	The specified LUN is not a LUN for a P-VOL but a SnapShot data.	Specify the LUN of a P-VOL.
9608	FFF9	84	The specified LUN is already in use.	Specify an available LUN.
9608	FFFA	84	The SnapShot data can not be identified from the combination of the specified P-VOL and SnapShot set name.	Specify a P-VOL and MU# to identify the target SnapShot data.
9608	FFFB	84	The specified MU# is beyond the limits of support.	Check the specified MU#.
9608	FFFC	84	The LUN of the specified P-VOL is beyond the limits of support.	Check the LUN for the specified P-VOL.
9608	FFFD	84	Over one P-VOL was specified for the command.	Specify one P-VOL only.
9608	FFFE	84	An internal error occurred regarding CCI.	Check the requirements for CCI to work correctly.
9608	FFFF	84	The raidcom command is not supported on this platform.	Confirm the raidcom command you are executing.
9608	x000	84	The controller that controls the VOL cannot be changed because pinned data exists.	Retry after eliminating pinned data.
9608	x001	84	The controller that controls the VOL cannot be changed temporarily.	Retry after waiting for a while.
9608	x002	84	The operation to change VOL is in progress.	Retry after waiting for a while.
9608	x003	84	There is no partition to which the current partition is to be changed.	Retry after waiting for a while.
9608	x004	84	The directory configuration is being changed.	Reboot the array.
9608	x005	84	The change of a controller that controls the VOL resulted in a time-out.	Retry after waiting for a while.
9608	x090	84	The partition or pair partition to which the target VOL belongs is incorrect.	Check the partition number.
9608	x091	84	The firmware internal error occurred.	Retry after waiting for a while. If an error occurred again, contact the service personnel.
9609	0001	84	The target VOL is undergoing the change of an ownership of VOL.	Retry after waiting for a while.
9609	0002	84	The target VOL is undergoing the change of an ownership of VOL.	Retry after waiting for a while.
9609	0003	84	An instruction to change the controller that controls the VOL was issued.	Retry after waiting for a while.
9609	0004	84	The owner controller LUs to be paired is detached.	Retry.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	0005	84	The owner controller LUs to be paired is detached.	Retry.
9609	0006	84	The owner controller LUs to be paired is detached.	Retry.
9609	0007	84	The owner controller LUs to be paired is detached.	Retry.
9609	0009	84	The owner controller LUs to be paired is detached.	Retry after waiting for a while.
9609	000A	84	The owner controller LUs to be paired is detached.	Retry after waiting for a while.
9609	000B	84	The owner controller LUs to be paired is detached.	Retry after waiting for a while.
9609	0019	84	The pair operation commands are a time-out.	Retry after waiting for a while.
9609	0060	94	The path of the local array is abnormal.	Check the status of the path.
9609	0061	94	The path of the local array is abnormal.	Check the status of the path.
9609	0062	94	The path of the local array is abnormal.	Check the status of the path.
9609	0063	94	The path of the local array is abnormal.	Check the status of the path.
9609	0065	84	Since the specified P-VOL requires a change of an ownership of VOL, it is undergoing the execution of the ownership of VOL change.	Retry after waiting for a while.
9609	0066	84	Though the specified P-VOL requires a change of an ownership of VOL, the controller to be changed is blocked.	Retry after waiting for a while.
9609	0067	84	Since the specified P-VOL requires a change of an ownership of VOL, the execution of the ownership of VOL change has been started.	Retry after waiting for a while.
9609	x001	84	The target VOL is undergoing the change of an ownership of VOL.	Retry after waiting for a while.
9609	x001	94	The path of the remote array was detached.	Check the status of the path.
9609	x002	84	The change of a controller that controls the VOL cannot be checked because the directory was blocked in the other controller.	Retry after waiting for a while.
9609	x002	94	The process is in progress.	Retry after waiting for a while.
9609	x003	84	An instruction to change the controller that controls the VOL was issued.	Retry after waiting for a while.
9609	x003	94	The process is in progress.	Retry after waiting for a while.
9609	x004	94	The process is in progress.	Retry after waiting for a while.
9609	x00A	94	The remote array is receiving a command.	Retry after waiting for a while.
9609	x00F	94	The path of the remote array was detached.	Check the status of the path.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x01E	94	The status of the remote array is in an inappropriate condition to operate the TrueCopy or TCE pair.	Check the pair status of the VOL, the status of the RAID group to which the target VOL belongs, and reconfigure memory status, the status of the DM-VOL, and the status of the DP pool to which the DM-VOL belongs. Retry after the RAID group status becomes Normal in case that the RAID group indicate a status other than Normal. Retry after the process of reconfigure memory is completed if it is in progress. Recover the DM-VOL status if the DM-VOL is detached. Retry after the DP pool status to which the DM-VOL belongs becomes Normal in case that the DP pool indicate a status other than Normal. Retry after eliminating pinned data if pinned data exists in the DM-VOL.
9609	x022	94	The process is in progress.	Retry after waiting for a while.
9609	x023	94	The process is in progress.	Retry after waiting for a while.
9609	x024	94	The process is in progress.	Retry after waiting for a while.
9609	x025	94	The S-VOL of the remote array is being formatted.	Retry after waiting for a while.
9609	x026	94	The remote array is undergoing the pseudo deliberate shutdown.	Retry after the pseudo deliberate shutdown is completed.
9609	x027	94	The remote array has undergone the pseudo deliberate shutdown.	Retry after waiting for a while.
9609	x028	94	The remote array is executing a command of CCI.	Retry after waiting for a while.
9609	x029	94	A command error occurred.	Retry after waiting for a while.
9609	x02A	94	The optional feature of TrueCopy or TCE of the remote array is invalid.	Unlock and validate the optional feature.
9609	x02B	94	The path of the remote array was detached.	Check the status of the path.
9609	x02C	94	The process is in progress.	Retry after waiting for a while.
9609	x02D	94	The S-VOL of the remote array is being formatted.	Retry after waiting for a while.
9609	x02E	94	The remote array is undergoing the pseudo deliberate shutdown.	Retry after the pseudo deliberate shutdown is completed.
9609	x02F	94	The remote array has undergone the pseudo deliberate shutdown.	Retry after waiting for a while.
9609	x030	94	The S-VOL is undefined.	Check the attribute of the VOL.
9609	x031	94	The specified S-VOL or the target volume of remote array is already paired by a different array.	Check the pair information.
9609	x032	94	The remote array is executing a command of CCI.	Retry after waiting for a while.
9609	x033	94	The remote array is undergoing hot replacement of the firmware.	Retry after waiting for a while.
9609	x034	94	A command error occurred.	Retry after waiting for a while.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x035	94	The optional feature of TrueCopy or TCE of the remote array is locked. Otherwise, the process of reconfigure memory is in progress on the remote array.	Unlock and enable the optional feature. Or retry after the process of reconfigure memory is completed.
9609	x036	94	The process is in progress.	Retry after waiting for a while. In case that the RAID group to which the VOL that will be S-VOL belongs indicate a status other than Normal, retry after the status becomes Normal.
9609	x037	94	The remote array is busy. Or the copy operation can not be performed because the capacity of the DP pool is depleted or can be depleted by this copy for either the S-VOL or an S-VOL of ShadowImage cascading in the remote array. Or the status of the object VOL is other than normal or regression. Or the full capacity mode is not supported.	Retry after checking the pair status of the VOL, Array ID, number of the connected arrays, and group number. Or resolve the insufficient capacity of the DP pool and retry. Or make the status of the object VOL normal or regression. Or check the firmware version of array.
9609	x038	94	Both of the two paths of the remote array were detached.	Check the status of the path.
9609	x039	94	The process is in progress.	Retry after waiting for a while.
9609	x03A	94	The process is in progress.	Retry after waiting for a while.
9609	x03E	94	The S-VOL command is receiving a command.	Retry after waiting for a while.
9609	x041	94	The S-VOL of the remote array is doing a duplicate writing.	Retry after waiting for a while.
9609	x042	94	The capacity of TCE pair is beyond the limits within the remote array.	Confirm the capacity of all the SnapShot P-VOLs, all the P-VOLs and S-VOLs of TCE pairs, and DP pools is less than or equal to the supported capacity for the installed cache memory.
9609	x058	94	The ShadowImage P-VOL of the remote array is in the PSUE (S-VOL Switch) status.	Contact the service personnel.
9609	x086	94	The S-VOL of the remote array is specified as a command device.	Specify a volume other than a command device of the remote array as the S-VOL.
9609	x087	94	The S-VOL of the remote array is executing format. Or management information of Dynamic Provisioning for the VOL specified as S-VOL in the remote array is being updated.	Create the pair again after the quick formatting is completed. Or retry after waiting a while.
9609	x088	94	The S-VOL of the remote array is specified as the DM-VOL.	Specify a volume other than the DM-VOL of the remote array as the S-VOL.
9609	x089	94	The S-VOL of the remote array is in the status of S-VOL Disable.	Check the status of the remote array and cancel the access attribute.
9609	x08A	94	The S-VOL in the remote array cannot be allocated the differential bit of TCE pair because the capacity is beyond the supported limit. Or the copy operation can not be performed because the capacity of the DP pool is depleted or can be depleted by this copy for either the S-VOL or an S-VOL of ShadowImage cascading in the remote array.	Check the status of the remote array. In addition, delete unnecessary pairs of the remote array. Or resolve the insufficient capacity of the DP pool and retry.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x08B	94	The capacity of TCE pair is beyond the limits within the remote array.	Confirm the capacity of all the SnapShot P-VOLs, all the P-VOLs and S-VOLs of TCE pairs, and DP pools is less than or equal to the supported capacity for the installed cache memory.
9609	x08C	94	The process is in progress.	Retry after waiting for a while.
9609	x08D	94	The S-VOL of the remote array does not meet the conditions of cascading with a SnapShot pair.	Check the status of the VOL in the remote array.
9609	x08E	94	The S-VOL in the remote array has created a ShadowImage pair.	The TCE and ShadowImage volumes cannot be cascaded with each other. Check the VOL status of the remote array.
9609	x091	94	The serial number of the S-VOL in the remote array is wrong.	Check the serial number of the remote array.
9609	x094	94	The RAID level of the S-VOL in the remote array is RAID 0.	Make the RAID level of the remote array other than RAID 0.
9609	x095	94	The S-VOL in the remote array is undergoing the forced parity correction.	Check the status of the remote array and retry after waiting for a while.
9609	x096	94	The S-VOL in the remote array is a SnapShot V-VOL.	The TCE and SnapShot V-VOLs cannot be cascaded with each other. Check the VOL status of the remote array.
9609	x097	94	The S-VOL in the remote array received an illegal command.	Check the status of the remote array.
9609	x098	94	The S-VOL in the remote array is changing the cache partition.	Check the status of the remote array and retry after waiting for a while.
9609	x09A	94	The VOL status of the VOL that will be S-VOL in the remote array is normal or other than regressed or the RAID group to which the VOL is belongs indicates a status other than Normal or the VOL is created in DP pool.	Check the VOL status of the remote array. Retry after the RAID group status becomes Normal in case that the RAID group indicates a status other than Normal. Specify an VOL other than an VOL created in DP pool to S-VOL.
9609	x09C	94	The VOL capacity of the S-VOL in the remote array is not the same as the P-VOL capacity. Or The full capacity mode differs between the P-VOL and S-VOL. Or the full capacity mode is not supported.	Make the VOL capacity of the remote array the same as that of the P-VOL. Or set both P-VOL and S-VOL the same value. Or check the firmware version of array.
9609	x09D	94	The S-VOL in the remote array is set to a Cache Residency VOL.	Specify an VOL other than a Cache Residency VOL of the remote array.
9609	x09E	94	An VOL with a capacity less than 1 GB is included in the LUs in which the S-VOL is unified in the remote array.	Check the status of the unified VOL of the remote array.
9609	x09F	94	This operation cannot be executed due to lack of resources within the remote array. Retry after waiting for a while.	Check the pool VOL status of the remote array.
9609	x0A0	94	The remote array has no DP pool.	Create a DP pool for the remote array.
9609	x0A2	94	The DP pool status in the remote array is normal or other than regressed.	Check the DP pool status of the remote array.
9609	x0A4	94	The S-VOL in the remote array exceeded the total allowable maximum number of TCE and SnapShot pairs.	Check the status of the remote array. In addition, delete unnecessary pairs of the remote array.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x0A5	94	The TCE pair status of the S-VOL in the remote array is PSUE.	Check the TCE pair status of the remote array.
9609	x0A6	94	The TCE pair status of the S-VOL in the remote array is PFUS.	Check the TCE pair status of the remote array.
9609	x0A7	94	The TCE pair status of the S-VOL in the remote array is PSUS (no reading/writing allowed).	Check the TCE pair status of the remote array.
9609	x0A8	94	The TCE pair status of the S-VOL in the remote array is SSWS or the determined data at the end of the previous cycle is being restored to the S-VOL.	Check the TCE pair status of the remote array.
9609	x0A9	94	The TCE pair status of the S-VOL in the remote array is SMPL.	Check the TCE pair status of the remote array.
9609	x0AA	94	The TCE pair status of the S-VOL in the remote array is PSUS.	Check the TCE pair status of the remote array.
9609	x0AB	94	The TCE pair status of the S-VOL in the remote array is not SMPL.	Check the TCE pair status of the remote array.
9609	x0B4	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, the special processing cannot be continued.	Check the status of the remote array and retry after waiting for a while.
9609	x0B5	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, an ownership of VOL change for it has been started.	Check the status of the remote array and retry after waiting for a while.
9609	x0B6	94	The S-VOL in the remote array does not exist on the default owner controller and it has started an ownership of VOL change.	Check the status of the remote array and retry after waiting for a while.
9609	x0B7	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, an ownership of VOL to be changed is blocked.	Check the status of the remote array and retry after waiting for a while.
9609	x0B8	94	The S-VOL in the remote array cannot change an ownership of VOL and, at the same time, it is using the sequential buffer.	Check the status of the remote array and retry after waiting for a while.
9609	x0B9	94	The S-VOL in the remote array cannot change an ownership of VOL temporarily.	Retry after waiting for a while.
9609	x0BA	94	The S-VOL in the remote array cannot change an ownership of VOL and, at the same time, it has pinned data.	Contact the service personnel.
9609	x0BB	94	The S-VOL in the remote array cannot change an ownership of VOL temporarily.	Retry after waiting for a while.
9609	x0BC	94	The S-VOL in the remote array cannot change an ownership of VOL temporarily.	Retry after waiting for a while.
9609	x0BD	94	The S-VOL in the remote array cannot change an ownership of VOL and a time-out occurred.	Check the status of the remote array and retry after waiting for a while.
9609	x0BE	94	The S-VOL in the remote array cannot change an ownership of VOL and, at the same time, the CTG# is illegal.	Check the status of the remote array.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x0C0	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, its disk drives are being spun up.	Check the status of the remote array and retry after waiting for a while.
9609	x0C1	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, it is making the system copy.	Check the status of the remote array and retry after waiting for a while.
9609	x0C2	94	The S-VOL in the remote array does not exist on the default owner controller and, at the same time, it is writing the takeover information.	Check the status of the remote array and retry after waiting for a while.
9609	x0C5	94	The cycle time that has been set for the remote array is less than the minimum interval.	Check the cycle time that has been set for the remote array.
9609	x0D9	94	The status of the remote array is in an inappropriate condition to operate the TrueCopy or TCE pair.	Check the Array ID, pair status of local and remote replication, the status of the RAID group to which the target VOL belongs, and reconfigure memory status, the status of the DM-VOL, and the status of the DP pool to which the DM-VOL belongs. Retry after waiting the RAID group status becomes Normal in case that the RAID group indicate a status other than Normal. Retry after the process of reconfigure memory is completed if it is in progress. Recover the DM-VOL status if the DM-VOL is detached. Retry after the DP pool status to which the DM-VOL belongs becomes Normal in case that the DP pool indicate a status other than Normal. Retry after eliminating pinned data if pinned data exists in the DM-VOL.
9609	x0E0	94	Auto Migration is being executed in the remote array just now.	Execute again after the Migration is completed.
9609	x0E5	94	The RAID group to which the VOL that will be specified to S-VOL of the remote array belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9609	x0E8	94	The remote array is executing a pair operation with another array.	Retry after the pair operation is completed with the array.
9609	x0EA	94	The VOL created in DP pool was specified as S-VOL.	Specify an VOL other than the VOL created in DP pool.
9609	x0ED	94	Management information of Dynamic Provisioning for the VOL specified as S-VOL in the remote array is being updated.	Retry after waiting a while.
9609	x0EF	94	The copy operation can not be performed because the capacity of the DP pool is depleted or can be depleted by this copy for either the S-VOL or an S-VOL of ShadowImage cascading in the remote array.	Resolve the insufficient capacity of the DP pool and retry.
9609	x0F2	94	The process of reconfigure memory is in progress on the remote array.	Retry after the process of reconfigure memory is completed.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x0F3	94	The remote array is reconstructing the memory or the target CTG is executing the cycle copy and receiving the cascaded SnapShot pair split.	Execute it again after waiting for a while. When the SnapShot split instruction is performed in the remote array, execute it again after completing the target CTG cascaded SnapShot pair split.
9609	x0F6	94	The full capacity mode differs between the P-VOL and S-VOL. Or the full capacity mode is not supported.	Set both P-VOL and S-VOL the same value. Or check the firmware version of array.
9609	x103	94	The copy operation can not be performed because the capacity of the DM-VOL is depleted.	Grow the capacity of DM-VOL.
9609	x106	94	The internal transaction of the specified VOL is working now.	Retry after waiting for a while.
9609	x107	94	The copy operation can not be performed because the DM-VOL is detached.	Recover the DM-VOL status.
9609	x109	94	The copy operation can not be performed because the DM-VOL is detached.	Recover the DM-VOL status.
9609	x10A	94	The copy operation can not be performed because the DP pool to which the DM-VOL belongs is detached.	Recover the DP pool.
9609	x10C	94	The copy operation can not be performed because the DP pool to which the DM-VOL belongs is detached.	Recover the DP pool.
9609	x10D	94	Pinned data exists in the DM-VOL.	Retry after eliminating pinned data.
9609	x10F	94	Pinned data exists in the DM-VOL.	Retry after eliminating pinned data.
9609	x110	94	The operation can not be performed due to insufficient capacity of the DP Pool for the DM-VOL.	Grow the capacity of DP pool.
9609	x112	94	The operation can not be performed due to insufficient capacity of the DP Pool for the DM-VOL.	Grow the capacity of DP pool.
9609	x115	94	The copy operation can not be performed because the DM-VOL has unwritten data.	Delete the ShadowImage pair that is cascaded with the specified pair.
9609	x123	94	The specified Replication Data DP pool for the remote array does not exist.	Check the status of the Replication Data DP pool for the remote array.
9609	x126	94	The specified Management Area DP pool for the remote array does not exist.	Check the status of the Management Area DP pool for the remote array.
9609	x129	94	The status of the specified Replication Data DP pool for the remote array is other than Normal or Regression.	Check the status of the Replication Data DP pool for the remote array.
9609	x12C	94	The specified Management Area DP pool for the remote array is other than Normal or Regression.	Check the status of the Management Area DP pool for the remote array.
9609	x12F	94	The specified Replication Data DP pool for the remote array is different from the one that the specified S-VOL is currently using.	Check the specified Replication Data DP pool number for the remote array.
9609	x133	94	The specified Management Area DP pool for the remote array is different from the one that the specified S-VOL is currently using.	Check the specified Management Area DP pool number for the remote array.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9609	x136	94	The TCE pair deletion process is running on the Replication Data DP pool of the remote array.	Retry after waiting for a while.
9609	x139	94	The TCE pair deletion process is running on the Management Area DP pool of the remote array.	Retry after waiting for a while.
9609	x13C	94	There are the maximum number of groups for TCE on the remote array.	Check the number of groups for TCE.
9609	X13F	94	The cycle time that has been set for the local array is less than the minimum interval.	Check the cycle time that has been set for the local array.
9609	X146	94	The target CTG is executing the cycle copy and receiving the cascaded SnapShot pair split.	Execute it again after completing the target CTG cascaded SnapShot pair split.
9611	0001	84	The object VOL is an invalidated one.	Check the status of the VOL.
9611	0002	84	The object VOL is a SubLU of a unified VOL.	Check the status of the VOL.
9611	0003	84	The S-VOL Disable was specified for the S-VOL of ShadowImage.	Check the pair status of the VOL.
9611	0004	84	The S-VOL Disable was specified for the S-VOL of TrueCopy.	Check the pair status of the VOL.
9611	0005	84	The S-VOL Disable was specified for the V-VOL of SnapShot.	Check the pair attribute of the VOL.
9611	0006	84	The access attribute cannot be changed because it is within the Retention Term.	-
9611	0007	84	The S-VOL Disable was specified for the ShadowImage P-VOL that was undergoing a reverse resynchronization.	Check the pair attribute of the VOL.
9611	0008	84	The S-VOL Disable was specified for the SnapShot P-VOL that was being restored.	Check the pair attribute of the VOL.
9611	0009	84	The Retention Term cannot be made shorter than the current one.	-
9611	000A	84	The access attribute cannot be changed because the Expiration Lock is turned on.	-
9611	000B	84	The Retention Term is beyond the limits of validity.	Check that the specified value that has been set is 0 to 21900.
9611	000C	84	The S-VOL Disable was specified for a ShadowImage S-VOL that is in a status other than SMPL and PSUS.	Check the pair attribute of the VOL.
9611	000D	84	The S-VOL Disable was specified for a TrueCopy S-VOL that is in a status other than SMPL and PSUS.	Check the pair attribute of the VOL.
9611	000E	84	The S-VOL Disable was specified for a SnapShot V-VOL that is in a status other than SMPL and PSUS.	Check the pair attribute of the VOL.
9611	000F	84	Because the term of validity of the temporary key was expired, the setting of the access level that turns on the Write Inhibit cannot be made.	Check the term of validity of the license key, or use the Data Retention function with the permanent key.
9611	0010	84	The target VOL is defined as the DM-VOL.	Check the attribute of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9611	0013	84	The specified VOL is an S-VOL of TCE that status is other than SMPL or PSUS.	Check the attribute of the VOL.
9611	0014	84	The specified VOL is an S-VOL of Volume Migration.	Check the status of the VOL.
9611	0015	84	The specified VOL is the reserve VOL.	Check the status of the VOL.
9611	0016	84	The data migration status is "data is being copied", "data copy fails", or "data copy is completed".	Check the data migration status.
9611	0017	84	The data migration status is "access path is being switched" or "access path switching fails".	Check the data migration status.
9611	0018	84	The specified VOL cannot set the Write prohibition attribute because of S-VOL of PSUS(SP) of ShadowImage.	Check the status of the VOL.
9611	0019	84	The VOL created in DP pool was specified.	Specify an VOL other than the VOL created in DP pool.
9612	0001	84	The P-VOL or S-VOL is being formatted.	Retry after the formatting is completed.
9612	0002	84	The P-VOL or S-VOL is being formatted.	Retry after the formatting is completed.
9612	0003	84	The P-VOL or S-VOL is being formatted.	Retry after the formatting is completed.
9612	0004	84	The P-VOL or S-VOL is being formatted.	Retry after the formatting is completed.
9612	0005	84	The P-VOL or S-VOL is being formatted.	Retry after the formatting is completed.
9613	0001	84	The S-VOL is in the S-VOL Disable mode.	Cancel the access attribute.
9613	0002	84	The P-VOL is in the S-VOL Disable mode (at the time of a restoration).	Cancel the access attribute.
9613	0003	84	The S-VOL Disable is specified for the P-VOL (at the time of a restoration only).	Cancel the access attribute.
9613	0004	84	The S-VOL Disable is specified for the S-VOL.	Cancel the access attribute.
9613	0005	84	Resynchronization is directed to the ShadowImage pair whose S-VOL is specified as S-VOL Disable.	Check the attribute of the VOL.
9613	0006	84	The S-VOL Disable is specified for the S-VOL (at the time of a restoration only).	Cancel the access attribute.
9618	0001	84	The P-VOL or S-VOL has not undergone the forced restoration by means of parity.	Retry after making the restoration by means of parity.
9618	0002	84	The P-VOL is undergoing the forced restoration by means of parity (at the time of a restoration).	Retry after the restoration by means of parity is completed.
9618	0003	84	The S-VOL is undergoing the forced restoration by means of parity.	Retry after making the restoration by means of parity.
9618	0011	84	The P-VOL has not undergone the forced restoration by means of parity.	Retry after making the restoration by means of parity.
9618	0012	84	The P-VOL is undergoing the forced restoration by means of parity.	Retry after the restoration by means of parity is completed.
9618	0021	84	The P-VOL has not undergone the forced restoration by means of parity.	Retry after making the restoration by means of parity.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9618	0022	84	The P-VOL is undergoing the forced restoration by means of parity (at the time of a restoration).	Retry after the restoration by means of parity is completed.
961C	0001	84	More LUs than supportable ones were specified for VOLs of the P-VOL.	Make sure of the number of the specified paired VOL.
961C	0002	84	More LUs than supportable ones were specified for VOLs of the S-VOL.	Make sure of the number of the specified paired VOL.
961C	0003	84	The P-VOL is in the status other than normal or regressive.	Check the status of the VOL.
961C	0004	84	The S-VOL is in the status other than normal or regressive.	Check the status of the VOL.
961C	0005	84	The primary sequence number is different from the own Array ID.	Check the Array ID.
961C	0006	84	The secondary sequence number is different from the own Array ID.	Check the Array ID.
961C	0007	84	The primary port number is not supported.	Check the specified port number.
961C	0008	84	The secondary port number is not supported.	Check the specified port number.
961C	0009	84	The P-VOL is a volume of ShadowImage and in the status other than SMPL.	Check the pair status of the VOL.
961C	000A	84	The S-VOL is a volume of ShadowImage and in the status other than SMPL.	Check the pair status of the VOL.
961C	000B	84	The P-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
961C	000C	84	The S-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
961C	000E	84	The P-VOL is a Cache Residency VOL.	Check the status of the VOL.
961C	000F	84	The S-VOL is a Cache Residency VOL.	Check the status of the VOL.
961C	0010	84	The P-VOL is reserved as a Cache Residency VOL.	Check the status of the VOL.
961C	0011	84	The S-VOL is reserved as a Cache Residency VOL.	Check the status of the VOL.
961C	0012	84	The P-VOL is a command device.	Check the status of the VOL.
961C	0013	84	The S-VOL is a command device.	Check the status of the VOL.
961C	0014	84	The VOLs of the P-VOL and S-VOL are the same.	Check the specified VOL.
961C	0015	84	The P-VOL is a volume of ShadowImage and in the pair status other than PSUS or PSUE.	Check the pair status.
961C	0016	84	The specified pair is in a status other than PSUS, PSUS(SP), or PSUE.	Check the pair status.
961C	0017	84	The VOL to be paired with the P-VOL is not an S-VOL.	Check the specified VOL.
961C	0018	84	The VOL of the P-VOL is higher than 512 (1,023).	Make sure of the number of the specified paired VOL.
961C	0019	84	The VOL of the S-VOL is higher than 512 (1,023).	Make sure of the number of the specified paired VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	001A	84	The primary sequence number is different from the own Array ID.	Check the Array ID.
961C	001B	84	The secondary sequence number is different from the own Array ID.	Check the Array ID.
961C	001C	84	The primary port number is not supported.	Check the specified port number.
961C	001D	84	The secondary port number is not supported.	Check the specified port number.
961C	001E	84	The P-VOL is a volume of ShadowImage and in the pair status of SMPL or PSUE.	Check the pair status of the VOL.
961C	001F	84	The S-VOL is a volume of ShadowImage and in the pair status of SMPL or PSUE.	Check the pair status of the VOL.
961C	0020	84	The VOL to be paired with the P-VOL is not an S-VOL.	Check the specified VOL.
961C	0021	84	The status of the P-VOL is other than Normal or Regression.	Check the status of the VOL.
961C	0022	84	The status of the S-VOL is other than Normal or Regression.	Check the status of the VOL.
961C	0023	84	The P-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
961C	0024	84	The S-VOL is a SubU of a unified VOL.	Check the status of the VOL.
961C	0026	84	The P-VOL has been set to the current Cache Residency VOL.	Check the status of the VOL.
961C	0027	84	The S-VOL has been set to the current Cache Residency VOL.	Check the status of the VOL.
961C	0028	84	The P-VOL is reserved as a Cache Residency VOL.	Check the status of the VOL.
961C	0029	84	The S-VOL is reserved as a Cache Residency VOL.	Check the status of the VOL.
961C	002A	84	The P-VOL is defined as a command device.	Check the status of the VOL.
961C	002B	84	The S-VOL is defined as a command device.	Check the status of the VOL.
961C	002C	84	The VOLs of the P-VOL and S-VOL are the same.	Check the specified VOL.
961C	002D	84	The number of the VOL to be paired is different.	Check the specified VOL.
961C	002E	84	The number of the VOL to be paired is different.	Check the specified VOL.
961C	002F	84	The pair status of the P-VOL/S-VOL is other than SMPL, PAIR, PAIR(IS), or COPY.	Check the pair status of the VOL.
961C	0030	84	The VOL of the P-VOL is beyond the limits of supported.	Check the specified VOL.
961C	0031	84	The VOL of the S-VOL is beyond the limits of supported.	Check the specified VOL.
961C	0032	84	The pair attribute of the VOL specified for a P-VOL is not a P-VOL.	Check the specified VOL.
961C	0033	84	The number of the VOL to be paired is different.	Check the specified VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	0034	84	The primary sequence number is different from the Array ID.	Check the specified primary sequence number.
961C	0035	84	The secondary sequence number is different from the Array ID.	Check the specified secondary sequence number.
961C	0036	84	The primary port number is beyond the limits of supported.	Check the specified primary port number.
961C	0037	84	The secondary port number is beyond the limits of supported.	Check the specified secondary port number.
961C	0038	84	A pair in the PSUE (S-VOL Switch) status received an instruction to restore.	Request that service personnel replace the drives that compose the P-VOL. Format them after the replacement, then resynchronize them.
961C	0039	84	The specified pair is in the PSUE (S-VOL Switch) status.	Request that service personnel replace the drives that compose the P-VOL. Format them after the replacement, then resynchronize them.
961C	003A	84	The pair in the PSUE (S-VOL Switch) status is undergoing resynchronization.	Wait until the resynchronization is completed.
961C	003B	84	The pair in the PSUE (S-VOL Switch) status is undergoing resynchronization.	Wait until the resynchronization is completed.
961C	003C	84	The group ID is out of appropriate ranges.	Make sure of the specified group ID number.
961C	003D	84	The number of pairs having the same group ID exceeded 32.	Make sure of the specified group ID number.
961C	003E	84	The specified P-VOL/S-VOL is not specified to be grouped. (Group ID suspension)	Check the pair status of the VOL.
961C	003F	84	A pair that is in a status other than PAIR or PAIR(IS) is included in the specified group.	Check the pair status of the VOL in the group.
961C	0046	84	The DM-VOL is not set.	Retry after setting the DM-VOL.
961C	0047	84	The DM-VOL was specified as P-VOL.	Check the status of the VOL.
961C	0048	84	The DM-VOL was specified as S-VOL.	Check the status of the VOL.
961C	004B	84	The DM-VOL is not set.	Retry after setting the DM-VOL.
961C	004C	84	The DM-VOL was specified as P-VOL.	Check the status of the VOL.
961C	004D	84	The DM-VOL was specified as S-VOL.	Check the status of the VOL.
961C	004E	84	Validity of the license expired.	Purchase the license.
961C	004F	84	Validity of the license expired.	Purchase the license.
961C	0050	84	An VOL, for which a change of the cache partitions had been reserved, was specified as a P-VOL.	Check the status of the VOL.
961C	0051	84	An VOL, for which a change of the cache partitions had been reserved, was specified as an S-VOL.	Check the status of the VOL.
961C	0052	84	An VOL, for which a change of the cache partitions had been reserved, was specified as a P-VOL.	Check the status of the VOL.
961C	0053	84	An VOL, for which a change of the cache partitions had been reserved, was specified as an S-VOL.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	005E	84	The specified P-VOL is a TCE pair.	Check the status of the VOL.
961C	005F	84	The specified S-VOL is a TCE pair.	Check the status of the VOL.
961C	0060	84	The specified P-VOL is a TCE pair.	Check the status of the VOL.
961C	0061	84	The specified S-VOL is a TCE pair.	Check the status of the VOL.
961C	0064	84	The specified MU# is used within the specified P-VOL.	Check the specified MU number.
961C	0065	84	One or more volumes of PAIR/COPY/RCOPY are under the specified P-VOL.	Check the pair status of the VOL.
961C	0066	84	One or more volumes of special PSUE are under the specified P-VOL.	Check the pair status of the VOL.
961C	0067	84	One or more PSUE pairs that are not readable/writable (PSUE transition due to a failure during the restoration) under the specified P-VOL.	Check the pair status of the VOL.
961C	0068	84	The group ID overlaps within the specified P-VOL at the time of creating the pair of which the group is specified.	Make sure of the specified group ID number.
961C	0069	84	The pair attribute of the specified P-VOL is not a P-VOL or the pair attribute of the specified S-VOL is not an S-VOL.	Check the pair attribute of the VOL.
961C	006A	84	The specified MU# and the MU# of the specified P-VOL are mismatched.	Check the specified MU number.
961C	006B	84	One or more volumes of PAIR/COPY/RCOPY are under the specified P-VOL.	Check the pair status of the VOL.
961C	006C	84	One or more PSUE pairs that are not readable/writable (PSUE transition due to a failure during the restoration) under the specified P-VOL.	Check the pair status of the VOL.
961C	006D	84	The pair attribute of the specified P-VOL is not a P-VOL or the pair attribute of the specified S-VOL is not an S-VOL.	Check the pair attribute of the VOL.
961C	006E	84	The specified MU# and the MU# of the specified S-VOL are mismatched.	Check the specified MU number.
961C	006F	84	The specified MU# and the MU# of the specified S-VOL are mismatched.	Check the specified MU number.
961C	0070	84	The specified MU# is used within the specified P-VOL.	Check the specified MU number.
961C	0071	84	One or more volumes of PAIR/COPY/RCOPY are under the specified P-VOL.	Check the pair status of the VOL.
961C	0072	84	One or more volumes of special PSUE are under the specified P-VOL.	Check the pair status of the VOL.
961C	0073	84	One or more PSUE pairs that are not readable/writable (PSUE transition due to a failure during the restoration) under the specified P-VOL.	Check the pair status of the VOL.
961C	0074	84	The specified MU# and the MU# of the specified S-VOL are mismatched.	Check the specified MU number.
961C	0075	84	The specified MU# and the MU# of the specified S-VOL are mismatched.	Check the specified MU number.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	0077	84	The specified P-VOL is the reserved VOL.	Check the status of the VOL.
961C	0078	84	The specified S-VOL is the reserved VOL.	Check the status of the VOL.
961C	0079	84	The specified S-VOL is undergoing the migration and its status is PSUS or PSUE.	Check the pair status of the VOL.
961C	0080	84	The specified S-VOL is undergoing the migration and its status is COPY or PSUS.	Check the pair status of the VOL.
961C	0081	84	The specified P-VOL is the reserved VOL.	Check the pair status of the VOL.
961C	0082	84	The specified S-VOL is the reserved VOL.	Check the pair status of the VOL.
961C	0083	84	The specified S-VOL is undergoing the migration and its status is COPY.	Check the pair status of the VOL.
961C	0084	84	The specified volume is undergoing the migration.	Check the pair status of the VOL.
961C	0085	84	The specified P-VOL is undergoing the migration.	Check the pair status of the VOL.
961C	0086	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
961C	0087	84	The disk drives that configure a RAID group, to which the specified S-VOL belongs have been spun down.	Check the status of the RAID group.
961C	0088	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
961C	0089	84	The disk drives that configure a RAID group, to which the specified S-VOL belongs have been spun down.	Check the status of the RAID group.
961C	008A	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
961C	008B	84	The disk drives that configure a RAID group, to which the specified S-VOL belongs have been spun down.	Check the status of the RAID group.
961C	008C	84	When creating a pair specifying a group ID, the specified group ID is already used for a SnapShot pair.	Check the specified group ID.
961C	008D	84	The S-VOL is a volume of Remote Replication and in a status other than Split and Failure.	Check the status of the Remote Replication pair.
961C	008F	84	An unsupported command option was received.	Check the specified value.
961C	0090	84	The specified P-VOL has been set to a ShadowImage S-VOL.	Check the status of the VOL.
961C	0091	84	The specified P-VOL has been set to a ShadowImage S-VOL.	Check the status of the VOL.
961C	0092	84	The Migration status is other than unexecuted.	Check the Migration status.
961C	0093	84	The Migration status is other than unexecuted.	Check the Migration status.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	0094	84	The Migration status is other than unexecuted.	Check the Migration status.
961C	0095	84	The Migration status is other than unexecuted.	Check the Migration status.
961C	0096	84	The Migration status is other than unexecuted.	Check the Migration status.
961C	0097	84	The Migration status is other than unexecuted.	Check the Migration status.
961C	0098	84	When the Inquiry Serial Number Conversion Mode is ON in the host group that the command device is mapped, the serial number of the received remote side array is the normal specification.	Check the remote array type.
961C	0099	84	When the Inquiry Serial Number Conversion Mode is ON in the host group that the command device is mapped, the serial number of the received remote side array is the normal specification.	Check the remote array type.
961C	009A	84	The Migration status is other than unexecuted.	Check the Migration status.
961C	009B	84	One or more volumes of PSUS(SP) or PAIR(IS) are under the specified P-VOL.	Check the pair status of the VOL.
961C	009C	84	The S-VOL of the specified pair is a volume of another TrueCopy or TCE pair.	Check the status of the VOL.
961C	009D	84	One or more volumes of PSUS(SP) or PAIR(IS) are under the specified P-VOL.	Check the pair status of the VOL.
961C	009E	84	The specified pair is in the PSUS(SP) status.	Retry after the status becomes PSUS.
961C	009F	84	A pair in the PSUE status received an instruction to resynchronize with Quick mode.	Request that service personnel to replace the drives that compose the P-VOL. Format them after the replacement then resynchronize them.
961C	00A0	84	One or more PSUE pairs that are not readable/writable under the specified P-VOL.	Check the pair status of the VOL.
961C	00A1	84	The capacity is beyond the limits of supported.	Split the unnecessary pairs.
961C	00A2	84	The S-VOL of the specified pair has been cascaded with a TrueCopy or TCE pair.	Check the status of the TrueCopy or TCE pair.
961C	00A3	84	The P-VOL or the S-VOL has not undergone the forced restoration by means of parity.	Retry after making the restoration by means of parity.
961C	00A4	84	The S-VOL is undergoing the forced restoration by means of parity.	Retry after making the restoration by means of parity.
961C	00A5	84	The disk drives that configure a RAID group to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
961C	00A6	84	The disk drives that configure a RAID group to which the specified S-VOL belongs have been spun down.	Check the status of the RAID group.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	00A7	84	A pair that is in a status other than PAIR, PAIR(IS), or COPY is included in the specified group.	Check the pair status of VOL in the group.
961C	00A8	84	A pair that shares the P-VOL with another pair that is in PSUE status that is not readable/writable is included in the specified group.	Check the pair status of VOL in the group.
961C	00A9	84	The capacity is beyond the limits of supported.	Split the unnecessary pairs.
961C	00AA	84	A pair that the S-VOL has been cascaded with a TrueCopy or TCE pair is included in the specified group.	Check the status of the TrueCopy or TCE pair.
961C	00AB	84	A pair that the P-VOL or the S-VOL has not undergone the forced restoration by means of parity is included in the specified group.	Retry after making the restoration by means of parity.
961C	00AC	84	A pair that the S-VOL is undergoing the forced restoration by means of parity is included in the specified group.	Retry after making the restoration by means of parity.
961C	00AD	84	A pair that the P-VOL belongs to a RAID group configured by the disk drives that have been spun down is in the specified group.	Check the status of the RAID group.
961C	00AE	84	A pair that the S-VOL belongs to a RAID group configured by the disk drives that have been spun down is in the specified group.	Check the status of the RAID group.
961C	00AF	84	One or more volumes of PSUS(SP) or PAIR(IS) are under the specified P-VOL.	Check the pair status of the VOL.
961C	00B0	84	The P-VOL or the S-VOL of the specified pair is a volume of another TrueCopy or TCE pair.	Check the status of the TrueCopy or TCE pair.
961C	00B1	84	The specified pair is in the PSUS(SP) status.	Check the pair status of the VOL.
961C	00B2	84	The RAID group to which the specified VOL belongs indicates a status other than Normal.	Retry after the status becomes Normal.
961C	00B3	84	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the specified group.	Retry after the RAID group status becomes Normal.
961C	00B4	84	The specified pair is in a status other than PSUS or PSUE.	Check the pair status.
961C	00B5	84	The VOL that was specified as P-VOL does not exist.	Check the specified VOL.
961C	00B6	84	The VOL that was specified as P-VOL does not exist.	Check the specified VOL.
961C	00B7	84	The VOL that was specified as S-VOL does not exist.	Check the specified VOL.
961C	00B8	84	The VOL that was specified as S-VOL does not exist.	Check the specified VOL.
961C	00B9	84	DP pool is insufficient.	Confirm the capacity of DP pool.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	00BA	84	DP pool is insufficient.	Confirm the capacity of DP pool.
961C	00BB	84	DP pool is insufficient.	Confirm the capacity of DP pool.
961C	00BC	84	DP pool is insufficient.	Confirm the capacity of DP pool.
961C	00BD	84	The specified P-VOL is a volume of TrueCopy pair and the specified S-VOL is an VOL created in DP pool.	Specify an VOL other than the VOL created in DP pool to S-VOL.
961C	00BE	84	The specified P-VOL is a volume of TrueCopy pair and the specified S-VOL is an VOL created in DP pool.	Specify an VOL other than the VOL created in DP pool to S-VOL.
961C	00BF	84	The specified S-VOL is an VOL created in DP pool and the specified P-VOL already has a pair whose S-VOL is a part of a TrueCopy pair.	Retry after deleting the TrueCopy pair.
961C	00C0	84	The specified S-VOL is an VOL created in DP pool and the specified P-VOL already has a pair whose S-VOL is a part of a TrueCopy pair.	Retry after deleting the TrueCopy pair.
961C	00C1	84	The DP optimization status of the specified P-VOL is not Normal.	Check the DP optimization status of the P-VOL.
961C	00C2	84	The DP optimization status of the specified S-VOL is not Normal.	Check the DP optimization status of the S-VOL.
961C	00C3	84	The DP optimization status of the specified P-VOL is not Normal.	Check the DP optimization status of the P-VOL.
961C	00C4	84	The DP optimization status of the specified S-VOL is not Normal.	Check the DP optimization status of the S-VOL.
961C	00C5	84	Management information regarding DP is being updated.	Retry after waiting for a while.
961C	00C6	84	Management information regarding DP is being updated.	Retry after waiting for a while.
961C	00C7	84	Management information regarding DP is being updated.	Retry after waiting for a while.
961C	00C8	84	Management information regarding DP is being updated.	Retry after waiting for a while.
961C	00C9	84	The specified P-VOL can not be read due to insufficient capacity of its DP pool.	Check the capacity of the DP pool.
961C	00CA	84	The specified P-VOL can not be read due to insufficient capacity of its DP pool.	Check the capacity of the DP pool.
961C	00CB	84	The specified S-VOL can not be read due to insufficient capacity of its DP pool.	Check the capacity of the DP pool.
961C	00CC	84	The specified P-VOL can not be read due to insufficient capacity of its DP pool.	Check the capacity of the DP pool.
961C	00CD	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
961C	00CE	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
961C	00CF	84	One or more volumes of RCPY are under the specified P-VOL.	Check the pair status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	00D0	84	Three or more volumes of PAIR/COPY/PAIR(IS)/PSUS(SP) can not exist under the specified P-VOL.	Check the pair status of the VOL.
961C	00D1	84	One or more volumes of RCPY are under the specified P-VOL.	Check the pair status of the VOL.
961C	00D2	84	Three or more volumes of PAIR/COPY/PAIR(IS)/PSUS(SP) can not exist under the specified P-VOL.	Check the pair status of the VOL.
961C	00D3	84	Two or more volumes of PSUS(SP) can not exist under the specified P-VOL.	Check the pair status of the VOL.
961C	00D4	84	Two or more volumes of PSUS(SP) can not exist under the specified P-VOL.	Check the pair status of the VOL.
961C	00D5	84	Two or more volumes of PSUS(SP) can not exist under the specified P-VOL.	Check the pair status of the VOL.
961C	00D6	84	Two or more volumes of PSUS(SP) can not exist under the specified P-VOL.	Check the pair status of the VOL.
961C	00D7	84	The full capacity mode differs between the P-VOL and S-VOL.	Set both P-VOL and S-VOL the same value.
961C	00D8	84	The full capacity mode differs between the P-VOL and S-VOL.	Set both P-VOL and S-VOL the same value.
961C	00D9	84	The status of the SnapShot pair cascading with the specified ShadowImage pair is invalid.	Check the status of the SnapShot pair.
961C	00DA	84	The status of a SnapShot pair cascading with the specified ShadowImage pair is PSUE where the SnapShot pair cannot accept Read/Write instructions.	Check the pair status.
961C	00DB	84	The specified VOL is a V-VOL.	Check the VOL.
961C	00DC	84	The specified S-VOL is the P-VOL of a SnapShot pair.	Check the pair status.
961C	00DD	84	The specified P-VOL already has the maximum number of S-VOLs.	Check the number of S-VOL paired with the P-VOL.
961C	00DE	84	Any pair operations cannot be performed due to the status of the TrueCopy pair cascading with the S-VOL of the SnapShot pair that shared P-VOL of the specified ShadowImage pair.	Check the TrueCopy pair status.
961C	00DF	84	The copy operation can not be performed because the capacity of the DM-VOL is depleted.	Grow the capacity of DM-VOL.
961C	00E0	84	The internal transaction of the specified VOL is working now.	Retry after waiting for a while.
961C	00E1	84	The DM-VOL status is invalid.	Check the DM-VOL status.
961C	00E2	84	The copy operation can not be performed because the DP pool to which the DM-VOL belongs is detached.	Recover the DP pool.
961C	00E3	84	Pinned data exists in the DM-VOL.	Retry after eliminating pinned data.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
961C	00E4	84	The operation can not be performed due to insufficient capacity of the DP pool for the DM-VOL.	Grow the capacity of DP pool.
961C	00E5	84	The copy operation can not be performed because the DM-VOL has unwritten data.	Delete the specified pair.
961C	00E6	84	The copy operation can not be performed because the DM-VOL has unwritten data.	Retry the operation per pair.
961C	00E7	84	The copy operation can not be performed because the DM-VOL has unwritten data.	Delete the TrueCopy pair that is cascaded with the S-VOL of the specified pair.
9622	0001	84	The specified P-VOL is Normal or other than Regression.	Check the status of the VOL.
9622	0002	84	The specified P-VOL has been set to the current Cache Residency VOL.	Check the attribute of the VOL.
9622	0003	84	The specified P-VOL has been set to the reserved Cache Residency VOL.	Check the attribute of the VOL.
9622	0004	84	The specified P-VOL has been defined to the command device.	Check the attribute of the VOL.
9622	0005	84	The accepted sequence number is different from the Array ID.	Check the Array ID.
9622	0006	84	Both of the two paths are abnormal.	Check the status of the path.
9622	0007	84	The specified P-VOL is a SubLU of a unified VOL.	Check the attribute of the VOL.
9622	0009	84	The status of the TCE pair of the specified P-VOL is other than SMPL.	Check the pair status of the VOL.
9622	000A	84	The specified P-VOL is a ShadowImage pair.	Check the attribute of the VOL.
9622	000B	84	The specified P-VOL is a SnapShot V-VOL.	Check the attribute of the VOL.
9622	000C	84	The CTG ID is beyond the limits (more than 16) of supported.	Check the CTG ID.
9622	000D	84	The pair status of the specified P-VOL is other than SSUS or PSUE.	Check the pair status of the VOL.
9622	000E	84	The specified P-VOL status is Normal or other than Regression.	Check the status of the VOL.
9622	000F	84	The specified S-VOL is not a pair target VOL.	Check the VOL of the S-VOL.
9622	0010	84	The accepted sequence number is different from the Array ID.	Check the Array ID.
9622	0011	84	Both of the two paths are abnormal.	Check the status of the path.
9622	0012	84	When the unit of pair is specified, the pair status of the specified P-VOL is other than COPY and PAIR.	Check the pair status of the VOL.
9622	0013	84	The capacity of TCE pair is beyond the limits.	Confirm the capacity of all the SnapShot P-VOLs, all the P-VOLs and S-VOLs of TCE pairs, and DP pools is less than or equal to the supported capacity for the installed cache memory.
9622	0014	84	The accepted sequence number is different from the Array ID.	Check the Array ID.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	0015	84	The process is in progress.	Retry after waiting for a while.
9622	0016	84	When the unit of pair is specified, the specified S-VOL is not a pair target VOL.	Check the VOL of the specified S-VOL.
9622	0017	84	The accepted sequence number is different from the Array ID.	Check the Array ID.
9622	0018	84	The command with the -R option was issued to the P-VOL and that with the -S option was issued to the S-VOL.	Check the pair attribute of the VOL.
9622	0019	84	This operation cannot be executed due to lack of resources.	Retry after waiting for a while.
9622	0020	84	The DP pool is not defined.	Define the DP pool and retry.
9622	0021	84	The specified fence level is STATUS.	Make sure of the specified fence level.
9622	0022	84	The capacity of TCE pair is beyond the limits.	Confirm the capacity of all the SnapShot P-VOLs, all the P-VOLs and S-VOLs of TCE pairs, and DP pools is less than or equal to the supported capacity for the installed cache memory.
9622	0023	84	The internal pair status of the specified P-VOL is "under pair deletion".	Check the pair status of the VOL.
9622	0025	84	The pairsplit -P (forced blockade of a P-VOL) command was accepted.	The pairsplit -P (forced blockade of a P-VOL) command is not supported.
9622	0026	84	The type of the pairsplit command is other than Drain (ordinary splitting).	Check the command line.
9622	0027	84	The S-VOL received an instruction.	Check the pair attribute of the VOL.
9622	0029	84	The S-VOL received an instruction.	Check the pair attribute of the VOL.
9622	002A	84	The P-VOL received an instruction.	Check the pair attribute of the VOL.
9622	002B	84	When the unit of pair is specified, the pair status of the specified S-VOL is SMPL or COPY.	Check the pair status of the VOL.
9622	002C	84	The accepted sequence number is different from the Array ID.	Check the Array ID.
9622	002D	84	The specified MU number is beyond the limits (0 to13) of supported.	Check the specified MU number.
9622	0030	84	The S-VOL received an instruction.	Check the pair attribute of the VOL.
9622	0032	84	The RAID group, to which the specified P-VOL belongs, is RAID 0.	Check the RAID level of the specified VOL.
9622	0036	84	The specified P-VOL is a SnapShot P-VOL and it is being restored.	Check the pair status of the SnapShot.
9622	0037	84	The specified P-VOL is a SnapShot P-VOL and its status was changed to PSUE during restoration.	Check the pair status of the SnapShot.
9622	0038	84	There is no vacancy in the generation bits.	Retry after waiting for a while.
9622	0039	84	There is one or more pairs in the status of "under execution of pairsplit -mascas command" in the target CTG.	Check the pair status of each VOL in the target CTG. It is required to wait until the process is completed.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	003A	84	There is one or more pairs in the status of "under pair splitting" in the target CTG.	Check the pair status of each VOL in the target CTG. It is required to wait until the process is completed.
9622	003C	84	There is one or more pairs in the status of "under pair deletion" in the target CTG.	Check the pair status of each VOL in the target CTG. It is required to wait until the process is completed.
9622	003D	84	The specified P-VOL is a SnapShot P-VOL and it is being restored.	Check the pair status of the SnapShot.
9622	003E	84	The specified P-VOL is a SnapShot P-VOL and its status was changed to PSUE during restoration.	Check the pair status of the SnapShot.
9622	003F	84	There is no pair, which is in the PAIR status, in the target CTG.	Check the pair status of each VOL in the target CTG.
9622	0042	84	When the unit of pair is specified, the pair status of the specified pair is PSUS (no reading/writing allowed).	Check the pair status.
9622	0044	84	When the unit of CTG is specified, there is one or more pairs placed in the PSUS status (no reading/writing allowed) in the CTG.	Check the pair status of each VOL in the target CTG.
9622	0045	84	When the unit of CTG is specified, there is no pair that is in the PAIR, PSUS, or PSUE status in the CTG.	Check the pair status of each VOL in the target CTG.
9622	0046	84	When the unit of CTG is specified, the internal status of the pair of the specified P-VOL is "under pair splitting".	Check the pair status of the VOL. It is required to wait until the process is completed.
9622	0047	84	The specified P-VOL has the incomplete DDCB.	Check the status of the VOL.
9622	0048	84	The specified P-VOL has unwritten data.	Contact the service personnel.
9622	0049	84	When the unit of pair is specified, the internal status of the pair of the specified P-VOL is "under pair deletion".	Check the pair status of the VOL. It is required to wait until the process is completed.
9622	004B	84	When the unit of pair is specified, the internal status of the pair of the specified P-VOL is "under execution of the pairsplit - mscas command".	Check the pair status of the VOL. It is required to wait until the process is completed.
9622	004C	84	When the unit of CTG is specified, there is one or more pairs that is in the status of "under pair splitting" in the CTG.	Check the pair status of each VOL in the target CTG.
9622	004D	84	The DM-VOL is not defined.	Define the DM-VOL.
9622	004E	84	The specified P-VOL has been set to the DM-VOL.	Check the attribute of the VOL.
9622	004F	84	Validity of the license expired.	Purchase the license.
9622	0050	84	When the unit of CTG is specified, there is one or more pair(s) that is in the status of "under pair deletion" in the CTG.	Check the pair status of each VOL in the target CTG.
9622	0052	84	When the unit of CTG is specified, there is one or more pairs that is in the status of "under execution of the pairsplit - mscas command" in the CTG.	Check the pair status of each VOL in the target CTG.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	0053	84	When the unit of CTG is specified, there is no pair, which is in the COPY or PAIR status, in the target CTG.	Check the pair status of each VOL in the target CTG.
9622	0054	84	The pair cancellation instruction was executed for the range that was not supported.	Check the specified value.
9622	0055	84	When the unit of pair is specified, the internal status of the pair of the specified P-VOL is "under pair splitting".	Check the pair status of the VOL. It is required to wait until the process is completed.
9622	0057	84	When the unit of pair is specified, the internal status of the pair of the specified P-VOL is "under execution of the pairsplit -msecs command".	Check the pair status of the VOL. It is required to wait until the process is completed.
9622	0059	84	The determined data at the end of the previous cycle is being restored to the S-VOL.	Retry after waiting for a while.
9622	005A	84	When the unit of CTG is specified, there is one or more pairs that is in the status of "under pair splitting" in the CTG.	Check the pair status of each VOL in the target CTG.
9622	005C	84	When the unit of CTG is specified, there is one or more pairs that is in the status of "under execution of the pairsplit -msecs command" in the CTG.	Check the pair status of each VOL in the target CTG.
9622	005E	84	When the unit of CTG is specified, an S-VOL exists in the target CTG to which the determined data at the end of the previous cycle is being restored.	Check the pair status of each VOL in the target CTG.
9622	0068	84	It is already used as an S-VOL.	Check the CTG ID.
9622	0069	84	The partition to which the VOL belongs is being changed to the other directory.	Retry after waiting for a while.
9622	006B	84	There is no pair, which is in the PAIR status, in the target CTG.	Check the pair status of each VOL in the target CTG.
9622	006C	84	The array has not been rebooted after the TCE option was unlocked.	Reboot the array.
9622	006D	84	The specified P-VOL is a unified VOL including an VOL with a capacity less than 1 GB.	Check the attribute of the VOL.
9622	006F	84	The DP pool status is normal or other than regressed.	Check the status of the DP pool.
9622	0071	84	It is exceeded the total allowable maximum number of TCE and SnapShot pairs.	Delete unnecessary pairs.
9622	0072	84	The -msecs command was accepted with the usual process code (12H).	Check the CCI version.
9622	0073	84	A pair was created with an S-VOL that was placed in the SMPL status by the pair ending (pairsplit -R) command for only S-VOL and its pair status became inconsistent.	Check the pair status of the specified S-VOL.
9622	0074	84	The suspension command was accepted with a specification of the unit of pair.	The specification of the unit of pair is not supported.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	0075	84	The specified P-VOL is a unified VOL whose component LUs include an VOL for which the quick format operation is being performed.	Check the attribute of the VOL.
9622	0076	84	The specified P-VOL is being quick formatted.	Check the attribute of the VOL.
9622	0077	84	The state of the forced parity correction for the specified P-VOL is Uncorrected or Uncorrected 2.	Check the status of the VOL.
9622	0078	84	The specified P-VOL has not undergone the forced parity correction.	Retry it after executing the forced parity correction.
9622	007B	84	There is one or more pairs in the status of PSUS or PSUE of "under pair deletion" in the target CTG.	Check the pair status of the VOL. It is required to wait until the process is completed.
9622	007C	84	The number of the unused bit numbers is insufficient.	Retry after waiting for a while.
9622	007D	84	The DP pool status is Normal or other than Regression.	Check the status of the DP pool.
9622	007F	84	There is one or more P-VOLs, the status of the forced parity correction for which is Uncorrected or Uncorrected 2, in the target CTG.	Check the status of each VOL in the target CTG.
9622	0080	84	There is one or more P-VOLs, status is Normal or other than Regression, in the target CTG.	Check the status of each VOL in the target CTG.
9622	0081	84	There is one or more TCE P-VOLs, which is cascaded with a SnapShot P-VOL being restored, in the target CTG.	Check the status of each VOL in the target CTG.
9622	0082	84	There is one or more TCE P-VOLs, which is cascaded with a SnapShot P-VOL that was placed in the PSUE status during restoration, in the target CTG.	Check the status of each VOL in the target CTG.
9622	0083	84	There is no pair, which is in the PSUS or PSUE status, in the target CTG.	Check the pair status of each VOL in the target CTG.
9622	0084	84	When a pair is created in the new CTG, the cycle time that has been set is less than "30 x number of CTGs" seconds.	Check the cycle time that has been set.
9622	0085	84	When the unit of pair is specified, the S-VOL of the target pair has not completed the resynchronization after it accepted the resync command.	Check the TCE pair status of the remote array.
9622	0086	84	When the unit of CTG is specified, there is one or more S-VOLs, which has not completed the resynchronization after it accepted the resync command, in the target CTG.	Check the TCE pair status of the remote array.
9622	0087	84	There are one or more pairs in the status of "under pair splitting" or "under pair competing" in the CTG.	Retry after waiting for a while.
9622	0088	84	The specified P-VOL is the reserved VOL.	Check the status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	0089	84	The specified P-VOL is undergoing the migration.	Check the pair status of the VOL.
9622	008A	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
9622	008B	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
9622	008C	84	There are one or more TCE P-VOLs corresponding to a RAID group that belongs to the CTG concerned and the disk drives that configure the RAID group have been spun down.	Check the status of the RAID group.
9622	008D	84	The primary DP pool ID is beyond the limits of supported.	Check the DP pool ID.
9622	008E	84	The secondary DP pool ID is beyond the limits of supported.	Check the DP pool ID.
9622	008F	84	The specified DP pool ID differs from the DP pool ID in use.	Check the DP pool ID.
9622	0090	84	The Swap pair has been issued to TCE pair with AMS500 or AMS1000.	The Swap command is not supported in this configuration.
9622	0091	84	The Swap operation was received in the P-VOL.	Check the pair attribute of the VOL.
9622	0092	84	The Swap operation was received by specifying the pair unit.	Confirm the operation and try again.
9622	0093	84	The VOL whose pair status is not SSWS exists in the target CTG.	Check the pair status of each VOL in the target CTG.
9622	0094	84	An S-VOL exists in the target CTG to which the determined data at the end of the previous cycle is being restored.	Check the pair status of each VOL in the target CTG.
9622	0095	84	There is a pair that is a status of SSWS and also deleted just in the local array in the CTG.	Delete the pair that is a status of SSWS in the CTG, not only in the local array but also in the remote array. Then execute again.
9622	0096	84	The internal transaction, which are splitting or deleting for SnapShot is working now.	Retry after waiting for a while.
9622	0097	84	The DP pool status is Normal or other than Regression.	Check the status of the DP pool.
9622	0099	84	There is one or more S-VOLs, the status of the forced parity correction for which is Uncorrected or Uncorrected 2, in the target CTG.	Check the status of each VOL in the target CTG.
9622	009A	84	There is one or more S-VOLs, status is Normal or other than Regression, in the target CTG.	Check the status of each VOL in the target CTG.
9622	009B	84	There is one or more TCE S-VOLs, which is cascaded with a SnapShot P-VOL being restored, in the target CTG.	Check the status of each VOL in the target CTG.
9622	009C	84	There is one or more TCE S-VOLs, which is cascaded with a SnapShot P-VOL that was placed in the PSUE status during restoration, in the target CTG.	Check the status of each VOL in the target CTG.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	009D	84	There is one or more S-VOLs of TCE pair in the same CTG, the RAID group belongs in Power Saving/Power Saving Plus mode.	Check the status of each VOL in the target CTG.
9622	009E	84	The firmware internal error occurred.	Retry after waiting for a while. If an error occurred again, contact the service personnel.
9622	009F	84	The specified secondary sequence number does not match with the remote array serial number.	Check the specified command device number.
9622	00A0	84	The command cannot execute because the Auto Migration is undergoing.	Check the Migration status.
9622	00A1	84	The command cannot execute because the Auto Migration is undergoing.	Check the Migration status.
9622	00A2	84	The command cannot execute because the Auto Migration is undergoing.	Check the Migration status.
9622	00A3	84	The RAID group to which the specified VOL belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9622	00A4	84	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the data pool that is specified when the pair operation or used by specified pair.	Retry after the RAID group status becomes Normal.
9622	00A5	84	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the group to which the specified pair belongs.	Retry after the RAID group status becomes Normal.
9622	00A6	84	An VOL that belongs to the RAID group that indicates a status other than Normal is included in the data pool that is used by pairs that belong to the same group as the specified pair.	Retry after the RAID group status becomes Normal.
9622	00A7	84	The VOL created in DP pool was specified as P-VOL.	Specify an VOL other than the VOL created in DP pool.
9622	00A8	84	The VOL that was specified as P-VOL does not exist.	Check the specified VOL.
9622	00AA	84	The operation can not be performed due to insufficient capacity of the DP pool for the specified P-VOL.	Check the capacity of the DP pool.
9622	00AD	84	The process of reconfigure memory is in progress.	Retry after the process of reconfigure memory is completed.
9622	00B0	84	The specified Replication Data DP pool number or Management Area DP pool number for the local array is beyond the limit.	Check the DP pool number.
9622	00B1	84	The specified Replication Data DP pool number or Management Area DP pool number for the remote array is beyond the limit.	Check the DP pool number.
9622	00B2	84	There are the maximum number of groups for TCE.	Check the number of groups for TCE.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9622	00B3	84	The specified Replication Data DP pool or Management Area DP pool does not exist.	Check the status of the DP pool.
9622	00B4	84	The status of the specified Replication Data DP pool or Management Area DP pool is other than Normal/Regression. Or Replication Data Released Threshold for the DP pool is exceeded. Or the DP pool is depleted.	Check the status of the DP pool.
9622	00B5	84	The specified Replication Data DP pool or Management Area DP pool is different from the one that the P-VOL is currently using.	Check the specified DP pool number.
9622	00B6	84	TCE pairs are being deleted.	Retry after waiting for a while.
9622	00B7	84	There are the maximum number of TCE pairs.	Check the number of pairs.
9622	00B8	84	The pair status of the specified S-VOL is invalid.	Check the pair status.
9622	00B9	84	Any pair in the specified group is not in the pair status where the operation can be performed.	Check the pair status.
9622	00BA	84	There is a pair in the specified group whose pair status is SSWS(R).	Retry after waiting for a while.
9629	0001	84	The Volume Migration optional feature is invalid.	Install the Volume Migration optional feature.
9629	0002	84	The temporary key of the Volume Migration was expired.	Purchase the license.
9629	0003	84	The status of the specified P-VOL is other than Normal or Regression.	Check the status of the VOL.
9629	0004	84	The status of the specified S-VOL is other than Normal or Regression.	Check the status of the VOL.
9629	0005	84	The status of the parity correction of the specified P-VOL is Uncorrected or Uncorrected 2.	Skip the parity correction or execute the parity correction, and wait for the completion of the correction. Re-execute it after performing the operation.
9629	0006	84	The status of the parity correction of the specified S-VOL is correcting, waiting correction, Uncorrected, or Uncorrected 2.	Skip the parity correction or execute the parity correction, and wait for the completion of the correction. Re-execute it after performing the operation.
9629	0007	84	The specified P-VOL has created a Volume Migration pair.	Check the pair status of the VOL.
9629	0008	84	The specified S-VOL has created a Volume Migration pair.	Check the pair status of the VOL.
9629	0009	84	The specified P-VOL has created a ShadowImage pair.	Check the pair status of the VOL.
9629	000A	84	The specified S-VOL has created a ShadowImage pair.	Check the pair status of the VOL.
9629	000B	84	The specified P-VOL is a command device.	Check the status of the VOL.
9629	000C	84	The specified S-VOL is a command device.	Check the status of the VOL.
9629	000D	84	The specified P-VOL has created a TrueCopy pair.	Check the pair status of the VOL.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9629	000E	84	The specified S-VOL has created a TrueCopy pair.	Check the pair status of the VOL.
9629	000F	84	The specified P-VOL has created a TCE pair.	Check the pair status of the VOL.
9629	0010	84	The specified S-VOL has created a TCE pair.	Check the pair status of the VOL.
9629	0011	84	The P-VOL is a Cache Residency VOL or has been set to the reserved Cache Residency VOL.	Check the status of the VOL.
9629	0012	84	The S-VOL is a Cache Residency VOL or has been set to the reserved Cache Residency VOL.	Check the status of the VOL.
9629	0013	84	The specified P-VOL has created a SnapShot pair.	Check the pair status of the VOL.
9629	0014	84	The specified S-VOL has created a SnapShot pair.	Check the pair status of the VOL.
9629	0015	84	The specified P-VOL is the pool VOL.	Check the status of the VOL.
9629	0016	84	The specified S-VOL is the pool VOL.	Check the status of the VOL.
9629	0017	84	The specified P-VOL is being quick formatted.	Retry after the quick formatting is completed.
9629	0018	84	The specified S-VOL is being quick formatted.	Retry after the quick formatting is completed.
9629	0019	84	The specified P-VOL is the DM-VOL.	Check the status of the VOL.
9629	001A	84	The specified S-VOL is the DM-VOL.	Check the status of the VOL.
9629	001B	84	The DM-VOL is not set.	Retry after setting the DM-VOL.
9629	001C	84	The specified P-VOL has unwritten data.	Check the status of the VOL.
9629	001D	84	The pair cannot be allocated the differential bit map.	Split the unnecessary pairs.
9629	001E	84	The specified P-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
9629	001F	84	The specified S-VOL is a SubLU of a unified VOL.	Check the status of the VOL.
9629	0020	84	The size of the specified P-VOL and the S-VOL are not the same.	Specify an VOL that the same size.
9629	0021	84	The DIRs in charge of the specified P-VOL and the S-VOL are not the same.	Specify an VOL that belongs to the same DIR.
9629	0022	84	The VOLs of the specified P-VOL and S-VOL are the same.	Check the specified VOL.
9629	0023	84	There exist maximum number of pairs already (included ShadowImage pairs).	Split the unnecessary pairs.
9629	0024	84	The specified P-VOL is the VOL, for which a change of the cache partitions had been reserved.	Retry after releasing the reserved status.
9629	0025	84	The specified S-VOL is the VOL, for which a change of the cache partitions had been reserved.	Retry after releasing the reserved status.
9629	0026	84	The RAID group of the specified P-VOL and S-VOL are the same.	Specify a different RAID group.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9629	0027	84	The specified P-VOL is the reserved VOL.	Check the status of the VOL.
9629	0028	84	The specified S-VOL is the reserved VOL.	Check the status of the VOL.
9629	0029	84	The access level of the specified S-VOL is other than the ordinary one.	Check the access level of the VOL.
9629	002C	84	The specified MU number is 8 or higher.	Make sure of the specified MU number.
9629	002D	84	The specified primary port number is beyond the limits of supported.	Check the specified primary port number.
9629	002E	84	The specified secondary port number is beyond the limits of supported.	Check the specified secondary port number.
9629	002F	84	The specified primary sequence number is different from the own serial number.	Check the specified primary sequence number.
9629	0030	84	The specified secondary sequence number is different from the own serial number.	Check the specified secondary sequence number.
9629	0031	84	The pair concerned is the one that the instruction to start the migration was issued by Navigator 2 or HiCommand.	Check the owner ID of the specified pair.
9629	0032	84	The disk drives that configure a RAID group, to which the specified P-VOL belongs have been spun down.	Check the status of the RAID group.
9629	0033	84	The disk drives that configure a RAID group, to which the specified S-VOL belongs have been spun down.	Check the status of the RAID group.
9629	0034	84	The data migration status is "data is being copied", "data copy fails", or "data copy is completed".	Check the data migration status.
9629	0035	84	The data migration status is "access path is being switched" or "access path switching fails".	Check the data migration status.
9629	0036	84	The RAID group to which the specified VOL belongs indicates a status other than Normal.	Retry after the status becomes Normal.
9629	0037	84	The VOL created in DP pool was specified as P-VOL or S-VOL.	Specify an VOL other than the VOL created in DP pool.
9629	0038	84	The specified P-VOL and S-VOL are the LUs in the same DP pool.	Check the specified LUs.
9629	0039	84	The specified S-VOL is an VOL created in a DP pool and the capacity of the DP pool is not enough.	Check the capacity of the DP pool.
9629	003A	84	The DP optimization status of the specified P-VOL is not Normal.	Check the DP optimization status of the P-VOL.
9629	003B	84	The DP optimization status of the specified S-VOL is not Normal.	Check the DP optimization status of the S-VOL.
9629	003C	84	Management information regarding DP is being updated.	Retry after waiting for a while.
9629	003D	84	Management information regarding DP is being updated.	Retry after waiting for a while.
9629	003E	84	The specified P-VOL can not be read due to insufficient capacity of its DP pool.	Check the capacity of the DP pool.

Sense code	Detailed code	Sub code	Error contents	Recommended Action
9629	0040	84	The full capacity mode differs between the P-VOL and S-VOL.	Set both P-VOL and S-VOL the same value.
9629	0041	84	The copy operation can not be performed because the capacity of the DM-VOL is depleted.	Grow the capacity of DM-VOL.
9629	0042	84	The internal transaction of the specified VOL is working now.	Retry after waiting for a while.
9629	0043	84	The DM-VOL status is invalid.	Check the DM-VOL status.
9629	0044	84	Pinned data exists in the DM-VOL.	Retry after eliminating pinned data.
9629	0045	84	The copy operation can not be performed because the DP pool to which the DM-VOL belongs is detached.	Recover the DP pool.
9629	0046	84	The operation can not be performed due to insufficient capacity of the DP Pool for the DM-VOL.	Grow the capacity of DP pool.
9629	0047	84	The copy operation can not be performed because the DM-VOL has unwritten data.	Recover the DM-VOL status.

## Using logging commands

Normally, logging of a command collects the error information when an error occurs in the command execution. In addition, it provides a function of logging all commands for the purpose of the examination and the verification of the command issued by the user script. The logging of all the commands can be done through the setting of the following control valuables.

- HORCC\_LOGSZ=file size: valuable

This valuable specifies the maximum size of the command log file. The \$HORCC\_LOG/horcc\_HOST.log file is moved to the \$HORCC\_LOG/horcc\_HOST.oldlog file when its size (in kB) exceeds the specified size.

This variable can be defined as an environmental variable or the following \$HORCC\_LOG/horcc\_HOST.conf file. When this variable is not specified or the size is specified as zero, the logging is done as a default operation only when an error occurs.

Setting example:

```
HORCC_LOGSZ=2048
Export HORCC_LOGSZ
```

- \$HORCC\_LOG/horcc\_HOST.conf file

This file describes the HORCC\_LOGSZ variable and the variable for masking the logging. Specify the maximum size. When the variable is not specified as the environmental variable, the HORCC\_LOGSZ variable described in this file is used. When neither of them is specified, the logging is done as a default operation only when an error occurs.

- HORCC\_LOGSZ variable

Describes as following.

```
# For example
HORCC_LOGSZ=2048
```

- Masking variable

This masking variable specifies a command name and a return value. However, the inqraid command and error codes are excluded. For example, when the user script tests the return value of the pairvolchk command at regular intervals, the log data may overflow. In this case, the logging can be masked through the specification of the HORCC\_LOGSZ environmental variable as zero, but the script must be changed as shown below.

```
# For example masking pairvolchk on the script
export HORCC_LOGSZ=0
Pairvolchk -g xxx -s
Unset HORCC_LOGSZ
```

This function validates logging of a command without changing the user script.

```
# For example,
# if you want to mask pairvolchk (returns 22) and raidqry,
# you can specify as below.

pairvolchk=22
raidqry=0
```

The user decides whether or not to mask the user script after tracking the \$HORCC\_LOG/horcc\_HOST.conf file without masking the user script.

- Relation between the environmental variable and the \$HORCC\_LOG/horcc\_HOST.conf file

When the HORCC\_LOGSZ environmental variable is not specified, the HORCC\_LOGSZ variable described in the \$HORCC\_LOG/horcc\_HOST.conf file is used. When neither of them is specified, the logging is done as a default operation only when an error occurs.

**Table 12-6 Relation between the environmental variable and the \$HORCC\_LOG/horcc\_HOST.conf file**

\$HORCC_LOGSZ	HORCC_HOST.conf	Operation
\$HORCC_LOGSZ=size	It is not influenced specification.	The logging is valid in the specified script.
\$HORCC_LOGSZ=0		The logging is invalid in the specified script.
It is not specified	HORCC_LOGSZ=size	The logging is valid in the instance.
	HORCC_LOGSZ=0	The logging is invalid in the instance.
	It is not specified or no file exists.	Default logging (logging is done only when an error occurs)

**Example:**

\HORCM\log\* directory

```
[root@raidmanager log9]# ls -l
total 16
drwxr-xr-x  3 root root   4096 Oct 27 17:33 curlog
-rw-r--r--  1 root root   3936 Oct 27 17:36 horcc_raidmanager.log
-rw-r--r--  1 root root 2097452 Oct 27 17:29 horcc_raidmanager.oldlog
-rw-r--r--  1 root root    46 Oct 27 17:19 horcc_raidmanager.conf
drwxr-xr-x  3 root root   4096 Oct 27 17:19 tmplog
```

\HORCM\log\*\horcc\_HOST.log file

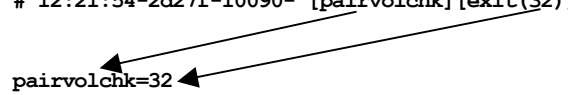
```
COMMAND NORMAL : EUserId for HORC : root (0)   Tue Nov  1 12:21:53 2005
CMDLINE : pairvolchk -ss -g URA
12:21:54-2d27f-10090- [pairvolchk][exit(32)]
COMMAND NORMAL : EUserId for HORC : root (0)   Thu Oct 27 17:36:32 2005
CMDLINE : raidqry -l
17:36:32-3d83c-17539- [raidqry][exit(0)]
COMMAND ERROR  : EUserId for HORC : root (0)   Thu Oct 27 17:31:28 2005
CMDLINE : pairdisplay -g UR
17:31:28-9a206-17514- ERROR:cm_sndrcv[rc < 0 from HORCM]
17:31:28-9b0a3-17514- [pairdisplay][exit(239)]
[EX_ENOGRP] No such group
[Cause ]:The group name which was designated or the device name doesn't exist
in the configuration file,or the network address for remote communication
doesn't exist.
[Action]:Please confirm if the group name exists in the configuration file
of the local and remote host.
```

\HORCM\log\*\horcc\_HOST.conf file

```
# For Example
HORCC_LOGSZ=2048

# The masking variable
# This variable is used to disable the logging by the command and exit code.
# For masking below log pairvolchk returned '32' (status is "SVOL_COPY")
# COMMAND NORMAL : EUserId for HORC : root (0) Tue Nov 1 12:21:53 2005
# CMDLINE : pairvolchk -ss -g URA
# 12:21:54-2d27f-10090- [pairvolchk][exit(32)]

pairvolchk=32
pairvolchk=22
```



## Copy command options

- ☐ [Paircreate options](#)
- ☐ [Pairsplit options](#)
- ☐ [Pairsync options](#)
- ☐ [Pairevtwait options](#)
- ☐ [Pairsyncwait options](#)
- ☐ [Pairmon options](#)
- ☐ [Pairvolchk options](#)
- ☐ [Pairdisplay options](#)
- ☐ [Paircurchk options](#)
- ☐ [Horctakeover options](#)
- ☐ [Horctakeoff options](#)
- ☐ [Raidscan options](#)
- ☐ [Raidar options](#)
- ☐ [Raidqry options](#)
- ☐ [Horcctl options](#)
- ☐ [Raidvchkset options](#)
- ☐ [Raidvchkdsp options](#)
- ☐ [Raidvchkscan options](#)

## Paircreate options

**Table 13-1 Paircreate options**

Com mand	Options	ShadowImage	SnapShot	TrueCopy	TCE
paircreate	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g [s] <group>	○	○	○	○
	-d [s] <pair Vol>	○	○	○	○
	-d [g] [s] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] [s] <seq#> <LDEV#> [MU#]	○	○	○	○
	-nomsg	○	○	○	○
	-vl or -pvol	○	○	○	○
	-vr or -svol	○	○	○	○
	-f <fence> [CTGID]	N/A	N/A	○	○
	-fg <fence> [CTGID]	N/A	N/A	○	○
	-jp <PID> -js <PID>	N/A	N/A	N/A	○
	-c <size>	○	○	○	○
	-cto <o-time> [c-time] [r-time]	N/A	N/A	N/A	N/A
	-nocopy	N/A	N/A	○	○
	-m <mode>	○	○	○	○
	-split [Split-Marker]	○	○	N/A	N/A
	-fq <mode>	○	N/A	N/A	N/A
	-pid <PID>	N/A	○	N/A	N/A
	-nocsus	N/A	N/A	N/A	N/A

## Pairsplit options

**Table 13-2 Pairsplit options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairsplit	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-nomsg	○	○	○	○
	-r	N/A	N/A	○	○
	-rw	N/A	N/A	○	○
	-S	○	○	○	○
	-R	× N/A	N/A	○	○
	-RS	N/A	N/A	○	○
	-RB	× N/A	N/A	○	○
	-P	N/A	N/A	○	N/A
	-l	○	○	○	○
	-FHORC [MU#]	○	○	N/A	N/A
	-FMRCF [MU#]	N/A	N/A	○	○
	-ms <Split-Marker> [MU#]	○	○	N/A	N/A
	-mscas <Split-Marker> [MU#]	N/A	N/A	N/A	N/A
	-C <size>	N/A	○	N/A	N/A
	-E	N/A	N/A	N/A	N/A
	-fq <mode>	N/A	N/A	N/A	N/A

## Pairsync options

**Table 13-3 Pairsync options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairresync	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-nomsg	○	○	○	○
	-c <size>	○	○	○	○
	-cto <o-time> [c-time] [r-time]	N/A	N/A	N/A	N/A
	-l	○	○	○	○
	-FHORC [MU#]	○	○	N/A	N/A
	-FMRCF [MU#]	N/A	N/A	○	○
	-swapp	N/A	N/A	○	○
	-swaps	N/A	N/A	○	○
	-restore	○	○	N/A	N/A
	-fq <mode>	○	N/A	N/A	N/A
	-f [g] <fence> [CTGID]	N/A	N/A	N/A	N/A

## Pairevtwait options

**Table 13-4 Pairevtwait options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairevtwait	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-nomsg	○	○	○	○
	-nowait	○	○	○	○
	-nowaits	○	○	○	○
	-s <status>	○	○	○	○
	-ss <status>	○	○	○	○
	-t <timeout> [interval]	○	○	○	○
	-l	○	○	○	○
	-FHORC [MU#]	○	○	N/A	N/A
	-FMRCF [MU#]	N/A	N/A	○	○

## Pairsyncwait options

**Table 13-5 Pairsyncwait options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairsyncwait	-h	N/A	N/A	N/A	○
	-z	N/A	N/A	N/A	○
	-zx	N/A	N/A	N/A	○
	-I[instance#]	N/A	N/A	N/A	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	N/A	○
	-IM[instance#]   -ISI[instance#]	N/A	N/A	N/A	N/A
	-q	N/A	N/A	N/A	○
	-xh	N/A	N/A	N/A	○
	-x <command> <arg>	N/A	N/A	N/A	○
	-g <group>	N/A	N/A	N/A	○
	-d <pair Vol>	N/A	N/A	N/A	○
	-d [g] <drive#(0-N)> [MU#]	N/A	N/A	N/A	○
	-d [g] <seq#> <LDEV#> [MU#]	N/A	N/A	N/A	○
	-nomsg	N/A	N/A	N/A	○
	-nowait	N/A	N/A	N/A	○
	-t <timeout> [interval]	N/A	N/A	N/A	○
	-m <Q-Marker>	N/A	N/A	N/A	○
	-fq	N/A	N/A	N/A	N/A

## Pairmon options

**Table 13-6 Pairmon options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairmon	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-D	○	○	○	○
	-allsnd	○	○	○	○
	-resevt	○	○	○	○
	-nowait	○	○	○	○
	-s <status>	○	○	○	○

## Pairvolchk options

**Table13-7 Pairvolchk options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairvolchk	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-nomsg	○	○	○	○
	-c	○	○	○	○
	-ss	○	○	○	○
	-FHORC [MU#]	○	○	N/A	N/A
	-FMRCF [MU#]	N/A	N/A	○	○

## Pairedisplay options

**Table13-8 Pairedisplay options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
pairedisplay	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-c	○	○	○	○
	-l	○	○	○	○
	-m <mode>	○	○	○	○
	-f [x]	○	○	○	○
	-f [c]	○	○	○	○
	-f [d]	○	○	○	○
	-f [m]	N/A	N/A	N/A	N/A
	-f [e]	○	○	○	○
	-f [w]	○	○	○	○
	-f [r]	N/A	N/A	N/A	N/A
	-CLI	○	○	○	○
	-FHORC [MU#]	○	○	N/A	N/A
	-FMRCF [MU#]	N/A	N/A	○	○
	-v jnl [t]	N/A	N/A	N/A	N/A
	-v ctg	N/A	N/A	N/A	N/A
	-v smk	○	○	N/A	N/A
	-v pid	× N/A	○	N/A	N/A

## Paircurchk options

**Table 13-9 Paircurchk options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
paircurchk	-h	N/A	N/A	○	○
	-z	N/A	N/A	○	○
	-zx	N/A	N/A	○	○
	-I[instance#]	N/A	N/A	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	N/A	N/A	N/A	N/A
	-q	N/A	N/A	○	○
	-xh	N/A	N/A	○	○
	-x <command> <arg>	N/A	N/A	○	○
	-g <group>	N/A	N/A	○	○
	-d <pair Vol>	N/A	N/A	○	○
	-d [g] <drive#(0-N)> [MU#]	N/A	N/A	○	○
	-d [g] <seq#> <LDEV#> [MU#]	N/A	N/A	○	○
	-nomsg	N/A	N/A	○	○

## Horctakeover options

**Table13-10 Horctakeover options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
horctakeover	-h	N/A	N/A	○	○
	-z	N/A	N/A	○	○
	-zx	N/A	N/A	○	○
	-I[instance#]	N/A	N/A	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	N/A	N/A	N/A	N/A
	-q	N/A	N/A	○	○
	-xh	N/A	N/A	○	○
	-x <command> <arg>	N/A	N/A	○	○
	-g <group>	N/A	N/A	○	○
	-d <pair Vol>	N/A	N/A	○	○
	-d [g] <drive#(0-N)> [MU#]	N/A	N/A	○	○
	-d [g] <seq#> <LDEV#> [MU#]	N/A	N/A	○	○
	-nomsg	N/A	N/A	○	○
	-S	N/A	N/A	○	○
	-l	N/A	N/A	○	N/A
	-t <timeout>	N/A	N/A	○	○

## Horctakeoff options

**Table13-11 Horctakeoff options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
horctakeoff	-h	N/A	N/A	N/A	N/A
	-z	N/A	N/A	N/A	N/A
	-zx	N/A	N/A	N/A	N/A
	-I[instance#]	N/A	N/A	N/A	N/A
	-IH[instance#]   -ITC[instance#]	N/A	N/A	N/A	N/A
	-IM[instance#]   -ISI[instance#]	N/A	N/A	N/A	N/A
	-q	N/A	N/A	N/A	N/A
	-xh	N/A	N/A	N/A	N/A
	-x <command> <arg>	N/A	N/A	N/A	N/A
	-g[s] <group>	N/A	N/A	N/A	N/A
	-d[s] <pair Vol>	N/A	N/A	N/A	N/A
	-d [g][s] <drive#(0-N)> [MU#]	N/A	N/A	N/A	N/A
	-d [g][s] <seq#> <LDEV#> [MU#]	N/A	N/A	N/A	N/A
	-nomsg	N/A	N/A	N/A	N/A
	-t <timeout>	N/A	N/A	N/A	N/A
	-jp <PID>   -js <PID>	N/A	N/A	N/A	N/A

# Raidscan options

**Table13-12 Raidscan options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
raidscan	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-p <port> [hgrp]	○	○	○	○
	-pd [g] <drive#(0-N)>	○	○	○	○
	-pi <strings>	○	○	○	○
	-t <targ>	○	○	○	○
	-l <lun>	○	○	○	○
	-m <mun>	○	○	○	○
	-s <seq#>	○	○	○	○
	-f [f]	○	○	○	○
	-f [x]	○	○	○	○
	-f [g]	○	○	○	○
	-f [d]	○	○	○	○
	-f [e]	○	○	○	○
	-f [r]	N/A	N/A	N/A	N/A
	-CLI	○	○	○	○
	-find [g]	○	○	○	○
	-find inst	○	○	○	○
	-find verify	○	○	○	○
	-find [g] conf	○	○	○	○
	-find sync	○	○	○	○
	-find syncd	N/A	N/A	N/A	N/A

## Raidar options

**Table 13-13 Raidar options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
raidar	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-s <interval> [count]	○	○	○	○
	-sm <interval> [count]	○	○	○	○
	-p <port> <targ> <lun>	○	○	○	○
	-pd [g] <drive#(0-N)>	○	○	○	○

## Raidqry options

**Table13-14 Raidqry options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
raidqry	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g	○	○	○	○
	-l	○	○	○	○
	-r <group>	○	○	○	○
	-f	○	○	○	○

## Horcctl options

**Table 13-15 Horcctl options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
horcctl	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	--num	N/A	N/A	N/A	N/A
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-d	○	○	○	○
	-c	○	○	○	○
	-S	○	○	○	○
	-D	○	○	○	○
	-DI	N/A	N/A	N/A	N/A
	-C	○	○	○	○
	-u <unitid>	○	○	○	○
	-ND	○	○	○	○
	-NC	○	○	○	○
	-g <group>	N/A	N/A	N/A	N/A
	-l <level>	○	○	○	○
	-b <y/n>	○	○	○	○
	-s <size(KB)>	○	○	○	○
	-t <type>	○	○	○	○

## Raidvchkset options

**Table13-16 Raidvchkset options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
raidvchkset	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-nomsg	○	○	○	○
	-vt [type]	N/A	N/A	N/A	N/A
	-vs <bsize> [SLBA] [ELBA]	N/A	N/A	N/A	N/A
	-vg [type] [rtime]	○	○	○	○
	-vext <size>	N/A	N/A	N/A	N/A

# Raidvchkdsp options

**Table13-17 Raidvchkdsp options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
raidvchkdsp	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-g <group>	○	○	○	○
	-d <pair Vol>	○	○	○	○
	-d [g] <drive#(0-N)> [MU#]	○	○	○	○
	-d [g] <seq#> <LDEV#> [MU#]	○	○	○	○
	-f [x]	○	○	○	○
	-f [d]	○	○	○	○
	-f [e]	N/A	N/A	N/A	N/A
	-v gflag	○	○	○	○
	-v pool	N/A	○	N/A	N/A
	-v cflag	N/A	N/A	N/A	N/A
	-v offset	N/A	N/A	N/A	N/A
	-v errcnt	N/A	N/A	N/A	N/A
	-v aoub	N/A	N/A	N/A	N/A
	-c	○	○	○	○

## Raidvchksan options

**Table13-18 Raidvchksan options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
raidvchksan	-h	○	○	○	○
	-z	○	○	○	○
	-zx	○	○	○	○
	-I[instance#]	○	○	○	○
	-IH[instance#]   -ITC[instance#]	N/A	N/A	○	○
	-IM[instance#]   -ISI[instance#]	○	○	N/A	N/A
	-q	○	○	○	○
	-xh	○	○	○	○
	-x <command> <arg>	○	○	○	○
	-p <port> [hgrp]	○	○	○	○
	-pd [g] <drive#(0-N)>	○	○	○	○
	-t <targ>	○	○	○	○
	-l <lun>	○	○	○	○
	-s <seq#>	○	○	○	○
	-f [x]	○	○	○	○
	-v gflag	○	○	○	○
N/A	-v pid <PID>	N/A	○	N/A	N/A
	-v jnl [t]	N/A	N/A	N/A	N/A
	-v pida	N/A	N/A	N/A	N/A
	-v pids	N/A	N/A	N/A	N/A
	-v pool	N/A	N/A	N/A	N/A
	-v cflag	N/A	N/A	N/A	N/A
	-v offset	N/A	N/A	N/A	N/A
	-v errcnt	N/A	N/A	N/A	N/A
	-v aou	N/A	N/A	N/A	N/A
	-v aoub	N/A	N/A	N/A	N/A

## Inqraid options

**Table13-19 Inqraid options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
inqraid	-h				
	-quit				
	-inqdump				
	-fx				
	-find [c]				
	-CLI				
	-CLIWP, -CLIWN				
	-sort [CM]				
	-gvinf, -gvinfex				
	-svinf, -svinfex				
	-gplba, -gplbaex	N/A	N/A	N/A	N/A
	-fv				
	-fp	N/A	N/A	N/A	N/A
	-fl				
	-pin	N/A	N/A	N/A	N/A
	-fg				
	-CLIB -sort	N/A	N/A	N/A	N/A
	-fh[c]	N/A	N/A	N/A	N/A
	-CLI -fn	N/A	N/A	N/A	N/A
	-CLI -export	N/A	N/A	N/A	N/A
	-fr	N/A	N/A	N/A	N/A
	-fe	N/A	N/A	N/A	N/A

## Mkconf options

**Table13-20 Mkconf options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
mkconf	-g <group>				
	-gg				
	-m <mu#>				
	-i <inst#>				
	-s <service>				
	-a				
	-c <drive#>				

## Rmawk options

**Table13-21 Rmawk options**

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
rmawk	-h	N/A	N/A	N/A	N/A
	exe="command_line"	N/A	N/A	N/A	N/A
	exe="print ..."	N/A	N/A	N/A	N/A
	exe="printn ..." or exe="prints ..."	N/A	N/A	N/A	N/A
	exe=exit	N/A	N/A	N/A	N/A
	sys="command_line"	N/A	N/A	N/A	N/A
	timeout=value	N/A	N/A	N/A	N/A
	interval=value	N/A	N/A	N/A	N/A
	-BL	N/A	N/A	N/A	N/A
	-AT	N/A	N/A	N/A	N/A
	-EC[VAL]	N/A	N/A	N/A	N/A
	@variable	N/A	N/A	N/A	N/A
	operators (-operator:)	N/A	N/A	N/A	N/A
	operators (=operator:)	N/A	N/A	N/A	N/A
	operators (-operator)	N/A	N/A	N/A	N/A
	raidcom * copy_grp	N/A	N/A	N/A	N/A
	raidcom * device_grp	N/A	N/A	N/A	N/A

Command	Options	ShadowImage	SnapShot	TrueCopy	TCE
	raidcom * external_grp	N/A	N/A	N/A	N/A
	raidcom * external_storage	N/A	N/A	N/A	N/A
	raidcom * host_grp	N/A	N/A	N/A	N/A
	raidcom * hba_wwn	N/A	N/A	N/A	N/A
	raidcom * journal	N/A	N/A	N/A	N/A
	raidcom * ldev	N/A	N/A	N/A	N/A
	raidcom * lun	N/A	N/A	N/A	N/A
	raidcom * path	N/A	N/A	N/A	N/A
	raidcom * pool	N/A	N/A	N/A	N/A
	raidcom * port	N/A	N/A	N/A	N/A
	raidcom * parity_grp	N/A	N/A	N/A	N/A
	raidcom * rcu	N/A	N/A	N/A	N/A
	raidcom * rcu_path	N/A	N/A	N/A	N/A
	raidcom * resource	N/A	N/A	N/A	N/A
	raidcom * snap_pool	N/A	N/A	N/A	N/A
	raidcom * ssid	N/A	N/A	N/A	N/A
	raidcom * dp_pool	N/A	N/A	N/A	N/A
	raidcom * pool	N/A	N/A	N/A	N/A
	raidcom * command_status	N/A	N/A	N/A	N/A
	raidcom * error_message	N/A	N/A	N/A	N/A
	raidcom * clpr	N/A	N/A	N/A	N/A
	raidcom * copy_grp	N/A	N/A	N/A	N/A
	raidcom * spm_wwn	N/A	N/A	N/A	N/A
	raidcom * spm_group	N/A	N/A	N/A	N/A
	raidcom * snapshot	N/A		N/A	N/A





# Acronyms and Abbreviations

AL-PA	arbitrated loop-physical address
AOU	allocation on use (another name for Dynamic Provisioning)
BMP	bitmap
CCI	Command Control Interface
CLI	command line interface
CM	cluster manager
CMDDEV	command device
CTG	consistency group
ELBA	ending logical block address
FC	fibre-channel
GB	gigabyte
GUI	graphical user interface
HA	high availability
HACMP	High Availability Cluster Multiprocessing
HDLM	Hitachi Dynamic Link Manager
HOMRCF	Hitachi Open Multi-RAID Coupling Feature (another name for ShadowImage)
HORC	Hitachi Open Remote Copy (another name for TrueCopy)
HORCM	HORC Manager (another name for the CCI software)
HUS	Hitachi Unified Storage
I/O	input/output
INST	instance number
IOPS	I/Os per second
IP	internet protocol
KB	kilobyte
LDEV	logical device
LDM	Logical Disk Manager
LV	logical volume

LVM	logical volume manager
MB	megabyte
MRCF	Multi-RAID Coupling Feature (refers to ShadowImage)
MSCS	Microsoft Cluster Server
MU	mirrored unit
MUN	mirror unit number
PB	petabyte
PC	personal computer system
PnP	Plug-and-Play
P-VOL	primary volume
R/W	read/write
RD	read
RM	RAID Manager (another name for CCI)
RPC	Remote Procedure Call
SCSI	small computer system interface
SI	ShadowImage
SMPL	simplex
S-VOL	secondary volume
TB	terabyte
TC	TrueCopy
TCE	TrueCopy Extended
TID	target ID
UDP	User Datagram Protocol
V-VOL	virtual volume
VOL	volume
VOL, VOL#	volume number
VSS	Volume Shadow Copy Service
VxFS	Veritas File System

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