

English



FUJITSU Software BS2000

SHC-OSD V12.0

Storage Management for BS2000

User Guide

Edition June 2016

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1 Preface

The SHC-OSD software product makes storage management functions available to the BS2000 operating system. It connects storage systems and their administration with the BS2000 operating system.

The SHC-OSD software product is the BS2000 host component for storage systems. SHC-OSD supports the ETERNUS DX storage systems of FUJITSU, as well as the Symmetrix® and EMC VMAX3™ of EMC² Corporation.

SHC-OSD implements information services and control commands for local and remote replication functions of the storage systems. The replication functions are offered with functions of the storage systems:

- Equivalent Copy (EC), SnapOPC+ and Remote Equivalent Copy (REC) for ETERNUS DX
- TimeFinder and SRDF™ for Symmetrix
- TimeFinder SnapVX™ and SRDF™ for VMAX3

In detail SHC-OSD offers the following functions:

- Information on the configuration of the storage system
 - output of global configuration data, such as model and firmware version, number of physical and logical devices, cache size
 - output of information on the logical devices of the storage system, such as device name, capacity, RAID level
- General functions for local replication
 - output of status information
 - set up and cancel local replication
 - splitting of original data and copy for independent processing of data
 - reconstruction of data
- Functions for local replication with ETERNUS DX
 - **Equivalent Copy (EC)**: quickly available complete copy of the data
 - **SnapOPC+**: directly available “snapshot” of the data.

- Functions for local replication with TimeFinder™ for Symmetrix/VMAX3
 - TimeFinder/Clone: directly available copy of the data, optionally as “snapshot” or as a complete copy
 - TimeFinder/Snap for Symmetrix and TimeFinder SnapVX for VMAX3: directly available “snapshot” of the data
 - TimeFinder/Mirror: complete copy of the data on additional mirror units, also referred to as Business Continuance Volumes (BCVs)
- General functions for remote replication
 - output of status information
 - set up and cancel remote replication
 - change the processing mode
 - testing the recovery procedures
 - control after a disaster
- Functions for remote replication with ETERNUS DX
 - **Remote Equivalent Copy (REC)**: synchronous and asynchronous replication between ETERNUS DX storage systems
- Functions for remote replication with Symmetrix/VMAX3 (SRDF, **S**ymmetrix **R**emote **D**ata **F**acility)
 - SRDF/S: synchronous replication between Symmetrix/VMAX3 storage systems
 - SRDF/A: asynchronous consistent replication between Symmetrix/VMAX3 storage systems
- Thin/virtual provisioning for ETERNUS DX and Symmetrix/VMAX3
 - output of configuration and status information
 - monitoring functions
- Automated Storage Tiering (AST) for ETERNUS DX
 - output of configuration and status information
 - monitoring functions

The settings required to use these functions in the storage systems are configured up front by a qualified technician. The necessary software and licenses must exist.

The prerequisites for the use of SHC-OSD and for the supported storage systems are described in the [section “Installing and configuring SHC-OSD” on page 55](#).

Integration of ETERNUS DX in SHC-OSD is based on the component StorMan from FUJITSU. StorMan integrates storage systems based on the SNIA standard SMI-S. For ETERNUS DX the SMI-S Provider of FUJITSU is used for this purpose.

Integration of Symmetrix/VMAX3 storage systems in SHC-OSD and is based on SYMAPI (Symmetrix Application Programming Interface), the strategic interface of EMC² Corporation for controlling the storage systems. This interface is used in the context of the partnership between FUJITSU and EMC² Corporation.

1.1 Objectives and target groups of this manual

The manual is aimed at systems support staff and customer support.

1.2 Summary of contents

In [chapter “Storage systems in BS2000”](#) the manual describes the basic functions and how the storage systems are connected to the BS2000 servers and to the BS2000 operating system.

The [chapter “Software product SHC-OSD”](#) provides an overview of the SHC-OSD product and the components SYMAPI and StorMan. The functions of SHC-OSD are implemented using commands. These are described in the [chapter “Commands”](#).

The [chapter “Overview of the replication functions”](#) is followed by a description of the storage systems' various replication functions and their use with SHC-OSD in BS2000.

The provisioning functions of the storage systems are described in the [chapter “Thin provisioning \(ETERNUS DX, Symmetrix/VMAX3\)”](#).

The functions of Automated Storage Tiering (AST) for ETERNUS DX are described in [chapter “Automated Storage Tiering \(ETERNUS DX\)”](#).

At the end of the manual you will find various lists which are designed to make it easier for you to use the manual.

Readme file

The product-specific Readme file contains details of functional changes to the current product version and additions to this manual.

Readme files are available to you online in the information on the product concerned in addition to the product manuals at <http://manuals.ts.fujitsu.com>. You will also find the Readme files on the Softbook DVD.

Information under BS2000

When a Readme file exists for a product version, you will find the following file on the BS2000 system:

```
SYSRME.<product>.<version>.<lang>
```

This file contains brief information on the Readme file in English or German (<lang>=E/D). You can view this information on screen using `SHOW-FILE` command or an editor.

The `/SHOW-INSTALLATION-PATH INSTALLATION-UNIT=<product>` command shows the user ID under which the product's files are stored.

Additional product information

Current information, version and hardware dependencies and instructions for installing and using a product version are contained in the associated Release Notice. These Release Notices are available online at <http://manuals.ts.fujitsu.com>.

Terminology used and explanations

The term **storage system** (previously also called disk storage system or disk storage subsystem) refers to an ETERNUS DX storage system, a Symmetrix storage system (DMX, VMAX1 or VMAX2), or VMAX3 storage system.

The terms **unit** and **device** each refer to a logical volume (logical disk) and a physical disk (physical device) in the storage system.

The term **replication function** (previously also called: mirroring function) refers to the functions of the storage systems which mirror all or some of a unit's data to another local or remote unit. See also the [chapter "Overview of the replication functions" on page 89](#).

The terms **original unit** and **source unit** in a replication function refer to the unit on which the data of an application is originally stored. The terms **clone unit**, **snap unit**, **target unit** and **additional mirror unit** refer to units to which the original data is mirrored.

In SHC-OSD commands the `UNIT` operand is used to define the (logical) volumes of the storage systems. In most commands one of the following can be specified for `UNIT`:

- controller (emulated controller, for /390 servers only)
- MN (mnemonic device name of the logical volume in BS2000)
- VSN (Volume Serial Number)
- Pubset ID or volume set ID (ID of an SF/SM pubset or ID of a volume set)
- Serial number of the storage system and internal number of the logical volume in the storage system

One or more logical volumes can therefore be specified for `UNIT`.

1.3 Changes since the last edition of the manual

The following major changes have been made since the last edition of this manual:

- Operation of the new ETERNUS DX 8700 S3 and VMAX3 storage systems.
- On VMAX3 the new function TimeFinder SnapVX replaces the functions of the TimeFinder product family previously used.
The functions of the TimeFinder product family are implemented compatibly by SHC-OSD in the existing scope with the existing interfaces on VMAX3.
The functions TimeFinder/Clone and TimeFinder/Mirror are emulated in VMAX3 by means of TimeFinder SnapVX. TimeFinder SnapVX replaces TimeFinder/Snap incompatibly.
- Connection of the storage systems via type S channel is no longer supported. The description of this has been removed.
- The SCCA-BS2 software product is obsolete. Its description has been removed from the manual.
- The SYMAPI server V8.2 and higher is no longer integrated in SHC-OSD, but resides on one or more external Management Servers. The SYMAPI client is integrated in SHC-OSD. The SHC-OSD selectable unit SYMAPI, the gatekeeper devices generated in BS2000, and the SYMAPI-D subsystem are no longer required in SHC-OSD V12.0 and higher.

1.4 Notational conventions

Because the names are referred to frequently, for simplicity's sake the following abbreviations are used:

- **BS2000 servers** for the servers with /390 architecture and the servers with x86 architecture. These servers are operated with the corresponding BS2000 operating system.
- Servers with /390 architecture (**/390 servers** for short) for the Server Unit /390 of the FUJITSU Server BS2000 SE Series and the Business Servers of the S Series
- Servers with x86 architecture (**x86 servers** for short) for the Server Unit x86 of the FUJITSU Server BS2000 SE Series and the Business Servers of the SQ Series (x86-64 architecture)
- **SE servers** for the FUJITSU Server BS2000 SE Series (Server Units /390 and x86)
- **S servers** for the Business Servers of the S series (/390 architecture)
- **SQ servers** for the Business Servers of the SQ series (x86-64 architecture)
- **ETERNUS DX** as the generic term for all supported ETERNUS DX storage systems of FUJITSU.
 - **ETERNUS DX S3** for the storage systems ETERNUS DX500 S3, DX600 S3 and DX8700 S3.
 - **ETERNUS DX S2** for the storage systems ETERNUS DX410 S2, DX440 S2 and DX8700 S2.
- **EMC** for the company EMC² Corporation.
- **Symmetrix/VMAX3** as the generic term for all supported Symmetrix DMX, VMAX1, VMAX2 and VMAX3 storage systems of EMC² Corporation.
- **Symmetrix** as the generic term for the Symmetrix DMX, VMAX1 and VMAX2 storage systems of EMC² Corporation.
- **VMAX3** as the generic term for all expansion stages of the "EMC VMAX3" storage systems of EMC² Corporation.



In this manual and in the EMC literature, "Symmetrix" refers only to the "older" storage systems DMX, VMAX1, and VMAX2. The latest storage system is called VMAX3.

The following notational conventions are used in this manual:



This symbol denotes important information which you should always observe.



This symbol and the word "**CAUTION!**" precede warning information. In the interests of system and operating security you should always observe this information.

`fixed`

Commands or statements that you can type at the keyboard, screen outputs, and path and file names in running text are displayed with a `fixed` font.

bold

Provides emphasis in running text.

[]

Abbreviated names followed by a number are used to refer to related publications. The complete title of each numbered publication is given in the list of related publications at the back of the manual.

In examples and file extracts the strings `<date>`, `<time>` and `<ver>` specify the current outputs for date, time and version when the details are otherwise independent of date, time and version.

2 Storage systems in BS2000

BS2000 supports the powerful midrange and high-end storage systems ETERNUS DX and Symmetrix/VMAX3 with a connection via Fibre Channel.

These storage systems offer enterprise-wide storage solutions in the highest performance class for BS2000 servers.

SHC-OSD integrates the functions of these systems in BS2000.

2.1 ETERNUS DX

The ETERNUS DX storage systems from FUJITSU support mainframes and open systems. SHC-OSD supports and integrates the ETERNUS DX storage systems for all current BS2000 servers.

The following model series are supported in BS2000:

- ETERNUS DX500 S3, DX600 S3, and DX8700 S3
(collectively referred to as ETERNUS DX S3)
- ETERNUS DX410 S2, DX440 S2, and DX8700 S2
(collectively referred to as ETERNUS DX S2)

ETERNUS DX offers the use of SSD, SAS and NL-SAS drive technologies.

ETERNUS DX supports emulations of the D3435 and D3475-8F disk types. For the BS2000 volumes, SHC-OSD supplies the information about the underlying drive technology.

The RAID functions RAID1, RAID5, RAID6 and RAID10 and also combined RAID functions can be used on ETERNUS DX to create failure tolerant disk system.

Detailed information – also on the architecture and components of ETERNUS DX storage systems – is available in the product manuals which you can download from the internet at: <http://support.ts.fujitsu.com/manuals/> > Storage > ETERNUS DX

2.1.1 Functions of ETERNUS DX

ETERNUS DX offers the following functions which are integrated in SHC-OSD:

- **EC (Equivalent Copy)**
EC generates local copies of a unit. The copies can be addressed separately and used to process critical data separately, e.g. for backup or test purposes.
- **REC (Remote Equivalent Copy)**
REC generates copies of a unit in a second storage system. The second storage system can (theoretically) be installed at any location. In the event of a disaster, a copy of the data is therefore always available on the remote storage system. Thus failure recovery functionality is provided.
- **SnapOPC+**
SnapOPC+ generates one or multiple "point in time" snapshots of the entire volume on the basis of the "copy-on-first-write" strategy. The copies can be addressed separately and used for separate processing, e.g. for backup.



These three functions are also collectively referred to as the **replication functions** of ETERNUS DX. See also the [chapter "Overview of the replication functions" on page 89](#).

- **thin provisioning**
The virtual provisioning function offers options for efficient use of the capacity of storage systems by preconfiguring devices with a virtual capacity.
- **Automated Storage Tiering**
The "Automated Storage Tiering (AST)" function permits the high-power use of disk storage devices offering different performances within the storage system. Here data is automatically migrated to disk storage devices featuring different access times and costs according to its access frequency.

2.1.2 Models and licenses for ETERNUS DX

SHC-OSD supports various model series of the ETERNUS DX storage system. Information on the firmware version supported is provided in the Release Notice for SHC-OSD. Service can upgrade the firmware version for you.

Appropriate hardware licenses are required for the use of "thin provisioning" and "Automated Storage Tiering". These are configured in the storage system. In order to use replication functions, all the storage systems which employ them require corresponding hardware and software licenses.

The "Hardware Advanced Copy" license is required on the storage systems.

The software licenses for managing the replication functions are only controlled using the SHC-CM-LR and SHC-CM-RR products, see [section "SHC-CM-LR and SHC-CM-RR products \(ETERNUS DX\)" on page 44](#).

The license is checked when SHC-OSD commands for replication functions are entered. If the license does not exist, the commands are rejected with message NDE2020 or NDE2021

2.1.3 Operating ETERNUS DX

The ETERNUS DX storage systems are supported for all current BS2000 servers with a connection via Fibre Channel.

Management with SHC-OSD is performed via the software product StorMan. The components of StorMan (StorMan server and StorMan client) are supplied with SHC-OSD. For details of installing StorMan on the StorMan server, see [section "Installing StorMan \(ETERNUS DX\)" on page 45](#). The StorMan client is a component of SHC-OSD.

2.1.3.1 Embedding of StorMan

StorMan runs on one of the following components, the so-called **StorMan server**:

- external Management Server under Windows or Linux
- for SE servers on the MU (SE Manager, StorMan add-on pack).
- for SQ servers SQ200 and higher on the MARS (SQ Manager, StorMan add-on pack).

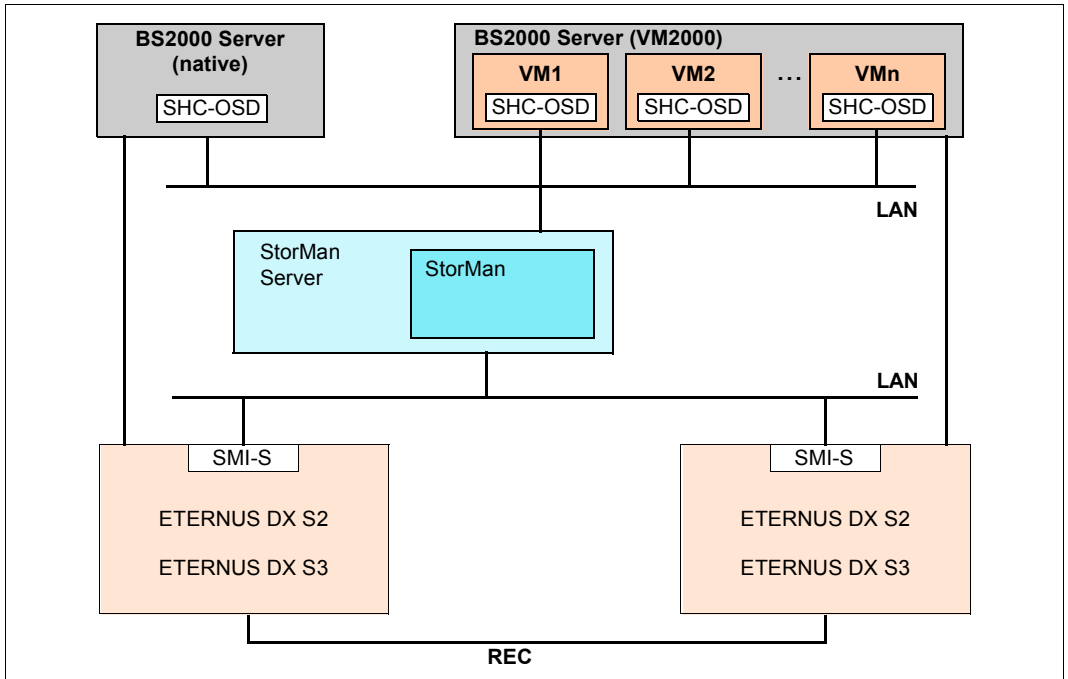


Figure 1: Embedding of StorMan

In SHC-OSD more than one StorMan server can be defined, see [section “Multiple StorMan servers \(ETERNUS DX\)” on page 49](#). However, only one of the defined StorMan servers is ever active. The active StorMan server can be switched to another defined StorMan server either automatically or manually,

Communication between SHC-OSD and StorMan takes place over a LAN (TCP/IP) using the internet protocol IPv4 or IPv6 (on SE servers with StorMan V6.0 or higher, optionally via the MNCPR, one of the private management networks).

StorMan uses the FUJITSU SMI-S Provider.

The SMI-S Provider is embedded in the storage system. It must be activated.

2.1.3.2 Configuring ETERNUS DX

For local and remote replication Service dimensions and configures the necessary resources in advance in the storage system.

- For local replication with EC Service configures the "Copy Table Size" in advance.
- For remote replication with REC Service configures in advance the connection between the storage systems which are to be mirrored remotely. The "Copy Table Size" and the "REC buffer" are also configured appropriately in the storage system in accordance with the planned replication.
- For the use of SnapOPC+ Service configures special logical volumes, so-called Snap Data Volumes (SDVs), in advance. The types and configured sizes of these units (logical volumes) must match those of the original units. SDVs are normally configured with a capacity of approx. 10% of that of the original units. In addition, a central Snap Data Pool (SDP) with joint Snap Data Pool Volumes (SDPVs) is configured in the storage system. The level of updating for the original units must be estimated to ensure the Snap Data Pool is of adequate size.
- The pools and volumes are configured in advance for the "Thin Provisioning" and "Automated Storage Tiering" functions.

Special configuration of the devices for EC and REC is **not** required.

Mapping of the devices of the storage system to BS2000 devices (to be addressed with the mnemonic) is only possible for devices which are connected to the server.

2.2 Symmetrix/VMAX3

The storage systems from EMC support mainframes and open systems. SHC-OSD supports and integrates storage systems for all current BS2000 servers.

The storage systems Symmetrix (DMX-4, VMAX1, VMAX2), and VMAX3 are supported in BS2000.



In this manual and in the EMC literature, "Symmetrix" refers only to the "older" storage systems DMX, VMAX1, and VMAX2. The latest storage system is called VMAX3.

They offer the use of SSD, SAS, Fibre Channel, and SATA drive technologies. For the BS2000 volumes, SHC-OSD supplies the information about the underlying drive technology.

They support emulation of controller type 3860-51 and of disks of the types D3435 and D3475-8F.

The RAID functions RAID1, RAID5, RAID6 and RAID10 and also combined RAID functions can be used to create failure tolerant storage systems (failure tolerant disk systems).

Detailed information – also on the architecture and components of the storage systems – is available in the product manuals of EMC which you can download from the internet at: <http://www.emc.com/products/>

2.2.1 Functions of Symmetrix/VMAX3

Symmetrix and VMAX3 offer the following functions which are integrated in SHC-OSD:

- **SRDF (Symmetrix Remote Data Facility)**
SRDF can be used to back up the productive data onto a second, geographically distant storage system without any additional load on the server. The second storage system can (theoretically) be installed at any location. In the event of a disaster, a copy of the data is always available on this remote storage system. Thus failure recovery functionality is provided. In this manual, the term disaster indicates the simultaneous failure of the main host and/or the local Symmetrix/VMAX3 of a Data Center, e.g. in the event of damage due to fire, flood, explosion, earthquake, etc.
- **TimeFinder and TimeFinder SnapVX**
The functions of the TimeFinder family enable copies of a unit to be generated. These copies can be addressed separately and used to process critical data separately, e.g. for backup or test purposes.

For **Symmetrix**, the TimeFinder family consists as previously of the functions TimeFinder/Snap, TimeFinder/Clone, and TimeFinder/Mirror.

The TimeFinder SnapVX function is offered instead of the TimeFinder family for **VMAX3**. The TimeFinder/Clone and TimeFinder/Mirror functions are implemented compatibly by SHC-OSD in the previous scope with the previous interfaces using TimeFinder SnapVX. The TimeFinder/Snap function is not offered. Snapshots are offered with enhanced functionality by TimeFinder SnapVX and implemented compatibly by SHC-OSD in the previous scope by TimeFinder/Snap with the previous interfaces.



These functions are also collectively referred to as the **replication functions** of the storage systems. See also the [chapter "Overview of the replication functions" on page 89](#).

- **Virtual provisioning**
The "Virtual Provisioning" function offers options for efficient use of the capacity of storage systems by preconfiguring devices with a virtual capacity. VMAX3 is implemented completely with Virtual provisioning.

Meta volumes (not for VMAX3)

The Symmetrix systems offer the option of working with meta volumes. A meta volume consists of multiple Symmetrix volumes. Only the first of the volumes (meta header volume) is visible to the host. The remaining meta member volumes are visible under SHC-OSD only as “non-generated” devices.

Meta volumes can be used as striped volumes (parallel addressing) and as concatenated volumes (sequential addressing).

2.2.2 Versions and licenses for Symmetrix/VMAX3

SHC-OSD supports the following storage systems of EMC:

- Symmetrix DMX-4 with Enginuity Version 5773 and SYMAPI V8.2 and higher
- Symmetrix VMAX1 and VMAX2 with Enginuity Version 5876 and SYMAPI V8.2 and higher
- EMC VMAX3 with HYPERMAX Version 5977 and SYMAPI V8.2 and higher

You can have the Enginuity version upgraded by customer support.

In order to use TimeFinder and SRDF functions, you must have the respective licenses for all storage systems which use them.

A license is required to use SHC-OSD with SYMAPI. It is installed directly in the storage system by EMC Support.

In order to use virtual provisioning, **no** separate license is required.

2.2.3 EMC VMAX3

SHC-OSD supports the EMC VMAX3™-product series with the products VMAX 100K, 200K, and 400K, as well as the HYPERMAX operating system Version 5977 and higher and with SYMAPI V8.2 and higher.

A detailed description of VMAX3 is provided in the EMC documentation.

Under SHC-OSD, VMAX3 offers the same functions as the other Symmetrix systems, and is operated with the same commands.

However, VMAX3 differs from its predecessors in the major points described below. The effects on working with SHC-OSD are also described.

VMAX3 is implemented completely with thin provisioning

See [section “Virtual provisioning \(VMAX3\)” on page 268](#).

VMAX3 has 5-character internal device numbers

In VMAX3 the internal device numbers have been increased from 4 to 5 characters. The device numbers are specified in ascending order from 00000 to FFFFF. This increases the maximum number of devices from 64,000 to 1,024,000. The internal data devices for mapping the thin pools are configured in descending order from FFFFF.

BS2000 currently (as previously) supports at most 4-character device numbers, i.e. the number range from 00000 through 0FFFF. The maximum number of devices thus remains unchanged at 64,000.

The LOGICAL-VOLUME operand of the /SHOW-SYMMETRIX-DEVICE-CONFIG command accepts 5-character device numbers for VMAX3. The information outputs of the SHOW commands and the messages of SHC-OSD display 5-character device numbers for VMAX3.

The LOGICAL-VOLUME operands of the other commands of SHC-OSD still accept only 4-character device numbers for all storage systems.

VMAX3 supports several ports per Remote Link Director

VMAX3 with the HYPERMAX operating system supports a variable number of ports per Remote Link Director.

For the display, the format `<director_name>:<port_number>` is used in the SHC-OSD information output, e.g. `2E:11` for port 11 on director 2E.

In the action commands of SHC-OSD the input of this combination takes place using the operands `DIRECTOR` (as is already the case) and `PORT` (new for VMAX3).

The Fibre Channel adapter (FC director) and the remote adapter (RA director) are important for SHC-OSD:

- An FC director supports up to 32 ports (up to VMAX2: 4 ports per FC director). All 32 ports are output with their connection status when `/SHOW-SYMMETRIX-CONFIGURATION INFORMATION=*DIRECTORS` is issued.
- An RA director can support up to 32 ports (up to VMAX2: one port per RA director). Currently up to 16 ports are supported. All ports are output with their properties when `/SHOW-SYMMETRIX-CONFIGURATION INFORMATION=*REMOTE-LINK-DIRECTORS` or `/SHOW-REMOTE-COPY-STATUS INFORMATION=*LINK-STATUS` is issued. The new operand `PORT` is available in the `ENABLE-/DISABLE-REMOTE-LINK-DIRECTOR` and `/ADD-/MODIFY-SYMMETRIX-RA-GROUP` commands.

VMAX3 knows only dynamic SRDF

Remote copy pairs can be preconfigured statically in VMAX3 and higher.

All generated volumes can be used as source or target units for SRDF. The remote copy pairs must be configured dynamically with the SHC-OSD command `/START-REMOTE-COPY` (dynamic remote copy pairs).

The RA groups for SRDF can be configured using the SHC-OSD commands `...-SYMMETRIX-RA-GROUP`.

In the command output of `/SHOW-SYMMETRIX-DEVICE-CONFIG` the SRDF devices are identified in the `REM-COPY` column with `D` (dynamically configured).

VMAX3 and adaptive copy (SRDF)

The `/MODIFY-REMOTE-COPY-PARAMETER` and `/START-REMOTE-COPY` commands are rejected with the message `NDE1019` if the `COPY-MODE=*ADAPTIVE-COPY` (`WRITE-BUFFER=*CACHE` operand is specified and the source unit resides on a VMAX3).

2.2.4 Operating Symmetrix/VMAX3

The storage systems Symmetrix and VMAX3 are supported for all current BS2000 servers with a connection via Fibre Channel. Management with SHC-OSD is performed via the software product SYMAPI.

The software for the external SYMAPI server is supplied by EMC as part of the software package "Solutions Enabler" or "Unisphere for VMAX" and installed on a Management Server. See also [section "Installing SYMAPI \(Symmetrix/VMAX3\)" on page 51](#). The SYMAPI client is a component part of SHC-OSD.



the "Embedded Element Management (EEM)" function offered by EMC for VMAX3 with the SYMAPI server as a VMAX3 application is currently not supported by SHC-OSD.

2.2.4.1 Embedding of SYMAPI

SYMAPI runs on one of the following components, the so-called **SYMAPI server**:

- external Management Server under Windows or Linux
- for SE servers, preferably on an AU.

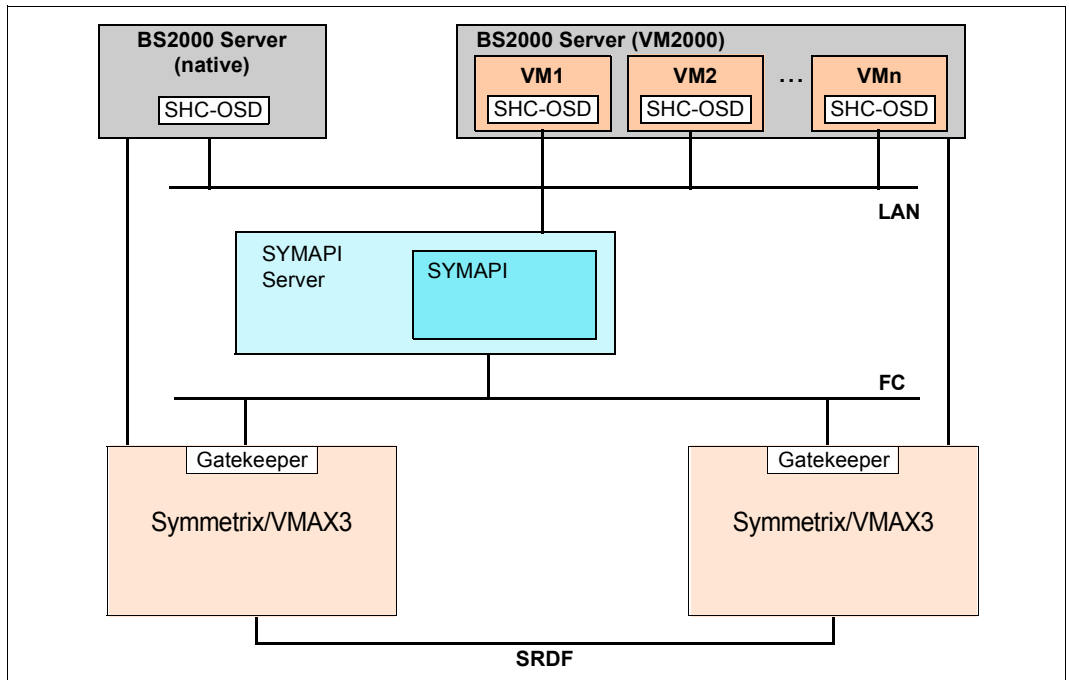


Figure 2: Embedding of SYMAPI

In SHC-OSD more than one SYMAPI server can be defined, see [section “Multiple SYMAPI servers \(Symmetrix/VMAX3\)” on page 53](#). However, only one of the defined SYMAPI servers is ever active. The active SYMAPI server can be switched to another defined SYMAPI server either automatically or manually,

Communication between SHC-OSD and SYMAPI is implemented over a LAN (TCP/IP) with the internet protocol IPv4.

Gatekeepers

SYMAPI on the external SYMAPI server requires so-called gatekeepers to operate. Gatekeepers are devices which are configured in the storage system and on the SYMAPI server for handling the inputs/outputs of the SYMAPI functions. Gatekeeper devices must **no longer** be generated in BS2000 in SHC/OSD V12.0 and higher.

Failure detection

Up to SHC-OSD V11.0 the integrated SYMAPI server enabled the failure of a storage system to be determined unambiguously by SHC-OSD and logged with NDE0008. Because of the modified structure of the SYMAPI servers, this is no longer possible in SHC-OSD V12.0 and higher. The storage system can still be active, even when the SYMAPI server no longer has access.

SHC-OSD can, as before, still determine whether a storage system can no longer be administered. This status is logged with NO in the HOST-ACCESS column in the outputs of the /SHOW-STORAGE-CONFIGURATION and /SHOW-SYMMETRIX-CONFIGURATION commands. However, this does not necessarily mean that the storage system has failed.

2.2.4.2 Configuring Symmetrix/VMAX3

For local and remote replication Service dimensions and configures the necessary resources in advance in the storage system.

- In order to use TimeFinder/Snap (not for VMAX3), special logical volumes (virtual devices, VDEVs) must be configured for TimeFinder/Snap. The types and sizes of these units (logical volumes) must match those of the original unit. Furthermore, at least one snap save pool of the type FBA must be configured in Symmetrix. In order to dimension the snap save pool correctly, you must estimate the degree to which the original units will be modified.
- In order to use TimeFinder/Mirror, special logical volumes (additional mirror units, BCVs) must be reserved. The reserved volumes should then only be used for TimeFinder/Mirror. The types and sizes of these units (logical volumes) must match those of the normal units.
- Before SRDF can be used, logical volumes must be made available on two storage systems, and two or more ports must be made available for remote links. The SRDF pairs can be configured either statically or dynamically (see also the `/START-REMOTE-COPY` and `/STOP-REMOTE-COPY` commands).
Storage systems VMAX3 and higher only know dynamic configuration.
- Gatekeeper devices must be configured in the storage system and on the SYMAPI server.

Special configuration of the devices for TimeFinder/Clone and TimeFinder SnapVX is **not** required.

Mapping of the devices of the storage system to BS2000 devices (to be addressed with the mnemonic) is only possible for devices which are connected to the server.

2.3 Storage systems connected to /390 servers

The relationships between unit names that conform with BS2000 language conventions and those that conform with the language conventions of the storage systems are illustrated in the figure below.

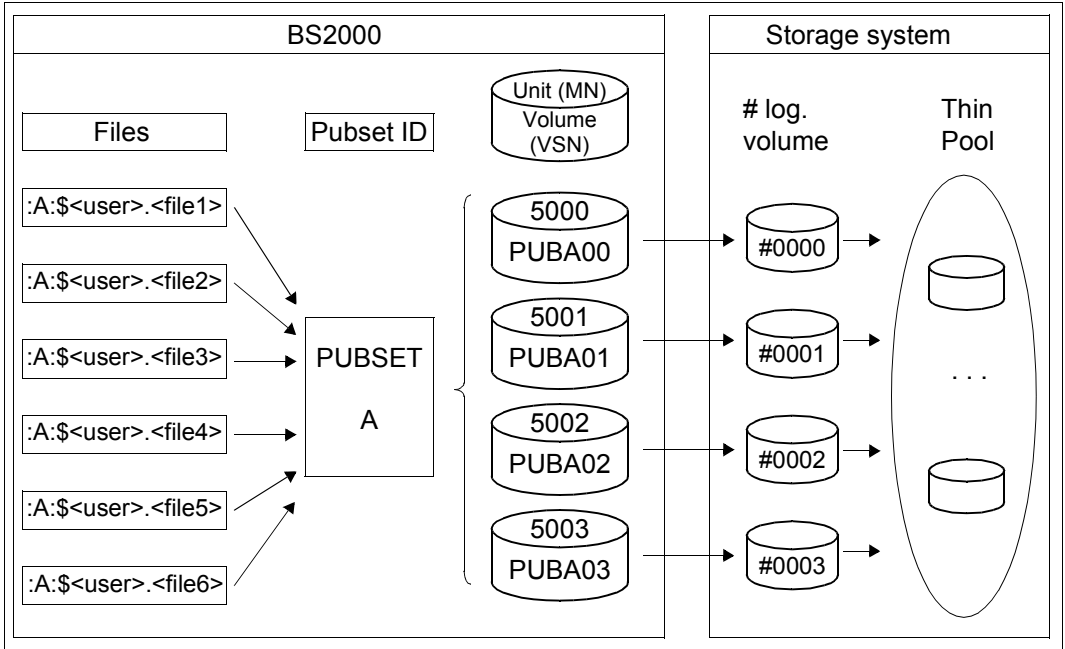


Figure 3: Assignment of the of units (BS2000 and storage system language conventions)

The files (`:A:$<user>.<file1>..6>`) reside on pubset A. Pubset A consists of the units 5000..5003 together with the allocated volumes PUBA00..PUBA03. These are assigned to the logical volumes #0000..#0003 in the storage system. (In VMAX3 logical volumes F0000..FFFFFF can also occur.) The logical volumes are configured in pools (thin pools or RAID groups of physical volumes). The configuration depends on the RAID level and on the storage system (in [figure 3](#) a thin pool is illustrated as an example).

In order to address and use the logical volumes of a storage system in BS2000, they are generated on /390 servers when the hardware is generated with IOGEN or by means of a dynamic I/O configuration change, see [section "Settings for /390 servers" on page 35](#). No generation is required in BS2000 for x86 servers.

When local replication is used, the units must also be generated in BS2000.

At least the source units must be generated when using remote replication in BS2000. The target units must be generated, for example, on the host that is to use them in the event of a disaster.

2.3.1 Configuration on /390 servers

BS2000 disks which are connected to a /390 server via Fibre Channel are operated on configured disks with FBA track format via one or more Fibre Channel-HBAs (Host Bus Adapters). They are always connected to the storage system via an FC switch.



On /390 servers the Fibre Channel connection is implemented over channel type IBF (MODE=FCP), see the "System Installation" manual [6].

BS2000 disks connected to a /390 server via a channel must be configured on storage system (1), switch (2) and BS2000 (3) levels (the level numbers as used in [figure 4 on page 34](#) are in parentheses). The figure shows the various levels, taking ETERNUS DX as an example. The same applies for Symmetrix/ VMAX3. The WWN of the Fibre Channel port (WWPN) of the storage system must be set for the channel at generation.



CAUTION!

If configuration changes are made on the storage system which change the assignment of the logical volumes to the storage system's FC adapter, no devices of any VM may be assigned when operating with VM2000.

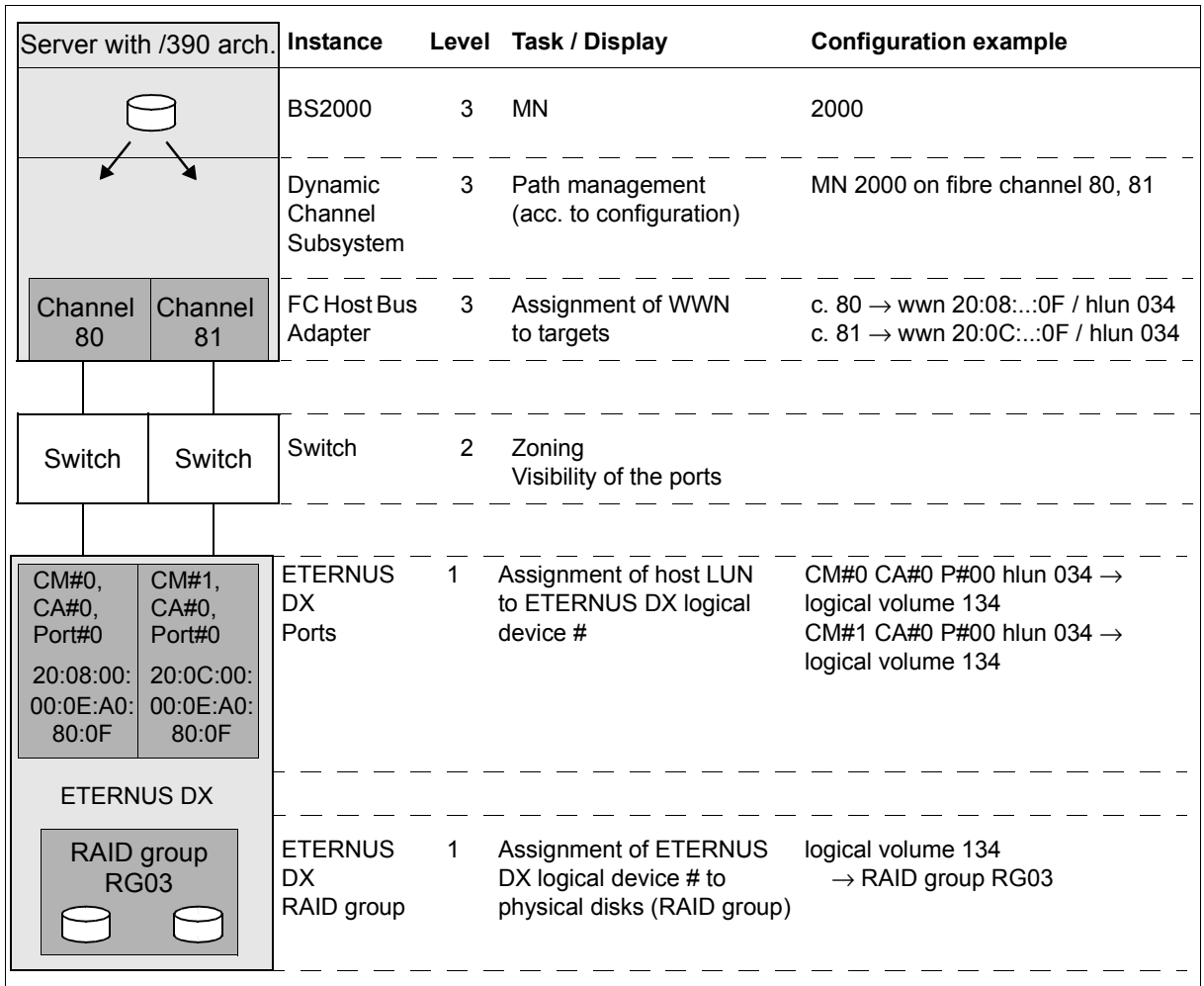


Figure 4: Configuration of the units on /390 servers for ETERNUS DX

2.3.2 Settings for /390 servers

FC switch / SAN fabric

The number of visible devices (zones) must be set correctly in the Fibre Channel switch. These settings must be entered by a qualified technician.

ETERNUS DX

The devices in the storage system have FBA track format.



The configuration settings should be entered by a qualified technician. The information required for this purpose is available on the FUJITSU extranet at:

https://partners.ts.fujitsu.com/sites/dmsp/docs/other/dp_etermus-dx-bs2.pdf

Symmetrix/VMAX3

The devices in the storage system have FBA track format.



The configuration settings on the storage system should be entered by a qualified technician.

Gatekeeper devices must be configured in the storage system, which the SYMAPI server must be able to access. However, in SHC-OSD V12.0 and higher they **no longer** need to be generated.

BS2000

Devices which operate on the FC channel must be generated with the IOGEN program (see the “System Installation” manual [6]).

2.4 Storage systems connected to x86 servers

2.4.1 Configuration on x86 servers

BS2000 disks which are connected to an x86 server via Fibre Channel are mapped to the configured Linux disks. These are operated using one or more Fibre Channel HBAs (Host Bus Adapters). The Linux disks are connected to the storage system directly or via a Fibre Channel switch. BS2000 disks connected to x86 servers via Fibre Channel must be configured on storage system (1), switch (2) and X2000 (4) levels (the level numbers as used in [figure 5 on page 38](#) are in parentheses). No special configuration is necessary at Linux level (3). Generation in BS2000 is **not** required.



CAUTION!

If configuration changes are made on the storage system which change the assignment of the logical volumes to the storage system's FC adapter, no devices of any VM may be assigned when operating with VM2000.

2.4.2 Settings for x86 servers

FC switch

The zone must be set correctly in the Fibre Channel switch.

X2000

Use the SE or SQ Manager to configure the disks of the storage system as BS2000 disks. Service must partition disks of the type D3475-8F beforehand. If disks of the type D3475-8F have been taken over from an SX server, they retain the Solaris label (for reasons of compatibility).



CAUTION!

If SHC-OSD is to handle disks of the type D3475-8F correctly, they must contain just one BS2000 partition. X2000 and SHC-OSD do not check the requirement. If the requirement is not satisfied, commands for replication may produce unwanted side effects because SHC-OSD can handle only complete devices.

For reasons of simplicity, only devices of a single storage system controller should be generated for each host connector (visible to BS2000 as a bus channel).

The disks can also be generated if their status is `NOT-READY` or `READ-ONLY`. This makes sense particularly for units to which data is copied during replication.

BS2000

Devices connected via Fibre Channel do not have a controller. This gives rise to the following special features:

- No controller mnemonic names are output by the SHOW commands.
- Controllers are not accepted as selection criteria for SHOW commands and SRDF commands. If controllers are entered as selection criteria, the entries are rejected with the message NDE1002.

ETERNUS DX

The devices in the storage system have FBA track format.



The configuration settings should be entered by a qualified technician. The information required for this purpose is available on the FUJITSU extranet at:

https://partners.ts.fujitsu.com/sites/dmsp/docs/other/dp_eternus-dx-bs2.pdf

The information provided below applies for ETERNUS DX and the various levels when BS2000 disks are configured on x86 servers over a Fibre Channel.

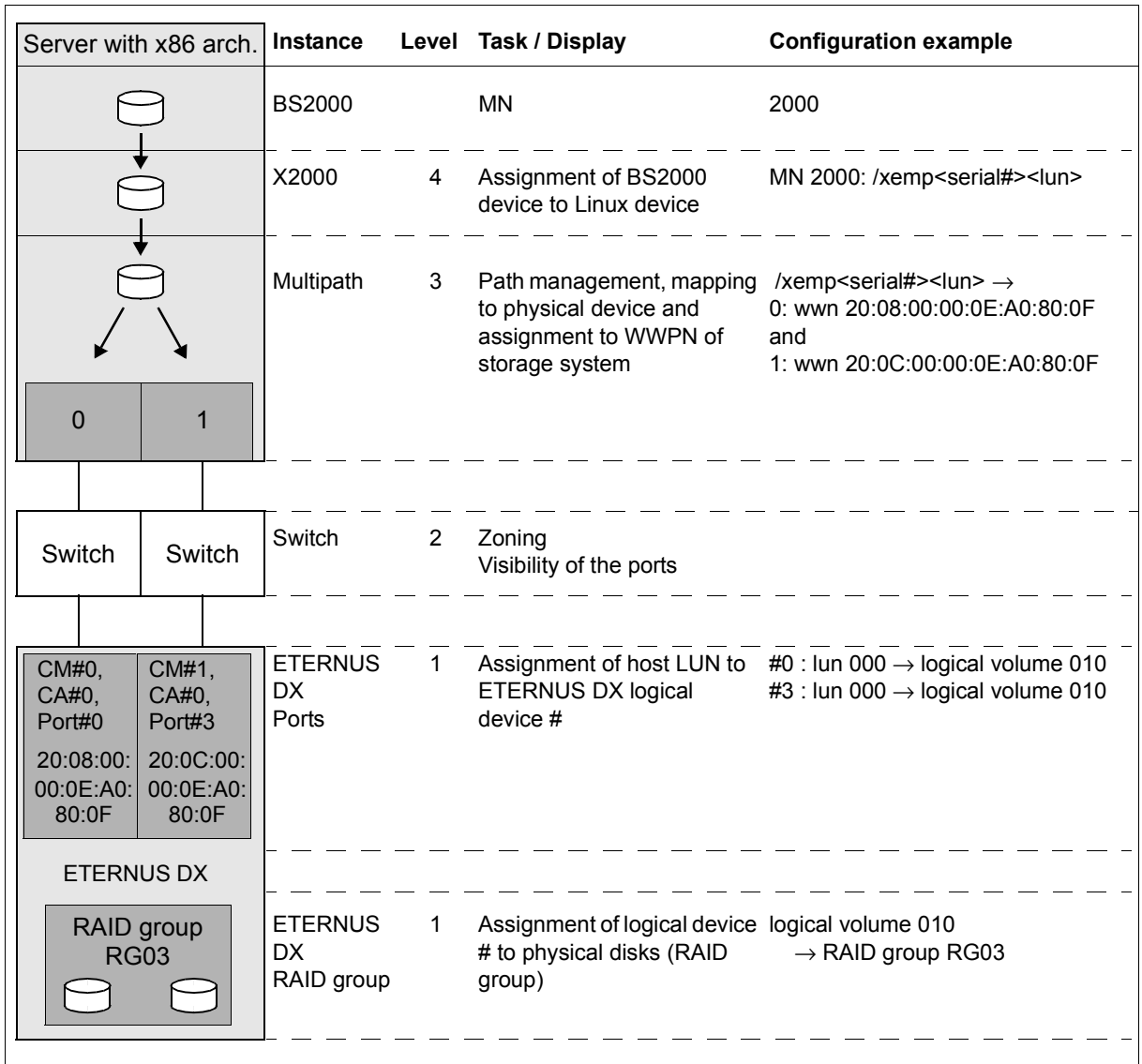


Figure 5: Configuration of the units on x86 servers for ETERNUS DX

Symmetrix/VMAX3

The devices have FBA track format.



The configuration settings on the storage system should be entered by a qualified technician.

Gatekeeper devices must be configured in the storage system, which the SYMAPI server must be able to access. However, in SHC-OSD V12.0 and higher they **no longer** need to be generated.

2.5 Disk capacity

In the storage systems many logical volumes can be set up. In this case the usable disk capacity depends on the formatting in BS2000.

Example

Usable net capacity of a physical disk in BS2000:

Device type	Formatting	Usable capacity
D3435	2K	80%
	NK2	100%
	NK4	not supported by BS2000

3 Software product SHC-OSD

SHC-OSD provides integrated services for administering the supported storage systems in BS2000.

SHC-OSD provides information on the global configuration, the device configuration and the thin provisioning and Automated Storage Tiering (AST) functions for ETERNUS DX. SHC-OSD controls the replication functions EC (Equivalent Copy), REC (Remote Equivalent Copy) and SnapOPC+ using BS2000 commands.

SHC-OSD provides information on the global configuration, the device configuration and the virtual provisioning function for Symmetrix/VMAX3. SHC-OSD controls the replication functions of the TimeFinder and SRDF products using BS2000 commands.

SHC-OSD controls the replication functions largely independently of the storage system using the same BS2000 commands. This reflects the high level of integration of the replication functions for the various storage systems. When BS2000 notation is used (e.g. pubset or mnemonic name) for the BS2000 volumes, SHC-OSD automatically recognizes the underlying storage system and executes the appropriate actions.

Control of the replication functions can be integrated in procedures. This results in a high level of automation and reliable processing in critical operating situations.

Use and control of replication functions are described in the sections below.

This chapter describes the requirements for the storage systems, the software product SHC-OSD with its component parts, the installation and configuration of SHC-OSD, and working with SHC-OSD.

3.1 Product structure of SHC-OSD

SHC-OSD consists of the SHC-OSD and StorMan selectable units (for ETERNUS DX). The software for the SYMAPI server (Symmetrix/VMAX3) is supplied by EMC.



Details of the current version and patch levels of the products and components which are required for operation are provided in the Data Sheet and Release Notice for SHC-OSD.

3.1.1 Selectable unit SHC-OSD (BS2000)

The SHC-OSD selectable unit consists of a system section which runs as a privileged task (SHC-OSD subsystem) and of a program with the same name (SHC-OSD) which runs in a POSIX environment and uses PTHREADS. To run the program, a type-TP batch task with the job name SHCUSERT is automatically started in the SHC-OSD subsystem under the TSOS ID.

The SHC-OSD selectable unit contains the following components:

Component	Meaning
SINLIB.SHC-OSD.<ver>	Library with components and scripts for installing SHC-OSD resources under POSIX
SIPLIB.SHC-OSD.<ver>	Library with privileged macros
SYSDOC.SHC-OSD.<ver>	License file for SHC-OSD
SYSDMP.SHC-OSD.<ver>	PRODAMP procedures which are merged into SYSDMP.DAMP and started using NDMDAMP
SYSENT.SHC-OSD.<ver>	ENTER job for SHC-OSD user task. This job is used internally only by SHC-OSD.
SYSFGM.SHC-OSD.<ver>.D or SYSFGM.SHC-OSD.<ver>.E	Release Notice, German / English
SYSLNK.SHC-OSD.<ver>	Load module library for /390 servers
SKMLNK.SHC-OSD.<ver>	Load module library for x86 servers
SYMES.SHC-OSD.<ver>	Message file
SYSPAR.SHC-OSD.<ver>	Parameter file of SHC-OSD
SYSPAR.SHC-OSD.<ver>.PTH	Parameter file for controlling the PTHREAD settings when the subsystem is started, corresponds to the PTHREAD options file
SYSPRG.SHC-OSD.<ver>	This program is used internally only by SHC-OSD.
SYSRME.SHC-OSD.<ver>.D bzw. SYSRME.SHC-OSD.<ver>.E	Readme file in German and English (optional)

Component	Meaning
SYSREP.SHC-OSD.<ver>	REP file for the subsystem
SYSRMS.SHC-OSD.<ver>	RMS delivery quantity
SYSSDF.SHC-OSD.<ver>	SDF syntax file
SYSSII.SHC-OSD.<ver>	IMON installation information
SYSSMB.SHC-OSD.<ver>	DAMP symbol files which are merged into SYSSMB.DAMP.
SYSSPR.SHC-OSD.<ver>	Compiled SDF-P procedure to start the SHC-OSD-TU program. The procedure is used internally only by SHC-OSD.
SYSSSC.SHC-OSD.<ver>	Subsystem declaration



See the relevant Release Notice for information on installing diagnostic aids. The [section “Diagnostic aids” on page 84](#) describes how to use diagnostic aids for SHC-OSD.

3.1.2 Selectable unit StorMan (ETERNUS DX)

The selectable unit StorMan is required to administer the storage system (see [section “Operating ETERNUS DX” on page 21](#)) and is supplied together with SHC-OSD. The following installation components of StorMan are relevant:

Component	Meaning
StorMan_Setup-<ver+hw>.exe	Installation file for Windows
MV.STORMAN-<ver>.iso	Add-on pack for MU (SE server)
MV.STORMAN-<ver>.mars.iso	Add-on pack for MARS (SQ server)
StorMan-<ver+hw>.rpm	Installation file for Linux
StorMan <ver> Release Notice	Release Notice
StorMan <ver> Manual	StorMan Manual

The requirements for installing and operating StorMan are described in the StorMan documentation (“StorMan” manual [16] and Release Notice).

3.1.3 SHC-CM-LR and SHC-CM-RR products (ETERNUS DX)

The software licenses for managing the replication functions of ETERNUS DX are controlled using the SHC-CM-LR and SHC-CM-RR products. For BS2000 they are supplied and (in POSIX) installed in addition to SHC-OSD.

Installation of the two products is a prerequisite for using local and remove replication with SHC-OSD. Install the products in POSIX using IMON.

They each have the same version number as SHC-OSD.

After the products SHC-CM-LR and SHC-CM-RR have been installed, the licenses become effective only after the SHC-OSD subsystem has been restarted.

SHC-CM-LR product

The SHC-CM-LR product offers support of local replication EC and for SnapOPC+ for ETERNUS DX S2.

You purchase one copy of SHC-CM-LR for each managed storage system. SHC-CM-LR consists of a software part which you install and a document which contains the license.

The CM-LR selectable unit contains the following components:

Component	Meaning
SINLIB.CM-LR.<ver>	Library for POSIX functions
SYSSII.CM-LR.<ver>	IMON installation information

SHC-CM-RR product

The SHC-CM-RR product offers support of remote replication REC for ETERNUS DX.

You purchase one copy of SHC-CM-RR for each managed storage system. SHC-CM-RR consists of a software part which you install and a document which contains the license.

Two copies of the product are thus required for a remote copy configuration.

The CM-RR selectable unit contains the following components:

Component	Meaning
SINLIB.CM-RR.<ver>	Library for POSIX functions
SYSSII.CM-RR.<ver>	IMON installation information

3.2 Installing and configuring external components

Install and configure StorMan (ETERNUS DX) on the StorMan server or SYMAPI (Symmetrix/VMAX3) on the SYMAPI server before you install SHC-OSD.

3.2.1 Installing StorMan (ETERNUS DX)

To manage the ETERNUS DX storage systems you install the software product StorMan on one or more external StorMan servers.

See the [section “Embedding of StorMan” on page 22](#).

Take note of [section “Version combinatorics of SHC-OSD and StorMan” on page 47](#).

The components for the StorMan server are supplied with SHC-OSD, see [section “Selectable unit StorMan \(ETERNUS DX\)” on page 43](#). The StorMan client is integrated into SHC-OSD.

Information on configuring multiple StorMan servers is provided in [section “Multiple StorMan servers \(ETERNUS DX\)” on page 49](#).

3.2.1.1 StorMan on an external server

Install StorMan on the Storman server. See [section “Embedding of StorMan” on page 22](#) and the "StorMan" manual [16].

Network connection

Communication between SHC-OSD and StorMan is implemented over a LAN (TCP/IP). A LAN connection is required from BS2000 to the Management Server (port: 4178) for StorMan:

- Enter the StorMan connection data in the SHC-OSD parameter file after installing SHC-OSD (see [“Parameters for operating ETERNUS DX” on page 59](#)).
- Keep port 4178 on the StorMan server free for communication with SHC-OSD. If necessary the firewall must be disabled for this connection.

StorMan requires a LAN connection to the managed storage systems. For details, see the “StorMan” manual [16]. The customer LAN can be used for the network connection.

3.2.1.2 StorMan on SE servers

For SE servers, StorMan is installed as an add-on pack for the SE Manager on the Management Unit (MU).

In the event of a version change, perform the installation steps described in the "Operation and Administration" manual [14] in the SE Manager.

Network connection

Communication between SHC-OSD and StorMan is implemented over a LAN (TCP/IP). The internal management network (MNCPR) of BS2000 (Server Unit) to the M2000 (port: 4178) is used primarily for StorMan. The customer LAN can also be used.

Enter the StorMan connection data in the SHC-OSD parameter file after installing SHC-OSD (see "[Parameters for operating ETERNUS DX](#)" on page 59).

StorMan requires a LAN connection to the managed storage systems. For details, see the "StorMan" manual [16]. The customer LAN can be used for the network connection.

3.2.1.3 StorMan on SQ servers

For SQ servers, StorMan is supplied as an add-on pack for the SQ Manager.

Perform the installation steps described in the "Operation and Administration" manual [13] in the SQ Manager.

Network connection

Communication between SHC-OSD and StorMan is implemented over a LAN (TCP/IP). A LAN connection is required from BS2000 (Server Unit) to the MARS (port: 4178) for StorMan. The customer LAN can be used for this purpose.

- Enter the StorMan connection data in the SHC-OSD parameter file after installing SHC-OSD (see "[Parameters for operating ETERNUS DX](#)" on page 59).

If the connection via the customer LAN is not possible from the administration LAN and the production LAN (e.g. for security reasons), an alternative connection must be configured between the Server Unit and the MARS. One of the additional LAN interfaces of the MARS can be used for this purpose. Proceed as follows:

- Set up a connection between a free additional LAN interface of the MARS (additional LAN 1 or LAN 2) and the production LAN (ZASLAN)
- Have the selected LAN interface configured by Service to an address in the production LAN

StorMan requires a LAN connection to the managed storage systems. For details, see the “StorMan” manual [16]. The customer LAN can be used for the network connection.

3.2.1.4 Version combinatorics of SHC-OSD and StorMan

In heterogeneous system environments and in particular when software product VM2000 is used, in a transitional phase it can occur that various version levels are active in BS2000 and on the StorMan server.

SHC-OSD can cooperate with different StorMan versions on the StorMan server. Functional restrictions can occur in such cases.

BS2000	StorMan server	Possible?	Note
SHC-OSD V11.0 (StorMan-Client V6.0)	StorMan V5.0	No	
SHC-OSD V11.0 (StorMan-Client V6.0)	StorMan V6.0	Yes	Functionality of StorMan V6.0
SHC-OSD V11.0 (StorMan-Client V6.0)	StorMan V7.0	Yes	Functionality of StorMan V6.0
SHC-OSD V12.0 (StorMan-Client V7.0)	StorMan V5.0 or V6.0	No	
SHC-OSD V12.0 (StorMan-Client V7.0)	StorMan V7.0	Yes	Functionality of StorMan V7.0
SHC-OSD V12.0 (StorMan-Client V7.0)	StorMan <ver> (follow-up version)	Yes	Functionality of StorMan V7.0

3.2.2 Configuring SHC-OSD for operation with StorMan (ETERNUS DX)

SHC-OSD is configured for operation with StorMan primarily using the settings in the SHC-OSD parameter file (after SHC-OSD has been installed, see [section “Configuration of SHC-OSD” on page 58](#)). Enter the configured StorMan server(s) in the SHC-OSD parameter file. The parameters required for this are `STORMAN-HOST`, `STORMAN-PORT` and `STORMAN-SSL`. You define the connection to StorMan servers.

On SE servers SHC-OSD can automatically ascertain and connect the StorMan server on the Management Unit (MU). The `STORMAN-HOST` parameter contains the values `*MU1` and `*MU2` for this purpose. When these values are specified, SHC-OSD automatically connects the StorMan server installed on the relevant MU.

3.2.3 Configuring StorMan for access to the storage systems (ETERNUS DX)

You should generally use the StorMan WebUI for this purpose, see the "StorMan" manual [\[16\]](#).

On SE servers the StorMan server and the SMI-S Provider can be configured via the SE Manager (StorMan WebUI).

If you want to configure StorMan using SHC-OSD, use the `/MODIFY-SHC-ENVIRONMENT` command to set up the configuration of the SMI-S Provider dynamically. You use the `CIMOM-SERVER` operand to define the connection to the SMI-S Provider which is required for operation with SHC-OSD and StorMan. You also use the `ACCESS` operand to define the required access authorization for the SMI-S Provider (account and password).

Enter the IP address of the storage system (the SMI-S Provider runs on the storage system) directly in the `SERVER-NAME` operand, see [figure 1 on page 22](#). It must be possible to reach the storage system from the external server on which StorMan executes.

The settings for the CIMOM server are stored in StorMan.

3.2.4 Multiple StorMan servers (ETERNUS DX)

You can also install StorMan on multiple StorMan servers, define these in the SHC-OSD parameter file, and use them dynamically in rotation.

This is particularly important when stringent requirements are made for availability (High Availability, HA) or for configurations for disaster recovery (DR).

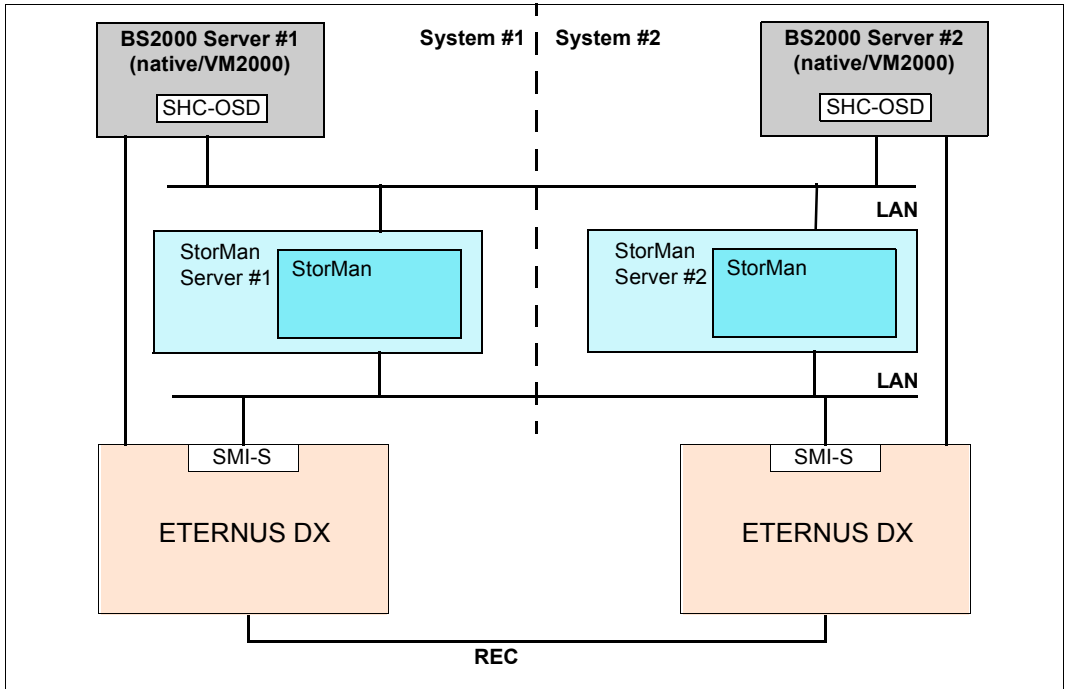


Figure 6: Two StorMan servers in an HA configuration

However, only one of the defined StorMan servers is ever active. When it starts, SHC-OSD activates the first StorMan server defined in the SHC-OSD parameter file which is in the OK status (StorMan server is running). Information on the active StorMan servers can be obtained with the `/SHOW-SHC-ENVIRONMENT INFORMATION=*STD` command.

Information on all StorMan servers defined in the SHC-OSD parameter file can be obtained with the `/SHOW-SHC-PROCESSING` and `/SHOW-SHC-ENVIRONMENT INFORMATION=*ALL` commands.

The active StorMan server can be switched over automatically or manually during ongoing SHC-OSD operation:

- Automatic switchover

SHC-OSD detects that the active StorMan server has crashed when the active StorMan server fails to respond to either the regular polling (default interval: 10 min.) or to an SHC-OSD command.

In this case SHC-OSD switches to the first available StorMan server from the list of defined StorMan servers in the SHC-OSD parameter file.

The switchover of the StorMan server is logged on the console with the messages NDE1836 (StorMan server no longer connected) and NDE1835 (StorMan server connected). Message NDE1836 must be confirmed by the operator.

- Manual switchover by command

The `/MODIFY-SHC-ENVIRONMENT` command enables you to switch over to any active StorMan server contained in the list of defined StorMan servers in the SHC-OSD parameter file during ongoing SHC-OSD operation.

The switchover can also take place from a procedure.

3.2.5 Installing SYMAPI (Symmetrix/VMAX3)

To manage the Symmetrix/VMAX3 storage systems you install the software product "Solutions Enabler" (SYMAPI) on one or more external SYMAPI servers according to the instructions of EMC. For management purposes, EMC requires a Management Server with "Solutions Enabler" or "Unisphere for VMAX". This calls for FC connections to the storage systems and the configured gatekeeper devices, as well as a LAN connection to SHC-OSD (BS2000).

See the [section "Embedding of SYMAPI" on page 29](#).

Take note of section ["Version combinatorics of SHC-OSD and SYMAPI" on page 51](#).

The components for the SYMAPI server are supplied by EMC. Further information on installing SYMAPI can be found in the EMC Release Notes.

The SYMAPI client is integrated into SHC-OSD.

Information on configuring multiple SYMAPI servers is provided in [section "Multiple SYMAPI servers \(Symmetrix/VMAX3\)" on page 53](#).

3.2.5.1 SYMAPI server on SE servers

The SYMAPI server can be installed and operated on an AU (Auxiliary Unit) of the SE server with "Unisphere for VMAX" and "Solutions Enabler."

When an AU is used exclusively for management on the SE server (via the SE Manager), only the customer LAN can be used for the LAN connection between the Server Unit and the AU (in IPv4 format only).



SYMAPI cannot be installed on the Management Unit of the SE servers or on the MARS of the SQ servers.

3.2.5.2 Version combinatorics of SHC-OSD and SYMAPI

SHC-OSD V12.0 and higher requires SYMAPI V8.2 or higher.

SYMAPI V8.2 and higher is downward-compatible. In other words, in heterogeneous environments (e.g. in VM2000 mode or when migrating versions) different (correction) versions of SHC-OSD V12.0 with SYMAPI V8.2 or higher can interwork.

SYMAPI versions up to V7.6 can be used parallel to this only with SHC-OSD V11.0 or earlier. SHC-OSD V11.0 or earlier contains the SYMAPI server as an integrated component, and requires no external SYMAPI server.

3.2.6 Configuring SYMAPI to operate SHC-OSD (Symmetrix/VMAX3)

Configuration of the SYMAPI server

In SHC-OSD V12.0 and higher the configuration settings for the interplay of SYMAPI and SHC-OSD are made solely on the SYMAPI server.

SHC-OSD requires the following configuration settings on the SYMAPI server:

- The port number can be defined on the SYMAPI server. The default is 2707.
- No SSL encryption ("NONSECURE")
The SYMAPI server must accept unencrypted connections. It must therefore be configured with `storsrvd:SECURE=NONSECURE/ANY` in the `.../EMC/SYMAPI/config/options` file.
- To create diagnostic documentation of the SYMAPI server with `/MODIFY-SHC-PROCESSING SYMAPI-DEBUG=*ON/*OFF` (see [page 85](#)), the SYMAPI server should be configured in such a way that the diagnostic settings from the SYMAPI client can be changed.
To do this, set `storsrvd:permit_symapi_debug=CLIENT` in the `.../EMC/SYMAPI/config/options` file.

Configuring the connection from the SYMAPI client to the SYMAPI server

The specifications for the connection of the SYMAP client to the SYMAPI servers are made in the SHC-OSD parameter file after SHC-OSD has been installed.

The IP address of the SYMAPI server and the port number to be used are defined in the SHC-OSD parameter file, see [section "Configuration of SHC-OSD" on page 58](#).

Enter the configured SYMAPI server(s) in the SHC-OSD parameter file. The parameters required for this are `SYMAPI-HOST` and `SYMAPI-PORT`. You define the connection to the possible SYMAPI servers.

SHC-OSD can work with up to four different SYMAPI servers.

SHC-OSD uses the following configuration settings:

- Address of the SYMAPI server (host name or IP address in IPv4 format)
- Port number on the SYMAPI server (default: 2707)

3.2.7 Multiple SYMAPI servers (Symmetrix/VMAX3)

You can also install SYMAPI V8.2 and higher on multiple SYMAPI servers, define these in the SHC-OSD parameter file, and use them dynamically in rotation.

This is particularly important when stringent requirements are made for availability (High Availability, HA) or for configurations for disaster recovery (DR).

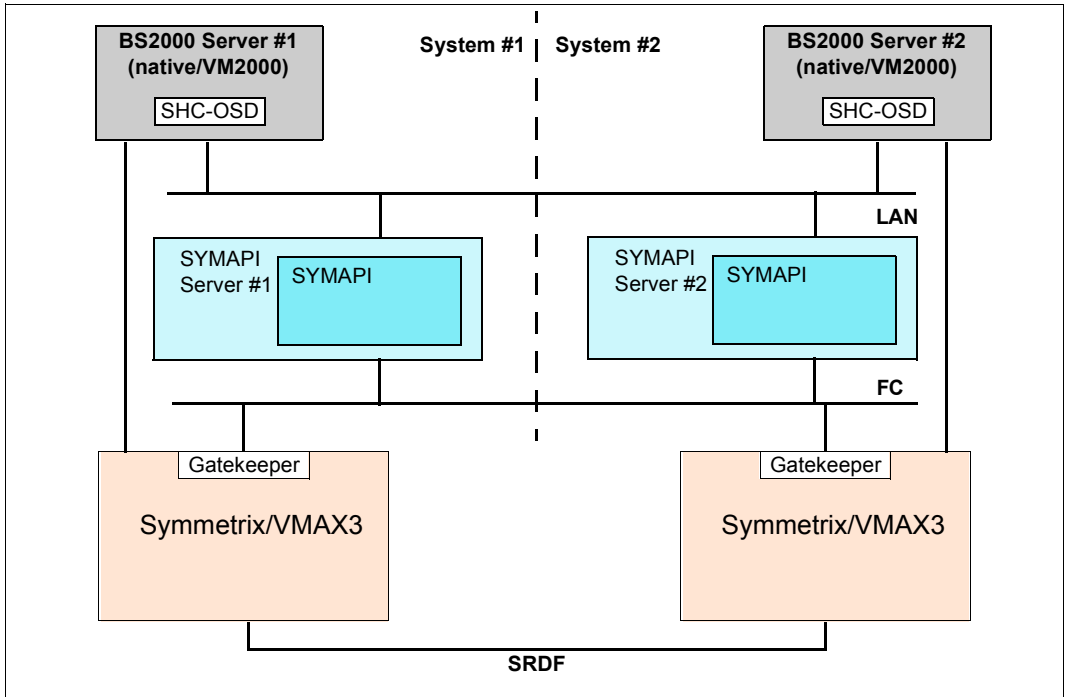


Figure 7: Two SYMAPI servers in an HA configuration

However, only one of the defined SYMAPI servers is ever active. When it starts, SHC-OSD activates the first SYMAPI server defined in the SHC-OSD parameter file which is in the OK status (SYMAPI server is running). Information on the active SYMAPI server can be obtained with the `/SHOW-SHC-ENVIRONMENT INFORMATION=*STD` command.

Information on all SYMAPI servers defined in the SHC-OSD parameter file can be obtained with the `/SHOW-SHC-PROCESSING` and `/SHOW-SHC-ENVIRONMENT INFORMATION=*ALL` commands.

The active SYMAPI server can be switched over automatically or manually during ongoing SHC-OSD operation:

- Automatic switchover

SHC-OSD detects that the active SYMAPI server has crashed when the active SYMAPI server fails to respond to either the regular polling (default interval: 10 min.) or to an SHC-OSD command.

In this case SHC-OSD switches to the first available SYMAPI server from the list of defined SYMAPI servers in the SHC-OSD parameter file.

The switchover of the SYMAPI server is logged on the console with the messages NDE1836 (SYMAPI server no longer connected) and NDE1835 (Storman server connected). Message NDE1736 must be confirmed by the operator.

- Manual switchover by command

The `/MODIFY-SHC-ENVIRONMENT` command enables you to switch over to any active SYMAPI server contained in the list of defined SYMAPI servers in the SHC-OSD parameter file during ongoing SHC-OSD operation.

The switchover can also take place from a procedure.

3.3 Installing and configuring SHC-OSD

SHC-OSD can run on the current BS2000 servers.

The following components must be installed and configured initially depending on the storage systems which are to be managed:

- For ETERNUS DX: selectable unit StorMan on the StorMan server (see [section “Installing StorMan \(ETERNUS DX\)” on page 45](#)).
- For Symmetrix/VMAX3: software product SYMAPI on the SYMAPI server (see [section “Installing SYMAPI \(Symmetrix/VMAX3\)” on page 51](#)).

SHC-OSD is installed with IMON. The installation procedure (version change or first-time installation) is described in detail in the current Release Notice.

3.3.1 Resources needed for operation

In order to operate, SHC-OSD needs a fixed batch task which is automatically started by SHC-OSD when the subsystem is started. It is started with the standard job class (for batch under TSOS) and without any time limit. The task has the job name `SHCUSERT`. SHC-OSD dynamically generates further tasks in order to execute commands.

To support SHC-OSD operation, at least 512 MB of additional capacity must be defined in the paging area. If a number of SHC-OSD commands are run in parallel, the memory requirements may be double this size.

The ADDRESS-SPACE-LIMIT must be at least 512 MB for the user IDs TSOS and SYSROOT.

The SHC-OSD commands are executed in fork tasks of the `SHCUSERT` batch task. Fork tasks do not inherit the `CPU-LIMIT=*NO` setting of the batch tasks they generate. The standard job class setting of the TSOS ID is valid for the fork tasks. (For information on fork tasks, refer to the “C Library Functions” manual [4].)

The POSIX file system must be configured for the use of SHC-OSD.

40-200 MB of free disk space for logging files in the `/shcosd` und `/symapi` subdirectories must be available in the `/var` file system. Disk space requirements are largely dependent on the number of logging files stored. The system administrator should delete or archive logging files regularly.

Automatic deletion of the SHC-OSD logging file can be set for SHC-OSD in the SHC-OSD parameter file (see [page 58](#)).

SHC-OSD uses POSIX semaphores (variables which control access to a shared resource). At least 20 free semaphore records should be available for operation (see "POSIX" manuals [2] and [3]).

SHC-OSD uses up to two POSIX shared memory segments.

You are recommended **not** to use the POSIX functionality "Journaling for File Systems" when all the following conditions are fulfilled for the pubset on which POSIX is installed:

- The pubset consists of multiple volumes
- The volumes are configured for DRV
- The pubset is mirrored locally or remotely
- The mirrors for the pubset are to be split consistently with SHC-OSD commands using `HOLD-IO=*UNTIL-...`

When "Journaling for File Systems" is used in POSIX, this can result in competing I/O activities which impede consistent splitting of the mirrors.

Using PTHREADS

SHC-OSD requires the PTHREADS functionality in BS2000 and StorMan. PTHREADS is a component part of BS2000.

The `SYSPAR.SHC-OSD.<ver>.PTH` file supplied with SHC-OSD contains the options for controlling PTHREADS operation of SHC-OSD.

SHC-OSD evaluates the corresponding parameter files for PTHREADS at startup time. The files can be edited. However, the values of the files supplied should only be modified in exceptional cases. Modifications become effective only after SHC-OSD has been restarted.

The `SYSPAR.SHC-OSD.<ver>.PTH` file contains the following options:

MINTH= Defines the minimum number of thread tasks.
The number of thread tasks should always be less than or equal to the number of processors.

The following specifications are possible:

*STD Stands for 1 (should not be changed)
n Integer between 1 and 59

MAXTH= Defines the maximum number of thread tasks.
The option can increase the space requirements for the tasks. The size of the memory pool may therefore also need to be adjusted (using the `SHAMS` option).
The number of thread tasks should always be less than or equal to the number of processors.

The following specifications are possible:

*STD Stands for 1 (should not be changed)
n Integer between 1 and 59

- SHAMS= Defines the number of pages for the memory pool.
This contains the application code and various runtime systems or parts thereof.
The size of the memory pool required also depends on the number of tasks defined with `MAXTH` and the possible number of threads. If `MAXTH` is much larger than the default value or if the application works with a very large number of parallel threads, the memory pool must also be enlarged.
- The following specifications are possible:
- *STD Stands for 32768 (PTHREADS default value).
The value 131072 is recommended for SHC-OSD (setting when supplied).
 - n Integer between 1 and 2147483647
- BUSYC= Defines the number of busy loops of PTHREADS before the next processor is released for the next request.
This setting has repercussions on the CPU utilization of the batch task `SHCUSER`, in particular in monoprocessor mode.
- The following specifications are possible:
- n Integer between 1 and 100000
The value 10 is recommended for SHC-OSD (default value).

Example

The `SYSPAR.SHC-OSD.<ver>.PTH` file supplied contains the following settings which should generally not be changed:

```
MINTH=1 ,  
MAXTH=1 ,  
SHAMS=131072  
BUSYC=10
```



The `SYSPAR.SHC-OSD.<ver>.PTH` file corresponds to the global PTHREADS options file. It only contains the parameters which are relevant for SHC-OSD. It should only be modified in exceptional cases.

3.3.2 Configuration of SHC-OSD

Parameter file `SYSPAR.SHC-OSD.<ver>` for configuring SHC-OSD is supplied with SHC-OSD. Changes in the parameter file become effective only when the SHC-OSD subsystem is restarted. The settings for operating CIMOM servers are specified using the `/MODIFY-SHC-ENVIRONMENT` command, see [page 335](#).

Global parameters

`DISCOVER-MODE=`

This parameter controls which storage systems are to be registered and administered with SHC-OSD.

`DISCOVER-MODE=FULL`

All supported storage systems (default setting).

`DISCOVER-MODE=BY-SYMAPI`

Only storage systems administered via SYMAPI are taken into account (Symmetrix/VMAX3).

`DISCOVER-MODE=BY-STORMAN`

Only storage systems administered via StorMan are taken into account (ETERNUS DX).

`LOG-FILE-RETENTION=10 / <integer 1..999>`

This parameter enables you to preset a value in days after which an SHC-OSD logging file is automatically deleted (see also [page 85](#)).

`THIN-POOL-MONITORING=`

This parameter controls the monitoring of thin pools for ETERNUS DX and Symmetrix/VMAX3. The SHC-OSD information commands display whether the thin pool is monitored by SHC-OSD.

`THIN-POOL-MONITORING=ON`

All thin pools are monitored.

A message is displayed on the console when the threshold values are reached.

`THIN-POOL-MONITORING=OFF`

Thin pools are not monitored.

No messages are issued when threshold values are reached.

`THIN-POOL-MONITORING=BS2-VOLUMES`

Default setting. Only thin pools containing BS2000 volumes are monitored. For VMAX3, all thin pools are monitored.

`THIN-POOL-MONITORING=BY-AVOID-FILE`

Thin pools which are entered in the `thinpoolavoid` file (in the `/var/shcosd/config` directory) are not monitored (not for VMAX3).

Parameters for operating ETERNUS DX

STORMAN-HOST=

This parameter specifies up to eight StorMan servers by means of their BCAM names or their IP addresses. IPv4 and IPv6 connections are supported. Multiple StorMan servers are separated by commas. The entry is also case-sensitive.

The values *MU1 and *MU2 can be used for SE servers. When these values are specified, SHC-OSD automatically connects the StorMan server of the relevant Management Unit (MU). *MU1 specifies the MU which exists by default, *MU2 an optional redundant MU.

SHC-OSD requires this entry before it starts.

When it starts, SHC-OSD activates the or the first StorMan server defined in the SHC-OSD parameter file which is in the OK status (StorMan server is running).

STORMAN-PORT=

This parameter specifies up to eight port numbers of the StorMan servers. Multiple port numbers (like the StorMan servers specified) are separated by commas. The default value is 4178.

STORMAN-SSL=DISABLE / ENABLE

This parameter defines whether communication between SHC-OSD and StorMan is safeguarded with SSL. Multiple parameters (like the StorMan servers specified) are separated by commas.

Example

```
STORMAN-HOST=SERVER1,SERVER2,SERVER3,SERVER4
STORMAN-HOST=111.222.123.123,1234:123::1::0,10:123
STORMAN-PORT=4178,4178,4178,4178,4178,4178
STORMAN-SSL=DISABLE,ENABLE,ENABLE,ENABLE,ENABLE,DISABLE
```

When a single line is not long enough, the parameter name must be repeated in a new line. The number and order of the parameter values in STORMAN-PORT and STORMAN-SSL must match the specifications in STORMAN-HOST.

FLEX-POOL-MONITORING=

This parameter controls the monitoring of flex pools (ETERNUS DX). The SHC-OSD information commands display whether the flex pool is monitored by SHC-OSD.

FLEX-POOL-MONITORING=ON

All flex pools are monitored.

A message is displayed on the console when the threshold values are reached.

FLEX-POOL-MONITORING=OFF

Flex pools are not monitored.

No messages are issued when threshold values are reached.

FLEX-POOL-MONITORING=BS2-VOLUMES

Only flex pools containing BS2000 volumes are monitored (default setting).

FLEX-POOL-MONITORING=BY-AVOID-FILE

Flex pools which are entered in the `thinpoolavoid` file (in the `/var/shcosd/config` directory) are not monitored.

BS2-VOLUME-ATTR=

This parameter controls the transfer of BS2000 device data (mnemonic, VSN, catalog ID) to the StorMan server.

BS2-VOLUME-ATTR=YES

The BS2000 device data is transferred to the StorMan server.

This setting is recommended on SE servers with StorMan on an MU to enhance performance (default setting).

BS2-VOLUME-ATTR=NO

The BS2000 device data is not transferred to the StorMan server.

Parameters for operating Symmetrix/VMAX3

SYMAPI-HOST=

This parameter specifies up to four SYMAPI servers by means of their BCAM names or their IP addresses. The IPv4 protocol is supported. Multiple SYMAPI servers are separated by commas. The entry is also case-sensitive.

SHC-OSD requires this entry before it starts.

When it starts, SHC-OSD uses the SYMAPI server or the first SYMAPI server defined in the SHC-OSD parameter file which is in the OK status (SYMAPI server is running).

SYMAPI-PORT=

This parameter specifies up to four port numbers of the SYMAPI servers. Multiple port numbers (corresponding to the SYMAPI servers specified) are separated by commas. The default value is 2707.

Example

```
SYMAPI-HOST=SYMAPI1,SYMAPI2
SYMAPI-HOST=111.222.123.123,1234:123::1::0
SYMAPI-PORT=2707,2707
```

The number and order of the parameter values in SYMAPI-PORT must match the specifications in SYMAPI-HOST.

PRESELECTED-SAVE-POOL=*STD / <pool name>

This parameter (not for VMAX3) enables a save pool to be preset when using TimeFinder/Snap on Symmetrix (see also [page 140](#) and the /START-SNAP-SESSION command on [page 587](#)). The default value specifies the default save pool.

MULTI-SNAP=ENABLED / DISABLED

The parameter (not for VMAX3) defines the maximum number of snap units which are supported for an original unit.

MULTI-SNAP=ENABLED

The default setting ENABLED permits up to 127 snap units.

MULTI-SNAP=DISABLED

The DISABLED setting permits up to 15 snap units. This setting is a prerequisite for the RESTORE-FROM-SNAP command and the use of virtual provisioning (see also [chapter “Thin provisioning \(ETERNUS DX, Symmetrix/VMAX3\)” on page 257](#)).

SAVE-POOL-SATURATION=

This parameter (not for VMAX3) enables a percentage threshold value to be preset to monitor the save pools when using TimeFinder/Snap on Symmetrix. The default is 80%. In other words, when the save pool is 80% full, this is displayed on the console by a message which must be acknowledged (see also [page 141](#)).

THIN-POOL-SATURATION=

This parameter enables a percentage threshold value to be preset to monitor thin pools for each storage system when using virtual provisioning on Symmetrix/VMAX3. The default is 80%. In other words, when a thin pool is 80% full, this is displayed on the console by a message which must be acknowledged (see also [page 267](#)).

THIN-DEV-SATURATION=

This parameter (nor for VMAX3) enables a percentage threshold value to be preset to monitor thin devices when using virtual provisioning on Symmetrix/VMAX3. The default is 80%. In other words, when a thin device is 80% full, this is displayed on the console by a message which must be acknowledged (see also [page 266](#)).

Current delivery file for SHC-OSD

```

#=====
# Parameter file for SHC-OSD V12.0: SYSPAR.SHC-OSD.120
#=====
#
#=====
# Global Parameters:
#-----
# Parameter defining the discovery mode
#
# - these settings define if a discovery is performed by
# SYMAPI (EMC SYMMETRIX), by StorMan (ETERNUS DX),
# or a complete discovery by SYMAPI and StorMan.
#
# DISCOVER-MODE=          Discover storage arrays
#           VALUES:      FULL (DEFAULT) SYMAPI and StorMan
#           BY-SYMAPI     SYMAPI only
#           BY-STORMAN    StorMan only
#
DISCOVER-MODE=FULL
#-----
# Parameter defining the setting for log file management:
# - retention in days to delete old shcosd log-files
#
# LOG-FILE-RETENTION=    Retention period (days) for shcosd log-files
#           VALUES:      0 = unlimited
#           DEFAULT = 10 days
#           <int_1..999>
#
LOG-FILE-RETENTION=10
#-----
# Parameter defining the monitoring for Thin Provisioning
#
# THIN-POOL-MONITORING=  Monitor the used space of Thin-Pools
#           VALUES:      ON          for all Thin-Pools
#           OFF           monitoring is turned off
#           BS2-VOLUMES  only for Thin-Pools
#                           containing BS2000-Volumes
#                           and all Thin-Pools of VMAX3.
#                           (DEFAULT)
#           BY-AVOID-FILE no monitoring of Thin-Pools
#                           defined by pool name and
#                           storage serial number in
#                           AVOID-FILE.
#
THIN-POOL-MONITORING=BS2-VOLUMES

```

```

#
#-----
# Parameters for ETERNUS DX Support:
#-----
# Parameters defining the connection for up to 8 StorMan Server.
# Specify names, port numbers, SSL setting as comma separated lists.
# Continue the list in next line starting with operand keyword.
#
# STORMAN-HOST=           Name of the StorMan Server
#           VALUES:      *MU1 (keyword) on MU (Management Unit)
#                         *MU2 (keyword) on redundant MU
#                         <IP_address_15> e.g. 111.111.111.111
#                         <IPv6_address> e.g. 2001:DB8:0:1::10:1FF
#                         a list of max. 8 STORMAN Server
#                         separated by comma is supported.
#
# STORMAN-PORT=          Port number of the StorMan Server
#           VALUES:      4178 (DEFAULT)
#                         <port_number_1..6> e.g. 1234,5678,9876
#                         a list of max. 8 STORMAN-PORT numbers
#                         separated by comma is supported.
#                         They have to correspond to the specific
#                         STORMAN-HOST values (list).
#
# STORMAN-SSL=           SSL setting of the StorMan Server
#           VALUES:      DISABLE (DEFAULT), ENABLE
#                         a list of max. 8 STORMAN-SSL values
#                         separated by comma is supported.
#                         They have to correspond to the specific
#                         STORMAN-HOST values (list).
#
# STORMAN-HOST=*MU1
# or
# STORMAN-HOST=111.111.111.111
# STORMAN-PORT=4178
# STORMAN-SSL=ENABLE
# or
# STORMAN-HOST=*MU1,111.111.111.111,MY_HOST,YOUR_HOST
# STORMAN-PORT=4178,4178,4178,4178
# STORMAN-SSL=ENABLE,DISABLE,ENABLE,DISABLE
#

```



```
#-----  
# Parameter defining the monitoring for Automated Storage Tiering  
#  
# FLEX-POOL-MONITORING= Monitor the used space of Flex-Pools  
#           VALUES:  ON           for all Flex-Pools  
#                   OFF          monitoring is turned off  
#                   BS2-VOLUMES  only for Flex-Pools  
#                               containing BS2000-Volumes  
#                               (DEFAULT)  
#                   BY-AVOID-FILE no monitoring of Flex-Pools  
#                               defined by pool name and  
#                               storage serial number in  
#                               AVOID-FILE.  
#  
FLEX-POOL-MONITORING=BS2-VOLUMES  
#-----  
# Parameter defining if the BS2000 volume attributes MN, VSN and catid  
# are supplied to StorMan.  
#  
# BS2-VOLUME-ATTR      =    BS2000 volume attributes  
#           VALUES:  YES (DEFAULT) provided to StorMan  
#                               recommended for SE-Servers  
#                               with StorMan on *MU  
#                   NO      not provided to StorMan  
#  
BS2-VOLUME-ATTR=YES  
#
```

```

#-----
# Parameters for EMC SYMMETRIX/VMAX3 Support:
#-----
# Parameters defining the connection for up to 4 SYMAPI Server.
# Specify names and port numbers as comma separated lists.
# Continue the list in next line starting with operand keyword.
#
# SYMAPI-HOST=          Name of the SYMAPI Server
#           VALUES:   <host_name_1..48> e.g. MY_HOST,YOUR_HOST,X
#                       <IP_address_15>  e.g. 111.111.111.111
#                       <IPv6_address>    e.g. 2001:DB8:0:1::10:1FF
#                       a list of max. 4 SYMAPI Server
#                       separated by comma is supported.
#
# SYMAPI-PORT=         Port number of the SYMAPI Server
#           VALUES:   2707          (DEFAULT)
#                       <port_number_1..4> e.g. 1234,5678,9876
#                       a list of max. 4 SYMAPI-PORT numbers
#                       separated by comma is supported.
#                       They have to correspond to the specific
#                       SYMAPI-HOST values (list).
#
# SYMAPI-HOST=LOCALHOST,127.0.0.1,MY_HOST,YOUR_HOST
# SYMAPI-PORT=2707,2707,2707,2707
SYMAPI-HOST=172.17.40.172
SYMAPI-PORT=2707
#
#-----
# Parameter defining the preselected SAVE-POOL for TimeFinder/Snap.
#
# PRESELECTED-SAVE-POOL= Name of the SAVE-POOL
#           VALUES:     *STD          (DEFAULT)
#                       <name_1..32> e.g. MY_SAVE_POOL
#
PRESELECTED-SAVE-POOL=*STD
#
#-----
# Parameter defining the MULTI-SNAP mode for TimeFinder/Snap.
#
# MULTI-SNAP=           Controls maximum number of Snap mirror
#                       pairs allowed to one original unit.
#           VALUES:    ENABLED max. 127 Snap pairs (DEFAULT)
#                       DISABLED max. 15 Snap pairs
#
MULTI-SNAP=ENABLED
#

```

```
#-----  
# Parameters defining threshold values for storage pool monitoring:  
#  
# - threshold value in percent for the saturation of SAVE-POOLS for  
#   TimeFinder/Snap.  
#  
# SAVE-POOL-SATURATION=      Saturation level in percent  
#           VALUES:        80           (DEFAULT)  
#                               <int_1..100>  
#  
SAVE-POOL-SATURATION=80  
#  
# - threshold value in percent for the saturation of THIN-POOLS for  
#   Virtual Provisioning.  
#  
# THIN-POOL-SATURATION=     Saturation level in percent  
#           VALUES:        80           (DEFAULT)  
#                               <int_1..100>  
#  
THIN-POOL-SATURATION=80  
#  
# - threshold value in percent for the saturation of THIN volumes for  
#   Virtual Provisioning.  
#  
# THIN-DEV-SATURATION=     Saturation level in percent  
#           VALUES:        80           (DEFAULT)  
#                               <int_1..100>  
#  
THIN-DEV-SATURATION=80  
#  
#-----
```

3.4 Starting SHC-OSD

After the external components and SHC-OSD have been installed, the SHC-OSD subsystem can be started:

```
/START-SUBSYSTEM SUBSYSTEM-NAME=SHC-OSD,VERSION=<<ver>
```

Only default values are allowed for the other operands of this command.

Due to POSIX dependency, SHC-OSD is not started automatically after `SYSTEM READY`, but must be started by the system administrator or in `CMDFILE`.

The following prerequisites must be met to start SHC-OSD successfully:

- All necessary files are installed.
- The version of SHC-OSD matches the BS2000 version, the StorMan version (ETERNUS DX), and the SYMAPI version (Symmetrix/VMAX3).
- POSIX and POSIX-SOCKETS are available, and POSIX has been started.
- PTHREADS is installed.
- For Symmetrix/VMAX3:
SYMAPI has been installed, configured, and started on the SYMAPI server, and defined in the SHC-OSD parameter file. SHC-OSD or the SYMAPI client and the SYMAPI server can communicate via LAN. The gatekeeper devices have been configured in the storage system and on the SYMAPI server.
- For ETERNUS DX:
StorMan has been installed, configured, and started, and defined in the SHC-OSD parameter file. SHC-OSD or the StorMan client and the StorMan server can communicate via LAN. The SMI-S Provider in the storage system has been enabled, configured in StorMan, and can be reached from StorMan via LAN.

i

 The StorMan server can also be started later. Because of the length of the initialization phase, the storage systems may not be visible immediately. The StorMan server can also be terminated and restarted while SHC-OSD is running.
- The batch job started by SHC-OSD is active and message `NDE1201` indicates that SHC-OSD has been initialized successfully.
- The `USER-ADDRESS-SPACE-LIMIT` (see `/SHOW-USER-ATTRIBUTES`) set for the TSOS user is checked by SHC-OSD when loaded, and if the setting is too low the start is rejected with the message `NDE1200`

3.5 Terminating SHC-OSD

The subsystem can be terminated at any time by means of:

```
/STOP-SUBSYSTEM SUBSYSTEM-NAME=SHC-OSD
```

DSSM automatically waits for completion of the last call, either by command or SVC interface. Only default values are allowed for the other operands of this command.

If POSIX is to be terminated, SHC-OSD must be terminated first.

3.6 Working with SHC-OSD

When working with SHC-OSD, it is necessary to know whether the units were generated in BS2000 or not. Usually, you work with generated units. The SHC-OSD functions are available without restriction for generated units.

With SHC-OSD you can address and administer a logical volume directly using the serial number of the storage system and the internal number of the logical volume in the storage system (internal device number). With the internal number of the logical volume each unit can be identified uniquely and independently of any host-specific names, such as different MNs on different hosts for the same unit in the storage system.

This functionality is available for generated as well as for non-generated units on the local host. In the case of Symmetrix/VMAX3 this also enables units to be addressed which can only be accessed indirectly via SRDF connections. This means that it is also possible to display non-generated units and to use the control functions for local and remote replication for non-generated units.

Partitioning



Partitioning is not supported by BS2000.

Disks of the type D3475-8F can be partitioned on SQ servers using X2000, see the “Operation and Administration” manual [13].

With various other operating systems, it is possible to partition a logical volume and thus divide it into several independent file systems.

Problems may occur if storage volumes are operated using the serial number and the device number because only one logical volume can be processed at a time. Specification of the logical volume is superfluous if partitioning has been performed. SHC-OSD is unable to recognize this discrepancy. It is therefore solely the responsibility of the SHC-OSD user to ensure correct addressing.

Meta volumes



Symmetrix meta volumes are supported by BS2000.
There are no meta volumes on VMAX3.

If Symmetrix volumes are operated using the serial number and the device number, only one logical volume is processed at a time. When using meta volumes, actions are accepted only for the meta-header volume and are implicitly executed for all meta-member volumes of the meta volume. Actions on meta-member volumes are rejected with message NDE1154.

3.6.1 Operating units not generated in BS2000

Requirements

To enable SHC-OSD to identify a storage system by means of its serial number and the internal number of the logical volume, the latter must be known in the configuration of StorMan on the Management Server. No unit of this storage system need be generated and attached in BS2000 for this purpose.

To enable SHC-OSD to identify a local or remote Symmetrix/VMAX3 by means of its serial number and internal device number, the latter must be known in the configuration of the SYMAPI server. No unit of this storage system need be generated and attached in BS2000 for this purpose.

Addressing the units of storage systems by means of serial and device numbers

The serial number of the storage system is a string which consists of numbers and letters.

The internal device number is a four-character hexadecimal number between 0000 and FFFF.

The internal device number of VMAX3 is a five-character hexadecimal number between 00000 and FFFFF. The specification in BS2000 and SHC-OSD commands always has four characters.

SHC-OSD offers the option of abbreviating the serial number. In the dialog, you need specify only the last three digits since these are usually unique. The serial number is then checked against the configuration currently known to ensure it is unique. If it is not unique, the corresponding command is rejected.

The complete string in the S variables should be used in procedures.



When two storage systems are used in which the last three characters are identical and one of the two is not known in the configuration, SHC-OSD cannot recognize this ambiguity. You should consequently check up front whether only one device with the number concerned is used.

In messages, the UNIT insert that contains the MN for generated devices is empty. However, other inserts exist which output the serial number and device number (see [section “Messages and inserts” on page 82](#)). “#” is used as the separator between the serial number and device number. Because the UNIT insert is empty, the message may contain some blanks.

Example

```
NDE1015 DEVICE 000183600026#0000 NOT DEFINED.
```

Addresses the ETERNUS DX Units by means of the serial number of the storage system and the internal number of the logical volume.

The syntax below is available for this purpose in the SHC-OSD commands:

```
UNIT=*BY-STORAGE(SERIAL-NUMBER=<serialnumber>, LOGICAL-VOLUME=<number>)
```

The serial number of an ETERNUS DX storage system is a ten-character number.

Addresses the Symmetrix/VMAX3 Units by means of the serial number of the storage system and the internal number of the logical volume.

The syntax below is available for this purpose in the SHC-OSD commands:

```
UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=<serialnumber>, LOGICAL-VOLUME=<number>)
```

The serial number of a Symmetrix/VMAX3 storage system is a twelve-character number.

3.6.2 Utilization concepts for non-generated units

Central administration

Central administration of the total storage system is supported. It permits the supported functions also to be managed on non-generated and/or detached units.



Security functions are available to prevent incorrect operation of the units. These are described in detail in [section “Security functions of SHC-OSD” on page 74](#).

Central monitoring

The units defined in BS2000 are monitored by default for storage systems. You can set central monitoring for the total storage system with

```
/MODIFY-SHC-PROCESSING STATE-CHANGE-POLLING=*PARAMETERS(SELECT-DEVICES=*ALL)
```

This causes all state changes to non-generated and detached units to be logged on the console by means of NDE0xxx messages.



CAUTION!

This setting is not recommended for very large configurations:

- It can lead to losses in performance and increased CPU requirements for processing by SHC-OSD.
- An extremely large number of console messages are generated.

Controlling remote Symmetrix/VMAX3 storage systems exclusively via SRDF

Irrespective of whether the storage systems can be reached from the BS2000 system, remote storage systems can also only be controlled from the SYMAPI server via SRDF (Long Distance SRDF/TimeFinder). The Target Units can thus be controlled independently of the remote storage system's host, even if the host and the remote storage system are not interconnected by means of channels (see [figure 8](#)). Any necessary actions can be performed centrally.

Only the source units should be generated if the same generated BS2000 hardware is to be used to continue work on the target units in the event of a disaster. If a disaster does occur, all that need be done is to switch the channel connections to the recovery storage system. This requires symmetric configuration of the two storage systems.

The ability to control remote storage systems using SRDF means that “vaulting scenarios” are also supported. In a “vaulting scenario” the remote storage system is not connected to the host or the SYMAPI server via channels. The second storage system is located in a fire-resistant area to ensure that at least the data on this storage system is not lost even if the Data Center with the first storage system fails as a result of a disaster (see [figure 9](#)).

The TimeFinder disks on the target units are controlled using the pubset ID. For this purpose the `SELECT=*TARGET-UNIT` operand is available in TimeFinder functions to activate or split multi-mirror, clone and snap pairs. Control via the pubset ID is available for all target units and their replications; they do not need to be generated or attached for this purpose.

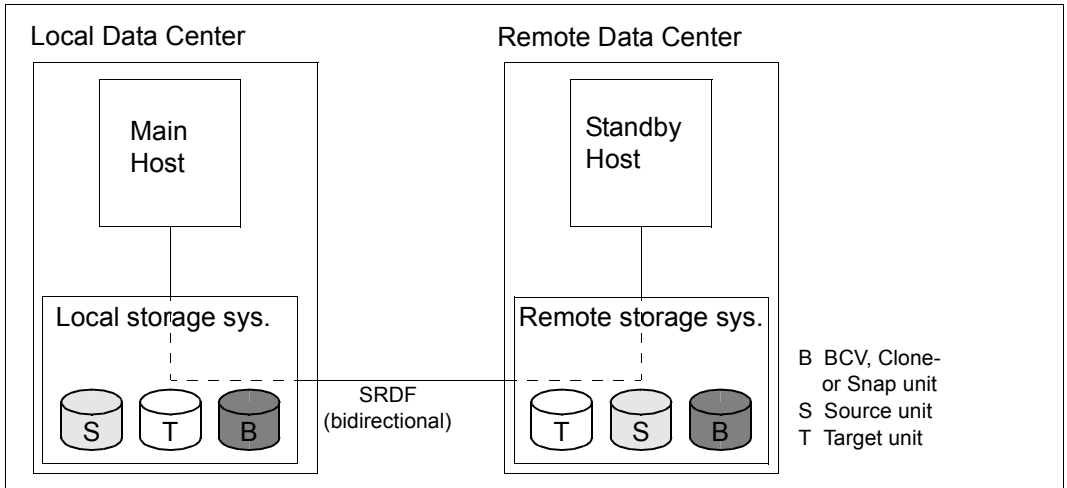


Figure 8: Main host controlling a remote storage system exclusively using SRDF

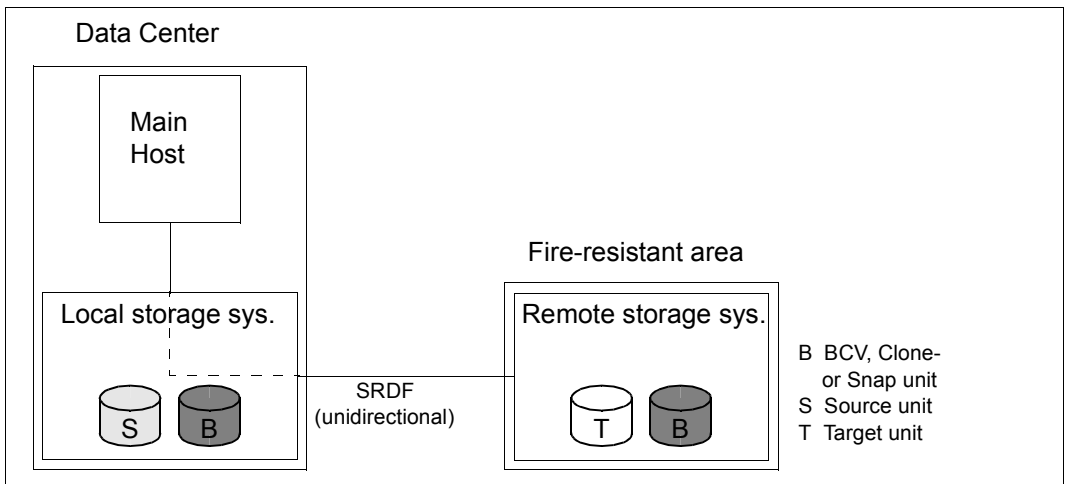


Figure 9: Remote storage system, geographically distant from the local storage system ("data vaulting")

3.6.3 Security functions of SHC-OSD

Before executing an action command, SHC-OSD checks the configuration of the storage volumes to prevent incorrect operation. Action commands are executed for detached and non-generated units only if this was expressly permitted by means of appropriate security functions. The basic setting is “secure mode”: action commands are not executed for detached and non-generated units.

Action commands on which a security check is performed

Command	Function	Page
ACTIVATE-CLONE	Activates a clone pair	280
ACTIVATE-SNAP	Activates a snap pair	290
HOLD-MULTI-MIRRORING	Splits a multi-mirror pair	306
HOLD-REMOTE-COPY	Interrupts remote copy mode	314
MODIFY-REMOTE-COPY-PARAMETER	Changes the processing mode and remote copy parameters	324
RESTART-CLONE-SESSION	Re-creating a clone pair	362
RESTART-SNAP-SESSION	Re-creates a snap pair	371
RESTORE-FROM-CLONE	Reconstructs an original from a clone unit	375
RESTORE-FROM-SNAP	Reconstructs an original from a snap unit	384
RESUME-MULTI-MIRRORING	Reconstructs a multi-mirror pair	395
RESUME-REMOTE-COPY	Resumes remote copy mode	402
SET-REMOTE-COPY-ACCESS	Sets the access path to the data of a remote copy pair	411
START-CLONE-SESSION	Creates a clone pair	559
START-MULTI-MIRRORING	Creates a multi-mirror pair	568
START-REMOTE-COPY	Creates remote copy pairs	575
START-SNAP-SESSION	Creates a snap pair	587
STOP-CLONE-SESSION	Cancels a clone pair	596
STOP-MULTI-MIRRORING	Cancels a multi-mirror pair	603
STOP-REMOTE-COPY	Cancels a remote copy pair	607
STOP-SNAP-SESSION	Cancels a snap pair	614
SWAP-CLONE-SESSION	Swaps a clone pair	622
SWAP-REMOTE-COPY	Swaps a remote copy pair	627

Default setting

Actions are permitted for attached units only.

The default setting for the security function can be changed using `/MODIFY-SHC-PROCESSING` (see [page 342](#)). This command has a global, cross-task operand (`SYSTEM-ADMIN-SCOPE`) and a task-specific operand (`TASK-ADMIN-SCOPE`). Changes to the security setting are logged at the console. The task-specific settings remain valid until the next `/EXIT-JOB` or `/LOGOFF`.

If no setting is made for the current task, the global default setting (`SYSTEM-ADMIN-SCOPE`) is assumed:

```
TASK-ADMIN-SCOPE=*PARAMETERS(DETACHED-DEVICES=*SYSTEM-ADMIN-SCOPE)
```



The setting for logging state changes at the console is independent of the global settings and can be changed using the `STATE-CHANGE-POLLING=*PAR(SELECT-DEVICES=*ALL/*ATTACHED)` operand of `/MODIFY-SHC-PROCESSING`.

Actions for detached units

The global default setting is specified by:

```
SYSTEM-ADMIN-SCOPE=*PARAMETERS(DETACHED-DEVICES=*ACCEPT / *REJECT)
```

The global default setting can be overridden by a task-specific setting:

```
TASK-ADMIN-SCOPE=*PARAMETERS(DETACHED-DEVICES=*ACCEPT / *REJECT)
```



Only if units are attached is it possible to check whether a disk formatted for BS2000 is being used by another system at the same time.

Actions for non-generated units

The global default setting is specified by:

```
SYSTEM-ADMIN-SCOPE=*PARAMETERS(NOT-DEFINED-DEVICES =*ACCEPT / *REJECT)
```

The global default setting can be overridden by a task-specific setting:

```
TASK-ADMIN-SCOPE=*PARAMETERS(NOT-DEFINED-DEVICES=*ACCEPT / *REJECT)
```



If the security functions are not used, users should consider the possible impact of actions on other systems that are also using a given disk. Use of these functions is the responsibility of SHC-OSD users.

Selection with command input

If the serial number of a storage system and the internal device number are specified in the command, the following entry affects both generated and non-generated units:

```
LOGICAL-VOLUME=*ALL-SOURCE-UNITS/*ALL-TARGET-UNITS
```

If, for Symmetrix/VMAX3, a controller is specified in the command, only generated devices are affected (except for `ENABLE-REMOTE-LINK-DIRECTOR` and `DISABLE-REMOTE-LINK-DIRECTOR`).

SHC-OSD responses

The rules governing how SHC-OSD responds to certain security settings and how units are configured for commands that trigger local and remote replications are described below.

The following general rules apply:

- If the unit is changed by the action, it must be attached.
- If it is not attached or not generated, the appropriate security level must be set.

Note

- In secure mode the local mirror units must always be attached, the normal or original units only when they are being modified.
- If the local or remote mirror units are to be renamed, they must be generated and attached.
- Following releases for the local or remote mirror units, no implicit `/UNLOCK-DISK` command can be executed internally to remove system assignments of the unit.

Displaying units

Default setting

- In SHOW commands UNIT=*BY-CONTROLLER / *BY-VOLUME / *BY-PUBSET / <alphanum-name 2..2> / <x-text 4..4> displays only generated units.
- In SHOW commands UNIT=*BY-SYMMETRIX/*BY-STORAGE displays all selected units of the storage system that are generated.
- Only state changes to attached storage system units are displayed on the console (NDEOxxx messages).

The display default settings for the SHOW commands can be changed using /MODIFY-SHC-PROCESSING DEVICE-PRESELECTION=*ANY or by specifying the SELECT=*BY-ATTRIBUTES(DEVICE=*ANY) operand in any SHOW command.

The default setting for console display also can be changed using /MODIFY-SHC-PROCESSING.

The following setting also displays state changes of non-generated and detached units:
/MODIFY-SHC-PROCESSING STATE-CHANGE-POLLING=*PARAMETERS(
SELECT-DEVICES=*ALL)

3.6.4 Renaming SF pubsets with SHC-OSD

In the following SHC-OSD commands an SF pubset can be renamed with the NEW-PUBSET operand:

- /ACTIVATE-CLONE (clone pubset)
- /ACTIVATE-SNAP (snap pubset)
- /HOLD-MULTI-MIRRORING (additional mirror pubset)
- /HOLD-REMOTE-COPY (remote pubset)
- /START-SNAP-SESSION (snap pubset)

The new pubset ID can also differ in length from the old pubset ID.

Renaming as a catalog ID with a different length is possible with the following exceptions:

- Renaming a catalog ID which is not four characters long as a four-character catalog ID is rejected with NDE1036.
- Renaming a two-character catalog ID as a one-character or three-character catalog ID is only possible for two-character volume numbers (00-99). Otherwise renaming is rejected with NDE1045.

The following types of renaming are possible:

PUBSET=A (1-character, PUBAxy) ¹	NEW-PUBSET=	Result
	B (1-character, PUBBxy)	Successful
	BB (2-character, BB.0xy)	Successful
	BBB (3-character, BBB.xy)	Successful
	BBBB (4-character)	NDE1036
PUBSET=AA (2-character, AA.xyz)	NEW-PUBSET=	Result
	B (1-character, PUBByz)	Successful when x=0, otherwise NDE1045
	BB (2-character, BB.xyz)	Successful
	BBB (3-character, BBB.yz)	Successful when x=0, otherwise NDE1045
	BBBB (4-character)	NDE1036
PUBSET=AAA (3-character, AAA.xy)	NEW-PUBSET=	Result
	B (1-character, PUBBxy)	Successful
	BB (2-character, BB.0xy)	Successful
	BBB (3-character, BBB.xy)	Successful
	BBBB (4-character)	NDE1036
PUBSET=AAAA (4-character, AAAA.x)	NEW-PUBSET=	Result
	B (1-character, PUBB0x)	Successful
	BB (2-character, BB.00x)	Successful
	BBB (3-character, BBB.0x)	Successful
	BBBB (4-character, BBBB.x)	Successful

¹ x, y, z: <integer 0..9>

3.6.5 Logging of state changes

The monitoring functions of SHC-OSD show:

- State changes in the configuration of the storage system
- Status of the units
- Status of remote copy mode
- Status of local replications
- Status of virtual provisioning and Automated Storage Tiering

When state changes are detected, a console message is output with routing code D. The message describes the detected state changes. State changes involving changes to host access to the storage system or the availability of the remote link between two storage systems are output as queries or a message (settable, see [page 80](#)) on the console, also using routing code D.

The monitoring function in SHC-OSD is called at intervals and implicitly for each command call of the SHC-OSD subsystem.

Logging of device-specific changes is dependent on subsystem-global operand `SELECT-DEVICES` of `/MODIFY-SHC-PROCESSING`. You can display the setting using `/SHOW-SHC-PROCESSING`:

- *ALL Changes are displayed for all generated and non-generated devices.
- *ATTACHED Changes are displayed only for the devices currently attached.



If only the state changes of the attached BS2000 devices are to be logged, only `SELECT-DEVICES=*ATTACHED` need be specified as this has a direct influence on the amount of configuration data required. In order to monitor the state changes, SHC-OSD periodically updates (default value: every 10 min.) the configuration data of the storage systems managed. In the event of large configurations, this can result in losses in performance and increased CPU requirements for the SHC user task.

Logging of state changes is dependent on the subsystem-global operand `LOG-CHANGES` in `/MODIFY-SHC-PROCESSING`. You can display the setting using `/SHOW-SHC-PROCESSING`:

- *ALL-EVENTS All state changes are logged.
- *MAJOR-EVENTS-ONLY Global state changes are logged.
In addition, state changes of the replication functions are logged.

Whether important state changes are logged as a query (operator order) or a message depends on the subsystem-global operand `OPERATOR-ORDERS` in `/MODIFY-SHC-PROCESSING`. You can display the setting using `/SHOW-SHC-PROCESSING`:

*YES Important state changes are logged as a query (operator order).

*NO Important state changes are not logged as a query (operator order) but as a simple message.

The monitored and logged state changes differ for the storage systems. The tables below provide an overview:

Message no.	ETERNUS DX	Symmetrix /VMAX3	Output for *MAJOR-EVENTS-ONLY	Output for *ALL-EVENTS	Output as a question (if selected)
NDE0002 - 3	-	x	x	x	-
NDE0006 - 7	-	x	x	x	-
NDE0008 ¹	x	x	x	x	x
NDE0010 - 12	-	x	x	x	x
NDE0019	x	-	x	x	x
NDE0051	x	x	x	x	-
NDE0052	-	x	x	x	-
NDE0053	x	-	x	x	-
NDE0055	x	x	x	x	x
NDE0056	-	x	x	x	x
NDE0057 - 59	x	-	x	x	x
NDE0070	x	x	x	x	x
NDE0070 - 71	-	x	x	x	x
NDE0073 - 74	x	-	x	x	x
NDE0075	-	x	x	x	x
NDE0076	x	x	x	x	x
NDE0077 - 78	x	-	x	x	x
NDE0083	x	-	x	x	x
NDE0087 - 88	x	-	x	x	x

Table 1: Changes to the storage system

¹ See the section ["Failure detection" on page 30](#).

Message no.	ETERNUS DX	Symmetrix /VMAX3	Output for *MAJOR-EVENTS-ONLY	Output for *ALL-EVENTS	Output as a question (if selected)
NDE0001	x	x	-	x	-
NDE0004 - 5	-	x	x	x	-
NDE0020	x	x	x	x	-
NDE0021 - 24	-	x	-	x	-
NDE0025 - 27	x	x	x	x	-
NDE0028 - 30	-	x	x	x	-
NDE0032	x	x	x	x	-
NDE0040 - 42	-	x	-	x	-
NDE0050	x	x	x	x	-
NDE0060	x	x	x	x	-
NDE0061	x	-	x	x	-
NDE0074	-	x	x	x	x

Table 2: Changes to the device state

Message no.	ETERNUS DX	Symmetrix /VMAX3	Output for *MAJOR-EVENTS-ONLY	Output for *ALL-EVENTS	Output as a question (if selected)
NDE0100	x	x	x	x	-

Table 3: Changes to the operating mode

3.6.6 Messages and inserts

You obtain information on the meaning of a message and any measures that need to be taken using the `/HELP-MSG-INFORMATION <msg-id>` command.

You can find all the SHC-OSD messages using an HTML application on the manual server (URL: <http://manuals.ts.fujitsu.com>) instead of in the former "System Messages" manual and on the "BS2000 SoftBooks" DVD.

The inserts and their contents are listed in the table below.

No	Content of insert	Length in characters
00	MN of the device	4
01	MN of the controller	4
02	Volume serial number (VSN)	6
03	pubset ID	4
04	Command name	32
05	Remote link director #	3
06	Second MN	4
07	Free text	32
08	Second free text	32
09	Separator	1
10	Serial number of the storage system	16
11	Internal number of the logical volume in the storage system	8
12	Second serial number of the storage system	16
13	Second internal number of the logical volume in the storage system	8
14	Separator	1
15	RA group	4
16	Third free text	34
17	Type of storage system	32

3.6.7 Resetting locks in the Symmetrix/VMAX3 storage system

SHC-OSD protects SRDF and TimeFinder actions against simultaneous actions of other tasks or systems by using locks (known as Symmetrix locks).

It may happen that either the global Symmetrix lock for SRDF actions or the individual device locks are set. This is indicated by messages NDE1152 and NDE1153. The name of the system which set the lock cannot be output.

The global Symmetrix locks for SRDF actions are displayed using `/SHOW-SYMMETRIX-CONFIGURATION . . . , INFORMATION=*LOCKS` and reset using `/UNLOCK-SYMMETRIX`. Global Symmetrix locks are not used for TimeFinder actions.

The device locks are displayed using `/SHOW-SYMMETRIX-DEVICE-CONFIG . . . , INFORMATION=*LOCKED-DEVICES` and reset using `/UNLOCK-SYMMETRIX-DEVICE`.

3.7 Diagnostic aids

SHC-OSD is a dynamically reloadable subsystem which is decoupled from BS2000.

The tasks generated by SHC-OSD have the job name `SHCUSERT`.

The POSIX shared memory segment generated by SHC-OSD cannot be uniquely identified by its `ipcs` key: it uses the key 0 (`PRIVATE`).

The following documents are required for diagnostic purposes when problems occur in the SHC-OSD environment:

1. SHC-OSD executive and error traces and tables which can be found in POSIX in the following files, see [“Creating diagnostic documentation using MODIFY-SHC-PROCESSING” on page 85](#):
`/var/shcosd/log/dumptrac-<yyyymmdd-hhmm>.txt`
`/var/shcosd/log/dumptabl-<yyyymmdd-hhmm>.txt`
2. `CONSLOG` file
3. Trace listing of the SHC-OSD command
4. Logging files of SHC-OSD from the `/var/shcosd/log` directory (see [“Logging files of SHC-OSD” on page 85](#))
5. For Symmetrix/VMAX3: Logging files and settings of the SYMAPI server from the corresponding directory of the SYMAPI server. Information on this is provided in the Release Notes of the product "Solutions Enabler" (SYMAPI).
6. Logging files of StorMan and possibly logging files of the SMI-S Provider (ETERNUS DX)
7. Dump of the `SERSLOG` file (in particular if problems occur when starting the subsystem): Serious errors or errors which cannot be stored in their own error trace will be entered in the `SERSLOG` file. The same identification, `NDE2000` ("Internal error"), is always used here. The areas specified (one or two) are variable and come from the error trace entry.
8. The `REP` file `SYSREP.SHC-OSD.<ver>` which is used and the loader status of BS2000 OSD/BC and of the NKVD subsystem
9. If required, system dump
10. `NDMDAMP` with SHC-OSD analysis for executive and error traces in the form of edited diagnostic data, see [“Creating diagnostic documentation using NDMDAMP” on page 86](#).

Creating diagnostic documentation using MODIFY-SHC-PROCESSING

The `/MODIFY-SHC-PROCESSING SAVE-TRACES=*YES, SAVE-TABLES=*YES` command writes SHC-OSD diagnostic data (traces and tables) from the executing system to the two files `dumptrac--<yyyymmdd-hhmm>.txt` and `dumptabl-<yyyymmdd-hhmm>.txt` in the POSIX directory `/var/shcosd/log`.

As these may be very large, they should be saved externally and then deleted in POSIX.

Logging files of SHC-OSD

The logging entries of SHC-OSD are written to a separate logging file. The logging file is created anew each day.

The file name is: `/var/shcosd/log/shcosd-<yyyymmdd>.log`.

Logging of SHC-OSD is performed in a separate task (fork) of the SHC-OSD user task (SHCUSERT). The user task is not blocked by SHC-OSD logging.

SHC-OSD logging files can grow to a considerable size (up to 1 MB per day). When the associated file system is full, this is reported by POSIX.

Obsolete SHC-OSD logging files are automatically deleted. The number of days before a logging file is deleted can be set in the SHC-OSD parameter file, see [section "Configuration of SHC-OSD" on page 58](#).

SYMAPI logging files

SYMAPI logging files are created only on the SYMAPI server in SHC-OSD V12.0 and higher. The settings for SYMAPI logging are entered on the SYMAPI server.

When additional information from SYMAPI is required for the diagnosis, you can use the `/MODIFY-SHC-PROCESSING SYMAPI-DEBUG=*ON/*OFF` command to enable and disable SYMAPI debugging on the SYMAPI server.

The command works remotely on the SYMAPI server when the SYMAPI server is configured accordingly, see [page 52](#)). The diagnostic documentation created is stored on the SYMAPI server.

Large volumes of data are generated in the SYMAPI server's file system in this case. Debugging should only be switched on upon request and temporarily. It is essential to disable the DEBUG option after a problem has been reproduced.

StorMan logging files

To diagnose errors, it is necessary to save the StorMan logging files and the repository, see the "StorMan" manual [16].

Creating diagnostic documentation using NDMDAMP

NDMDAMP (see “Diagnostics Handbook” [7]) extracts SHC-OSD data from a SLED or from the running system (this information cannot be found in system dumps because they contain no SHC-OSD administration data in the system section nor in the SHC task segment). The size of the trace area may not be sufficient or extended traces may need to be started for diagnosis. This can be done using the `MODIFY-SHC-PROCESSING` command.

Diagnostic documentation can, for example, be generated as follows:

```
/MODIFY-SDF-OPTION SYSSDF.NDMDAMP.<ver>.USER  
/START-NDM-DIAGNOSIS *SYSTEM
```

The result of the evaluation is saved in a printable file with the name `SYSLST.NDMDAMP.<date>.<time>` under the TSOS ID.

3.8 SYMACL - Symmetrix Access Control

SYMACL (Symmetrix Access Control) is a product of EMC which is used for authorizing and monitoring the rights of various SYMAPI servers which are used to control Symmetrix/VMAX3 storage systems. The SYMAPI servers are monitored on a function-specific basis, e.g. for basic functions such as information interfaces or for the TimeFinder and SRDF functions. SYMACL enables rights to be defined and monitored on an individual SYMAPI server basis for each individual device or for complete device groups of the storage systems.

A detailed description of the product is provided in the documentation of EMC.

SYMACL and SHC-OSD

SYMAPI servers and SHC-OSD support SYMACL. This allows SHC-OSD to be used for storage systems which are protected with SYMACL.

Multiple SYMAPI servers can exist with SHC-OSD V12.0 and higher. The connected SYMAPI server has a unique host ID. The different rights for the connected SYMAPI server are defined using SYMACL on the basis of this ID. Each action which is sent from the connected SYMAPI server to the storage system which is protected using SYMACL also contains the ID, thus enabling SYMACL to check the SYMAPI server's authorization.

When a storage system is protected with SYMACL and the SYMAPI server used is not authorized to perform a particular management action, SHC-OSD commands are rejected with the return code `NDE1018`.

SYMACL itself runs on an external server.

Outputting the unique host ID

The SHC-OSD command `/SHOW-SHC-PROCESSING` outputs the unique host ID of the connect SYMAPI server. This changes when the SYMAPI server changes.

Example

```
% ...
% UNIQUE-HOST-ID = AAAAAAAAA-BBBBBBBB-CCCCCCC      (SYMACL)
% ...
```

4 Overview of the replication functions

The replication functions of the storage systems generate and manage redundant data inventories which are created by partial or complete replication (formerly called: mirroring) of the original data inventories.

A distinction is made between the following classes of replication functions according to the distance of the redundant data inventories to their original data inventories:

- Local replication (formerly also called: local mirroring)
The redundant data inventories are stored on the same storage system, but on a different volume.
- Remote replication (formerly also called: remote mirroring)
The redundant data inventories are stored on a geographically distant storage system.

Overview of the replication functions for ETERNUS DX

Replication function	ETERNUS DX S3	ETERNUS DX S2
Local, complete replication	EC	EC
Local copies (snapshots)	SnapOPC+	SnapOPC+
Synchronous remote replication	REC (synchronous)	REC (synchronous)
Asynchronous remote replication	REC (asynchronous)	-
Combinations of replication (see also chapter "Mixed forms of replication (ETERNUS DX, Symmetrix/VMAX3)" on page 235)	EC & REC (syn/asyn) EC & SnapOPC+ SnapOPC+ & REC (syn/asyn)	EC & REC (syn) EC & SnapOPC+ SnapOPC+ & REC (syn)

Overview of the replication functions for Symmetrix/VMAX3

Replication function	Symmetrix	VMAX3
Local, complete replication	TimeFinder/Clone TimeFinder/Mirror	TimeFinder/Clone ¹ TimeFinder/Mirror ¹
Local copies (snapshots)	TimeFinder/Snap	TimeFinder SnapVX
Synchronous remote replication	SRDF/S	SRDF/S
Asynchronous remote replication	SRDF/A	SRDF/A
Combinations of replication (see also chapter "Mixed forms of replication (ETERNUS DX, Symmetrix/VMAX3)" on page 235)	TimeFinder/Mirror & TimeFinder/Snap TimeFinder/Clone & TimeFinder/Snap TimeFinder & SRDF	TimeFinder SnapVX & SRDF

¹ Compatibly implemented by SHC-OSD. Emulated via TimeFinder SnapVX.

4.1 Local replication

The following functions are available for local replication:

- For ETERNUS DX, the EC (Equivalent Copy) and SnapOPC+ functions
- For Symmetrix, the TimeFinder product family
- For VMAX3 TimeFinder SnapVX

EC (Equivalent Copy)

EC creates (additional) copies of application data within a storage system. When it has been split from the original data, the copied data can then be edited separately. EC has the following properties:

- EC creates a complete copy of the data. The data is available once the initial copying of the data from the original unit to the target unit has been completed. A detailed description of this function is provided in the [chapter “Local replication with clones \(ETERNUS DX, Symmetrix/VMAX3\)” on page 97](#).
- High-performance and highly available physical copies (on clone units) of the application data
- Copies are available after the copy processes have terminated
- 100% additional requirement for disk storage capacity for each copy
- Ideal for applications with a high level of updating and for migration

SnapOPC+

SnapOPC+ creates space-saving "snapshot" copies of application data within a storage system. SnapOPC+ has the following properties:

- SnapOPC+ creates a "snapshot" of the data which is immediately available. A detailed description of this function is provided in the [chapter “Local replication with snapshots \(ETERNUS DX, Symmetrix/VMAX3\)” on page 127](#).
- Low additional requirement for disk storage capacity depending on the level of updating
- Ideal for applications with a low level of updating

The EC (Equivalent Copy) and SnapOPC+ functions can be combined. When used in combination for the same original unit, general conditions must be borne in mind, see [section “EC and SnapOPC+ \(ETERNUS DX\)” on page 244](#).

TimeFinder for Symmetrix

The TimeFinder product family from EMC creates (additional) copies of the application data within a storage system. When it has been split from the original data, the copied data can then be edited separately.

The following replication functions are available:

- TimeFinder/Clone: Directly available copy of the data, optionally implemented as a “snapshot” or as a complete copy. A detailed description of this function is provided in the [chapter “Local replication with clones \(ETERNUS DX, Symmetrix/VMAX3\)” on page 97](#).
- TimeFinder/Snap: Directly available “snapshot” of the data. A detailed description of this function is provided in the [chapter “Local replication with snapshots \(ETERNUS DX, Symmetrix/VMAX3\)” on page 127](#).
- TimeFinder/Mirror: Complete copy of the data on additional mirror units, also referred to as **Business Continuance Volume (BCV)**. A detailed description of this function is provided in the [chapter “Local replication with TimeFinder/Mirror \(Symmetrix/VMAX3\)” on page 159](#).

The TimeFinder/Clone, TimeFinder/Snap and TimeFinder/Mirror functions can be combined with each other. If they are used in combination for the same original unit, a number of constraints must be borne in mind which are explained in detail in the descriptions of the various functions. The constraints must be taken into consideration above all when restoring the original data from a snap unit or clone unit.

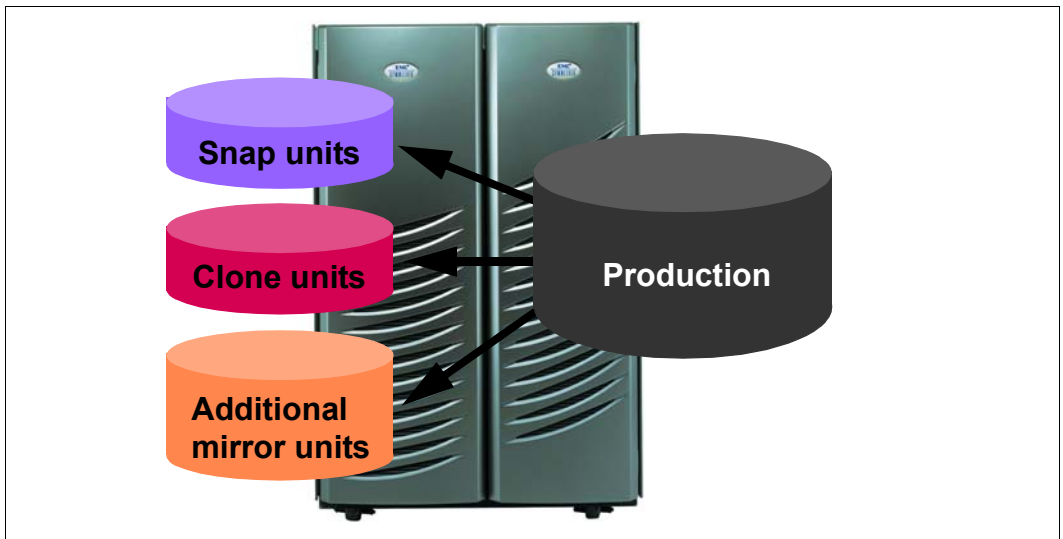


Figure 10: TimeFinder product family

TimeFinder/Clone

- High-performance logical copies of the application data
- Immediate availability of the copies
- 100% additional requirement for disk storage capacity for each copy
- High availability can optionally be achieved through complete copy
- Ideal for applications with a high level of updating and for migration

TimeFinder/Snap

- “Snapshot” copies of the application data which save disk space
- Low additional requirement for disk storage capacity depending on the level of updating
- Immediate availability of the copies
- No complete copy, consequently dependent on the availability of the original
- Ideal for applications with a low level of updating

TimeFinder/Mirror (TimeFinder on BCVs)

- High-performance and highly available physical copies of the application data
- Copies available after the copy process has terminated
- 100% additional requirement for disk storage capacity for each copy
- Ideal for applications with the highest requirements for performance and high availability

TimeFinder Snap VX for VMAX3

The TimeFinder SnapVX product from EMC creates (additional) copies of the application data within a storage system. The copied data can be used independently of the original data.

The following replication functions are available:

- TimeFinder SnapVX: immediately available "snapshots" of the data in the storage system. The snapshots are available dynamically as snap units. A detailed description of this function is provided in the [chapter "Local replication with snapshots \(ETERNUS DX, Symmetrix/VMAX3\)" on page 127](#). In SHC-OSD V12.0 this function is implemented compatibly in the existing functional scope by TimeFinder/Snap.
- TimeFinder/Clone: Directly available copy of the data, optionally implemented as a "snapshot" or as a complete copy. A detailed description of this function is provided in the [chapter "Local replication with clones \(ETERNUS DX, Symmetrix/VMAX3\)" on page 97](#). In SHC-OSD V12.0 this function is implemented compatibly. SYMAPI emulates TimeFinder/Clone using TimeFinder SnapVX.
- TimeFinder/Mirror: Complete copy of the data on additional mirror units, also referred to as **Business Continuance Volume (BCV)**. A detailed description of this function is provided in the [chapter "Local replication with TimeFinder/Mirror \(Symmetrix/VMAX3\)" on page 159](#). In SHC-OSD V12.0 this function is implemented compatibly. SYMAPI emulates TimeFinder/Mirror using TimeFinder SnapVX.

The TimeFinder SnapVX function cannot be combined with TimeFinder/Clone or TimeFinder/Mirror at volume level.

TimeFinder SnapVX

- Disk-storage-space-saving "snapshot" copies of the application data in the joint thin pool
- Emulation of the functions of TimeFinder/Clone and TimeFinder/Mirror
- No separate snap pool required
- Immediate availability and dynamic assignment of the copies
- Maximum flexibility

4.2 Remote replication

The following functions are available for local replication (also called: remote copy):

- For ETERNUS DX, the REC (Remote Equivalent Copy) functions
- For Symmetrix/VMAX3, the SRDF product family

As remote replication is operated independently of the storage system's operating system version, every application can use this function.

Remote replication enables the data which is important for business operations to be made available quickly if, for example, the local storage system or the complete local Data Center is not available because it has crashed or a disaster has occurred.

If a storage system crashes, the current data (when synchronous replication mode is used) always also exists on the remote storage system. As far as data is concerned, this means that after a failure:

- the current data does not have to be reimported
- no check is necessary to determine whether the backups are usable or consistent
- there is no need to roll back to an obsolete status

REC (Remote Equivalent Copy) for ETERNUS DX

REC creates (additional) copies of the application data of a local storage system in other remote storage systems. This makes sense in particular for high availability, disaster protection and migration scenarios.

A detailed description of this function is provided in the [chapter “Remote replication with REC \(ETERNUS DX\)” on page 177](#).

REC offers:

- Synchronous replication to one or more remote storage systems.
- Asynchronous replication between storage systems with and without guaranteed data consistency.

Remote copy configurations supported:

- Remote copy pairs (single remote copy configuration)
- Concurrent remote copy pairs (multiple simultaneous replications)
- Cascaded remote copy (multiple cascaded replications)
- Switched remote copy (SAN connection)

SRDF (Symmetrix Remote Data Facility) for Symmetrix/VMAX3

EMC's SRDF product family supports replication of data of a local storage system to one or more remote storage systems.

A detailed description of this function is provided in the [chapter “Remote replication with SRDF \(Symmetrix/VMAX3\)” on page 199](#).

SRDF offers:

- Synchronous replication to one or more remote storage systems.
This is supported in particular for disaster protection scenarios.
- Asynchronous replication between storage systems with cross-disk data consistency

Remote copy configurations supported:

- Remote copy pairs (single remote copy configuration)
- Concurrent remote copy pairs (multiple simultaneous replications)
- Cascaded remote copy (cascaded replications)
- Switched remote copy (SAN connection)

5 Local replication with clones (ETERNUS DX, Symmetrix/VMAX3)

The following functions are available for local replication with clones:

- For ETERNUS DX, the EC (Equivalent Copy) function
- For Symmetrix/VMAX3, the TimeFinder/Clone function



On VMAX3, TimeFinder/Clone is implemented compatibly by SHC-OSD in the previous functional scope with the previous interfaces. SYMAPI emulates TimeFinder/Clone using TimeFinder SnapVX. The statements in this chapter therefore also apply for VMAX3.

The functions execute in a similar manner and are controlled in BS2000 by SHC-OSD with the same commands. The functions are consequently (to some degree) presented in parallel in this chapter:

Section	Page	Relevant for
Equivalent Copy (EC, ETERNUS DX)	99	ETERNUS DX
TimeFinder/Clone (Symmetrix/VMAX3)	102	Symmetrix/VMAX3
Status of the clone session and of the devices	105	All functions and storage systems
Working with clones	108	All functions and storage systems
Utilization concepts for clones	120	All functions and storage systems
EC and REC (ETERNUS DX)	240	ETERNUS DX
TimeFinder/Clone and SRDF (Symmetrix/VMAX3)	249	Symmetrix/VMAX3

Commands for EC (ETERNUS DX) and TimeFinder/Clone (Symmetrix/VMAX3)

Command	Function	Page
ACTIVATE-CLONE	Activates a clone pair	280
RESTART-CLONE-SESSION	Re-creating a clone pair	362
RESTORE-FROM-CLONE	Reconstructs an original from a clone unit	375
SHOW-CLONE-SESSION-STATUS	Displays the status of clone pairs	418
SHOW-STORAGE-CONFIGURATION	Displays the configuration (ETERNUS DX)	499
SHOW-STORAGE-DEVICE-CONFIG	Displays the device configuration, (ETERNUS DX)	512
SHOW-SYMMETRIX-CONFIGURATION	Displays the configuration (Symmetrix/VMAX3)	526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays the device configuration, (Symmetrix/VMAX3)	537
START-CLONE-SESSION	Creates a clone pair	559
STOP-CLONE-SESSION	Cancel a clone pair	596
SWAP-CLONE-SESSION	Swaps original and clone attributes of a clone pair (ETERNUS DX)	622

The commands for the EC and TimeFinder/Clone functions control replication functions which assign one or more clone units to an original unit and manage the clone pairs (clone sessions) created. The SHOW commands display the current processing status, the status of the clone sessions and the configuration.

5.1 Equivalent Copy (EC, ETERNUS DX)

This section describes the replication function EC (Equivalent Copy) for ETERNUS DX which offers the clone functionality.

Overview

EC creates a copy of the original unit at a particular time ("Point-in-Time copy"). The copy, which is called a clone unit, is available immediately after it has been activated. However, it can only be activated after the copy operation between the original and the copy has been completed.

Together the original unit and clone unit form the clone pair which is managed by EC.



For simplicity's sake, the term unit is generally used in this manual instead of original unit. A clone pair therefore consists of a unit and a clone unit.

EC does not require any special preconfigured devices. Any units of the same size of the storage system can be used as clone units. After activation, the unit and clone unit are accessible, which enables both to be processed separately, for example by different applications. After separate processing has been completed, the copy containing the original data can be updated to restore their identical status.

Write accesses to the unit in mirrored status also take place simultaneously to the clone unit.

For the duration of initial synchronization that can have repercussions on the performance of the application which accesses data on the original unit. The clone unit (also referred to as local mirror) can only be activated when synchronization has been completed.

When replication is interrupted or after the pair has been canceled, both the unit and the clone unit can be accessed by the server.

When replication is resumed, only the modified data is copied from the unit to the clone unit.

Direct reconstruction (copying back) from a clone unit to the unit (restore) is possible.

If the copy is discarded, the clone session is terminated and the clone unit can be used freely again.

SHC-OSD offers the option of consistent generation of a pubset's clone units during ongoing operation. Stopping all inputs/outputs on all the units concerned while splitting is in progress ensures data consistency. Among other things, this can be used to create a consistent standby pubset from the home pubset.

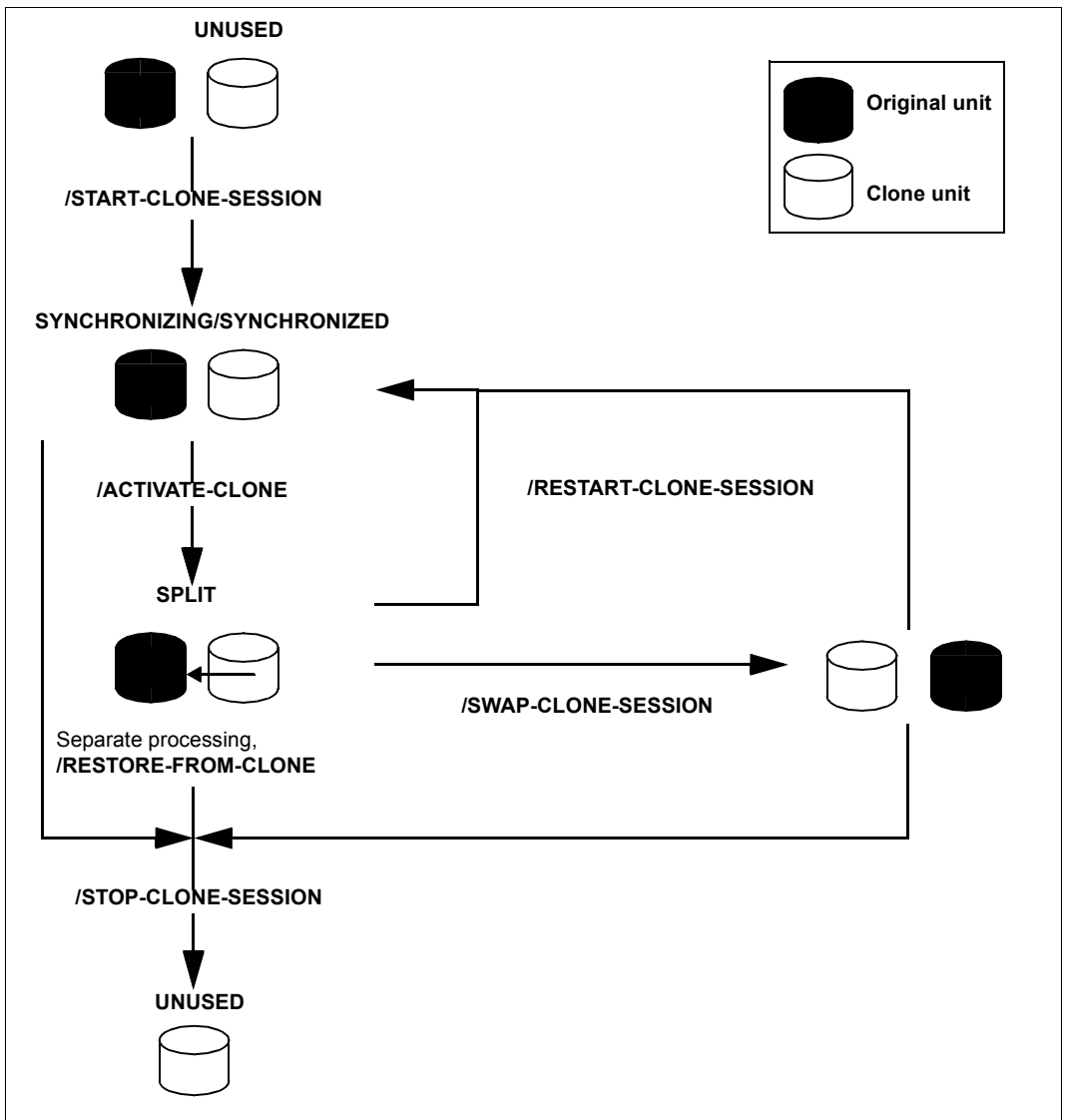


Figure 11: Equivalent Copy

Application

The clone units which are provided by EC supply copies of the productive application data. Data backups, batch evaluations and program tests can consequently be executed on the copies of the “live data”. The original data is available in parallel to the main application, and as a result the latter can remain productive longer.

The copies generated with EC can be used for data backup (e.g. with HSMS or FDDRL). Replicas of databases can be generated with clone units.

Migration

The EC function is ideally suited to migrating data. To do this, a clone session is set up between the unit with the data to be migrated and the target unit (= clone unit), if required between multiple original and multiple target units.

After the copy procedure has been completed and the clone unit has been activated, the data is available on the new clone unit. The clone session is now terminated and the clone unit can be used with the migrated data.

Device configuration

Special configuration of the devices for EC is **not** required. The ETERNUS DX devices can be mapped to BS2000 mnemonic names when at least one device is connected to the server.

Clone units in ETERNUS DX

Freely available devices can be used as clone units provided they match the devices to be copied in terms of capacity and device type (D3435 and D3475-8F). The RAID level can differ.

Like any other disk, the units used as clone units must be generated in BS2000.

At present up to 32 clone units can be configured for a unit. This maximum number is determined by the EC function and relates to the total value of EC and REC.

5.2 TimeFinder/Clone (Symmetrix/VMAX3)

This section describes the function TimeFinder/Clone of the TimeFinder product family. All products of this family enable (additional) copies of the application data to be created within a storage system.



For VMAX3, TimeFinder/Clone is implemented by SHC-OSD in the previous functional scope with the previous interfaces. SYMAPI emulates TimeFinder/Clone using TimeFinder SnapVX. The statements in this chapter therefore also apply for VMAX3.

Overview

TimeFinder/Clone creates a copy of the original unit at a particular time (“Point-in-Time copy”), either in the form of a complete copy or a “snapshot”. In both cases the copy, which is called a clone unit, is available immediately after it has been activated. You do not need to wait for the copy process between the original and the copy to be completed (as with TimeFinder/Mirror).

Together the original unit and clone unit form the clone pair. TimeFinder/Clone manages this in a clone session.



For simplicity’s sake, the term unit is generally used in this manual instead of original unit. A clone pair therefore consists of a unit and a clone unit.

TimeFinder/Clone creates a clone unit in accordance with the “Copy-On-Access strategy”: Data (more precisely: tracks) is copied to the clone unit when the data on the unit is accessed in write mode or that on the clone unit in read mode. When TimeFinder/Clone copies the unit in full, this is done in the background. TimeFinder/Clone requires no specially preconfigured devices. Any units of the Symmetrix/VMAX3 can be used as clone units.

After they are activated, the unit and clone unit are split, which enables both to be processed separately, for example by different applications.

After separate processing has been completed, either the original data or the copy can be updated to restore their identical status. If the copy is discarded, the clone session is terminated and the clone unit is released again.

TimeFinder/Clone can also be used in conjunction with SRDF for SRDF source units or SRDF target units.

SHC-OSD offers consistent generation of a pubset’s clone units during ongoing operation. Stopping all inputs/outputs on all the units concerned while splitting is in progress ensures data consistency. Among other things, this can be used to create a consistent standby pubset from the home pubset.

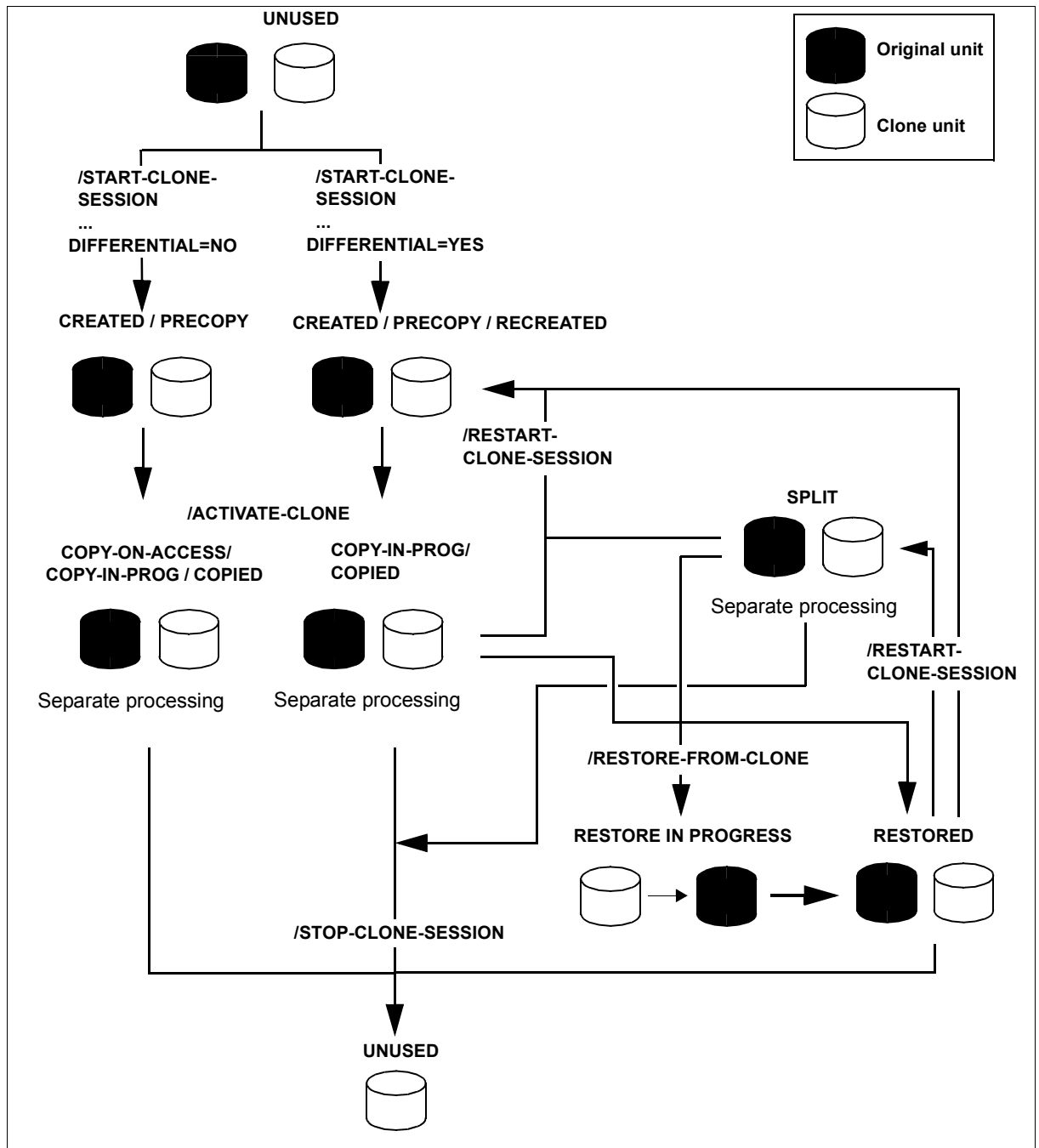


Figure 12: TimeFinder/Clone

Application

The clone units which are provided by TimeFinder/Clone and are immediately available supply copies of the productive application data. Data backups, batch evaluations and program tests can consequently be executed on the copies. The original data is available in parallel to the main application, and as a result the latter can remain productive longer.

The copies generated using TimeFinder/Clone can be used for data backup (e.g. with HSMS or FDDRL). Replicas of databases can be generated with clone units.

Migration

The TimeFinder/Clone function is ideally suited to migrating data. To do this, a clone session with a complete data copy is set up between the unit with the data to be migrated and the target unit (= clone unit), if required between multiple original and multiple target units.

After the clone unit has been activated and the copy procedure has been completed, the data is available on the new clone unit. The clone session is now terminated and the clone unit can be used directly. Further replication is possible using SRDF and/or TimeFinder.

Clone units in Symmetrix/VMAX3

TimeFinder/Clone does not require specially configured device types in the storage system. Freely available devices can be used as clone units. Meta volumes can also be used as clone units provided they match the original units in terms of stripe size and stripe count.



Clone units can have a greater capacity than the original units. This is particularly interesting for migration scenarios. The software product SPACEOPT (see the "SPACEOPT" manual [15]) enables the additional capacity to be made available for BS2000.

Like any other disk, the units used as clone units must be generated during hardware generation of the BS2000 server using IOGEN (/390 servers) or in X2000 (x86 servers).

Up to 16 clone units can be configured for a unit. This value is determined by the current storage systems, which permit a maximum of 16 copy sessions per original device. This value consists of the sum of the BCV, clone and snap sessions which are active at a given time. Clone sessions which are set up using `/START-CLONE-SESSION ... DIFFERENTIAL=YES` and the first snap session are counted twice here. All snap units for a unit are regarded as a single snap session.

5.3 Status of the clone session and of the devices

A distinction is made between unit and clone unit.

The unit is generally in the `READY` status.

The following replication options are available for the unit:

- For ETERNUS DX the unit can be mirrored by RAID, SnapOPC+ or REC.
- For Symmetrix the unit can be mirrored by RAID, TimeFinder or SRDF.
- For VMAX3 the unit can be mirrored by RAID or SRDF.

The clone unit itself can also be mirrored:

- For ETERNUS DX the clone unit can be mirrored by RAID, SnapOPC+ or REC.
- For Symmetrix/VMAX3 the clone unit can be mirrored using RAID or SRDF; further TimeFinder replication is also possible with certain constraints, but not for VMAX3.

The relevant status of the clone unit is determined by the status of the clone session.

The lifetime of a clone session extends from the time it is created (`/START-CLONE-SESSION`) to the time it is terminated (`/STOP-CLONE-SESSION`). During its lifetime, it can assume one of the following statuses:

`CREATE-IN-PROG`

TimeFinder only: the clone session is in the process of being created, i.e. the clone unit is being connected to the unit.

The clone unit is in the `NOT-READY` status.

`CREATED`

TimeFinder only: the clone session has been created, i.e. the clone unit is connected to the unit but has not yet been activated. No data is (yet) copied in the background.

The clone unit is in the `NOT-READY` status.

`COPY-ON-ACCESS`

TimeFinder only: the clone session has been activated; the unit and clone unit can be processed separately. Data is copied to the clone unit if and only if this data is accessed in write mode on the unit or in read mode on the clone unit. In other words the clone unit can only be used within the clone session.

The clone unit is in the `READY` status.

COPY-IN-PROG

TimeFinder only: the clone session has been activated; the unit and clone unit can be processed separately. All the data on the unit is copied to the clone unit in the background.

The clone unit is in the **READY** status.

COPIED

TimeFinder only: the clone session has been activated; the unit and clone unit are synchronous and can be processed separately. The clone unit is a complete copy of the unit.

The clone unit is in the **READY** status.

REST-IN-PROG

TimeFinder only: the unit is reconstructed from the clone unit; the modified data is copied in the background from the clone unit to the unit.

The clone unit is in the **READY** status. The unit is also in the **READY** status (**REST-IN-PROG** must be regarded as being the same as **COPY-IN-PROG**, just in the opposite direction).

RESTORED

TimeFinder only: the unit has been fully restored from the clone unit. This status has the effect of a lock for the restored data on the unit which ensures that the data which has been restored is not destroyed again, i.e. in the normal case the clone session can only be terminated. To enable the clone session still to be used, it must first be placed in the **SPLIT** status.

The clone unit is in the **READY** status.

RECREATED

TimeFinder only: the clone session was restarted with a clone pair with which a clone session already exists. The clone unit is therefore still connected to the unit, but has not yet been activated and has not yet been updated with the unit's data. It can be activated. The copying of modified data from the unit to the clone unit is only started when activating it.

The clone unit is in the **NOT-READY** status.

SPLIT

For TimeFinder: the unit has been completely restored from the clone unit but not locked to prevent further actions, i.e. the clone session can continue (e.g. a **/RESTART-CLONE-SESSION** is once more possible).

For EC: the clone session is split after the unit and clone unit have been full synchronized. The unit and clone unit operate separately. The clone session can be continued.

For EC: The **/RESTORE-FROM-CLONE** command was executed successfully.

The clone unit is in the **READY** status.

SYNCHRONIZING

For EC: the clone session has been configured or newly created, i.e. the clone unit is connected to the unit but has not yet been activated. The unit is copied to the clone unit in the background.

The clone unit is in the `NOT-READY` status.

SYNCHRONIZED

For EC: the clone session has been created but not activated. After the completed copy procedure the clone pair is synchronous. This status was achieved after configuration (start), or after a restart. The clone unit is in the `NOT-READY` status.

PRECOPY

TimeFinder only: the clone session has been created or restarted, i.e. the clone unit is connected to the unit, but has not yet been activated. The unit is copied to the clone unit in the background or the unit and clone unit are already synchronous.

The clone unit is in the `NOT-READY` status.

TERM-IN-PROG

The clone session is in the process of being terminated.

The clone unit is in the `READY` status.

FAILED

The clone session has become unusable. It can only be terminated using `/STOP-CLONE-SESSION`.

The clone unit is in the `NOT-READY` status.

5.4 Working with clones

SHC-OSD provides information services and commands for controlling the EC and TimeFinder/Clone functions.

When the SHC-OSD commands for pubsets, MN or VSN of BS2000 are called, SHC-OSD automatically discovers the type of storage system and maps the call to the corresponding function.

The major difference between the clone functions is that with EC clone units can only be activated after they have been synchronized with the original. The copy process is therefore always started with the `/START-CLONE` command. The clone pair must already have been copied fully and be consistent when activation takes place with the `/ACTIVATE-CLONE` command. In the case of TimeFinder/Clone, on the other hand, starting the copy process with `/START-CLONE` is only an option. It can also be started only when `/ACTIVATE-CLONE-SESSION` is issued, or not at all. (See also the difference in the statuses in [section “Status of the clone session and of the devices” on page 105.](#))

The devices which are controlled using these commands must be attached on the host. `/MODIFY-SHC-PROCESSING` also permits (not-defined) devices which are detached or are not connected directly to the host to be controlled.

Clone pairs are managed in clone sessions. Clone sessions, on the other hand, are managed on the storage system.

5.4.1 Creating clone pairs

At the start of a clone session, the `/START-CLONE-SESSION` command creates a clone pair. Before the command is executed, the clone units must be free units, i.e. they may not belong to another clone pair. After the command has been executed, they are in the `NOT-READY` status.

The clone pairs can be created during normal processing. The current VSN and the formatting of the units are irrelevant.

A distinction must be made according to whether clone units are created for the entire pubset or only for one unit or several specific units.

Entire pubset

A unit which can also be used as a clone unit must also exist for each unit of the pubset.

Create clone pairs for all units of a pubset:

```
/START-CLONE-SESSION
  UNIT=*BY-PUBSET(PUBSET=<cat-id>),CLONE-UNIT=<clone units MN list>
```

The sequence of the clone units is determined by the VSN of the pubset's disks. If, for example, the pubset ID or volume set ID is CLN, the first clone unit is assigned to the VSN CLN.00, the second to the VSN CLN.01, and so forth.

Individual units

Create a clone pair with one unit and one clone unit:

```
/START-CLONE-SESSION
  UNIT=<unit MN>,CLONE-UNIT=<clone unit MN>
```

Further sequence of operations

The copy process is always initiated for ETERNUS DX.

For Symmetrix/VMAX3, `/START-CLONE-SESSION` optionally enables a copy process to be initiated which copies the unit's data onto the clone unit. This function is selected using the `COPY-COMPLETE-DATA=*YES(START=*IMMEDIATE)` operand.

For TimeFinder/Clone, console message `NDE0060` indicates that the clone pair has been created and, if required, when the copy process was terminated that the `CREATED` status was assumed.

For ETERNUS DX no provision must be made for restarting the clone session when the clone pair is created.

For Symmetrix/VMAX3, when the clone pair is created, the `DIFFERENTIAL` operand is used to define whether reconstruction of the clone unit or a restart of the clone pair should be possible later. Only if this is explicitly requested are the differences between the original unit and the clone unit managed in the storage system.

A clone session can be terminated without the clone unit ever being activated. In this case the clone unit may possibly not contain any consistent data. In the case of EC the session can be terminated only if the clone unit is in the `SYNCHRONIZED` or `SPLIT` status.



Repeated entry of the `/START-CLONE-SESSION` command enables multiple clone sessions (multiple clone pairs) to be generated for a unit. For Symmetrix/VMAX3 this is possible only provided no earlier snap or clone session in the `RESTORED` status exists. If a snap or clone session in the `RESTORED` status does exist, it must be terminated before a new clone session is generated (`/STOP-SNAP-SESSION` or `/STOP-CLONE-SESSION`).

5.4.2 Activating clone pairs

In order to use clone units, the clone pairs must be activated in a clone session using `/ACTIVATE-CLONE`. For Symmetrix/VMAX3 the clone pair must be in the status `CREATED`, `RECREATED` or `PRECOPY`, and for ETERNUS DX in the `SYNCHRONIZED` status. For Symmetrix/VMAX3 the unit and clone unit do not need to be synchronous; activation can consequently take place immediately after the clone session has been created.

Following successful activation, the unit and the clone unit are split, i.e. both can be accessed by the host for applications. The clone unit contains all the data which was on the unit at the time the command was processed.

The clone pairs which are activated can be selected in different ways: via their `VSN`, their mnemonic name, their internal number in the storage system, or the ID of the pubset or volume set to which they belong. The most frequent method is selection via the pubset ID, which enables all clone pairs of this pubset to be activated. This method is described below.

Pubset

All clone pairs in a pubset are activated using the following command:

```
/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=<cat-id>,....),...
```

A synchronization point for the data must be created beforehand:

- suspend or terminate applications
- close all files or
- export the pubset.
Only with an exported pubset is it ensured that all data buffered using DAB will be written back from the cache (database etc.).

If you do not export the pubset, note the following:

- Write caching using DAB at server level must be terminated:
 - PFA caching: /STOP-PUBSET-CACHING
 - ADM-PFA caching: /STOP-DAB-CACHING
- If the pubset consists of more than one unit, the input and output processes should be suspended during splitting: /ACTIVATE-CLONE command with the UNIT=*BY-PUBSET and HOLD-IO=*UNTIL-ACTIVATED operands.
- During import, the split pubset on the clone units behaves as if the last export procedure had not been executed. Consequently either the message DMS038C must be answered with Y or the SESSION-CHECK-MSG=*NO operand must be specified in /IMPORT-PUBSET. The F5 labels on the disks are reconstructed from the catalog.

Files on the split pubset are in the same status as on the original pubset at the time splitting took place; they may possibly not have been closed. In this case the /REPAIR-DISK-FILES command is required if this is not executed automatically by the application (same effect as restart capability after system failure).

For details of the commands mentioned, please refer to the “Commands” manual [1].

If the split pubsets are processed in the same BS2000 session as the originals, they must be renamed. Note the following:

- The clone units must be (generated and) attached.
- SF pubsets can be renamed directly using /ACTIVATE-CLONE with the NEW-PUBSET=<new cat id> operand. The new pubset ID can also be shorter than the old pubset ID.
- IMON uses the SYS.IMON.SCI file, which contains pubset IDs. If the SCI file is located on the pubset which is split and renamed, when renaming takes place using /ACTIVATE-CLONE it must be modified manually using /MODIFY-IMON-SCI (see the “IMON” manual [11]). The PVSREN program does this automatically.
- SF pubsets can also be renamed automatically using /ACTIVATE-CLONE with the NEW-PUBSET=*SPECIAL-VSN operand in order to prevent confusion with the original. The period in a VSN is changed to a colon; in the case of single-digit catalog IDs, the “PUB” string is changed to “P:B”. Backups using the software product FDDRL are then performed using the original VSN and can be restored under the original VSN. For information on FDDRL (Fast Disk Dump and ReLoad) see the “FDDRL” manual [9].

- When HSMS (see the “HSMS” manual [10]) is used, TimeFinder/Clone only duplicates the S0 level (normal processing level) of the pubset; migrated files consequently exist once only on the tape and in the HSMS directory.

**CAUTION!**

No files may be migrated or restored on the additional mirror pubset. Otherwise data can be lost.

- Paging files are renamed automatically. If pubset IDs or VSNs have been programmed into the applications, these must be adjusted manually.

The PVSREN program can complete renaming operations performed by SHC-OSD for IMON, SYSID and the default pubset for user IDs.

- If a system is to be started from the clone unit, the `SYSID` must be changed beforehand using `/SET-PUBSET-ATTRIBUTES` (see the “Commands” manuals [1]).



A unique `SYSID` is required in MSCF environments!

If the pubset is not renamed, the clone units cannot be used in the same system because they have the same VSN. They can, however, be used by another host or a virtual machine.

Private disks

The following special aspects must be borne in mind for clone pairs on private disks:

- Private disks cannot be renamed.
- The applications must be terminated.
- The `HOLD-IO` operand is not supported.
- Private disks must be released using `/SET-DISK-PARAMETER` with the `ASSIGN-TIME=*USER` operand.

Further sequence of operations

`/UNLOCK-DISK` is executed internally for all clone units (see the “Commands” manuals [1]) provided these are attached.

Console message `NDE0060` indicates that the activation process has been completed. After the split process has been completed, the status can also be displayed using `/SHOW-CLONE-SESSION-STATUS`.

When all clone units of a pubset have been activated, the clone pubset can be imported as soon as the split process has been completed and the `COPY-ON-ACCESS`, `COPY-IN-PROG` or `COPIED` status has been assumed for Symmetrix/VMAX3 or the `SPLIT` status for ETERNUS DX. The associated MRSCAT entry is automatically created or updated.

Consistent splitting of a pubset in the shared pubset network

Requirements

- No DAB write caching may be active.
- All sharers have SHC-OSD V11.0 or higher started.
- The command is executed on the master.
- There must be MSCF connections between the master and all sharers.
- The pubset may not have the `QUIET` status.

`/ACTIVATE-SNAP` with the `UNIT=*BY-PUBSET(...,HOLD-IO=*UNTIL-ACTIVATED)` operand enables clone activation at a synchronization point during ongoing operation without exporting the pubset. Shared pubsets with multiple sharers in a CCS network can also be split consistently. This function interrupts all outputs to the pubset during splitting. It is therefore possible, for example, to create a consistent copy of the home pubset during ongoing operation and to back it up or use it in parallel as a standby pubset.



CAUTION!

`/RESUME-IO` can be used to resume suspended input/output activity for pubsets. This command is provided **for emergencies only** and if used without due care may endanger data consistency on the split clone units.

5.4.3 Re-creating a clone pair

When separate processing has been completed, the clone pair can be re-created. In this case the clone session takes the current status of the original unit as a basis and is restarted. The restart option must already be available for TimeFinder/Clone at creation time. Re-creation can be started for all clone pairs of a pubset or for individual clone pairs.

When a clone pair is re-created, all the changes on the clone units are discarded and the clone session is continued. The modified data is copied from the original units onto the clone units. For TimeFinder/Clone the copy process can optionally be started immediately or only at activation time.

Requirements

- For TimeFinder/Clone the clone session was initiated using `DIFFERENTIAL=*YES` in the `/START-CLONE-SESSION` command, and the `COPIED` status is assumed after `/ACTIVATE-CLONE`.
- For EC the clone unit is in the `SPLIT` status after `/ACTIVATE-CLONE`.
- Processing has been terminated on all clone units.
- The pubset has been exported if all clone pairs are to be re-created for a pubset.

Initiating a restart

Discard the modifications on the clone units and restart the clone session:

```
/RESTART-CLONE-SESSION
  UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) / <unit MN> /...
```

Symmetrix/VMAX3 only: when any TimeFinder/Clone session of the unit is in the `RESTORED` status, the command can only be executed for the clone unit of this session. Processing then depends on the `RESTORED-SESSION` operand:

- In the case of `RESTORED-SESSION=*REJECT` (default) the command is rejected.
- In the case of `RESTORED-SESSION=*ACCEPT` the command is executed. The clone session is switched from the `SPLIT` status to the `RECREATED` or `PRECOPY` status.
- In the case of `RESTORED-SESSION=*SPLIT-ONLY` the command is executed. The clone session is placed in the `SPLIT` status.

Further sequence of operations

Console message `NDE0060` indicates that the restart process has been completed. The TimeFinderClone pairs then have the `RECREATED` status.

The restart process has been completed for EC when the `SYNCHRONIZED` status has been achieved. The statuses of other clone units remain unchanged.

The clone units are not accessible. They can be activated using `/ACTIVATE-CLONE`.

5.4.4 Swapping the direction of local replication for clone pairs on ETERNUS DX

This function is offered only for ETERNUS DX by EC.

The original or clone unit property can be swapped for clone pairs. This swaps the direction of local replication: what were initially original units become clone units, and the clone units become the new original units.

Swapping can take place when the clone pairs are in the `SPLIT` status and after separate processing on the unit and clone unit has been concluded.

After swapping the clone pairs remain in the `SPLIT` status. The original units and clone units remain accessible.

Swapping the replication direction enables the changes made on the original clone unit to be transferred to the original unit. To do this, restart the clone session after swapping (`/RESTART-CLONE-SESSION` command).

Prerequisite

For EC Clone the clone unit is in the `SPLIT` status after `/ACTIVATE-CLONE`.

Initiating the swap

Swap the properties of the original units and the clone units:

```
/SWAP-CLONE-SESSION  
UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) / <unit MN> /...
```

The `RENAME-PUBSET` operand enables you to rename the pubsets with the new original units provided the pubsets are exported.

Further sequence of operations

Console message `NDE0061` indicates that the swap process has been completed.

The clone pairs remain in the `SPLIT` status. The statuses of other EC clone units of the unit remain unchanged.

The new clone units remain accessible. The clone session can be resumed using `/RESTART-CLONE-SESSION`.

5.4.5 Reconstructing the unit from the clone unit

The data of the original unit can be reconstructed using the data of the clone unit when all current data of the original unit is to be discarded. Reconstruction makes sense, for example, when changes are to be undone. The procedures for reconstruction are integrated into the `/RESTORE-FROM-CLONE` command in accordance with the storage system:

- For ETERNUS DX this is done internally in several steps:
 - Swap the replication direction between the original and clone units (Swap function)
 - Synchronize the original and clone units (Restart function)
 - Swap the replication direction between the original and clone units again (Swap function)
- For Symmetrix/VMAX3 the data is reconstructed directly from the clone unit (Restore function).

The next two sections below describe the reconstruction procedures.

5.4.5.1 Reconstructing the unit for ETERNUS DX

Requirements

- All clone pairs are in the `SPLIT` status.
- Processing has been terminated on the units and clone units.
- The original pubsets and clone pubset have been exported if all original units of a pubset are to be reconstructed.
- The units and clone units are in the `READY` status.

Initiating reconstruction

Copy the data to the original units:

```
/RESTORE-FROM-CLONE
  UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) / <unit MN> /
    *BY-STORAGE(SERIAL-NUMBER=<serialnumber>,
      LOGICAL-VOLUME=<logical volume number>)
```

When multiple clone sessions exist for the same original unit and are in the `SPLIT` status, the command automatically selects the first possible pair.

Further sequence of operations

During the reconstruction process the clone pairs change their status and, temporarily, the replication direction. Console message NDE0060 indicates that reconstruction is complete and that the status is once again `SPLIT`. The clone units are accessible. The clone pairs can continue to be used directly.

When the clone units of the split pubsets are renamed during activation, integrated renaming can also take place as part of `RESTORE` processing. Here the original name of the original pubser or any other name can be used. The general conditions described in [section “Activating clone pairs” on page 110](#) also apply here.

Asynchronous command processing

For `ETERNUS DX` no asynchronous command processing is possible because of the integrated process. The `WAIT=*NO` operand is not supported.

Synchronous command processing

When the `WAIT=*UNTIL-RESTORED` operand is specified in `/RESTORE-FROM-CLONE`, the command waits for the reconstruction process to terminate, i.e. until the `CLONE` pair is in the `SPLIT` status and is once again synchronous. This is the only possible command processing for `ETERNUS DX`.

Resuming the original clone replication

In another optional step the original clone replication can be resumed again. This enables the original clone pairs containing the data of the clone units to be used again.

```
/RESTART-CLONE-SESSION  
  UNIT=*BY-PUBSET(PUBSET=<orig-cat-id>) / *BY-VOLUME(<vsn>) / <unit MN> /  
  *BY-STORAGE(SERIAL-NUMBER=<serialnumber>,  
  LOGICAL-VOLUME=<logical volume number>)
```

If further clone sessions which are not in the `SPLIT` status exist for the same original unit, the command is rejected.

During the reconstruction process the clone pairs are in the `SYNCHRONIZING` status. Console message NDE0060 indicates that reconstruction is complete and that the status is `SYNCHRONIZED`. The clone units are not accessible.

5.4.5.2 Reconstructing the unit for Symmetrix/VMAX3

Reconstruction must already be available for TimeFinder/Clone at creation time.

Requirements

- For TimeFinder/Clone the clone session was initiated using `DIFFERENTIAL=*YES` and `COPY-COMPLETE-DATA=*YES` in the `/START-CLONE-SESSION` command.
- Processing has been terminated on the units and clone units.
- The original pubsets and clone pubset have been exported if all original units of a pubset are to be reconstructed.
- No snap session exists for this original unit.

Initiating reconstruction

Copy the data to the original units:

```
/RESTORE-FROM-CLONE
  UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) / <unit MN> /
    *BY-SYMMETRIX(SERIAL-NUMBER=<Symmetrix serialnumber>,
      LOGICAL-VOLUME=<logical volume number>)
```

When multiple clone sessions exist for the same original unit and all TimeFinder/Clone sessions are in the `COPIED` or `SPLIT` status, the command can be entered without any further operands.

When any TimeFinder/Clone session of the unit is in the `RESTORED` status, the command can only be executed for the clone unit of this session. Processing then depends on the `RESTORED-SESSION` operand:

- In the case of `RESTORED-SESSION=*REJECT` (default) the command is rejected.
- In the case of `RESTORED-SESSION=*ACCEPT` the command is executed. The clone session is switched from the `SPLIT` status to the `RESTORED` status.

Further sequence of operations

During the reconstruction process the clone pairs are in the `REST-IN-PROG` status. Console message `NDE0060` indicates that reconstruction is complete and that the status is `RESTORED`. The clone units are accessible.

A TimeFinder/Clone pair in the `RESTORED` status cannot be used directly and should be canceled. This is particularly true when multiple clone pairs were created for one unit or a new clone pair is to be created with the unit.

A TimeFinder/Clone session in the `RESTORED` status can, however, also be placed in another status so that the unit and clone unit can continue to be used:

- With `/RESTART-CLONE-SESSION . . . RESTORED-SESSION=*SPLIT-ONLY` the clone session is placed in the `SPLIT` status. The unit and clone unit can then be processed separately.
- With `/RESTART-CLONE-SESSION . . . RESTORED-SESSION=*ACCEPT` the clone session is placed in the `RECREATED` or `PRECOPY` status. The unit and clone unit can then be activated again.

When the clone units of the split pubsets are renamed during activation, integrated renaming can also take place as part of `RESTORE` processing. Here the original name of the original pubser or any other name can be used. The general conditions described in [section “Activating clone pairs” on page 110](#) also apply here.

Asynchronous command processing

When the `WAIT=*NO` operand is specified in `/RESTORE-FROM-CLONE`, the command does not wait for the reconstruction process to terminate.

Synchronous command processing

When the `WAIT=*UNTIL-SYNCHRONIZED` operand is specified in `/RESTART-CLONE-SESSION`, the command waits for the reconstruction process to terminate, i.e. until the clone pair is in the `RESTORED` status. In interactive mode, this wait status can be aborted by hitting the `[K2]` key.

5.4.6 Cancels a clone pair

When the assignment of one or more clone pairs is no longer required, it can be canceled using `/STOP-CLONE-SESSION` (see [page 596](#)). This command permits the first possible, a particular preceding, the oldest or all clone sessions for a unit to be canceled. Furthermore, the clone units can also be selected directly via their mnemonic device names or via the pubset ID of the split pubset.

The handling of the `VSN` on the clone unit can be controlled with the `CLONE-VSN` operand after the clone session has been terminated (prevention of ambiguous `VSNs`).

5.4.7 Displaying information on clone pairs

The `/SHOW-CLONE-SESSION-STATUS` command (see [page 418](#)) provides information on the status of clone pairs.

5.5 Utilization concepts for clones

The utilization concepts for clones described below relate to the clone functionalities of all supported storage systems. Differences in the utilization or processing of commands are pointed out. It is also pointed out when utilization scenarios are only offered for one particular function.

5.5.1 Clone unit with complete copy of the original data

If the clone unit is a complete copy of the original unit, all the data on the clone unit is available to an application. While an application is working with the data on the original unit, no other application can use the copied data on the clone unit. If more than two applications are to be able to access the data, multiple clone sessions can be set up so that each application can work with its own data.

In the BS2000 environment, the main concern is to process or save the data of a pubset. Consequently, in this section it is always assumed that complete pubsets are processed and mirrored/copied homogeneously. A copy of a pubset's data is made on the clone units which are assigned to the original units of the pubset. For simplicity's sake, the clone units of a pubset are referred to as a clone pubset.

A clone pubset made from split clone units should always be renamed.

Processing of the data by multiple applications

With this utilization it is assumed that an application processes the pubset's data on the original units. This will generally be the main application with the longest access times and the largest update volume. A separate clone session is set up for every further application which is to access the data. Before an application accesses the data, the original and clone units are synchronized.

Example

Pubset A comprises three units. In addition to the main application ("Main"), two further applications ("Save" and "Report") sporadically access the data of pubset A. Two clone sessions are started:

For EC:

```
/START-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=A),  
    CLONE-UNIT=(2000,2001,2002)
```

```
/START-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=A),  
    CLONE-UNIT=(1000,1001,1002)
```


For TimeFinder/Clone:

```
/START-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=A),
    CLONE-UNIT=(2000,2001,2002),DIFFERENTIAL=*YES,COPY-COMPLETE-DATA=*YES
```

```
/START-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=A),
    CLONE-UNIT=(1000,1001,1002),DIFFERENTIAL=*YES,COPY-COMPLETE-DATA=*YES
```

In normal operation only the “Main” application accesses the data. When the “Save” application wants to access the data, the clone units of a session are activated. The pubset is then renamed (a synchronization point should be created beforehand, see [page 110](#)):

```
/ACTIVATE-CLONE UNIT=*BY-PUBSET
    (PUBSET=A,NEW-PUBSET=B,HOLD-IO=*UNTIL-ACTIVATED),
    CLONE-UNIT=(2000,2001,2002)
```

The “Save” application can now access the data of clone pubset B directly. This data is the original data from activation time. After access has been terminated, the clone session is restarted so that the data can once more be synchronized between the original and clone units:

```
/RESTART-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=A),
    CLONE-UNIT=*BY-PUBSET(CLONE-PUBSET=B)
```

If the “Save” option is to access the data again, the `/ACTIVATE-CLONE` command is entered once more.

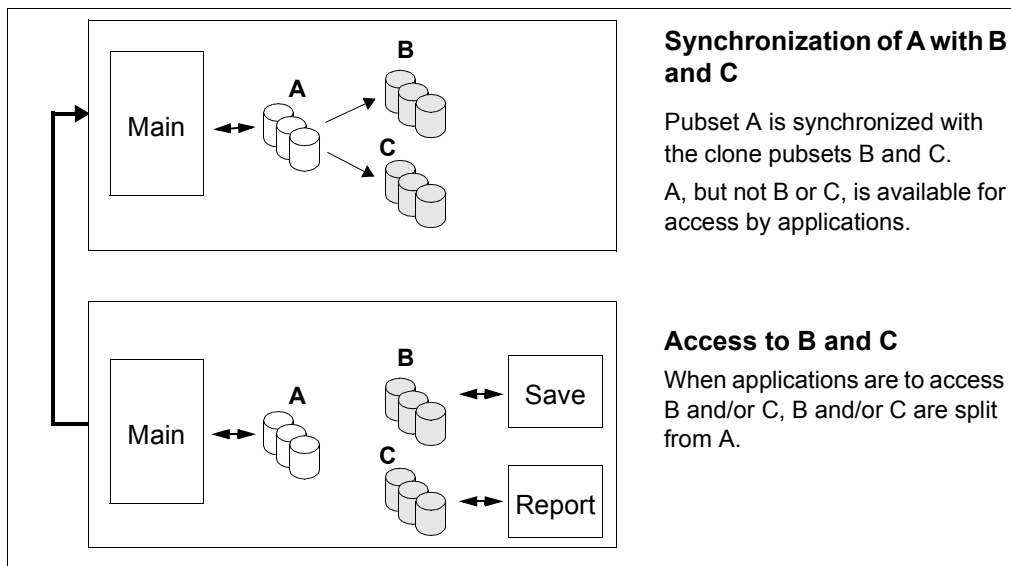
The procedure for the “Report” application is the same except that the clone pubset name here is C:

```
/ACTIVATE-CLONE UNIT=*BY-PUBSET
    (PUBSET=A,NEW-PUBSET=C,HOLD-IO=*UNTIL-ACTIVATED),
    CLONE-UNIT=(1000,1001,1002)
```

After the application has terminated:

```
/RESTART-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=A),
    CLONE-UNIT=*BY-PUBSET(CLONE-PUBSET=C)
```

The “Main”, “Save” and “Report” applications access the data relatively independently of each other. Interruptions occur only when a synchronization point is created ahead of an `/ACTIVATE-CLONE` command.



Synchronization of A with B and C

Pubset A is synchronized with the clone pubsets B and C. A, but not B or C, is available for access by applications.

Access to B and C

When applications are to access B and/or C, B and/or C are split from A.

Clone units and TimeFinder/Mirror

EC and TimeFinder/Clone can be used in the same way as TimeFinder/Mirror if the clone unit is a complete copy of the original unit.

EC offers the same utilization scenarios on ETERNUS DX as TimeFinder/Mirror does on Symmetrix/VMAX3.

TimeFinder/Clone offers more flexible functionality than TimeFinder/Mirror, in particular because the clone units can be freely selected. No specific device type which is preconfigured in the storage system is required (such as BCVs for TimeFinder/Mirror). The option of switching from TimeFinder/Mirror to TimeFinder/Clone is provided for existing applications. For this purpose the functions of TimeFinder/Mirror can be mapped onto functions of TimeFinder/Clone.

When you change storage system, the function of TimeFinder/Mirror can be mapped to EC.

The table below provides an overview of command implementation:

Commands for TimeFinder/Mirror	Commands for TimeFinder/Clone	Commands for EC Clone
START-MULTI-MIRRORING	START-CLONE-SESSION ... ,DIFFERENTIAL=*YES ,COPY-COMPLETE-DATA = *YES(START=*IMMEDIATE)	START-CLONE-SESSION
HOLD-MULTI-MIRRORING	ACTIVATE-CLONE	ACTIVATE-CLONE
RESUME-MULTI-MIRRORING ... ,RESTORE= *FROM-ORIGINAL	RESTART-CLONE-SESSION ... START-COPY=*IMMEDIATE)	RESTART-CLONE-SESSION
RESUME-MULTI-MIRRORING ... ,RESTORE=*TO-ORIGINAL ,RESTORE-DATA=*ALL-DATA	Not required	Not required
RESUME-MULTI-MIRRORING ... ,RESTORE=*TO-ORIGINAL ,RESTORE-DATA= *MODIFIED-ONLY	RESTORE-FROM-CLONE	RESTORE-FROM-CLONE or SWAP-CLONE-SESSION and RESTART-CLONE-SESSION
STOP-MULTI-MIRRORING	STOP-CLONE-SESSION	STOP-CLONE-SESSION

5.5.2 Further utilization concepts

Swap function for clone units

Clone units provide a very simple way of implementing swap functionality which can, for example, be used when migrating applications or software versions.

Swapping: for a clone session the previous clone unit is used as the original unit of the session; the previous original unit is used as the new clone unit for the session.

EC offers this function directly for ETERNUS DX. In SHC-OSD it is mapped to the `/SWAP-CLONE-SESSION` command, see [section “Swapping the direction of local replication for clone pairs on ETERNUS DX” on page 115](#).

This function is not offered directly for Symmetrix/VMAX3; it can be mapped to a sequence of the `/STOP-CLONE-SESSION` and `/START-CLONE-SESSION` commands. After a clone session has been canceled, the previous clone unit is used as the original unit of a new session; the previous original unit is used as the new clone unit for the session. Bidirectional replication is implemented for the clone pair in this way.

As a result, the new versions of an application can, for example, be tested on clone units. After a successful test the clone and original units are swapped. The application can continue to run in the new version without interruption. It is not necessary to reload the application on the original units - which would cause an interruption.

Cascaded clone configuration for ETERNUS DX

The cascaded clone function is offered for ETERNUS DX. This enables a clone unit to be used simultaneously as a unit (original) of another EC replication. This functionality is included in the clone commands. For such a unit the information function `/SHOW-CLONE-SESSION` automatically displays both clone relationships in two output lines.

Consequently, for example, consistent data can be generated periodically on clone units and also be provided and updated automatically on another clone unit. The original clone relationship is not canceled when this happens; no complex copy process is required in the storage system.

The following functions are used in SHC-OSD to support cascaded clone:

- For cascaded clone volumes, i.e. for volumes which are both original units and clone units, the `/SHOW-STORAGE-DEVICE-CONFIG` command displays a “B” for “both” in the column for clone usage.

- The `/SHOW-CLONE-SESSION` command displays two lines with the two relationships of the clone pairs for cascaded clone volumes.
- The cascaded clone functionality is included in all action commands.

Cascaded clone configuration for Symmetrix VMAX and VMAX3

The cascaded clone function is offered for Symmetrix VMAX and VMAX3. This enables a clone unit to be used simultaneously as a unit (original) of another TimeFinder/Clone replication. This functionality is included in the clone commands. For such a unit the information function `/SHOW-CLONE-SESSION` automatically displays both clone relationships in two output lines.

Consequently, for example, consistent data can be generated periodically on clone units and also be provided and updated automatically on another clone unit. The original clone relationship is not canceled when this happens; no complex copy process is required in the storage system.

The following functions of SHC-OSD are used to support cascaded TimeFinder/Clone:

- The `/SHOW-SYMMETRIX-DEVICE-CONFIG` command displays a “B” for “both” for clone usage for TimeFinder cascaded clone volumes, i.e. for volumes which are both original units and clone units, in the TimeFinder column.
- The `/SHOW-CLONE-SESSION` command displays two lines with the two relationships of the clone pairs for cascaded clone volumes.
- The cascaded clone functionality is included in all action commands.

Utilization of TimeFinder/Clone without a copy of the original units on the clone units

In this form, TimeFinder/Clone can basically be used in the same way as TimeFinder/Snap. TimeFinder/Clone is recommended when the requirements for performance and fault tolerance are greater and/or a high level of updates for the application is expected. The load on the storage system is decreased by dispensing with the copy process in the background.

Utilization of TimeFinder/Clone for TimeFinder/Mirror pairs

TimeFinder/Mirror normal units can be used additionally as original units for TimeFinder/Clone.

They can also be used as clone units for TimeFinder/Clone when the TimeFinder/Mirror pair is not involved in a copy process.

Additional mirror units (BCVs) can also be used as original units or clone units for TimeFinder/Clone when the following requirements are met:

- The TimeFinder/Mirror devices are in the `SPLIT` or `UNUSED` status.
- The TimeFinder/Mirror pair is not involved in a copy process.

6 Local replication with snapshots (ETERNUS DX, Symmetrix/VMAX3)

The following functions are available for local replication with snapshots:

- For ETERNUS DX, the SnapOPC+ function
- For Symmetrix, the TimeFinder/Snap function
- For VMAX3, the TimeFinder SnapVX function



SHC-OSD implements TimeFinder SnapVX compatibly in the previous functional scope of TimeFinder/Snap with the previous interfaces. The statements in this chapter therefore generally also apply for VMAX3.

The functions execute in a similar manner and are controlled in BS2000 by SHC-OSD with the same commands. The functions are consequently (to some degree) presented in parallel in this chapter:

Section	Page	Relevant for
SnapOPC+ (ETERNUS DX)	129	ETERNUS DX
Snap units (ETERNUS DX)	132	ETERNUS DX
TimeFinder/Snap (Symmetrix)	135	Symmetrix
Snap units (Symmetrix)	139	Symmetrix
TimeFinder SnapVX (VMAX3)	142	VMAX3
Snap units (VMAX3)	144	VMAX3
Status of the snap session and of the units	147	All functions and storage systems
Working with snap units	149	All functions and storage systems
SnapOPC+ and REC (ETERNUS DX)	245	ETERNUS DX
TimeFinder/Snap and SRDF (Symmetrix)	253	Symmetrix
TimeFinder SnapVX and SRDF (VMAX3)	256	VMAX3

Commands for SnapOPC+ (ETERNUS DX), TimeFinder/Snap (Symmetrix) and TimeFinder SnapVX (VMAX3)

Command	Function	Page
ACTIVATE-SNAP	Renames an activated snapshot pubset (ETERNUS DX, VMAX3), activates a snap pair (Symmetrix)	290
RESTART-SNAP-SESSION ¹	Re-creates a snap pair (Symmetrix)	371
RESTORE-FROM-SNAP	Reconstructs an original unit from a snap unit	384
SHOW-SNAP-SESSION-STATUS	Displays the status of snap pairs	487
SHOW-STORAGE-CONFIGURATION	Displays the configuration (ETERNUS DX)	499
SHOW-STORAGE-DEVICE-CONFIG	Displays the device configuration, (ETERNUS DX)	512
SHOW-SYMMETRIX-CONFIGURATION	Displays the configuration (Symmetrix/VMAX3)	526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays the device configuration, (Symmetrix/VMAX3)	537
START-SNAP-SESSION	Creates and activates a snap pair (ETERNUS DX, VMAX3) Creates a snap pair (Symmetrix)	587
STOP-SNAP-SESSION	Cancels a snap pair	614

¹ Not for VMAX3

The commands for these functions control replication functions which assign one or more snap units to an original unit and manage the snap pairs (snap sessions) created. The SHOW commands display the current processing status, the status of the snap sessions and the configuration.

6.1 SnapOPC+ (ETERNUS DX)

This section describes the SnapOPC+ function.

SnapOPC+ is the name of the snap function for ETERNUS DX with the option of creating and operating multiple snap sessions for one original unit.

SnapOPC+ is supported in BS2000/OSD-BC V9.0 and higher.

Overview

SnapOPC+ creates a "snapshot" of a logical unit (or of multiple logical units). The snapshot, which is called a snap unit, is a logical copy of the original unit at a particular time ("Point-in-Time copy"): while the data on the original unit can be modified, the snap unit retains the status of the data at the time the snapshot was created.

The snapshot is available immediately after creation (and implicit activation) of the snap pair, i.e. there is no copy operation. Creation of a snap unit consequently offers extremely high performance. The original and snap units together form the snap pair. SnapOPC+ manages this in what is known as a snap session. Up to 256 snap units can exist for one original unit.



In commands the `UNIT=` operand always specifies the original unit. The `SNAP-UNIT=` operand specifies the snap unit of a snap pair.

SnapOPC+ works with the "Copy-On-First-Write strategy": only if data on the original unit is modified is the original data concerned saved beforehand in the storage system. As a result, SnapOPC+ only requires little disk capacity. Nevertheless, from the user viewpoint a complete copy of the original data is always available. This copy is split from the original, thus permitting the original and the copy to be processed separately, for example by different applications.

If the capacity of the SDV has been exhausted, it is provided with further capacity from a central storage area (Snap Data Pool, SDP) of the storage system.

After separate processing of the original and snap units has been completed, the snap unit's data can be stored, discarded or reconstructed on the original units.



Multiple snap sessions of an original unit are **dependent** on each other. They can be terminated individually, beginning with the "oldest" snap session (`/STOP-SNAP-SESSION FORCE=*NO`). A "younger" snap session can also be terminated, in which case all corresponding "older" snap sessions are also terminated implicitly (`/STOP-SNAP-SESSION FORCE=*YES`).

SHC-OSD offers the option of consistent generation of a pubset's snap units during ongoing operation. Stopping all inputs/outputs on all the units concerned while splitting is in progress ensures data consistency.

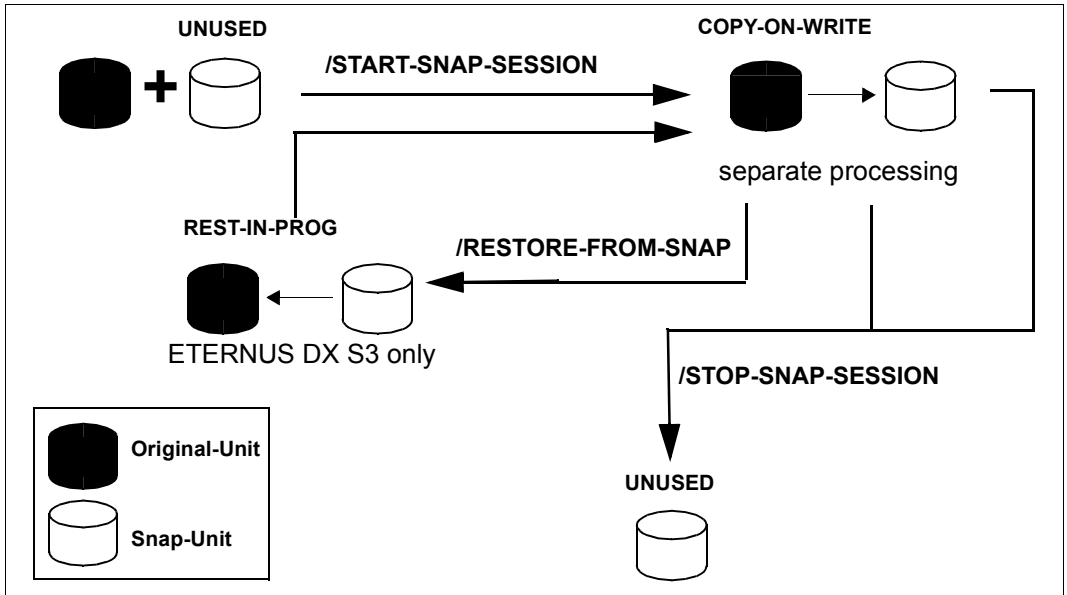


Figure 13: SnapOPC+

Application and use

The snap units which are provided by SnapOPC+ and are immediately available supply copies of the productive application data. Data backups, batch evaluations and program tests can consequently be executed on the copies of the “live data”. The original data is available in parallel to the main application, and as a result the latter can remain productive longer.

SnapOPC+ can also be used to speed up accesses when, for example, copies are provided for the accesses of multiple applications instead of the original data.

SnapOPC+ is particularly useful when (for example in the course of a day) multiple backups or copies of productive data are to be created which require a low level of updating. In this case SnapOPC+ offers a favorable alternative to clones with their complete copies (see [page 99](#)) as considerably less disk capacity is required. The figure below shows a comparison of the functions.

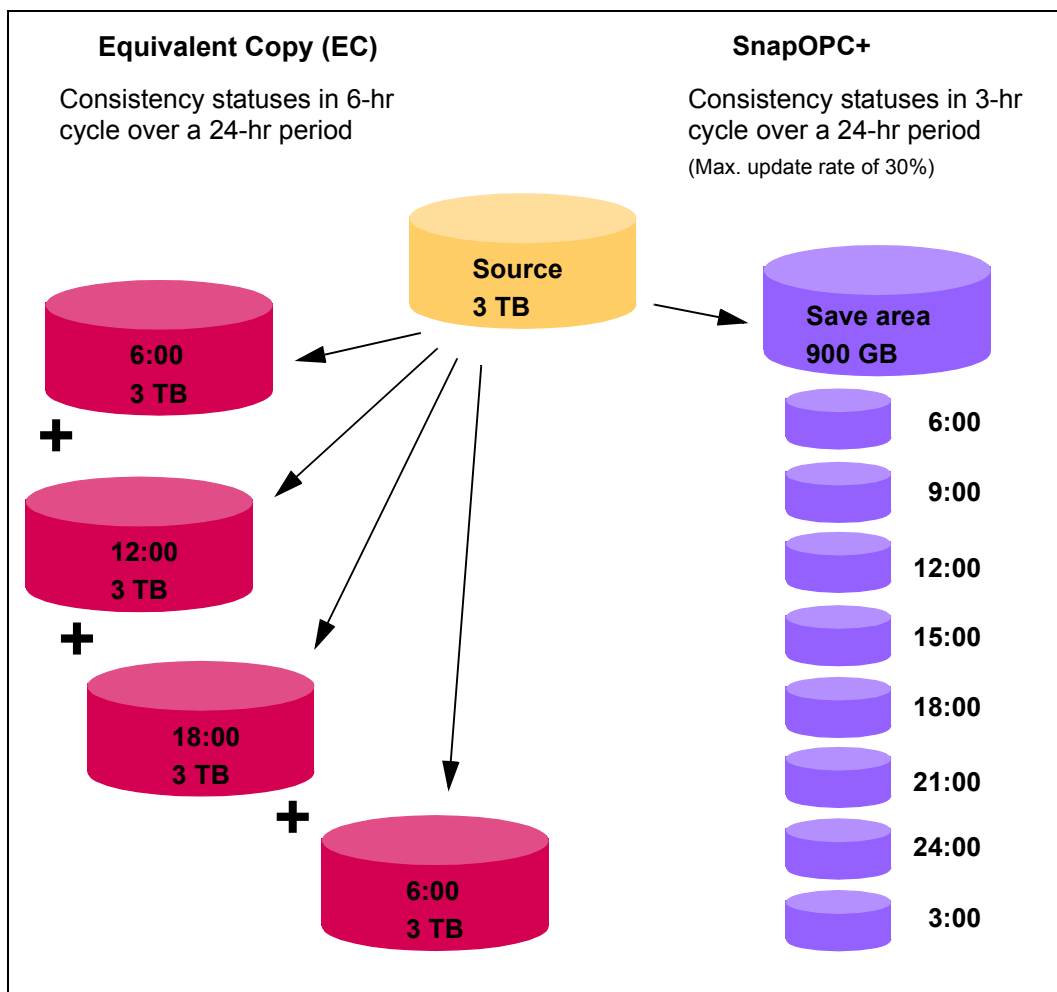


Figure 14: Comparison of the capacity requirement for periodic consistency statuses when EC/SnapOPC+ is used:

Four full copies with clone units require 12 TB of additional capacity.

Up to 15 Point-In-Time copies with snap units require only 900 GB of additional capacity.

The copies generated using SnapOPC+ can be used for data backup and for creating replicas of databases.

BS2000 offers an integrated solution for creating snap copies of pubsets. This function is used for data backup and is offered under the name Snapsets. For details, see the "Introduction to System Administration" manual [5].

6.2 Snap units (ETERNUS DX)

Snap Data Volumes (SDVs)

SnapOPC+ uses specially configured devices in the storage system, which are known as Snap Data Volumes (SDVs), as snap units. The disk type D3435 is supported in BS2000 for SDVs.

A sufficient number or size of SDV must be available.

SDVs are configured and initialized in the storage system by a qualified technician. SDVs can also be accessed from the server.

The capacity of the SDVs can be specified when they are configured. By default SDVs are configured with a capacity of 25 MB + 0.1% of the capacity of the original unit.



Recommendation

Configure the SDVs with a capacity which will presumably be required in operation. In the storage system an estimation function provides a clue here.

SDVs cannot be used as an original unit for other replication functions.

An SDV initially uses its configured capacity for data storage. If the capacity of the SDV has been exhausted, it is provided with further capacity from a central storage area (Snap Data Pool, SDP) of the storage system, see [figure 15 on page 134](#).

SHC-OSD checks the total capacity of an SDV when a snap session is created. It must be greater than or equal to the capacity of the original unit.



It is recommended that SDVs always be operated with the Snap Data Pool. Otherwise the SDV must always have sufficient capacity.

Snap Data Pool Volumes (SDPVs), Snap Data Pool Elements (SDPEs), Snap Data Pool (SDP)

If the capacity of an SDV has been exhausted, because of the "Copy-On-First-Write strategy" further changes are stored in so-called Snap Data Pool Volumes (SDPVs). SDPVs provide the SDVs with temporary storage space in the form of multiple Snap Data Pool Elements (SDPEs), see [figure 15 on page 134](#). The temporary storage space made available for an SDV can be located on more than one SDPV. It is released again when the snap session is terminated (= cancelation of the snap pair with `/STOP-SNAP-SESSION`).

SDPVs are volumes in the Snap Data Pool (SDP) of the storage system.

SDPVs are partitioned in units of 1, 2 or 4 GB, the so-called Snap Data Pool Elements (SDPEs).

SDPVs are configured and initialized in the storage system by a qualified technician. The SDP is also configured implicitly and the SDPV is assigned to the SDP.



The specifications for save pools in the SHC-OSD parameter file (`PRESELECTED-SAVE-POOL` and `SAVE-POOL-SATURATION` parameters) and in the commands `/START-SNAP-SESSION` (`SAVE-POOLS` operand) and `/MODIFY-SHC-PROCESSING` (`SNAP-SAVE-POOL-SAT` operand) have **no** meaning for ETERNUS DX .

The available capacity of the SDP is determined by the size and number of its SDPVs and is consequently limited. The required capacity must therefore be planned carefully in advance.

The required capacity depends on the following factors:

- Data volume of the applications for which snap sessions are to be generated
- Number of snap units per original unit
- Change volume on the original unit (and the associated snap units)



CAUTION!

When the SDP is full (overflow), the existing snap sessions can only be continued until the SDV's capacity limit is reached. After that they can only be terminated. The data modified on the snap units is then lost. The SHC-OSD functions for monitoring save pools should therefore be used.

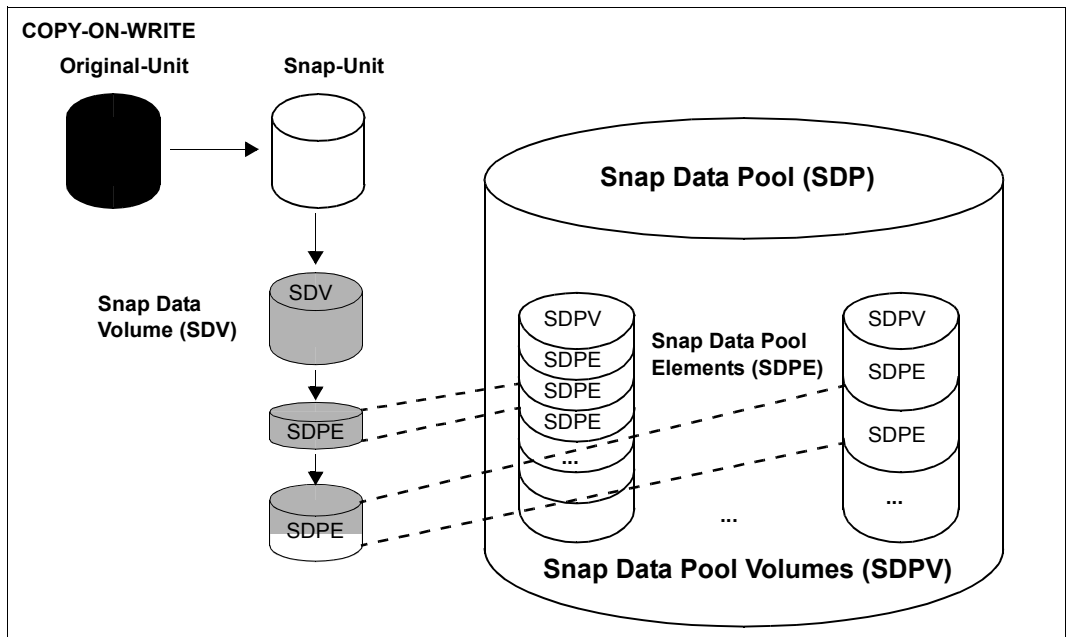


Figure 15: Concept of the Snap Data Pool (ETERNUS DX)

Areas shaded gray show the current occupancy level of SDV and SDPV.

Monitoring the SDP

SHC-OSD offers monitoring of the occupancy level of the SDP for ETERNUS DX. The `/SHOW-STORAGE-CONFIGURATION INFORMATION=*SAVE-POOLS` command (see [page 499](#)) displays information on the SDP with details of the current occupancy level and alarm status. In addition, the messages NDE0057 through NDE0059 (which you can answer) on the console show when a particular limit value for the occupancy level of the SDP has been exceeded.

The limit values for the various alarm statuses (ATTENTION, WARNING, CRITICAL) are set in the storage system and **cannot** be modified with SHC-OSD means. Default limit values: ATTENTION: 50% of the available capacity used; WARNING: 70%; CRITICAL: 99%.

When a limit value is reached, administrative intervention enables additional capacity to be provided again in the SDPI. Old snap sessions which use the SDP and whose data has been saved can be terminated (`/STOP-SNAP-SESSION`). Alternatively, the SDP can be extended in the storage system. When sufficient space is once more available in the SDP (alarm status NORMAL), this is indicated by the message NDE0053 on the console. Unanswered messages NDE0057 through NDE0059 are then answered automatically.

6.3 TimeFinder/Snap (Symmetrix)

This section describes the TimeFinder/Snap function. TimeFinder/Snap together with TimeFinder/Clone (see [page 97](#)) and TimeFinder/Mirror (see [page 159](#)) form the TimeFinder product family for Symmetrix. All products of this family enable (additional) copies of the application data to be created within a Symmetrix.

Overview

TimeFinder/Snap creates a “snapshot” of a logical unit (or of multiple logical units). The snapshot, which is called a snap unit, is a logical copy of the original unit at a particular time (“Point-in-Time copy”): while the data on the original unit can be modified, the snap unit retains the status of the data at the time the snapshot was created.

The snapshot is available immediately after it is activated, i.e. there is no copy operation as there is with TimeFinder/Mirror. Creation of a snap unit consequently offers extremely high performance. The original and snap units together form the snap pair. TimeFinder/Snap manages this in what is known as a snap session.



In commands the `UNIT=` operand always specifies the original unit. The `SNAP-UNIT=` operand specifies the snap unit of a snap pair.

TimeFinder/Snap works using the “Copy-On-First-Write strategy”: only when data on the original unit is changed is the original data concerned written into a central save pool of Symmetrix beforehand. As a result, TimeFinder/Snap only requires little disk capacity. Nevertheless, from the user viewpoint a complete copy of the original data at the time the snapshot was created is always available. This copy is split from the original, thus permitting the original and the copy to be processed separately, for example by different applications.

After separate processing of the original unit and snap unit has been completed, the snap units' data can either be discarded immediately or initially restored to the original units and then discarded.



Multiple snap sessions of an original unit are independent of each other. They can be terminated individually and in any order.

TimeFinder/Snap can also be used in conjunction with SRDF for SRDF source units or SRDF target units.

SHC-OSD offers the option of consistent generation of a pubset's snap units during ongoing operation. Stopping all inputs/outputs on all the original units concerned while splitting is in progress ensures data consistency.

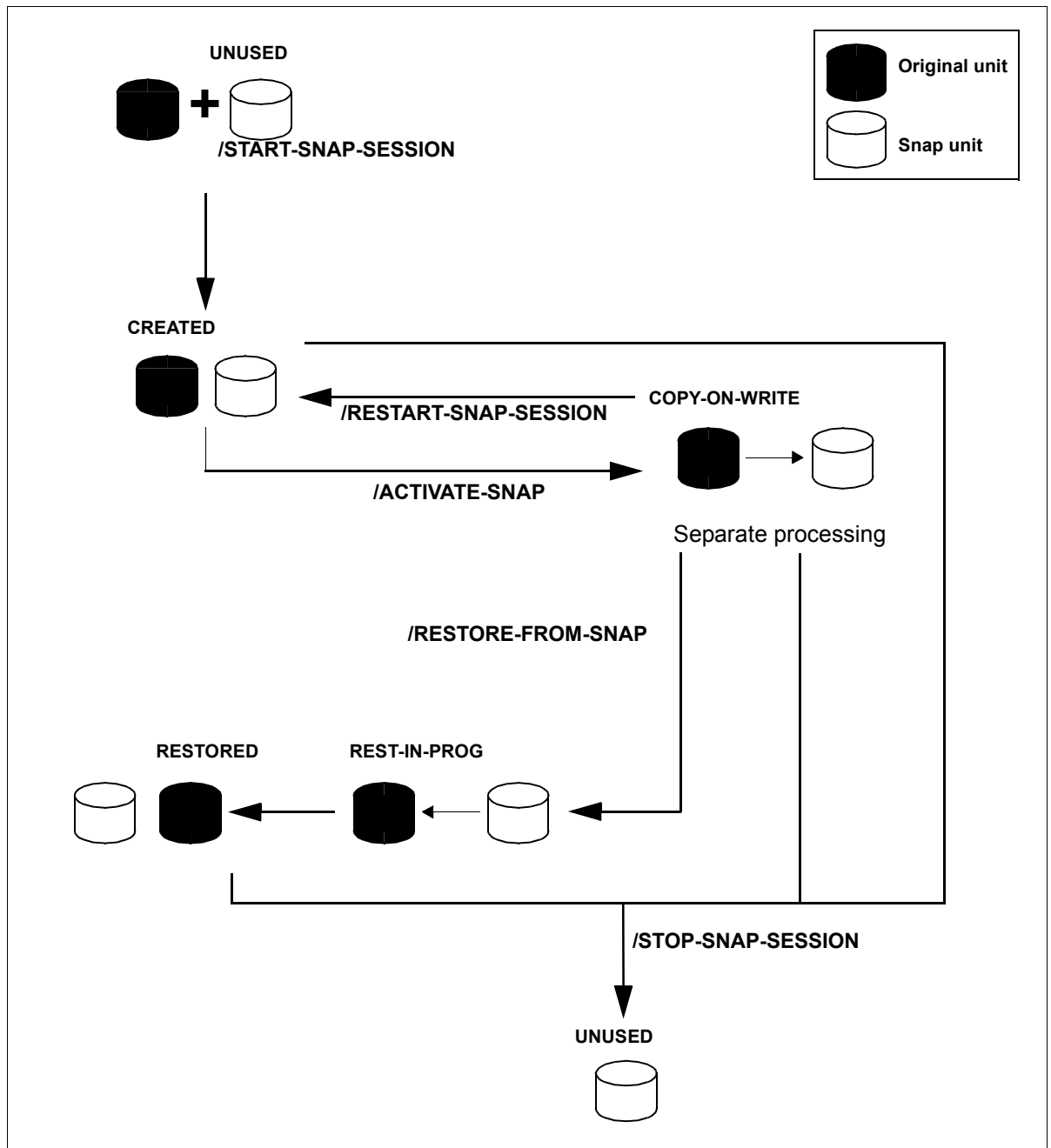


Figure 16: TimeFinder/Snap

Application and use

The snap units which are provided by TimeFinder/Snap and are immediately available supply copies of the productive application data. Data backups, batch evaluations and program tests can consequently be executed on the copies of the “live data”. The original data is available in parallel to the main application, and as a result the latter can remain productive longer.

TimeFinder/Snap can also be used to speed up accesses when, for example, copies are provided for the accesses of multiple applications instead of the original data.

TimeFinder/Snap is particularly useful when (for example in the course of a day) multiple backups or copies of productive data are to be created which require a low level of updating. In this case TimeFinder/Snap offers a favorable alternative to TimeFinder/Mirror with multi-BCVs (see [page 162](#)) or to TimeFinder/Clone with complete copies (see [page 97](#)) as considerably less disk capacity is required. The figure below shows a comparison of the TimeFinder functions.

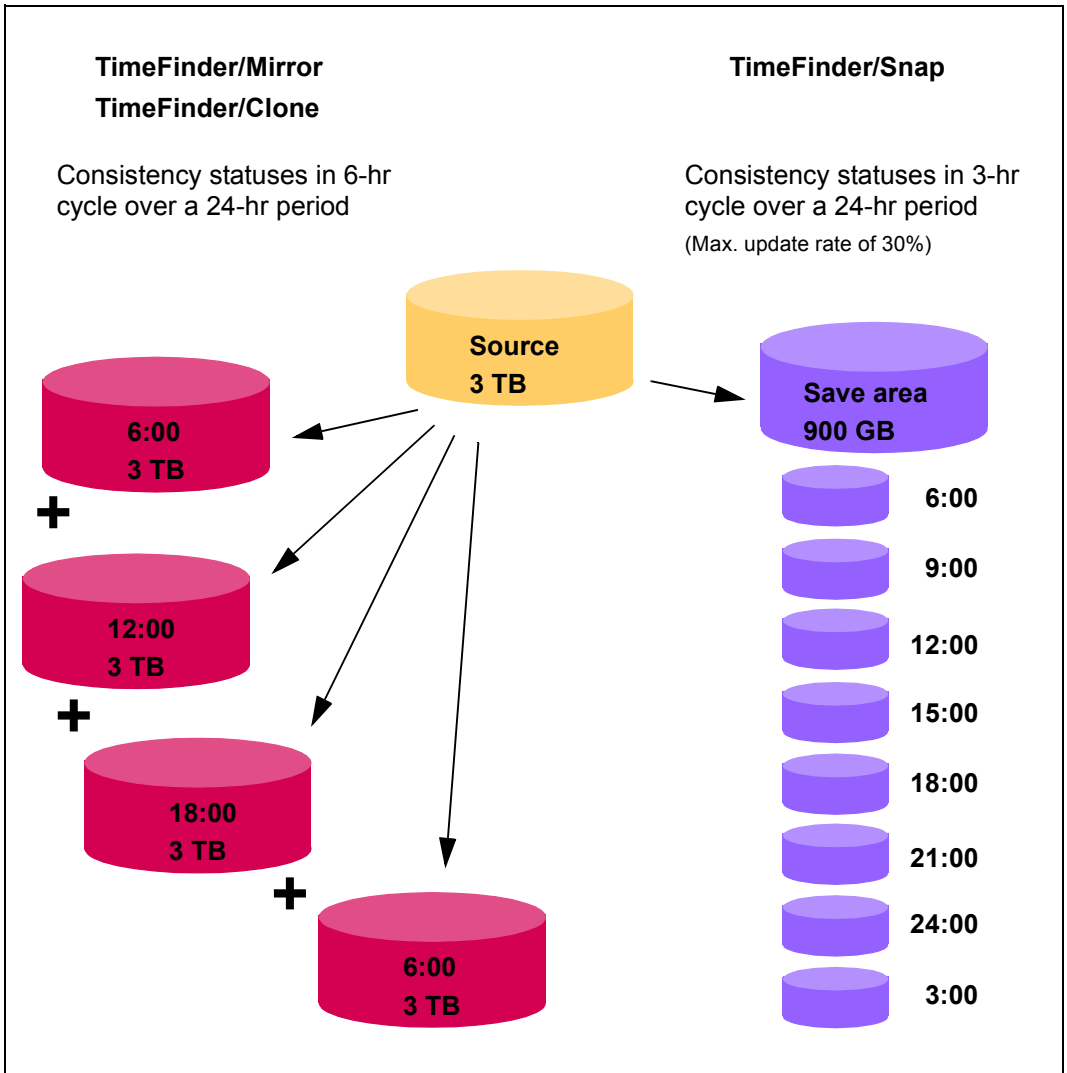


Figure 17: Comparison of the capacity requirement for periodic consistency statuses when TimeFinder is used:
 Four full copies with additional mirror units or clone units require 12 TB of additional capacity.
 Up to 15 Point-In-Time copies with snap units require only 900 GB of additional capacity.

The copies generated using TimeFinder/Snap can be used for data backup and for creating replicas of databases.

BS2000 offers an integrated solution for creating snap copies of pubsets. This function is used for data backup and is offered under the name Snapsets. For details, see the "Introduction to System Administration" manual [5].

6.4 Snap units (Symmetrix)

TimeFinder/Snap requires specially configured device types in Symmetrix, so-called virtual devices and save devices:

- If, after a snap unit has been activated, data is modified on the original unit (or on the snap unit), the original data is written to a **save device**. A group of save devices is called a **save pool**.
- The **virtual device** contains the references to the original data. The virtual device of the Symmetrix is the snap unit which can be accessed by the host.

Virtual devices

A virtual device consists of track pointers. The pointers refer to the physical devices which contain the snap session's original data. In the case of unmodified data (tracks) the pointers point to the original unit, and in the case of modified data to the save device involved. As virtual devices only contain the relevant pointers, they only occupy a minimal disk capacity.

After being assigned with `/START-SNAP-SESSION` and activated with `/ACTIVATE-SNAP`, the snap unit is immediately available to the application. All the pointers initially point to the original unit. The Copy-On-First-Write process begins: When the first write access takes place, the track concerned is copied to a free track on a save device and the pointer is switched to this.

Via the virtual device, the application which is working with a snap unit has a complete view of the data which is provided via the original unit's relevant pointers or by the save device.

The virtual devices must be configured in Symmetrix. Only these virtual devices can be used as snap units.

Virtual devices must match the original unit in terms of their configured size, emulation type (track format FBA) and, if required, meta type and meta stripe size. They must be generated during hardware generation of the BS2000 server using IOGEN (/390 servers) or in X2000 (x86 servers). For information on generation, see [section "Snap units \(Symmetrix\)" on page 142](#).

When the snap session is terminated (= cancelation of the snap pair), the pointers are deleted again and the memory area on the save device is released.

Save devices

Save devices save all original data which was modified on the original unit (and also on the snap unit) in the course of a snap session

Save devices are internal devices which are specially configured in Symmetrix by a qualified technician which provide storage space to accommodate the old contents of modified tracks. Save devices cannot be accessed by the host. You are recommended to back up save devices using RAID procedures. A sufficient number of save devices of sufficient size must be configured and enabled.

Save pools

Save devices are grouped on Symmetrix in so-called save pools. Each save pool is available in its entirety to the user for his/her snap session(s).

By default there is a default pool. In addition to the default pools, further named save pools can be configured and have save devices assigned.

A save pool is selected when a snap session is started. Via the SHC-OSD parameter file the `PRESELECTED-SAVE-POOL` operand enables a save pool name to be preset, and this name is then selected by default.

The available capacity of a save pool is determined by the size and number of its save devices and is consequently limited. The required capacity must therefore be planned carefully in advance.

The required capacity depends on the following factors:

- Data volume of the applications for which snap sessions are to be generated
- Number of snap units per original unit
- Change volume on the original unit (and the associated snap units)



CAUTION!

When a save pool is full (overflow), the existing snap sessions can no longer be continued. They can only be terminated. The data modified on the snap units is lost. The SHC-OSD functions for monitoring the save pools should therefore be used.

Setting up multiple save pools permits partitioning here, for example by having the snap sessions of different applications which operate with different pubsets assigned to different save pools. As a result, overflows of save pools only affect the snap sessions of the pools involved and consequently the application(s) operating with this pool.

Monitoring the save pools

SHC-OSD offers monitoring of the occupancy level of the save pool for Symmetrix.

The `/SHOW-SYMMETRIX-CONFIGURATION` command with the `INFORMATION=*SAVE-POOLS` operand (see [page 526](#)) provides information on the save pools, including their current occupancy levels.

In addition, the messages `NDE0055` and `NDE0056` (which you can answer) on the console show when the limit value for the occupancy level of a save pool has been exceeded.

The limit value for the occupancy level of a save pool is set in the SHC-OSD parameter file using the `SAVE-POOL-SATURATION` operand (default value: 80%). The `SNAP-SAVE-POOL-SAT` operand in the `/MODIFY-SHC-PROCESSING` command modifies the limit value during ongoing operation. The current value can be inquired with `/SHOW-SHC-PROCESSING`.

When the limit value is reached, administrative intervention enables capacity to be provided again in the save pool. Old snap sessions which use the same save pool and whose data has been saved can be terminated (`/STOP-SNAP-SESSION`). Alternately, the save pool in the Symmetrix configuration can be extended. When sufficient space is once more available in the save pool, this is indicated by the messages `NDE0051/NDE0052` on the console. Unanswered messages `NDE0055/NDE0056` are then answered automatically.

Limiting the number of snap units / snap sessions

Currently a maximum of 127 snap units can be configured for an original unit in Symmetrix.

In SHC-OSD the use of 127 snap units is preset (this can be checked with `/SHOW-SHC-PROCESSING`). If a only maximum of 15 snap units are to be supported, this must be set with `/MODIFY-SHC-PROCESSING MULTI-SNAP=*DISABLE`.

The maximum number of BCV, clone and snap session active at any one time is 16. If the system is operating with a maximum of 127 snap units, all snap units count as only one snap session. If the system is operating with a maximum of 15 snap units, the first one counts as two snap sessions and each additional snap unit as one. Clone sessions which are set up using `/START-CLONE-SESSION ... DIFFERENTIAL=*YES` and the first snap session are counted twice.

The maximum value for pubsets may be reduced when the “Snapsets” function (see the “Introduction to System Administration” manual [5]) is used because a specific number of sessions can be reserved for Snapsets.

Generating virtual devices

Virtual devices in Symmetrix (see [page 139](#)) are by default in the `NOT-READY` status and are only in the `READY` status while they are being activated as snap units and can then only be seen and accessed by the server.

All BS2000 devices which are connected over Fibre Channel to x86 servers must be configured in X2000:

On x86 servers all the BS2000 devices which are planned to be used as snap units should be generated in advance in X2000. Devices in the `READY` or `NOT-READY` status can be configured. “Overconfiguration”, i.e. configuration of BS2000 devices which are not (yet) available, is also possible.

6.5 TimeFinder SnapVX (VMAX3)

This section describes the TimeFinder SnapVX function. TimeFinder SnapVX offers a new strategy for local replication on VMAX3. On VMAX3 it replaces the previous function TimeFinder/Snap and also offers extensive functionality which goes beyond this. A detailed description is provided in the EMC documentation.



SHC-OSD currently implements TimeFinder SnapVX compatibly in the previous functional scope of TimeFinder/Snap with the previous interfaces.

Overview

TimeFinder SnapVX creates a “snapshot” of a logical unit (or of one (possibly of multiple) logical unit(s)). The snapshot is a logical copy of the original unit at a particular time (“Point-in-Time copy”): while the data on the original unit is modified, the snapshot retains the status of the data at the time the snapshot was created.

The snapshot is available immediately after creation (and implicit activation) of the snap pair, i.e. there is no copy operation. Creation of the snapshot consequently offers extremely high performance.

The snapshots can be (dynamically) assigned snap units retroactively in order to enable a server to access the snapshot's data. Multiple snap units can be assigned simultaneously to a snapshot.

The original and snap units together form the snap pair. TimeFinder SnapVX manages it in what is known as a snap session. Up to 256 snapshots can currently exist for one original unit.



In commands the `UNIT=` operand always specifies the original unit. The `SNAP-UNIT=` operand specifies the snap unit of a snap pair.

TimeFinder SnapVX works using the “Copy-On-First-Write strategy”: only when data on the original unit is changed is the original data concerned written into a central storage area beforehand. As a result, TimeFinder SnapVX only requires little disk capacity. Nevertheless, from the user viewpoint a complete copy of the original data at the time the snapshot was created is always available. This copy is split from the original, thus permitting the original and the copy to be processed separately, for example by different applications.

After separate processing of the original unit and snap unit has been completed, the snap units' data can either be discarded immediately or initially restored to the original units and then discarded.

i Multiple snap sessions of an original unit are independent of each other. They can be terminated individually and in any order.

TimeFinder/ SnapVX can also be used in conjunction with SRDF for SRDF source units or SRDF target units. TimeFinder SnapVX **cannot** be used in conjunction with TimeFinder/Clone or TimeFinder/Mirror verwendet.

SHC-OSD offers the option of consistent generation of a pubset's snap units during ongoing operation. Stopping all inputs/outputs on all the original units concerned while splitting is in progress ensures data consistency.

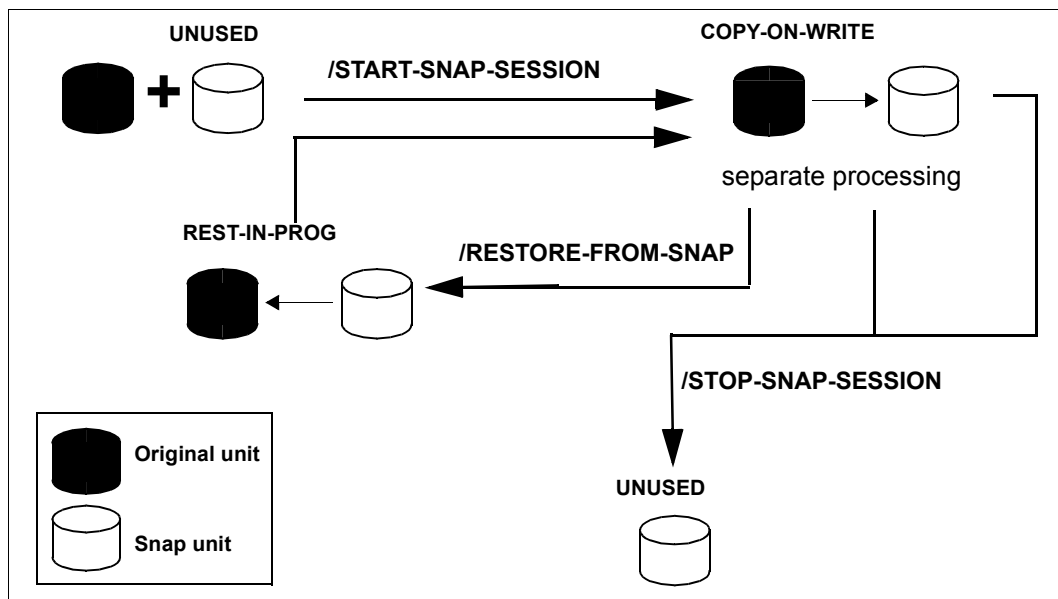


Figure 18: TimeFinder SnapVX

Application and use

The snap units which are provided with TimeFinder SnapVX and are immediately available supply copies of the productive application data. Data backups, batch evaluations and program tests can consequently be executed on the copies of the “live data”. The original data is available in parallel to the main application, and as a result the latter can remain productive longer.

TimeFinder SnapVX can also be used to speed up accesses when, for example, copies are provided for the accesses of multiple applications instead of the original data.

TimeFinder SnapVX is particularly useful when (for example in the course of a day) multiple backups or copies of productive data are to be created which require a low level of updating. See [figure 17 on page 138](#).

The copies generated using TimeFinder SnapVX can be used for data backup and for creating replicas of databases.

BS2000 offers an integrated solution for creating snap copies of pubsets. This function is used for data backup and is offered under the name Snapsets. For details, see the “Introduction to System Administration” manual [5].

6.6 Snap units (VMAX3)

Snapshots are generated in VMAX3 as internal “Point-in-Time copies.” They initially have no logical unit number (LUN). A server cannot access them directly. Snapshots are managed in VMAX3 using the unique **snapshot name**.

Random, unused volumes are used to access snapshots. These volumes are connected with the snapshot. The connection of snapshot and snap unit is dynamic, i.e. a snap unit can by turns be assigned to different snapshots. The connection can be canceled without terminating the snapshot. Up to 1024 volumes can also be connected with the snapshot.

Storage areas for the data of the snapshot are allocated from the same thin pool as for the original unit.

In SHC-OSD snapshots in the `/START-SNAP-SESSION` command are always connected with a snap unit.



Snapshots without a connection to a snap unit can be managed using the VMAX3's management software. In SHC-OSD itself, no snapshots can currently be generated without a connection to a snap unit.

No preconfigured volumes and no save pool are required for TimeFinder SnapVX.

Snapshot name

The snapshot name is assigned for a volume or pubset in the `/START-SNAP-SESSION` command, and designates the snapshot for all further actions.

The snapshot name is an alphanumeric string with at least one and at most 32 characters. The special characters "-" (hyphen) and "_" (underscore) can be specified. A distinction is made between uppercase and lowercase.

When `SNAPSHOT-NAME = *BY-RULE` is specified, SHC-OSD forms the snapshot name according to the rule: `SHC-OSD-<mn1>-<mn2>` (e.g. `SHC-OSD-4740-4762`), the following applying here:

- When a unit is specified, `<mn1>` is the mnemonic or logical unit number of the original unit, and `<mn2>` is the the mnemonic or logical unit number of the snap unit.
- When a pubset is specified, `<mn1>` is the mnemonic or pubres of the original unit, and `<mn2>` is the mnemonic of the snap unit for the pubres.

The snapshot name is output with the `/SHOW-SNAP-SESSION` command.



CAUTION!

No check is made to see whether a snapshot name applies for one or for more than one volume. Snapshots can be created for further volumes with the same name. The resulting snapshot is then possibly not consistent. The consistency must be ensured by the caller.

Snapshot generations

When further snapshots with the same name are generated for a volume or pubset, TimeFinder SnapVX manages these snapshots as new generations for the existing snapshot. Up to 255 generations are possible.



Generations can be created using the VMAX3's management software. Generations are displayed in the `/SHOW-SNAP-SESSION` command.

In SHC-OSD itself no generations can currently be displayed; generation 0 is always worked with.

Generation 0 is always created when a snapshots is created. If a snapshot with this name already exists, its existing generations are incremented by 1 (the previous generation 0 becomes generation 1, generation 1 becomes generation 2, etc.). The generations are sorted chronologically in the order in which they were created.

The latest generation (0) is always worked with. When a snapshot is terminated, generation 0 s terminated. If the terminated snapshor has further generations, its generations are decremented by 1 (the previous generation 1 becomes generation 0, generation 2 becomes generation 1, etc.).

Individual generations of a snapshot can be addressed directly via the VMAX3's management software (exception: creation of the snapshot).

Automatic selection of snap units

VMAX3 knows no special snap volumes. Basically all configured volumes can be used as snap units.

The `SNAP-UNIT = *AUTO-SELECT` operand in the `/START-SNAP-SESSION` command is used for automatic selection of suitable BS2000 volumes as snap units.

This is important in particular when using the "Snapsets" function (see the "Introduction to System Administration" manual [5]).

When BS2000 volumes are to be used automatically as snap units, they must be initialized in advance with the VOLIN utility (see the "Utility Routines" manual [8]).

The special notation `S#<mn>` is introduced as the VSN for these volumes, e.g. `S#5234`, where `<mn>` is the device mnemonic.

Such volumes prepared especially in BS2000 for the `*AUTO-SELECT` option are not displayed with the `UNUSED` status in the `/SHOW-SNAP-SESSION-STATUS` command. Selection in the `/SHOW-SYMMETRIX-DEVICE-CONFIG` command also has no effect for these volumes.

When the snap session is terminated with `/STOP-SNAP-SESSION`, the special VSN `S#<mn>` can be discarded or reconstructed with the `SNAP-UNIT=*DESTROY/*UNUSED` operand. When the special VSN is reconstructed, the volume is still included in the automatic selection.



Volumes which are configured as additional mirror units (for TimeFinder/Mirror) are also included in the automatic selection.

Limiting the number of snap units

Currently a maximum of 127 snap units can be configured for an original unit in VMAX3.

In SHC-OSD the use of 127 snap units is preset. This setting cannot be changed for TimeFinder SnapVX (`/MODIFY-SHC-PROCESSING`).

6.7 Status of the snap session and of the units

A distinction is made between original unit and snap unit.

The original unit is generally in the `READY` status. It can be mirrored by RAID, SnapOPC+, EC, REC (ETERNUS DX), TimeFinder (Symmetrix), TimeFinder SnapVX (VMAX3), or SRDF (Symmetrix/VMAX3).

The snap unit cannot be mirrored. The relevant status of the snap unit is determined by the status of the snap session.

From the SHC-OSD viewpoint the lifetime of a snap session is the lifetime of a snap pair, i.e. it extends from the time it is created (`/START-SNAP-SESSION`) to the time it is terminated (`/STOP-SNAP-SESSION`).

During its lifetime, a snap session can assume one of the following statuses:

CREATE-IN-PROG

Relevant for SnapOPC+ and TimeFinder/Snap.

The snap session (the snap pair) is currently being created (Symmetrix) or is currently being created and activated (ETERNUS DX), i.e. the snap unit is currently being connected to the original unit.

The snap unit is in the `NOT-READY` status.

CREATED

Relevant for TimeFinder/Snap.

The snap session has been created, i.e. the snap unit is connected to the original unit but has not yet been activated.

The snap unit is in the `NOT-READY` status.

COPY-ON-WRITE

Relevant for SnapOPC+, TimeFinder/Snap, and TimeFinder SnapVX.

The snap session is activated. The original unit and snap unit can be processed separately. Only the original versions of modified data are copied onto the volumes provided for this purpose.

In addition for TimeFinder SnapVX: the snap unit has a link to the snapshot. This status is also reached after the (possibly multiple) `/RESTORE-FROM-SNAP` command(s).

Changes on the snap unit are only local. The snapshot remains unchanged.

The snap unit is in the `READY` status.

COPIED

Relevant for TimeFinder/Snap.

The snap session has been activated; 100% of the snap unit data is contained on the save devices, i.e. no track pointer now points to the original.

The snap unit is in the `READY` status.

The `COPIED` status does not correspond to the normal application for snap units because the latter are envisaged for original units with only a low level of updating.

REST-IN-PROG

Not relevant for SnapOPC+ on ETERNUS DX S2

The original unit is reconstructed from the snap unit; the saved data is copied from the snap unit to the original unit.

The snap unit is in the NOT-READY status (Symmetrix).

The snap unit is in the READY status (ETERNUS DX S3 and VMAX3).

RESTORED

Relevant for TimeFinder/Snap and TimeFinder SnapVX.

The original unit has been fully reconstructed from the snap unit.

The snap unit is in the NOT-READY status.

SNAP-RESTORED

Relevant for TimeFinder SnapVX.

The original unit has been fully reconstructed from a snapshot (not from the snap unit).

Multiple reconstruction is possible. It is independent of whether the snapshot is connected with a snap unit.

The snap unit is in the NOT-READY status.

UNUSED

Relevant for SnapOPC+ and TimeFinder/Snap and TimeFinder SnapVX.

The snap unit is not connected to any original unit. It is free for a /START-SNAP-SESSION.

The special VSN $S\#\langle mn \rangle$ is output for VMAX3 (no preconfigured snap devices), see section [“Automatic selection of snap units” on page 146](#)

The snap unit is in the NOT-READY status.

TERM-IN-PROG

Relevant for TimeFinder/Snap and TimeFinder SnapVX.

The snap session is in the process of being terminated.

The snap unit is in the NOT-READY status.

FAILED

Relevant for SnapOPC+ and TimeFinder/Snap and TimeFinder SnapVX.

The snap session has become unusable (e.g. because of a save pool overflow); the data on the snap unit is lost. The session can only be terminated using /STOP-SNAP-SESSION.

The snap unit is in the NOT-READY status.

6.8 Working with snap units

SHC-OSD provides information services and commands for controlling the SnapOPC+, TimeFinder/Snap, and TimeFinder SnapVX functions. The devices which are controlled using these commands must be attached on the server.

Detached devices or those not connected directly to the server can be controlled using `/MODIFY-SHC-PROCESSING`

Snap pairs are managed in snap sessions. Snap sessions, in turn, are managed on the storage system.

6.8.1 Synchronization point for the snapshot

Before the snapshot is created, in other words before the snap session or snap pair is operated, a synchronization point must be created for the data. For this purpose the following actions must be performed before the snap pair is created (ETERNUS DX, VMAX3) or before the snap pair is activated (Symmetrix):

- suspend or terminate applications
- close all files or
- export the pubset
Only with an exported pubset is it ensured that all data buffered using DAB will be written back from the cache (database etc.).

If you do not export the pubset, note the following, see the “Commands” manuals [1]:

- Write caching using DAB at server level must be terminated:
 - PFA caching: `/STOP-PUBSET-CACHING`
 - ADM-PFA caching: `/STOP-DAB-CACHING`
- If the pubset consists of more than one original unit, input and output processes should be stopped during splitting:
The `/START-SNAP-SESSION` (ETERNUS DX, VMAX3) or `/ACTIVATE-SNAP` (Symmetrix) command, each with the `UNIT=*BY-PUBSET` and `HOLD-IO=*UNTIL-ACTIVATED` operands.
- During import, the split pubset on the snap units behaves as if the last export procedure had not been executed. Consequently either the message `DMS038C` must be answered with `Y` or the `SESSION-CHECK-MSG=*NO` operand must be specified in `/IMPORT-PUBSET`. The F5 labels on the disks are reconstructed from the catalog.

Files on the split pubset are in the same status as on the original pubset at the time splitting took place; they may possibly not have been closed. In this case the `/REPAIR-DISK-FILES` command is required if this is not executed automatically by the application (same effect as restart after system failure).

If the split pubsets are processed in the same BS2000 session as the originals, they must be renamed. Note the following:

- The snap units must be (generated and) attached.
- SF pubsets can be renamed directly using `/START-SNAP-SESSION (ETERNUS DX, VMAX3)` or `/ACTIVATE-SNAP (Symmetrix)`, each with the `NEW-PUBSET=<new-cat id>` operand. The new pubset ID can also be shorter than the old pubset ID.
- IMON uses the `SYS.IMON.SCI` file, which contains pubset IDs. If the SCI file is located on the pubset which is split and renamed, when renaming takes place using `/ACTIVATE-SNAP` it must be modified manually using `/MODIFY-IMON-SCI` (see the “IMON” manual [11]). The PVSREN program does this automatically.
- SF pubsets can also be renamed automatically with `/START-SNAP-SESSION (ETERNUS DX, VMAX3)` or `/ACTIVATE-SNAP (Symmetrix)`, each with the `NEW-PUBSET=*SPECIAL-VSN` operand, to avoid confusion with the original. The period in a VSN is changed to a colon; in the case of single-digit catalog IDs, the “PUB” string is changed to “P:B”. Backups using the software product FDDRL are then performed using the original VSN and can be restored under the original VSN. For information on FDDRL, refer to the “FDDRL” manual [9].
- When System Managed Storage and HSMS (see the “HSMS” manual [10]) are used, TimeFinder/Snap only duplicates the S0 level (normal processing level) of the pubset; migrated files consequently exist once only on the tape and in the HSMS directory.

**CAUTION!**

No files may be migrated or restored on the additional mirror pubset. Otherwise data can be lost.

- Paging files are renamed automatically. If pubset IDs or VSNs have been programmed into the applications, these must be adjusted manually. The PVSREN program can complete renaming operations performed by SHC-OSD for IMON, SYSID and the default pubset for user IDs.

If the pubset is not renamed, the snap units cannot be used in the same system because they have the same VSN. They can, however, be used by another server or a virtual machine.

Consistent splitting of a pubset in the shared pubset network

Requirements:

- No DAB write caching may be active.
- All sharers have SHC-OSD V11.0 or higher started.
- The command is executed on the master.
- There must be MSCF connections between the master and all sharers.
- The pubset may not have the `QUIET` status.

`/START-SNAP-SESSION (ETERNUS DX, VMAX3)` or `/ACTIVATE-SNAP (Symmetrix)`, each with the `UNIT=*BY-PUBSET(. . . ,HOLD-IO=*UNTIL-ACTIVATED)` operand, enables snap activation at a synchronization point during ongoing operation without exporting the pubset. Shared pubsets with multiple sharers in a CCS network can also be split consistently. This function interrupts all outputs to the pubset during splitting. It is therefore possible, for example, to create a consistent copy of the home pubset during ongoing operation and to back it up or use it in parallel as a standby pubset.

During separate processing of the snap units, actions which entail a high level of updating, such as data reorganization using `SPACEOPT`, must be avoided on the original pubset.



CAUTION!

`/RESUME-IO` can be used to resume suspended input/output activity for pubsets. This command is provided **for emergencies only** and if used without due care may endanger data consistency on the split snap units.



When an original unit is reformatted using the `VOLIN` utility routine, `VOLIN` terminates all snap sessions with this original unit following a query. Reformatting the snap unit with `VOLIN` is always rejected for `ETERNUS DX` and `Symmetrix`.

Private disks

The following special aspects must be borne in mind for snap pairs on private disks:

- Private disks cannot be renamed.
- The applications must be terminated.
- The `HOLD-IO` operand is not supported.
- Private disks must be released using `/SET-DISK-PARAMETER` with the `ASSIGN-TIME=*USER` operand.

6.8.2 Creating snap pairs

At the start of a snap session, snap pairs are created from the original units and the free snap units using the `/START-SNAP-SESSION` command. The snap units must be free. For ETERNUS DX and Symmetrix this means that they must be in the `UNUSED` status from the point of view of snap unit usage. The definitions for snap unit usage in [section “Snap units \(VMAX3\)” on page 144](#) apply for VMAX3.

The snap pairs can be created during normal processing of the original unit. Snap pairs on ETERNUS DX and VMAX3 are activated immediately when a command is executed. Snap pairs on a Symmetrix must be activated retroactively (see the next section).

A distinction must be made according to whether snap units are created for the entire pubset, only for one original unit or for more than one particular original unit.

Entire pubset

An appropriate snap unit, identified by its mnemonic name (MN), must be available for each original unit.

Create snap pairs for all original units of a pubset:

```
/START-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=<cat-id>
,SNAP-UNIT=<snap units MN list> / *AUTO-SELECT
,SAVE-POOL=*DEFAULT-POOL / <Save Pool Name> (Symmetrix)
```

The sequence of the snap units is determined by the VSN of the pubset’s disks. If, for example, the pubset ID or volume set ID is SNP, the first snap unit is assigned to the VSN SNP.00, the second to the VSN SNP.01, and so forth.

`SNAP-UNIT=*AUTO-SELECT` provides a user-friendly way of assigning suitable snap units to a pubset. Depending on the storage system, SHC-OSD automatically selects suitable snap units from the existing free snap units which are in the `UNUSED` status. In the case of automatic selection, only devices which are configured and attached in the local BS2000 are taken into consideration.

Individual original units

Create a snap pair with one original unit and one snap unit:

```
/START-SNAP-SESSION UNIT=<unit MN>
,SNAP-UNIT=<snap unit MN> / *AUTO-SELECT
,SAVE-POOL=*DEFAULT-POOL / <Save Pool Name> (Symmetrix)
```


Further sequence of operations

ETERNUS DX and VMAX3

`/UNLOCK-DISK` is executed internally for all snap units (see the “Commands” manuals [1]) provided these are attached.

Console message `NDE0050` indicates that the snap pair has been created and activated and has been assigned the `COPY-ON-WRITE` status. The status can also be displayed using `/SHOW-SNAP-SESSION-STATUS`.

`/ACTIVATE-SNAP` enables the pubset to be optionally renamed if this has not already been done with `/START-SNAP-SESSION`.

The snap pubset can be imported. The associated MRSCAT entry is automatically created or updated.

Repeated entry of the `/START-SNAP-SESSION` command enables multiple snap sessions (multiple snap pairs) to be generated for an original unit.

Symmetrix

Console message `NDE0050` indicates that the snap pair has been created and has assumed the `CREATED` status. The snap pair can then be activated using `/ACTIVATE-SNAP`.

Repeated entry of the `/START-SNAP-SESSION` command enables multiple snap sessions (multiple snap pairs) to be generated for an original unit. For Symmetrix this is possible only if no earlier snap or clone session in the `RESTORED` status exists. If such a snap or clone session in the `RESTORED` status does exist, it must be terminated before a new snap session is generated (`/STOP-SNAP-SESSION` or `/STOP-CLONE-SESSION`).

6.8.3 Activating a snap pair (Symmetrix)

In order to use snap units, the snap pairs must be activated in a snap session on Symmetrix using `/ACTIVATE-SNAP`. (Snap pairs for ETERNUS DX and VMAX3 are activated immediately after they have been created.) Activation for Symmetrix can take place after the snap session has been created provided the snap pair has the `CREATED` status.

Activation means two things:

- The Copy-On-First-Write process starts: as soon as data is modified on the original unit, the original data is written to the snap unit (to the save pool).
- The original unit and snap unit are split, i.e. both can be accessed separately by applications from the host.

The snap pairs which are activated can be selected in different ways: By means of their VSN, their mnemonic name, their internal Symmetrix number, or the ID of the pubset or volume set to which they belong. The most frequent method is selection via the pubset ID, which enables all snap pairs of this pubset to be activated. This method is described below.

Pubset

All snap pairs in a pubset are activated using the command `/ACTIVATE-SNAP UNIT=*BY-PUBSET(PUBSET=<cat-id>,...),...`

Further sequence of operations

`/UNLOCK-DISK` is executed internally for all snap units (see the “Commands” manuals [1]) provided these are attached.

Console message `NDE0050` indicates that the activation process has been completed. After the split process has been completed, the status can also be displayed using `/SHOW-SNAP-SESSION-STATUS`.

When all snap units of a pubset have been activated, the snap pubset can be imported as soon as the split process has been completed and the `COPY-ON-WRITE` or `COPIED` status has been assumed. The associated MRSCAT entry is automatically created or updated.

Sufficient space must be available for activation in the save pool, see [“Save pools” on page 140](#) and [“Monitoring the save pools” on page 141](#).

6.8.4 Restoring an original unit

Within a snap session, the original unit of a snap pair can be reconstructed by copying the data from the snap unit to the original unit. This reconstruction can be started for all snap pairs of a pubset or for individual snap pairs. Reconstruction results in all modifications which were made on the original unit after the snap unit was activated being discarded.

Requirements

- Processing on the original unit and snap unit has been terminated.
- Original pubsets and the snap pubset have been exported, provided all original units of a pubset are to be reconstructed.
- Only relevant for Symmetrix: when multiple snap sessions exist for the same original unit, all of these are in the `COPY-ON-WRITE` or `COPIED` status, i.e. no snap session for the original unit is in the `CREATED` or `RESTORED` status.
- Only relevant for Symmetrix: No clone session exists for the original unit.

Initiating reconstruction

Copy the data to the original units using the `/RESTORE-FROM-SNAP` command (see [page 384](#)):

```
/RESTORE-FROM-SNAP
  UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) / <unit MN> /...
```

Further sequence of operations

ETERNUS DX

- After reconstruction snap sessions are in the `COPY-ON-WRITE` status and accessible.
- The snap pairs can still be used. Further reconstructions can also be started.
- For ETERNUS DX S2 the reconstruction always runs asynchronously after command execution in the storage system. It cannot be monitored from the outside.
- In ETERNUS DX S3 and higher, asynchronous reconstruction after command execution or synchronous reconstruction during command execution is possible (`WAIT` operand). The snap pair is in the `REST-IN-PROG` status during synchronous reconstruction. Waiting can be aborted in dialog mode by hitting the `[K2]` key.
- The `/STOP-SNAP-SESSION` and `/START-SNAP-SESSION` commands are rejected with return code `NDE1820` while reconstruction is being performed. They can only be executed successfully after reconstruction has been completed.
- Reconstruction is not possible if the original unit is also a clone unit.

Symmetrix

- During the copy process the snap pairs are in the `REST-IN-PROG` status, and after termination in the `RESTORED` status. The message `NDE0050` indicates these statuses.
- Snap units are not accessible after reconstruction has taken place.
- A snap pair in the `RESTORED` status can no longer be used and should be canceled. This is particularly true when multiple snap pairs were created for a original unit or a new clone pair is to be created with the original unit.
- Other snap statuses can also be reconstructed.
- The `WAIT=*NO` operand in `/RESTORE-FROM-SNAP` defines that the command is not waiting for reconstruction to terminate (asynchronous command execution).
- The `WAIT=*UNTIL-RESTORED` operand in `/RESTORE-FROM-SNAP` defines that the command will wait for reconstruction to terminate (synchronous command execution), i.e. until the snap pair is in the `RESTORED` or `COPY-ON-WRITE` status. In interactive mode, the wait status can be aborted by hitting the `[K2]` key.

VMAX3

- After reconstruction snap sessions are in the `COPY-ON-WRITE` status and accessible.
- The snap pairs can still be used. Further reconstructions can also be started.
- Reconstruction itself is always executed synchronously in the `VMAX3`. It cannot be monitored from the outside.

6.8.5 Cancels a snap pair

The `/STOP-SNAP-SESSION` command (see [page 614](#)) terminates snap sessions. The snap pairs are canceled and the snap unit is discarded. The data of the snap units can then no longer be accessed. On command execution, the snap unit assumes the `UNUSED` status (not for `VMAX3`).

Snap units can also be selected directly via their mnemonic device names or via the pubset ID of the split pubset.

ETERNUS DX

If more than one snap session (snap unit) exists for an original unit, by default SnapOPC+ only enables the "oldest" snap session to be terminated, see [page 129](#).

"Younger" snap sessions can be terminated using the `FORCE=*YES` operand. In this case all other "older" snap sessions are also terminated implicitly.

The `/STOP-SNAP-SESSION` command is rejected with return code `NDE1820` while reconstruction is being performed. It can only be executed successfully after reconstruction has been completed.

Symmetrix/VMAX3

Random (the first possible, a particular preceding, the oldest) or all snap sessions for an original/unit can be canceled.

6.8.6 Displaying information on snap pairs

The `/SHOW-SNAP-SESSION-STATUS` command (see [page 487](#)) provides information on the status of snap pairs.

7 Local replication with TimeFinder/Mirror (Symmetrix/VMAX3)

This chapter describes the TimeFinder/Mirror function. Together with TimeFinder/Snap (described starting on [page 127](#)) and TimeFinder/Clone (described starting on [page 97](#)) it forms the TimeFinder product family. All products of this family enable (additional) copies of the application data to be created within a Symmetrix/VMAX3. When it has been split from the original data, the copied data can then be edited separately.



The TimeFinder/Mirror function from EMC is no longer marketed for Symmetrix VMAX and higher. The functionality is still supported, offering interface compatibility, on the basis of TimeFinder/Clone or TimeFinder SnapVX.

On VMAX3, TimeFinder/Mirror is implemented compatibly by SHC-OSD in the existing functional scope with the previous interfaces. SYMAPI emulates TimeFinder/Clone using TimeFinder SnapVX. The statements in this chapter therefore also apply for VMAX3.

Overview

TimeFinder/Mirror always copies a complete logical unit. The unit with the productive data is called a normal unit, and the unit with the copy of the data an additional mirror unit or **Business Continance Volume (BCV)**. Together with the additional mirror unit, the normal unit forms a multi-mirror pair. When a pair has been created, every change to the data is made on both units, in other words in the original data and also in the copy.

TimeFinder/Mirror can split the multi-mirror pair, which permits the original unit and the additional mirror unit to be processed separately, e.g. by different applications.

After completion of separate processing, either the original data or the copy can be updated (reconstructed) in order to synchronize the data. The copy can also be discarded. In this case the additional mirror unit can be used to mirror a different unit.

TimeFinder/Mirror can also be used in conjunction with SRDF. The additional mirror unit can be appended to the SRDF source unit or SRDF target unit.

When SHC-OSD is used, the multi-mirror pairs of a pubset can be split during current operation. Stopping all inputs/outputs on all the units concerned while splitting is in progress ensures data consistency. Among other things, this can be used to create a consistent standby pubset from the home pubset.

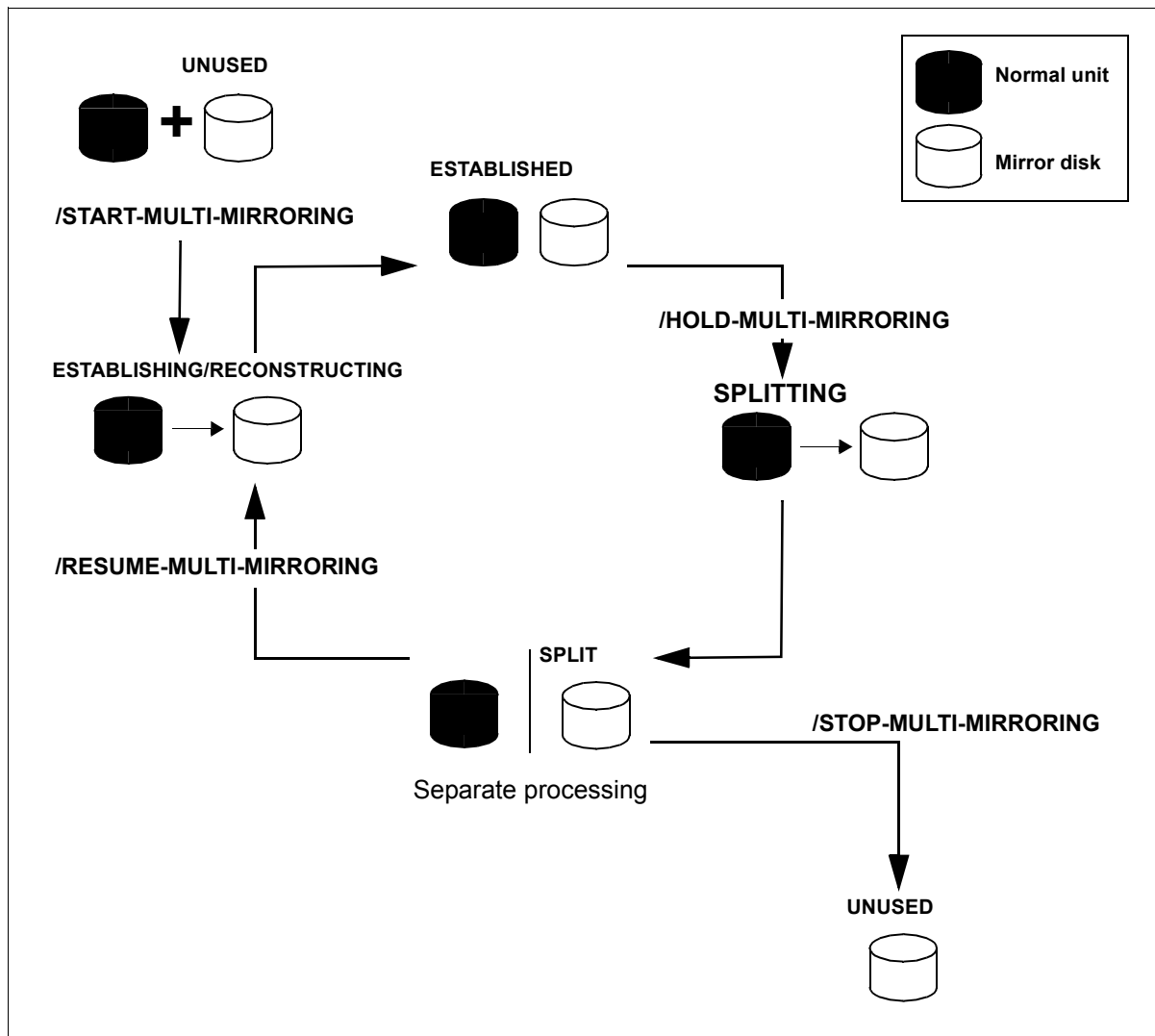


Figure 19: TimeFinder/Mirror

Application

The additional copy of the original data on the additional mirror unit enables applications to be productive for longer.

While the original data is available for the main application, backup and batch evaluations (which normally require the application to be terminated/interrupted) can now be executed in parallel on the copy. In other words a copy of the application's "live data" can be created in order to test program modifications without restricting the availability of the main application (see [figure 20](#)).

The HSMS software product in conjunction with the CCOPY function can also use the TimeFinder/Mirror function for data backup. Data is backed up from the split additional mirror units. When backup has been completed, the multi-mirror pairs are reconstructed automatically. If an error occurs, backup can be repeated to the status of the additional mirror unit.

In the HSMS statement `//BACKUP-FILES` the `CONCURRENT-COPY=*YES(WORK-FILE-NAME=*BY-ADDITIONAL-UNIT)` operand must be specified. This form of embedding enables TimeFinder/Mirror to be used transparently to back up SF and SM pubsets.

The TimeFinder/Mirror function is also supported when saving database systems (e.g. SESAM/SQL Server, refer also to the "SESAM/SQL Server" manual [12]).

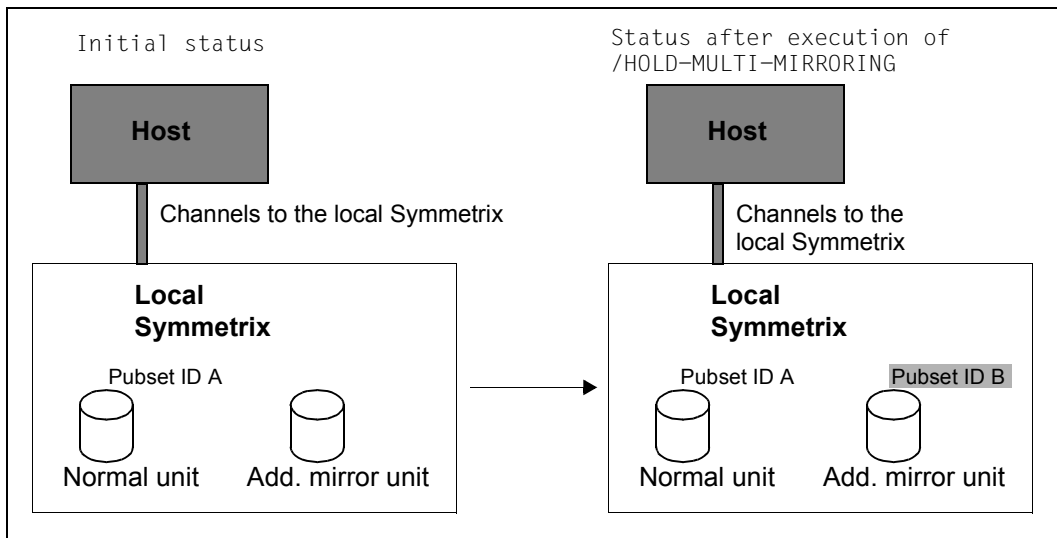


Figure 20: Effect of the `/HOLD-MULTI-MIRRORING PUBSET=A,NEW-PUBSET=B` command

Migration

The TimeFinder/Mirror function can also be used for data migration from one unit to another. For this purpose an additional mirror unit is assigned to the unit with the data to be migrated. Following synchronization, the additional mirror unit can be split using `/HOLD-MULTI-MIRRORING` and assigned to another normal unit with `/START-MULTI-MIRRORING` command. `RESTORE=*TO-ORIGINAL` copies the data from the additional mirror unit to the new normal unit which then also contains the migrated data.

When copying has been completed, the additional mirror unit can be split off again using `/HOLD-MULTI-MIRRORING`; it is then available for other tasks.

Multi BCV (multi additional mirror units)

TimeFinder/Mirror offers the multi BCV function as standard. In the storage system, this function manages all assignments and change information of a normal unit for up to 16 additional mirror units.

This maximum number is determined by the current storage systems, which at present are limited to a maximum of 16 copy sessions per original device. This value consists of the sum of the BCV, clone and snap sessions which are active at a given time. Clone sessions which are set up using `/START-CLONE-SESSION ... DIFFERENTIAL=YES` and the first snap session are counted twice here.

The maximum number of additional mirror units that may be assigned is limited by a global setting. This setting is preset with up to 8 additional mirror units and can be changed using `/MODIFY-SHC-PROCESSING MAX-MULTI-BCV=<1 .. 16>`.

Its current value can be displayed using `/SHOW-SHC-PROCESSING`.

Concurrent BCV

TimeFinder/Mirror features the concurrent BCV function as standard. This function can be used in combination with the multi BCV function. A normal unit can have up to two established additional mirror units at the same time. In the storage system it is then possible to keep a maximum of two additional mirror units synchronized with a normal unit.

Requirements

One or more additional mirror units must be configured in the storage system (interruption-free installation is possible).

Service must configure additional mirror units on physical drives on the same storage system. The additional mirror units must be of the same disk type and have the same capacity as the normal units to which they are assigned. The additional mirror units, like every other disk, must be defined in the files with the I/O configuration data when hardware generation takes place (in BS2000 or X2000).

Only when a total of four internal physical disks are already in use for a logical disk (in other words, the unit itself and a further three physical mirrors, e.g. concurrent SRDF and RAID1) is it not possible to configure a multi-mirror pair. If multiple BCVs are used with the multi BCV and concurrent BCV functions, they count as one internal physical disk. The maximum of 16 BCVs are managed separately in the storage system.

Commands for TimeFinder/Mirror (Symmetrix/VMAX3)

Command	Function	Page
HOLD-MULTI-MIRRORING	Splits a multi-mirror pair	306
RESUME-IO	Resume input/output activity for pubsets	393
RESUME-MULTI-MIRRORING	Reconstructs a multi-mirror pair	395
SHOW-MULTI-MIRRORING-STATUS	Displays the status of multi-mirror pairs	429
SHOW-SYMMETRIX-CONFIGURATION	Displays the configuration	526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays the device configuration,	537
START-MULTI-MIRRORING	Creates a multi-mirror pair	568
STOP-MULTI-MIRRORING	Cancel a multi-mirror pair	603
UNLOCK-SYMMETRIX-DEVICE	Lifts device locks	635

The commands for controlling the TimeFinder/Mirror functions are used to create and split multi-mirror pairs and to reconstruct split multi-mirror pairs. The SHOW commands display the current processing status, the status of the multi-mirror pairs and the configuration.

7.1 Device status

A distinction is made between a normal unit and an additional mirror unit.

A normal unit contains the original data and is protected by RAID or SRDF.

An additional mirror unit is used to keep a separable copy of the data on the normal units. If necessary, the copy can also be protected by RAID1, RAID5, RAID6 or SRDF.

The additional mirror unit can assume one of the following statuses:

UNUSED

The additional mirror unit is not connected to any normal unit. SHC-OSD then also shows that the unit is `UNUSED`

- its status is `SPLIT` and the associated normal unit is used in another multi-mirror pair
or
- its assignment is cancelled with `/STOP-MULTI-MIRRORING`



CAUTION!

The additional mirror unit can be used by the host but all data on the unit is lost if its state is changed to `ESTABLISHED`.

UNUSED-LOCKED

Corresponds to `UNUSED`.

A `/RESUME-MULTI-MIRRORING` or `/START-MULTI-MIRRORING` command without the `UNLOCK-ADD-MIRROR=*YES` operand is rejected. This protects the additional mirror unit against "inadvertent" activation of TimeFinder/Mirror mode. This status is not supported for additional mirror units protected with RAID5 or RAID6.

ESTABLISHING

The additional mirror unit is connected to a normal unit but the copy operation is not yet complete. The unit is not available to the host. When copying is complete, the status is set to `ESTABLISHED`.

ESTABLISHED

The additional mirror unit is synchronous with the normal unit. All writes on the normal unit are also executed on the additional mirror unit. The additional mirror unit is not directly available to the host. The additional mirror unit can be split at any time when it has this status.

SPLITTING

Splitting is not yet complete. Writes are executed on the normal unit only and are noted on the normal unit as pending writes for the additional mirror unit. The additional mirror unit is not available to the host. When splitting is complete, the status changes to `SPLIT`.

SPLIT

The additional mirror unit is available to the host. It can be read and updated. All writes for the additional mirror unit and normal unit are noted on each as pending writes for the other unit. The normal unit and additional mirror unit are processed separately in this status.

SPLIT-BACKG

Splitting has been started but is not yet complete. All writes for the additional mirror unit and normal unit are noted on each as pending writes for the other unit. In this transitional status, the additional mirror unit is already available for use with the optimized "Instant Split" function. However, it is not possible to start TimeFinder/Mirror mode with a new normal unit.

SPLIT-LOCKED

Corresponds to SPLIT.

A `/RESUME-MULTI-MIRRORING` or `/START-MULTI-MIRRORING` command without the `UNLOCK-ADD-MIRROR=*YES` operand is rejected; the additional mirror unit is locked against "inadvertent" resumption of TimeFinder/Mirror mode. This ensures that the additional mirror unit is available for separate processing (on a long-term basis). This status is not supported for additional mirror units protected with RAID5 or RAID6 or Symmetrix VMAX or higher.

SPLIT-LOCKED-B

Corresponds to SPLIT-BACKG as a transitional status after SPLIT-LOCKED.

Splitting has been started but is not yet complete. The additional mirror unit is protected against inadvertent overwriting and cannot be accessed by the host. This status is not supported for additional mirror units protected with RAID5 or RAID6.

RECONSTRUCTING

The additional mirror unit is not available to the host. The normal unit is reconstructed by the additional mirror unit. When reconstruction is complete, the status is reset to ESTABLISHED.

7.2 Working with TimeFinder/Mirror

The SHC-OSD subsystem provides information services and commands for controlling the TimeFinder/Mirror function. The devices which are controlled using these commands must be attached on the host.

Detached devices or those not connected directly to the host can be controlled using
/MODIFY-SHC-PROCESSING

7.2.1 Creates a multi-mirror pair

The current VSN and the formatting of the additional mirror units are not relevant.

A distinction must be made between creating additional mirror units for the entire pubset or for one or more specific normal units only.

Entire pubset

An additional mirror unit must be available for each normal unit of the pubset.

Creating one or more multi-mirror pairs

```
/START-MULTI-MIRRORING
  PUBSET=<cat-id>
  ,ADDITIONAL-MIRROR-UNIT=<Additional-Mirror-Units MN list>
```

The order of the additional mirror units is determined by the archive number (VSN) of the disks of the pubset. If the pubset ID or volume set ID is MMF, the first additional mirror unit will be assigned the VSN MMF.00, the second the VSN MMF.01, and so on.

Individual units

Alternatively, an additional mirror unit can be assigned to each normal unit.

Creates a multi-mirror pair

```
/START-MULTI-MIRRORING
  NORMAL-UNIT=<normal unit MN>
  ,ADDITIONAL-MIRROR-UNIT=<Additional-Mirror-Units MN list>
```

The multi-mirror pairs can be created during normal processing. The copy process may cause a slight loss of performance.

It is also possible to specify /START-MULTI-MIRRORING when the additional mirror unit is linked with another normal unit. However, the unit must then have the SPLIT or SPLIT-LOCKED status.

Further sequence of operations

When the `/START-MULTI-MIRRORING` command is executed, the data of the normal unit is copied to the additional mirror unit in the storage system. In other words, the multi-mirror pair is created.

The console message `NDE0030` indicates that copying is complete and that the status is `ESTABLISHED`. On completion of copying, the `/SHOW-MULTI-MIRRORING-STATUS` command displays the `ESTABLISHED` status.

Asynchronous command processing

`/START-MULTI-MIRRORING` with the `WAIT=*NO` operand instructs the command not to wait until synchronization is complete.

The process can be monitored using the following commands:

```
/SHOW-MULTI-MIRRORING-STATUS  PUBSET=<cat-id>  
/SHOW-MULTI-MIRRORING-STATUS  UNIT=<normal units MN list>
```

Synchronous command processing

`/START-MULTI-MIRRORING` with the `WAIT=*UNTIL-SYNCHRONIZATION` operand instructs the command to wait until synchronization is complete, i.e. it waits until the multi-mirror pair is `ESTABLISHED`. In dialog mode, waiting can be terminated by hitting the `[K2]` key.

Multi BCV and concurrent BCV

The modifications to a normal unit compared to all assigned additional mirror units which are in the `SPLIT` or `SPLIT-LOCKED` status are stored in the storage system. If an additional mirror unit is reassigned to the normal unit, only those changes made in the meantime need to be copied.

Concurrent BCV pairs can be generated with the same normal unit by two successive `/START-MULTI-MIRRORING` commands.

With multi BCV, it is possible to generate concurrent BCV pairs using the `/RESUME-MULTI-MIRRORING` command. However, the maximum number of BCVs that can be established is two; all further BCVs assigned are in the `SPLIT` status.

As a result, the concurrent BCV function can also be regarded as a special case of multi BCV but with two BCVs with the `ESTABLISHED` status at the same time.

Note the following when creating pairs:

- No more than one of all currently assigned additional mirror units may have the `ESTABLISHED` status. All further assigned additional mirror units must have the `SPLIT` status. Otherwise, the command is rejected with message `NDE1180` because no more than two BCVs may be established.
- Multi BCVs are always generated automatically.
- If the maximum number of additional mirror units set for each normal unit is exceeded in the `/START-MULTI-MIRRORING` command because, for example, different additional mirror units have been assigned, the message `NDE1051` is output. The additional mirror units which are no longer required must be cancelled with `/STOP-MULTI-MIRRORING`.
- No more than two additional mirror units may have the `ESTABLISHED` status at any one time; the rest are split from the normal unit and have the `SPLIT` status (see [figure 21](#)).

Further information on concurrent BCV and multi BCV is provided in the manuals of EMC, see the corresponding notes in [section “Symmetrix/VMAX3” on page 24](#).

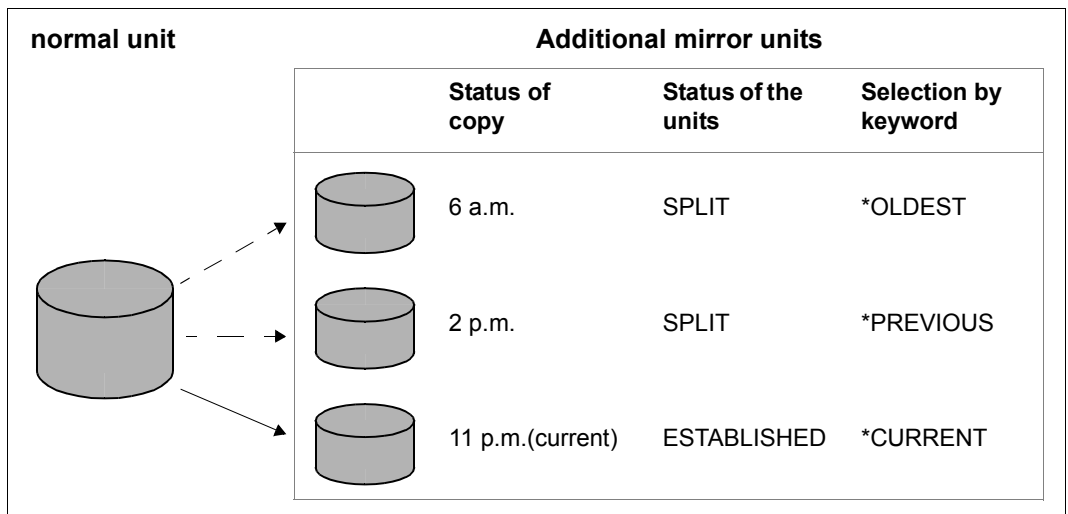


Figure 21: Example of multi BCV usage



Note on performance: If possible, the normal unit and the additional mirror unit should not be located on the same physical disks. To achieve optimum synchronization times, it is also better if they are connected to different disk adapters (DAs). The disk adapters should have either an even or odd adapter number.

7.2.2 Splits a multi-mirror pair

The multi-mirror pairs which are split can be selected in various ways: using their VSN, their mnemonic name, their internal number in the storage system, or the ID of the pubset or volume set to which they belong. The method used most frequently is selection by means of the pubset ID, which ensures that all pairs in the pubset concerned are split. This method is described below.

Pubset

1. Begin by checking whether all multi-mirror pairs of the pubset are synchronized.
`/SHOW-MULTI-MIRRORING-STATUS` must display the `ESTABLISHED` status and not `ESTABLISHING` or `RECONSTRUCTING`.
2. A synchronization point for the data must then be generated:
 - suspend or terminate applications
 - close all files or
 - export the pubset
Only with an exported pubset is it ensured that all data buffered using DAB will be written back from the cache (database etc.).



You are advised to export the pubset even though the `/HOLD-MULTI-MIRRORING` command does not require you to do so.

If you do not export the pubset, note the following:

- Write caching using DAB on the server level must be terminated. With PFA caching, you must issue `/STOP-PUBSET-CACHING`; with ADM caching, you must issue `/STOP-DAB-CACHING` (see the “Commands” manual [1]).
- If the pubset consists of more than one unit, input and output processes should be stopped during splitting. You can do this using `/HOLD-MULTI-MIRRORING UNIT=*BY-PUBSET` and the `HOLD-IO=*UNTIL-SPLIT` operand.
- During import, the split pubset on the additional mirror units reacts as though the last import had not been performed. You must either answer the message `DMS038C` with `Y` or, with `/IMPORT-PUBSET`, specify the `SESSION-CHECK-MSG=*NO` operand (see the “Commands” manual [1]). The F5 labels on the disks are reconstructed from the catalog.
- Files on the split pubset are in the same status as they were on the original pubset at the time splitting was performed, i.e. they may not have been closed. If the application does not do this, you will need to issue a `/REPAIR-DISK-FILES` command (same effect as restart after system failure) (see the “Commands” manual [1]).

3. When the multi-mirror pairs are synchronized and the data is consistent, the multi-mirror pairs are split using `/HOLD-MULTI-MIRRORING`.

When using concurrent BCV, you must use `SELECT-ADD-MIRROR` to specify which pair is to be split or whether both pairs are to be split at the same time.

If the split pubsets are processed in the same session as the originals, they must be renamed. Note the following:

- The additional mirror units must be generated and attached.
- SF pubsets can be renamed directly by means of `/HOLD-MULTI-MIRRORING`. The new pubset ID must be the same length as the old pubset ID. If there are concurrent BCVs and these are to be split together with `SELECT-ADD-MIRROR=*ALL`, both can be renamed directly on two different new pubset IDs.
- The PVSREN utility routine must be used for any other renaming. See the description of PVSREN in the “Utility Routines” manual [8].
- IMON uses the `SYS.IMON.SCI` file, which contains pubset IDs. If the `SCI` file is located on the pubset that is being split and renamed, the `SCI` file must be modified manually using `/MODIFY-IMON-SCI` (see the “IMON” manual [11]). PVSREN does this automatically.
- You must note the following, regardless of whether you use the PVSREN program or `/HOLD-MULTI-MIRRORING` for renaming:
 - With TimeFinder/Mirror, only the S0 level of the pubset (normal processing level - for more detailed information see the “HSMS” manual [10]) is duplicated; the migrated files exist only once on the tape and in the HSMS directory.

**CAUTION!**

No files may be migrated or restored on the additional mirror pubset. Otherwise data can be lost.

- Paging files are renamed automatically. If pubset IDs or VSNs have been programmed into the applications, they must be changed manually.



The PVSREN program can complete renaming operations performed by SHC-OSD for IMON, SYSID and the default pubset for user IDs.

- If a system is started from the additional mirror unit, the SYSID must be changed beforehand using `/SET-PUBSET-ATTRIBUTES` (see manual “Commands” [1]).



A unique SYSID is required in MSCF environments!

- If the pubset is not renamed, the additional mirror units cannot be used in the same system because they have the same VSN. They can be used by another host or a virtual machine.
- The additional mirror units can be renamed (using the `NEW-PUBSET=*SPECIAL-VSN` operand) if they are backed up with the FDDRL software product or if the multi-mirror pairs are implicitly split using HSMS. This prevents ambiguous VSNs in the system. Further information on FDDRL is provided in the “FDDRL” manual [9].

Private disks

- Private disks cannot be renamed.
- The applications must be terminated.
- The `HOLD-IO` operand is not supported.
- Private disks must be released using `/SET-DISK-PARAMETER` with the `ASSIGN-TIME=*USER` operand.

Further sequence of operations

The storage system writes all data from the cache to the normal unit and additional mirror unit before splitting is performed (synchronization point).

The `/UNLOCK-DISK` command is issued internally for all additional mirror units (see the “Commands” manual [1]), provided they are attached.

The new pubset can be imported as soon as splitting is complete and the status is `SPLIT`. The associated MRSCAT entry is automatically created or updated.

When the status is `SPLIT`, every change made on the original pubset or the new pubset is noted as a pending write in the storage system. No additional cache space is required for this purpose.

Console message `NDE0030` indicates that splitting is complete and that the status is `SPLIT`. On completion of splitting, the status can be displayed using `/SHOW-MULTI-MIRRORING-STATUS`.

Splitting a pubset in the shared pubset network while retaining data consistency

Requirements

- No DAB write caching may be active.
- All sharers have SHC-OSD V11.0 or higher started.
- The command is executed on the master.
- There must be MSCF connections between the master and all sharers.
- The pubset may not have the `QUIET` status.

Multi-mirror pairs can be split using `/HOLD-MULTI-MIRRORING` and the `UNIT=*BY-PUBSET(HOLD-IO=*UNTIL-SPLIT)` operand at a synchronization point during current operation and without having to export the pubset. Shared pubsets with multiple sharers in a CCS network can also be split consistently. This function interrupts all outputs to the pubset during splitting. It is possible, for example, to create a consistent copy of the home pubset during current operation and to back it up or use it in parallel as a standby pubset.



CAUTION!

`/RESUME-IO` can be used to resume suspended input/output activity for pubsets. This command is provided **for emergencies only** and if used without due care may endanger data consistency on the split additional mirror units.

Optimized copying of additional mirror units

The volume of data copied from the additional mirror unit to the internal mirror disk can be restricted. `/HOLD-MULTI-MIRRORING` and the `RESTORE-DATA=*MODIFIED-ONLY` operand copy change data only. This is of relevance only for additional mirror units that have a second, internal RAID1 or SRDF mirror disk.

With `/HOLD-MULTI-MIRRORING` and the `RESTORE-DATA=*MODIFIED-ONLY` operand, the changes between the additional mirror unit and the internal mirror disk are noted in the storage system. This data is evaluated the next time `/HOLD-MULTI-MIRRORING RESTORE-DATA=*MODIFIED-ONLY` is executed, i.e. only changed data is copied to the second, internal RAID1 or SRDF mirror disk.

With `/HOLD-MULTI-MIRRORING` and the `RESTORE-DATA=*ALL-DATA` operand, the changes noted in the storage system are discarded.

In addition, you can use the `/HOLD-MULTI-MIRRORING` command with the `RESUME-REMOTE-COPY=*BY-SYSTEM/*BY-USER` operand to specify for mirror units that are also SRDF source units whether data synchronization from the additional mirror unit to the remote storage system is to be performed automatically or whether it must be started explicitly by the user.

Multi BCV and Concurrent BCV

When multi BCV and concurrent BCV are used together, two multi-mirror pairs can be established at the same time. The `/HOLD-MULTI-MIRRORING` command (`SELECT-ADD-MIRROR` operand) can be used to specify which of the active pairs is split. The first pair is split by default. However, either both pairs can be selected or a BCV identified by its mnemonic name can be selected.

7.2.3 Reconstructs a multi-mirror pair

A multi-mirror pair can be reconstructed once separate processing has been terminated. Reconstruction can be started for all multi-mirror pairs of a pubset or for individual multi-mirror pairs.

The following options are available:

- *Copy data from the normal unit to the additional mirror unit*

If all changes on the additional mirror units are discarded, either all data or only the changed data can be copied from the normal units to the additional mirror units.

- Terminate processing on the additional mirror units and export the pubset.
- Copy all data or only changed data to the additional mirror unit.

```
/RESUME-MULTI-MIRRORING
  UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) /
    <normal unit MN> /
    *BY-SYMMETRIX(SERIAL-NUMBER=<Serialnumber>,
      LOGICAL-VOLUME=<logical volume number>)
  ,RESTORE=*FROM-ORIGINAL
  ,RESTORE-MODE=*MODIFIED-ONLY / *ALL-DATA
```

- *Copy data from the additional mirror unit to the normal unit*

If all changes on the normal units are discarded, either all data or only the changed data can be copied from the additional mirror units to the normal units.

- Terminate processing on the normal units and the additional mirror units of the pubset and export both pubsets.
- Copy all data or only changed data to the normal units.

```
/RESUME-MULTI-MIRRORING
  UNIT=*BY-PUBSET(PUBSET=<cat-id>) / *BY-VOLUME(<vsn>) /
    <normal unit MN> /
    *BY-SYMMETRIX(SERIAL-NUMBER=<Serialnumber>,
      LOGICAL-VOLUME=<logical volume number>)
  ,RESTORE=*TO-ORIGINAL
  ,RESTORE-MODE=*MODIFIED-ONLY / *ALL-DATA
```

Further sequence of operations

During reconstruction, the multi-mirror pairs have the `ESTABLISHING` or `RECONSTRUCTING` status depending on the direction of copying. The additional mirror units can no longer be accessed.

Console message `NDE0030` indicates that reconstruction is complete and that the status is `ESTABLISHED`. On completion of reconstruction, the status can be displayed using `/SHOW-MULTI-MIRRORING-STATUS`.

Asynchronous command processing

`/RESUME-MULTI-MIRRORING` with the `WAIT=*NO` operand instructs the command not to wait until reconstruction is complete.

Synchronous command processing

`/RESUME-MULTI-MIRRORING` with the `WAIT=*UNTIL-SYNCHRONIZATION` operand instructs the command to wait until reconstruction is complete, i.e. to wait until the multi-mirror pair is `ESTABLISHED`. In dialog mode, waiting can be terminated by hitting the `[K2]` key.

Multi BCV and Concurrent BCV

The new `SELECT-ADD-MIRROR` operand of the `/RESUME-MULTI-MIRRORING` command lets you choose which additional mirror unit is used to reconstruct the multi-mirror pair in multi BCV mode.

The `/RESUME-MULTI-MIRRORING` command can be used to establish up to two BCVs for a normal unit. If two concurrent BCVs are already established, each further `/RESUME-MULTI-MIRRORING` command with a BCV in the `SPLIT` status is rejected.

The following operand values are available for multi BCV and concurrent BCV: `*CURRENT`, `*PREVIOUS`, `*OLDEST`, `*SPECIAL-VSN` and `*BY-PUBSET`. For details see `/RESUME-MULTI-MIRRORING` on [page 395](#).

7.2.4 Cancels a multi-mirror pair

If the assignment of one or more multi-mirror pairs is no longer required, it can be canceled using `/STOP-MULTI-MIRRORING`. If multi BCV is used, this command enables the current, previous, oldest or all additional mirror unit assignments to be canceled. The additional mirror units can also be selected directly by means of their mnemonic name or the pubset ID of the split pubset. In [figure 22](#), the oldest assignment is deactivated using `/STOP-MULTI-MIRRORING` together with the `SELECT-ADD-MIRROR=*OLDEST` operand. For details of this command see [page 603](#).

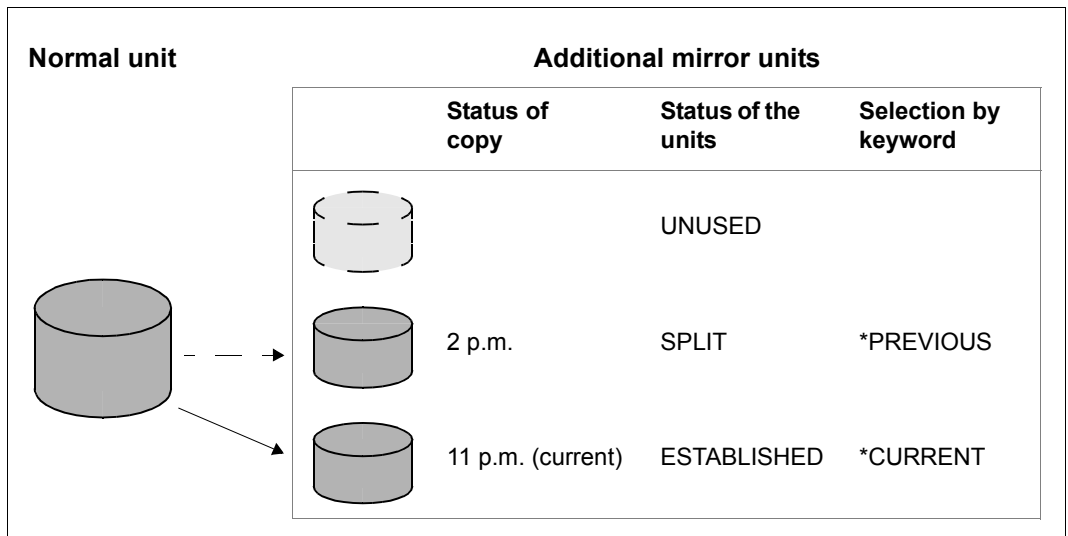


Figure 22: Canceling the last multi-mirror pair (oldest assignment)

7.2.5 Displaying information on multi-mirror pairs

The `/SHOW-MULTI-MIRRORING-STATUS` command (see [page 487](#)) provides information on the status of multi-mirror pairs.

8 Remote replication with REC (ETERNUS DX)

The REC (Remote Equivalent Copy) function creates (additional) copies of the application data of a local storage system in other, geographically distant (remote) storage systems. When it has been split from the original data, the copied data can then be edited separately.

REC offers:

- Synchronous and asynchronous replication to one or more remote systems. This makes sense in particular for high availability, disaster protection and migration scenarios. Asynchronous replication is provided only for ETERNUS DX S3.
- Cascaded remote copy and concurrent remote copy
These functions are used particularly in high availability and disaster protection configurations when remote replication in the local area is to be combined with remote replication over a long distance.

Remote replication consists of an original volume as the source unit which is mirrored to a target unit in a remote storage system.

For replication purposes the local and remote storage systems are connected to each other over at least two remote links.

The two storage systems can be up to 10 km apart. Longer distances between two storage systems are possible if extensions are used.

As REC is operated on the storage system itself independently of the application and operating system version, any application can use REC.

Remote copy pair (single REC configuration)

The remote copy pair consists of a source unit (original) and a target unit (data copy) which are both of the same size and of the same type.

The source unit is in the storage system that receives the writes in normal remote copy mode. It sends the updated data to the remote storage system, which saves the data on the target unit.

The remote copy pair is generated dynamically using the SHC-OSD command `/START-REMOTE-COPY`.

Cascaded remote copy pairs (cascaded REC configuration)

In the case of cascaded remote copy the source unit (original) has a target unit in synchronous copy mode. This target unit is at the same time the source unit of another target unit which is operated for ETERNUS DX S2 in synchronous copy mode. It can be operated in synchronous or asynchronous copy mode for ETERNUS DX S3.

The source unit (original) resides in the storage system that receives the reads and writes in normal remote copy mode. It sends the updated data synchronously to the first remote storage system, which saves the data on the first target unit. From this target unit, which is at the same time the source unit of another target unit, the updated data is transferred synchronously or asynchronously to the second target unit in another storage system and stored there.

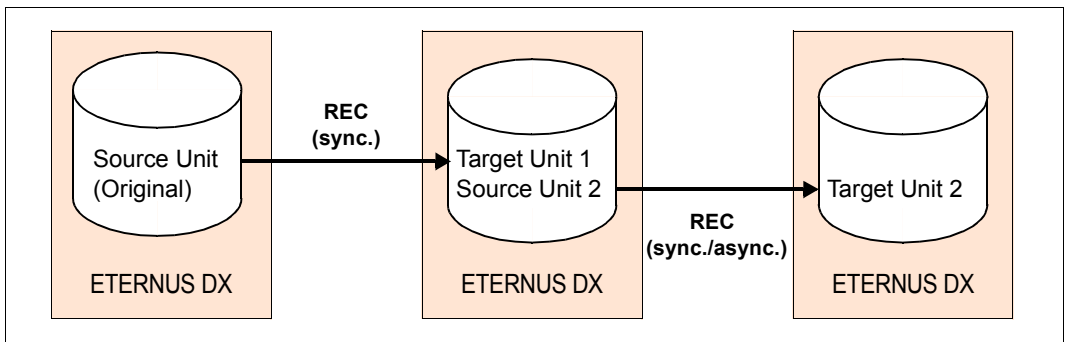


Figure 23: Cascaded remote copy configuration

Cascaded remote copy can be configured using the `/START-REMOTE-COPY` command. Only cascaded remote copy configurations are supported in which the target units reside in different storage systems.

For source units which are used as the original in cascaded remote copy replication, the `/SHOW-REMOTE-COPY` command displays all mirror pairs in several lines. Thus in the figure above when `UNIT=<Source Unit 2>` is specified.

You can switch from cascaded remote copy to concurrent remote copy with the `/SWAP-REMOTE-COPY TARGET-UNIT=` command.

Concurrent remote copy pairs (concurrent REC configuration)

With concurrent remote copy, the source unit (original) has two to four target units. The source unit is in the storage system that receives the reads and writes in normal remote copy mode. It sends the updated data simultaneously to the remote storage systems, which save the data on the target units. Here the second storage system is operated in synchronous copy mode. For ETERNUS DX S3 the other storage systems can be operated in synchronous or asynchronous copy mode.

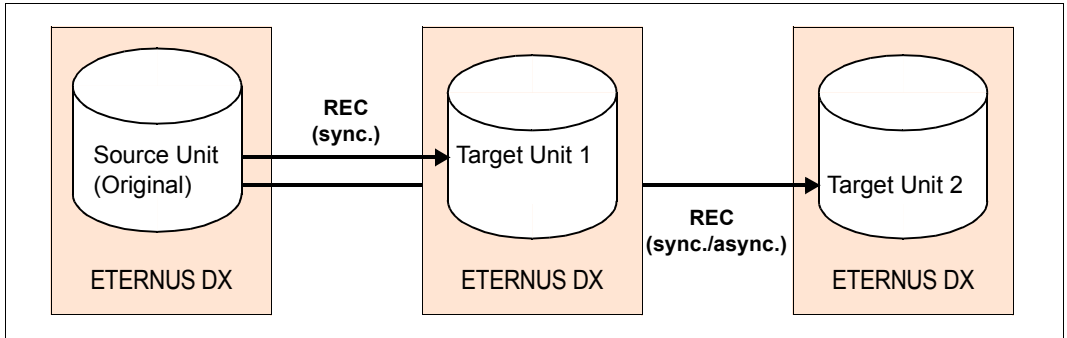


Figure 24: Concurrent remote copy configuration

Concurrent remote copy can be configured using the `START-REMOTE-COPY` command.

Only concurrent remote copy configurations are supported in which the target units reside in different storage systems.

For source units which are also used as target units in concurrent remote copy replication, the `/SHOW-REMOTE-COPY` command displays all mirror pairs in several lines.

You can switch from concurrent remote copy to cascaded remote copy with the `/SWAP-REMOTE-COPY TARGET-UNIT=` command.

Remote link

The remote link can be implemented via Fibre Channel or iSCSI. The remote link between the storage systems using Fibre Channel is a link between the FC ports of the two storage systems. The FC ports which are used for the remote link can also be operated in parallel as FC connections to the servers (CA/RA mode of the storage system). For redundancy reasons at least two remote links must be configured between two storage systems. The remote links can be operated directly or via FC switch.

The remote link for a remote copy pair is `AVAILABLE` when at least one of the remote links is available. If the remote link is not in the `AVAILABLE` status, the source and target units are not synchronized.

switched remote copy

Remote links of the type Fibre Channel can be connected to the remote storage systems via an FC switch. A configuration in which the FC ports for the remote links are connected via a SAN is referred to as a switched remote copy.

Device configuration

Special configuration of the devices for REC is **not** required. Only devices of the storage system which are connected to the server can be mapped to BS2000 mnemonic names.

Commands for REC (ETERNUS DX)

Command	Function	Page
HOLD-REMOTE-COPY	Interrupts remote copy mode	314
RESUME-REMOTE-COPY	Resumes remote copy mode	402
SHOW-REMOTE-COPY-STATUS	Displays the status of remote copy pairs	441
SHOW-STORAGE-CONFIGURATION	Displays the configuration	499
SHOW-STORAGE-DEVICE-CONFIG	Displays the device configuration	512
START-REMOTE-COPY	Creates remote copy pair	575
STOP-REMOTE-COPY	Cancels a remote copy pair	607
SWAP-REMOTE-COPY	Swaps the source and target property of a remote copy pair or makes a target unit accessible	627

The functions for remote replication (REC) can be controlled via SHC-OSD for ETERNUS DX. The SHOW commands display the status of the remote copy pairs and the configuration.

8.1 REC configurations

There are unidirectional and bidirectional REC configurations:

- Unidirectional means that with two storage systems all source units are located in one storage system and all target units in the other.
- In bidirectional configurations, each storage system has both source and target units.

Each host that uses REC units in normal remote copy mode must generate the source units in the usual way. The target units must be generated for each host that is to access them. If the same host is to access source and target units, both must be generated on the host. It is then possible to access the target units if the storage system with the source units fails.

The figure below shows a unidirectional remote copy configuration for REC (simplified diagram). The local storage system contains all the source units. It is connected to the remote storage system over two remote links. The remote storage system contains all the target units.

Remote copy mode is indicated by the black arrows. The main host in the local system accesses the source units. The target units are accessed via the remote links. If the local system fails in the event of a disaster, processing can be continued on the standby host (gray arrows). The standby system accesses the target units after it has been released.

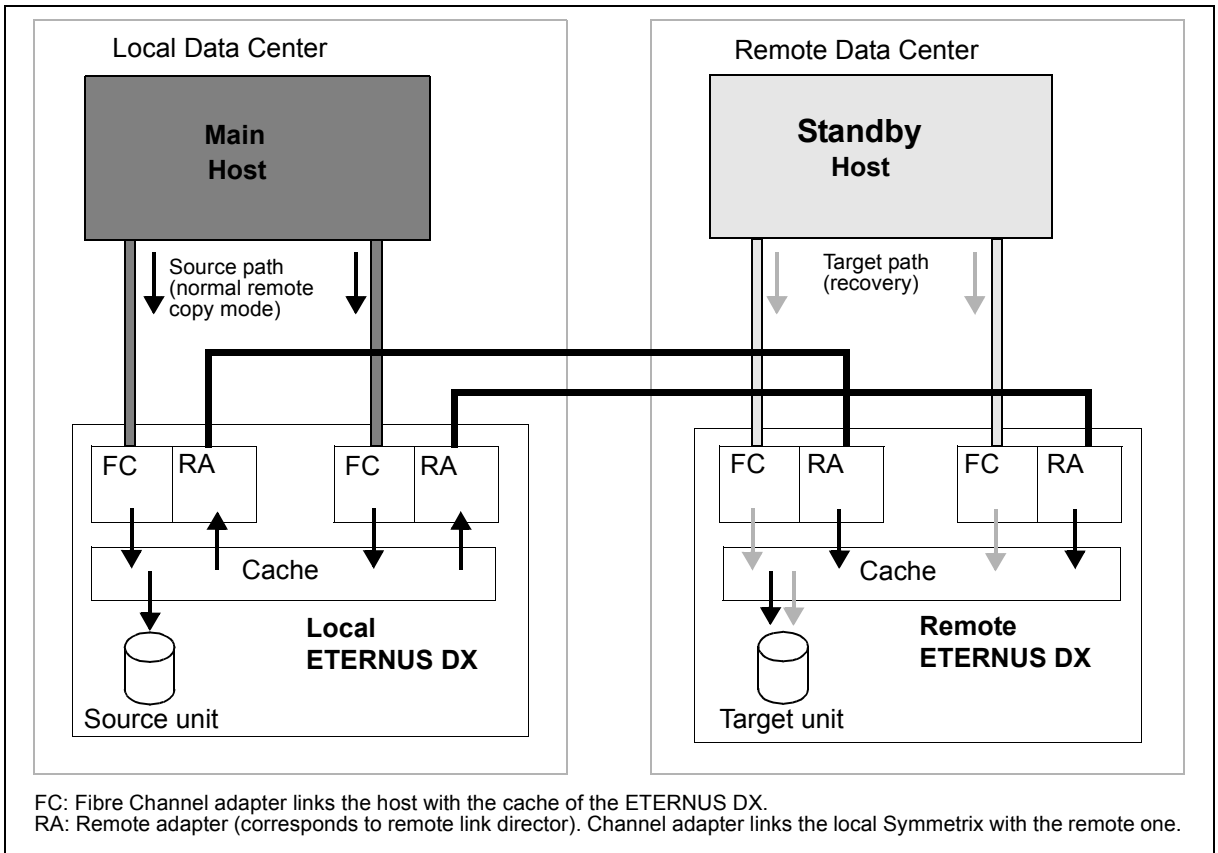


Figure 25: Unidirectional remote copy configuration (REC)

8.2 Remote copy mode

Settings for remote copy mode are specified using the remote copy parameters.

SHC-OSD supports synchronous and asynchronous remote copy mode.

Asynchronous remote copy mode is possible when both remote copy partners use ETERNUS DX S3 or higher.

In the `/SHOW-REMOTE-COPY-STATUS` command only `INFORMATION=*SUMMARY/*PORT-STATUS/*ALL` is offered for ETERNUS DX.

8.2.1 COPY-MODE (processing mode)

Remote copying is available in synchronous or in one of the asynchronous processing modes. The initial settings are made when the remote copy pair is created with `/START-REMOTE-COPY`. The processing mode can be changed using the `COPY-MODE` operand of `/MODIFY-REMOTE-COPY-PARAMETER`. The modification can only be made when remote replication is suspended (`IN-HOLD` status).

- **SYNCH**ronous processing mode

Processing mode = synchronous processing. All writes are written from the local system to the cache of the local storage system and are forwarded from there to the cache of the remote storage system. The local system is notified on successful completion. Only then can the next write be performed.

With this processing mode, data is written on the source unit and the target unit after every successful write.

Synchronous processing mode is the most secure mode.

- **ASYNCH**ronous processing mode

Processing mode = asynchronous processing with guaranteed data consistency in the event of hardware failure. This mode requires suitably dimensioned remote copy buffers (cache) on the ETERNUS DX S3 storage systems involved.



In the remote copy status `ACTIVE`, pairs are also displayed as synchronized when `COPY-MODE=ASYNCH`.

In this processing mode there may be more than one pending write. The data on the target units is however always in a state that is consistent across disks even in the event of failures because the writes are transmitted in bundled form and in the correct order.

- Processing mode **ASYNC-STACK**
Processing mode = asynchronous processing without guaranteed data consistency in the event of hardware failure. This mode requires suitably dimensioned REC buffers (cache) on the ETERNUS DX S3 storage systems involved. In this processing mode there may be more than one pending write.
- Processing mode **ASYNC-THROUGH**
Processing mode = asynchronous processing without guaranteed data consistency in the event of hardware failure. In this processing mode each input/output is transferred to the remote system with a delay. Through mode cannot be set. It occurs temporarily in the event of internal state changes between modes in the ETERNUS DX S3 storage system.

8.2.2 Remote copy status

The `/SHOW-REMOTE-COPY-STATUS` command indicates the remote copy status.

The remote copy status can be: `ACTIVE`, `ERROR`, `IN-HOLD` or `BROKEN`.

The status depends on the availability of the source units, target units and (at least one) remote link. The physical volumes containing the source or target unit must therefore be ready. It is not sufficient that the source or target unit can be addressed from the system.

ACTIVE

If the source unit and target unit are ready and there is a link between the local and remote storage systems, the remote copy status is `ACTIVE` (normal status in remote copy mode).

The remote copy status `ACTIVE` is characterized by the following outputs:

Output	Output field	Command
ACTIVE	REMOTE-COPY STATE	SHOW-REMOTE-COPY-STATUS
BY-SRC	TARGET-ACCESS	SHOW-REMOTE-COPY-STATUS
AVAIL	LINK	SHOW-REMOTE-COPY-STATUS
100%	SYNC	SHOW-REMOTE-COPY-STATUS
READY	STATE (for source unit)	SHOW-STORAGE-DEVICE-CONFIG
NOT-READY	STATE (for target unit)	SHOW-STORAGE-DEVICE-CONFIG

The output field `LAST-STA-CHNG` is not supplied with information.

Examples

```
/SHOW-REMOTE-COPY-STATUS UNIT=9A01
```

```

% -----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE  ACCESS!DDDD.HH:MM:SS!      !      !-RA!R-C!R-C
% -----
% 9A01  9C01  S351.1!ACTIVE  SYNC  BY-SRC!      -      !AVAIL.!100%! - !NO ! -

```

```
/SHOW-STORAGE-DEVICE-CONFIG UNIT=9A01,CONF=*REM-COPY-PAIRS,INF=*ALL
```

```

% -----
% UNIT  VOL  TYPE  SERIAL-NO  LOG-  STA  TIER  RAID  REM  LOC  SIZE:
%          !          !          !          VOLUME  TYPE  TYPE  COPY  CURR/MAX.
% -----
% 9A01  S351.1  D3435  4621347002  000C3  RDY  SAS  5  S  -/-  14/  14 GB
% 9C01          D3435  4621349005  000C3  N-R  SAS  5  T  -/-  - /  14 GB
% -----
% UNIT  VOL  !HOST-LUN!  POOL-NAME  !OWNING-CONTR
% -----
% 9A01  S351.1!  1  !  RG900_04  !CM00
% 9C01          !  1  !  RG900_04  !CM00

```

ERROR

If one of the units or the last remote link fails, the remote copy status is **ERROR**. You can use `/SHOW-REMOTE-COPY-STATUS` to display the failed component: one or more components of the remote copy pair will have the status **ERROR** or **NOT-AVAIL**. The **SYNC** status displays a value under **100%** if the source and the target units are no longer synchronized. The output field **LAST-STA-CHNG** is not supplied with information.

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=9A01
```

```

% -----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE  ACCESS!DDDD.HH:MM:SS!      !      !-RA!R-C!R-C
% -----
% 9A01  9C01  S351.1!ERROR  SYNC  BY-SRC!      -      !NOT-AV!100%! - !NO ! -

```

IN-HOLD

When remote copy mode is halted from the outside but the source unit, target unit and also the remote links are physically available, the remote copy status is `IN-HOLD`. In this case you can use the `/RESUME-REMOTE-COPY` command to resume operation.

The output field `LAST-STA-CHNG` displays how much time has elapsed since remote mirroring was halted (format `<days>:HH:MM:SS`).

The remote copy status `IN-HOLD` is also displayed for ETERNUS DX if the target units were released following the failure of the source units. This is also the case when the source unit and remote link are not yet available again. In this case the `RESUME-REMOTE-COPY` command is rejected.

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=9A02
```

```

% -----
% SRC   TAR   VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT  UNIT           !STATE   MODE  ACCESS!DDDD.HH:MM:SS!    !    !-RA!R-C!R-C
% -----
%      9A02  9C02  S351.2!IN-HOLD  SYNC  DIRECT!    0.06:13:48!NOT-AV!100%! - !NO ! -

```

BROKEN

The remote copy status `BROKEN` occurs when remote copy mode fails because of a serious problem and cannot be restored, e.g. when one of the storage systems involved needs to be completely replaced. Owing to the problem, only the source unit or only the target unit is available. In this case the remote copy pair can only be canceled with `/STOP-REMOTE-COPY`.

8.2.3 Operating statuses

The following table shows how operating statuses during remote copy mode can be recognized using the output of /SHOW-REMOTE-COPY-STATUS.

The operating status is indicated by the values of REM-COPY-STATE and TARGET-ACCESS (see table). The other fields indicate the device status.

Operating status	Output of /SHOW-REMOTE-COPY-STATUS	
	REM-COPY-STATE column	TARGET-ACCESS column
OK	ACTIVE	BY-SRC
Failure of part of the remote copy pair	ERROR	NONE
Complete failure	ERROR / BROKEN	NONE
Failure after target units were released	IN-HOLD	DIRECT
Failure recovery (after /SWAP-REMOTE-COPY)	ERROR	UNKNOW
Failure recovery test	IN-HOLD	DIRECT

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=9A01
```

```
% -----
% SRC   TAR   VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE ACCESS!DDDD.HH:MM:SS!  !    !-RA!R-C!R-C
% =====
%      9A02  9C02  S351.2!IN-HOLD SYNC DIRECT!   0.06:13:48!AVAIL.! 90%! - !NO ! -
```

8.3 Failure scenarios and measures

In failure scenarios it is first necessary to determine whether data is mirrored using REC or whether a concurrent remote copy configuration is in use.

This section deals with the most important failure scenarios without concurrent remote copy. In concurrent remote copy configurations the scenarios and measures apply analogously, but the following general conditions should also be taken into account when deciding on the measures:

- In the event of local failures, a decision must be made as to which of the two standby systems is to continue operation.
- In the event of failback, concurrent remote copy replication must also be resumed on both standby systems.
The general conditions of the SWAP-REMOTE-COPY functionality must be observed.

The following failure scenarios and measures for maintaining operation will be examined:

1. Failure of a source or target unit (see [page 189](#))
2. Failure of the remote link (see [page 189](#))
3. Failure of the remote storage system (see [page 189](#))
4. Failure of the local storage system (see [page 190](#))
5. Failure of the local system (see [page 190](#))
6. Failure of the local storage system and of the local system (complete failure, see [page 191](#))
7. Failure as a result of failback to the local storage system (see [page 192](#))

After a storage system failure or a different failure in the local system, a check should be carried out to establish whether local troubleshooting can recover the application faster than remote recovery. In many cases local troubleshooting is quicker.

If remote recovery is performed, you must consider the application downtime involved in switching to the standby system, starting the application there, and then switching back to the local system once the problem has been resolved.



In addition to the failure scenarios under SHC-OSD examined here, further functions for enhancing availability are provided in the high availability (HA) cluster or by means of live migration.

8.3.1 Failure of a source or target unit

The source or target units are protected locally by RAID1 or RAID5. Consequently the data can still be accessed after a failure has occurred. Applications are not stopped. Data consistency is maintained.

8.3.2 Failure of the remote link

The failure of a single remote link has the same effect as the failure of a unit (see "[Failure of a source or target unit](#)").

The failure of the last remote link has the same effect as the failure of a remote storage system (see [page 189](#)). In the event of a failure, operation continues with the remaining source unit only; the applications are not stopped.

8.3.3 Failure of the remote storage system

If the remote storage system fails, operation continues with the remaining source unit only, in other words with reduced availability; the applications are not stopped. Remote replication cannot be continued. If the source unit subsequently fails, it is then no longer possible to switch to the target unit later.

When the remote storage system and/or the remote link is available again, replication is resumed when a command is entered. This is not the case when the remote storage system needs to be replaced completely after it has failed. Reconfiguration by Service using SHC-OSD is then necessary.

8.3.4 Failure of the local storage system

If the local storage system fails, processing can be resumed in a short time using the target units of the remote storage system. Data may be inconsistent if the remote link or the target unit had already failed before the local failure occurred.

If paging is affected, the local system also fails (see [section “Failure of the local storage system and of the local system” on page 191](#)).

Actions in the local system

1. Use `/ATTACH-DEVICE` to attach the source and target units (see the “Commands” manual [1]).
2. Set the target units to `READY`.
If the remote storage system contains only target units which are affected by the failure, the entire local storage system can be specified. Switchover takes place simultaneously for all the devices affected.

```
/HOLD-REMOTE-COPY
  UNIT=*BY-STORAGE(SERIAL-NUMBER=<local serialnumber>
    , LOGICAL-VOLUMES=*ALL-SOURCE-UNITS)
```

For this function, the values `DETACHED-DEVICES=*ACCEPT` and `NOT-DEFINED-DEVICES=*ACCEPT` must be set for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE`.

If not all target units of the remote storage system are affected by the failure, all defined BS2000 volumes, all attached BS2000 volumes or the units can be specified separately by means of their MN.

The `*BY-VOLUME` operand can only be used if the source unit was accessible, i.e. the VSN could be read there. The `*BY-PUBSET` operand cannot be used for the switchover because of the failure.

3. Check data integrity (see [section “Data integrity after a failure” on page 193](#)).
4. Import the pubsets and start the applications.

8.3.5 Failure of the local system

If the local system fails, no data inconsistency occurs because operation is interrupted. The local system must be restarted.

If the local system cannot be restarted and switchover is to take place to the standby system, the actions are performed on the standby system as described in the section below..

8.3.6 Failure of the local storage system and of the local system

If the local system fails completely, processing can be continued on the standby system. If the home pubset of the local system has been duplicated with REC, and if the standby system is to be started with the same home pubset, a further “small” system with SHC-OSD is required to activate the target path before startup (`/HOLD-REMOTE-COPY` for the volumes of the home pubset).

Data may be inconsistent if the remote link or the target unit had already failed before the local system failed.

A suitably configured and active StorMan server must be available to execute the actions of SHC-OSD.

Actions on the standby system

1. Use `/ATTACH-DEVICE` to attach the target units (see the “Commands” manual [1]).
2. Activate the target path (set target units to `READY`).
If the remote storage system contains only target units which are affected by the failure, the entire remote storage system can be specified. Switchover takes place simultaneously for all the devices affected.

```
/HOLD-REMOTE-COPY
  UNIT=*BY-STORAGE(SERIAL-NUMBER=<local serialnumber>
    , LOGICAL-VOLUMES=*ALL-SOURCE-UNITS)
```

For this function, the values `DETACHED-DEVICES=*ACCEPT` and `NOT-DEFINED-DEVICES=*ACCEPT` must be set for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE`.

If not all target units of the remote storage system are affected by the failure, all defined BS2000 volumes, all attached BS2000 volumes or the units can be specified separately by means of their MN.

The `*BY-VOLUME` operand can only be used if the source unit was accessible, i.e. the VSN could be read there. The `*BY-PUBSET` operand cannot be used for the switchover because of the failure.

3. Check data integrity (see [page 193](#)).
4. Import the pubsets and start the applications.

8.3.7 Failure as a result of failback to the local storage system

When the local storage system or the local system is operational again, processing can once more be switched back to the local storage system and the local system. To permit this, the modified data of the remote storage system is transferred to the local storage system. The applications on the standby system are terminated and restarted on the local system. If the home pubset is also affected, the standby system must be shut down.

In symmetrical configurations (known as X configurations) failure as a result of failback can be prevented or deferred to a more suitable time using the `SWAP-REMOTE-COPY` function. Without interrupting the application, this function enables source units to be changed into target units and target units on which the applications run to be changed into source units. From this point onwards, secure operation with remote copy data replication is ensured, even without failback.

Actions on the local system (Part 1)

1. Prepare the local storage system:
 - Disable all the channels and remote links (to prevent access).
 - Reconnect all the channel or remote link cables.
 - Start the local storage system.
 - Service should check the local storage system for damage.
2. Activate the remove links on the local storage system.

Actions on the standby system

1. Terminate the applications and export the pubsets.
2. Resynchronize the REC pairs (relicts) from the remote storage system to the local storage system with the `/RESUME-REMOTE-COPY RESTORE=*TO-SOURCE` command.

If the local storage system contains only source units which are affected by the failure, the entire remote storage system can be specified.

```
/RESUME-REMOTE-COPY
  UNIT=*BY-STORAGE(SERIAL-NUMBER=<local serialnumber>
    , LOGICAL-VOLUMES=*ALL-SOURCE-UNITS), WAIT=*UNTIL-SYNCH, RESTORE=*TO-SOURCE
```

3. Use `/DETACH-DEVICE` to detach the target units (see the “Commands” manual [1])

For these functions, for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE` you may have to set the values `DETACHED-DEVICES=*ACCEPT` and `NOT-DEFINED-DEVICES=*ACCEPT` (see the `/MODIFY-SHC-PROCESSING` command, [page 342](#)).

Actions on the local system (Part 2)

1. Activate the host channels on the local storage system. The host channels can be set to `online` once synchronization has been completed.
2. Start the local system.
3. Attach the source units on the local system and resume processing: `/ATTACH-DEVICE` (see the “Commands” manual [1]).
4. Import the pubsets and start the applications.

8.3.8 Data integrity after a failure

The data integrity after a failure depends on the COPY-MODE set (processing mode SYNCH, ASYNCH or ASYNC-STACK).

If a link or device error occurs before or during a failure, the source and target units will no longer be synchronized. In other words if the internal synchronization process in processing mode SYNCH or ASYNCH is interrupted, the source and target units will receive inconsistent data.

This is also the case when the synchronization process initiated with `/RESUME-REMOTE-COPY` is interrupted.

8.3.9 Summary of failure scenarios

Failure	Condition	Reported with	Operation interrupted?	Impact	Response (measure)	Data inconsistency on later switch to targets?
Source unit	Protected	NDE0020	No	Local redundancy	Customer support	No
Target unit	Protected	NDE0020	No	Remote redundancy	Customer support	No
Single remote link		NDE0019	No	Write performance	Customer support	No
Last remote link		NDE0019	No	-	Customer support Note inconsistency	Yes
Storage system with source units		PGER message	Yes		Measure A	Possible ¹
Local system		-	Yes	-	Restart	No
Complete failure ²		-	Yes		Measure A	Possible ¹
Failback to local storage system		-	Yes		Measure B	

¹ Data inconsistency on later switching to the targets is possible in the event of preceding faults on the remote links or target units.

² Failure of the local storage system with source units and failure of the local system.

Failure recovery measures

Measure	Description	Condition	Action	Command
A	Switch to target unit, local system affected		Start standby host, attach target units	/ATTACH-DEVICE
		Source and target units were synchronized	Make target units available	/HOLD-REMOTE-COPY
		Source and target units were not synchronized, inconsistencies acceptable (or reset to last synchronization point)		/HOLD-REMOTE-COPY . . . , FORCE=YES
B	Failback to the local storage system, operation on standby host		Terminate use of target units	/EXPORT-PUBSET
			Disable all channels and remote links on local storage system	(Service)
			Start local storage system	(Service)
		Local storage system OK (Service will check)	Attach and enable remote links	(Service)
			reconstruct source units from target units	/RESUME-REMOTE-COPY RESTORE=*TO-SOURCE or in single steps
		Comparison OK / automatic synchronization begun?	Attach channels	(Service)
			Start local system	

8.4 Testing the recovery procedures

The REC function supports parallel mode for processing on the source units and target units. It must be borne in mind here that when remote replication is stopped (/HOLD-REMOTE-COPY) the target units are automatically made available for system accesses.

When remote replication is stopped, failure tests can be conducted on the source units without interrupting the applications in the local system. The test scenario differs from a genuine failure in that the local storage system is active during the test. Processing on the source units takes place in the local system. The recovery procedures are tested in the standby system using the target units.

Overview

A recovery procedure consists of the following steps:

- Failure detection
- A check to establish whether processing can be continued on the local system (with the source units)
- Interrupting remote copy mode and enabling the target path
- If required, shutdown of local system
- Startup of the standby system and continuation of processing (IPL, attach, import, change network node, restart applications)

The actions needed to interrupt remote copy mode and enable the target path are described on [page 197](#). The actions needed to recover the source and target units are described on [page 198](#).

8.4.1 Interrupting remote copy mode and enabling the target path

Remote copy mode must be interrupted because the local storage system must remain ready for operation during the test. In order to have consistent data for the test, a synchronization point should be created beforehand. It can also make sense to rename the pubset concerned.

Actions in the local system

1. Check whether the source and target units are synchronized.

Global check: SYNCH field displays 100%

```
/SHOW-REMOTE-COPY-STATUS UNIT=F300, INFORMATION=*SUMMARY
```

```

%-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT UNIT          !STATE  MODE ACCESS!DDDD.HH:MM:SS!      !      !-RA!R-C!R-C
%-----
%   F300  F886  ET01.0!ACTIVE  SYNC BY-SRC!      -      !AVAIL.!100%! - !NO ! -

```

2. Interrupt remote copy mode (optionally with integrated pubset renaming), e.g. /HOLD-REMOTE-COPY.

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=F300, INFORMATION=*SUMMARY
```

```

%-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT UNIT          !STATE  MODE ACCESS!DDDD.HH:MM:SS!      !      !-RA!R-C!R-C
%-----
%   F300  F886  ET01.0!IN-HOLD  SYNC DIRECT!      -      !AVAIL.! 99%! - !NO ! -

```

Actions on the standby system

None

The target unit is activated automatically by /HOLD-REMOTE-COPY, i.e. the target units are in the READY status.

8.4.2 Reconstructing the source and target units after the test

Before remote copy mode is resumed, the remote copy pair must be checked for data differences. After the tests the changes to the source unit are as a rule accepted and replication is resumed.

Actions on the standby system

- ▶ Terminate the application on the target units.

Actions in the local system

- ▶ Keep the changes on the source units (i.e. all changes made on the target units during the recovery tests are discarded).
 - Remote copy mode is restarted.
 - Processing is once again to take place via the source path.

```
/RESUME-REMOTE-COPY
  UNIT=<source_unit_MN> / *BY-PUBSET(PUBSET=<cat-id>) /
    *BY-VOLUME(VOLUME=<vsn>) >) /
    *BY-STORAGE(SERIAL-NUMBER=<local serialnumber>
      ,LOGICAL-VOLUME=*ALL-SOURCE-UNITS),WAIT=*UNTIL-SYNCH
```

The `WAIT` operand specifies whether the command waits for synchronization to be completed (`WAIT=*UNTIL-SYNCHRONIZATION`) or not (`WAIT=*NO`). This simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress of the remote copy pair are unnecessary.

9 Remote replication with SRDF (Symmetrix/VMAX3)

The SRDF (**S**ymmetrix **R**emote **D**ata **F**acility) product family of EMC supports replication of data on a local storage system to one or more remote storage systems. For example, with concurrent SRDF data is simultaneously mirrored to two remote storage systems. This is also referred to as "remote copy" for short.



SRDF is offered in the same way for Symmetrix and VMAX3. The statements in this chapter therefore also apply for VMAX3.

SRDF links between VMAX3 and Symmetrix are also possible. The prerequisites are described in the EMC literature.

The local and remote storage systems are linked to each other by at least two remote link directors (remote adapters, RAs; see [figure 26 on page 204](#)). Each storage system can be linked to several others by means of remote links.

Links via the RA can be implemented using Fibre Channel or GigE (Gigabit Ethernet).

With a Fibre Channel connection, two storage systems can be up to 10 km apart. Longer distances between two storage systems are possible if extensions are used. Regardless of the distance involved, SRDF can be used in unidirectional or bidirectional configurations.

If a storage system crashes, the current data (when synchronous SRDF processing mode is used) always also exists on the remote storage system. As far as data is concerned, this means that after a failure:

- the current data does not have to be reimported,
- no check is necessary to determine whether the backups are usable or consistent,
- there is no need to roll back to an obsolete status.

In addition to synchronous replication using SRDF, SRDF/A also features asynchronous replication with cross-disk data consistency. This ensures that consistent, up-to-date data is available on the remote storage system after a failure.

Any application can use SRDF since it is operated by the storage system itself, regardless of the operating system version.

Remote copy pair (single SRDF configuration)

The remote copy pair consists of the source unit (original) and the target unit (data copy) that are connected to each other by means of a remote link.

The source unit is in the storage system that receives the writes in normal remote copy mode. It sends the updated data to the remote storage system, which saves the data on the target unit. The remote copy pair can be preconfigured statically or (only with VMAX3 or higher) set up dynamically, e.g. with the SHC-OSD command `/START-REMOTE-COPY` (dynamic remote copy pairs).

Concurrent remote copy pairs (concurrent SRDF configuration)

With concurrent remote copy, the source unit (original) has two target units connected via remote links. The source unit is in the storage system that receives the reads and writes in normal remote copy mode. It sends the updated data simultaneously to both remote storage systems, which save the data on the target units.

Concurrent remote copy can be configured using the SHC-OSD command `/START-REMOTE-COPY`.

For source units which are used as the original in concurrent remote copy replication, the `SHOW-REMOTE-COPY` command displays both mirror pairs in two lines.

Cascaded remote copy pairs (cascaded SRDF configuration)

With cascaded remote copy, the target unit (data copy) of a remote copy pair is simultaneously also the source unit (original) of a (cascaded) remote copy replication to another target unit which is connected via remote links.

Cascaded remote copy can be configured using the SHC-OSD command `/START-REMOTE-COPY`.

For units which are used simultaneously as a source unit and a target unit in cascaded remote copy replication, the `SHOW-REMOTE-COPY` command displays both mirror pairs in two lines.

For these volumes the `/SHOW-SYMMETRIX-DEVICE-CONFIG` command displays a “B” for “both” for remote copy usage.

Remote link director (remote adapter, RA)

The remote link director is a channel adapter for for the FC connection or for GigE connections (Gigabit Ethernet). It is used to connect the local and remote storage systems for remote copying.

Each RA has one to four ports (VMAX3: up to 32 ports), each of which can be used for remote links. The RA has a logical status (`ENABLE` or `DISABLE`). The director is active only when the logical status is `ENABLE` and the status of the port (storage system control panel) is `CONNECTED`.

A remote copy pair has at least two RA ports that function as remote links between source and target units. The remote link for the pair is `AVAILABLE` when at least one of the two remote links is available. If the remote link is not in the `AVAILABLE` status, the source and target units are not synchronized.

An RA can serve several logical RA groups (e.g. for switched SRDF or SRDF/A).

Switched SRDF

Remote link directors for FC connections can also be connected to several remote storage systems via an FC switch. A configuration in which the remote link directors are connected via a SAN is referred to as a switched SRDF. You can display all remote storage systems served by a remote link director using `/SHOW-SYMMETRIX-CONFIGURATION . . . , INF=*REMOTE-LINK-DIRECTORS`.

Refer to the Support Matrix of EMC for information on which FC switches are supported.

RA groups

RA groups define the logical SRDF link between two storage systems and are set up in advance by Service or dynamically during ongoing operation. They are assigned numbers from 1 through 250. An RA group contains volumes and two or more RA ports. Each volume used for SRDF can be assigned to one RA group only or, as a concurrent SRDF source unit, to two RA groups. You can display the assignment using `/SHOW-REMOTE-COPY-STATUS` (see [page 441](#)) or `/SHOW-SYMMETRIX-CONFIGURATION` (see [page 526](#)).

For VMAX3, RA groups can currently be displayed, but not managed, with SHC-OSD.

Commands for SRDF (Symmetrix/VMAX3)

Command	Function	Page
ADD-SYMMETRIX-RA-GROUP	Creates an RA group	297
DISABLE-REMOTE-LINK-DIRECTOR	Disables a remote link director	300
ENABLE-REMOTE-LINK-DIRECTOR	Enables a remote link director	303
HOLD-REMOTE-COPY	Interrupts remote copy mode	314
MODIFY-REMOTE-COPY-PARAMETER	Changes the processing mode and remote copy parameters	324
MODIFY-SYMMETRIX-RA-GROUP	Changes the RA group	357
REMOVE-SYMMETRIX-RA-GROUP	Cancels the RA group	360
RESUME-REMOTE-COPY	Resumes remote copy mode	402
SET-REMOTE-COPY-ACCESS	Sets the access path to the data of a remote copy pair	411
SHOW-REMOTE-COPY-STATUS	Displays the status of remote copy pairs	441
SHOW-SYMMETRIX-CONFIGURATION	Displays the configuration	526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays the device configuration,	537
START-REMOTE-COPY	Creates a remote copy pair	575
STOP-REMOTE-COPY	Cancels a remote copy pair	607
SWAP-REMOTE-COPY	Swaps the source and target property of a remote copy pair	627
UNLOCK-SYMMETRIX	Lifts locks	634
UNLOCK-SYMMETRIX-DEVICE	Lifts device locks	635

SRDF functionality can be controlled for Symmetrix/VMAX3 using SHC-OSD. The SHOW commands display the status of the remote copy pairs, the SRDF settings and the configuration.

9.1 SRDF configurations

There are unidirectional and bidirectional SRDF configurations.

- Unidirectional means that with two storage systems all source units are located in one storage system and all target units in the other.
- In bidirectional configurations, each storage system has both source and target units.

Each system that uses SRDF units in normal remote copy mode must generate the source units in the usual way. The target units must be generated for each system that is to access them. If the same system is to access source and target units, both must be generated on the system. It is then possible to access the target units if the storage system with the source units fails.

The figure below shows a unidirectional remote copy configuration for SRDF (simplified diagram). The local storage system contains all the source units. It is connected to the remote storage system over two remote links. The remote storage system contains all the target units.

This example shows only one source unit, one target unit and two remote links: RA 5B and 12B of the local storage system are linked to RA 3B and 14B of the remote storage system. Remote copy mode is indicated by the black arrows. The main host in the local Data Center accesses the source unit. The target unit is accessed via the remote links. If the local Data Center fails in the event of a disaster, processing can be continued on the standby host (gray arrows). The standby host in the remote Data Center accesses the target unit.

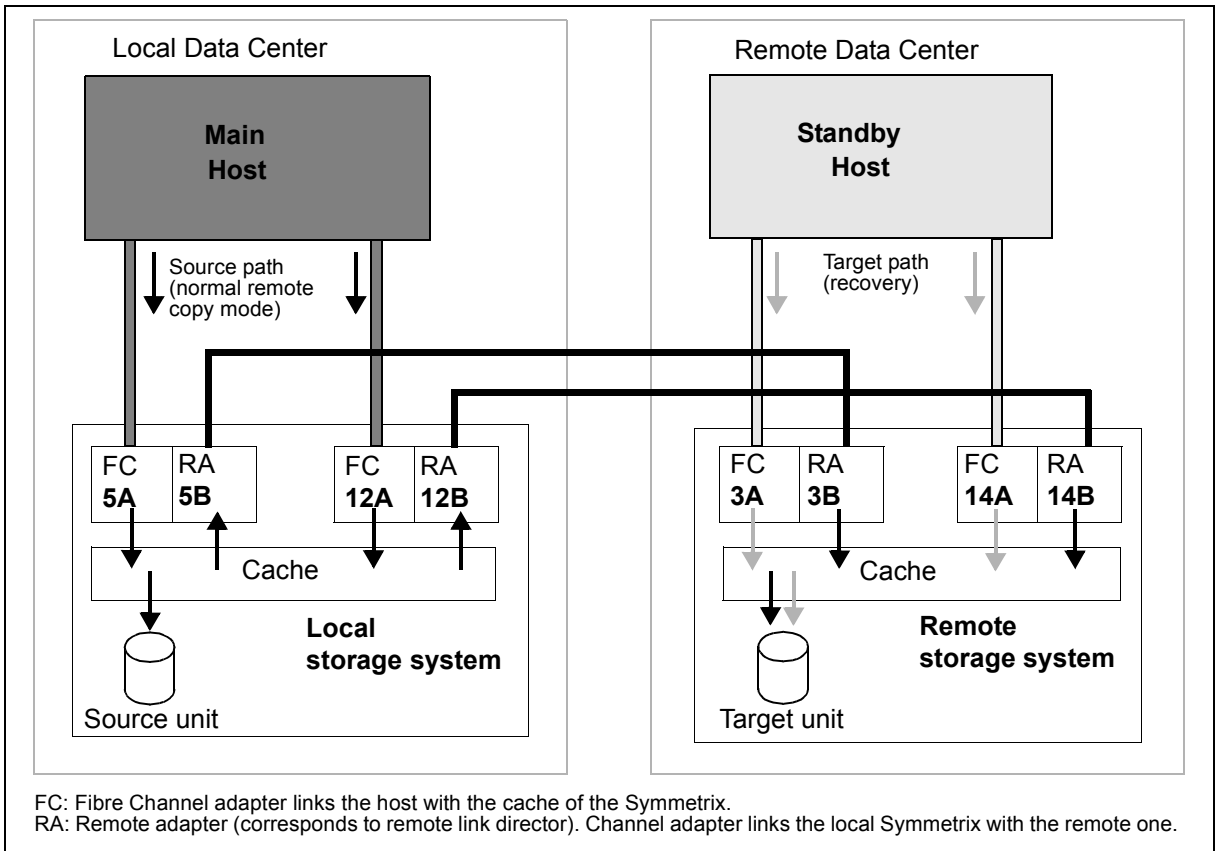


Figure 26: Unidirectional remote copy configuration (SRDF)

9.2 SRDF/A configurations

SRDF/A is the asynchronous replication function for Symmetrix/VMAX3 that features cross-disk data consistency.

SRDF/A mirrors data over long distances either with either no impact or minimal impact on the application. Data consistency is guaranteed at all times.

SRDF/A is fully integrated into SRDF and employs the technology and infrastructure of SRDF. Starting with another copy mode of SRDF (generally “synchronous” or “adaptive copy” mode), an “SRDF/A session” is initiated in which “asynchronous” copy mode is set. This SRDF/A session is terminated by setting a different copy mode. In an SRDF/A session the local data is buffered in special cache areas and is sent cyclically to the remote storage system. The maximum delta between the local data and the consistent data status on the remote storage system is the amount of data modified locally during a single cycle. Default cycle duration is 30 seconds.

SRDF/A control and status

The initial state for SRDF/A is an existing SRDF replication. For reasons of data consistency, it is advisable to base SRDF/A on synchronous mode.

SRDF/A status

- **ACTIVE**
SRDF replication takes place in asynchronous SRDF/A mode in the **ACTIVE** status.
- **INACTIVE**
SRDF replication is suspended (**IN-HOLD**) or takes place in synchronous or adaptive-copy mode.

SRDF/A control

- **Activating SRDF/A** – this corresponds to switching to asynchronous copy mode. The SRDF/A status becomes **ACTIVE**.
 - The data on the target units is consistent immediately if synchronous copy mode was set before SRDF/A is activated.
 - Transmission of the invalid tracks starts immediately if adaptive-copy mode was set before SRDF/A is activated. The data on the target units is not consistent until transmission has been completed.

- Deactivating SRDF/A – this corresponds to switching to synchronous or adaptive-copy mode of SRDF. The SRDF/A session is terminated, SRDF replication continues, data consistency on the target side is possibly no longer guaranteed.
 - When synchronous copy mode is switched to, the `CONSISTENT` operand in the `/MODIFY-REMOTE-COPY-PARAMETERS` command controls whether or not the data is kept consistently for the duration of any synchronization which may be required (default value: the data is not kept consistently).
 - Consistency is lost if a switch is made to adaptive-copy mode.
- Terminating the SRDF/A session – this corresponds to direct transition from `ACTIVE` to `INACTIVE`.

There are two ways of terminating the SRDF/A session, both of which guarantee data consistency of the SRDF pair:

- Immediate termination (e.g. after failure of the SRDF links); there are then invalid tracks on the source and target side.
- Termination after completion of the current cycle; there are then invalid tracks on the source side only, e.g. as a result of `/HOLD-REMOTE-COPY`.

In the event of termination, the `CONSISTENCY-PROTECT` operand of the `/MODIFY-REMOTE-COPY-PARAMETERS` command controls the data consistency of all SRDF pairs in an RA group.

SRDF/A parameters

The duration of a cycle can be set by customer support. The minimum value and also the default value is 30 seconds.

9.3 Remote copy mode

Settings for remote copy mode are specified using the remote copy parameters. The remote copy parameters are `COPY-MODE`, `ON-ERROR` and `PENDING-UPDATES`.

You can set the `COPY-MODE` and `ON-ERROR` remote copy parameters using the `/MODIFY-REMOTE-COPY-PARAMETER` command. The `PENDING-UPDATES` parameter is always set on the storage system with the target unit. If an error occurs, the `ON-ERROR` and `PENDING-UPDATES` remote copy parameters have a considerable impact on the availability of the source and target units (see [section "ON-ERROR" on page 210](#) and [section "PENDING-UPDATES" on page 211](#)).

`/SHOW-REMOTE-COPY-STATUS` displays the values of the `ON-ERROR` parameter in a separate column. The internal storage system parameter `PENDING-UPDATES` is displayed in the two-part column `PEND-UPD-ON-TARGET`. The `ALLOW` column indicates whether or not `PENDING-UPDATES` are permitted. The `CURR-SIZE` column indicates the current size of outstanding writes to the target unit.

```
/SHOW-REMOTE-COPY-STATUS UNIT=(587C,587D),INF=*PARAMETERS
```

%	-----								
%	SRC	TAR	VOLUME	COPY-MODE:		ON-	PEND-UPD-ON-TARG:		
%	UNIT	UNIT		!MODE	WR-BUFF	P-UPD-LIM!	!ERROR	!ALLOW	CURR-SIZE
%	-----								
%	587C	#007C	8BN4.0	!SYNCH	-	-	!CONTI	!NO	0 MB
%	587D	#007D	8BN4.1	!SYNCH	-	-	!CONTI	!NO	0 MB

9.3.1 COPY-MODE (processing mode)

Remote copying is available in synchronous, adaptive-copy or asynchronous processing mode. The initial settings are made when the remote copy pair is created. The processing mode can be changed using the `COPY-MODE` operand of `/MODIFY-REMOTE-COPY-PARAMETER`.

- **SYNCH**ronous processing mode

Processing mode = synchronous processing. All writes are written via the host channel to the cache of the local storage system and are forwarded from there to the cache of the remote storage system. The main host is notified on successful completion. Only then the next write can be performed.

With this processing mode, data is written on the source unit and the target unit after every successful write.

Synchronous processing mode is the most secure mode.

When synchronous processing mode is set using `/MODIFY-REMOTE-COPY-PARAMETER WAIT=*UNTIL-SYNCHRONIZATION`, the system waits until the remote copy pair is synchronized again. This is possible only when the remote copy status is `ACTIVE`. In dialog mode you can terminate waiting by hitting the **[K2]** key.

- **ADAPTIVE-COPY** processing mode

Processing mode = asynchronous processing. In this processing mode there may be more than one pending write.

The maximum value for pending writes can be set explicitly using the `PENDING-UPDATE-LIMIT` operand in `/MODIFY-REMOTE-COPY-PARAMETER`. If the number of pending writes exceeds the set limit, synchronous processing mode is set automatically until the number of pending writes falls below the limit again.

This processing mode is available in two submodes which use different strategies for noting pending write. You can use `/MODIFY-REMOTE-COPY-PARAMETER` and the `WRITE-BUFFER=*DISK` or `WRITE-BUFFER=*CACHE` operand to specify whether pending writes are noted on the source unit or in the cache of the local storage system.



The processing mode `ADAPTIVE-COPY (WRITE-BUFFER=*CACHE)` is not supported if the source unit resides on VMAX3. See the commands `/MODIFY-REMOTE-COPY-PARAMETER` on [page 324](#) and `/START-REMOTE-COPY` on [page 575](#).

In `ADAPTIVE-COPY` processing mode, performance improves during write load, but remote copy reliability is reduced because the source and target units may differ by several writes.

If `ADAPTIVE-COPY` processing mode is terminated, all pending writes are transferred before a new write is forwarded from the host. If the unprotected source unit fails (i.e. no RAID protection) when `WRITE-BUFFER=*DISK` is set, all data not yet transferred is lost.

The `WRITE-BUFFER=*DISK` setting should be used for data migration. The `WRITE-BUFFER=*CACHE` setting should be used if there is a high write load with reproducible writes.

Because the data still to be transferred is buffered in the cache, the cache space available for other actions is reduced. That may negatively impact throughput.

- **ASYNCH**ronous processing mode (SRDF/A)
SRDF/A is an asynchronous replication function that features cross-disk data consistency. SRDF/A is fully integrated into SRDF and employs the technology and infrastructure of SRDF. Starting with another common copy mode of SRDF (generally “synchronous” or “adaptive copy” mode), an “SRDF/A session” is initiated in which “asynchronous” copy mode is set. The SRDF/A session is terminated by setting a different SRDF copy mode.

In this processing mode there may be more than one pending write. The data on the target units of an SRDF/A session is however always in a state that is consistent across disks even in the event of failures because the writes are transmitted in bundled form and in the correct order.

Constraints for SRDF/A:

- Operation and control only for all devices of the RA group at the same time
- The entry `UNIT=*BY-PUBSET` is possible if the volumes of the pubset match the volumes of the RA group exactly.

9.3.2 ON-ERROR

The `ON-ERROR` remote copy parameter allows you to control how the storage system responds when part of the remote copy pair is no longer available (if the remote link or the source or target unit fails).

If the storage system with the source unit fails, this parameter has no effect. The application encounters an error (REMOUNT message) because neither the remote link nor the source or the target unit is available.

ON-ERROR=*CONTINUE

In the event of a failure, work continues with the remaining unit; the applications are not stopped. If the target unit fails, a subsequent switch to the target unit is not possible.

ON-ERROR=*HOLD

In the event of a failure (of the remote link or target unit), the storage system with the source units rejects all further writes; the applications are stopped and wait for a response.

A decision can then be made (automatically or by the user) as to whether to continue with the source unit alone or to suspend operation in order to preserve data consistency.

Enter the following commands to resume operation:

```
/MODIFY-REMOTE-COPY-PARAMETER . . . ,ON-ERROR=*CONTINUE
```

```
/SET-REMOTE-COPY-ACCESS . . . ,TARGET-ACCESS=*BY-SOURCE
```



`ON-ERROR=*HOLD` must not be specified for paging units. Otherwise it may be that no further SHC-OSD commands can be executed.

With the `ON-ERROR=*HOLD` setting, suspension of remote copy mode by means of `/HOLD-REMOTE-COPY` is rejected by default to prevent application interruption.

9.3.3 PENDING-UPDATES

If the source unit or the entire local Data Center fails, the data copy can be accessed directly via the target path in the remote Data Center. What happens next depends on whether or not the internal setting is overridden.

The internal setting of the `PENDING-UPDATES` parameter is always made on the storage system with the target unit. This can be done only by customer support.

```
/SET-REMOTE-COPY-ACCESS . . . ,TARGET-ACCESS=*DIRECT(ALLOW-PEND-UPDATES=*NO)
```

The `PENDING-UPDATES` parameter setting is not overridden. The target unit rejects the transition to `READY` and assumes the `DISABLED` status if there are still pending writes on the target unit.

```
/SET-REMOTE-COPY-ACCESS . . . ,TARGET-ACCESS=*DIRECT(ALLOW-PEND-UPDATES=*YES)
```

The `PENDING-UPDATES` parameter setting is overridden. The target unit assumes the `READY` status even if there are still pending writes.



CAUTION!

Overriding the `PENDING-UPDATES` parameter setting can result in data inconsistency.

9.3.4 Remote copy status

The `/SHOW-REMOTE-COPY-STATUS` command indicates the remote copy status.

The remote copy status can be: `ACTIVE`, `ERROR` or `IN-HOLD`.

The status depends on the availability of the physical source units, target units and (at least one) remote link. The physical volumes containing the source or target unit must therefore be ready. It is not sufficient that the source or target unit can be addressed from the host.

A timestamp is stored in the storage system each time the remote copy status changes. This timestamp is output as the `LAST-STA-CHNG` field in the `/SHOW-REMOTE-COPY` command and displays the time (format `DDDD.HH:MM:SS`) which has passed since the last time the remote replication function was halted or resumed.

ACTIVE

If the source unit and target unit are ready and there is a link between the local and remote storage systems, the remote copy status is **ACTIVE** (normal status).

The remote copy status **ACTIVE** is characterized by the following outputs:

Output	Output field	Command
ACTIVE	REM-COPY-STATE	SHOW-REMOTE-COPY-STATUS
BY-SOURCE	TARGET-ACCESS	SHOW-REMOTE-COPY-STATUS
AVAILABLE	LINK	SHOW-REMOTE-COPY-STATUS
YES oder NO	SYNCH	SHOW-REMOTE-COPY-STATUS
READY	STATE (for source unit)	SHOW-SYMMETRIX-DEVICE-CONFIG
NOT-READY / READ-ONLY	STATE (for target unit)	SHOW-SYMMETRIX-DEVICE-CONFIG

Examples

```
/SHOW-REMOTE-COPY-STATUS UNIT=587C
```

```
%-----%
% SRC   TAR   VOLUME!REMOTE-COPY TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE ACCESS!DDDD.HH:MM:SS!      !CH !-RA!R-C!R-C
%-----%
%      587C 5FA0 XXXX.0!ACTIVE  SYNC BY-SRC!  47.11:58:12!AVAIL.!YES! 10!NO ! -
```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=8280,CONF=*REM-COPY-PAIRS,INF=*ALL
```

```
%-----%
% UNIT  VOL  TYPE      CONTR-UNIT1 STA TIER- RAID  REM- TIME-      SIZE:
%              /SERIAL-NO      TYPE  /META COPY FINDER CURR./MAXIMUM
%-----%
% 8280 SMEC.0 D3435      8200   RDY  FC    1/-   S/-  -/-/-  3840/ 3840 MB
% 5280          D3435      5200   N-R  FC    1/-   T/-  -/-/-  - / 3840 MB
%-----%
% UNIT  VOL  !INTERNAL-DISK: PHYSICAL-INFORMATION
%              !TYPE      PENDING DA-NO DISK STA !TYPE      PENDING DA-NO DISK STA
%-----%
% 8280 SMEC.0!LOCAL :    0 MB  6C  C9  READY!MIRROR:    0 MB  8A  C9  READY
%              !REMOTE:    0 MB              READY
% 5280          !REMOTE:    0 MB              READY!LOCAL :    0 MB  6C  C9  READY
%              !MIRROR:    0 MB  8A  C9  READY
```

ERROR

If one of the units or the last remote link fails, the remote copy status is `ERROR`. You can use `/SHOW-REMOTE-COPY-STATUS` to display the failed component: one or more components of the remote copy pair will have the status `ERROR` or `NOT-AV`. If the remote links are disabled using `/DISABLE-REMOTE-LINK-DIRECTOR`, the remote copy status is also `ERROR`. The `SYNCH` status is `NO` if the source and the target units are no longer synchronized.

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=587C
```

```
% -----
% SRC   TAR   VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE ACCESS!DDDD.HH:MM:SS!    !CH !-RA!R-C!R-C
% =====
%      587C  5FA0 XXXX.0!ERROR   SYNC NONE  !   0.01:38:12!NOT-AV!NO ! 10!NO ! -
```

IN-HOLD

The remote copy status is `IN-HOLD` if `/HOLD-REMOTE-COPY` has been executed. In this case, the status of the target unit is always `ERROR` (can be displayed using `/SHOW-REMOTE-COPY-STATUS`).

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=587C
```

```
% -----
% SRC   TAR   VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE ACCESS!DDDD.HH:MM:SS!    !CH !-RA!R-C!R-C
% =====
%      587C  5FA0 XXXX.0!IN-HOLD SYNC BY-SRC!   1.10:58:54!AVAIL.!NO ! 10!NO ! -
```

9.3.5 Operating statuses

The following table shows how operating statuses during remote copy mode can be recognized using the output of /SHOW-REMOTE-COPY-STATUS.

The operating status is indicated by the values of REM-COPY-STATE and TARGET-ACCESS (see table). The other fields indicate the device status.

Operating status	Output of /SHOW-REMOTE-COPY-STATUS	
	REM-COPY-STATE column	TARGET-ACCESS column
OK	ACTIVE	BY-SOURCE
Failure of part of the remote copy pair	ERROR	BY-SOURCE or NONE (ON-ERROR=HOLD)
disaster	ERROR	NONE
Failure recovery	ERROR	DIRECT
Failure recovery test	IN-HOLD	DIRECT

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=(587C,587D)
```

```

% -----
% SRC   TAR   VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE  ACCESS!DDDD.HH:MM:SS!      !CH !-RA!R-C!R-C
% =====
%      587C  5FA0  XXXX.0!IN-HOLD  SYNC  DIRECT!    0.00:01:12!AVAIL.!NO ! 10!NO ! -
%      587D  5FA1  XXXX.1!ACTIVE   SYNC  BY-SRC!   47.11:58:58!AVAIL.!YES! 10!NO ! -

```

9.4 Failure scenarios and measures

In failure scenarios it is first necessary to determine whether data is mirrored using SRDF or whether a concurrent SRDF configuration is in use. This section deals with the most important failure scenarios (but not those for concurrent SRDF). The failure scenarios and actions to be taken are similar in concurrent SRDF configurations; however, the following constraints must be taken into account on a case-to-case basis:

- In the event of local failures, a decision must be made as to which of the two remote sites is to continue operation.
- Failure during failback is required because the SWAP-REMOTE-COPY function is not available in concurrent SRDF configurations.
- In the event of failback, concurrent SRDF replication should also be resumed at both remote sites.

The following failure scenarios (without concurrent SRDF) and measures for maintaining operation will be examined:

1. Failure of a protected source or target unit (see [page 216](#))
2. Failure of an unprotected source or target unit (see [page 216](#))
3. Failure of the remote link (see [page 217](#))
4. Failure of the remote storage system (see [page 217](#))
5. Failure of the local storage system (see [page 217](#))
6. Failure of the main host (see [page 218](#))
7. Failure of the local storage system and the main host (Data Center failure) (see [page 219](#))
8. Failure as a result of failback to the local storage system (see [page 220](#))

If a unit fails, it is necessary to establish whether or not the unit was protected by RAID1, RAID5, RAID6 or by a spare unit. If the remote link fails, it is necessary to establish whether one link or the last remote link failed.

After a storage system failure or another failure in the local Data Center, a check should be carried out to establish whether local troubleshooting can recover the application faster than remote recovery. In most cases, local troubleshooting is quicker and remote recovery is not recommended.

If remote recovery is performed, you must consider the application downtime involved in switching to the remote Data Center, starting the application there, and then switching back to the local Data Center once the problem has been resolved.

9.4.1 Failure of a protected source or target unit

If the source or target unit is protected locally by RAID1, RAID5 or RAID6, data can still be accessed after a failure. Applications are not stopped. Data consistency is maintained.

If the failed unit is replaced or a spare unit is used, all readable data is copied from the failed unit. Data that cannot be read is copied from the other (source or target) unit via the remote link.

9.4.2 Failure of an unprotected source or target unit

The `ON-ERROR` operand of `/MODIFY-REMOTE-COPY-PARAMETER` controls how the storage system responds. The initial settings of the operands are made by customer support. In concurrent SRDF configurations the settings apply for both remote copy pairs because the same `ON-ERROR` setting is mandatory for both remote copy pairs.

The following applies for an unprotected source unit: data is only lost in `ADAPTIVE-COPY` processing mode when `WRITE-BUFFER=*DISK` is set.

If both the source unit and target unit fail, operation cannot be maintained. The output of `/SHOW-REMOTE-COPY-STATUS` shows the value `NONE` for `TARGET-ACCESS`.

The setting for the `ON-ERROR` operand determines what happens in this case.

```
/MODIFY-REMOTE-COPY-PARAMETER ... ,ON-ERROR=*CONTINUE
```

In the event of a failure, operation continues with the remaining unit only; the applications are not stopped. If the target unit fails, a subsequent switch to the target unit is not possible.

```
/MODIFY-REMOTE-COPY-PARAMETER ... ,ON-ERROR=*HOLD
```

The storage system with the source units rejects all subsequent writes; the applications are stopped and wait for a response. The source unit assumes the `REMOUNT` status.

A decision can then be made (automatically or by the user) as to whether to continue with the source unit alone or to suspend operation in order to preserve data consistency. The `ON-ERROR=*HOLD` setting may not be specified for paging units because it might then be the case that no more SHC-OSD commands can be executed. In the case of concurrent SDRF configurations processing continues if only one of the two SDRF links fails.

The following commands must be issued to resume operation:

```
/MODIFY-REMOTE-COPY-PARAMETER ... ,ON-ERROR=*CONTINUE
/SET-REMOTE-COPY-ACCESS ... ,TARGET-ACCESS=*BY-SOURCE
```


9.4.3 Failure of the remote link

The failure of a single remote link has the same effect as the failure of a protected unit (see [section “Failure of a protected source or target unit” on page 216](#)).

The failure of the last remote link has the same effect as the failure of an unprotected unit (see [section “Failure of an unprotected source or target unit” on page 216](#)).

9.4.4 Failure of the remote storage system

The failure of the remote storage system has the same effect as the failure of an unprotected unit (see [section “Failure of an unprotected source or target unit” on page 216](#)).

9.4.5 Failure of the local storage system

If the local storage system fails, processing can be resumed within a short time using the target units of the remote storage system. There may be data inconsistency if asynchronous processing mode was set before local failure, or if local failure was preceded by failure of the remote link or target unit.

If paging is affected, the main host also fails (see [section “Failure of the local storage system and of the main host” on page 219](#)).

In concurrent SRDF configurations it is first necessary to select the storage system or location where operation is to be resumed.

Actions on the main host

1. Use `/ATTACH-DEVICE` to attach the target units (see the “Commands” manual [1])

2. Set the target units to `READY`.

If the remote storage system contains only target units affected by the failure, the entire remote storage system can be specified. Switchover takes place simultaneously for all the devices affected.

```
/SET-REMOTE-COPY-ACCESS  
  UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=<remote serialnumber>  
  , LOGICAL-VOLUMES=*ALL-TARGETS), TARGET-ACCESS=*DIRECT
```

For this function, the values `DETACHED-DEVICES=*ACCEPT` and `NOT-DEFINED-DEVICES=*ACCEPT` must be set for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE`.

If not all target units of the remote storage system are affected by the failure, the units must be specified separately. Device selection depends on the settings for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE` and is made using:

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-CONTROLLER(CONTROLLER=<MN of controller with target unit>) /
    *BY-VOLUME(VOLUME=<vsn>) / *BY-PUBSET(PUBSET=<cat-id>) /
    <MN of target unit>
  ,TARGET-ACCESS=*DIRECT
```

If the target unit was not synchronized with the source unit, transition to `READY` is rejected if `PENDING-UPDATES` are not allowed for the unit. This setting can be overridden by means of the following command:

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-CONTROLLER(CONTROLLER=<MN of controller with target unit>) /
    *BY-VOLUME(VOLUME=<vsn>) / *BY-PUBSET(PUBSET=<cat-id>) /
    <MN of target unit>
  ,TARGET-ACCESS=*DIRECT(ALLOW-PEND-UPDATES=*YES)
```

The `*BY-VOLUME` operand may only be used if the target unit was `READ-ONLY` and is unique, or if the source unit was accessible, i.e. the VSN was readable on the unit. The `*BY-PUBSET` operand cannot be used for the switchover because of the failure.

3. Check data integrity (see [section “Data integrity after a failure” on page 223](#))
4. Import the pubsets and start the applications

9.4.6 Failure of the main host

If the main host fails, no data inconsistency occurs because operation is interrupted. The main host must be restarted.

If the main host cannot be restarted and a switch is to be made to the standby host, remote copy mode must first be interrupted with `/HOLD-REMOTE-COPY`. Actions on the standby host are then performed as described in the following section.

9.4.7 Failure of the local storage system and of the main host

If the local Data Center fails, processing can be continued on the standby host.

If the home pubset of the main host has been duplicated with SRDF, and if the standby host is to be started with the same home pubset, a further “small” system is required to activate the target path before startup (`/SET-REMOTE-COPY-ACCESS` with `TARGET-ACCESS= *DIRECT`). There may be data inconsistency if asynchronous processing mode was set before local failure, or if local failure was preceded by failure of the remote link or target unit.

In concurrent SRDF configurations it is first necessary to select the storage system or location where operation is to be resumed.

Actions on the standby host

1. Use `/ATTACH-DEVICE` to attach the target units (see the “Commands” manual [1])
2. Activate the target path (set target units to `READY`).
If the remote storage system contains only target units affected by the failure, the entire remote storage system can be specified. Switchover takes place simultaneously for all the devices affected.

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=<remote serialnumber>
    , LOGICAL-VOLUMES=*ALL-TARGETS)
    , TARGET-ACCESS=*DIRECT
```

For this function, the values `DETACHED-DEVICES=*ACCEPT` and `NOT-DEFINED-DEVICES=*ACCEPT` must be set for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE` in the `/MODIFY-SHC-PROCESSING` command.

If not all target units of the remote storage system are affected by the failure, the units must be specified separately. Device selection depends on the settings for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE` and is made using:

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-CONTROLLER(CONTROLLER=<MN of controller with target unit>) /
    *BY-VOLUME(VOLUME=<vsn>) / *BY-PUBSET(PUBSET=<cat-id>) /
    <MN of target unit>
    , TARGET-ACCESS=*DIRECT
```

The `*BY-VOLUME` operand can be only used if the target unit was `READ-ONLY` and is unique, or if the source unit was accessible, i.e. `VSN` on the source unit was readable. The `*BY-PUBSET` operand cannot be used for the switchover because of the failure.

If the target unit was not synchronized with the source unit, transition to `READY` is rejected if `PENDING-UPDATES` are not allowed for the unit.

This setting can be overridden by the following command:

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-CONTROLLER(CONTROLLER=<MN of controller with target unit>) /
    *BY-VOLUME(VOLUME=<vsn>) / *BY-PUBSET(PUBSET=<cat-id>) /
    <MN of target unit>
    ,TARGET-ACCESS=*DIRECT(ALLOW-PEND-UPDATES=*YES)
```

3. Check data integrity (see [page 223](#))
4. Import the pubsets and start the applications

9.4.8 Failure as a result of failback to the local storage system

When the local storage system or the local Data Center is operational again, processing can once more be moved back to the local storage system and the local Data Center. The applications must be terminated on the standby host and restarted on the main host. If the home pubset is also affected, the standby host must be shut down.

In symmetrical configurations (known as X configurations) failure as a result of failback can be prevented or deferred to a more suitable time using the `SWAP-REMOTE-COPY` function. Without interrupting the application, this function enables source units to be changed into target units and target units on which the applications run to be changed into source units. From this point onwards, secure operation with remote copy data replication is ensured, even without failback.

Actions in the remote Data Center

1. Terminate the applications and export the pubsets
2. Switch to the source path (i.e. set the target unit to `NOT-READY` or `READ-ONLY`). If the remote storage system contains only target units affected by the failure, the entire remote storage system can be specified. Switchover takes place simultaneously for all the devices affected.

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=<remote serialnumber>
    ,LOGICAL-VOLUMES=*ALL-TARGETS)
    ,TARGET-ACCESS=*BY-SOURCE
```

For this function, the values `DETACHED-DEVICES=*ACCEPT` and `NOT-DEFINED-DEVICES=*ACCEPT` must be set for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE`.

The default setting causes all units generated in BS2000 to be set to `NOT-READY` and all other units to `READ-ONLY`. Target units in BS2000 must be `NOT-READY` as otherwise duplicate (i.e. non-unique) VSNs would result in the system. The `READ-ONLY` status is required for other target units as these are not otherwise be recognized by the relevant system. Target units that are not correctly included in the default setting must be processed separately.

If the remote storage system has target units other than those affected by the failure, these must be specified separately. Device selection depends on the settings for `SYSTEM-ADMIN-SCOPE` or `TASK-ADMIN-SCOPE` and is made using:

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-CONTROLLER(CONTROLLER=<MN of controller with target unit>) /
    *BY-VOLUME(VOLUME=<vsn>) / *BY-PUBSET(PUBSET=<cat-id>)
    <MN of target unit>
  ,TARGET-ACCESS=*BY-SOURCE
```

3. Enable the remote links on the remote storage system.

If the remote storage system contains only target units affected by the failure, all the remote links can be enabled.

```
/ENABLE-REMOTE-LINK-DIRECTOR
  DIRECTOR=*ALL,SERIAL-NUMBER=<remote serialnumber>
```

or

```
/ENABLE-REMOTE-LINK-DIRECTOR
  DIRECTOR=*ALL,CONTROLLER-UNIT=<MN of remote controller>
```

If not all target units of the remote storage system are affected by the failure, the units must be specified separately.

4. Use `/DETACH-DEVICE` to detach the target units (see the “Commands” manual [1])

Subsequently replication with data recovery can be resumed.

Actions in the local Data Center

1. Prepare the local storage system:
 - Disable all the channels and remote links (to prevent access).
 - Reconnect all the channel or remote link cables.
 - Start the local storage system.
 - Service should check the local storage system for damage. This includes checking whether all tracks on the source units are readable and whether the local storage system is ready for synchronization.
2. Activate the remote links on the local storage system.
The local and remote storage systems begin synchronization. Data is copied from the target units to the source units once the remote links have been enabled.
3. Activate the host channels on the local storage system.
The host channels can be set to online once synchronization has started.
4. Start main host
5. Attach the source units on the main host and resume processing: /ATTACH-DEVICE (see manual “Commands” [1]).
The reconstruction process can be checked by means of the following command

```
/SHOW-SYMMETRIX-DEVICE-CONFIG
UNIT=<MN of source unit(s) / MN of target unit(s)>,
CONFIGURATION=*REMOTE-COPY-PAIRS,
INFORMATION=*PHYSICAL
```
6. Import the pubsets and start the applications

9.4.9 Data integrity after a failure

Data integrity after a failure is dependent on the processing mode (SYNCH, ADAPTIVE-COPY, ASYNCH) and the number of pending writes.

If a link or device error occurs before or during a failure, the source and target units will no longer be synchronized. In other words, if the internal synchronization process is interrupted by a failure in SYNCH or ASYNCH processing mode, the source and target units contain inconsistent data. This is also the case when the synchronization process started by /RESUME-REMOTE-COPY is interrupted.

The situation is even more complicated if not all logically interdependent data is located on the same remote copy pair. In the following case, a device or link error occurs while a DB record is being written. The host does not respond to the error and writes the associated LOG record to another remote copy pair that is not affected by the error. The data on the target units with the DB and LOG records is then inconsistent.

There are two ways of preventing this:

- By using SYNCH processing mode and protecting the target units with RAID1, RAID5 or RAID6. It is advisable to configure the target units with the logically interlinked data on the same storage system. In this case, only a remote link failure can interrupt operation, and this affects all devices at the same time.
- By using SYNCH processing mode and entering /MODIFY-REMOTE-COPY-PARAMETER . . . ,ON-ERROR=*HOLD for all source units. If a device or link error occurs, host access is interrupted. A decision can then be made as to whether to continue with the remaining unit only (failure of an individual device, not a disaster) or to suspend operation in order to maintain data consistency.

9.4.10 Summary of failure scenarios

Failure	Condition	Reported with	Operation interrupted?	Impact	Response (measure)	Data inconsistency on later switch to targets?
Source or target unit	Protected	NJD0012 ¹	No	-	Customer support (measure A)	No
	Unprotected, ON-ERR=*CONT	NJD0012 ¹ , NDE0020	No	Performance, if source unit is affected	Customer support Note inconsistency (measure B)	Yes, if target unit is affected
	Unprotected, ON-ERR=*HOLD	NJD0012 ¹ , NDE0020	REMOUNT NKVD014	Applications wait	Measure A or continue with remaining unit	No Yes
Single remote link		NJD0012 ¹ , NDE0010	No	Write performance	Customer support	No
Last remote link	ON-ERR=*CONT	NJD0012 ¹ , NDE0010, NDE0012	No	-	Customer support Note inconsistency	Yes
	ON-ERR=*HOLD	NJD0012 ¹ , NDE0010, NDE0020, NDE0012	REMOUNT NKVD014	Applications wait for response	Measure A or continue with remaining unit	No Yes
Storage system with source units		PGER message	Yes		Measure A	Possible ²
Local host	-	..	Yes	-	Restart	No
Complete failure ³		..	Yes		Measure A	Possible ²
Failback to local storage system		-	Yes		Measure B	

¹ NJD0012 messages are not supported for x86 servers.

² Data inconsistency on later switching to the targets is possible unless synchronous or asynchronous (SRDF/A) processing mode is set or if errors have already occurred on remote links or target units.

³ Failure of the local storage system with source units and failure of the main host.

Failure recovery measures

Measure	Description	Condition	Action	Command
A	Switch to target unit, main host affected		Start standby host, attach target units	/ATTACH-DEVICE
		Source and target units were synchronized	Make target units available	/SET-REMOTE-COPY-ACCESS TARGET-ACCESS=*DIRECT
		Source and target units were not synchronized, inconsistencies acceptable (or reset to last synchronization point)		/SET-REMOTE-COPY-ACCESS TARGET-ACCESS= *DIRECT(PEND-UPD- ALLOWED=*YES)
B	Failback to the local storage system, operation on standby host		Terminate use of target units	/EXPORT-PUBSET
			Make target units unavailable	/SET-REMOTE-COPY-ACCESS TARGET-ACCESS= *BY-SOURCE
			Disable all channels and remote links on the local storage system	(Service)
			Start local storage system	(Service)
		Local storage system OK (Service will check)	Attach and enable remote links	(Service)
		Comparison OK / automatic synchronization begun?	Attach channels	(Service)
			Start main host	

Special information on failure scenarios with SRDF/A

SRDF/A always builds on an existing SRDF replication (see [page 205](#)). Restart of SRDF/A after a failure is therefore performed in two steps. SRDF replication must be restarted first (as described in the above sections) and then the SRDF/A session can be reactivated.

If a failure occurs, the following should be noted with regard to SRDF/A replication.

- SRDF link failure
 - Temporary failure:
SRDF/A is able to compensate temporary failures of SRDF links. A time interval of 0 to 10 seconds can be configured in the storage system for which SRDF/A will tolerate an SRDF link failure. If the links are reestablished within this interval, there is no impact on the application. After expiry of the interval, the failure is treated as a permanent failure.
 - Permanent failure:
The SRDF/A session is automatically terminated in the event of a permanent failure. The data on the target side is consistent. Once the links are reestablished, SRDF operation can be resumed using normal SRDF recovery procedures and a new SRDF/A session can be activated.
- Available cache for SRDF/A in the local storage system is full

If the I/O load for the local storage system, the available bandwidth for SRDF/A replication and the cache size of the storage system are not (or no longer) correctly configured, the entire write cache for SRDF/A in the local storage system may be used up.

In this case two alternative procedures can be set by customer support:

 - The application is slowed down to the transmission speed of the SRDF links. This means that during this period performance is poorer than with synchronous SRDF mode in the same configuration.
 - The SRDF/A session is terminated immediately and automatically. Termination can be delayed by a configurable time interval (the default setting is 0 seconds). The application is slowed during this interval. If the bottleneck is cleared within this time interval, the SRDF/A session is continued; otherwise it is terminated.
- Disaster recovery, failback procedure on the target side

Data on the target side is consistent in the event of a failure. The failback procedure is the same as that for SRDF. After a failback, SRDF/A can be reactivated as soon as the application is available again on the local host.

9.5 Testing the recovery procedures

The test scenario differs from a genuine failure in that the local storage system is active during the test. Processing on the source units takes place in the local Data Center. The recovery procedures are tested in the remote Data Center using the target units.



CAUTION!

If the source units are not protected locally by RAID1, RAID5 or RAID6, data loss can occur while the source and target units are split. If a system is started from a target unit, the SYSID of the pubset must first be changed using `/SET-PUBSET-ATTRIBUTES` (see the "Commands" manual [1]). Otherwise, problems can occur with sharable units.

Overview

A recovery procedure consists of the following steps:

- Failure detection
- A check to establish whether processing can be continued on the main host (with the source units)
- Interrupting remote copy mode and enabling the target path
- Shutdown of the main host, if necessary
- Startup of the standby host and continuation of processing (IPL, attach, import, change network node, restart applications)

The actions needed to interrupt remote copy mode and enable the target path are described on [page 228](#). The actions needed to recover the source and target units are described on [page 232](#).

9.5.1 Interrupting remote copy mode and enabling the target path

Remote copy mode must be interrupted because the local storage system must remain ready for operation during the tests.

Actions on the main host

1. Before remote copy mode is interrupted, the `/MODIFY-REMOTE-COPY-PARAMETER` command must be specified with `ON-ERROR=*CONTINUE`. Otherwise the source unit will reject all writes.

```
/MODIFY-REMOTE-COPY-PARAMETER
UNIT=<MN of source unit> /
  *BY-VOLUME(VOLUME=<vsfn>) /
  *BY-PUBSET(PUBSET=<cat-id>) /
  *BY-CONTROLLER(CONTROLLER-UNIT=
    <MN of controller with target unit>) /
  *BY-SYMMETRIX(SERIAL-NUMBER=
    <serialnumber of controller with source unit>
    ,LOGICAL-VOLUME=*ALL-SOURCES / <internal device number>)
,ON-ERROR=*CONTINUE
```



It is important to specify the `ON-ERROR=*CONTINUE` operand.

2. The source unit and target unit must be synchronized or be consistent. The processing mode must therefore be set to `SYNCH` or `ASYNCH` because pending writes could be noted in `ADAPTIVE-COPY` processing mode.

```
/MODIFY-REMOTE-COPY-PARAMETER
UNIT=<MN of source unit> /
  *BY-VOLUME(VOLUME=<vsfn>) /
  *BY-PUBSET(PUBSET=<cat-id>) /
  *BY-CONTROLLER(CONTROLLER-UNIT=
    <MN of controller with source unit>) /
  *BY-SYMMETRIX(SERIAL-NUMBER=
    <serialnumber of controller with source unit>
    ,LOGICAL-VOLUME=*ALL-SOURCES / <internal device number>)
,COPY-MODE=*SYNCH / *ASYNCH
```



It is important to specify the `COPY-MODE=*SYNCH` operand for synchronous remote copy pairs or `COPY-MODE=*ASYNCH` for consistent remote copy pairs.

A timestamp is stored in the storage system each time the remote copy status changes. This timestamp is output as the `LAST-STA-CHNG` field in the `/SHOW-REMOTE-COPY` command and displays the time (format `DDDD.HH:MM:SS`) which has passed since the last time the remote replication function was halted or resumed.

3. Terminate applications, if necessary, to maintain data consistency on the source and target units.
4. Check whether the source and target units are synchronized or are consistent.

For COPY-MODE=*SYNCH:

Global check: YES is shown in the SYNCH field

```
/SHOW-REMOTE-COPY-STATUS UNIT=587C, INFORMATION=*SUMMARY
```

```

%-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT UNIT  !STATE  MODE  ACCESS!DDDD.HH:MM:SS!  !CH !-RAIR-C!R-C
%=====
% 587C 5FA0 XXXX.0!ACTIVE  SYNC BY-SRC!  47.11:58:38!AVAIL.!YES! 10!NO ! -
%-----

```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG
```

```
UNIT=<MN der Source-Unit> / <MN of target unit>
```

```
, CONFIGURATION=*REMOTE-COPY-PAIRS
```

```
, INFORMATION=*PHYSICAL
```

Detailed check: The number of pending writes for the target unit must be 0 (see the grayed field in the example below).

Example

```
[Targets detached!]
```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=(28AA), CONF=*REM-COPY-PAIRS, INF=*ALL
```

```

%-----
% UNIT  VOL  TYPE  CONTR-UNIT1 STA TIER- RAID  REM- TIME-  SIZE:
% /SERIAL-NO  TYPE /META COPY FINDER CURR. /MAXIMUM
%=====
% 28AA XXXX.0 D3435 000190100207 RDY - 5/- S/- -/-/- 3984/ 3984 MB
% 5FA0 D3435 000287400368 N-R - 5/- T/- -/-/- - / 3984 MB
%-----
% UNIT  VOL  !INTERNAL-DISK: PHYSICAL-INFORMATION
% !TYPE  PENDING DA-NO DISK STA !TYPE  PENDING DA-NO DISK STA
%=====
% 28AA XXXX.0!REMOTE: 0 MB  READY
% !RAID5 : 16C C7 READY!RAID5 : 2C C7 READY
% !RAID5 : 1D C7 READY!RAID5 : 15D C7 READY
% 5FA0 !REMOTE: 0 MB  READY
% !RAID5 : 16A D8 READY!RAID5 : 16B C8 READY
% !RAID5 : 1C C8 READY!RAID5 : 1D D8 READY
%-----

```

For COPY-MODE=*ASYNCH (SRDF/A):

Global check: Y is shown in the TARGET-UNIT: CONS field

```
/SHOW-REMOTE-COPY-STATUS UNIT=3AAB, INFORMATION=*ASYNCHRONOUS-SESSION
```

```

%-----
% SRC  TARG !SRDF/A-SESSION:  !TARGET-UNIT:
% UNIT UNIT !ACT  NUM  CYCL# #DEV  T-PEND CYCL-T!PEND  LAG-T CONS PROT
%=====
% 3AAB 38AB ! Y    0    6    29    0 MB 00:29!  0 MB 00:50  Y  DIS
%-----

```

5. Interrupt remote copy mode.

```
/HOLD-REMOTE-COPY
UNIT=<MN of source unit> / *BY-VOLUME(VOLUME=<vsn>) /
    *BY-PUBSET(PUBSET=<cat-id>) / *BY-SYMMETRIX(SERIAL-NUMBER=<ser-no>,
    LOGICAL-VOLUME=*ALL-SOURCE-UNITS(RA-GROUP=<no>))
```

The main host continues processing using only the source units.

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=587C, INFORMATION=*SUMMARY
```

```
% -----
% SRC   TAR   VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT      !STATE   MODE ACCESS!DDDD.HH:MM:SS!  !CH !-RA!R-C!R-C
% -----
%   587C  5FA0  XXXX.0!IN-HOLD SYNC BY-SRC!  47.11:58:38!AVAIL.!YES! 10!NO ! -
```



The information output reflects the view on the remote copy pair and not on an individual unit. The `/SHOW-SYMMETRIX-DEVICE-CONFIG` command (see [page 537](#)) supplies detailed information on a unit.

Actions on the standby host

1. The remote links need not be deactivated as long as remote copy mode is interrupted. This can be done by the recovery procedures. Before you start the test, you should therefore ensure that no other unit is using these remote links.

Enable the target path by setting the target units to `READY`.

```
/SET-REMOTE-COPY-ACCESS
UNIT=<MN of target unit> / *BY-VOLUME(VOLUME=<vsn>) /
    *BY-PUBSET(PUBSET=<cat-id>) /
    *BY-SYMMETRIX(SERIAL-NUMBER=<target serialnumber>
    , LOGICAL-VOLUME=*ALL-TARGET-UNITS(RA-GROUP=<no>))
    , TARGET-ACCESS=*DIRECT
```

The standby host can access the target units once this command has been executed. The recovery procedures can now be tested. The main host continues to access the source units because the `/SET-REMOTE-COPY-ACCESS` command does not affect on the source units if `/HOLD-REMOTE-COPY` was issued beforehand.

The `*BY-VOLUME` operand may only be used if the target unit was `READ-ONLY` and is unique, or if the source unit was accessible, i.e. VSN was readable on the unit.

The `*BY-PUBSET` operand can be only used if the source unit was accessible and the pubset is imported on this host.

2. If the source unit and target unit were not fully synchronized before `/HOLD-REMOTE-COPY` was issued, and if `PENDING-UPDATES` are not allowed, transition of the target unit to `READY` is rejected. This prevents the use of invalid data. This can be overridden by the following command.

```
/SET-REMOTE-COPY-ACCESS
  UNIT=<MN of target unit> / *BY-VOLUME(VOLUME=<vsn>) /
    *BY-PUBSET(PUBSET=<cat-id>) /
    *BY-SYMMETRIX(SERIAL-NUMBER=<target serialnumber>
, LOGICAL-VOLUME=*ALL-TARGET-UNITS(RA-GROUP=<no>))
, TARGET-ACCESS=*DIRECT(ALLOW-PEND-UPDATES=*YES)
```

Example

```
/SHOW-REMOTE-COPY-STATUS UNIT=587C, INFORMATION=*SUMMARY
```

```
-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE  ACCESS!DDDD.HH:MM:SS!  !CH !-RA!R-C!R-C
% -----
% 587C  5FA0  XXXX.0!IN-HOLD SYNC  DIRECT!  47.11:58:38!AVAIL.!NO ! 10!NO ! -
% -----
```



The information output reflects the view on the remote copy pair and not on an individual unit. The `/SHOW-SYMMETRIX-DEVICE-CONFIG` command (see [page 537](#)) supplies detailed information on a unit.

9.5.2 Reconstructing the source and target units after the test

Before remote copy mode is resumed, the remote copy pair must be checked for data differences, and a decision must be made as to whether to accept the differences on the source or on the target unit.

Actions on the standby host

Access of the standby host to the target units must be interrupted; processing is resumed over the source path.

If necessary, enable the remote link (/ENABLE-REMOTE-LINK-DIRECTOR).

```
/SET-REMOTE-COPY-ACCESS
  UNIT=<MN der Target-Unit> / *BY-PUBSET(PUBSET=<cat-id>) /
    *BY-VOLUME(VOLUME=<vsfn>) >) /
    *BY-SYMMETRIX(SERIAL-NUMBER=<target serialnumber>
, LOGICAL-VOLUME=*ALL-TARGET-UNITS(RA-GROUP=<no>))
, TARGET-ACCESS=*BY-SOURCE
```

Actions on the main host

Check whether there is a data difference between the source unit and target unit (not for VMAX3).

```
/SHOW-SYMMETRIX-DEVICE-CONFIG
  UNIT=<MN of source unit> / <MN of target unit>
, CONFIGURATION=*REMOTE-COPY-PAIRS
, INFORMATION=*PHYSICAL
```

Depending on the result of the SHOW output, a decision must be made on the appropriate action.

- Keep the changes on the source units (i.e. all changes made on the target unit during the recovery tests are discarded).

```
/RESUME-REMOTE-COPY
  UNIT=<MN of source unit> / *BY-VOLUME(VOLUME=<vsfn>) /
    *BY-PUBSET(PUBSET=<cat-id>) / *BY-SYMMETRIX(SERIAL-NUMBER=<ser-no>
, LOGICAL-VOLUME=*ALL-SOURCE-UNITS(RA-GROUP=<no>))
, RESTORE=*FROM-SOURCE
, WAIT=*UNTIL-SYNCHRONIZATION
```


- Keep the changes on the target units (i.e. all changes made on the source unit during the recovery tests are discarded).
 - Terminate the applications on the source units (but the source unit should remain attached).
 - Start the restore process.

```
/RESUME-REMOTE-COPY
  UNIT=<MN of source unit> / *BY-VOLUME(VOLUME=<vsn>) /
    *BY-PUBSET(PUBSET=<cat-id>) /
    *BY-SYMMETRIX(SERIAL-NUMBER=<ser-no>
, LOGICAL-VOLUME=*ALL-SOURCE-UNITS(RA-GROUP=<no>))
, RESTORE=*TO-SOURCE
, WAIT=*UNTIL-SYNCHRONIZATION
```

The `WAIT` operand specifies whether the command is to wait until synchronization is terminated or, in asynchronous processing mode (SRDF/A), for consistency (`WAIT=*UNTIL-SYNCHRONIZATION`) or not (`WAIT=*NO`). This simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress of the remote copy pair are unnecessary.

10 Mixed forms of replication (ETERNUS DX, Symmetrix/VMAX3)

This chapter initially describes the concept of "data mobility", the use of mixed forms of replication for redundant data management.

Detailed information is then provided on using the mixed forms of replication in the storage systems operated with SHC-OSD.

10.1 Data mobility

Data mobility refers to the periodic creation of a consistent version of the productive data at a second, geographically distant location. It is therefore an appropriate variant for implementing a disaster protection strategy. It is based on a configuration of local and remote replication in a specified configuration and, depending on the application scenario, provides an alternative to synchronous and asynchronous remote replication.

Data mobility defines the hardware and software configuration for redundant data management using mixed replication functions for the ETERNUS DX and Symmetrix/VMAX3 storage systems.

Data mobility uses subsets as data management units.

Control of the processes required can be automated using SHC-OSD commands in procedures.

Data mobility comprises two scenarios:

1. Automatic and periodical creation of consistent data at a second, geographically distant location. The synchronization point is defined by the application.
2. Quick reconstruction of the data from the second, geographically distant location.

In the following information the ETERNUS DX storage systems are taken as an example. The scenarios described also apply for Symmetrix/VMAX3 systems.

Initial configuration

The initial configuration is a combination of local replication using EC in both the local storage system and in the remote storage system in conjunction with remote replication using REC.

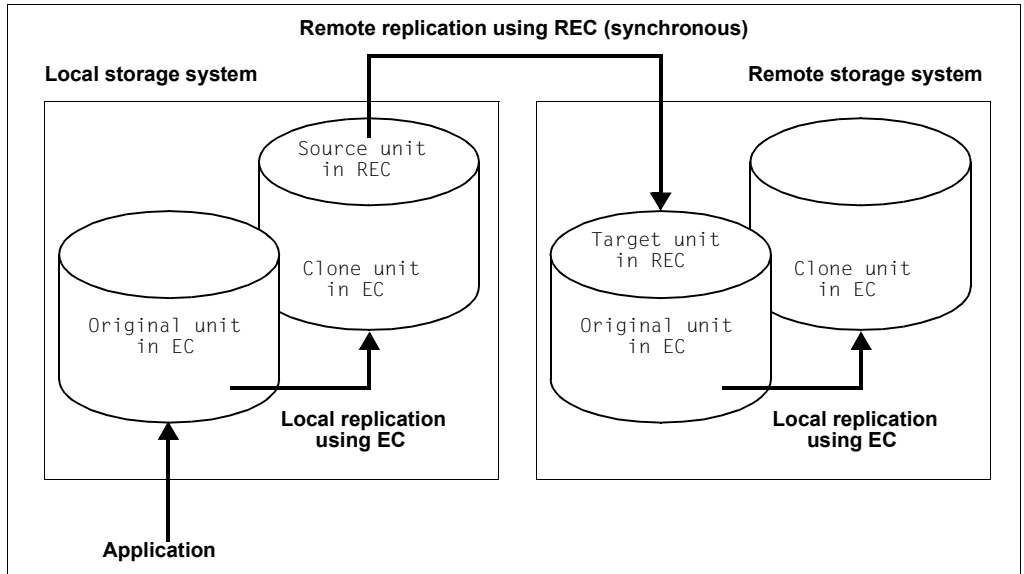


Figure 27: Data mobility: Initial configuration

Creating the consistent data

To create the consistent data on the second, geographically distant location, first of all a synchronization point is defined and created for use in the local storage system. In an initial step local replication using EC is suspended at this synchronization point, thus ensuring consistent data on the local clone unit. Subsequently the application can continue to execute.

Parallel to this the local clone unit, which is also the source unit for remote replication using REC, is synchronized with the target unit in the remote storage system.

After synchronization has been concluded, in a further step the clone unit for EC is updated with this status on the remote storage system and then split.

As a result the data created is now available on the clone unit of the remote storage system.

This procedure can be repeated periodically. Further consistent backups of the data will then be created on clone units of the remote storage system.

Reconstruction

The backed-up data is reconstructed from the clone unit of the remote storage system to the original volume.

Various options are available for this:

- Reconstruction from the clone unit in the remote storage system directly to the original unit in the local storage system in the following steps:
 1. Cancel the clone pairs in the local and remote storage systems with `/STOP-CLONE-SESSION`
 2. Suspend remote copy mode with `/HOLD-REMOTE-COPY`
 3. Temporary replication (using REC) from the clone unit of the remote storage system to the original unit of the local storage system to synchronize the data inventories:
 - a) Create remote copy pair with `/START-REMOTE-COPY UNIT=<clone-unit (remote)>, TARGET-UNIT=<original-unit (local)>, WAIT=*UNTIL-SYNCRONIZATION`

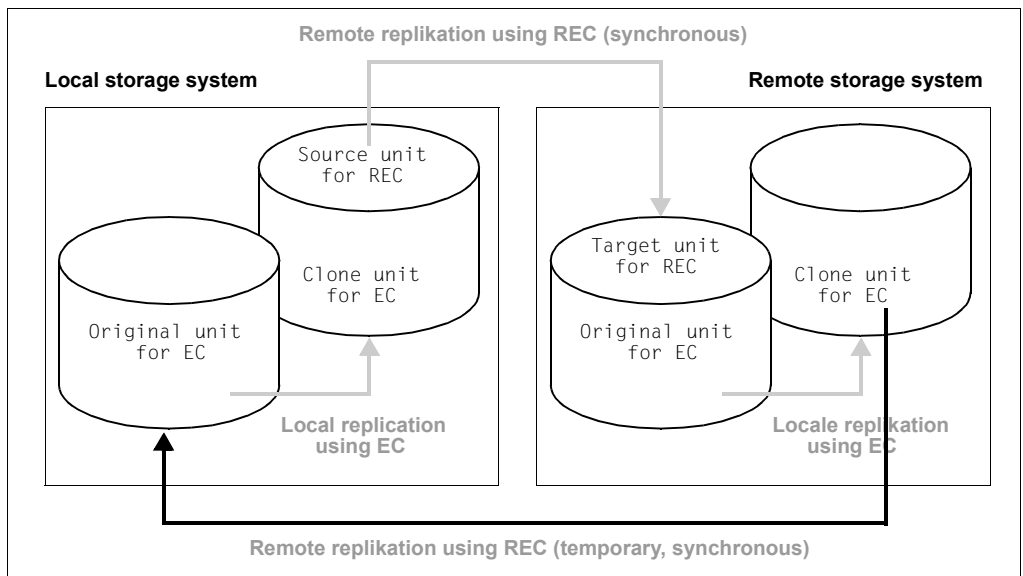


Figure 28: Data mobility: Reconstruction of clone unit (remote)

- b) Suspend remote copy mode and rename pubset with `/HOLD-REMOTE-COPY UNIT=*BY-PUBSET(PUBSET=..., NEW-PUBSET=...)`
 - c) Temporary remote copy mode terminated with `/STOP-REMOTE-COPY`
4. Set up the initial configuration for data mobility again

The advantage of this concept is that the original data is reconstructed quickly in one synchronization process with few processing steps.

The disadvantage of this concept is that a complete copy is needed both when restoring the original unit and also after this when reconstructing the original configuration for data mobility.

However, reconstruction will tend to be performed only rarely.

- Reconstruction through temporary reversal of the replication direction for all mirror pairs in the following steps:
 1. Swap the original and clone properties of the clone pairs in the local and remote storage systems with `/SWAP-CLONE-SESSION`
 2. Swap the source and target properties of the remote copy pair with `/SWAP-REMOTE-COPY`

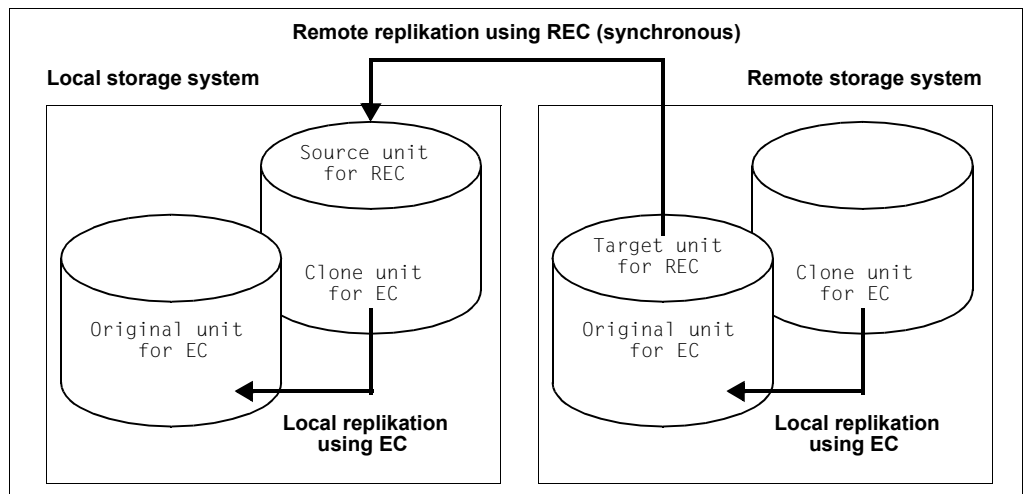


Figure 29: Data mobility: Temporary reversal of the replication direction

3. Start resynchronization for all EC and REC pairs beginning with the clone unit on the remote storage system.
4. Set up the initial configuration for data mobility again

The advantage of this concept is that only delta copies are required both for reconstruction and also for restoring the initial configuration for data mobility. Consequently only a slight load is placed on the storage systems and the remote links.

The disadvantage of this concept is the large number of processing steps involved in reconstructing the original data.

- Continuation of the application(s) using the remote storage system as the database without reconstruction (reversal of the replication direction in the case of symmetrical configurations)
 1. Terminate remote copy mode with `/STOP-REMOTE-COPY`
 2. Restart the application, use remote storage system
 3. Split the local and remote EC pairs
 4. Create remote copy pair with `/START-REMOTE-COPY UNIT=<clone-unit (remote)>, TARGET-UNIT=<original-unit (local)>, WAIT=*UNTIL-SYNCRONIZATION`

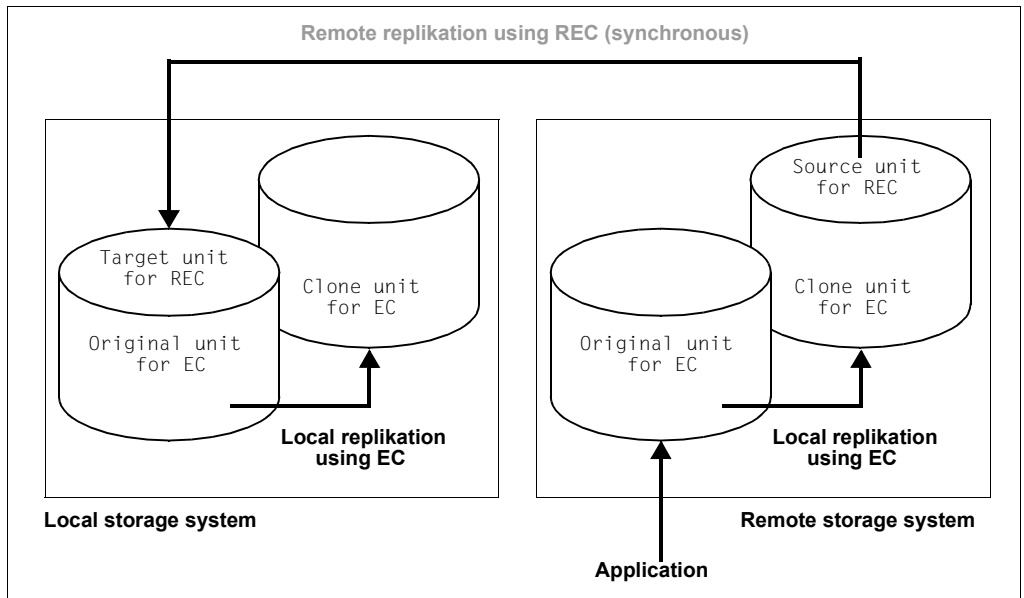


Figure 30: Data mobility: Symmetrical configuration

The advantage of this concept is the rapid restoration of the configuration for data mobility.

The disadvantage of this concept can be that the application(s) is/are relocated or restarted using the original unit in the remote storage system as as the database.

10.2 EC and REC (ETERNUS DX)

EC can be used together with REC. A number of cases must be distinguished here:

- Clone units are assigned to the source unit and/or target unit of a REC pair. They are consequently simultaneously the original unit of the clone pair.
- The REC source unit is simultaneously the clone unit of a clone pair.



An EC clone unit cannot simultaneously also be a REC target unit.

In all described cases REC can be operated in synchronous and (for ETERNUS DX S3) in asynchronous copy mode, see [chapter “Remote replication with REC \(ETERNUS DX\)” on page 177](#).

You can switch from cascaded remote copy to concurrent remote copy and vice versa with the `/SWAP-REMOTE-COPY TARGET-UNIT=` command, see [page 178](#). This gives rise to various combinations of EC and REC.

10.2.1 EC clone unit as REC source unit

This configuration defines a cascade of local and remote replication.

A clone pair can consist of a unit and a clone unit which is simultaneously a REC source unit. Such a clone pair can be managed with the usual commands.

10.2.2 REC source unit is simultaneously EC original unit

This configuration defines a simultaneous local and remote replication.

A clone pair can consist of a unit which is simultaneously the REC source unit and a clone unit. Such a clone pair can be managed with the usual commands.

10.2.3 REC target unit as EC original unit

This configuration defines a cascade of local and remote replication.

A clone pair can consist of a unit which is simultaneously the REC target unit and a clone unit. In this case the clone pair generally cannot be accessed via the VSN or the pubset ID because the target unit is not readable. If the source unit is attached, the pubset ID of the source unit can be specified in the clone session commands using the `UNIT=*BY-PUBSET(. . .)` operand in conjunction with `SELECT=*TARGET-UNIT`.

The following requirements must be met to permit a clone pair with a target unit to be selected via the VSN or pubset ID:

- The source unit is attached.
- In the case of `/ACTIVATE-CLONE` one of the two following cases occurs:
 - Remote copy mode is interrupted; `/SHOW-REMOTE-COPY-STATUS` displays the remote copy status `IN-HOLD` or `ERROR`.
 - In the case of remote copy mode, synchronous processing mode is set and the remote copy pair is synchronized.

When BS2000 has a Fibre Channel connection to the remote storage system, SF pubsets can be renamed implicitly using `/ACTIVATE-CLONE` and `NEW-PUBSET=<new cat id>`. The I/Os to the source unit can be suspended in ongoing operation by means of `/ACTIVATE-CLONE` and the `HOLD-IO=*UNTIL-ACTIVATED` operand to ensure consistent splitting.

Scenarios for EC in REC configurations

Without renaming of the clone units

The source unit and target unit form a remote copy pair (see the figure below).

At the same time the two also form a clone pair:

- The source unit with the clone unit of the local storage system
- The target unit with the clone unit of the remote storage system

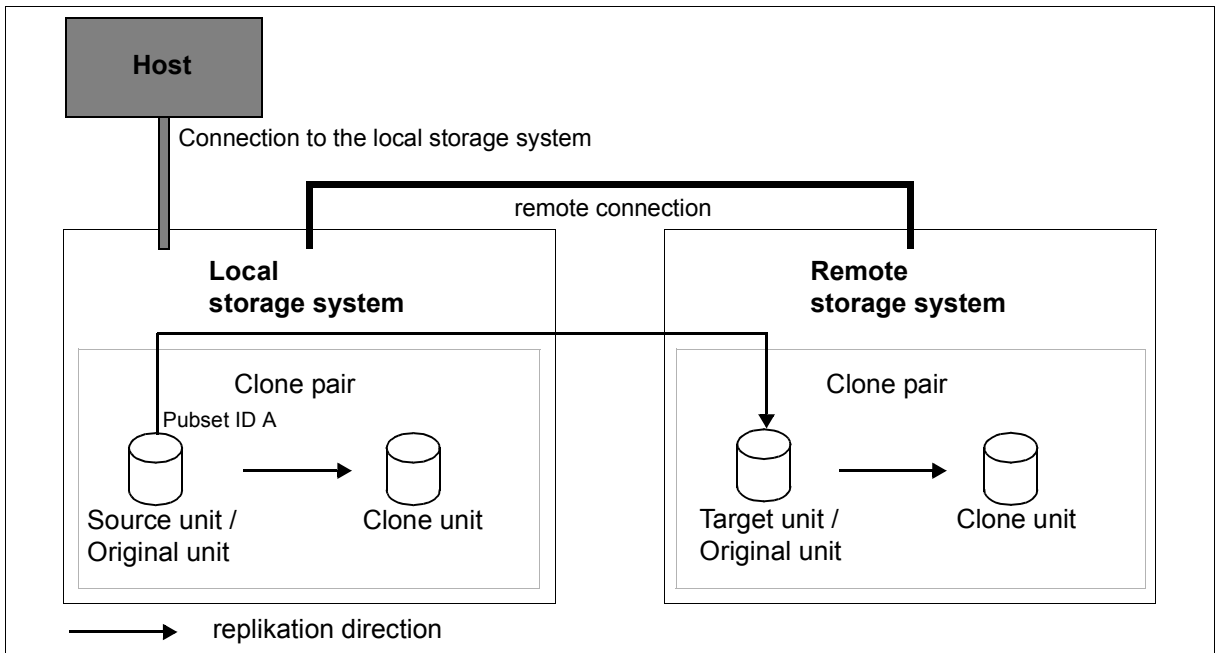


Figure 31: EC Clone with REC, no renaming of the clone units

The host has no connections to the remote storage system, which cannot therefore be accessed directly from the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

The clone pair in the remote storage system is activated using `/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=A) , SELECT=*TARGET-UNIT.`

With renaming of the clone units

The source unit and target unit form a remote copy pair (see the figure below).

At the same time each of the two units forms a clone pair:

- The source unit with the clone unit of the local storage system
- The target unit with the clone unit of the remote storage system

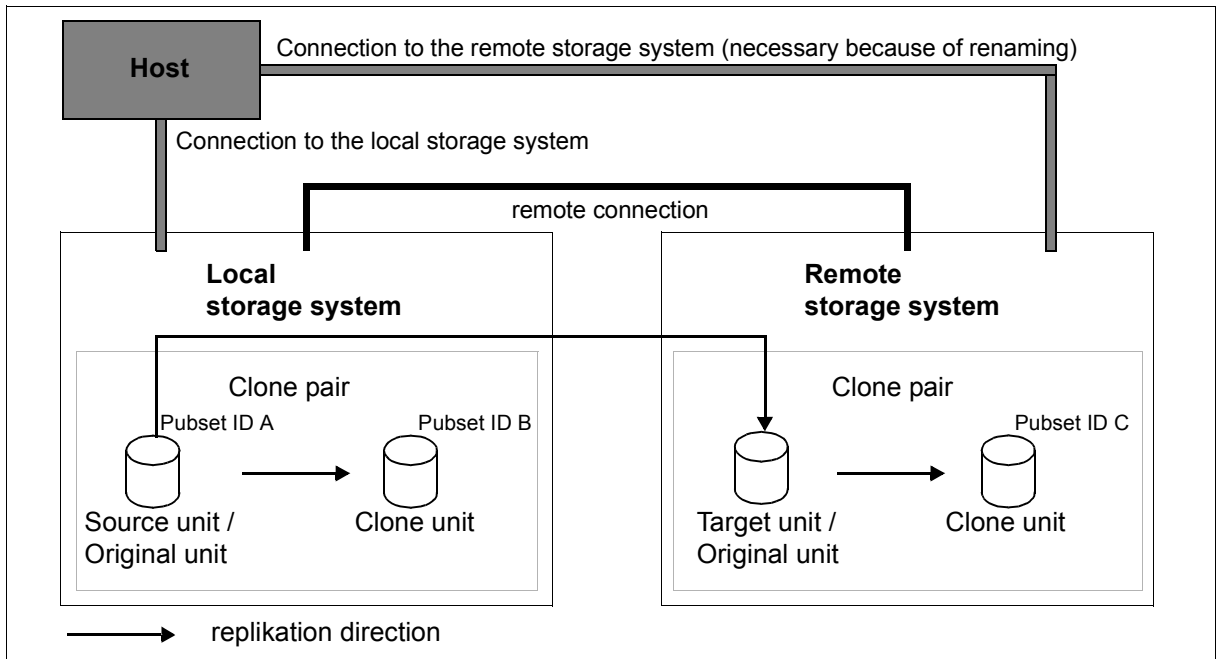


Figure 32: EC/Clone with REC with renaming of the clone unit in the remote storage system

The host has connections to the remote storage system, which means that the latter can be accessed directly by the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

`/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=A, NEW-PUBSET=B)` causes the clone pair in the local storage system to be split and the clone unit's pubset ID to be changed to B.

`/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=A, NEW-PUBSET=C), SELECT=*TARGET-UNIT` is used to split the clone pair in the remote storage system, and the pubset ID of the clone unit is changed to C.

This permits the units to be used as follows, for example:

- the source unit (with pubset ID A) for the main application
- The clone unit of the local storage system (with pubset ID B) for the backup
- the target unit as a copy in case a disaster occurs
- The clone unit of the remote storage system (with pubset ID C) for evaluations

10.3 EC and SnapOPC+ (ETERNUS DX)

SnapOPC+ snap sessions can be created on EC original and clone units, i.e. snap units can be assigned to both the original and the clone unit of a clone pair. The snap unit and the original/clone unit then form a snap pair in the context of a snap session. The original/clone unit is then also the original unit of the snap pair.



A snap unit cannot become an EC original unit.

`/SWAP-CLONE-SESSION` can also be used together with SnapOPC+.

When a snap pair consists of a clone unit and a snap unit, access to the snap pair via the VSN or pubset ID is not possible because the clone unit is generally not readable.

Prerequisites for addressing a snap pair with clone unit via the pubset ID or VSN:

- The original unit is attached.
- In addition, in the case of `/START-SNAP-SESSION` replication with EC must either be interrupted (`/SHOW-CLONE-SESSION-STATUS` displays the `SPLIT` status) or the clone pair must be synchronized in the event of active replication.

SF pubsets can also be implicitly renamed with `/ACTIVATE-SNAP` or `/START-SNAP-SESSION NEW-PUBSET=<new cat id>`. The I/Os to the original unit can be suspended in ongoing operation using the `HOLD-IO=*UNTIL-ACTIVATED` operand to ensure consistent splitting.

10.4 SnapOPC+ and REC (ETERNUS DX)

SnapOPC+ snap sessions can be created on REC source and target units, i.e. snap units can be assigned to both the source and the target unit of a remote copy pair. The snap unit and the source/target unit then form a snap pair in the context of a snap session. The source/target unit is then also the original unit of the snap pair.



A snap unit cannot become an REC original unit.

`/SWAP-REMOTE-COPY` can also be used together with SnapOPC+.

When a snap pair consists of a target unit and a snap unit, access to the snap pair via the VSN or pubset ID is not possible because the target unit is generally not readable. If the source unit is attached, the pubset ID of the source unit can also be specified in the snap session commands using the `UNIT=*BY-PUBSET(...)` operand in conjunction with `SELECT=*TARGET-UNIT`.

Prerequisites for addressing a snap pair with target unit via the pubset ID or VSN:

- The source unit is attached.
- In addition, in the case of `/START-SNAP-SESSION` remote copy mode must either be suspended (`/SHOW-REMOTE-COPY-STATUS` shows the remote copy status `IN-HOLD` or `ERROR`) or, if remote copy mode is active, the remote copy pair must be synchronized.

SF pubsets can also be implicitly renamed with `/ACTIVATE-SNAP` or `/START-SNAP-SESSION NEW-PUBSET=<new cat id>`. The I/Os to the source unit can be suspended in ongoing operation using the `HOLD-IO=*UNTIL-ACTIVATED` operand to ensure consistent splitting.

Scenarios for SnapOPC+ in REC configurations

i In all described cases REC can be operated in synchronous and (for ETERNUS DX S3) in asynchronous copy mode, see [chapter “Remote replication with REC \(ETERNUS DX\)” on page 177](#).

No renaming of the snap units

The source unit and target unit form a remote copy pair (see the figure below).

At the same time each of the two units forms a snap pair:

- The source unit with the snap unit of the local storage system
- The target unit with the snap unit of the remote storage system

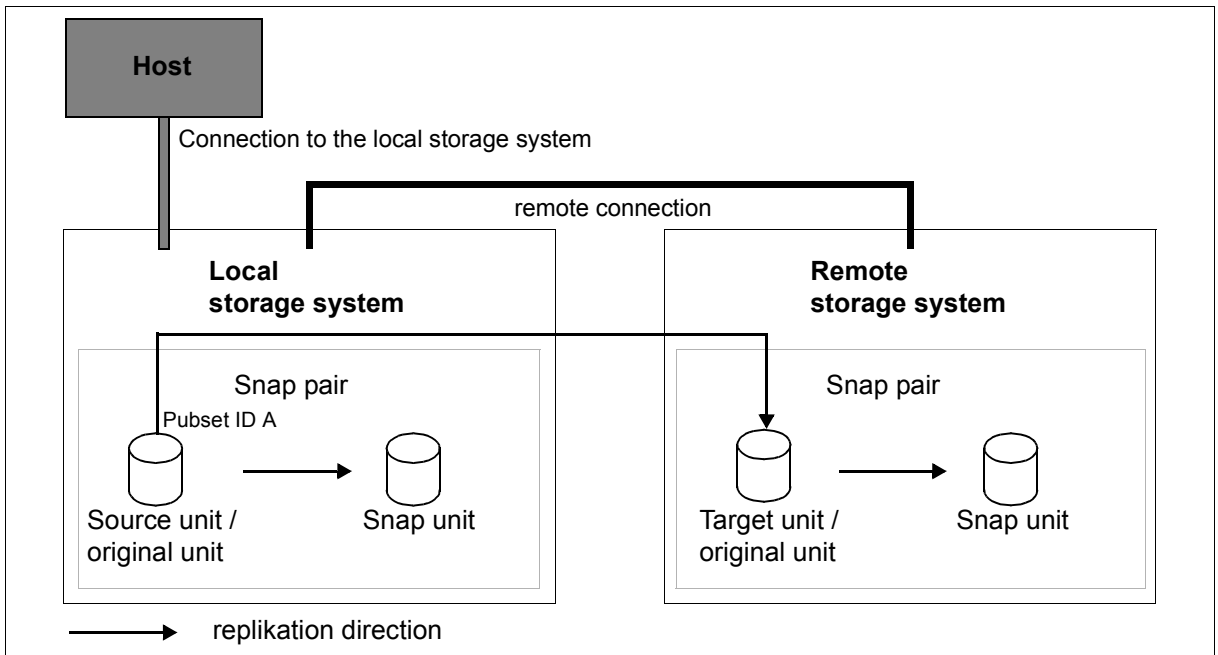


Figure 33: SnapOPC+ with REC, no renaming of the snap units

The host has no connection to the remote storage system and cannot therefore be accessed directly from the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

The snap pair in the remote storage system is activated using `/START-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=A),SELECT=*TARGET-UNIT`.

With renaming of the snap units

The source unit and target unit form a remote copy pair (see [figure 34](#)).

At the same time each of the two units forms a snap pair:

- The source unit with the snap unit of the local storage system
- The target unit with the snap unit of the remote storage system

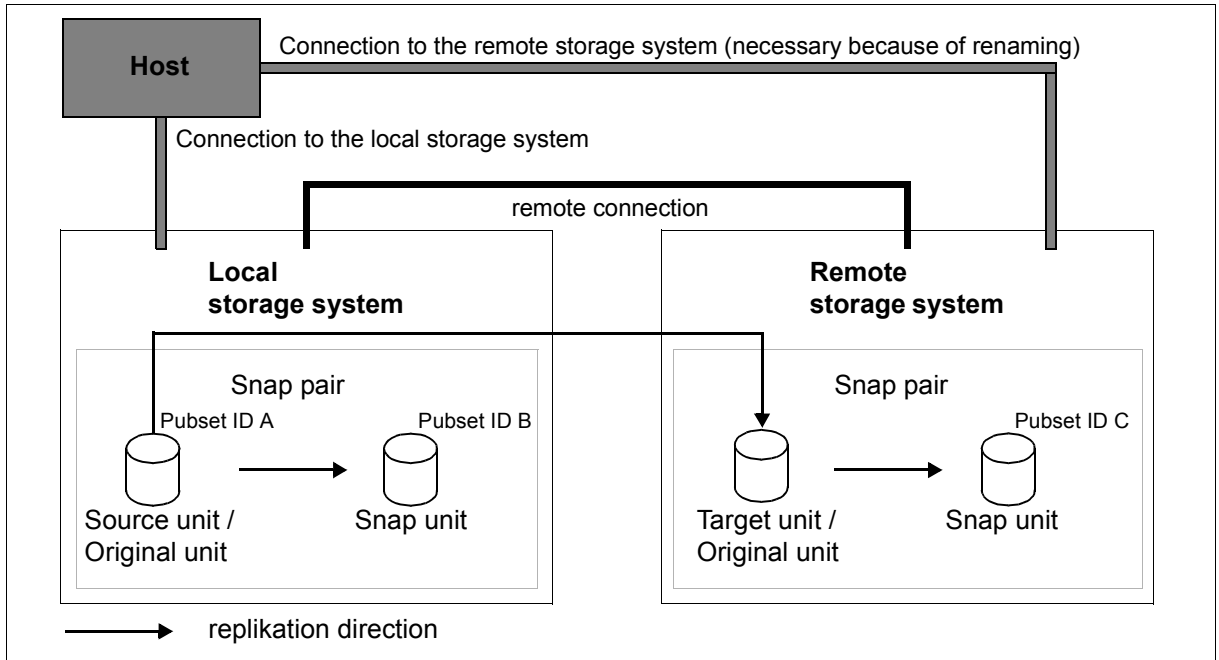


Figure 34: SnapOPC+ with REC with renaming of the snap units in the remote storage system

The host has connections to the remote storage system, which means that the latter can be accessed directly by the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

`/START-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=A, NEW-PUBSET=B)` is used to configure the snap pair in the local storage system, and the pubset ID of the snap unit is changed to C.

`/START-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=A, NEW-PUBSET=C), SELECT=*TARGET-UNIT` is used to split the snap pair in the remote storage system, and the pubset ID of the snap unit is changed to C.

This permits the units to be used as follows, for example:

- the source unit (with pubset ID A) for the main application
- the snap unit of the local storage system (with pubset ID B) for the backup
- the target unit as a copy in case a disaster occurs
- the snap unit of the remote storage system (with pubset ID C) for evaluations

`/RESTORE-FROM-SNAP` for an REC target unit can be used only if the target unit is in the `READY` status, i.e. the remote copy status is `IN-HOLD` or `ERROR` and `TARGET-ACCESS` has the value `DIRECT`. As a result of this, the last consistent status can, for example, be copied from the snap unit to the target unit in the event of a disaster.

10.5 TimeFinder/Clone and SRDF (Symmetrix/VMAX3)

TimeFinder/Clone can be used together with SRDF.

Two cases must be distinguished here:

- Clone units are assigned to the source unit and target unit of a remote copy pair. The source/target unit is also the original unit of the clone pair.
- The source unit and target unit each forms the clone unit of a clone pair.



TimeFinder/Clone is implemented compatibly by SHC-OSD on VMAX3. SYMAPI emulates TimeFinder/Clone via TimeFinder SnapVX.

10.5.1 Source/target unit as original unit

When a clone pair consists of a source unit and a clone unit, no special aspects need be borne in mind. This is not the case when a clone pair consists of a target unit and a clone unit. In this case the clone pair generally cannot be accessed via the VSN or the pubset ID because the target unit is not readable. If the source unit is attached, the pubset ID of the source unit can be specified in the clone session commands using the `UNIT=*BY-PUBSET(. . .)` operand in conjunction with `SELECT=*TARGET-UNIT`.

The following requirements must be met to permit a clone pair with a target unit to be selected via the VSN or pubset ID:

- The source unit is attached.
- In addition, either remote copy mode must be interrupted with `/ACTIVATE-CLONE (/SHOW-REMOTE-COPY-STATUS` indicates the remote copy status `IN-HOLD` or `ERROR`) or synchronous processing mode must be set and the remote copy pair must be synchronized when remote copy mode is active.

SF pubsets can be renamed implicitly using `/ACTIVATE-CLONE NEW-PUBSET=<new cat id>` provided the host has connections to the remote storage system (i.e. this can be reached directly from the host). The I/Os on the source unit can be suspended during ongoing operation using `/ACTIVATE-CLONE` and the `HOLD-IO=*UNTIL-ACTIVATED` operand to permit consistent splitting.

Scenarios for TimeFinder/Clone in SRDF configurations

Without renaming of the clone units

The source unit and target unit form a remote copy pair (see the figure below).

At the same time the two also form a clone pair:

- The source unit with the clone unit of the local storage system
- The target unit with the clone unit of the remote storage system

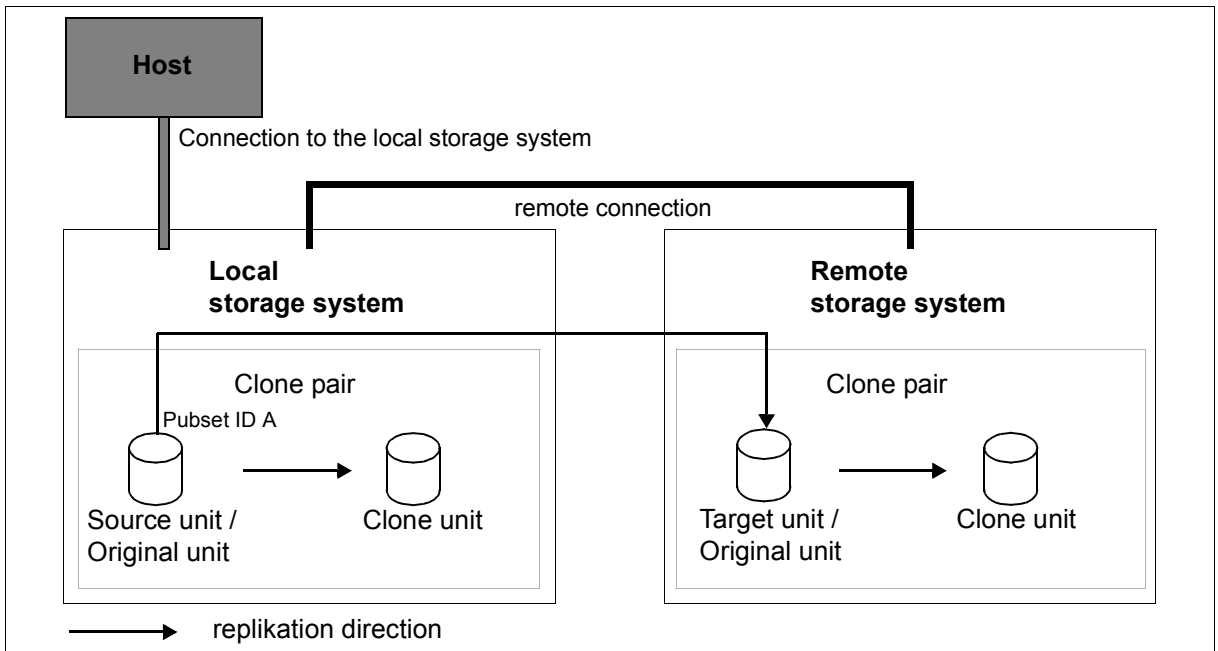


Figure 35: TimeFinder/Clone with SRDF, no renaming of the clone units

The host has no connections to the remote storage system, which cannot therefore be accessed directly from the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

The clone pair in the remote storage system is activated using `/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=A),SELECT=*TARGET-UNIT`. In the case of concurrent target units, the required target unit is selected by specifying the RA group.

With renaming of the clone units

The source unit and target unit form a remote copy pair (see the figure below).

At the same time the two also form a clone pair:

- The source unit with the clone unit of the local storage system
- The target unit with the clone unit of the remote storage system

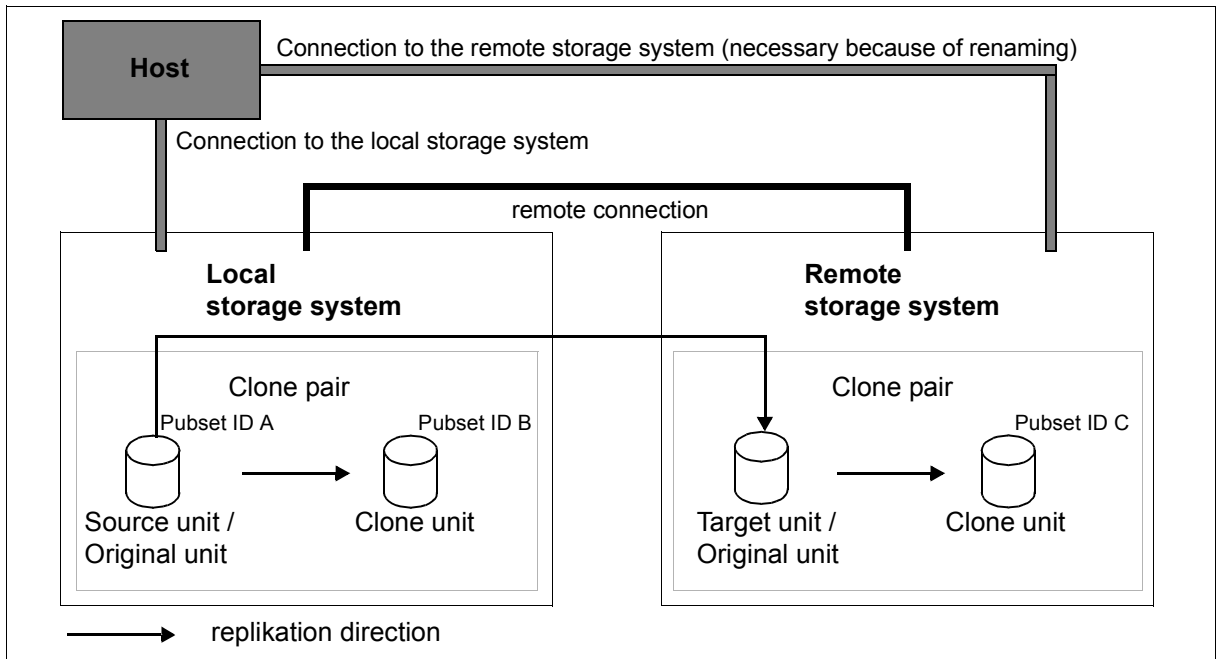


Figure 36: TimeFinder/Clone with SRDF with renaming of the clone unit in the remote storage system

The host has connections to the remote storage system, which means that the latter can be accessed directly by the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

`/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=A, NEW-PUBSET=B)` causes the clone pair in the local storage system to be split and the clone unit's pubset ID to be changed to B.

`/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=A, NEW-PUBSET=C), SELECT=*TARGET-UNIT` is used to split the clone pair in the remote storage system, and the pubset ID of the clone unit is changed to C. In the case of concurrent target units, the required target unit is selected by specifying the RA group.

This permits the units to be used as follows, for example:

- the source unit (with pubset ID A) for the main application
- The clone unit of the local storage system (with pubset ID B) for the backup
- the target unit as a copy in case a disaster occurs
- The clone unit of the remote storage system (with pubset ID C) for evaluations

`/RESTORE-FROM-CLONE` for an SRDF target unit can be used only if the target unit is in the **READY** status, i.e. the remote copy status is **IN-HOLD** or **ERROR** and **TARGET-ACCESS** has the value ***DIRECT**. As a result of this, the last consistent status can, for example, be copied from the clone unit to the target unit in the event of a disaster.

The data can therefore be copied from the clone unit on the remote storage system to the source unit on the local storage system in several stages.

10.5.2 Source/target unit as TimeFinder/Clone unit

If a TimeFinder/Clone unit is also an SRDF source unit, the following constraints apply:

- The clone session can be aborted at any time (using `/STOP-CLONE-SESSION`).
- All other TimeFinder/Clone functions are by default possible only in the remote copy status **IN-HOLD** or **ERROR** with an accessible clone unit (status: **READY**).
- If the SRDF connection is in the remote copy status **ACTIVE** or **ERROR** and the clone unit is in the **NOT-READY** status, the clone functions can be executed with **FORCE=*YES**. A prerequisite is that the clone session was started with a complete copy of the original unit (`/START-CLONE-SESSION` with **COPY-COMPLETE-DATA=*YES**). Otherwise the command is rejected with the message **NDE1199**.

If a TimeFinder/Clone unit is also an SRDF target unit, the following constraints apply:

- The clone session can be aborted at any time (using `/STOP-CLONE-SESSION`).
- All other TimeFinder/Clone functions are possible only in the remote copy status **IN-HOLD** or **ERROR** and in the case of `/SET-REMOTE-COPY-ACCESS` with **TARGET-ACCESS=*DIRECT**.
- The processing mode (copy mode) must be **SYNCH**.
- The SRDF source unit and SRDF target units have the same capacity.
- The clone unit cannot be activated (`/ACTIVATE-CLONE`) for the duration of the SRDF copy processes.

10.6 TimeFinder/Snap and SRDF (Symmetrix)

TimeFinder/Snap sessions can be created on SRDF source and target units, i.e. snap units can be assigned to both the source and the target unit of a remote copy pair. The snap unit and the source/target unit then form a snap pair in the context of a snap session. The source/target unit is then also the original unit of the snap pair.

When a snap pair consists of a target unit and a snap unit, access to the snap pair via the VSN or pubset ID is not possible because the target unit is generally not readable. If the source unit is attached, the pubset ID of the source unit can also be specified in the snap session commands using the `UNIT=*BY-PUBSET(...)` operand in conjunction with `SELECT=*TARGET-UNIT`.

Prerequisites for addressing a snap pair with target unit via the pubset ID or VSN:

- SRDF mirroring takes place between two Symmetrix systems, not between Symmetrix and VMAX3).
- The source unit is attached.
- Synchronous processing mode must be set for `/ACTIVATE-SNAP`.
- In addition, remote copy mode must be suspended (`/SHOW-REMOTE-COPY-STATUS` shows the remote copy status `IN-HOLD` or `ERROR`) in the event of `/ACTIVATE-SNAP`, or if remote copy mode is active, the remote copy pair must be synchronized.

SF pubsets can also be renamed using `/ACTIVATE-SNAP NEW-PUBSET=<new cat id>`. The I/Os to the source unit can be suspended in ongoing operation using the `HOLD-IO=*UNTIL-ACTIVATED` operand to ensure consistent splitting.

Scenarios for TimeFinder/Snap in SRDF configurations

No renaming of the snap units

The source unit and target unit form a remote copy pair (see [figure 37](#)).

At the same time the two also each form a snap pair:

- The source unit with the snap unit of the local storage system
- The target unit with the snap unit of the remote storage system

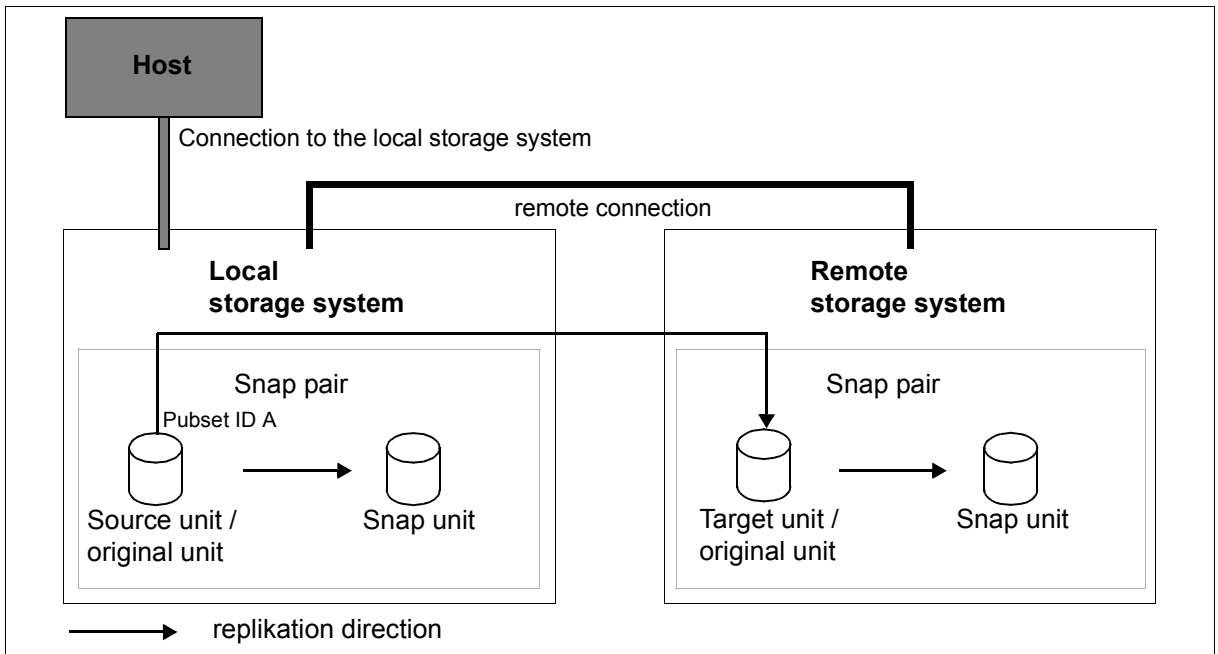


Figure 37: TimeFinder/Snap with SRDF, no renaming of the snap units

The host has no connections to the remote storage system, which cannot therefore be accessed directly from the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

The snap pair in the remote storage system is activated using `/ACTIVATE-SNAP UNIT=*BY-PUBSET(PUBSET=A), SELECT=*TARGET-UNIT`. In the case of concurrent target units, the required target unit is selected by specifying the RA group.

With renaming of the snap units

The source unit and target unit form a remote copy pair (see [figure 38](#)).

At the same time each of the two units forms a snap pair:

- The source unit with the snap unit of the local storage system
- The target unit with the snap unit of the remote storage system

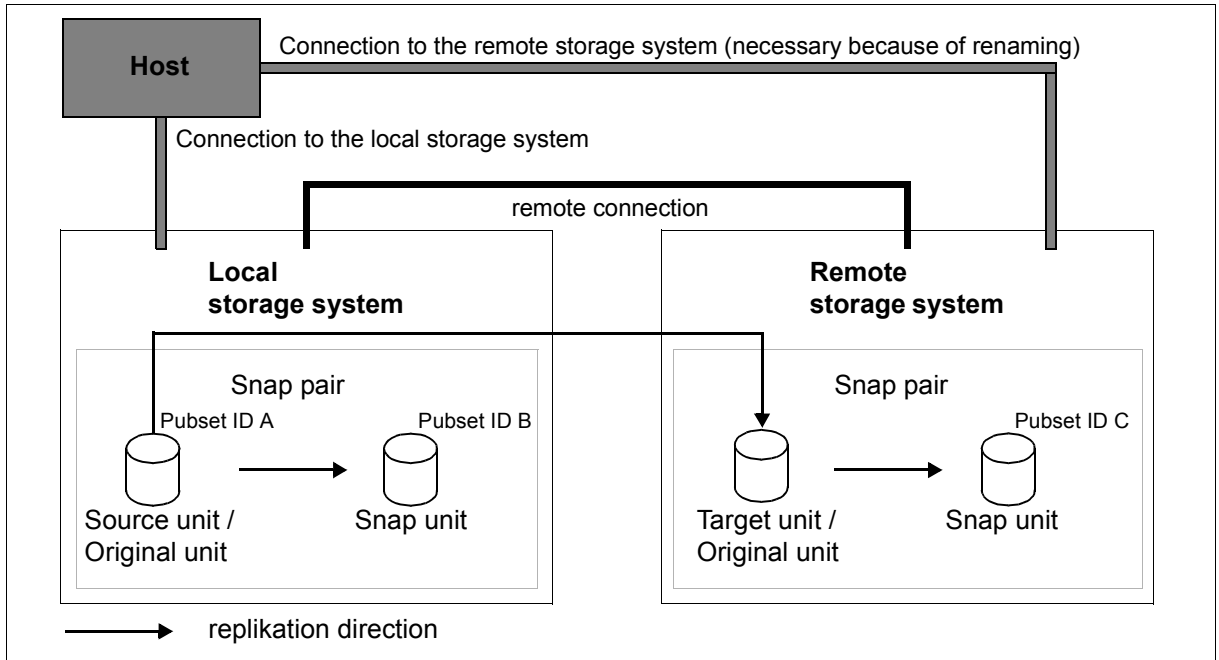


Figure 38: TimeFinder/Snap with SRDF with renaming of the snap unit in the remote storage system

The host has connections to the remote storage system, which means that the latter can be accessed directly by the host. The target unit cannot be addressed via the VSN or pubset ID. The source unit has pubset ID A.

`/ACTIVATE-SNAP UNIT=*BY-PUBSET(PUBSET=A,NEW-PUBSET=B)` causes the snap pair in the local storage system to be split and the snap unit's pubset ID to be changed to B.

`/ACTIVATE-SNAP UNIT=*BY-PUBSET(PUBSET=A,NEW-PUBSET=C)`, `SELECT=*TARGET-UNIT` is used to split the snap unit in the remote storage system, and the pubset ID of the snap unit is changed to C. In the case of concurrent target units, the required target unit is selected by specifying the RA group.

This permits the units to be used as follows, for example:

- the source unit (with pubset ID A) for the main application

- the snap unit of the local storage system (with pubset ID B) for the backup
- the target unit as a copy in case a disaster occurs
- the snap unit of the remote storage system (with pubset ID C) for evaluations

`/RESTORE-FROM-SNAP` for an SRDF target unit can be used only if the target unit is in the **READY** status, i.e. the remote copy status is **IN-HOLD** or **ERROR** and **TARGET-ACCESS** has the value **DIRECT**. As a result of this, the last consistent status can, for example, be copied from the snap unit to the target unit in the event of a disaster.

10.7 TimeFinder SnapVX and SRDF (VMAX3)

TimeFinder SnapVX sessions can be created on SRDF source and target units, i.e. snap units can be assigned to both the source and the target unit of a remote copy pair. The snap unit and the source/target unit then form a snap pair in the context of a snap session. The source/target unit is then also the original unit of the snap pair.

When a snap pair consists of a target unit and a snap unit, access to the snap pair via the VSN or pubset ID is not possible because the target unit is generally not readable. If the source unit is attached, the pubset ID of the source unit can also be specified in the snap session commands using the `UNIT=*BY-PUBSET(. . .)` operand in conjunction with `SELECT=*TARGET-UNIT`.

Prerequisites for addressing a snap pair with target unit via the pubset ID or VSN:

- SRDF mirroring takes place between two VMAX3 systems (not between VMAX3 and Symmetrix).
- The source unit is attached.
- Synchronous or asynchronous (SRDF/A) process mode must be set for `/START-SNAP-SESSION`.

In SRDF configurations TimeFinder SnapVX supports the same scenarios as TimeFinder/Snap, see [section “TimeFinder/Snap and SRDF \(Symmetrix\)” on page 253](#). The following must be borne in mind here:

- The `/START-SNAP-SESSION` generates **and** activates the snap session.
- For VMAX3, RA groups can currently be displayed but not managed with SHC-OSD.
- SRDF source and SRDF target units cannot be used as snap units for TimeFinder SnapVX.

11 Thin provisioning (ETERNUS DX, Symmetrix/VMAX3)

The thin provisioning function permits the capacity of storage systems to be used efficiently. Devices (LUNs) with preconfigured virtual capacity are offered to the application, while internally the storage system provides the necessary physical capacity. SHC-OSD supports thin provisioning for the storage systems ETERNUS DX and for Symmetrix/VMAX3.

When storage space is provided for a new application, the administrators must take into account both the current and the future capacity requirements of the application. Users as a rule assign an application far more physical storage than is actually required for a particular period in order to reduce the risks of capacity bottlenecks, interruptions of the application, and effort involved in providing additional storage. This assigned but unused storage causes costs both when it is procured and when it is operated.

However, even with careful planning it is, on the other hand, repeatedly necessary to provide additional storage for an application. This generally entails a temporary failure of the application.

Thin provisioning solves these problems by avoiding unused, cost-intensive storage. It is based on the option of configuring and making accessible a virtual volume with high capacity for a server or an application. This virtual volume occupies physical storage from a jointly used storage pool as required. Sufficient capacity for the applications is provided in this storage pool. The capacity can be changed dynamically.

Implementation of thin provisioning depends on the storage system.

Commands for thin provisioning

Command	Function	Page
MODIFY-SHC-PROCESSING	Sets limit values for thin provisioning (Symmetrix/VMAX3)	342
SHOW-SHC-PROCESSING	Displays limit values for thin provisioning (Symmetrix/VMAX3)	473
SHOW-STORAGE-CONFIGURATION	Displays the configuration of the TPPs (ETERNUS DX)	499
SHOW- STORAGE-DEVICE-CONFIG	Displays device information of the TPVs (ETERNUS DX)	512
SHOW-SYMMETRIX-CONFIGURATION	Displays the configuration of the thin pools (Symmetrix/VMAX3)	526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays device information of the thin devices and data devices (Symmetrix/VMAX3)	537

11.1 Thin provisioning (ETERNUS DX)

ETERNUS DX offers the thin provisioning function.

An ETERNUS DX storage system can optionally be configured entirely as a thin provisioning system.

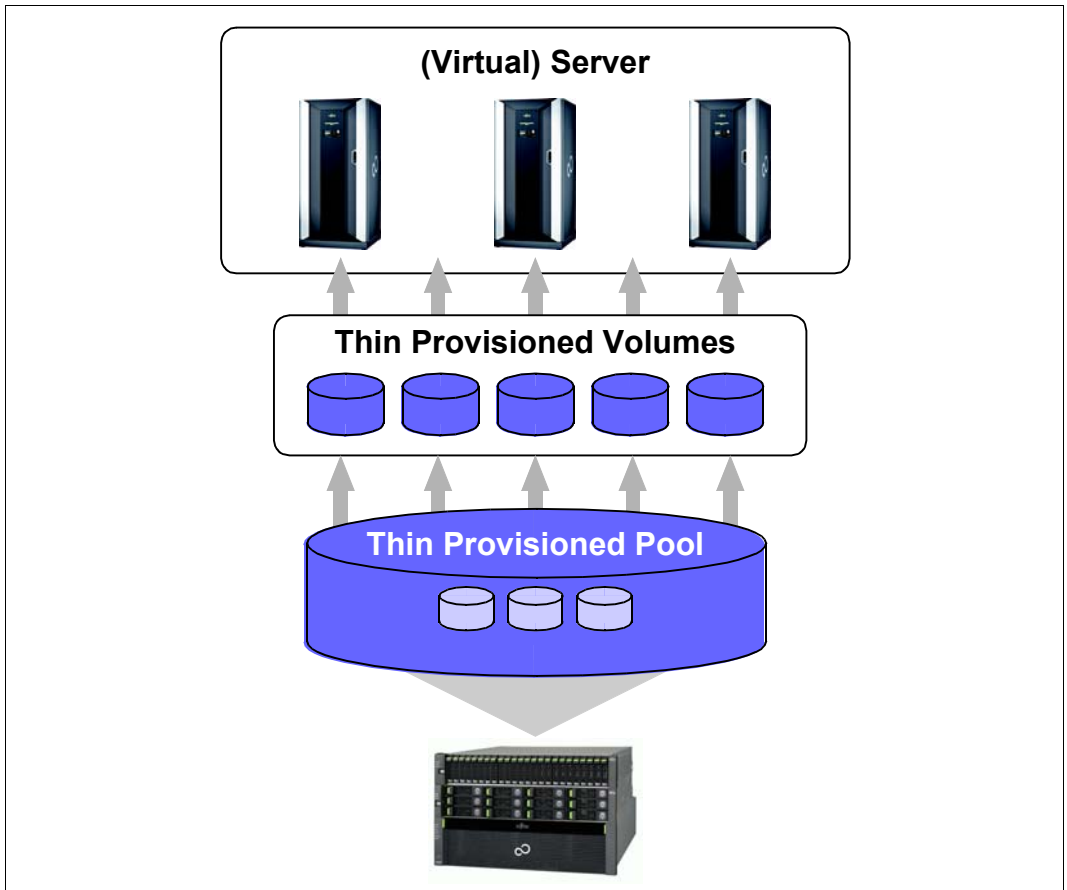


Figure 39: Thin provisioning for ETERNUS DX

11.1.1 Overview

Thin provisioning for ETERNUS DX is based on:

- Thin Provisioned Volumes (TPVs), i.e. volumes which, from the server's viewpoint, are configured with a capacity which is greater than their real available capacity

- Thin Provisioned Pools (TPPs), i.e. predefined pools of physical disks for providing the physical storage space for Thin Provisioned Volumes

Thin Provisioned Volumes (TPVs)

TPVs are configured in the storage system with a particular physical size and labeled as TPVs. The size configured virtually for them can be considerably greater than the real size of a volume. The server sees the virtually configured size (capacity) of a volume and uses it like a conventional volume. In contrast to conventional volumes, the physical storage does not have to be fully assigned to the TPVs at configuration time. The physical storage place required for the TPVs is provided by a Thin Provisioned Pool.

Thin Provisioned Pools (TPPs)

TPPs are pools of one or more RAID groups (physical disks) to provide capacity for thin provisioning. The storage space for multiple TPVs is provided by one TPP.

A TPP always has one specified RAID type, but multiple RAID groups can be concatenated to form one TPP. Consequently a TPP can consist of multiple RAID groups of the same RAID type.

Different RAID types are implemented in different TPPs.

More than one TPP can be configured for each storage system. The maximum number depends on the model and is currently 256 TPPs for ETERNUS DX8700 S2.

The allocation unit in the TPP comprises 32 MB.

Monitoring the TPPs

Two threshold values are set on the storage system for each TPP to monitor the storage space consumption of the various TPPs. These are set when the TPPs are generated and can be modified during operation:

- **ATTENTION:** 75% (default value) of the TPP's available capacity has been used
- **WARNING:** 90% (default value) of the TPP's available capacity has been used

When the load on the TPP is 100%, writes to areas which have already been allocated are still executed, but writes which require a new area are rejected with an error.

SHC-OSD reports when each monitored TPP reaches the threshold values and also reports its current status. Monitoring by SHC-OSD can be set, see the `THIN-POOL-MONITORING` parameter in the SHC-OSD parameter file in the [section "Configuration of SHC-OSD" on page 58](#).

Configuration in the storage system

Thin provisioning is configured in the storage system by a qualified technician.

Proceed as follows:

1. Enter the license for the "Thin Provisioning Feature"
2. Generate TPPs from one or more RAID groups
3. Generate TPVs within a TPP
4. Set the monitoring threshold values for each TPP
5. Dynamic extension of the TPPs (when required)
When more storage is required for existing or future TPVs, existing TPPs can also be extended dynamically by additional physical devices. This extension takes place without interrupting any application which is executing.

Thin provisioning and replication functions

The following combinations of TPVs and replications are supported for ETERNUS DX:

- EC: Replication from TPV to TPV
- REC: Replication from TPV to TPV
- SnapOPC+: Replication from TPV to snap unit

In the case of EC and REC, TPVs and normal volumes can be combined. However, this is not recommended as the advantage of thin provisioning is then lost.

TPVs for the original and the mirror unit must reside in different TPPs.

11.1.2 Thin provisioning for ETERNUS DX in BS2000

Thin provisioning and the enhancement in performance it provides are supported by SHC-OSD for /390 and x86 servers. Device type D3475-8F is not supported.

Information on Thin Provisioned Volumes (TPVs)

The `/SHOW-STORAGE-DEVICE-CONFIG RAID-LEVEL=*TDEV` command selects TPVs. These are labeled with **T** in the `RAID` display column.

The `/SHOW-STORAGE-DEVICE-CONFIG INFORMATION=*THIN-DEVICES` command displays the specific properties of a TPV with the assignment to a TPP and the specific capacity values. See the examples on [page 519](#).

Information on Thin Provisioned Pools (TPPs)

The `/SHOW-STORAGE-CONFIGURATION INFORMATION=*THIN-POOLS` command supplies information on the configuration of the TPPs. The information also shows the allocation of the RAID groups to the TPPs; the implementation for TPPs on ETERNUS DX builds directly on RAID groups. See the example on [page 501](#).

Monitoring the Thin Provisioned Pools (TPP)

SHC-OSD monitors the occupancy level of the TPPs using the threshold values `ATTENTION` and `WARNING` which were set in the storage system. Monitoring by SHC-OSD can be set, see the `THIN-POOL-MONITORING` parameter in the SHC-OSD parameter file in the [section "Configuration of SHC-OSD" on page 58](#).

Messages `NDE0077` (`ATTENTION`) and `NDE0078` (`WARNING`) (which you can answer) on the console show when a particular threshold value for the occupancy level of a TPP has been exceeded.

When the limit value is reached, further capacity can be provided in the TPP either automatically or through administrative intervention. When the threshold values set are fallen below again in the TPP, this is shown by the message `NDE0073` on the console. Messages `NDE0077/NDE0078` are then answered automatically if they are still open.



TPVs are not monitored.

The threshold value setting in the SHC-OSD parameter file (`THIN-POOL/DEV-SATURATION` parameter) and in the `/MODIFY-SHC-PROCESSING` command (`THIN-POOL/DEVICE-SAT` operation) has **no** meaning for ETERNUS DX.

11.2 Virtual provisioning (Symmetrix)

The term used for thin provisioning in the Symmetrix documentation is "virtual provisioning."

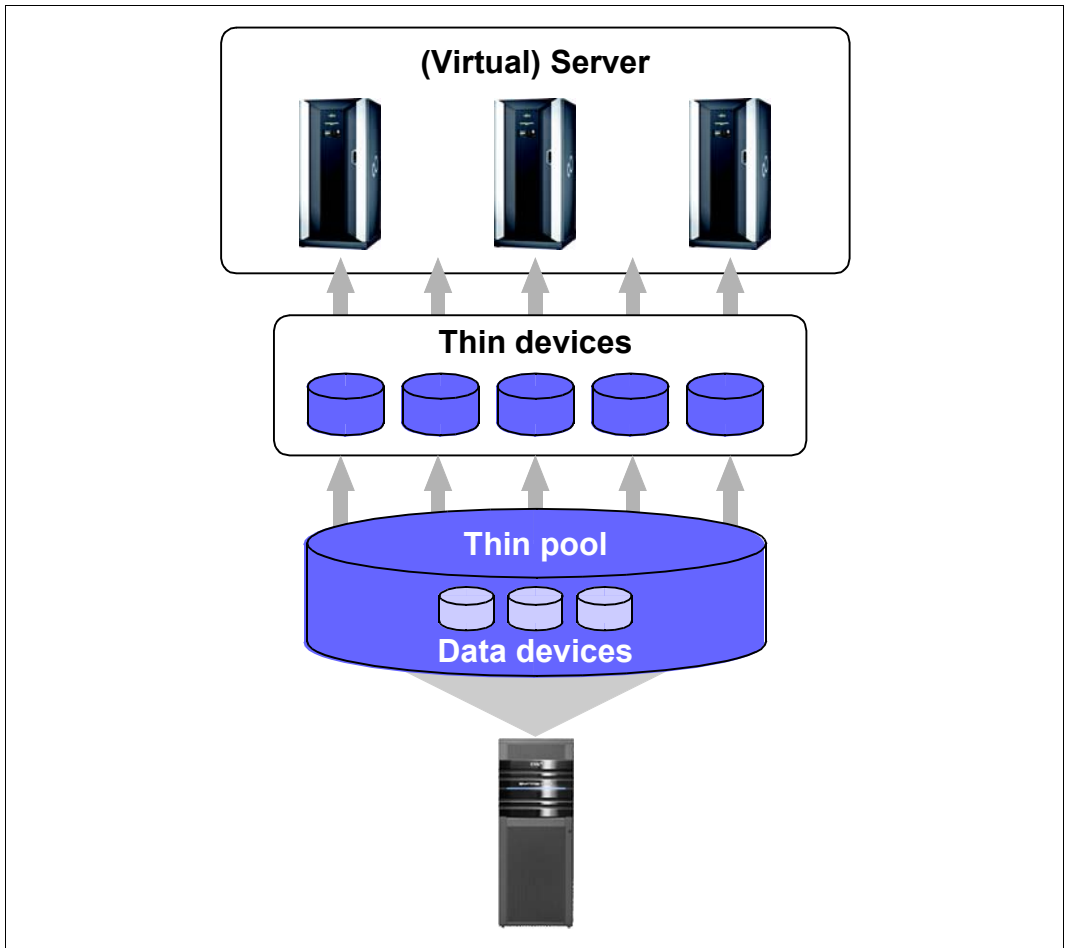


Figure 40: Virtual provisioning in Symmetrix

11.2.1 Overview

Configuration

The physical storage used by the thin devices comes from jointly used thin pools to which the thin devices are assigned dynamically. A thin pool, in turn, consists of the so-called data devices. Data devices are configured as special, internal volumes of the storage system which cannot be addressed from the outside. They are dynamically assigned to a thin pool and activated for use.

A detailed description is provided in the EMC documentation.

All the actions needed to configure virtual provisioning must be executed by an external management instance. From the server's point of view a thin device is no different from a conventional volume; it appears with the preconfigured capacity which is theoretically usable.

Dynamic extension

The virtual provisioning resources can be extended dynamically by the external management instance without interrupting the application. New thin devices can be configured and assigned to the thin pools. The RAID level of the thin device is specified by the thin pool.

Monitoring

Storage consumption by thin devices and thin pools is monitored using SHC-OSD. Monitoring by SHC-OSD can be set, see the `THIN-POOL-MONITORING` parameter in the SHC-OSD parameter file in the [section "Configuration of SHC-OSD" on page 58](#). The currently used capacity of the thin devices is monitored in relation to the configured capacity and that displayed by the server. Parallel to this, the occupancy of the jointly used thin pools is also monitored.

Virtual provisioning for Symmetrix DMX

Symmetrix DMX offers the license-free virtual provisioning function.

RAID 1, RAID 5 and RAID 6 are supported for Symmetrix DMX with restrictions in the replication functions TimeFinder and SRDF and a combination of the two:

- TimeFinder/Clone: original unit and clone unit each reside on thin devices
- TimeFinder/Snap: for a unit on a thin device, the snap unit also resides on a thin device
- SRDF/S and SRDF/A: original unit and target unit each reside on thin devices

Virtual provisioning for Symmetrix VMAX1 and VMAX2

Symmetrix VMAX1 and VMAX2 also offer the virtual provisioning function. This function offers additional functions compared to Symmetrix DMX:

- Thin pools can also be reduced in size.
- Partitioning of up to 4 thin pools per Symmetrix system is possible.
- The restrictions when used with RAID types and the replication functions TimeFinder and SRDF have been lifted.

11.2.2 Virtual provisioning and BS2000

Virtual provisioning requires specially configured device types in the storage system, so-called thin devices and data devices.

Thin devices

The server sees a thin device in its configured size. Internally it must always be assigned to a thin pool in which the resources are contained.

When an area of the thin device is written to, the storage system assigns the thin device a minimum amount of physical storage from the thin pool.

When a read operation takes place on a thin device, the data is read from the data device in the thin pool to which the thin device is assigned. The thin pools are assigned further data devices to satisfy enhanced capacity requirements for writes of the thin devices.

When more storage is required for existing or future thin devices, existing thin pools can also be extended dynamically by additional data devices.

New thin devices which can be accessed and used by the server are configured dynamically in the storage system and assigned to the thin pools. They must be generated like normal units when hardware generation of BS2000 takes place with IOGEN (/390 servers) or in X2000 (x86 servers).

The `/SHOW-SYMMETRIX-DEVICE-CONFIG RAID=*TDEV` command selects thin devices. These are labeled with **T** in the **RAID** column.

The `/SHOW-SYMMETRIX-DEVICE-CONFIG INFORMATION=*THIN-DEVICES` command displays the specific properties of a thin device with the assignment to a thin pool and the specific capacity values.

See the examples on [page 549](#).

Monitoring the thin devices

SHC-OSD monitors the occupancy levels of the thin devices.

Message NDE0074 (which you can answer) on the console shows when a particular limit value for the occupancy level of a thin device has been exceeded. The `THIN-DEV-SAT` operand in the `/MODIFY-SHC-PROCESSING` command or the `THIN-DEVICE-SATURATION` parameter in the SHC-OSD parameter file determines the limit value (default value 80%). The current value can be inquired with `/SHOW-SHC-PROCESSING`.

When the limit value is reached, administrative intervention enables capacity to be provided again.

Data devices

Data devices are internal devices which are configured in the storage system and provide storage space for storing the contents of the thin devices. Data devices cannot be accessed by the host.

A sufficient number of adequately sized data devices must be configured and activated.

The `/SHOW-SYMMETRIX-DEVICE-CONFIG TYPE=*DATA-DEV` command selects data devices. These are labeled with `DATA-DEV` in the `TYPE` column.

The `/SHOW-SYMMETRIX-DEVICE-CONFIG INFORMATION=*DATA-DEVICES` command displays the specific properties of a data device with the assignment to a thin pool and the specific capacity values. See the examples on [page 549](#).

Thin pools

Data devices are managed in the storage system in so-called thin pools. Each thin pool is available to the user in its entirety for his/her thin devices.



CAUTION!

When a thin pool is full (overflow), no more storage space can be provided for the assigned thin devices for writes. The applications which are using it encounter an error (remount message). The functions of SHC-OSD for monitoring the thin pools should thus be used.

In Symmetrix VMAX1 and VMAX2, setting up multiple thin pools permits partitioning, for example by having the thin devices of various applications which operate with different pubsets assigned to different thin pools.

The `/SHOW-SYMMETRIX-CONFIGURATION INFORMATION=*THIN-POOLS` command displays information on the thin pools, including their current occupancy levels. See the example on [page 529](#).

Monitoring the thin pools

SHC-OSD offers monitoring of the occupancy levels of the monitored thin pools for the storage system. See also the `THIN-POOL-MONITORING` parameter in the SHC-OSD parameter file (see the [section “Configuration of SHC-OSD” on page 58](#)).

Messages `NDE0070` and `NDE0071` (which you can answer) on the console show when a particular limit value for the occupancy level of a thin pool has been exceeded. The `THIN-POOL-SAT` operand in the `/MODIFY-SHC-PROCESSING` command or the `THIN-POOL-SATURATION` parameter in the SHC-OSD parameter file determines the limit value (default value 80%). The current value can be inquired with `/SHOW-SHC-PROCESSING`.

When the limit value is reached, administrative intervention enables further capacity to be provided in the thin pool; the thin pool in the storage system can be extended by further data devices. When sufficient space is once more available in the thin pool, this is indicated by messages `NDE0075/NDE0076` on the console. Messages `NDE0070/NDE0071` are then answered automatically.

11.3 Virtual provisioning (VMAX3)

The term used for thin provisioning in the VMAX3 documentation is "virtual provisioning."

The VMAX3 storage system is implemented entirely with thin provisioning, see [figure 40 on page 263](#).

11.3.1 Overview

Configuration

The storage areas are provided (provisioning) not at volume level but at track level from a joint Storage Resource Pool (SRP). This SRP can be formed from different thin pools, from different tiers, and with different attributes. The appropriate provisioning is determined automatically on the basis of the selected Service Level Agreement and the policy set.

The FAST (Automated Storage Tiering) function required for this purpose runs automatically on VMAX3 and transparently for BS2000.

A detailed description is provided in the EMC documentation.

From the server viewpoint, a thin device is no different to a conventional volume. It is displayed with the configured capacity which is theoretically usable.

Provisioning begins only after the first allocation for a volume. Before this, the output columns `POOL-NAME` and `TIER-NAME` remain empty when `/SHOW-SYMMETRIX-DEVICE-CONFIG` is issued. After allocation, the SRP name is output as `POOL-NAME`. Consequently no unambiguous RAID level and no `TIER-TYPE` can be output for a volume.

As the volumes of VMAX3 only use areas of the physical storage which are already occupied, only this area is physically copied or transferred for the volume when a local or remote replication is generated. This reduces the synchronization times and the load on the storage system **significantly**.

Monitoring

SHC-OSD is used to monitor the storage space consumption of thin pools with respect to the utilization of the jointly used thin pools. Monitoring by SHC-OSD can be set, see the `THIN-POOL-MONITORING` parameter in the SHC-OSD parameter file in the [section "Configuration of SHC-OSD" on page 58](#).

11.3.2 VMAX3 volumes and BS2000

Thin provisioning of the VMAX3 volumes is transparent for BS2000. The volumes are displayed as thin devices with the preconfigured capacity which is theoretically available.

As the volumes with storage areas are constructed from different, automatically allocated thin pools, no allocation to a thin pool, to a RAID type, or to a physical device can be determined. No information on this subject is provided by the `/SHOW-SYMMETRIX-DEVICE-CONFIG` command.

Data devices

Data devices are internal devices configured in VMAX3 for configuring the thin pools. They provide storage space to accommodate the contents of the thin devices. Data devices cannot be accessed by the host.

A sufficient number of adequately sized data devices must be configured and activated.

The `/SHOW-SYMMETRIX-DEVICE-CONFIG TYPE=*DATA-DEV` command selects data devices.

These are labeled with `DATA-DEV` in the `TYPE` column.

The `/SHOW-SYMMETRIX-DEVICE-CONFIG INFORMATION=*DATA-DEVICES` command displays the specific properties of a data device with the assignment to a thin pool and the specific capacity values. See the examples on [page 549](#).

Thin pools

Data devices are managed in VMAX3 in so-called thin pools. Each thin pool is available to the user in its entirety for his/her thin devices.



CAUTION!

When the thin pools of a Storage Resource Pool are full (overflow), no more storage space can be provided for the assigned volumes for writes. The applications which are using it encounter an error (remount message). The functions of SHC-OSD for monitoring the thin pools should thus be used.

The `/SHOW-SYMMETRIX-CONFIGURATION INFORMATION=*THIN-POOLS` command displays information on the thin pools, including their current occupancy levels. See the example on [page 529](#).

Monitoring the thin pools

SHC-OSD offers monitoring of the occupancy levels of the monitored thin pools for VMAX3. See also the `THIN-POOL-MONITORING` parameter in the SHC-OSD parameter file (see the [section “Configuration of SHC-OSD” on page 58](#)).

As the provision of storage areas (provisioning) takes place not at volume level but at track level, the monitoring cannot refer to volumes. The thin pool is monitored as a whole.

Messages `NDE0070` and `NDE0071` (which you can answer) on the console show when a particular limit value for the occupancy level of a thin pool has been exceeded. The `THIN-POOL-SAT` operand in the `/MODIFY-SHC-PROCESSING` command or the `THIN-POOL-SATURATION` parameter in the SHC-OSD parameter file determines the limit value (default value 80%). The current value can be inquired with `/SHOW-SHC-PROCESSING`.

When the limit value is reached, administrative intervention enables further capacity to be provided. When sufficient space is once more available in the thin pool, this is indicated by messages `NDE0075/NDE0076` on the console. Messages `NDE0070/NDE0071` are then answered automatically.

12 Automated Storage Tiering (ETERNUS DX)

The "Automated Storage Tiering (AST)" function permits the high-power use of disk storage devices offering different performances within the storage system.

Here data is automatically migrated to disk storage featuring different access times, sizes and costs according to its access frequency.

Access frequency	Storage medium
High-tier class	High-performance disks
Mid-tier class	Mid-tier class disks
Low-tier class	Favorably priced large disks

Table 4: Automated Storage Tiering

Automated Storage Tiering is based on the "thin provisioning" functionality of the ETERNUS DX storage systems. The management software ETERNUS SF is required for configuration and administration.

Automated Storage Tiering requires a set of disk storage devices offering different performances, the **flexible tier pool** with its **flexible tier subpools**. The Automated Storage Tiering disk storage devices are also called **flexible tier volumes**.

Data migration is controlled by definable migration rules, which are known as **tiering policies**.



The comparable function FAST runs automatically on VMAX3 storage systems, and transparently for BS2000, see [section "Virtual provisioning \(VMAX3\)" on page 268](#).

Commands for Automated Storage Tiering

Command	Function	Page
SHOW-STORAGE-CONFIGURATION	Displays the configuration of the flex pools	499
SHOW- STORAGE-DEVICE-CONFIG	Displays the device information of the flex volumes	512

12.1 Overview

Flexible tier pools (flex pools)

Flex pools are used to manage the flexible tier volumes. They consist of two or three flexible tier subpools with the performance classes "high", "middle" (optional depending on the tiering policies) and "low".

Flexible tier subpools (flex subpools)

Flex subpools correspond to thin provisioned RAID groups whose total storage is available for Automated Storage Tiering. The RAID levels of the flex subpools which are supported are RAID 1, RAID 1+0, RAID 5 and RAID 6. The flex subpools use the same storage technology (SSD, SAS or NL-SAS).

Flexible tier volumes (flex volumes)

Flex volumes are generated volumes in a flex subpool. They can be seen and addressed by the servers as "normal" volumes. During configuration the flex volumes are assigned to a flex subpool.

tiering policies

Tiering policies are definable migration rules for Automated Storage Tiering. They define whether, how and when data migration is started. The definition and implementation of the tiering policies take place in the storage system with the management software ETERNUS SF. Monitoring and data migration are based on the I/O values measured per sub LUN.

Monitoring the flex pools

Two threshold values are set on the storage system for each flex pool to monitor the storage space consumption of the various flex pools. These are set when the flex pools are generated and cannot be modified during operation:

- **ATTENTION:** 75% (default value) of the flex pool's available capacity has been used
- **WARNING:** 90% (default value) of the flex pool's available capacity has been used

When the load on the flex pool is 100%, writes to areas which have already been allocated are still executed, but writes which require a new area are rejected with an error. The BS2000 volume is assigned the REMOUNT state.

SHC-OSD reports when each monitored flex pool reaches the threshold values and also reports its current status. Monitoring by SHC-OSD can be set, see the `FLEX-POOL-MONITORING` parameter in [section "Configuration of SHC-OSD" on page 58](#).

Configuration of the storage system for AST

Automated Storage Tiering is configured in the storage system by a qualified technician using the management software ETERNUS SF.

The following steps are required (for details, refer to the documentation on ETERNUS DX and ETERNUS SF):

1. Enter the license for the "Thin Provisioning Feature"
2. Switch on the Automated Storage Tiering function
3. Generate the flex pool from one or more RAID groups
4. Generate flex subpools within a flex pool
5. Generate flex volumes in the flex subpools
6. Define the tiering policies
7. Set the monitoring threshold values for each flex pool
8. Dynamic extension of the flex pools (when required)
When more storage is required for existing or future flex pools, existing flex pools can also be extended dynamically by additional physical devices. This extension takes place without interrupting any application which is executing.

Automated Storage Tiering and replication functions

The following combinations of flex pools and replications are supported:

- EC: Replication from flex volumes to flex volumes
- REC: Replication from flex volumes to flex volumes
- SnapOPC+: Replication from flex volumes to snap unit

In the case of EC and REC, flex volumes and normal volumes can be combined. However, this is not recommended as the advantage of Automated Storage Tiering is then lost.

12.2 Automated Storage Tiering in BS2000

Automated Storage Tiering and the performance and cost optimization associated with it are supported by SHC-OSD for /390 servers and for x86 servers. Device type D3475-8F is not supported.

Information on flex volumes

The `/SHOW-STORAGE-DEVICE-CONFIG RAID-LEVEL=*FDEV` command selects flex volumes. These are labeled with `F` in the `RAID` display column.

The `/SHOW-STORAGE-DEVICE-CONFIG INFORMATION=*FLEX-DEVICES` command displays the specific properties of a flex volume with the assignment to a flex pool and the specific capacity values.

See the examples on [page 519](#).

Information on flex pools

The `/SHOW-STORAGE-CONFIGURATION INFORMATION=*FLEX-POOLS` command supplies information on the configuration of the flex pools. The assignment of the RAID groups to the flex pools is also apparent from the information. The implementation for flex pools builds directly on RAID groups.

See the example on [page 501](#).

Monitoring the flex pools

SHC-OSD monitors the occupancy level of the flex pools using the threshold values `ATTENTION` and `WARNING` which were set in the storage system. Monitoring by SHC-OSD can be set, see the `FLEX-POOL-MONITORING` parameter in the SHC-OSD parameter file in the [section “Configuration of SHC-OSD” on page 58](#).

Messages `NDE0087 (ATTENTION)` and `NDE0088 (WARNING)` (which you can answer) on the console show when a particular threshold value for the occupancy level of a flex pool has been exceeded.

When the limit value is reached, administrative intervention enables further capacity to be provided in the flex pool. When the threshold values set are fallen below again in the flex pool, this is shown by the message `NDE0083` on the console. Messages `NDE0087/NDE0088` are then answered automatically if they are still open.



Flex volumes are not monitored.

13 Commands

This chapter provides a description of the syntax and semantics of all SHC-OSD commands. An overview of all the commands is provided on the next page.

The commands are described in alphabetical order, and the descriptions have the following structure:

- the command name and function
- a description of the command function
- an illustration of the command format
- a description of the command operands
- information on command processing, if necessary
- one or more examples, if necessary
- for SHOW commands: output formats
- for SHOW commands: output in S variables
- a description of the command return codes

The 1st volume of the manual “Commands” [1] provides general explanations regarding the metasyntax used, the command return codes and display of S variables.

Command overview

Command	Function	Symmetrix /VMAX3	ETERNUS DX	Page
ACTIVATE-CLONE	Activates a clone pair	X	X	280
ACTIVATE-SNAP	Activates a snap pair	X	X	290
ADD-SYMMETRIX-RA-GROUP	Creates a RA group	X		297
DISABLE-REMOTE-LINK-DIRECTOR	Disables a remote link director	X		300
ENABLE-REMOTE-LINK-DIRECTOR	Enables a remote link director	X		303
HOLD-MULTI-MIRRORING	Splits a multi-mirror pair	X		306
HOLD-REMOTE-COPY	Interrupts remote copy mode	X	X	314
MODIFY-REMOTE-COPY-PARAMETER	Changes the processing mode and remote copy parameters	X	X	324
MODIFY-SHC-ENVIRONMENT	Modifirs the configuration of the external servers		X	335
MODIFY-SHC-PROCESSING	Changes settings of SHC-OSD	X	X	342
MODIFY-SYMMETRIX-RA-GROUP	Changes the RA group	X		357
REMOVE-SYMMETRIX-RA-GROUP	Cancels the RA group	X		360
RESTART-CLONE-SESSION	Re-creating a clone pair	X	X	362
RESTART-SNAP-SESSION	Re-creates a snap pair	X		371
RESTORE-FROM-CLONE	Reconstructs an original from a clone unit	X	X	375
RESTORE-FROM-SNAP	Reconstructs an original from a snap unit	X	X	384
RESUME-IO	Resume input/output activity	X	X	393
RESUME-MULTI-MIRRORING	Reconstructs a multi-mirror pair	X		395
RESUME-REMOTE-COPY	Resumes remote copy mode	X	X	402
SET-REMOTE-COPY-ACCESS	Sets the access path to the data of a remote copy pair	X		411
SHOW-CLONE-SESSION-STATUS	Displays the status of clone pairs	X	X	418
SHOW-MULTI-MIRRORING-STATUS	Displays the status of multi-mirror pairs	X		429
SHOW-REMOTE-COPY-STATUS	Displays the status of remote copy pairs	X	X	441

Command	Function	Symmetrix /VMAX3	ETERNUS DX	Page
SHOW-SHC-ENVIRONMENT	Displays configuration of the external servers	X	X	465
SHOW-SHC-PROCESSING	Displays settings of SHC-OSD	X	X	473
SHOW-SNAP-SESSION-STATUS	Displays the status of snap pairs	X	X	487
SHOW-STORAGE-CONFIGURATION	Displays storage configuration		X	499
SHOW-STORAGE-DEVICE-CONFIG	Displays storage device configuration		X	512
SHOW-SYMMETRIX-CONFIGURATION	Shows the Symmetrix/VMAX3 configuration	X		526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays the Symmetrix/VMAX3 device configuration	X		537
START-CLONE-SESSION	Creates a clone pair	X	X	559
START-MULTI-MIRRORING	Creates a multi-mirror pair	X		568
START-REMOTE-COPY	Creates a remote copy pair	X	X	575
START-SNAP-SESSION	Creates a snap pair	X	X	587
STOP-CLONE-SESSION	Cancels a clone pair	X	X	596
STOP-MULTI-MIRRORING	Cancels a multi-mirror pair	X		603
STOP-REMOTE-COPY	Cancels a remote copy pair	X	X	607
STOP-SNAP-SESSION	Cancels a snap pair	X	X	614
SWAP-CLONE-SESSION	Swaps original and clone attributes of a clone pair		X	622
SWAP-REMOTE-COPY	Swaps the source and target property of a remote copy pair	X	X	627
UNLOCK-SYMMETRIX	Lifts Symmetrix/VMAX3 device locks	X		634
UNLOCK-SYMMETRIX-DEVICE	Lifts Symmetrix/VMAX3 device locks	X		635

Commands according to function groups

An overview of the commands for the functions can be found in the chapters with the related functional description:

- for local replication with clones on [page 98](#)
- for local replication with snapshots on [page 128](#)
- for local replication with TimeFinder/Mirror on [page 163](#)
- for remote replication with REC on [page 180](#)
- for remote replication with SRDF on [page 202](#)
- for thin provisioning on [page 258](#)
- for Automated Storage Tiering on [page 271](#)

Commands for controlling the internal settings

Command	Function	Page
MODIFY-SHC-ENVIRONMENT	Modify configuration of the external servers	335
MODIFY-SHC-PROCESSING	Changes settings of SHC-OSD	342
SHOW-SHC-ENVIRONMENT	Displays configuration of the external servers	465
SHOW-SHC-PROCESSING	Displays settings of SHC-OSD	473

The internal settings for execution, maintenance and diagnostics of the SHC-OSD subsystem can be displayed and modified dynamically. This option complements the settings via the SHC-OSD parameter file (see [section “Configuration of SHC-OSD” on page 58](#)).

SHOW commands

Command	Function	Page
SHOW-CLONE-SESSION-STATUS	Displays the status of clone sessions	418
SHOW-MULTI-MIRRORING-STATUS	Displays the status of multi-mirror pairs (Symmetrix/VMAX3)	429
SHOW-REMOTE-COPY-STATUS	Displays the status of remote copy pairs	441
SHOW-SHC-ENVIRONMENT	Displays configuration of the external servers	465
SHOW-SHC-PROCESSING	Displays settings of SHC-OSD	473
SHOW-SNAP-SESSION-STATUS	Displays the status of snap sessions	487
SHOW-STORAGE-CONFIGURATION	Displays the configuration (ETERNUS DX)	499
SHOW-STORAGE-DEVICE-CONFIG	Displays the device configuration, (ETERNUS DX)	512
SHOW-SYMMETRIX-CONFIGURATION	Displays the configuration (Symmetrix/VMAX3)	526
SHOW-SYMMETRIX-DEVICE-CONFIG	Displays the device configuration, (Symmetrix/VMAX3)	537

The SHOW commands support the structured output to S variables.

ACTIVATE-CLONE

Activates a clone pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/ACTIVATE-CLONE` activates one or more clone pairs, each of which consists of one original unit and one clone unit. Following successful activation, the original unit and the clone unit are split: Both can be accessed from the host by applications. From the application's viewpoint, the clone unit contains all the data of the original unit at command processing time.

The original units of the clone pairs are specified in the UNIT operand.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), clone units must exist for all units of the pubset. The clone pubset on the clone units can be renamed directly using the `NEW-PUBSET` operand if an SF pubset is involved.

The `CLONE-UNIT` operand enables the clone unit which is to be activated to be selected if several pairs in the `CREATED` status exist for an original unit. By default the first clone unit is activated.

The file consistency over multiple volumes must be ensured by the caller. For this purpose a synchronization point should be created for the data before the command is called, see [section "Activating clone pairs" on page 110](#).

Before `/ACTIVATE-CLONE` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For EC clone on ETERNUS DX

The command is executed only if the clone pair has the `SYNCHRONIZED` status.

The `CLONE-UNIT` operand enables the clone unit which is to be activated to be selected if multiple pairs in the `SYNCHRONIZED` status exist for an original unit.

By default the first possible clone unit is activated.

When the `REC` function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a clone pair. In this case the source unit is specified in the `UNIT` operand, and the clone pair on the target unit is selected using the `SELECT=*TARGET-UNIT` operand. No concurrent remote copy is supported in such a configuration.

After the clone pair has been activated, it assumes the `SPLIT` status.

For TimeFinder/Clone on Symmetrix/VMAX3

The command is executed only if the clone pair is in the `CREATED`, `RECREATED` or `PRECOPY` status.

When the `SRDF` function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a clone pair. In this case the source unit is specified in the `UNIT` operand, and the clone pair of the target unit is selected using the `SELECT=*TARGET-UNIT` operand.

After the clone pair has been activated/split, the Copy-On-Access process begins (see [“Overview” on page 102](#)). Depending on the options with which it was created, the pair is in the status `COPY-ON-ACCESS`, `COPY-IN-PROGRESS` or `COPIED` (see the `/START-CLONE-SESSION` command on [page 559](#)).

ACTIVATE-CLONE

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
      <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>
  | ,NEW-PUBSET = *SAME / *SPECIAL-VSN / <cat-id 1..4>
  | ,HOLD-IO = *NO / *UNTIL-ACTIVATED

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = <x-text 1..4>

,CLONE-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *BY-SYMMETRIX(...) /
             *BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
  | POSITION = *LAST / <integer 1..16>

*BY-SYMMETRIX(...)
  | CLONE-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
  | CLONE-LOGICAL-VOLUME = <x-text 1..4>

,COPY-COMPLETE-DATA = *UNCHANGED / *NO / *YES

,SELECT = *STD / *TARGET-UNIT(...)

  *TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>

,FORCE = *NO / *YES

,WAIT = *NO / *UNTIL-SYNCHRONIZATION

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing. When an SF pubset is selected, the volumes of the clone pubset can be renamed using NEW-PUBSET.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID. When HOLD-IO=*UNTIL-ACTIVATED, no volume set ID may be specified.

NEW-PUBSET =

Determines the catalog ID of the clone pubset.

NEW-PUBSET = *SAME

The clone pubset is not renamed, i.e. it retains the same name.

NEW-PUBSET = *SPECIAL-VSN

All volumes of an SF pubset's clone units are automatically renamed to prevent confusion with the original. For this purpose the period in a VSN in point notation is changed to a colon (e.g. AA.001 to AA:001), or in PUB notation the PUB string is changed to P:B (e.g. PUBA01 to P:BA01).

NEW-PUBSET = <cat-id 1..4>

An SF pubset's clone pubset is renamed by specifying the new catalog ID explicitly. The catalog ID can also differ in length from the PUBSET operand. The new clone pubset also becomes an SF pubset. An existing MRSCAT entry is used if it is of the correct type. If it is not, it is deleted and created again. See the notes in [section "Renaming SF pubsets with SHC-OSD" on page 77](#).

HOLD-IO =

Handles inputs/outputs on the clone pair during splitting (see [“Consistent splitting of a pubset in the shared pubset network” on page 113](#)).

HOLD-IO = *NO

The inputs/outputs on the clone pair are executed without any change. This can lead to data inconsistencies on the clone units for applications which are not suspended before splitting takes place.

HOLD-IO = *UNTIL-ACTIVATED

The inputs/outputs on the clone pair are suspended until all the imported pubset's clone pairs are in the `COPY-ON-ACCESS` status. Subsequently inputs/outputs are resumed on the units. If an error occurs when inputs/outputs are suspended or resumed, the command is aborted. The input/output activity may need to be resumed using `/RESUME-IO`.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

CLONE-UNIT =

Selects the clone unit. If more than one clone unit exists for a unit, a specific clone unit must be selected.

CLONE-UNIT = *FIRST-POSSIBLE

Selects the first possible clone unit for the command.

CLONE-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the clone unit via its position in the output list of /SHOW-CLONE-SESSION-STATUS.

POSITION = *LAST

Selects the last clone unit in the output list.

POSITION = <integer 1..16>

Specifies the position of the clone unit.

CLONE-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume.

COPY-COMPLETE-DATA =

Only relevant for Symmetrix/VMAX3.

Specifies whether the storage system should copy the complete unit to the clone unit in the background following activation. The copy mode set when the clone session was started can be changed (see /START-CLONE-SESSION on [page 559](#)).

COPY-COMPLETE-DATA = *UNCHANGED

The copy mode set when the clone session was started is retained.

COPY-COMPLETE-DATA = *NO

The storage system copies only those tracks to the clone unit which are accessed in write mode on a unit of the clone pair or in read mode on the clone unit.

COPY-COMPLETE-DATA = *YES

Following activation the storage system copies all tracks to the clone unit.

SELECT =

Selects the clone pairs.

SELECT = *STD

Selects the clone pairs which were defined using the `UNIT` operand.

SELECT = *TARGET-UNIT(...)

Selects the clone pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the `UNIT` operand.

For ETERNUS DX the selection can only be made if the target unit is unique. Concurrent remote copy is not supported here.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

FORCE =

Only relevant for Symmetrix/VMAX3.

`FORCE` controls the activation of a clone pair with a clone unit which is also an SRDF source unit in the remote copy status `ERROR` and not accessible. (In this case the clone session is in the status `PRECOPY`, `CREATED` or `RECREATED`.)

FORCE = *NO

Activation is rejected.

FORCE = *YES

Activation is executed. The remote copy status changes to `ACTIVE`.

A prerequisite is that the clone session was created using `/START-CLONE-SESSION ...`

`COPY-COMPLETE-DATA=*YES(...)`.

WAIT =

Only relevant for Symmetrix/VMAX3.

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

`WAIT=*UNTIL-SYNCHRONIZATION` simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress are unnecessary.

Waiting can be aborted in dialog mode by hitting the `[K2]` key.

Command processing

Message `NDE1073` is output to `SYSOUT` for each device and distributed via routing code 0, i.e. it is logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [\[5\]](#).

Examples

```
/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=OLD,NEW-PUBSET=*SAME)
```

```
/ACTIVATE-CLONE UNIT=*BY-PUBSET(PUBSET=OLD,NEW-PUBSET=NEW,  
HOLD-IO=*UNTIL-ACTIVATED)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	1	NDE1036	PUBSET and NEW-PUBSET have different lengths
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1044	NEW-PUBSET already exists
	64	NDE1087	HOLD-IO=*UNTIL-ACTIVATED permitted only for imported pubsets
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1104	HOLD-IO=*UNTIL-ACTIVATED: DAB caching active
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Logical volume not found
	64	NDE1120	Error suspending or resuming input/output access to pubset
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1155	RAID10 devices not supported
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1530	No clone function for the unit
	64	NDE1531	Different number of devices in the unit and clone unit specifications
	64	NDE1535	Device is a clone unit
	64	NDE1540	Incorrect state of unit
	64	NDE1541	Incorrect state of clone unit
	64	NDE1549	No clone unit assigned for clone unit selection
	64	NDE1553	Device is not a clone unit
	64	NDE1584	Clone pair already activated, command not processed
	64	NDE1592	Clone pair already activated and clone unit renamed
	64	NDE1596	Clone pair(s) already activated
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1890	CIMOM not found
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix/VMAX3 license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

ACTIVATE-SNAP

Activates a snap pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

For ETERNUS DX and VMAX3 `/ACTIVATE-SNAP` offers renaming of an activated snapshot pubset. For Symmetrix it activates snap pairs.

The original units of the snap pairs are specified in the `UNIT` operand.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), snap units must exist for all units of the pubset. The snap pubset on the snap units can be renamed directly using the `NEW-PUBSET` operand if an SF pubset is involved.

The file consistency over multiple volumes must be ensured by the caller. For this purpose a synchronization point should be created for the data before the command is called, see [section “Synchronization point for the snapshot” on page 149](#).

Before `/ACTIVATE-SNAP` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For SnapOPC+ on ETERNUS DX and TimeFinder SnapVX on VMAX3

Snap pairs are activated immediately after `/START-SNAP-SESSION`. They then have the `COPY-ON-WRITE` status.

`/ACTIVATE-SNAP` offers renaming of a pubset which has already been activated which consists of snap units (`*BY-PUBSET(. . .)` operand). The status of the snap pairs remains unchanged.

For TimeFinder/Snap on Symmetrix

`/ACTIVATE-SNAP` activates one or more snap pairs, each of which consists of one original unit and one snap unit. After successful activation, the original and snap units are split. Both are available for applications from the host. From the application's viewpoint, the snap unit contains all the data of the original unit at command processing time.

The command is executed only if the snap pair is in the `CREATED` status.

The `SNAP-UNIT` operand enables the snap unit which is to be activated to be selected if several pairs in the `CREATED` status exist for an original unit. By default the first possible snap unit is activated.

When the SRDF function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a snap pair. In this case the source unit is specified in the `UNIT` operand, and the snap pair on the target unit is selected using the `SELECT=*TARGET-UNIT` operand.

After the snap pair has been activated/split, the Copy-On-First-Write process begins (see the [chapter "Local replication with snapshots \(ETERNUS DX, Symmetrix/VMAX3\)" on page 127](#)). The pair is in the status `COPY-ON-WRITE` or `COPIED`.

ACTIVATE-SNAP

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>
  | ,NEW-PUBSET = *SAME / *SPECIAL-VSN / <cat-id 1..4>
  | ,HOLD-IO = *NO / *UNTIL-ACTIVATED

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = <x-text 1..4>

,SNAP-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *BY-SYMMETRIX(...) /
  list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
  | POSITION = <integer 1..127> / *LAST

*BY-SYMMETRIX(...)
  | SNAP-LOGICAL-VOLUME = <x-text 1..4>

,SELECT = *STD / *TARGET-UNIT(...)

*TARGET-UNIT(...)
  | RA-GROUP = *UNIQUE / <integer 1..250>

```

UNIT =

For ETERNUS DX and VMAX3 only **UNIT=*BY-PUBSET** makes sense.

Selects the units by means of a particular **VSN** (***BY-VOLUME**), a particular catalog ID (***BY-PUBSET**), by means of the serial number and the internal number of the logical volume in the storage system (***BY-SYMMETRIX**/***BY-STORAGE**), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Only relevant for Symmetrix.

Selects the units by means of a particular **VSN**.

VOLUME = <vsn 1..6>

Specifies the volume's **VSN**.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing. When an SF pubset is selected, the volumes of the snap pubset can be renamed using `NEW-PUBSET`.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID. When `HOLD-IO=*UNTIL-ACTIVATED`, no volume set ID may be specified.

NEW-PUBSET =

Determines the catalog ID of the snap pubsets of the snap unit(s).

NEW-PUBSET = *SAME

The snap pubset of the snap unit(s) is not renamed, i.e. it retains the same name.

NEW-PUBSET = *SPECIAL-VSN

All volumes of an SF pubset's snap units are automatically renamed to prevent confusion with the original. For this purpose the period in a VSN in point notation is changed to a colon (e.g. AA.001 to AA:001), or in PUB notation the PUB string is changed to P:B (e.g. PUBA01 to P:BA01).

NEW-PUBSET = <cat-id 1..4>

An SF pubset's snap pubset is renamed by specifying the new catalog ID explicitly. The catalog ID can also differ in length from the `PUBSET` operand. The new snap pubset also becomes an SF pubset. An existing MRSCAT entry is used if it is of the correct type. If it is not, it is deleted and created again. See the notes in [section "Renaming SF pubsets with SHC-OSD" on page 77](#).

HOLD-IO =

Only relevant for Symmetrix.

Handles inputs/outputs on the snap pair during splitting (see ["Consistent splitting of a pubset in the shared pubset network" on page 151](#)).

HOLD-IO = *NO

The inputs/outputs on the original units are executed without any change. This can lead to data inconsistencies on the snap units for applications which are not suspended before splitting takes place.

HOLD-IO = *UNTIL-ACTIVATED

The inputs/outputs on the original units are suspended until all the imported pubset's snap pairs are in the `COPY-ON-WRITE` status. Subsequently inputs/outputs are resumed on the units. If an error occurs when inputs/outputs are suspended or resumed, the command is aborted. The input/output activity may need to be resumed using `/RESUME-IO`.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix.

Selects the unit by means of the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Only relevant for Symmetrix.

Selects the unit by means of the mnemonic device name of the logical volume.

SNAP-UNIT =

Selects the snap units. If more than one snap unit exists for a unit, a specific snap unit must be selected.

SNAP-UNIT = *FIRST-POSSIBLE

Selects the first assigned snap unit possible for the command.

SNAP-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the snap unit via its position in the output list of /SHOW-SNAP-SESSION-STATUS.

POSITION = <integer 1..127>

Specifies the position of the snap unit.

POSITION = *LAST

Selects the last snap unit in the output list.

SNAP-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix.

Selects the snap unit by means of the the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the snap units.

SELECT =

For ETERNUS DX and VMAX3 only SELECT=*STD is supported.

Selects the snap pairs.

SELECT = *STD

Selects the snap pairs which were defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Only relevant for Symmetrix.

Selects the snap pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the UNIT operand.

RA-GROUP =

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1044	NEW-PUBSET already exists
	64	NDE1087	HOLD-IO=*UNTIL-ACTIVATED permitted only for imported pubsets
	64	NDE1100	Invalid pubset state
	64	NDE1101	HOLD-IO=*UNTIL-ACTIVATED: more than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1104	HOLD-IO=*UNTIL-ACTIVATED: DAB caching active
	64	NDE1105	Inconsistent pubset

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1110	SELECT=*TARGET-UNIT: SRDF not synchronous or IN-HOLD
	64	NDE1111	Volume allocated to DRV, HOLD-IO not possible
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Logical volume not found
	64	NDE1120	Error suspending or resuming input/output access to pubset
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1155	RAID10 devices not supported
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1430	No Snap function for device
	64	NDE1431	Different number of devices in the unit and snap unit specifications
	64	NDE1435	Device is a virtual unit
	64	NDE1437	MNs of the unit and of the snap unit are identical
	64	NDE1438	Unit and virtual snap unit are different types
	64	NDE1440	Incorrect state of unit (of a snap pair)
	64	NDE1441	Incorrect state of snap unit
	64	NDE1449	No snap unit assigned to specified snap unit
	64	NDE1453	Device is not a snap unit
	64	NDE1454	Device is unused snap unit
	64	NDE1484	Snap pair already activated, command not processed
	64	NDE1492	Snap pair already split and snap unit renamed
	64	NDE1496	Snap pair(s) already activated
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in the storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

ADD-SYMMETRIX-RA-GROUP Defines the RA group

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/ADD-SYMMETRIX-RA-GROUP` defines a new logical SRDF connection with the help of the local and remote connection parameters. New local and remote RA groups are defined for a new SRDF connection. If the specified RA groups already exist, the command is rejected.

The SRDF connection is managed via a freely assignable label. It is defined using parameters of the local and remote storage systems.

The local parameters comprise the local serial number and a local RA group to which (at least two) physical remote link directors are assigned.

The remote parameters comprise the remote serial number and a remote RA group to which, in turn, the same number of physical remote link directors is assigned on the remote side. The physical connection between the specified local and the remote remote link directors must already have been configured.

ADD-SYMMETRIX-RA-GROUP

```

LABEL = *STD / <posix-filename 1..10>
,SERIAL-NUMBER = <alphanum-name 3..12>
,RA-GROUP = <integer 1..250>
,DIRECTOR = list-poss(4): <alphanum-name 1..3>
,PORT-NO = *STD / list-poss(4): <integer 0..31>
,REMOTE-SERIAL-NUMBER = <alphanum-name 3..12>
,REMOTE-RA-GROUP = <integer 1..250>
,REMOTE-DIRECTOR = list-poss(4): <alphanum-name 1..3>
,REMOTE-PORT-NO = *STD / list-poss(4): <integer 0..31>

```

LABEL =
Label of the SRDF connection.

LABEL = *STD
Standard label. Assigned by SHC-OSD.

LABEL = <posix-filename 1..10>
Specifies a freely selectable label.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the local storage system (make sure it is unique!).

RA-GROUP = <integer 1..250>

Specifies the new local RA group which is to be created.

DIRECTOR = list-poss(4):<alphanum-name 1..3>

Specifies the local remote link director(s).

PORT-NO =

Specifies the port number of the local remote link director(s).

PORT-NO = *STD

The default port number for VMAX3 is 0.

The operand is ignored for the other storage systems.

PORT-NO = list-poss(4):<integer 0..31>

Specifies the port number of the local remote link director(s).



The specifications for **DIRECTOR** and **PORT** must correspond to each other in pairs, e.g. **DIRECTOR=(11,12),PORT=(8,9)** for director 11 at port 8 and 12 at port 9.

REMOTE-SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the remote storage system (make sure it is unique!).

REMOTE-RA-GROUP = <integer 1..250>

Specifies the new remote RA group which is to be created.

REMOTE-DIRECTOR = list-poss(4): <alphanum-name 1..3>

Specifies the remote remote link director(s).

REMOTE-PORT-NO =

Specifies the port number of the remote remote link director(s).

REMOTE-PORT-NO = *STD

The default port number for VMAX3 is 0.

The operand is ignored for the other storage systems.

REMOTE-PORT-NO = list-poss(4):<integer 0..31>

Specifies the port number of the remote remote link director(s).



The specifications for **DIRECTOR** and **PORT** must correspond to each other in pairs, e.g. **DIRECTOR=(11,12),PORT=(8,9)** for director 11 at port 8 and 12 at port 9.

Command processing

- When processing is successful, message NDE1074 is output to SYSOUT by every director.
- When processing is not successful, one of the messages NDE2013 or NDE2008 is output to SYSOUT:

Example

```
/ADD-SYMMETRIX-RA-GROUP LABEL=A1_e2K-r3,SERIAL-NUMBER=1234,RA-GROUP=10,
DIRECTOR=12H,PORT-NO=8,REMOTE-SERIAL-NUMBER=5678,REMOTE-RA-GROUP=10,
REMOTE-DIRECTOR=6H,REMOTE-PORT-NO=4
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1010	Engenuity version not supported (too low or too high)
	64	NDE1023	Director is not a remote link director of the storage system
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1136	RA group already exists
	64	NDE1153	Symmetrix device lock set
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2008	Command not processed for director
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

DISABLE-REMOTE-LINK-DIRECTOR

Disables a remote link director

Storage system: Symmetrix/VMAX3

Domain: DEVICE

Privileges: TSOS

`/DISABLE-REMOTE-LINK-DIRECTOR` disables remote link directors (remote adapters, RAs) of a storage system. After execution of the command, the directors are offline.



In VMAX3 the remote link directors have several ports (see [page 28](#)) which can be processed separately in this command (`DIRECTOR` and `PORT` operands).

For Symmetrix, the remote link director is always processed with all its ports.

Remote copy mode is then no longer possible via the remote link directors. If the last remote link director is disabled, the source unit and target unit are no longer synchronized, and the remote copy pair switches to the remote copy state `ERROR`.

This command is used for failure recovery or in order to change the remote link state after a failure.

In the case of a storage system accessible only via SRDF, the last remote link director is not disabled, since it would then no longer be possible to access the remote storage system. If the last remote link director were to be disabled, this state could not be reversed by the same host.

When a failed storage system is started, disabling of its remote link directors prevents automatic connection of the two storage systems.

DISABLE-REMOTE-LINK-DIRECTOR

DIRECTOR = ***ALL** / <alphanumeric-name 1..3> / ***BY-RA-GROUP**(...)

***BY-RA-GROUP**(...)

 | **RA-GROUP** = <integer 1..250>

,**PORT** = ***NO** / <integer 0..31>

,**UNIT** = ***BY-CONTROLLER**(...) / ***BY-SYMMETRIX**(...)

***BY-CONTROLLER**(...)

 | **CONTROLLER-UNIT** = <alphanumeric-name 2..2> / <x-text 4..4>

***BY-SYMMETRIX**(...)

 | **SERIAL-NUMBER** = <alphanumeric-name 3..12>

DIRECTOR =

Specifies which remote link directors of a storage system are to be disabled. Each remote link director is processed individually. The `PORT` operand must also be taken into account for VMAX3. The `PORT` operand has no meaning for Symmetrix.

DIRECTOR = *ALL

Disables all remote link directors.

For VMAX3, this operand value is only permitted in conjunction with `PORT=*NO`.

DIRECTOR = <alphanum-name 1..3>

Name of the remote link director to be deactivated. Names from the value range 1A...16A, 1B...16B, ..., through 1H...16H can be specified.

DIRECTOR = *BY-RA-GROUP(...)

RA group whose remote link directors are to be deactivated.

RA-GROUP = <integer 1..250>

RA group.

PORT =

Only relevant for VMAX3.

Determines the port of the remote link director to be disabled.

PORT = *NO

The status of the ports remain unchanged.

PORT = <integer 0..31>

Specifies the number of the port which is to be disabled.

UNIT =

Selects the storage system by means of the mnemonic name of the emulated controller (`*BY-CONTROLLER`) or the storage system's serial number (`*BY-SYMMETRIX`).

UNIT = *BY-CONTROLLER(...)

Selects the storage system by means of the mnemonic name of the emulated controller. This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller on which the remote link director is to be disabled.

UNIT = *BY-SYMMETRIX(...)

Selects the storage system by means of the serial number.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

Command processing

The following messages are output to SYSOUT for each director and distributed via routing code 0, i.e. they are logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing: NDE1074
- For unsuccessful processing: NDE2008

Examples

```
/DISABLE-REMOTE-LINK-DIRECTOR DIRECTOR=*ALL,UNIT=*BY-CONTROLLER(
    CONTROLLER-UNIT=S4)
```

```
/DISABLE-REMOTE-LINK-DIRECTOR DIRECTOR=15A,CONTROLLER-UNIT=S4
```

```
/DISABLE-REMOTE-LINK-DIRECTOR DIRECTOR=12D,SERIAL-NUMBER=525
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1002	Controller not found
	64	NDE1010	Engenuity version not supported (too low or too high)
	64	NDE1023	Director is not a remote link director of the storage system
	64	NDE1057	Function not supported for VMAX3
	64	NDE1080	No remote link director for specified storage system
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1130	Last remote link director is not disabled
	64	NDE1131	RA group not known on storage subsystem
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered

ENABLE-REMOTE-LINK-DIRECTOR

Enables a remote link director

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/ENABLE-REMOTE-LINK-DIRECTOR` enables remote link directors of a storage system. After execution of the command, the directors are online.



In VMAX3 the remote link directors have several ports (see [page 28](#)) which can be processed separately in this command (`DIRECTOR` and `PORT` operands).
 For Symmetrix, the remote link director is always processed with all its ports.

A prerequisite for successful processing is that the remote links of the remote link director (remote adapter, RA) are physically connected.

This command is used for failure recovery or in order to change the remote link state after a failure.

ENABLE-REMOTE-LINK-DIRECTOR

```

DIRECTOR = *ALL / < alphanum-name 1..3> / *BY-RA-GROUP(...)
  |
  | *BY-RA-GROUP(...)
  |   |
  |   | RA-GROUP = <integer 1..250>
  |
,PORT = *NO / <integer 0..31>
,UNIT = *BY-CONTROLLER(...) / *BY-SYMMETRIX(...)
  |
  | *BY-CONTROLLER(...)
  |   |
  |   | CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>
  |
  | *BY-SYMMETRIX(...)
  |   |
  |   | SERIAL-NUMBER = <alphanum-name 3..12>
  
```

DIRECTOR =

Specifies which remote link directors of a storage system are to be enabled. Each remote link director is processed individually. The `PORT` operand must also be taken into account for VMAX3. The `PORT` operand has no meaning for Symmetrix.

DIRECTOR = *ALL

Enables all remote link directors.

For VMAX3, this operand value is only permitted in conjunction with `PORT=*NO`.

DIRECTOR = <alphanum-name 1..3>

Name of the remote link director to be enabled. Names from the value range 1A...16A, 1B...16B, ..., through 1H...16H can be specified.

DIRECTOR = *BY-RA-GROUP(...)

RA group whose remote link directors are to be enabled.

RA-GROUP = <integer 1..250>

RA group.

PORT =

Only relevant for VMAX3.

Determines the port of the remote link director to be enabled.

PORT = *NO

The status of the ports remain unchanged.

PORT = <integer 0..31>

Specifies the number of the port which is to be enabled.

UNIT =

Selects the storage system by means of the mnemonic name of the emulated controller (`*BY-CONTROLLER`) or the storage serial number (`*BY-SYMMETRIX`).

UNIT = *BY-CONTROLLER(...)

Selects the storage system by means of the mnemonic name of the emulated controller. This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller on which the remote link director is to be disabled.

UNIT = *BY-SYMMETRIX(...)

Selects the storage system by means of the serial number.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

Command processing

The following messages are output to SYSOUT for each director and distributed via routing code 0, i.e. they are logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing: NDE1074
- For unsuccessful processing: NDE2008

Examples

```
/ENABLE-REMOTE-LINK-DIRECTOR DIRECTOR=*ALL,CONTROLLER-UNIT=S5
```

```
/ENABLE-REMOTE-LINK-DIRECTOR DIRECTOR=15A,CONTROLLER-UNIT=S4
```

```
/ENABLE-REMOTE-LINK-DIRECTOR DIRECTOR=12D,SERIAL-NUMBER=525
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1002	Controller not found
	64	NDE1010	Engenuity version not supported (too low or too high)
	64	NDE1023	Director is not a remote link director of the storage system
	64	NDE1057	Function not supported for VMAX3
	64	NDE1080	No remote link director for specified storage system
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1131	RA group not known on storage subsystem
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered

HOLD-MULTI-MIRRORING

Splits a multi-mirror pair

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/HOLD-MULTI-MIRRORING` splits one or more multi-mirror pairs consisting of a normal unit and an additional mirror unit. After successful splitting, the additional mirror unit is available to the host and contains all the data of the normal unit at the time the command was processed.

The normal units of the multi-mirror pairs must always be specified in the `UNIT` operand. When the SRDF function is used, the normal unit specified can also be the source unit of a remote copy pair. The `SELECT=*TARGET-UNIT` operand can be used to select the multi-mirror pair on the target unit.

With concurrent additional mirror units, the `SELECT-ADD-MIRROR` operand can be used to select the additional mirror unit to be split. The first additional mirror units are assigned by default.

The command is not executed unless the multi-mirror pair has the state `ESTABLISHED`. A synchronization point should be created for the data before the command is called. To do this, the applications must be terminated, all files must be closed, and the pubset must be exported. Only in the exported status is it ensured that all data buffered using DAB will be written back from the cache (database etc.).

Only pubsets that have been completely mirrored are processed. The additional mirror pubset on the additional mirror unit can be renamed directly using the `NEW-PUBSET` operand if an SF pubset is involved.

Concurrent additional mirror pubsets can both be given different names.

While the multi-mirror pair is split, the changed data on the normal unit and the additional mirror unit is noted as pending writes on the normal unit and the additional mirror unit. This information is used to speed up the reconstruction process with `/RESUME-MULTI-MIRRORING`.

With additional mirror units that are also SRDF source units, remote copy mode can be resumed after splitting the multi-mirror pairs. This must be initiated explicitly with `/RESUME-REMOTE-COPY`.

SHC-OSD checks the global and task-specific security settings before the `/HOLD-MULTI-MIRRORING` command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

HOLD-MULTI-MIRRORING

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / <alphanum-name 2..2> / <x-text 4..4>

  *BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

  *BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
    | ,NEW-PUBSET = list-poss(2): *SAME / *SPECIAL-VSN / <cat-id 1..4>
    | ,HOLD-IO = *NO / *UNTIL-SPLIT

  *BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = *ALL-NORMAL-UNITS(...) / <x-text 1..4>
    |   *ALL-NORMAL-UNITS(...)
    |     | SELECT = *ANY / *ALL-DEFINED / *ATTACHED

,LOCK-ADD-MIRROR = *NO / *YES
,RESTORE-DATA = *ALL-DATA / *MODIFIED-ONLY
,FORCE = *NO / *YES
,SELECT = *STD / *TARGET-UNIT(...)

  *TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>

,SELECT-ADD-MIRROR = *CURRENT / *ALL / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY SYMMETRIX), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID. No volume set ID may be specified with HOLD-IO=*UNTIL-SPLIT.

NEW-PUBSET =

Catalog ID of the additional mirror pubset of the additional mirror unit(s). Specifying a list is meaningful only for concurrent additional mirror pubsets and SELECT-ADD-MIRROR=*ALL. In this case, the first additional mirror pubset after the first list element and the second after the second list element are renamed. If only one operand value is specified for concurrent additional mirror pubsets and SELECT-ADD-MIRROR=*ALL, only the first pubset is renamed and the second is treated as if *SAME had been specified.

NEW-PUBSET = *SAME

The additional mirror pubset of the additional mirror unit(s) is not renamed; it keeps the same name.

NEW-PUBSET = *SPECIAL-VSN

*SPECIAL-VSN names all volumes of the additional mirror unit of an SF pubset to prevent confusion with the original. For this purpose the period in a VSN in point notation is changed to a colon (e.g. AA.001 to AA:001), or in PUB notation the PUB string is changed to P:B (e.g. PUBA01 to P:BA01).

NEW-PUBSET = <cat-id 1..4>

An SF pubset's additional mirror pubset is renamed by specifying the new catalog ID explicitly. The catalog ID can also differ in length from the PUBSET operand. The new additional mirror pubset also becomes an SF pubset. An existing MRSCAT entry is used if it is of the correct type. If it is not, it is deleted and created again. See the notes in [section "Renaming SF pubsets with SHC-OSD" on page 77](#).

HOLD-IO =

Processing of input/output operations on the multi-mirror pair while the pair is being split (see [“Splitting a pubset in the shared pubset network while retaining data consistency” on page 172](#)).

HOLD-IO = *NO

Input/output on the multi-mirror pair continues as before. This may lead to data inconsistencies on the additional mirror units in applications that were not stopped before the pair was split.

HOLD-IO = *UNTIL-SPLIT

Input/output on the multi-mirror pair is stopped until all multi-mirror pairs of the imported pubset is `SPLIT`. Thereafter, input/output on the normal units continues. If an error occurs when inputs/outputs are suspended or resumed, the command is also aborted with an error. It may be necessary to restart input/output activity with `/RESUME-IO`.

UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-NORMAL-UNITS(...)

Selects the normal units of the specified storage system.

SELECT = *ANY

Selects all normal units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all normal units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all normal units (attached in BS2000) of the specified storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

LOCK-ADD-MIRROR =

Specifies whether the additional mirror unit is protected against inadvertent overwriting by /RESUME-MULTI-MIRRORING or /START-MULTI-MIRRORING.

LOCK-ADD-MIRROR is not supported for RAID5 additional mirror units.

LOCK-ADD-MIRROR = *NO

The additional mirror unit is not locked.

LOCK-ADD-MIRROR = *YES

The additional mirror unit is locked.

Exception: A lock is not possible for RAID5 additional mirror units and is ignored.

RESTORE-DATA =

Specifies whether only changed data or all data is to be copied to the internal RAID1 or SRDF mirror disks of the additional mirror unit.

RESTORE-DATA = *ALL-DATA

All data is copied.

RESTORE-DATA = *MODIFIED-ONLY

Only changed data is copied.

FORCE =

FORCE controls the splitting of multi-mirror pairs which are not (yet) synchronous.

FORCE = *NO

Non-synchronous multi-mirror pairs are not split; the command is rejected with the message NDE1032.

FORCE = *YES

Multi-mirror pairs are always split.

SELECT =

Selection of the multi-mirror pairs.

SELECT = *STD

Selection of the multi-mirror pairs defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selection of the multi-mirror pairs assigned to the target unit of a remote copy pair.

RA-GROUP =

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

SELECT-ADD-MIRROR =

Selection of the additional mirror units to be split. If the concurrent BCV function is used, all or just one of the two additional mirror units can be selected for splitting.

SELECT-ADD-MIRROR = *CURRENT

Selects the first additional mirror unit.

SELECT-ADD-MIRROR = *ALL

Selects all currently assigned additional mirror units.

SELECT-ADD-MIRROR = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selection of the additional mirror unit by means of the mnemonic device name of the logical volume. A unit list is not accepted unless a mnemonic device name or a pubset was specified for the UNIT operand.

Command processing

Message NDE1073 is output to SYSOUT for each device and distributed via routing code 0, i.e. it is logged in the CONSLLOG file only. You will find detailed information on the CONSLLOG file (logging file) in the "Introduction to System Administration" manual [5].

Examples

```
/HOLD-MULTI-MIRRORING UNIT=*BY-PUBSET(PUBSET=A,NEW-PUBSET=*SAME),
  LOCK-ADD-MIRROR=*YES
/HOLD-MULTI-MIRRORING UNIT=*BY-PUBSET(PUBSET=OLD,NEW-PUBSET=NEW,
  HOLD-IO=*UNTIL-SPLIT)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	1	NDE1036	PUBSET and NEW-PUBSET have different lengths
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version not supported (too low or too high)
	64	NDE1015	Device not defined in BS2000
	64	NDE1030	No multi-mirror function for the unit
	64	NDE1032	Multi-mirror pair is not yet synchronized
	64	NDE1035	Device is not a normal unit
	64	NDE1040	Incorrect state of the normal unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1043	Pubset type not SF pubset
	64	NDE1044	NEW-PUBSET already exists
	64	NDE1045	HOLD-MULTI-MIRRORING not yet completed, renaming of the pubset not possible
	64	NDE1087	HOLD-IO=*UNTIL-SPLIT permitted only for imported pubsets
	64	NDE1092	Already split and additional mirror unit already renamed
	64	NDE1100	Invalid pubset state
	64	NDE1101	HOLD-IO=*UNTIL-SPLIT: more than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1104	HOLD-IO=*UNTIL-SPLIT: DAB caching active
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1110	SELECT=*TARGET-UNIT: SRDF not synchronous or IN-HOLD
	64	NDE1111	Volume allocated to DRV, HOLD-IO not possible
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1120	Error suspending or resuming input/output access to pubset

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

HOLD-REMOTE-COPY

Interrupts remote copy mode

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/HOLD-REMOTE-COPY` interrupts remote copy mode. The remote copy pair is given the remote copy state `IN-HOLD`. On successful execution of this command, no further data is transferred to the target unit (no synchronization). Both source unit and target unit note the data delta as pending writes for each other.

In concurrent remote copy configurations, remote copy mode can be interrupted either for a specific target unit or for both target units.

The command is used for recovery procedure tests.



CAUTION!

The target unit and source unit can contain inconsistent or differing data if an asynchronous processing mode is set. To ensure that data is identical on the source unit and target unit, on Symmetrix/VMAX3 systems you should, before suspending remote copy mode, use the `/MODIFY-REMOTE-COPY-PARAMETER` command to set synchronous processing mode and wait for synchronization to be completed.

The command is executed only for source units.

The file consistency over multiple volumes must be ensured by the caller.

A synchronization point should be created for the data before the command is called, see the description of a synchronization point on [page 149](#).

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

For REC on ETERNUS DX

When REC replication is suspended, as in the case of local replication with EC the server can immediately access the target unit (`READY` status). It is not necessary to explicitly release the target units as for SRDF (`/SET-REMOTE-COPY-ACCESS` command).

Synchronous REC pairs in which the target unit and source unit are not synchronized can only be split using the `FORCE=*YES` operand.

`/HOLD-REMOTE-COPY` is also executed in `REMOTE-COPY-STATUS=ERROR` in order to permit switchover after the storage system has failed.

The remote pubset can be renamed directly using the `NEW-PUBSET` operand if an SF pubset is involved.

In the event of switchover after failure of the storage system with the source units, note that you cannot specify the units via the pubset as in this case the pubset can no longer be accessed. In this case perform the switchover for each mnemonic name or for the entire storage system.

The command can be entered for REC pairs in remote copy status `ACTIVE` or `ERROR`.

For SRDF on Symmetrix/VMAX3:

Splitting of SRDF devices on which target unit and source unit are not synchronized (SRDF/S) or consistent (SRDF/A) is permitted only with the `FORCE=*YES` operand. The `FORCE=*YES` operand is only effective if the parameter `SYMAPI_ALLOW_RDF_SYMFORCE=TRUE` is set in the SYMAPI option file.

This command is not executed unless the remote copy pair has the remote copy state `ACTIVE` and access is performed via the source path. The command is rejected if the source unit is not available or if `/MODIFY-REMOTE-COPY-PARAMETER . . . ,ON-ERROR=*HOLD` (domino mode) is specified and `CHECK-ON-ERROR-PARAM=*YES` was specified.

Splitting of remote copy pairs in asynchronous processing mode (SRDF/A) is possible for complete RA groups only. The entry `UNIT=*BY-PUBSET` is possible if the volumes of the pubset match the volumes of the RA group exactly.



An RA group can also contain units not defined in BS2000.

HOLD-REMOTE-COPY

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
    *BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
    | ,NEW-PUBSET = *SAME / *SPECIAL-VSN / <cat-id 1..4>
    | ,HOLD-IO = *NO / *UNTIL-SPLIT

*BY-CONTROLLER(...)
    | CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
    |   *ALL-SOURCE-UNITS(...)
    |     | SELECT = *ANY / *ALL-DEFINED / *ATTACHED
    |     | ,RA-GROUP = *ANY / <integer 1..250>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
    |   *ALL-SOURCE-UNITS(...)
    |     | SELECT = *ANY / *ALL-DEFINED / *ATTACHED

,FORCE = *NO / *YES

,CHECK-ON-ERROR-PARAM = *YES / *NO

,TARGET-UNIT = *UNIQUE / *ALL / *FIRST-POSSIBLE / *BY-RA-GROUP(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-RA-GROUP(...)
    | SOURCE-RA-GROUP = <integer 1..250>

*BY-STORAGE(...)
    | TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

If VOLUME, PUBSET or CONTROLLER-UNIT is specified, the action is automatically performed for the correct unit (i.e. the source unit). A mnemonic name or the internal number of the logical volume in the storage system can only be specified for source units.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

Only relevant for ETERNUS DX: When an SF pubset is selected, the volumes of the remote pubset can be renamed using NEW-PUBSET.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

NEW-PUBSET =

Only relevant for ETERNUS DX and SF pubsets.

Determines the catalog ID of the remote pubset.

NEW-PUBSET = *SAME

The remote pubset is not renamed, i.e. it retains the same name.

NEW-PUBSET = *SPECIAL-VSN

All volumes of the remote copy units are automatically renamed to prevent confusion with the original. For this purpose the period in a VSN in point notation is changed to a colon (e.g. AA.001 to AA:001), or in PUB notation the PUB string is changed to P:B (e.g. PUBA01 to P:BA01).

NEW-PUBSET = <cat-id 1..4>

An SF pubset's remote pubset is renamed by specifying the new catalog ID explicitly. The catalog ID can also differ in length from the PUBSET operand. The new remote pubset also becomes an SF pubset. An existing MRSCAT entry is used if it is of the correct type. If it is not, it is deleted and created again. See the notes in [section "Renaming SF pubsets with SHC-OSD" on page 77](#).

HOLD-IO =

Only relevant for ETERNUS DX and SF pubsets.

Processing of input/output operations on the remote copy pair while the pair is being split (see [“Consistent splitting of a pubset in the shared pubset network” on page 113](#)).

HOLD-IO = *NO

Input/output on the remote copy pair continues as before. This can lead to data inconsistencies on the remote copy units for applications which are not suspended before splitting takes place.

HOLD-IO = *UNTIL-SPLIT

Input/output on the remote copy pair is stopped until all remote copy pairs of the imported pubset are in the `SPLIT` status. Subsequently inputs/outputs are resumed on the units. If an error occurs when inputs/outputs are suspended or resumed, the command is aborted. The input/output activity may need to be resumed using `/RESUME-IO`.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the mnemonic name of the emulated controller. This is not possible when the storage system is connected to x86 servers. See also [section “Configuration on x86 servers” on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the specified storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all source units of an RA group. This entry is particularly important for asynchronous processing mode (SRDF/A).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the units by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the specified storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

FORCE =

FORCE controls the interruption of remote copy mode for remote copy pairs that are not (yet) synchronous. For ETERNUS DX the operand has the same effect in synchronous and asynchronous processing mode. For Symmetrix/VMAX3, in asynchronous processing mode (SRDF/A) this operand controls interruption for inconsistent remote copy pairs.

FORCE = *NO

Remote copy mode is only not interrupted for non-synchronous or non-consistent pairs (Symmetrix/VMAX3, SRDF/A). The command is rejected with the message NDE1067. For ETERNUS DX the command is executed even if the remote copy pair is in **ERROR** status.

FORCE = *YES

Remote copy mode is always interrupted.

For Symmetrix/VMAX3, the `SYMAPI_ALLOW_RDF_SYMFORCE=TRUE` option is required in the SYMAPI options. If this option is not set, the command is rejected with the message NDE1152.

CHECK-ON-ERROR-PARAM =

Only relevant for Symmetrix/VMAX3.

CHECK-ON-ERROR-PARAM controls interruption of remote copy mode as a function of the **ON-ERROR** mode set.

CHECK-ON-ERROR-PARAM = *YES

Remote copy mode is interrupted only if **ON-ERROR = *CONTINUE**.

The command is rejected if **ON-ERROR = *HOLD**.

CHECK-ON-ERROR-PARAM = *NO

Remote copy mode is interrupted regardless of the **ON-ERROR** mode set. However, SYMAPI does not carry out the interrupt request unless the SYMAPI option is set to `SYMAPI_ALLOW_RDF_SYMFORCE=TRUE`. If the option is not set, the command is rejected with the message NDE1065.

TARGET-UNIT =

Controls selection of the target unit for concurrent remote copy.

TARGET-UNIT = *UNIQUE

Remote copy mode is interrupted for the one existing target unit.

TARGET-UNIT = *ALL

Remote copy mode is interrupted for all target units.

TARGET-UNIT = *FIRST-POSSIBLE

Remote copy mode is interrupted for the first target unit which permits /HOLD-REMOTE-COPY.

TARGET-UNIT = *BY-RA-GROUP(...)

Only relevant for Symmetrix/VMAX3.

Remote copy mode is interrupted for the target unit for the specified RA group on the source side.

SOURCE-RA-GROUP = <integer 1..250>

Specifies the source RA group

TARGET-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the target unit using the serial number in the storage system.

TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!) with the target unit.

Command processing

The following messages are output to SYSOUT for each device and distributed via routing code 0, i.e. they are logged in the CONSOLE file only. You will find detailed information on the CONSOLE file (logging file) in the "Introduction to System Administration" manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/HOLD-REMOTE-COPY UNIT=*BY-VOLUME(VOLUME=RDF.00)
```

```
/HOLD-REMOTE-COPY UNIT=*BY-PUBSET(PUBSET=RDF)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
3	0	NDE1067	Remote copy pair not yet synchronized
3	0	NDE1069	No current information available about some remote copy pairs
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1021	Device is not a source unit
	64	NDE1022	Device is or has no target unit
	64	NDE1028	Volume not unique in the unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1043	Pubset type not supported
	64	NDE1044	NEW-PUBSET already exists
	64	NDE1060	Remote copy state is not ACTIVE
	64	NDE1062	Access to target unit of the remote copy pair is DIRECT
	64	NDE1063	Source unit does not have the state READY
	64	NDE1065	ON-ERROR=*HOLD for the remote copy pair
	64	NDE1066	No remote link director available
	64	NDE1067	Remote copy pair is not synchronized
	64	NDE1079	None of the selected devices is attached
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1107	No pubset allocation possible
	64	NDE1114	Serial number not found

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1152	FORCE option not permitted
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1190	Command for COPY-MODE=ASYNCHRON for entire RA group only
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1819	Command with UNIT=*BY-CONTROLLER not possible
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1860	Remote copy pair not in ACTIVE status
	64	NDE1862	Remote copy pair already in IN-HOLD status
	64	NDE1863	Remote copy pair already in IN-HOLD status Target already renamed
	64	NDE1866	No remote link available
	64	NDE1890	CIMOM not found
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered
	64	NDE2021	No license for remote replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

MODIFY-REMOTE-COPY-PARAMETER

Changes the processing mode and remote copy parameters

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/MODIFY-REMOTE-COPY-PARAMETER` enables the processing mode (`COPY-MODE`) to be modified, see the relevant section on [page 183](#) (ETERNUS DX) or [page 208](#) (Symmetrix/VMAX3). You change the remote copy parameters for Symmetrix/VMAX3 by means of the `ON-ERROR` operand. This controls whether applications are stopped if there is a device failure or whether operation continues with the remaining unit (see [section “ON-ERROR” on page 210](#)).

The command is executed only for source units.

In concurrent remote copy configurations, synchronous processing mode can be combined with asynchronous processing mode (with or without data consistency).

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

For ETERNUS DX

The command is offered for ETERNUS DX S3 and higher.

The remote copy pair must have `IN-HOLD` status.

For Symmetrix/VMAX3

When changing in synchronous processing mode, `WAIT=*UNTIL-SYNCHRONIZATION` can be used in order to instruct the command to wait for synchronization to complete.

Changing to/from asynchronous processing mode (SRDF/A) is possible for a complete RA group only. This RA group must also have SRDF/A capability. The entry `UNIT=*BY-PUBSET` is possible if the volumes of the pubset match the volumes of the RA group exactly.



An RA group can also contain units not defined in BS2000.

A consistent switch from asynchronous (SRDF/A) to synchronous processing mode is supported by means of `CONSISTENT=YES`.

The `ON-ERROR` setting for concurrent remote copy configurations must be the same for both connections.

The `CONSISTENCY-PROTECT` operand enables you to specify how the storage system should react when data can no longer be copied from the source unit to the target unit in SRDF/A mode. Data consistency can be achieved for all data on the target units.

MODIFY-REMOTE-COPY-PARAMETER

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
*BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>

*BY-CONTROLLER(...)
  | CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
  | *ALL-SOURCE-UNITS(...)
  | | SELECT = *ANY / *ALL-DEFINED / *ATTACHED
  | | ,RA-GROUP = *ANY / <integer 1..250>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
  | *ALL-SOURCE-UNITS(...)
  | | SELECT = *ANY / *ALL-DEFINED / *ATTACHED

,COPY-MODE = *UNCHANGED / *SYNCHRONOUS(...) / *ADAPTIVE-COPY(...) / *ASYNCHRONOUS /
*ASYNC-STACK

*SYNCHRONOUS(...)
  | WAIT = *NO / *UNTIL-SYNCHRONIZATION
  | ,CONSISTENT = *NO / *YES

*ADAPTIVE-COPY(...)
  | WRITE-BUFFER = *CACHE / *DISK
  | ,PENDING-UPDATE-LIMIT = *UNCHANGED / <integer 1...65535>

,ON-ERROR = *UNCHANGED / *HOLD / *CONTINUE

,CONSISTENCY-PROTECT = *UNCHANGED / *ENABLE / *DISABLE

,TARGET-UNIT = *UNIQUE / *ALL / *BY-RA-GROUP(...) / *BY-STORAGE(...)

*BY-RA-GROUP(...)
  | SOURCE-RA-GROUP = <integer 1..250>

*BY-STORAGE(...)
  | TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name.

If VOLUME, PUBSET or CONTROLLER-UNIT is specified, the action is automatically performed for the correct unit (i.e. the source unit). A mnemonic name or the internal number of the logical volume in the storage system can only be specified for source units.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects source units by means of the mnemonic name of the emulated controller. This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the specified storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all source units of an RA group.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

COPY-MODE =

Modifies the processing mode of remote copy mode, see the relevant section on [page 183](#) (ETERNUS DX) or [page 208](#) (Symmetrix/VMAX3).

COPY-MODE = *UNCHANGED

The processing mode remains unchanged. The initial setting is made by customer support.

COPY-MODE = *SYNCHRONOUS(...)

Sets the processing mode to synchronous processing.

This mode ensures that data was written to both the source and target unit after every successful write.

For ETERNUS DX S3: Remote mirroring must be suspended (remote copy status `IN-HOLD`).

WAIT =

Only relevant for Symmetrix/VMAX3.

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

`WAIT=*UNTIL-SYNCHRONIZATION` simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress of the remote copy pair are unnecessary.

Waiting can be aborted in dialog mode by hitting the `[K2]` key.

CONSISTENT =

Specifies the transition from asynchronous to synchronous processing mode.

CONSISTENT = *NO

The transition from asynchronous to synchronous mode does not take place consistently.

CONSISTENT = *YES

The transition from asynchronous to synchronous mode takes place consistently.

COPY-MODE = *ADAPTIVE-COPY(...)

Only relevant for Symmetrix/VMAX3.

Sets the processing mode to asynchronous processing. In this mode, performance improves during write load but remote copy reliability is reduced because the source and target units may differ by several writes.

This entry must not be used together with `ON-ERROR=*HOLD`.

WRITE-BUFFER =

Specifies whether pending writes are to be noted on the source unit or in the cache of the local storage system.

WRITE-BUFFER = *CACHE

Pending writes are noted in the cache of the local storage system. This reduces the cache storage space available for the read buffer. Performance may be impaired if a higher value has been specified for the `PENDING-UPDATE-LIMIT` operand.



The command is rejected with the message NDE1019 if the `COPY-MODE=*ADAPTIVE-COPY(WRITE-BUFFER=*CACHE)` operand is specified and the source unit resides on a VMAX3.

WRITE-BUFFER = *DISK

Pending writes are noted on the source unit. If the unprotected source unit fails, all data that has not yet been transferred is lost.

PENDING-UPDATE-LIMIT =

Specifies how many pending writes can be noted. If the maximum number of pending writes exceeds this limit, the processing mode is switched to semi-synchronous until the number falls below the limit.

PENDING-UPDATE-LIMIT = *UNCHANGED

Previous entry remains unchanged. The initial setting is made by customer support.

PENDING-UPDATE-LIMIT = <integer 1..65535>

Maximum number of pending write permitted.

COPY-MODE = *ASYNCHRONOUS

Sets the processing mode to asynchronous processing (consistency mode in ETERNUS DX S3 and SRDF/A in Symmetrix/VMAX3).

For ETERNUS DX S3: Remote mirroring must be suspended (remote copy status `IN-HOLD`).

COPY-MODE = *ASYNC-STACK

Only relevant for ETERNUS DX.

Sets the processing mode to asynchronous processing (asynchronous REC, stack mode).

ON-ERROR =

Only relevant for Symmetrix/VMAX3.

Specifies how the storage system is to respond if part of the remote copy pair is no longer available (in the event of the failure of the remote link, the source unit or the target unit).

The setting is always valid for both remote copy pairs with concurrent SRDF.

ON-ERROR = *UNCHANGED

Previous entry remains unchanged. The initial setting is made by customer support.

ON-ERROR = *HOLD

The storage system with the source units rejects all subsequent requests; the applications are stopped and wait for a response. The source unit assumes the `REMount` status. A decision can then be made (automatically or by the user) as to whether to continue with the source unit alone or to suspend operation in order to preserve data consistency.

This entry must not be specified for paging units because it may then be that no more SHC-OSD commands can be executed.

This entry must not be specified together with `COPY-MODE=*ADAPTIVE-COPY` or `COPY-MODE=*ASYNCHRONOUS`.

ON-ERROR = *CONTINUE

In the event of a failure, work continues with the remaining unit; the applications are not stopped. If the target unit fails, data loss occurs when a switch is later made to the target unit.

CONSISTENCY-PROTECT =

Only relevant for Symmetrix/VMAX3.

Specifies how the storage system is to react when data can no longer be copied from a source unit to the target unit in SRDF/A mode.

`CONSISTENCY-PROTECT` can only be set for all devices of an RA group simultaneously.

CONSISTENCY-PROTECT = *UNCHANGED

The setting remains unchanged.

CONSISTENCY-PROTECT = *ENABLE

When data can no longer be copied from a source unit of an RA group to a target unit in SRDF/A mode, the connection to all devices of an RA group is interrupted. Consequently all data on the target unit remains consistent. To permit this, the copy mode must be

`ASYNCHRONOUS` and the status `ACTIVE`.

CONSISTENCY-PROTECT = *DISABLE

When a remote copy pair of an RA group fails in SRDF/A mode, the target data becomes inconsistent.

TARGET-UNIT =

Controls selection of the target unit for concurrent remote copy.

TARGET-UNIT = *UNIQUE

Changes the processing mode for the one existing target unit.

TARGET-UNIT = *ALL

Changes the processing mode for all target units.

TARGET-UNIT = *BY-RA-GROUP(...)

Only relevant for Symmetrix/VMAX3.

Changes the processing mode for the target unit for the specified source RA group.

SOURCE-RA-GROUP = <integer 1..250>

Specifies the source RA group

TARGET-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Changes the processing mode for the target unit of the specified storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

Command processing

The following messages are output to SYSOUT for each device and distributed via routing code 0, i.e. they are logged in the CONSOLE file only. You will find detailed information on the CONSOLE file (logging file) in the "Introduction to System Administration" manual [5].

- For successful processing: NDE1070, NDE1071
- For unsuccessful processing NDE2007

Examples

```
/MODIFY-REMOTE-COPY-PARAMETER UNIT=*BY-PUBSET(PUBSET=RDF),
COPY-MODE=*SYNCH,ON-ERROR=*HOLD
```

```
/MODIFY-REMOTE-COPY-PARAMETER UNIT=5000,COPY-MODE=*ADAPTIVE-COPY(
WRITE-BUFFER=*CACHE,PENDING-UPDATE-LIMIT=44)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
3	0	NDE1067	Remote copy pair not yet synchronized
3	0	NDE1069	No current information available about some remote copy pairs
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1021	Device is not a source unit
	64	NDE1028	Volume not unique in the unit
	64	NDE1077	Combination of COPY-MODE=*AD-COPY(WR-BUFFER=*DISK) and ON-ERROR=*HOLD not supported
	64	NDE1079	None of the selected devices is attached
	64	NDE1081	Synchronous command processing not possible
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1163	Device is not SRDF/A-capable
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1174	Invalid combination for concurrent target units with COPY-MODE or ON-ERROR
	64	NDE1190	Command for COPY-MODE=ASYNCHRON for entire RA group only
	64	NDE1191	Modified tracks in the target unit

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1196	Combination of COPY-MODE=*ASYNCH and ON-ERROR=*HOLD not supported
	64	NDE1198	Remote copy pair not in copy mode ASYNCHRONOUS and status is not ACTIVE
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1819	Command with UNIT=*BY-CONTROLLER not possible
	64	NDE1842	Configuration error in the REC buffer
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

MODIFY-SHC-ENVIRONMENT

Modify configuration of the external servers

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/MODIFY-SHC-ENVIRONMENT` manages the settings for operating SHC-OSD with SYMAPI, StorMan and the CIMOM servers. The valid settings are displayed with `/SHOW-SHC-ENVIRONMENT` and are described in the example for this command, see [page 465](#).

The `CONNECTED-SYMAPI` operand enables the SYMAPI server to be switched over. In this case the connected SYMAPI server is disabled and another SYMAPI server defined in the SHC-OSD parameter file is connected.

The `CONNECTED-STORMAN` operand enables the StorMan server to be switched over. In this case the connected StorMan server is disabled and another StorMan server defined in the SHC-OSD parameter file is connected.

StorMan requires the CIMOM server to manage the ETERNUS DX systems. This corresponds to the SMI-S Provider and is embedded in the storage system's firmware.

The settings for the CIMOM server must be made prior to management access to the storage system in order to enter the access data for the CIMOM server in StorMan. This is done using the `CIMOM-SERVER` operand.



When a new CIMOM server element is created, StorMan expects not only the server name but also a port number. Otherwise the command is aborted with message NDE2016.

The settings can be specified directly on the StorMan server concerned. On SE servers the settings for the CMOM server can also be specified via the StorMan interface in the SE Manager.

The `STORMAN-PARAMETER` operand enables the parameters to be managed by StorMan. All parameters which StorMan offers via the `storparam` interface can be modified (see the "StorMan" manual [16]). This function is required in particular for diagnostics. The settings for the StorMan server refer to the external StorMan server. The settings for the StorMan client refer to the StorMan calls integrated into SHC-OSD. When multiple StorMan parameters are to be modified, the command must be entered multiple times.

MODIFY-SHC-ENVIRONMENT

```

CONNECTED-STORMAN = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    |
    | HOST-NAME = *FIRST-AVAILABLE / *DISABLE-ALL / *MU1 / *MU2 /
    |   <c-string 1..48 with-low> / <posix-filename 1..48>
    |
    | ,WAIT = *NO / *UNTIL-UPDATED
,CONNECTED-SYMAPI = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    |
    | HOST-NAME = *FIRST-AVAILABLE / *DISABLE-ALL /
    |   <c-string 1..48 with-low> / <posix-filename 1..48>
,CIMOM-SERVER = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    |
    | SERVER-NAME = <c-string 1..48 with-low> / <alphanumeric-name 1..48>
    | ,PORT-NUMBER = *STD / *BY-DEFAULT / <alphanumeric-name 1..8>
    | ,USER-IDENTIFICATION = *UNCHANGED / *NO / <c-string 1..32 with-low> / <alphanumeric-name 1..32>
    | ,USER-PASSWORD = *UNCHANGED / *NO / <c-string 1..32 with-low> / <alphanumeric-name 1..32>
    | ,MODE = *UPDATE / *REMOVE
    | ,STORMAN-SERVER = *ALL / *CONNECTED / <integer 1..8>
,STORMAN-PARAMETER = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    |
    | NAME = <c-string 1..32 with-low> / <posix-filename 1..32>
    | ,VALUE = <c-string 1..32 with-low> / <posix-filename 1..32>
    | ,DESTINATION = *SERVER(...) / *CLIENT
    |
    | *SERVER(...)
    |   |
    |   | SAVE = *NO / *YES
    |   |
    |   | , STORMAN-SERVER = *ALL / *CONNECTED / <integer 1..8>

```

CONNECTED-STORMAN = *UNCHANGED / *PARAMETERS(...)

Only relevant for ETERNUS DX.

Modifies the connected StorMan server.

HOSTNAME =

Specifies the StorMan server to be used.

HOST-NAME = *FIRST-AVAILABLE

Disables the connected StorMan server and then connects the first StorMan server in the OK status from the list defined in the SHC-OSD parameter file.

HOST-NAME = *DISABLE-ALL

Disables the connected StorMan server. Following this the storage systems can no longer be managed.

HOST-NAME = *MU1

Only for SE servers.

Disables the connected StorMan server and then connects the StorMan server on the first MU of the SE server.

HOST-NAME = *MU2

Only for SE servers.

Disables the connected StorMan server and then connects the StorMan server on another MU of the SE server (if one exists).

HOST-NAME = <c-string 1..48 with-low> / <posix-filename 1..48>

Name or IP address (IPv4 or IPv6) of the StorMan server. The StorMan server to be connected must be entered in the SHC-OSD parameter file and be in the OK status.

WAIT = *NO / *UNTIL-UPDATED

Specifies whether execution of the command should wait for data update by the StorMan server to end (*UNTIL-UPDATED) or not (*NO).

CONNECTED-SYMAPI = *UNCHANGED / *PARAMETERS(...)

Only relevant for Symmetrix/VMAX3.

Modifies the connected SYMAPI server.

HOSTNAME =

Specifies the SYMAPI server to be used.

HOST-NAME = *FIRST-AVAILABLE

Disables the connected SYMAPI server and then connects the first SYMAPI server in the OK status from the list defined in the SHC-OSD parameter file.

HOST-NAME = *DISABLE-ALL

Disables the connected SYMAPI server. Following this the storage systems can no longer be managed.

HOST-NAME = <c-string 1..48 with-low> / <posix-filename 1..48>

Name or IP address (IPv4) of the SYMAPI server. The SYMAPI server to be connected must be entered in the SHC-OSD parameter file and be in the OK status.

CIMOM-SERVER = *UNCHANGED / *PARAMETERS(...)

Only relevant for ETERNUS DX.

Changes the settings for the CIMOM server for use by StorMan.

SERVER-NAME =

Specifies the CIMOM server. If no entry has yet been made, a new one is specified, otherwise the properties are updated.

SERVER-NAME = <c-string 1..48 with-low> / <alphanum-name 1..48>

Specifies the CIMOM server by means of its IP address or host name.

PORT-NUMBER =

Specifies the CIMOM server's port number.

PORT-NUMBER = *STD

The default port number 5988 is included in new entries for the CIMOM server. The port number remains unchanged for existing entries.

PORT-NUMBER = *BY-DEFAULT

The default port number 5988 is entered for new or existing entries for the CIMOM server.

PORT-NUMBER = <alphanum-name 1..8>

Specifies the port number.

USER-IDENTIFICATION =

Specifies the user ID for authentication on the CIMOM server.

USER-IDENTIFICATION = *UNCHANGED

If an entry for the CIMOM server already exists, the user ID remains unchanged. When a new entry is made, a user ID must be specified.

USER-IDENTIFICATION = <alphanum-name 1..32 with-low> / <c-string 1..32>

Explicit specification of the user ID.

USER-PASSWORD =

Specifies the password of the user ID on the CIMOM server

USER-PASSWORD = *UNCHANGED

If an entry for the CIMOM server already exists, the password remains unchanged. When a new entry is made, a password must also be specified for the user ID.

USER-PASSWORD = *NO

No password protection is provided for the user ID on the CIMOM server.

USER-PASSWORD = <c-string 1..32 with-low>

The password is specified directly in quotes. Lowercase and uppercase characters can be used. The password is blanked out when entered.

USER-PASSWORD = <alphanum-name 1..32>

The password is specified directly. Lowercase letters are converted to uppercase.

MODE =

Selects the change modes

MODE = *UPDATE

If no entry with the specified name has yet been made, a new one is specified, otherwise the properties of the existing entry are updated.

MODE = *REMOVE

The entry is deleted from StorMan management.

STORMAN-SERVER =

Specifies the StorMan servers for which the parameter is to be modified.

STORMAN-SERVER = *ALL

The StorMan parameter is modified for all StorMan servers.

STORMAN-SERVER = *CONNECTED

The StorMan parameter is modified for the active StorMan server.

STORMAN-SERVER = <integer 1..8>

The StorMan parameter is modified for the StorMan server which has the index in the list defined in the SHC-OSD parameter file.

STORMAN-PARAMETER = *UNCHANGED / *PARAMETERS(...)

Only relevant for ETERNUS DX.

Changes the StorMan parameters.

These settings only need to be changed for diagnosing problems. A selection of the dynamically settable parameters of the StorMan configuration is supported (see the `storparam` command in the "StorMan" manual [16]).

NAME = <c-string 1..32 with-low> / <posix-filename 1..32>

Name of the StorMan parameter. The following parameters are supported:

- Debug (maximum trace level for StorMan)
- DebugCom (trace level for communication (MaxTraceLevel 4 or higher))
- TraceWorker (trace level for StorMan worker threads)

This specification is case-sensitive.

VALUE = <c-string 1..32 with-low> / <posix-filename 1..32>

New value for the StorMan parameter. The permissible value range for the parameters is described under the `storparam` command. This specification is case-sensitive.

DESTINATION = *SERVER(...)/ *CLIENT

Addressee for the changed parameter.

DESTINATION = *SERVER (...)

The parameter is to be changed for the StorMan server.

SAVE =

Specifies whether the StorMan parameter is to be changed permanently.

SAVE = *NO

The StorMan parameter only remains changed until StorMan is started again.

SAVE = *YES

The changed StorMan parameter is saved permanently in the StorMan configuration file and also applies when StorMan is started again.

STORMAN-SERVER =

Specifies the StorMan servers for which the parameter is to be modified.

STORMAN-SERVER = *ALL

The StorMan parameter is modified for all StorMan servers in the OK status.

STORMAN-SERVER = *CONNECTED

The StorMan parameter is modified for the active StorMan server.

STORMAN-SERVER = <integer 1..8>

The StorMan parameter is modified for the StorMan server which has the index in the list defined in the SHC-OSD parameter file.

DESTINATION = *CLIENT

The parameter is only to be changed for the StorMan client.

Examples

```
/MODIFY-SHC-ENVIRONMENT CIMOM-SERVER=*PARAMETERS(SERVER-NAME=123.123.123.123,
  USER-IDENTIFICATION=test,USER-PASSWORD='test')
```

```
/MODIFY-SHC-ENVIRONMENT STORMAN-PARAMETER=*PARAMETERS(NAME=debug,VALUE=3,
  DESTINATION=*SERVER(SAVE=*YES))
```

```
/MODIFY-SHC-ENVIRONMENT
  CONNECTED-STORMAN=*PARAMETERS(HOST-NAME=23.123.123.123)
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
	1	CMD0202	Syntax error
	64	NDE1730	SYMAPI server not found
	64	NDE1731	SYMAPI server could not be connected
	64	NDE1732	SYMAPI server is already connected
	64	NDE1733	No suitable SYMAPI server found
	64	NDE1830	StorMan server not found
	64	NDE1831	StorMan server could not be connected
	64	NDE1832	StorMan server is already connected
	64	NDE1833	No suitable Storman server found
	64	NDE1834	StorMan server with error
	64	NDE1835	SHC-OSD connected to StorMan server
	64	NDE1890	CIMOM not found
	64	NDE1892	SMI-S Provider added, but CIMOM not started or not yet found
	64	NDE2000	Execution partially successful
	32	NDE2002	Internal error
	32	NDE2014	StorMan error in command
	64	NDE2016	Invalid parameter entered in the command
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available

MODIFY-SHC-PROCESSING

Changes settings of SHC-OSD

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/MODIFY-SHC-PROCESSING` allows you to change the settings for SHC-OSD for maintenance and diagnostics. The initial settings are described in the example for `/SHOW-SHC-PROCESSING` on [page 474](#).

The current settings can be displayed by means of `/SHOW-SHC-PROCESSING`.

Changes to security settings using the `SYSTEM-ADMIN-SCOPE` and `TASK-ADMIN-SCOPE` operands are logged on the console.

MODIFY-SHC-PROCESSING

TRACE = *UNCHANGED / *PARAMETERS(...)

***PARAMETERS(...)**

EXTENDED-TRACE = *UNCHANGED / *OFF / *ON
,NEW-TRACE-SIZE = *UNCHANGED / <integer 64..4096 Kbyte>
,NEW-ERROR-TRACE-SIZE = *UNCHANGED / <integer 64..4096 Kbyte>
,RELEASE-TRACE-AT-UNLOAD = *UNCHANGED / *YES / *NO
,SYMAPI-DEBUG = *UNCHANGED / *ON / *OFF
,SYMAPI-LOG = *UNCHANGED / *ON / *OFF
,SHC-OSD-LOG = *UNCHANGED / *ON / *OFF
,SAVE-TRACES = *NO / *YES
,SAVE-TABLES = *NO / *YES

,LOCK-RETRY = *UNCHANGED / *PARAMETERS(...)

***PARAMETERS(...)**

WAIT-TIME = *UNCHANGED / <integer 1..10 seconds>
,RETRY-COUNT = *UNCHANGED / <integer 1..100>

,IO-RETRY = *UNCHANGED / *PARAMETERS(...)

***PARAMETERS(...)**

WAIT-TIME = *UNCHANGED / <integer 1..10 seconds>
,RETRY-COUNT = *UNCHANGED / <integer 1..100>

,SYNCH-WAIT-RETRY = *UNCHANGED / *PARAMETERS(...)

***PARAMETERS(...)**

WAIT-TIME = *UNCHANGED / <integer 1..120 seconds>
,RETRY-COUNT = *UNCHANGED / <integer 1..100>

,COMM-WAIT-RETRY = *UNCHANGED / *PARAMETERS(...)

***PARAMETERS(...)**

WAIT-TIME = *UNCHANGED / <integer 10..100 seconds>
,RETRY-COUNT = *UNCHANGED / <integer 1..100>

(part 1 of 2)

```

,STATE-CHANGE-POLLING = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    SHORT-INTERVAL = *UNCHANGED / <integer 30..3600 seconds>
    ,NORMAL-INTERVAL = *UNCHANGED / <integer 60..7200 seconds>
    ,LONG-INTERVAL = *UNCHANGED / <integer 360..86400 seconds>
    ,SELECT-DEVICES = *UNCHANGED / *ALL / *ATTACHED
    ,OPERATOR-ORDERS = *UNCHANGED / *YES / *NO
    ,NEXT-CONFIG-UPDATE = *UNCHANGED / *DISCOVER
    ,LOG-CHANGES = *UNCHANGED / *ALL-EVENTS / *MAJOR-EVENTS-ONLY
    ,POLLING-MODE = *UNCHANGED / *NONE / *PING / *SYNC / *STD / *DISCOVER
    ,REDISCOVER-TIME = *UNCHANGED / *NO / *UNLIMITED / <integer 1..9999>
    ,SNAP-SAVE-POOL-SAT = *UNCHANGED / <integer 1..100>
    ,THIN-POOL-SAT = *UNCHANGED / <integer 1..100>
    ,THIN-DEVICE-SAT = *UNCHANGED / *OFF / <integer 1..100>
,USER-TASK-SETTINGS = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    USER-TASK-PRIO = *UNCHANGED / <integer 80..255>
    ,FORK-ACTION = *UNCHANGED / *YES / *NO
,DEVICE-PRESELECTION = *UNCHANGED / *ALL-DEFINED / *ANY
,SYSTEM-ADMIN-SCOPE = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    DETACHED-DEVICES = *UNCHANGED / *ACCEPT / *REJECT
    ,NOT-DEFINED-DEVICES = *UNCHANGED / *ACCEPT / *REJECT
,TASK-ADMIN-SCOPE = *UNCHANGED / *PARAMETERS(...)
  *PARAMETERS(...)
    DETACHED-DEVICES = *UNCHANGED / *ACCEPT / *REJECT / *SYSTEM-ADMIN-SCOPE
    ,NOT-DEFINED-DEVICES = *UNCHANGED / *ACCEPT / *REJECT / *SYSTEM-ADMIN-SCOPE
,MAX-MULTI-BCV = *UNCHANGED / <integer 1..16>
,MULTI-SNAP = *UNCHANGED / *ENABLE / *DISABLE
,PRESELECT-SAVE-POOL = *UNCHANGED / *DEFAULT-POOL / <name 1..32>

```

(part 2 of 2)

TRACE = *UNCHANGED / *PARAMETERS(...)

Changes the trace and logging options.

EXTENDED-TRACE = *UNCHANGED / *OFF / *ON

Controls the size of the entries in the normal trace of SHC-OSD. If EXTENDED-TRACE=*ON is specified, additional information is recorded to facilitate diagnosis. The default setting is *OFF.

NEW-TRACE-SIZE =

Specifies whether the size of the trace area in class 4 memory is to be changed. If it is, the existing area is released and the new area requested.

NEW-TRACE-SIZE = *UNCHANGED

The previous setting remains unchanged.

NEW-TRACE-SIZE = <integer 64..4096 Kbyte>

New size of the trace area.

NEW-ERROR-TRACE-SIZE =

Specifies whether the size of the error trace area in class 4 memory is to be changed. If it is, the existing area is released and the new area requested.

NEW-ERROR-TRACE-SIZE = *UNCHANGED

The previous setting remains unchanged.

NEW-ERROR-TRACE-SIZE = <integer 64..4096 Kbyte>

New size of the error trace area.

RELEASE-TRACE-AT-UNLOAD =

Specifies whether the trace area is released if the /HOLD-SUBSYSTEM or /STOP-SUBSYSTEM SHC-OSD command was specified (see the “Commands” manual [1]).

RELEASE-TRACE-AT-UNLOAD = *UNCHANGED

The previous setting remains unchanged. The initial setting is *YES.

RELEASE-TRACE-AT-UNLOAD = *YES

Trace areas are released when SHC-OSD is unloaded.

RELEASE-TRACE-AT-UNLOAD = *NO

/HOLD-SUBSYSTEM (see manual “Commands” [1]) allows diagnostic information to be generated on problems associated with subsystem termination by running NDMDAMP after /HOLD-SUBSYSTEM. The memory area in class 4 memory cannot be released.

SYMAPI-DEBUG =

Only relevant for Symmetrix/VMAX3.

Changes the debug mode setting for the SYMAPI server.

SYMAPI-DEBUG = *UNCHANGED

The previous setting remains unchanged.

SYMAPI-DEBUG = *OFF

Debug mode is deactivated.

SYMAPI-DEBUG = *ON(...)

Debug mode is activated. All activities of the SYMAPI server are logged.

SYMAPI-LOG =

Only relevant for Symmetrix/VMAX3.

Switches SYMAPI logging to the current log file on the SYMAPI server on or off.



This operand should be used with care. If it is switched off, SYMAPI no longer generates diagnostic documents.

SYMAPI-LOG = *UNCHANGED

The previous setting remains unchanged.

SYMAPI-LOG = *ON

SYMAPI logging is switched on.

SYMAPI-LOG = *OFF

SYMAPI logging is switched off.

SHC-OSD-LOG =

Switches SHC-OSD logging to the current log file in the POSIX file system (path: `/var/shcosd/1og`) on or off. General SHC-OSD errors and messages for supporting ETERNUS DX are logged. Information about SHC-OSD logging can be found in [section "Diagnostic aids" on page 84](#).

SHC-OSD-LOG = *UNCHANGED

The previous setting remains unchanged.

SHC-OSD-LOG = *ON

SHC-OSD logging is switched on.

SHC-OSD-LOG = *OFF

For ETERNUS DX: The entire SHC-OSD logging is switched off.

For Symmetrix/VMAX3: SHC-OSD logging is switched off. SHC-OSD logging is independent of SYMAPI logging, see the `SYMAPI-LOG` parameter.

SAVE-TRACES =

Starts the (one-off) backup of the SHC traces to a file `/var/shcosd/log/dumptrac-yyyymmdd-hhmm.txt`. This operand is used only to create diagnostic information.

SAVE-TRACES = *NO

Backup of the SHC traces is not started.

SAVE-TRACES = *YES

Backup of the SHC traces is started once.

SAVE-TABLES =

Starts the (one-off) backup of the SHC tables to a file `/var/shcosd/log/dumptabl-yyyymmdd-hhmm.txt`. This operand is used only to create diagnostic information.

SAVE-TABLES = *NO

Backup of the SHC tables is not started.

SAVE-TABLES = *YES

Backup of the SHC tables is started once.

LOCK-RETRY = *UNCHANGED / *PARAMETERS(...)

Changes the retry count and the wait time between retries when a lock conflict occurs in SHC-OSD.

WAIT-TIME = *UNCHANGED / <integer 1..10 seconds>

Wait time between retries.

RETRY-COUNT = *UNCHANGED / <integer 1..100>

Maximum number of retries (retry count).

IO-RETRY = *UNCHANGED / *PARAMETERS(...)

Changes the retry count and wait time between retries when an expected state change does not occur in the storage system.

WAIT-TIME = *UNCHANGED / <integer 1..10 seconds>

Wait time between retries.

RETRY-COUNT = *UNCHANGED / <integer 1..100>

Maximum number of retries (retry count).

SYNCH-WAIT-RETRY = *UNCHANGED / *PARAMETERS(...)

Changes the retry count and wait time between retries when WAIT=*UNTIL-SYNCHRONIZATION is issued with a command.

WAIT-TIME = *UNCHANGED / <integer 1..120 seconds>

Wait time between retries.

RETRY-COUNT = *UNCHANGED / <integer 1..100>

Maximum number of retries (retry count).

COMM-WAIT-RETRY = *UNCHANGED / *PARAMETERS(...)

Changes the retry count and wait time between retries for FITC communication of SHC-OSD

WAIT-TIME = *UNCHANGED / <integer 10..100 seconds>

Wait time between retries.

RETRY-COUNT = *UNCHANGED / <integer 1..100>

Maximum number of retries (retry count).

STATE-CHANGE-POLLING = *UNCHANGED / *PARAMETERS(...)

Changes the polling interval for the periodic check of all units in the storage system after state changes. Specifies whether state changes are to be recorded for all devices or for attached devices only.

SHORT-INTERVAL = *UNCHANGED / <integer 30..3600 seconds>

Polling interval for checks at short intervals (i.e. a unit in the storage system was not accessible at the last polling).

NORMAL-INTERVAL = *UNCHANGED / <integer 60..7200 seconds>

Polling interval for checking at normal intervals (i.e. no problems during last polling cycle).

LONG-INTERVAL = *UNCHANGED / <integer 360..86400 seconds>

Polling interval for checks at long intervals (i.e. no supported unit was found in the storage system at the last polling).

SELECT-DEVICES = *UNCHANGED / *ALL / *ATTACHED

Specifies whether state changes found during polling or SHC-OSD commands are to be output for all devices or for the currently attached devices only.

OPERATOR-ORDERS = *UNCHANGED / *YES / *NO

Specifies whether operator orders that must be acknowledged or simple messages only are to be output in the event of state changes.

NEXT-CONFIG-UPDATE = *UNCHANGED / *DISCOVER

Specifies whether all configuration changes are to be discovered at the next update.

LOG-CHANGES =

Specifies whether all state changes or only global state changes are to be logged on the console.

LOG-CHANGES = *UNCHANGED

The previous setting remains unchanged.

LOG-CHANGES = *ALL-EVENTS

All state changes are logged on the console. This means that all state changes detected in the storage system, including state changes of individual logical units and their mirror disks, are logged on the console.

LOG-CHANGES = *MAJOR-EVENTS-ONLY

All global state changes detected in the storage system, as well as state changes for functions offered in the storage system, are logged on the console. State changes of individual logical volumes and their mirror disks are not logged.

POLLING-MODE =

Specifies the polling mode, which determines the scope of the periodic check.

POLLING-MODE = *UNCHANGED

The polling mode remains unchanged.

POLLING-MODE = *NONE

No periodic check; consequently no monitoring of any type (“Event Monitoring”) takes place.

POLLING-MODE = *PING

Only the failure (or the availability) of a storage system is checked in the periodic check.



For Symmetrix: This mode should not be set when TimeFinder/Snap is used because in this mode the occupancy level of the save pool is not monitored.

POLLING-MODE = *SYNC

The failure and status changes of a storage system are checked in the periodic check.

POLLING-MODE = *STD

The failure and status changes of a storage system and of the selected devices are checked in the periodic check.

POLLING-MODE = *DISCOVER

Only relevant for Symmetrix/VMAX3.

Complete redetermination of the configuration and status data of the storage system in every periodic check. This mode also detects configuration changes in the storage system.



This mode should not be set in normal operation because it is very resource-intensive.

REDISCOVER-TIME =

Only relevant for Symmetrix/VMAX3.

Specifies the time in hours during which a failed storage system should automatically be checked for rediscovery.

REDISCOVER-TIME = *UNCHANGED

The time for the automatic check remains unchanged.

REDISCOVER-TIME = *NO

No automatic check for rediscovery. This setting is recommended when, for example, a storage system has been permanently removed from the configuration.

REDISCOVER-TIME = *UNLIMITED

Unlimited automatic check for rediscovery. In this way SHC-OSD automatically recognizes when a storage system is available again.

REDISCOVER-TIME = <integer 1..9999>

Time for the automatic check for rediscovery in hours.

SNAP-SAVE-POOL-SAT =

Only relevant for Symmetrix.

Specifies a limit value for the occupancy level of the save pool. When you are using TimeFinder/Snap, message NDE0055/NDE0056 is displayed on the console to indicate that the limit value has been reached or exceeded (see [“Monitoring the save pools” on page 141](#)).

SNAP-SAVE-POOL-SAT = *UNCHANGED

The limit value remains unchanged.

SNAP-SAVE-POOL-SAT = <integer 1..100>

Specifies the limit value in percent.

THIN-POOL-SAT =

Only relevant for Symmetrix/VMAX3.

Specifies a limit value for the occupancy level of the thin pools used for virtual provisioning. The limit value applies for the thin pools selected in the SHC-OSD parameter file with the `THIN-POOL-MONITORING` parameter (see [page 58](#)). When the limit value is reached or exceeded, this is logged on the console with messages NDE0070/NDE0071 (see [“Monitoring the thin pools” on page 267](#)).

THIN-POOL-SAT = *UNCHANGED

The limit value remains unchanged.

THIN-POOL-SAT = <integer 1..100>

Specifies the limit value in percent.

THIN-DEVICE-SAT =

Only relevant for Symmetrix.

Specifies a limit value for the occupancy level of the Symmetrix volumes used with virtual provisioning at volume level. When the limit value is reached or exceeded, this is logged on the console with message NDE0074.

THIN-DEVICE-SAT = *UNCHANGED

The limit value remains unchanged.

THIN-DEVICE-SAT = *OFF

The limit value is not monitored.

THIN-DEVICE-SAT = <integer 1..100>

Specifies the limit value in percent.

USER-TASK-SETTINGS =

Settings for the user task of SHC-OSD with the job name SHCUSERT.

USER-TASK-SETTINGS = *UNCHANGED

The settings for the user task remain unchanged.

USER-TASK-SETTINGS = *PARAMETERS(...)

Parameters for the settings for the user task.

USER-TASK-PRIO =

Specifies the priority of the SHC-OSD user task with the job name SHCUSERT.

USER-TASK-PRIO = *UNCHANGED

The priority remains unchanged.

USER-TASK-PRIO = <integer 80..255>

Specifies the priority in the range from 80 (highest priority) through 255 (lowest priority).

FORK-ACTION =

Specifies whether or not the user task of SHC-OSD with the job name SHCUSERT uses the POSIX function `fork`.

FORK-ACTION = *UNCHANGED

The setting for using the `fork` function remains unchanged.

FORK-ACTION = *YES

The user task uses `fork` (normal case).

FORK-ACTION = *NO

The user task does not use `fork`. This setting is used only for error analysis.

DEVICE-PRESELECTION =

Preselection of units for which information is output by default by SHOW commands. If the basic setting is used, only generated units are displayed.

DEVICE-PRESELECTION = *UNCHANGED

The previous setting remains unchanged.

DEVICE-PRESELECTION = *ALL-DEFINED

By default, the SHOW commands return information on all units generated in BS2000 in accordance with the basic setting.

DEVICE-PRESELECTION = *ANY

By default, the SHOW commands return information on all units in the selected storage system.

SYSTEM-ADMIN-SCOPE =

Changes the global security settings for executing actions. Depending on the setting, such actions may be performed only for devices attached or defined (generated) in BS2000 or for any devices of a storage system. The security settings apply for all action commands:

- ACTIVATE-CLONE on [page 280](#)
- ACTIVATE-SNAP on [page 290](#)
- HOLD-MULTI-MIRRORING on [page 306](#)
- HOLD-REMOTE-COPY on [page 314](#)
- MODIFY-REMOTE-COPY-PARAMETER on [page 324](#)
- RESTART-CLONE-SESSION on [page 362](#)
- RESTART-SNAP-SESSION on [page 371](#)
- RESTORE-FROM-CLONE on [page 375](#)
- RESTORE-FROM-SNAP on [page 384](#)
- RESUME-MULTI-MIRRORING on [page 395](#)
- RESUME-REMOTE-COPY on [page 402](#)
- SET-REMOTE-COPY-ACCESS on [page 411](#)
- START-CLONE-SESSION on [page 559](#)
- START-MULTI-MIRRORING on [page 568](#)

- START-REMOTE-COPY on [page 575](#)
- START-SNAP-SESSION on [page 587](#)
- STOP-CLONE-SESSION on [page 596](#)
- STOP-MULTI-MIRRORING on [page 603](#)
- STOP-REMOTE-COPY on [page 607](#)
- STOP-SNAP-SESSION on [page 614](#)
- SWAP-CLONE-SESSION on [page 622](#)
- SWAP-REMOTE-COPY on [page 627](#)

The basic setting corresponds to the values `DETACHED-DEVICES=*REJECT` and `NOT-DEFINED-DEVICES=*REJECT`.

SYSTEM-ADMIN-SCOPE = *UNCHANGED

The previous setting remains unchanged.

SYSTEM-ADMIN-SCOPE = *PARAMETERS(....)

The setting is made by means of parameters.

DETACHED-DEVICES =

Actions are executed for detached devices.

DETACHED-DEVICES = *UNCHANGED

The previous setting remains unchanged.

DETACHED-DEVICES = *REJECT

Actions are rejected for detached devices.

DETACHED-DEVICES = *ACCEPT

Actions are executed for detached devices.

NOT-DEFINED-DEVICES =

Actions are executed for devices not generated in BS2000

NOT-DEFINED-DEVICES = *UNCHANGED

The previous setting remains unchanged.

NOT-DEFINED-DEVICES = *REJECT

Actions are rejected for devices not generated.

NOT-DEFINED-DEVICES = *ACCEPT

Actions are executed for devices not generated.

TASK-ADMIN-SCOPE =

Changes the task-specific security settings for executing actions. Depending on the setting, such actions may be performed only for devices attached or defined (generated) in BS2000 or for any devices of a storage system. The security settings apply for all action commands:

- ACTIVATE-CLONE on [page 280](#)
- ACTIVATE-SNAP on [page 290](#)
- HOLD-MULTI-MIRRORING on [page 306](#)
- HOLD-REMOTE-COPY on [page 314](#)
- MODIFY-REMOTE-COPY-PARAMETER on [page 324](#)
- RESTART-CLONE-SESSION on [page 362](#)
- RESTART-SNAP-SESSION on [page 371](#)
- RESTORE-FROM-CLONE on [page 375](#)
- RESTORE-FROM-SNAP on [page 384](#)
- RESUME-MULTI-MIRRORING on [page 395](#)
- RESUME-REMOTE-COPY on [page 402](#)
- SET-REMOTE-COPY-ACCESS on [page 411](#)
- START-CLONE-SESSION on [page 559](#)
- START-MULTI-MIRRORING on [page 568](#)
- START-REMOTE-COPY on [page 575](#)
- START-SNAP-SESSION on [page 587](#)
- STOP-CLONE-SESSION on [page 596](#)
- STOP-MULTI-MIRRORING on [page 603](#)
- STOP-REMOTE-COPY on [page 607](#)
- STOP-SNAP-SESSION on [page 614](#)
- SWAP-CLONE-SESSION on [page 622](#)
- SWAP-REMOTE-COPY on [page 627](#)

The basic setting corresponds to the values `DETACHED-DEVICES=*SYSTEM-ADMIN-SCOPE` and `NOT-DEFINED-DEVICES=*SYSTEM-ADMIN-SCOPE`.

TASK-ADMIN-SCOPE = *UNCHANGED

The previous setting remains unchanged.

TASK-ADMIN-SCOPE = *PARAMETERS(...)

The setting is made by means of parameters.

DETACHED-DEVICES =

Actions are executed for detached devices.

DETACHED-DEVICES = *UNCHANGED

The previous setting remains unchanged.

DETACHED-DEVICES = *REJECT

Actions are rejected for detached devices.

DETACHED-DEVICES = *ACCEPT

Actions are executed for detached devices.

DETACHED-DEVICES = *SYSTEM-ADMIN-SCOPE

The global system setting applies.

NOT-DEFINED-DEVICES =

Actions are executed for devices not generated in BS2000

NOT-DEFINED-DEVICES = *UNCHANGED

The previous setting remains unchanged.

NOT-DEFINED-DEVICES = *REJECT

Actions are rejected for devices not generated.

NOT-DEFINED-DEVICES = *ACCEPT

Actions are executed for devices not generated.

NOT-DEFINED-DEVICES = *SYSTEM-ADMIN-SCOPE

The global system setting applies.

MAX-MULTI-BCV =

Only relevant for Symmetrix.

For Symmetrix, changes the maximum number of additional mirror units allowed per normal unit for use with the multi BCV and concurrent BCV functions.

This setting has no effect on the maximum permissible number of clone units and snap units. The joint maximum value of 16 copies for TimeFinder/Mirror, TimeFinder/Clone and TimeFinder/Snap is dependent on this setting.

MAX-MULTI-BCV = *UNCHANGED

The previous setting remains unchanged.

MAX-MULTI-BCV = <integer 1.. 16>

A new maximum value is set (default: 8).

MULTI-SNAP =

Only relevant for Symmetrix.

Changes the setting for supporting a maximum of 127 snap units per original unit for TimeFinder/Snap.

MULTI-SNAP = *UNCHANGED

The previous setting remains unchanged

MULTI-SNAP = *ENABLED

Support for up to 127 snap units per original unit for TimeFinder/Snap is enabled.

MULTI-SNAP = *DISABLED

Support for up to 127 snap units per original unit for TimeFinder/Snap is disabled. In this case up to 15 snap units per original unit are supported for TimeFinder/Snap.

PRESELECT-SAVE-POOL =

Only relevant for Symmetrix.

Specifies which save pool is to be used for TimeFinder/Snap if automatic selection by means of `SAVE-POOL=*BY-PRESELECTION` is specified in the `/START-SNAP-SESSION` command.

PRESELECT-SAVE-POOL = *UNCHANGED

The previous setting remains unchanged

PRESELECT-SAVE-POOL = *DEFAULT-POOL

The storage system's default pool is used as the save pool.

PRESELECT-SAVE-POOL = <name 1..32 with-under with-low>

Specifies the name of the storage system's save pool.

This specification is case-sensitive.

Examples

```
/MODIFY-SHC-PROCESSING TRACE=*PARAMETERS(EXTENDED-TRACE=*ON)
```

```
/MODIFY-SHC-PROCESSING LOCK-RETRY=*PARAMETERS(WAIT-TIME=2,RETRY-COUNT=40)
```

```
/MODIFY-SHC-PROCESSING STATE-CHANGE-POLLING=*PARAMETERS(
    SELECT-DEVICES=*ALL)
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available

MODIFY-SYMMETRIX-RA-GROUP

Modify assignment of remote link directors to RA groups

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

/MODIFY-SYMMETRIX-RA-GROUP modifies the assignment of remote link directors to existing RA groups, e.g. to add or remove a remote link for an existing SRDF connection. The modification will take place for each storage system. In other words when the assignment is modified for a connection, the command must be executed for both the local storage system and for the remote storage system.

MODIFY-SYMMETRIX-RA-GROUP

SERIAL-NUMBER = <alphanum-name 3..12>

,**RA-GROUP** = <integer 1..250>

,**DIRECTOR** = *ADD(...) / *REMOVE(...)

*ADD(...)

DIR-NO = <alphanum-name 1..3>

PORT-NO = *STD / <integer 1..31>

*REMOVE(...)

DIR-NO = <alphanum-name 1..3>

PORT-NO = *STD / <integer 1..31>

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

RA-GROUP = <integer 1..250>

Specifies the RA group affected.

DIRECTOR = *ADD(...)

Assigns another remote link director to the RA group.

DIR-NO = <alphanum-name 1..3>

Specifies the local remote link director.

PORT-NO =

Specifies the port number of the local remote link director.

PORT-NO = *STD

The default port number for VMAX3 is 0.

The operand is ignored for the other storage systems.

PORT-NO =<integer 0..31>

Specifies the port number of the local remote link director.

DIRECTOR = *REMOVE(...)

Removes the remote link director from the RA group.

DIR-NO = <alphanum-name 1..3>

Specifies the local remote link director.

PORT-NO =

Specifies the port number of the local remote link director.

PORT-NO = *STD

The default port number for VMAX3 is 0.

The operand is ignored for the other storage systems.

PORT-NO =<integer 0..31>

Specifies the port number of the local remote link director.

Command processing

The following messages are output to SYSOUT.

- For successful processing: NDE1074
- For unsuccessful processing: NDE2008, NDE2013

Examples

Assigning another remote link director:

```
/MODIFY-SYMMETRIX-RA-GROUP SERIAL-NUMBER=1234,RA-GROUP=4,  
DIRECTOR=*ADD(DIR-NO=12H)
```

Removing a remote link director:

```
/MODIFY-SYMMETRIX-RA-GROUP SERIAL-NUMBER=56778,RA-GROUP=5,  
DIRECTOR=*REMOVE(DIR-NO=6H)
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1010	Engenuity version not supported (too low or too high)
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1153	Symmetrix device lock set
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2008	Command not processed for director
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

REMOVE-SYMMETRIX-RA-GROUP

Cancel SRDF connection via RA groups

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/REMOVE-SYMMETRIX-RA-GROUP` cancels an existing logical SRDF connection. In this case the associated RA groups on the local and the remote storage system are deleted. The physical connection between the remote link directors is not affected by this.

The logical SRDF connection can be selected using its label or an RA group.

REMOVE-SYMMETRIX-RA-GROUP

```

SERIAL-NUMBER = <alphanum-name 3..12>
RA-SELECTION = *BY-NUMBER(...)/ *BY-LABEL(...)
  *BY-NUMBER(...)
    | RA-GROUP = <integer 1..250>
  *BY-LABEL(...)
    | LABEL= <posix-filename 1..10>

```

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

RA-SELECTION = *BY-NUMBER(...)

Selects the SRDF connection using the storage system's RA group.

RA-GROUP= <integer 1..250>

Specifies the number of the RA group.

RA-SELECTION = *BY-LABEL(...)

Selects the SRDF connection using the internal label.

LABEL= <posix-filename 1..10>

Specifies the SRDF connection's label.

Command processing

The following messages are output to SYSOUT for each director.

- For successful processing: NDE1074
- For unsuccessful processing: NDE2008, NDE2013

Examples

```
/REMOVE-SYMMETRIX-RA-GROUP SERIAL-NUMBER=1234 ,
  RA-SELECTION=*BY-NUMBER(RA-GROUP=12)
```

```
/REMOVE-SYMMETRIX-RA-GROUP SERIAL-NUMBER=1234 ,
  RA-SELECTION=*BY-LABEL(LABEL=1_Abc_34-D)
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1010	Enginuity version not supported (too low or too high)
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1131	RA group not found in the storage system
	64	NDE1153	Symmetrix device lock set
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2008	Command not processed for director
	64	NDE2011	Symmetrix license not entered
	64	NDE2016	Invalid parameter entered in the command
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

RESTART-CLONE-SESSION

Re-creating a clone pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/RESTART-CLONE-SESSION` updates a clone session and resets the clone unit of a clone pair to the status of the original/unit. The existing assignment between the unit and clone unit is retained.

When the command is executed, the data is copied from the original unit to the clone unit. No other access may take place to either of these units.

The original units of the clone pairs are specified in the `UNIT` operand.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), clone units must exist for all units of the pubset.

For the restart the clone units can be selected explicitly (e.g. by means of the catalog ID of a renamed pubset) or implicitly according to their position in a `SYSOUT` output (`*FROM-SHOW-OUTPUT(...)` operand).

Before `/RESTART-CLONE-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For EC on ETERNUS DX

The command is executed only if the clone pair has the `SPLIT` status. After the restart, the status of the clone pair changes from `SYNCHRONIZING` to `SYNCHRONIZED`.

When the `REC` function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a clone pair. In this case the source unit is specified in the `UNIT` operand, and the clone pair of the target unit is selected using the `SELECT=*TARGET-UNIT` operand.

For TimeFinder/Clone on Symmetrix/VMAX3

`/RESTART-CLONE-SESSION` restarts an existing close session and resumes replication to the clone unit of a clone pair. A restart is possible only if the clone pair was created using `DIFFERENTIAL=*YES` and `COPY-COMPLETE-DATA=*YES` (see `/START-CLONE-SESSION` on [page 559](#)).

When the `SRDF` function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a clone pair. In this case the source unit is specified in the `UNIT` operand, and the clone pair of the target unit is selected using the `SELECT=*TARGET-UNIT` operand.

RESTART-CLONE-SESSION

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = <x-text 1..4>

,CLONE-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *BY-PUBSET(...) /
    *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
    | POSITION = <integer 1..16> / *LAST

*BY-PUBSET(...)
    | CLONE-PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

,START-COPY = *STD / *AT-ACTIVATION / *IMMEDIATE

,RESTORED-SESSION = *STD / *REJECT / *ACCEPT / *SPLIT-ONLY

,SELECT = *STD / *TARGET-UNIT(...)

    *TARGET-UNIT(...)
        | RA-GROUP = *UNIQUE / <integer 1..250>

,FORCE = *NO / *YES

,WAIT = *NO / *UNTIL-SYNCHRONIZATION

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

**CAUTION!**

When a pubset is reconstructed from the clone units using UNIT=*BY-PUBSET(. . .), it may not have been reconfigured or, in particular, not have been reduced in size in the meantime. The clone units selected must contain a consistent pubset.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

CLONE-UNIT =

Selects the clone unit. If more than one clone unit exists for a unit, a specific clone unit must be selected.

CLONE-UNIT = *FIRST-POSSIBLE

Selects the first possible clone unit for the command.

CLONE-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the clone unit via its position in the output list of /SHOW-CLONE-SESSION-STATUS.

POSITION = <integer 1..16>

Specifies the position of the clone unit.

POSITION = *LAST

Selects the last clone unit in the output list.

CLONE-UNIT = *BY-PUBSET(...)

Selects the clone unit via the pubset ID of the activated and renamed pubset.

CLONE-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

CLONE-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume.

START-COPY =

Only relevant for Symmetrix/VMAX3. On ETERNUS DX copying is always started immediately.

Controls the time from when the modified data should be copied from the original unit to the clone unit.

START-COPY = *STD

*AT-ACTIVATION is taken as the default value.

START-COPY = *AT-ACTIVATION

Copying only starts at activation time.
The status of the clone session is RECREATED.

START-COPY = *IMMEDIATE

Copying starts immediately. The status of the clone session switches to PRECOPY.

RESTORED-SESSION =

Only relevant for Symmetrix/VMAX3.
Determines how a clone session or a session's pairs are to be treated in the RESTORED status.

RESTORED-SESSION = *STD

*REJECT is taken as the default value.

RESTORED-SESSION = *REJECT

The command is rejected for clone pairs in the RESTORED status.

RESTORED-SESSION = *ACCEPT

The command is executed for clone pairs in the RESTORED status. The clone pair is initially briefly placed in the SPLIT status, and then in the RECREATED or PRECOPY status.

RESTORED-SESSION = *SPLIT-ONLY

The command is executed for clone pairs in the RESTORED status. The clone pairs are placed in the SPLIT status and remain in this status until another action is performed.

SELECT =

Selects the clone pairs.

SELECT = *STD

Selects the clone pairs which were defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selects the clone pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the UNIT operand.
For ETERNUS DX the selection can only be made if the target unit is unique. Concurrent remote copy is not supported here.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.
Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

FORCE =

Only relevant for Symmetrix/VMAX3.

FORCE controls the restart of a clone session with a clone unit which is also an SRDF source unit in the remote copy status **ACTIVE**.

FORCE = *NO

The restart is rejected.

FORCE = *YES

The restart is executed. The remote copy status changes to **ERROR**.

WAIT =

Only relevant for ETERNUS DX.

Specifies whether the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

WAIT=*UNTIL-SYNCHRONIZATION simplifies the programming of test procedures because extensive queries regarding the synchronization progress are unnecessary.

Command processing

The following messages are output to **SYSOUT** for each director and distributed via routing code 0, i.e. they are logged in the **CONSLOG** file only. You will find detailed information on the **CONSLOG** file (logging file) in the "Introduction to System Administration" manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/RESTART-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=TFC),  
    CLONE-UNIT=*FROM-SHOW-OUTPUT(POSITION=2)
```

```
/RESTART-CLONE-SESSION UNIT=*BY-VOLUME(VOLUME=TFC.00)
```


Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1006	Pubset/volume is allocated
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1530	No clone function for the unit
	64	NDE1531	Different number of devices for units and clone unit
	64	NDE1535	Device is a clone unit
	64	NDE1540	Incorrect state of unit
	64	NDE1541	Incorrect state of clone unit
	64	NDE1549	No clone unit assigned for clone unit selection

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1553	Device is not a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1890	CIMOM not found
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2011	Symmetrix license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

RESTART-SNAP-SESSION

Re-creates a snap pair

Storage system: Symmetrix
Domain: DEVICE
Privileges: TSOS

`/RESTART-SNAP-SESSION` terminates the snap session and retains the assignment of one or more snap pairs. For this purpose the snap session must be in the `CREATED`, `COPY-ON-WRITE` or `RESTORED` status. Following execution of the command, the snap session is in the `CREATED` status, as it is after the snap pair has been created using `/START-SNAP-SESSION`.

`/RESTART-SNAP-SESSION` is not supported for multi-snaps.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), snap units must exist for all units of the pubset.

Before `/RESTART-SNAP-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

RESTART-SNAP-SESSION

```

UNIT = *BY-PUBSET(...)/ *BY-VOLUME(...)/ *BY-SYMMETRIX(...)/ <alphanum-name 2..2> / <x-text 4..4>
  *BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
  *BY-VOLUME(...)
    | VOLUME = <vsn 1..6>
  *BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>
,SNAP-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...)/ *BY-PUBSET(...)/
          *BY-SYMMETRIX(...)/ list-poss(256): <alphanum-name 2..2> / <x-text 4..4>
  *FROM-SHOW-OUTPUT(...)
    | POSITION = <integer 1..127> / *LAST
  *BY-PUBSET(...)
    | SNAP-PUBSET = <cat-id 1..4>
  *BY-SYMMETRIX(...)
    | ,SNAP-LOGICAL-VOLUME = <x-text 1..4>

```

UNIT =

Selects the units by means of a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name (*BY-VOLUME).

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SNAP-UNIT =

Selects the snap units. If more than one snap unit exists for a unit, a specific snap unit must be selected.

SNAP-UNIT = *FIRST-POSSIBLE

Selects the first assigned snap unit possible for the command.

SNAP-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the snap unit via its position in the output list of /SHOW-SNAP-SESSION-STATUS.

POSITION = <integer 1..127>

Specifies the position of the snap unit.

POSITION = *LAST

Selects the last snap unit in the output list.

SNAP-UNIT = *BY-PUBSET(...)

Selects the snap unit via the pubset ID of the activated and renamed pubset.

SNAP-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

SNAP-UNIT = *BY-SYMMETRIX(...)

Selects the snap unit by means of the the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the snap units.

A list is accepted only if a pubset was specified in the UNIT operand.

Command processing

Message NDE1073 is output to SYSOUT for each device and distributed via routing code 0, i.e. it is logged in the CONSOLE file only. You will find detailed information on the CONSOLE file (logging file) in the "Introduction to System Administration" manual [5].

Example

```
/RESTART-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=TFS)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1006	Pubset/volume is allocated

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1008	Volume cannot be allocated
	64	NDE1015	Device not defined in BS2000
	64	NDE1019	Not supported by Enginuity or SYMAPI version
	64	NDE1043	Pubset type not supported
	64	NDE1057	Function not supported for VMAX3 and higher
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1430	No Snap function for device
	64	NDE1431	Different number of devices for units and snap units
	64	NDE1435	Device is a virtual unit
	64	NDE1437	MNs of the unit and of the snap unit are identical
	64	NDE1438	Unit and virtual snap unit are different types
	64	NDE1440	Incorrect state of unit (of a snap pair)
	64	NDE1441	Incorrect state of snap unit
	64	NDE1449	No snap unit assigned to specified snap unit
	64	NDE1453	Device is not a snap unit
	64	NDE1454	Device is unused snap unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

RESTORE-FROM-CLONE

Reconstructs an original from a clone unit

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/RESTORE-FROM-CLONE` reconstructs the original unit of a clone pair from the clone unit.

When the command is executed, the data is copied from the clone unit to the original unit. No other access may take place to either of these units. The original unit can be accessed again after the copy process has been started.

The original units of the clone pairs are specified in the `UNIT` operand.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), clone units must exist for all units of the pubset.

The clone units can be selected for reconstruction either explicitly (e.g. via the catalog ID of a renamed pubset) or implicitly according to their position in a `SYSOUT` output (`*FROM-SHOW-OUTPUT(...)` operand).

If the original unit also has snap units, the command is rejected.

If the original unit is also the target unit of a remote copy pair, the remote copy status must be `IN-HOLD` or `ERROR`, and `TARGET-ACCESS` must be `DIRECT`.

Before `/RESTART-CLONE-SESSION` is executed, `SHC-OSD` checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For EC clone on ETERNUS DX

Reconstruction takes place in SHC-OSD in several steps which are combined in the command.

After reconstruction has been completed, the clone pairs are still in the SPLIT status.

When the REC function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a clone pair. However, no reconstruction to the original unit is possible on the target unit.

For TimeFinder/Clone on Symmetrix/VMAX3

Reconstruction is possible only if the clone pair was created using `DIFFERENTIAL=*YES` and `COPY-COMPLETE-DATA=*YES` (see `/START-CLONE-SESSION` on [page 559](#)) and the `COPIED` status was then assumed after `/ACTIVATE-CLONE` (see [page 280](#)).

If multiple clone sessions exist for the same original unit and all of these are in the `COPIED` status, the command is executed for the selected units. If any of the unit's clone sessions is in the `RESTORED` status, the command can only be executed for this session's clone unit. The processing depends on the `RESTORED-SESSION` operand.

When the SRDF function is used, the original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a clone pair. In this case the source unit is specified in the `UNIT` operand, and the clone pair of the target unit is selected using the `SELECT=*TARGET-UNIT` operand.

After the command has been executed the clone session is in the `RESTORED` status and cannot be used directly for anything else. Only the commands `/STOP-CLONE-SESSION`, `/RESTART-CLONE-SESSION ... RESTORED-SESSION=*SPLIT-ONLY/*ACCEPT` and another `/RESTORE-FROM-CLONE ... RESTORED-SESSION=*ACCEPT` are possible (see also [page 113](#) and [page 118](#)). While the clone session is in the `RESTORED` status, no other clone or snap session can be started with the same original unit.

`WAIT=*UNTIL-RESTORED / *NO` specifies whether the command waits (synchronous command execution) or not (asynchronous command execution) for reconstruction to be completed.

RESTORE-FROM-CLONE

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
    | ,RENAME-PUBSET = *NO / *SAME / <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = <x-text 1..4>

,CLONE-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *BY-PUBSET(...) /
    *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
    | POSITION = <integer 1..16> / *LAST

*BY-PUBSET(...)
    | CLONE-PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)1
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

,RESTORED-SESSION = *REJECT / *ACCEPT

,WAIT = *STD / *NO / *UNTIL-RESTORED

,SELECT = *STD / *TARGET-UNIT(...)

    *TARGET-UNIT(...)
        | RA-GROUP = *UNIQUE / <integer 1..250>

,FORCE = *NO / *YES

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing. The relevant clone pubset is found automatically.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

**CAUTION!**

When a pubset is reconstructed from the clone units using UNIT=*BY-PUBSET(. . .), it may not have been reconfigured or, in particular, not have been reduced in size in the meantime. The clone units selected must contain a consistent pubset.

RENAME-PUBSET =

Specifies the pubset ID or volume set ID of the reconstructed pubset.

RENAME-PUBSET = *NO

The reconstructed pubset is not renamed. The pubset ID of the clone pubset is implicitly taken over.

RENAME-PUBSET = *SAME

The reconstructed pubset is renamed with the pubset ID or volume set ID of the original pubset.

RENAME-PUBSET = <cat-id 1..4>

The reconstructed pubset is renamed with the specified pubset ID or volume set ID.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

CLONE-UNIT =

Selects the clone unit. If more than one clone unit exists for a unit, a specific clone unit must be selected.

CLONE-UNIT = *FIRST-POSSIBLE

Selects the first possible clone unit for the command.

CLONE-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the clone unit via its position in the output list of /SHOW-CLONE-SESSION-STATUS.

POSITION = <integer 1..16>

Specifies the position of the clone unit.

POSITION = *LAST

Selects the last clone unit in the output list.

CLONE-UNIT = *BY-PUBSET(...)

Selects the clone unit via the pubset ID of the activated and renamed pubset.

CLONE-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

CLONE-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume.

RESTORED-SESSION =

Only relevant for Symmetrix/VMAX3.

Controls how a clone session or a session's pairs are to be treated in the `RESTORED` status.

RESTORED-SESSION = *REJECT

For clone pairs in the `RESTORED` status the command is rejected with the message `NDE2003`.

RESTORED-SESSION = *ACCEPT

The command is executed for clone pairs in the `RESTORED` status. The clone pair is initially briefly placed in the `SPLIT` status, and then ultimately in the `RESTORED` status.

WAIT =

Specifies whether or not the command waits for reconstruction to be completed.

WAIT = *STD

`WAIT=*UNTIL-RESTORED` is used for ETERNUS DX.

`WAIT=*NO` is used for Symmetrix/VMAX3.

WAIT = *NO

Only relevant for Symmetrix/VMAX3.

The command does not wait for reconstruction to be completed.

WAIT = *UNTIL-RESTORED

The command waits for reconstruction to be completed.

`WAIT=*UNTIL-RESTORED` facilitates the programming of test procedures for recovery operations because no complex inquiries regarding the progress of reconstruction are required for the clone pairs.

SELECT =

Selects the clone pairs.

SELECT = *STD

Selects the clone pairs which were defined using the `UNIT` operand.

SELECT = *TARGET-UNIT(...)

Selects the clone pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the `UNIT` operand.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

FORCE =

Only relevant for Symmetrix/VMAX3.

FORCE controls the reconstruction of a clone unit which is also an SRDF source unit in the remote copy status **ACTIVE**.

FORCE = *NO

Reconstruction is rejected.

FORCE = *YES

Reconstruction is executed.

Command processing

The following messages are output to **SYSOUT** for each director and distributed via routing code 0, i.e. they are logged in the **CONSL0G** file only. You will find detailed information on the **CONSL0G** file (logging file) in the "Introduction to System Administration" manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/RESTORE-FROM-CLONE UNIT=*BY-PUBSET(PUBSET=TFC),CLONE-UNIT=*FIRST-POSSIBLE
```

```
/RESTORE-FROM-CLONE UNIT=*BY-VOLUME(VOLUME=TFC.00)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1006	Pubset/volume is allocated
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1531	Different number of devices for units and clone unit
	64	NDE1535	Device is a clone unit
	64	NDE1540	Incorrect state of unit
	64	NDE1541	Incorrect state of clone unit
	64	NDE1542	Unit is an SRDF target unit and unit is not in *READY state
	64	NDE1549	No clone unit assigned for clone unit selection

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1553	Device is not a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in the storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1822	Reconstruction step RESTART-CLONE aborted
	64	NDE1823	Reconstruction step ACTIVATE-CLONE aborted
	64	NDE1824	Reconstruction step SWAP-CLONE aborted
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

RESTORE-FROM-SNAP

Reconstructs an original from a snap unit

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/RESTORE-FROM-SNAP` reconstructs the original unit of a snap pair from the snap unit. When the command is executed, the data is always copied from the snap unit to the original unit.

The original units of the snap pairs are specified in the `UNIT` operand.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), snap units must exist for all units of the pubset.

The snap units can be selected for reconstruction either explicitly (e.g. via the `catid` of a renamed pubset) or implicitly according to their relative age (e.g. `*FROM-SHOW-OUTPUT(*LAST)`).

The original unit can also be the source unit of a remote copy pair. The target unit can also be the original unit of a snap pair. In this case the source unit is specified in the `UNIT` operand, and the snap pair on the target unit is selected using the `SELECT=*TARGET-UNIT` operand.

Before `/RESTART-FROM-SNAP` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For SnapOPC+ on ETERNUS DX

Data stored on the snap unit is copied to the original unit. The original unit can be accessed again after reconstruction has been completed.

If more than one snap unit is assigned to the same original unit, the other snap sessions are not affected by reconstruction. Multiple reconstructions can take place one after the other. However, no snap session may be included in a reconstruction.

The snap session remains in the `COPY-ON-WRITE` status. No status change is logged. After the command has been executed, the snap session is resumed using the reconstructed data.

If the original unit is also the clone unit of a clone pair or the target unit of a remote copy pair, `/RESTORE-FROM-SNAP` is not possible.

For ETERNUS DX S2 reconstruction always runs asynchronously after command execution in the storage system. It cannot be monitored from the outside.

In ETERNUS DX S3 and higher, asynchronous reconstruction after command execution or synchronous reconstruction during command execution is possible (`WAIT` operand). The snap pair is in the `REST-IN-PROG` status during synchronous reconstruction. Waiting can be aborted in dialog mode by hitting the `[K2]` key.

The `/STOP-SNAP-SESSION` and `/START-SNAP-SESSION` commands are rejected with return code `NDE1820` while reconstruction is being performed. They can only be executed successfully after reconstruction has been completed.

For TimeFinder/Snap on Symmetrix

`WAIT=*UNTIL-RESTORED / *NO` specifies whether the command waits (synchronous command execution) or not (asynchronous command execution) for reconstruction to be completed.

No other access may take place to the original and snap units. The snap session must be in the `COPY-ON-WRITE` status.

After the command has been executed the snap session is in the `RESTORED` status and cannot be used for anything else. Only the `/STOP-SNAP-SESSION` command is possible.

When multiple snap units are assigned to the same original unit, no snap session may be in the `CREATED` or `RESTORED` status. If the original unit also has clone units, the command is rejected.

If the original unit is also the target unit of a remote copy pair, the remote copy status must be `IN-HOLD` or `ERROR`, and `TARGET-ACCESS` must be `DIRECT`.

For TimeFinder SnapVX on VMAX3

`WAIT=*UNTIL-RESTORED` always applies, i.e. the command waits for reconstruction to terminate (synchronous command execution).

No other access may take place to the original and snap units. The snap session must be in the `COPY-ON-WRITE` status.

A temporary snap session is established between the snap unit and original unit for reconstruction. Subsequently the original unit contains the status of the reconstructed snap unit, in other words the status at the time the snapshot was created and all other changes performed on the snap unit since then. All snapshots of the original units continue to exist unchanged. The snap pair is temporarily in the `REST-IN-PROG` status during reconstruction. After reconstruction has terminated, it is once again in the `COPY-ON-WRITE` status and can continue to be used on the basis of the reconstructed data. Reconstruction can be repeated multiple times with any snap unit statuses of an original unit.

If more than one snap unit is assigned to the same original unit, the other snap sessions are not affected by reconstruction.

Multiple reconstructions one after another are possible. Parallel reconstructions of multiple snap sessions are not possible.

If the original unit is also the target unit of a remote copy pair, the remote copy status must be `IN-HOLD` or `ERROR`, and `TARGET-ACCESS` must be `DIRECT`.

RESTORE-FROM-SNAP

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = <x-text 1..4>

,SNAP-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *BY-PUBSET(...) /
    *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
    | POSITION = <integer 1..127> / *LAST

*BY-PUBSET(...)
    | SNAP-PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SNAP-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SNAP-LOGICAL-VOLUME = <x-text 1..4>

,WAIT = *NO / *UNTIL-RESTORED

,SELECT = *STD / *TARGET-UNIT(...)
    *TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>

,FORCE = *NO / *YES

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

**CAUTION!**

When a pubset is reconstructed from the snap units using `UNIT=*BY-PUBSET(...)`, it may not have been reconfigured or, in particular, not have been reduced in size in the meantime. The snap units selected must contain a consistent pubset.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects a unit using the mnemonic device name of the logical volume.

SNAP-UNIT =

Selects the snap units. If more than one snap unit exists for a unit, a specific snap unit must be selected.

SNAP-UNIT = *FIRST-POSSIBLE

Selects the first assigned snap unit possible for the command.

SNAP-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the snap unit via its position in the output list of /SHOW-SNAP-SESSION-STATUS.

POSITION = <integer 1..127>

Specifies the position of the snap unit.

POSITION = *LAST

Selects the last snap unit in the output list.

SNAP-UNIT = *BY-PUBSET(...)

Selects the snap units using the pubset ID of the activated and renamed pubset.

SNAP-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

SNAP-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the snap unit by means of the the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the snap unit by means of the the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the snap units.

WAIT =

Not relevant for ETERNUS DX S2.

WAIT=*UNTIL-RESTORED always applies for VMAX3.

Specifies whether or not the command waits for reconstruction to be completed.

WAIT = *NO

The command does not wait for reconstruction to be completed (asynchronous command execution).

WAIT = *UNTIL-RESTORED

The command waits for reconstruction to be completed (synchronous command execution).

This facilitates the programming of test procedures for recovery operations because no complex inquiries regarding the progress of reconstruction are required for the snap pairs. Waiting can be aborted in dialog mode by hitting the **[K2]** key.

SELECT =

Selects the snap pairs.

SELECT = *STD

Selects the snap pairs which were defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selects the snap pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the UNIT operand.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

FORCE =

Only relevant for Symmetrix.

FORCE controls the reconstruction of a unit which is also an SRDF source unit in the ACTIVE status.

FORCE = *NO

Reconstruction is rejected.

FORCE = *YES

Reconstruction is executed.

Command processing

The following messages are output to SYSOUT for each director and distributed via routing code 0, i.e. they are logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/RESTORE-FROM-SNAP UNIT=*BY-PUBSET(PUBSET=TFS),
    SNAP-UNIT=*FROM-SHOW-OUTPUT(POSITION=*LAST)

/RESTORE-FROM-SNAP UNIT=*BY-VOLUME(VOLUME=TFS.00)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1006	Pubset/volume is allocated
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1430	No Snap function for device
	64	NDE1431	Different number of devices for units and snap units
	64	NDE1434	Virtual snap unit already used in other pair
	64	NDE1435	Device is a virtual unit
	64	NDE1440	Incorrect state of unit (of a snap pair)
	64	NDE1441	Incorrect state of snap unit
	64	NDE1442	Unit is an SRDF target unit and unit is not in *READY state
	64	NDE1449	No snap unit assigned to specified snap unit
	64	NDE1453	Device is not a snap unit
	64	NDE1454	Device is unused snap unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in the storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

RESUME-IO

Resume input/output activity for pubsets

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

/RESUME-IO is used to resume input/output activity for pubsets after activity has been halted by SHC-OSD.

In normal operation, SHC-OSD automatically halts and then resumes input/output activity for pubsets to ensure consistent splitting of additional mirror units set up using TimeFinder.



CAUTION!

This command is provided **for emergencies only** and should be used with great care so as not to endanger data consistency during splitting.

RESUME-IO
PUBSET = <u>*ALL</u> / <cat-id 1..4>

PUBSET =

Selects the pubset with stopped input/output activity.

PUBSET = *ALL

Selects all pubsets for which input/output activity is currently stopped.

PUBSET = <cat-id 1..4>

Specifies the pubset ID.

Example

```
/RESUME-IO PUBSET=MMF
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0216	Required privilege not available
	64	NDE1004	Pubset not found or wrong pubset type

RESUME-MULTI-MIRRORING

Reconstructs a multi-mirror pair

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/RESUME-MULTI-MIRRORING` allows you to reconstruct a multi-mirror pair split using `/HOLD-MULTI-MIRRORING`.

The normal units of the multi-mirror pairs must always be specified in the `UNIT` operand. When the SRDF function is used, the normal unit specified can also be the source unit of a remote copy pair. The `SELECT=*TARGET-UNIT` operand can be used to select the multi-mirror pair on the target unit.

The additional mirror units are assigned automatically.

During reconstruction, the information on pending writes noted during splitting can be evaluated (`RESTORE-DATA=*MODIFIED-ONLY`), or a full copy can be created (`RESTORE-DATA=*ALL-DATA`).

Data can be copied either from the normal unit to the additional mirror unit or vice versa. The additional mirror unit must not be allocated. The normal unit must also not be allocated if `RESTORE=*TO-ORIGINAL` is specified. If the normal unit is also the target unit of a remote copy pair, `RESTORE=*TO-ORIGINAL` is possible only if the remote copy state is `IN-HOLD` or `ERROR` and `TARGET-ACCESS` has the value `DIRECT`.

To protect against data inconsistency, the command is rejected if pending writes are noted on the source unit (determined by the copy direction).

If the additional mirror unit was locked with `/HOLD-MULTI-MIRRORING` and the `LOCK-ADD-MIRROR=*YES` operand, `/RESUME-MULTI-MIRRORING` must be specified with the `UNLOCK-ADD-MIRROR=*YES` operand to release the lock again.

When the multi BCV and concurrent BCV functions are used, the additional mirror units for the reconstruction process can be selected explicitly (e.g. using the catalog ID of the renamed subset) or implicitly according to their relative age (e.g. `*OLDEST`, `*PREVIOUS`, ...).

Copy direction `RESTORE=*TO-ORIGINAL` is not supported for the concurrent BCV function because a multi-mirror pair already has the state `ESTABLISHED`.

`WAIT=*UNTIL-SYNCHRONIZATION / *NO` specifies whether or not the command waits for synchronization to complete.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

RESUME-MULTI-MIRRORING

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / <alphanum-name 2..2> / <x-text 4..4>
  *BY-VOLUME(...)
    | VOLUME = <vsn 1..6>
  *BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
  *BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>
,RESTORE = *FROM-ORIGINAL / *TO-ORIGINAL
,RESTORE-DATA = *MODIFIED-ONLY / *ALL-DATA
,UNLOCK-ADD-MIRROR = *NO / *YES
,WAIT = *NO / *UNTIL-SYNCHRONIZATION
,SELECT = *STD / *TARGET-UNIT(...)
  *TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>
,SELECT-ADD-MIRROR = *CURRENT / *PREVIOUS / *OLDEST / *SPECIAL-VSN / *BY-PUBSET(...) /
  list-poss(256): <alphanum-name 2..2> / <x-text 4..4>
  *BY-PUBSET(...)
    | ADD-MIRROR-PUBSET = <cat-id 1..4>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY SYMMETRIX), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing. The corresponding additional mirror pubset is found automatically.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

RESTORE =

Specifies the copy direction when data on the normal unit and additional mirror unit differs.

RESTORE = *FROM-ORIGINAL

Copies from the normal unit to the additional mirror unit.

RESTORE = *TO-ORIGINAL

Copies from the additional mirror unit to the normal unit.

**CAUTION!**

When restoring a pubset from additional mirror units using `UNIT=*BY-PUBSET(...)`, you must ensure that the pubset was not reconfigured and, more particularly, was not reduced in size in the meantime. You are responsible for ensuring that the selected additional mirror units contain a consistent pubset.

RESTORE-DATA =

Specifies whether all data or only changed data is to be copied.

RESTORE-DATA = *MODIFIED-ONLY

Copies all changed data from the “source” unit (normal unit or additional mirror unit, depending on RESTORE) to the “target” unit; replaces data modified on the “target” unit with data from the “source” unit.

RESTORE-DATA = *ALL-DATA

All data is copied.

UNLOCK-ADD-MIRROR =

Specifies whether the lock set previously with /HOLD-MULTI-MIRRORING and the LOCK-ADD-MIRROR=*YES operand is to be released or not.

UNLOCK-ADD-MIRROR = *NO

If there is a lock, it is not released.

However, if at least one additional mirror unit is locked, the command is rejected with message NDE1083.

UNLOCK-ADD-MIRROR = *YES

If there is a lock, it is released.

WAIT =

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

WAIT=*UNTIL-SYNCHRONIZATION simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress of the remote copy pair are unnecessary.

Waiting can be aborted in dialog mode by hitting the K2 key.

SELECT =

Selection of the multi-mirror pairs.

SELECT = *STD

Selection of the multi-mirror pairs defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selection of the multi-mirror pairs assigned to the target unit of a remote copy pair.

RA-GROUP =

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

SELECT-ADD-MIRROR =

Selects the additional mirror units assigned to the specified multi-mirror pairs. If the multi BCV function is used, it is also possible to select the additional mirror unit last split or the oldest additional mirror unit.

**CAUTION!**

If the normal units previously had established concurrent additional mirror units and if these were split using `HOLD-MULTI-MIRRORING . . . ,SELECT-ADD-MIRROR=*ALL`, the order of the first and second additional mirror units may be reversed after the split. If it is important to retain the same additional mirror units, they should be selected explicitly and the operand values `*CURRENT`, `*PREVIOUS` and `*OLDEST` should not be used.

SELECT-ADD-MIRROR = *CURRENT

Selects the additional mirror unit currently attached.

SELECT-ADD-MIRROR = *PREVIOUS

Selects the second assigned additional mirror unit.

SELECT-ADD-MIRROR = *OLDEST

Selects the oldest additional mirror unit.

SELECT-ADD-MIRROR = *SPECIAL-VSN

Selects the additional mirror unit with a special VSN, i.e. the unit in whose VSN the period or the U of PUB was replaced with a colon is selected.

SELECT-ADD-MIRROR = *BY-PUBSET(...)

Explicitly selects the additional mirror unit using the pubset ID of the split and renamed pubset.

ADD-MIRROR-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

SELECT-ADD-MIRROR = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Explicitly selects the additional mirror unit by means of the mnemonic device name of the logical volume.

Command processing

The following messages are output to SYSOUT for each director and distributed via routing code 0, i.e. they are logged in the CONSLLOG file only. You will find detailed information on the CONSLLOG file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/RESUME-MULTI-MIRRORING UNIT=*BY-PUBSET(PUBSET=MMF),
      SELECT-ADD-MIRROR=*PREVIOUS
```

```
/RESUME-MULTI-MIRRORING UNIT=*BY-VOLUME(VOLUME=MMF.00)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1006	Pubset/volume is allocated
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1030	No multi-mirror function for the unit
	64	NDE1033	Multi-mirror pair is not split
	64	NDE1035	Device is not a normal unit
	64	NDE1040	Incorrect state of the normal unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1042	Normal unit is SRDF target unit and RESTORE=*TO-ORIGINAL, normal unit is not in *READY state

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1043	Pubset type not supported
	64	NDE1076	Additional mirror unit has pending writes, copy to normal unit rejected
	64	NDE1083	Additional mirror unit locked
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1180	Too many concurrent additional mirror units
	64	NDE1181	Maximum number of internal mirrors reached
	64	NDE1182	Concurrent BCV not possible after RESTORE=*TO-ORIGINAL
	64	NDE1183	Combination of concurrent BCV and RESTORE=*TO-ORIGINAL not possible
	64	NDE1535	Device is a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

RESUME-REMOTE-COPY

Resumes remote copy mode

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/RESUME-REMOTE-COPY` reactivates remote copy mode after it has been interrupted (for example using `/HOLD-REMOTE-COPY`).

The command is effective in both synchronous and asynchronous processing modes (`COPY-MODE`).

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

For REC on ETERNUS DX

While remote copy mode is interrupted (remote copy status `IN-HOLD`), data on the source unit and target unit can be modified. The `RESTORE` operand can be used to specify the copy direction for subsequent synchronization of the remote copy pair. `WAIT=*UNTIL-SYNCHRONIZATION` ensures that the command waits for synchronization to terminate in both synchronous and asynchronous processing mode.

REC replication can be resumed immediately after use of the target unit has terminated (`READY` status). It is not necessary to explicitly detach the target units (`NOT-READY` status) using the `/SET-REMOTE-COPY-ACCESS` command as for SRDF.

Original units can be reconstructed directly from the target units in synchronous processing mode (`RESTORE=*TO-SOURCE`).

Reconstruction is performed internally in SHC-OSD in the following individual steps:

1. `/SWAP-REMOTE-COPY` to swap the source/target relationship
2. `/RESUME-REMOTE-COPY` to reconstruct the "new" source on the "new" target
3. `/HOLD-REMOTE-COPY` as a prerequisite for another swap
4. `/SWAP-REMOTE-COPY` to restore the source/target relationship
5. `/RESUME-REMOTE-COPY` to resume the original remote replication

Following reconstruction, the remote copy pair is once again in the `ACTIVE` state

For SRDF on Symmetrix/VMAX3:

If data was changed on the source unit or target unit when the remote copy state was `IN-HOLD`, the `RESTORE` operand can be used to specify the copy direction during subsequent synchronization of the remote copy pair. `WAIT=*UNTIL-SYNCHRONIZATION` can be used to specify that the command waits in synchronous processing mode until synchronization is complete and in asynchronous processing mode (SRDF/A) until data consistency is achieved.

The command is executed for source units only if the remote copy pair has the remote copy state `IN-HOLD` and access is via the source path (`TARGET-ACCESS=*BY-SOURCE`).

Activating remote copy pairs in asynchronous processing mode (SRDF/A) is possible for an entire RA group only. The entry `UNIT=*BY-PUBSET` is possible if the volumes of the pubset match the volumes of the RA group exactly.



An RA group can also contain units not defined in BS2000.

To prevent data inconsistency, the command is rejected if it is found that pending writes are noted for the receiving unit or that reconstruction of a local replication (e.g. clone unit) is in progress on the receiving unit.

RESUME-REMOTE-COPY

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
      *BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>
  | ,RENAME-PUBSET = *NO / *SAME / <cat-id 1..4>

*BY-CONTROLLER(...)
  | CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
  |   *ALL-SOURCE-UNITS(...)
  |     | SELECT = *ANY / *ALL-DEFINED / *ATTACHED
  |     | ,RA-GROUP = *ANY / <integer 1..250>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
  |   *ALL-SOURCE-UNITS(...)
  |     | SELECT = *ANY / *ALL-DEFINED / *ATTACHED

,RESTORE = *FROM-SOURCE / *TO-SOURCE(...)

*TO-SOURCE(...)
  | CONCURRENT-TARGET = *REJECT-IF-ACTIVE / *ALLOW

,WAIT = *STD / *NO / *UNTIL-SYNCHRONIZATION

,TARGET-UNIT = *UNIQUE / *ALL / *FIRST-POSSIBLE / *BY-RA-GROUP(...) / *BY-STORAGE(...) /
             <alphanum-name 2..2> / <x-text 4..4>

*BY-RA-GROUP(...)
  | SOURCE-RA-GROUP = <integer 1..250>

*BY-STORAGE(...)
  | TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

If VOLUME, PUBSET or CONTROLLER-UNIT is specified, the action is automatically performed for the correct unit (i.e. the source unit). If a mnemonic name or the internal name in the storage system (*BY-SYMMETRIX, *BY-STORAGE) was specified, only source units are permissible.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

RENAME-PUBSET =

Selects the pubset ID to which the source units of the pubset are to be renamed after /RESUME-REMOTE-COPY when RESTORE=*TO-SOURCE is specified.

RENAME-PUBSET = *NO

The pubset is not renamed, i.e. the catalog ID of the target units remains unchanged.

RENAME-PUBSET = *SAME

The pubset is assigned the catalog ID of the original before /RESUME-REMOTE-COPY.

RENAME-PUBSET = <cat-id 1..4>

Explicit specification of the new pubset ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the mnemonic name of the emulated controller. This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all source units of an RA group.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the units by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the specified storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

RESTORE =

Specifies the copy direction when data on the source unit and target unit differs.

RESTORE = *FROM-SOURCE

Copies from the source unit to the target unit.

RESTORE = *TO-SOURCE(...)

Copies from the target unit to the source unit.

CONCURRENT-TARGET =

Determines the behavior if the source unit has a second target unit with the `ACTIVE` state.

CONCURRENT-TARGET = *REJECT-IF-ACTIVE

The command is rejected if the source unit has a second target unit with the `ACTIVE` state.

CONCURRENT-TARGET = *ALLOW

If the source unit has a second target unit with the `*ACTIVE` state, the latter is also updated.



To ensure data consistency, the copy direction `*TO-SOURCE` is accepted only if no local pending writes are noted on the target unit.

The source units must not be allocated (export subset).

`*TO-SOURCE` is only possible for synchronous REC, also when `WAIT=*UNTIL-SYNCHRONIZATION` is specified.

WAIT =

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *STD

`WAIT=*UNTIL-SYNCHRONIZATION` is used for ETERNUS DX.

`WAIT=*NO` is used for Symmetrix/VMAX3.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete or, with SRDF/A, until a consistent state is reached.

`WAIT=*UNTIL-SYNCHRONIZATION` simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress of the remote copy pair are unnecessary. Waiting can be aborted in dialog mode by hitting the `[K2]` key.

TARGET-UNIT =

Controls selection of the target unit for concurrent remote copy.

TARGET-UNIT = *UNIQUE

Remote copy mode is restarted for the one existing target unit.

TARGET-UNIT = *ALL

Remote copy mode is restarted for all target units.

TARGET-UNIT = *FIRST-POSSIBLE

Remote copy mode is restarted for the first target unit which allows /RESUME-REMOTE-COPY.

TARGET-UNIT = *BY-RA-GROUP(...)

Only relevant for Symmetrix/VMAX3.

Remote copy mode is restarted for the target unit for the specified source RA group.

SOURCE-RA-GROUP = <integer 1..250>

Specifies the source RA group

TARGET-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the target unit using the serial number in the storage system.

TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!) with the target unit.

Command processing

The following messages are output to SYSOUT for each mirror pair and distributed via routing code 0, i.e. they are logged in the CONSLLOG file only. You will find detailed information on the CONSLLOG file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/RESUME-REMOTE-COPY UNIT=*BY-VOLUME(VOLUME=RDF.00),RESTORE=*TO-SOURCE
```

```
/RESUME-REMOTE-COPY UNIT=*BY-PUBSET(PUBSET=RDF),RESTORE=*FROM-SOURCE
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
3	0	NDE1067	Remote copy pair not yet synchronized
3	0	NDE1068	Refreshing the remote copy pair not successful
3	0	NDE1069	No current information available about some remote copy pairs
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1006	Pubset/volume is allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1021	Device is not a source unit
	64	NDE1022	Device is or has no target unit
	64	NDE1028	Volume not unique in the unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1061	Remote copy state is not IN-HOLD
	64	NDE1062	Access to target unit of the remote copy pair is DIRECT
	64	NDE1063	Source unit does not have the state READY
	64	NDE1064	Target unit in *READY, *READ-ONLY or *DISABLE state
	64	NDE1065	ON-ERROR=*HOLD
	64	NDE1066	No remote link director available
	64	NDE1076	Local pending writes are noted on the target unit in the case of RESTORE=*TO-SOURCE

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1079	None of the selected devices is attached
	64	NDE1081	Synchronous command processing not possible
	64	NDE1093	Remote copy state no longer ACTIVE
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1107	No pubset allocation possible
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1173	Source unit has concurrent target unit with ACTIVE state
	64	NDE1190	Command for COPY-MODE=ASYNCHRON for entire RA group only
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1819	Command with UNIT=*BY-CONTROLLER not possible
	64	NDE1822	Reconstruction step RESUME-REMOTE-COPY aborted
	64	NDE1823	Reconstruction step HOLD-REMOTE-COPY aborted
	64	NDE1824	Reconstruction step SWAP-REMOTE-COPY aborted
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1861	Remote copy pair is not in IN-HOLD status
	64	NDE1866	No remote link available
	64	NDE1890	CIMOM not found
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	64	NDE2021	No license for remote replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

SET-REMOTE-COPY-ACCESS

Sets the access path to the data of a remote copy pair

Storage system: Symmetrix/VMAX3

Domain: DEVICE

Privileges: TSOS

`/SET-REMOTE-COPY-ACCESS` changes the access path to the data of a remote copy pair (access via the source path or target path).

The data of the remote copy pair is normally accessed via the source path (i.e. the target unit can only be accessed internally via the remote link).

If either the storage system with the source units or the entire local Data Center fails, the data can be accessed directly via the target path. This is done by entering the command with `TARGET-ACCESS=*DIRECT`.

The command is rejected if the remote copy pair has the remote copy state `ACTIVE`.

Controlling remote copy pairs in asynchronous processing mode (SRDF/A) is possible for an entire RA group only. The entry `UNIT=*BY-PUBSET` is possible if the volumes of the pubset match the volumes of the RA group exactly.



An RA group can also contain units not defined in BS2000.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

SET-REMOTE-COPY-ACCESS

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
| VOLUME = <vsn 1..6>

*BY-PUBSET(...)
| PUBSET = <cat-id 1..4>

*BY-CONTROLLER(...)
| CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
| SERIAL-NUMBER = <alphanum-name 3..12>
| LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / *ALL-TARGET-UNITS(...) / <x-text 1..4>
|   *ALL-SOURCE-UNITS(...)
|   | SELECT = *ANY / *ALL-DEFINED / *ATTACHED
|   | RA-GROUP = *ANY / <integer 1..250>
|   *ALL-TARGET-UNITS(...)
|   | SELECT = *ANY / *ALL-DEFINED / *ATTACHED
|   | RA-GROUP = *ANY / <integer 1..250>

,TARGET-ACCESS = *BY-SOURCE(...) / *DIRECT(...)

*BY-SOURCE(...)
| TARGET-STATE = *STD / *NOT-READY / *READ-ONLY

*DIRECT(...)
| ALLOW-PEND-UPDATES = *NO / *YES

,TARGET-UNIT = *UNIQUE / *ALL / *BY-RA-GROUP(...)

*BY-RA-GROUP(...)
| SOURCE-RA-GROUP = <integer 1..250>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Selects the units by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all source units of an RA group.

LOGICAL-VOLUME = *ALL-TARGET-UNITS(...)

Selects the target units of the storage system.

SELECT = *ANY

Selects all target units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all target units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all target units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all target units of an RA group.

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

TARGET-ACCESS =

Specifies the access path to the data of a remote copy pair.

TARGET-ACCESS = *BY-SOURCE(...)

The data of the remote copy pair is accessed via the source path (i.e. the source unit is addressed).

This is the normal access path for the remote copy pair or when remote copy mode is to be resumed after a failure.

The target units are not addressed in this state. The `NOT-READY` state is set by default for generated target units to prevent ambiguous VSNs in BS2000 operation. The `READ-ONLY` state is set for all other target units, e.g. all target units of non-BS2000 systems.

TARGET-STATE =

Specifies the state setting for the target units.

TARGET-STATE = *STD

The target unit setting depends on generation in BS2000 as described in TARGET-ACCESS=*BY-SOURCE(...).

TARGET-STATE = *NOT-READY

Sets the NOT-READY state for all target units.

TARGET-STATE = *READ-ONLY

Sets the READ-ONLY state for all target units.

TARGET-ACCESS = *DIRECT(...)

The data of the remote copy pair is accessed directly (i.e. the target unit is addressed). This access path is set if either the storage system with the source units or the local Data Center fails and operation is to continue with the target unit until the problem is resolved. What happens then depends on whether or not the internal PEND-UPD=NOT-ALLOWED or ALLOWED setting is overridden.

ALLOW-PEND-UPDATES =

Specifies how the PEND-UPD=NOT-ALLOWED setting is to be handled. This setting prevents inadvertent use of invalid data if the target unit is no longer synchronized.

ALLOW-PEND-UPDATES = *NO

The PEND-UPD=NOT-ALLOWED setting is not overridden. The target unit rejects the transition to READY and is given the DISABLED state if pending writes are still noted on the target unit.

ALLOW-PEND-UPDATES = *YES

The PEND-UPD=NOT-ALLOWED setting is overridden. The target unit is given the READY state even if pending writes are still noted. This can result in data inconsistencies.

TARGET-UNIT =

Controls selection of the target unit for concurrent remote copy.

TARGET-UNIT = *UNIQUE

Remote copy mode is changed for the one existing target unit.

TARGET-UNIT = *ALL

Remote copy mode is changed for all target units.

TARGET-UNIT = *BY-RA-GROUP(...)

Remote copy mode is changed for the target unit of the specified source RA group.

SOURCE-RA-GROUP = <integer 1..250>

Specifies the source RA group

Command processing

The following messages are output to SYSOUT for each mirror pair and distributed via routing code 0, i.e. they are logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing: NDE1072
- For unsuccessful processing NDE2007

Examples

```
/SET-REMOTE-COPY-ACCESS UNIT=*BY-PUBSET(PUBSET=RDF),TARGET-ACCESS=*DIRECT
```

```
/SET-REMOTE-COPY-ACCESS UNIT=*BY-VOLUME(VOLUME=RDF.00),
TARGET-ACCESS=*BY-SOURCE
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
3	0	NDE1025	Direct access to the source unit not possible
3	0	NDE1069	No current information available about some remote copy pairs
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1021	Device is not a source unit
	64	NDE1026	Direct access to the target unit not possible
	64	NDE1027	Remote copy state is ACTIVE
	64	NDE1028	Volume not unique in the unit
	64	NDE1029	Target unit in the state DISABLED

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1065	ON-ERROR=*HOLD
	64	NDE1078	TARGET-ACCESS=*BY-SOURCE not permitted when paging is active on the target unit
	64	NDE1079	None of the selected devices is attached
	64	NDE1094	TARGET-ACCESS=*BY-SOURCE not allowed, if source unit is in state DISABLED and ON-ERROR=*HOLD
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1107	No pubset allocation possible
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1190	Command in COPY-MODE=*ASYNCHRONOUS only supported for entire RA group
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

SHOW-CLONE-SESSION-STATUS

Displays the status of clone pairs

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
SW-MONITOR-ADMINISTRATION,
HSMS-ADMINISTRATION
Routing code: @

`/SHOW-CLONE-SESSION-STATUS` provides information on the status of clone pairs in storage systems.

When device selection takes place, SHC-OSD automatically determines the correct volumes on the storage system concerned and then outputs the data which is relevant for the system. Only clone pairs of one storage system type can be selected (e.g. ETERNUS DX or Symmetrix/VMAX3).

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-CLONE-SESSION-STATUS

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER / *BY-SYMMETRIX(...) /
*BY-STORAGE(...) / list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = list-poss(24): <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = list-poss(24): <cat-id 1..4>

*BY-CONTROLLER
  | CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = *ALL / <x-text 1..4>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = *ALL / <x-text 1..4>

,SELECT = *ALL-PRESELECTED / *BY-ATTRIBUTES(...)

*BY-ATTRIBUTES(...)
  | REMOTE-COPY-USE = *STD / *TARGET-UNIT(...)
  | *TARGET-UNIT(...)
  | | RA-GROUP = *UNIQUE / <integer 1..250>
  | ,DEVICE = *ALL-PRESELECTED / *ALL-DEFINED / *ATTACHED / *DETACHED / *ANY

,UPDATE = *STD / *NO

```

UNIT =

Selects the units by means of a particular VSN (***BY-VOLUME**), a particular catalog ID (***BY-PUBSET**), an emulated controller (***BY-CONTROLLER**), by means of the serial number and the internal number of the logical volume in the storage system (***BY-SYMMETRIX**/***BY-STORAGE**), or directly by means of the logical volume's mnemonic device name. At least one unit must be attached per emulated controller.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = list-poss(24): <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. Information is output for all volumes of the specified pubset. IDs of SF pubsets, volume sets or imported SM pubsets can be specified. No information is output for exported SM pubsets.

PUBSET = list-poss(24): <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SELECT =

Selects the units by means of their remote copy use or their status as seen by BS2000.

SELECT = *ALL-PRESELECTED

The set of units is not restricted further. The global setting for SHC-OSD applies (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

SELECT = *BY-ATTRIBUTES(...)

The set of units is restricted by means of selection criteria.

REMOTE-COPY-USE =

Units with the specified remote copy use are selected.

REMOTE-COPY-USE = *STD

Outputs information on all units regardless of their remote copy use.

REMOTE-COPY-USE = *TARGET-UNIT(...)

Selects the clone pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the `UNIT` operand.

For ETERNUS DX the selection can only be made if the target unit is unique.

Concurrent remote copy is not supported in the output.

Simultaneous entry of an emulated controller (`*BY-CONTROLLER`) in the `UNIT` operand is not supported.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Selects the target units of the specified source RA group.

DEVICE =

Selects the units by means of their status as seen by BS2000.

DEVICE = *ALL-PRESELECTED

Selects all units corresponding to the global setting for the SHC-OSD subsystem (value of `DEVICE-PRESELECT` in the output of `/SHOW-SHC-PROCESSING`).

DEVICE = *ALL-DEFINED

Selects all units generated in BS2000.

DEVICE = *DETACHED

Selects units which are generated in BS2000 but detached.

DEVICE = *ATTACHED

Selects all units attached in BS2000.

DEVICE = *ANY

Selects all units of the storage system which was specified in the UNIT operand.

UPDATE =

Controls updating of the data provided.

UPDATE = *STD

The data is updated in SHC-OSD before the SHOW command is executed.

UPDATE = *NO

The SHOW command is executed without the data being updated in SHC-OSD.

Examples

```
/SHOW-CLONE-SESSION-STATUS UNIT=*BY-CONTR(CONTR-UNIT=5400)
/SHOW-CLONE-SESSION-STATUS UNIT=*BY-STOR(SERIAL-NUM=1003,LOGICAL-VOLUME=100)
/SHOW-CLONE-SESSION-STATUS UNIT=*BY-SYMM(SERIAL-NUM=227,
      LOGICAL-VOLUME=100),REMOTE-COPY-USE=*TARGET-UNIT(RA-GROUP=*UNIQUE)
/SHOW-CLONE-SESSION-STATUS UNIT=5244
```

Output for clone pairs

The layout of the SYSOUT output differs because not all output fields are supplied with values by all storage systems. SHC-OSD automatically selects the correct output format.

Outputs for ETERNUS DX

```
/SHOW-CLONE-SESSION-STATUS UNIT=*BY-STORAGE(SERIAL-NUMBER=7011)
```

UNIT	VOLUME!	!	!	SERIAL-NO	LOG-VOL
2200	TFAB.0!	!	!	4531107011	00080
2202	!SYNCHRONIZED!	!	-	!	100 % 00082
2208	!SYNCHRONIZED!	!	-	!	100 % 00088
2204	E221.0!	!	!	4531107011	00084
2218	CC21.0!SPLIT	!	19.01:57:48!	!	99 % 00098
2214	CC21.0!SPLIT	!	118.00:35:14!	!	12 % 00094

Outputs for Symmetrix/VMAX3

/SHOW-CLONE-SESSION-STATUS UNIT=5244

```

%-----
% UNIT          VOLUME!          !          !SERIAL-NO          LOG-VOL
%-----
%          CLONE VOLUME!STATE          !ACTIVE-FOR !INDIRECT SIZE          PERCENT- BACK/
%          UNITS          !          !DDD.HH:MM:SS!UNIT          CLONE          COPIED DIFF
%-----
% 5244         CL1.00!          !          !000287400587          01600
%          5260          !PRECOPY          !          -          !          0 MB          0 MB 100 % 01700 Y/N
%          5261         CLA.00!COPY-ON-ACCES!          0.00:33:12!3610 MB 3610 MB 99 % 01701 N/N
%-----
    
```

/SHOW-CLONE-SESSION-STATUS UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=207)

```

%-----
% UNIT          VOLUME!          !          !SERIAL-NO          LOG-VOL
%-----
%          CLON- VOLUME!STATE          !ACTIVE-FOR !INDIRECT SIZE          PERCENT- BACK/
%          UNITS          !          !DDD.HH:MM:SS!UNIT          CLONE          COPIED          DIFF
%-----
% 260A         !          !          !000190100207          0004D
%          26D2          !CREATED          !          -          !          17734 MB 7734 MB 0 % 0016F Y/Y
%-----
% 260B         !          !          !000190100207          0004E
%          26D3          !CREATED          !          -          !          17734 MB 7734 MB 0 % 00170 Y/Y
%-----
% 260C         !          !          !000190100207          0004F
%          26D4          !CREATED          !          -          !          17734 MB 7734 MB 0 % 00171 Y/Y
%-----
% 260D         !          !          !000190100207          00050
%          26D5          !PRECOPY          !          -          !          0 MB          0 MB 100 % 00172 Y/N
%-----
% 260E         !          !          !000190100207          00051
%          26D6          !PRECOPY          !          -          !          0 MB          0 MB 100 % 00173 Y/N
%-----
% 2804         !          !          !000190100207          002DD
%          2807          !RECREATED          !          -          !          0 MB          0 MB 100 % 002E0 Y/Y
%          2806          !RECREATED          !          -          !          1 MB          1 MB 99 % 002DF Y/Y
%          2805          !COPIED          !176.23:57:25!          0 MB          0 MB 100 % 002DE Y/Y
%-----
% 28E1         !          !          !000190100207          0041A
%          28E8          !CREATED          !          -          !          13984 MB 3984 MB 0 % 00421 Y/Y
%          28E7          !CREATED          !          -          !          13984 MB 3984 MB 0 % 00420 Y/Y
%          28E3          !CREATED          !          -          !          13984 MB 3984 MB 0 % 0041C Y/Y
%          28E2          !CREATED          !          -          !          13984 MB 3984 MB 0 % 0041B Y/Y
%-----
    
```

Meaning of the output columns (in alphabetical order)

Keyword	Meaning
ACTIVE-FOR	Time since activation (/ACTIVATE-CLONE), format: DDD.HH:MM:SS.
BACK	Setting of the clone pair for copying in the background (Symmetrix/VMAX3 only) Y Copies the entire unit in the background N Does not copy the entire unit in the background
CLONE UNITS	MN of a clone unit or internal number of the logical volume in the storage system (5-character if the 1st character is not 0 (VMAX3) or with prefix #)
DIFF	Setting of the clone pair for the DIFFERENTIAL operand (option for reconstruction and restart of the clone session) (Symmetrix/VMAX3 only) Y Reconstruction and restart of the clone session are possible N Reconstruction and restart of the clone session are not possible
INDIRECT SIZE UNIT CLONE	Still unchanged on the unit concerned / for the particular status (in MB or GB) (Symmetrix/VMAX3 only)
LOG-VOL	Internal number of the logical volume in the storage system
PERCENT-COPIED	Data copied to the clone unit in percent
SERIAL-NO	Serial number of the storage system

(part 1 of 2)

Keyword	Meaning
STATE	<p>Device status.</p> <p>CREAT-IN-PROG Clone unit is being connected to a unit to form a clone pair, no separate processing (Symmetrix/VMAX3 only)</p> <p>CREATED Clone unit is connected to a unit but not yet activated, no separate processing (Symmetrix/VMAX3 only)</p> <p>COPY-ON-ACCES Clone session is activated, the clone unit is READY, separate processing (Symmetrix/VMAX3 only)</p> <p>COPY-IN-PROG Clone session is activated, the clone unit is READY, separate processing, the unit is copied onto the clone unit in the background (Symmetrix/VMAX3 only)</p> <p>COPIED Clone session is activated, the clone unit is READY, separate processing, the clone unit is a complete copy (Symmetrix/VMAX3 only)</p> <p>RECREATED Clone unit is connected to a unit but not yet activated, no separate processing (Symmetrix/VMAX3 only)</p> <p>REST-IN-PROG Unit being reconstructed from the clone unit, data will be copied from the clone unit to the unit, no separate processing (Symmetrix only) (Symmetrix/VMAX3 only)</p> <p>RESTORED Unit has been reconstructed (Symmetrix/VMAX3 only)</p> <p>PRECOPY Clone unit is connected to a unit but not yet activated, however, the unit is already being copied to the clone unit, no separate processing (Symmetrix/VMAX3 only)</p> <p>SPLIT Clone unit is connected to a unit n and is READY, separate processing</p> <p>SYNCHRONIZING Unit is copied to clone unit, the clone unit is NOT-READY, no separate processing (ETERNUS DX only)</p> <p>SYNCHRONIZED The clone pair is synchronized, the clone unit is NOT-READY, no separate processing (ETERNUS DX only)</p> <p>TERM-IN-PROG The clone pair is being canceled, no separate processing (Symmetrix/VMAX3 only)</p> <p>FAILED Error state</p>
UNIT	MN of a unit or internal number of the logical volume in the storage system (5-character if the 1st character is not 0 (VMAX3) or with prefix #)
VOLUME	VSN of a unit

(part 2 of 2)

S variables

The S variables are identical for all storage systems; not all values are necessarily supplied.

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Unchanged data on the clone unit during the *COPY-ON-ACCESS status or data that is still to be restored (in MB) (Symmetrix/VMAX3)	var(*LIST).CLONE-UNIT(*LIST).CLONE-INDIRECT-SIZE	I	<integer 0..268435456>
Unchanged data on the unit (in MB) (Symmetrix/VMAX3)	var(*LIST).CLONE-UNIT(*LIST).UNIT-PROTECTED-SIZE	I	<integer 0..268435456>
Internal number of the logical volume	var(*LIST).CLONE-UNIT(*LIST).LOGIC-VOL	S	" <c-string 1..5>
Period since a clone unit was activated, format DDDD.HH:MM:SS without leading zeros	var(*LIST).CLONE-UNIT(*LIST).ACTIVE-FOR	S	" <c-string 13..13>
Setting for copying in the background (Symmetrix/VMAX3)	var(*LIST).CLONE-UNIT(*LIST).BACKG-COPY	S	Y N
Setting for reconstruction and restart (DIFFERENTIAL) (Symmetrix/VMAX3)	var(*LIST).CLONE-UNIT(*LIST).DIFFERENTIAL	S	Y N
First copy process after the start of the clone session has been completed, unit has been copied in full onto the clone unit (does not mean that the clone pair is synchronous) (Symmetrix/VMAX3)	var(*LIST).CLONE-UNIT(*LIST).PRECOPIED	S	Y N "

(part 1 of 2)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Device status of a clone unit *CREATE-IN-PROGRESS: Clone pair being created (Symmetrix/VMAX3) *CREATED: Clone pair created (Symmetrix/VMAX3) *COPY-ON-ACCESS: Clone pair activated, separate processing (Symmetrix/VMAX3) *COPY-IN-PROGRESS: Clone pair activated, separate processing (Symmetrix/VMAX3) *COPIED: Clone pair activated, separate processing (Symmetrix/VMAX3) *RECREATED: Clone pair created again (Symmetrix/VMAX3) *RESTORE-IN-PROGRESS: Copying from the clone unit to the unit (after /RESTORE-FROM-CLONE) (Symmetrix/VMAX3) *RESTORED: Reconstruction of the unit from the clone unit completed (Symmetrix/VMAX3) *TERM-IN-PROGRESS: Clone pair being canceled (Symmetrix/VMAX3) *PRECOPY: Clone pair created, unit already being copied to clone unit (Symmetrix/VMAX3) *SPLIT: Clone pair being separated after reconstruction *SYNCHRONIZING: Unit is being copied to clone unit (ETERNUS DX) *SYNCHRONIZED: Clone pair is synchronized (ETERNUS DX) *FAILED: Error state	var(*LIST).CLONE-UNIT(*LIST).STA	S	*CREATE-IN-PROGRESS *CREATED *COPY-ON-ACCESS *COPY-IN-PROGRESS *COPIED *RECREATED *RESTORE-IN-PROGRESS *RESTORED *TERM-IN-PROGRESS *PRECOPY *SPLIT *SYNCHRONIZING *SYNCHRONIZED *FAILED
MN of a clone unit	var(*LIST).CLONE-UNIT(*LIST).UNIT	S	" <mnemo-name>
VSN of a clone unit	var(*LIST).CLONE-UNIT(*LIST).VOL	S	" <vsn>
Internal number of the logical volume	var(*LIST).UNIT-LOGIC-VOL	S	" <c-string 1..5>
MN of a unit	var(*LIST).UNIT	S	" <mnemo-name>
VSN of a unit	var(*LIST).UNIT-VOL	S	" <vsn>
Number of assigned clone units	var(*LIST).NUM-OF-CLONE-UNITS	I	<integer 0..65535>
Serial number of the storage system	var(*LIST).SERIAL-NO	S	" <c-string 3..14>
Data copied to the clone unit in percent	var(*LIST).CLONE-UNIT(*LIST).PERCENT-COPIED	I	<Integer 0..100>

(part 2 of 2)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1119	No target unit found
	64	NDE1125	Initialization of storage system information running
	64	NDE1126	Device unknown or storage system not supported
	64	NDE1127	Device of a storage system is not supported
	64	NDE1128	At least one unit from system is not Symmetrix/VMAX3
	64	NDE1150	No gatekeeper device found
	64	NDE1800	Device not found or not in the storage system
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1890	CIMOM not found
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command

SHOW-MULTI-MIRRORING-STATUS

Displays the status of multi-mirror pairs

Storage system: Symmetrix/VMAX3

Domain: DEVICE

Privileges: TSOS, OPERATING, HW-MAINTENANCE,
SW-MONITOR-ADMINISTRATION,
HSMS-ADMINISTRATION

Routing code: @

/SHOW-MULTI-MIRRORING-STATUS displays the status of multi-mirror pairs (see also [section "Device status" on page 164](#)).

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-MULTI-MIRRORING-STATUS

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER / *BY-SYMMETRIX(...) /
      list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = list-poss(24): <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = list-poss(24): <cat-id 1..4>

*BY-CONTROLLER(...)
  | CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | LOGICAL-VOLUME = *ALL / <x-text 1..4>

,SELECT = *ALL-PRESELECTED / *BY-ATTRIBUTES(...)

*BY-ATTRIBUTES(...)
  | MULTI-MIRROR-STATUS = *ANY / *ESTABLISHED / *ESTABLISHING / *SPLIT / *SPLITTING /
  |                       *RECONSTRUCTING / *UNUSED
  | ,SYNCHRONIZED = *ANY / *YES / *NO
  | ,REMOTE-COPY-USE = *STD / *TARGET-UNIT(...)
  |   *TARGET-UNIT(...)
  |     | RA-GROUP = *UNIQUE / <integer 1..250>
  |     | ,DEVICE = *ALL-PRESELECTED / *ALL-DEFINED / *ATTACHED / *DETACHED / *ANY

,INFORMATION = *CURRENT / *ALL-ADD-MIRRORS

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name. At least one unit must be attached per emulated controller.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = list-poss(24): <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. Information is output for all volumes of the specified pubset. IDs of SF pubsets, volume sets or imported SM pubsets can be specified. No information is output for exported SM pubsets.

PUBSET = list-poss(24): <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SELECT =

Selects the units as a function of the multi-mirror status, synchronization and remote copy use.

SELECT = *ALL-PRESELECTED

The set of units is not restricted further. The global setting for SHC-OSD applies (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

SELECT = *BY-ATTRIBUTES(...)

The set of units is restricted by means of selection criteria.

MULTI-MIRROR-STATUS =

Outputs information only on multi-mirror pairs with the specified status.

MULTI-MIRROR-STATUS = *ANY

Outputs information on all multi-mirror pairs regardless of their status.

MULTI-MIRROR-STATUS = *ESTABLISHED

Outputs information only on `ESTABLISHED` multi-mirror pairs.

MULTI-MIRROR-STATUS = *ESTABLISHING

Outputs information only on `ESTABLISHING` multi-mirror pairs.

MULTI-MIRROR-STATUS = *SPLIT

Outputs information only on `SPLIT`, `SPLIT-BACKG` and `SPLIT-LOCKED` multi-mirror pairs.

MULTI-MIRROR-STATUS = *SPLITTING

Outputs information only on `SPLITTING` multi-mirror pairs.

MULTI-MIRROR-STATUS = *RECONSTRUCTING

Outputs information only on `RECONSTRUCTING` multi-mirror pairs.

MULTI-MIRROR-STATUS = *UNUSED

Outputs information only on `UNUSED` and `UNUSED-LOCKED` multi-mirror pairs.

SYNCHRONIZED =

Outputs information only on multi-mirror pairs depending on their synchronization.

SYNCHRONIZED = *ANY

Outputs information on all multi-mirror pairs regardless of their synchronization.

SYNCHRONIZED = *YES

Outputs information only on synchronized multi-mirror pairs.

SYNCHRONIZED = *NO

Outputs information only on synchronized multi-mirror pairs.

REMOTE-COPY-USE =

Outputs information only on units with the specified remote copy use.

REMOTE-COPY-USE = *STD

Outputs information on all units regardless of their remote copy use.

REMOTE-COPY-USE = *TARGET-UNIT(...)

Of the devices selected with the `UNIT` operand, only the SRDF source units are considered. The multi-mirror pairs for the target units allocated to the source units are output. This corresponds to multi-mirror pair selection using the `SELECT=*TARGET-UNIT` operand of the `/HOLD-MULTI-MIRRORING` and `/RESUME-MULTI-MIRRORING` commands. Entry of an emulated controller (`*BY-CONTROLLER`) in the `UNIT` operand is not supported.

RA-GROUP =

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Selects the target units of the specified source RA group.

DEVICE =

Outputs information on units with the specified status in BS2000.

DEVICE = *ALL-PRESELECTED

Outputs information on all units corresponding to the global setting for SHC-OSD (value of `DEVICE-PRESELECT` in the output of `/SHOW-SHC-PROCESSING`).

DEVICE = *ALL-DEFINED

Selects all units generated in BS2000.

DEVICE = *DETACHED

Selects units which are generated in BS2000 but detached.

DEVICE = *ATTACHED

Selects all units attached in BS2000.

DEVICE = *ANY

Selects all units belonging to the storage system specified in `UNIT` regardless of generation in BS2000.

INFORMATION =

Selects information on the additional mirror units assigned to the normal unit.

INFORMATION = *CURRENT

The currently assigned additional mirror unit is shown.

INFORMATION = *ALL-ADD-MIRRORS

All additional mirror units assigned to a normal unit until now are shown (multi BVC).

Examples

/SHOW-MULTI-MIRRORING-STATUS UNIT=*BY-CONTR(CONTR-UNIT=4700)

```

% -----
% NORMAL-      !ADD-MIRROR- !SERIAL-NO   !STATE       !PENDING-SYNCH
% UNIT  VOLUME!UNIT  VOLUME!                !              !NORM-UNIT  ADD-MIRR
% =====
% 4700 MAX3.0! 47E0      !000296800293!ESTABLISHED !           0 MB   0 MB
% 4701 MAX3.1! 47E1      !000296800293!ESTABLISHED !           0 MB   0 MB
% 4702 MAX3.2! 47E2      !000296800293!ESTABLISHED !           0 MB   0 MB
%                ! 47E3      !000296800293!UNUSED    !           0 MB   0 MB
    
```

/SHOW-MULTI-MIRRORING-STATUS UNIT=*BY-SYMM(SERIAL-NO=227, LOGICAL-VOLUME=100)

```

% -----
% NORMAL-      !ADD-MIRROR- !SERIAL-NO   !STATE       !PENDING-SYNCH
% UNIT  VOLUME!UNIT  VOLUME!                !              !NORM-UNIT  ADD-MIRR
% =====
% #0100        !#011A      !000184500227!ESTABLISHED !           0 MB   0 MB
    
```

/SHOW-MULTI-MIRRORING-STATUS UNIT=*BY-SYMM(SERIAL-NO=227,
LOGICAL-VOLUME=100), REMOTE-COPY-USE=*TARGET-UNIT

```

% -----
% NORMAL-      !ADD-MIRROR- !SERIAL-NO   !STATE       !PENDING-SYNCH
% UNIT  VOLUME!UNIT  VOLUME!                !              !NORM-UNIT  ADD-MIRR
% =====
% 5200         ! 522C      !000183500813!ESTABLISHED !           0 MB   0 MB
    
```

/SHOW-MULTI-MIRRORING-STATUS UNIT=4700, INF=*ALL-ADD-MIRRORS

```

% =====
% NORMAL-UNIT: 4700  NORMAL-VOLUME: MAX3.0  SERIAL-NO: 000296800293
% -----
% ADD-MIRROR- !STATE      !SPLIT-SINCE !PENDING-SYNCH
% UNIT  VOLUME!          !DDDD.HH:MM:SS!CURR:  NORM:  ADD-M:  BACKG:
% -----
% 47E0        !ESTABLISHED !          -   ! 0 MB  0 MB  0 MB  0 MB
% 47E8 MAX3.0!SPLIT  ! 0.00:00:28! 0 MB  0 MB  0 MB  0 MB
    
```

SYSOUT output for concurrent BCV

With concurrent BCV, two lines are output for each normal unit, each with one of the two created additional mirror units.

SYSOUT output when INFORMATION=*CURRENT is specified for the volume with the mnemonic name 50BE with created concurrent additional mirror units:

```
/SHOW-MULTI-MIRRORING-STATUS UNIT=50BE, INFORMATION=*CURRENT
```

```

%=====
%  NORMAL-      !ADD-MIRROR- !SERIAL-NO  !STATE          !PENDING-SYNCH
%  UNIT  VOLUME!UNIT  VOLUME!              !              !NORM-UNIT  ADD-MIRR
%=====
%    50BE      ! 50C7      !000282500505!ESTABLISHED    !      0 MB   0 MB
%    50BE      ! 50C8      !000282500505!ESTABLISHED    !      0 MB   0 MB
%=====

```

SYSOUT output when INFORMATION=*ALL-ADD-MIRRORS is specified for the volume with the mnemonic name 22A0 with created concurrent additional mirror units:

```
/SHOW-MULTI-MIRRORING-STATUS UNIT=22A0, INFORMATION=*ALL-ADD-MIRRORS
```

```

%=====
%  NORMAL-UNIT: 22A0  NORMAL-VOLUME:          SERIAL-NO: 000184500219
%=====
%  ADD-MIRROR- !STATE          !SPLIT-SINCE !PENDING-SYNCH
%  UNIT  VOLUME!              !DDD.DD:MM:SS!CURR:  NORM:  ADD-M:  BACKG:
%=====
%    2248      !ESTABLISHED    !      -      !      0 MB   0 MB   0 MB   0 MB
%    2244      !ESTABLISHED    !      -      !      0 MB   1 MB   0 MB   0 MB
%    2240      !SPLIT          ! 20.19:53:19!      0 MB   1 MB  234 MB   0 MB
%    223C      !SPLIT          ! 20.20:09:07!      0 MB   1 MB  333 MB   0 MB
%    2238      !SPLIT          ! 20.20:18:28!      0 MB   1 MB  333 MB   0 MB
%=====

```

Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
ADD-MIRROR-UNIT	MN of an additional mirror unit (Business Continuance Volume) or internal number of the logical volume in the storage system (5-character if the 1st character is not 0 (VMAX3) or with prefix #)	*CURRENT *ALL-ADD-MIRRORS
ADD-MIRROR-VOLUME	VSN of an additional mirror unit	*CURRENT *ALL-ADD-MIRRORS
NORMAL-UNIT	MN of a normal unit or internal number of the logical volume in the storage system (5-character if the 1st character is not 0 (VMAX3) or with prefix #)	*CURRENT *ALL-ADD-MIRRORS
NORMAL-VOLUME	VSN of a normal unit	*CURRENT *ALL-ADD-MIRRORS
PENDING-SYNCH ADD-MIRR NORM-UNIT	Pending writes on the particular unit / for the particular state (in MB or GB) Pending writes on the additional mirror unit with ESTABLISHING state Pending writes on the normal unit	*CURRENT
PENDING-SYNCH ADD-M BACKG CURR NORM	Pending writes on the particular unit / for the particular state (in MB or GB) Pending writes on the additional mirror unit with ESTABLISHING state Pending background writes during a background SPLIT for an additional mirror unit Pending writes with the ESTABLISHING or RECONSTRUCTING state Pending writes on the normal unit	*ALL-ADD-MIRRORS
SERIAL-NO	Serial number of the storage system	*CURRENT *ALL-ADD-MIRRORS
SPLIT-SINCE	Time since last split (SPLIT); format: DDDD.HH:MM:SS	*ALL-ADD-MIRRORS

(part 1 of 2)

Keyword	Meaning	with INF =
STATE	<p>Device status</p> <p>ESTABLISHED Normal unit and additional mirror unit are synchronized</p> <p>ESTABLISHING Copying from the normal unit to the additional mirror unit (synchronization) after /START-MULTI-MIRRORING or /RESUME-MULTI-MIRRORING</p> <p>SPLIT Separate processing, data difference is noted</p> <p>SPLITTING Additional mirror unit is being split from the normal unit after /HOLD-MULTI-MIRRORING</p> <p>SPLIT-BACKG Separate processing, data difference is noted. Splitting has been started but is not yet complete.</p> <p>SPLIT-LOCKED Separate processing, data difference is noted. Additional mirror unit is protected against inadvertent overwriting.</p> <p>SPLIT-LOCKED-B Separate processing, data difference is noted. Additional mirror unit is protected against inadvertent overwriting. Splitting has been started but is not yet complete.</p> <p>RECONSTRUCTING Copying from the additional mirror unit to the normal unit after splitting and /RESUME-MULTI-MIRRORING</p> <p>UNUSED Unit is not connected to a normal unit</p> <p>UNUSED-LOCKED Unit is not connected to a normal unit and is protected against inadvertent overwriting.</p>	<p>*CURRENT</p> <p>*ALL-ADD-MIRRORS</p>

(part 2 of 2)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Pending writes on an additional mirror unit with the state *ESTABLISHING (in MB)	var(*LIST).ADD-MIRROR(*LIST). ADD-PEND	I	<integer 0..268435456>	*ALL-ADD-M
Pending background writes during a background SPLIT for an additional mirror unit (in MB)	var(*LIST).ADD-MIRROR(*LIST). BACKG-PEND	I	<integer 0..268435456>	*ALL-ADD-M
SPLIT process running in background or completed ": state is not *SPLIT or *UNUSED Y: SPLIT process in background N: no SPLIT process in background	vsn(*LIST).ADD-MIRROR(*LIST). BACKG-SPLIT	S	" Y N	*ALL-ADD-M
Pending writes with the state *ESTABLISHING or *RECONSTRUCTING (in MB)	var(*LIST).ADD-MIRROR(*LIST). CURR-PEND	I	<integer 0..268435456>	*ALL-ADD-M
Lock against overwriting the additional mirror unit with state *SPLIT or *UNUSED ": state is not *SPLIT or *UNUSED Y: additional mirror unit locked N: additional mirror unit not locked	var(*LIST).ADD-MIRROR(*LIST). LOCKED	S	" Y N	*ALL-ADD-M
Internal number of the logical volume	var(*LIST).ADD-MIRROR(*LIST). LOGIC-VOL	S	" <c-string 1..5>	*ALL-ADD-M
Pending writes on the normal unit (in Mbyte)	var(*LIST).ADD-MIRROR(*LIST). NORM-PEND	I	<integer 0..268435456>	*ALL-ADD-M
Time in seconds since last split of an additional mirror unit (BCV)	var(*LIST).ADD-MIRROR(*LIST). SPLIT-SINCE	S	" <c-string 11..11>	*ALL-ADD-M
Device status of an additional mirror unit (BCV) *UNUSED: unit is not connected to a normal unit *ESTABLISHING: copying from the normal unit to the additional mirror unit (synchronization) after /START-MULTI-MIRRORING or /RESUME-MULTI-MIRRORING *ESTABLISHED: additional mirror unit and normal unit are synchronized *SPLITTING: additional mirror unit is being split from the normal unit after /HOLD-MULTI-MIRRORING *SPLIT: separate processing, data difference is noted *RECONSTRUCTING: copying from the additional mirror unit to the normal unit (after splitting and /RESUME-MULTI-MIRRORING)	var(*LIST).ADD-MIRROR(*LIST). STA	S	" *UNUSED *ESTABLISHING *ESTABLISHED *SPLITTING *SPLIT *RECONSTRUCTING	*ALL-ADD-M
MN of an additional mirror unit (BCV)	var(*LIST).ADD-MIRROR(*LIST). UNIT	S	" <mnemo-name>	*ALL-ADD-M

(part 1 of 3)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
VSN of an additional mirror unit	var(*LIST).ADD-MIRROR(*LIST).VOL	S	" <vsn>	*ALL-ADD-M
Internal number of the logical volume	var(*LIST).ADD-MIRROR-LOGIC-VOL	S	" <c-string 1..5>	*CURRENT
Pending writes on an additional mirror unit with the state *ESTABLISHING (in MB)	var(*LIST).ADD-MIRROR-PEND	I	<integer 0..268435456>	*CURRENT
MN of an additional mirror unit (BCV)	var(*LIST).ADD-MIRROR-UNIT	S	" <mnemo-name>	*CURRENT
VSN of the additional mirror unit	var(*LIST).ADD-MIRROR-VOL	S	" <vsn>	*CURRENT
SPLIT process running in background or completed ": state is not *SPLIT or *UNUSED Y: SPLIT process in background N: no SPLIT process in background	vsn(*LIST).BACKG-SPLIT	S	" Y N	*CURRENT
Internal number of the logical volume	var(*LIST).NORMAL-LOGIC-VOL	S	" <c-string 1..5>	*CURRENT *ALL-ADD-M
Pending writes on the normal unit (in MB)	var(*LIST).NORMAL-PEND	I	<integer 0..268435456>	*CURRENT
MN of a normal unit	var(*LIST).NORMAL-UNIT	S	" <mnemo-name>	*CURRENT *ALL-ADD-M
VSN of a normal unit	var(*LIST).NORMAL-VOL	S	" <vsn>	*CURRENT *ALL-ADD-M
Number of assigned additional mirror units	var(*LIST).NUM-OF-ADD-MIRROR	I	<integer 0..65535>	*ALL-ADD-M
Lock against overwriting the additional mirror unit with state *SPLIT or *UNUSED ": state is not *SPLIT or *UNUSED Y: additional mirror unit locked N: additional mirror unit not locked	var(*LIST).LOCKED	S	" Y N	*CURRENT

(part 2 of 3)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Device status. *UNUSED: unit is not connected to a normal unit *ESTABLISHING: copying from the normal unit to the additional mirror unit (synchronization) after /START-MULTI-MIRRORING or /RESUME-MULTI-MIRRORING *ESTABLISHED: additional mirror unit and normal unit are synchronized *SPLITTING: additional mirror unit is being split from the normal unit after /HOLD-MULTI-MIRRORING *SPLIT: separate processing, data difference is noted *RECONSTRUCTING: copying from the additional mirror unit to the normal unit (after splitting and /RESUME-MULTI-MIRRORING)	var(*LIST).STA	S	" *UNUSED *ESTABLISHING *ESTABLISHED *SPLITTING *SPLIT *RECONSTRUCTING	*CURRENT
Serial number of the storage system	var(*LIST).SERIAL-NO	S	"<c-string 3..12>	*CURRENT *ALL-ADD-M

(part 3 of 3)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1030	No multi-mirror function for the unit
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1119	No target unit found
	64	NDE1125	Initialization of storage system information running
	64	NDE1126	Device unknown or storage system not supported
	64	NDE1127	Device of a storage system is not supported
	64	NDE1128	At least one unit from system is not Symmetrix/VMAX3
	64	NDE1150	No gatekeeper device found
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of the command

SHOW-REMOTE-COPY-STATUS

Displays the status of remote copy pairs

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
SW-MONITOR-ADMINISTRATION,
HSMS-ADMINISTRATION
Routing code: @

`/SHOW-REMOTE-COPY-STATUS` displays information on the status of remote copy pairs and remote links and on the operating parameters set for all supported remote copy configurations.

The remote copy status can be: `ACTIVE`, `ERROR`, `IN-HOLD` or `BROKEN`. The status is dependent on the availability of the physical source units, target units and (at least) one remote link. In other words, the physical volumes that contain the source or target units must be ready for operation; it does not mean that the source or target units can be addressed from the host. For more details see also [section “Remote copy status” on page 211](#).

The command supports structured output to S variables (for further information, see the manual “Commands” [1]).

SHOW-REMOTE-COPY-STATUS

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER / *BY-SYMMETRIX(...) /
      *BY-STORAGE(...) / list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = list-poss(24): <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = list-poss(24): <cat-id 1..4>

*BY-CONTROLLER(...)
  | CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>
  | ,REMOTE-CONTROLLER = *ANY / <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = *ALL / *ALL-SOURCE-UNITS / *ALL-TARGET-UNITS /
  |                   *BY-RA-GROUP(...) / <x-text 1..4>
  |   *BY-RA-GROUP(...)
  |     | RA-GROUP = <integer 1..250>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = *ALL / *ALL-SOURCE-UNITS / *ALL-TARGET-UNITS / <x-text 1..4>

,SELECT = *ALL-PRESELECTED / *BY-ATTRIBUTES(...)

*BY-ATTRIBUTES(...)
  | REMOTE-COPY-STATUS = *ANY / *ACTIVE / *ERROR / *IN-HOLD
  | ,TARGET-ACCESS = *ANY / *BY-SOURCE / *DIRECT / *NONE
  | ,SYNCHRONIZED = *ANY / *YES / *NO
  | ,LINK-STATUS = *ANY / *AVAILABLE / *NOT-AVAILABLE
  | ,COPY-MODE = *ANY / *SYNCHRONOUS / *SEMI-SYNCHRONOUS / *ADAPTIVE-COPY /
  |             *ASYNCHRONOUS / *ASYNC-STACK / *ASYNC-THROUGH
  | ,ON-ERROR = *ANY / *HOLD / *CONTINUE
  | ,DEVICE = *ALL-PRESELECTED / *ALL-DEFINED / *ATTACHED / *DETACHED / *ANY

,INFORMATION = *SUMMARY / *PARAMETERS / *LINK-STATUS / *PORT-STATUS / *ALL /
              *ASYNCHRONOUS-SESSION

,UPDATE = *STD / *NO

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name.

At least one unit must be attached per emulated controller.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = list-poss(24): <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. Information is output for all volumes of the specified pubset. IDs of SF pubsets, volume sets or imported SM pubsets can be specified. No information is output for exported SM pubsets.

PUBSET = list-poss(24): <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

REMOTE-CONTROLLER =

Selects the remote copy pairs using the related remote storage system as well.

REMOTE-CONTROLLER = *ANY

Outputs information on all remote copy pairs of the controllers selected by means of CONTROLLER-UNIT.

REMOTE-CONTROLLER = <alphanum-name 2..2> / <x-text 4..4>

Outputs information only on remote copy pairs with the controller selected with CONTROLLER-UNIT. The remote copy pairs must be linked to the remote storage system selected by means of the explicitly specified mnemonic name of the remote controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME =

Selects the logical volumes of the storage system.

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = *ALL-SOURCE-UNITS

Selects all source units of the storage system.

LOGICAL-VOLUME = *ALL-TARGET-UNITS

Selects all target units of the storage system.

LOGICAL-VOLUME = *BY-RA-GROUP(...)

RA group of the logical volumes.

RA-GROUP = <integer 1..250>

Selects the units for the specified RA group.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = *ALL-SOURCE-UNITS

Selects all source units of the storage system.

LOGICAL-VOLUME = *ALL-TARGET-UNITS

Selects all target units of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SELECT =

The set of units can be selected according to the remote copy status, access path, synchronization, link status, copy mode and the remote copy parameter `ON-ERROR`.

SELECT = *ALL-PRESELECTED

The set of units is not restricted further. The global setting for SHC-OSD applies (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

SELECT = *BY-ATTRIBUTES(...)

The set of units is restricted by means of selection criteria.

REMOTE-COPY-STATUS =

Outputs information only on remote copy pairs with the specified remote copy status.

REMOTE-COPY-STATUS = *ANY

Outputs information on all remote copy pairs regardless of their remote copy status.

REMOTE-COPY-STATUS = *ACTIVE

Outputs information only on `ACTIVE` remote copy pairs.

REMOTE-COPY-STATUS = *IN-HOLD

Outputs information only on remote copy pairs in the remote copy status `IN-HOLD`.

REMOTE-COPY-STATUS = *ERROR

Outputs information only on remote copy pairs with the remote copy status `ERROR`.

TARGET-ACCESS =

Outputs information only on remote copy pairs with the specified access path.

TARGET-ACCESS = *ANY

Outputs information on all remote copy pairs regardless of the access path set.

TARGET-ACCESS = *BY-SOURCE

Outputs information on all remote copy pairs with the `BY-SOURCE` access path.

TARGET-ACCESS = *DIRECT

Outputs information on all remote copy pairs with the `DIRECT` access path.

TARGET-ACCESS = *NONE

Outputs information on all remote copy pairs with no access path to the target unit.

SYNCHRONIZED =

Outputs information on the remote copy pairs depending on their synchronization.

SYNCHRONIZED = *ANY

Outputs information on all remote copy pairs regardless of their synchronization.

SYNCHRONIZED = *YES

Outputs information only on synchronized remote copy pairs.

SYNCHRONIZED = *NO

Outputs information only on non-synchronized remote copy pairs.

LINK-STATUS =

Outputs information only on remote copy pairs with the specified availability of the remote link.

LINK-STATUS = *ANY

Outputs information on all remote copy pairs regardless of the availability of their remote link.

LINK-STATUS = *AVAILABLE

Outputs information only on remote copy pairs whose remote link is available.

LINK-STATUS = *NOT-AVAILABLE

Outputs information only on remote copy pairs whose remote link is not available.

COPY-MODE =

Outputs information only on remote copy pairs with the specified copy mode.

COPY-MODE = *ANY

Outputs information on all remote copy pairs regardless of their copy mode.

COPY-MODE = *SYNCHRONOUS

Outputs information only on remote copy pairs with the copy mode `SYNCHRONOUS`.

COPY-MODE = *ADAPTIVE-COPY

Outputs information only on remote copy pairs with the copy mode `ADAPTIVE-COPY` (SRDF).

COPY-MODE = *ASYNCHRONOUS

Outputs information only on remote copy pairs with the copy mode `ASYNCHRONOUS`.

COPY-MODE = *ASYNC-STACK

Outputs information only on remote copy pairs with the copy mode `ASYNC-STACK` (stack mode, asynchronous REC).

COPY-MODE = *ASYNC-THROUGH

Outputs information only on remote copy pairs with the copy mode `ASYNC-THROUGH` (through mode, asynchronous REC).

ON-ERROR =

Only relevant for Symmetrix/VMAX3.

Outputs information on remote copy pairs depending on the set remote copy `ON-ERROR` (DOMINO mode).

ON-ERROR = *ANY

Outputs information on all remote copy pairs regardless of the set remote copy parameter `ON-ERROR`.

ON-ERROR = *HOLD

Outputs information only on remote copy pairs with the remote copy parameter `ON-ERROR=HOLD`.

ON-ERROR = *CONTINUE

Outputs information only on remote copy pairs with the remote copy parameter `ON-ERROR=CONTINUE`.

DEVICE =

Outputs information on units with the specified status in BS2000.

DEVICE = *ALL-PRESELECTED

Outputs information on all units in accordance with the global setting for SHC-OSD (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

DEVICE = *ALL-DEFINED

Selects all units generated in BS2000.

DEVICE = *DETACHED

Selects all units generated in BS2000 which are detached.

DEVICE = *ATTACHED

Selects all units attached in BS2000.

DEVICE = *ANY

Selects all devices of the storage system specified with `UNIT`.

INFORMATION =

Determines the scope of the information which is output.

A header line is output followed by a line with the corresponding values for each unit, see the examples for the command.

The information shown always relates to the remote copy pairs selected with `SELECT=...`

INFORMATION = *SUMMARY

Summary information is output on the mnemonic names of the source and target units, the remote copy status, the access path, the state of the source and target units, the remote link and the synchronization state of the source and the target units.



The information output reflects the view on the remote copy pair and not on an individual unit. Detailed information about a unit is supplied by `/SHOW-STORAGE-DEVICE-CONFIG` (see [page 512](#)) or `/SHOW-SYMMETRIX-DEVICE-CONFIG` (see [page 537](#)).

INFORMATION = *PARAMETERS

Only relevant for Symmetrix/VMAX3.

Outputs information on the processing mode (`COPY-MODE`, `WR-BUFF`, `PEND-UPD-LIM`) and the remote copy parameters (`ON-ERR`, `PEND-UPD`).

INFORMATION = *LINK-STATUS

Only relevant for Symmetrix/VMAX3.

Outputs information on the status of the remote links and of the remote copy pairs. The assignment of the units to the RA groups is shown below `GRP` (decimal values 1 through 250), see also [“RA groups” on page 201](#).

INFORMATION = *PORT-STATUS

Only relevant for ETERNUS DX.

Outputs information on the status of the remote links for the remote copy pairs.

INFORMATION = *ALL

For Symmetrix/VMAX3 all information specified in `*SUMMARY`, `*PARAMETERS` and `*LINK-STATUS` is output.

For ETERNUS DX, outputs all information specified for `*SUMMARY` and `*PORT-STATUS`.

INFORMATION = *ASYNCHRONOUS-SESSION

Only relevant for Symmetrix/VMAX3.

Outputs information on the asynchronous session (`SRDF/A`).

UPDATE =

Controls updating of the data provided.

UPDATE = *STD

The data is updated in SHC-OSD before the SHOW command is executed.

UPDATE = *NO

The SHOW command is executed without the data being updated in SHC-OSD.

Examples for ETERNUS DX

```
/SHOW-REMOTE-COPY-STATUS UNIT=2204, INFORMATION=*PORT-STATUS
```

```
%
% -----
% SRC  TAR  !SOURCE:                !TARGET:                !CONN
% UNIT UNIT ! SERIAL-NO  PORT-NAME              ! SERIAL-NO  PORT-NAME              !-STA
% =====
% 2304 2204! 4531125002 FCP_CM00CA01P00 ! 4531107011 FCP_CM00CA01P00 ! UP
%          ! 4531125002 FCP_CM01CA01P00 ! 4531107011 FCP_CM01CA01P00 ! UP
% -----
%
```

```
/SHOW-REMOTE-COPY-STATUS UNIT=9A01, INFORMATION=*ALL
```

```
%
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT UNIT          !STATE  MODE  ACCESS!DDDD.HH:MM:SS!      !      !-RA!R-C!R-C
% =====
% 9A01 9C01 S351.1!IN-HOLD SYNC DIRECT! 183.19:31:08!AVAIL.! 99%! - !NO ! -
% -----
% SRC  TAR  !SOURCE:                !TARGET:                !CONN
% UNIT UNIT ! SERIAL-NO  PORT-NAME              ! SERIAL-NO  PORT-NAME              !-STA
% =====
% 9A01 9C01! 4621347002 FCP_CM00CA00P00 ! 4621349005 FCP_CM01CA01P03 ! UP
%          ! 4621347002 FCP_CM01CA01P03 ! 4621349005 FCP_CM00CA00P00 ! UP
% -----
%
```

Examples for Symmetrix/VMAX3

```
/SHOW-REMOTE-COPY-STATUS UNIT=*BY-PUBSET(PUBSET=XXXX), INFORMATION=*SUMMARY
```

```
%-----%
% SRC   TAR   VOLUME!REMOTE-COPY TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT           !STATE  MODE  ACCESS!DDDD.HH:MM:SS!    !CH !-RA!R-C!R-C
%-----%
% 28AA  5FA0 XXXX.0!ACTIVE  SYNC BY-SRC!      -      !AVAIL.!YES! 10!NO !-
% 28AB  5FA1 XXXX.1!ACTIVE  SYNC BY-SRC!      -      !AVAIL.!YES! 10!NO !-
% 28AC  5FA2 XXXX.2!ACTIVE  SYNC BY-SRC!      -      !AVAIL.!YES! 10!NO !-
```

```
/SHOW-REMOTE-COPY-STATUS UNIT=*BY-PUBSET(PUBSET=RDF), INFORMATION=*PARAMETERS
```

```
%-----%
% SRC   TAR   VOLUME!COPY-MODE:      !ON-   !PEND-UPD-ON-TARG:
% UNIT  UNIT           !MODE  WR-BUFF P-UPD-LIM!ERROR !ALLOW  CURR-SIZE
%-----%
% 5244  5844  RDF.00!SYNCH          -      -      !CONTI !NO      0 MB
% 5245  5845  RDF.01!SYNCH          -      -      !CONTI !NO      0 MB
% 5246  5846  RDF.02!AD-COPY  CACHE 999!CONTI !NO      0 MB
```

```
/SHOW-REMOTE-COPY-STATUS UNIT=*BY-PUBSET(PUBSET=XXXX),
INFORMATION=*LINK-STATUS
```

```
%-----%
% SRC   TAR   !SOURCE CONTR1  DIRECTOR:      !TARGET CONTR1  DIRECTOR:
% UNIT  UNIT   !/SERIAL-NO  GRP  PORT  STA P-C!/SERIAL-NO  GRP  PORT  STA P-C
%-----%
% 4700  4900 !    4700      1  1E:11 ENA Y !    4900      1  1E:11 ENA Y
%           !000296800293  2E:11 ENA Y !000296800294  2E:11 ENA Y
%-----%
% 4701  4901 !    4700      1  1E:11 ENA Y !    4900      1  1E:11 ENA Y
%           !000296800293  2E:11 ENA Y !000296800294  2E:11 ENA Y
%-----%
% 4702  4902 !    4700      1  1E:11 ENA Y !    4900      1  1E:11 ENA Y
%           !000296800293  2E:11 ENA Y !000296800294  2E:11 ENA Y
%-----%
```

Examples for concurrent remote copy

With concurrent target units, two lines with the different target units are output for each source unit.

ETERNUS DX (REC)

/SHOW-REMOTE-COPY-STATUS UNIT=9A40, INFORMATION=*ALL

```

%-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYNC!SRC!CON!CAS
% UNIT  UNIT  !STATE  MODE  ACCESS!DDDD.HH:MM:SS!  !  !-RA!R-C!R-C
%-----
% 9A40 9C40 S3SN.0!IN-HOLD ASYN DIRECT! 128.01:52:13!AVAIL.! 89%! - !YES! -
% 9A40 BD20 S3SN.0!ACTIVE  SYNC BY-SRC!  -  !AVAIL.! 33%! - !YES! -
%-----
% SRC  TAR  !SOURCE:  !TARGET:
% UNIT  UNIT  !SERIAL-NO  PORT-NAME  !SERIAL-NO  PORT-NAME  !CONN
%-----
% 9A40 9C40! 4621347002 FCP_CM00CA00P00 ! 4621349005 FCP_CM01CA01P03 ! UP
% ! 4621347002 FCP_CM01CA01P03 ! 4621349005 FCP_CM00CA00P00 ! UP
%-----
% 9A40 BD20! 4621347002 FCP_CM00CA01P03 ! 4621351008 FCP_CM00CA01P03 ! UP
% ! 4621347002 FCP_CM01CA00P00 ! 4621351008 FCP_CM01CA00P00 ! UP
%-----
%

```

VMAX3 (SRDF)

/SHOW-REMOTE-COPY-STATUS UNIT=4780

```

%-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT  !STATE  MODE  ACCESS!DDDD.HH:MM:SS!  !CH !-RA!R-C!R-C
%-----
% 4780 4980 RDFA.0!IN-HOLD ASYN BY-SRC! 71.02:16:20!AVAIL.!NO ! 99!YES! -
% 4780 4984 RDFA.0!IN-HOLD SYNC BY-SRC! 71.02:16:08!AVAIL.!NO ! 1!YES! -
%-----
%

```

/SHOW-REMOTE-COPY-STATUS UNIT=4780, INFORMATION=*ALL

```

%-----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT  UNIT  !STATE  MODE  ACCESS!DDDD.HH:MM:SS!  !CH !-RA!R-C!R-C
%-----
% 4780 4980 RDFA.0!IN-HOLD ASYN BY-SRC! 71.02:25:56!AVAIL.!NO ! 99!YES! -
% 4780 4984 RDFA.0!IN-HOLD SYNC BY-SRC! 71.02:25:44!AVAIL.!NO ! 1!YES! -
%-----
% SRC  TAR  VOLUME!COPY-MODE:  !ON-  !PEND-UPD-ON-TARG:
% UNIT  UNIT  !MODE  WR-BUFF P-UPD-LIM!ERROR !ALLOW  CURR-SIZE
%-----
% 4780 4980 RDFA.0!ASYNCH  -  -  !CONTI !YES  1 MB
% 4780 4984 RDFA.0!SYNCH  -  -  !CONTI !YES  1 MB
%-----
% SRC  TAR  !SOURCE CONTR1  DIRECTOR:  !TARGET CONTR1  DIRECTOR:
% UNIT  UNIT  !/SERIAL-NO  GRP  PORT  STA P-C!/SERIAL-NO  GRP  PORT  STA P-C
%-----
% 4780 4980 ! 4700 99 1E:11 ENA Y ! 4900 99 1E:11 ENA Y
% !000296800293 2E:11 ENA Y !000296800294 2E:11 ENA Y
%-----
% 4780 4984 ! 4700 1 1E:11 ENA Y ! 4900 1 1E:11 ENA Y
% !000296800293 2E:11 ENA Y !000296800294 2E:11 ENA Y
%-----
%

```

Example for cascaded remote copy (ETERNUS DX)

With cascaded remote copy two lines are output when a cascading unit is specified. The cascading unit of the line is displayed in the last column. When non-cascading units are specified, only a line with a remote copy pair is output.

```
/SHOW-REMOTE-COPY-STATUS UNIT=9C41, INFORMATION=*ALL
```

```
%
% -----
% SRC   TAR   VOLUME!REMOTE-COPY TARGET!LAST-STA-CHNG!LINK   !SYNC!SRC!CON!CAS
% UNIT  UNIT      !STATE  MODE  ACCESS!DDDD.HH:MM:SS!      !      !-RA!R-C!R-C
% -----
% 9A41  9C41  S3SN.1!IN-HOLD ASYN DIRECT!   9.00:57:30!AVAIL.! 87%! - !NO !TAR
% 9C41  BD21  S3Y4.1!IN-HOLD SYNC DIRECT!   0.04:15:08!AVAIL.!100%! - !NO !SRC
% -----
% SRC   TAR   !SOURCE:                !TARGET:
% UNIT  UNIT ! SERIAL-NO   PORT-NAME          ! SERIAL-NO   PORT-NAME          !CONN
% -----
% 9A41  9C41!  4621347002  FCP_CM00CA00P00 !  4621349005  FCP_CM01CA01P03 ! UP
%          !  4621347002  FCP_CM01CA01P03 !  4621349005  FCP_CM00CA00P00 ! UP
% -----
% 9C41  BD21!  4621349005  FCP_CM00CA00P01 !  4621351008  FCP_CM00CA00P01 ! UP
%          !  4621349005  FCP_CM01CA00P01 !  4621351008  FCP_CM01CA00P01 ! UP
% -----
%
```

Example for asynchronous processing mode

ETERNUS DX (REC)

```
/SHOW-REMOTE-COPY-STATUS UNIT=*BY-STORAGE(SERIAL-NUMBER=7002),
      SELECT=*BY-ATTRIBUTES(COPY-MODE=*ASYNCHRONOUS), INFORMATION=*SUMMARY
```

```
% -----
% SRC  TAR  VOLUME!REMOTE-COPY  TARGET!LAST-STA-CHNG!LINK  !SYN!SRC!CON!CAS
% UNIT UNIT      !STATE  MODE  ACCESS!DDDD.HH:MM:SS!      !CH !-RA!R-C!R-C
% -----
% 9A40 9C40 S3SN.0!IN-HOLD ASYN DIRECT! 497.21:00:52!AVAIL.! 89%! - !YES! -
% 9A41 9C41 S3SN.1!IN-HOLD ASYN DIRECT! 497.21:00:52!AVAIL.! 87%! - !NO !TAR
```

The last status change (LAST-STA-CHNG) in remote copy status IN-HOLD is output for ETERNUS DX.

Symmetrix (SRDF/A)

```
/SHOW-REMOTE-COPY-STATUS UNIT=823F, INFORMATION=*ASYNCHRONOUS-SESSION
```

```
% -----
% SRC  TAR  !SRDF/A-SESSION:      !TARGET-UNIT:
% UNIT UNIT  !ACT  NUM  CYCL#  #DEV  T-PEND  CYCL-T!PEND  LAG-T  CONS  PROT
% -----
% 823F 523F ! N    44    0    6    0 MB 00:00!  0 MB 08:12  Y   DIS
```

```
/SHOW-REMOTE-COPY-STATUS UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=225,
      LOGICAL-VOLUME=*BY-RA-GROUP(RA-GROUP=05)),
      SELECT=*BY-ATTRIBUTES(DEVICE=*ANY), INFORMATION=*ASYNCHRONOUS-SESSION
```

```
% -----
% SRC  TAR  !SRDF/A-SESSION:      !TARGET-UNIT:
% UNIT UNIT  !ACT  NUM  CYCL#  #DEV  T-PEND  CYCL-T!PEND  LAG-T  CONS  PROT
% -----
% 823C 523C ! N    44    0    6    0 MB 00:00!  0 MB 10:27  Y   DIS
% 823D 523D ! N    44    0    6    0 MB 00:00!  0 MB 10:27  Y   DIS
% 823E 523E ! N    44    0    6    0 MB 00:00!  0 MB 10:27  Y   DIS
% 823F 523F ! N    44    0    6    0 MB 00:00!  0 MB 10:27  Y   DIS
% 829E 529E ! N    44    0    6    0 MB 00:00!  0 MB 10:27  Y   DIS
% 829F 529F ! N    44    0    6    0 MB 00:00!  0 MB 10:27  Y   DIS
```

Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
CAS-R-C	Cascaded remote copy (Symmetrix/VMAX3) – No cascaded remote copy pair SRC Source unit is cascaded TAR Target unit is cascaded SDL Source unit is cascaded with semiconductor storage (DL = diskless) TDL Target unit is cascaded with semiconductor storage (DL = diskless)	*SUM *ALL
CONN-STA	Status of the remote link between the storage systems UP Connection operational DOWN Connection severed UNDEF Connection not defined	*ALL *PORT-STA
CON-R-C	concurrent remote copy NO Source unit has no concurrent target units YES Source unit has concurrent target units	*SUM *ALL
COPY-MODE:	This output column contains data for the processing mode: see MODE, P-UPD-LIM, WR-BUFF	*PAR *ALL
DIRECTOR: PORT	Name of the remote link director for the source and target unit. (1A...16A, 1B...16B, ..., 1H...16H or ”), followed by the port number (0...31) in the format <name>:<port-no> (Symmetrix/VMAX3)	*ALL *LINK-STA
DIRECTOR: GRP	RA group of the remote link director for the source and the target unit (decimal 1, ..., 250 or “-”) (Symmetrix/VMAX3)	*ALL *LINK-STA
DIRECTOR: STA	State of the remote link director for the source and target unit. (Symmetrix/VMAX3) ENABLE Remote link director activated and connected DISABLE Remote link director deactivated or not connected UNDEFINED No information available on the remote link director	*ALL *LINK-STA
DIRECTOR: P-C	Port connected (Symmetrix/VMAX3) Y At least one port is connected N No ports are connected	*ALL *LINK-STA
LAST-STA-CHNG	Time since the last action for halting or resuming replication in the format DDDD.HH:MM:SS (without leading zeros).	*SUM *ALL
LINK	State of the remote links. AVAIL. Remote link activated and connected NOT-AV Remote link deactivated or not connected UNDEF No information available on the remote link	*SUM *ALL

(part 1 of 4)

Keyword	Meaning	with INF =
MODE	<p>Processing mode (Symmetrix/VMAX3)</p> <p>SYNCH Target unit is updated before the next write access to the source unit</p> <p>AD-COPY The writes are processed asynchronously</p> <p>ASYNCH Writes are processed asynchronously and their order is guaranteed, i.e. crash-consistently (SRDF/A)</p>	*PAR *ALL
ON-ERR	<p>Specifies what happens if one part of the remote copy pair fails (see section "ON-ERROR" on page 210) (Symmetrix/VMAX3)</p> <p>HOLD If one part of the remote copy pair fails, the applications are stopped and wait for a reply.</p> <p>CONTI If one part of the remote copy pair fails, processing continues with the remaining unit.</p>	*PAR *ALL
PEND-UPD-ON-TARG:ALLOW	<p>Transition to READY with pending writes on the target unit (Symmetrix/VMAX3)</p> <p>YES Transition permitted</p> <p>NO Transition not permitted</p> <p>UNDEF No information, since the remote storage system with the target units is not available</p>	*PAR *ALL
PEND-UPD-ON-TARG:CURR-SIZE	<p>Current value of pending writes from the source unit on the target unit, in MB or GB (only on the storage system with the target unit) (Symmetrix/VMAX3)</p>	*PAR *ALL
PORT-NAME	<p>Name of the port</p>	*ALL *PORT-STA
P-UPD-LIM	<p>Max. number of pending writes (0...65535) (Symmetrix/VMAX3)</p> <p>– Irrelevant for the processing mode set</p>	*PAR *ALL
REMOTE-COPY MODE	<p>Processing mode</p> <p>SYNC Target unit is updated before the next write access to the source unit</p> <p>AD-C The writes are processed asynchronously (Symmetrix/VMAX3)</p> <p>ASYN The writes are processed asynchronously and their order is guaranteed, i.e. crash-consistently (asynchronous REC, consistency mode for ETERNUS DX, SRDF/A for Symmetrix/VMAX3)</p> <p>STCK The writes are processed asynchronously without failure guarantee (asynchronous REC, consistency mode, for ETERNUS DX)</p> <p>THRU The writes are processed asynchronously in ETERNUS DX (asynchronous REC, through mode for ETERNUS DX)</p>	*SUM *ALL

(part 2 of 4)

Keyword	Meaning	with INF =
REMOTE-COPY STATE	Remote copy status ACTIVE Remote copy mode active IN-HOLD Remote copy mode interrupted by means of /HOLD- REMOTE-COPY ERROR Remote copy mode interrupted due to an error BROKEN Remote copy mode terminated because of failure	*SUM *ALL
SERIAL-NO	Serial number of the storage system	*PORT-STA *ALL
SOURCE :	This output column contains data of the local storage system: see SERIAL-NO, PORT-NAME	*ALL *PORT-STA
SOURCE CONTR1 / SERIAL-NO	MN of the first emulated controller (on the storage system with the source unit) / Serial number of the storage system with the source unit	*LINK-STA *ALL
SRC UNIT	MN or internal numbers of the logical volume in the local storage system (5- character if the 1st character is not 0 (VMAX3) or with prefix #)	*SUM *PAR *ALL *LINK-STA *ASYNC-S *PORT-STA
SRC-RA	Source unit RA group number (Symmetrix/VMAX3) Values decimal 1, ..., 250 oder ' - ' (not accessible)	*SUM *ALL
SRDF/A-SESSION ACT	State of the SRDF/A session (Symmetrix/VMAX3) - Remote copy pair does not belong to any SRDF/A session Y Asynchronous session is active N Asynchronous session is inactive	*ASYNC-S
SRDF/A-SESSION NUM	Session number of the SRDF/A session (Symmetrix/VMAX3)	*ASYNC-S
SRDF/A-SESSION CYCL#	Cycle number of the SRDF/A session (Symmetrix/VMAX3)	*ASYNC-S
SRDF/A-SESSION #DEV	Number of devices in the SRDF/A session (Symmetrix/VMAX3)	*ASYNC-S
SRDF/A-SESSION T-PEND	Total number of PENDING-UPDATES of the SRDF/A session (Symmetrix/VMAX3)	*ASYNC-S
SRDF/A-SESSION CYCL-T	Average duration of a cycle in the SRDF/A session (format mm:ss) (Symmetrix/VMAX3)	*ASYNC-S
SYNC	Synchronization value of a remote copy pair (0..100%, ETERNUS DX) N-C Synchronization value is not consistent	*SUM *ALL
SYNCH	Synchronization status of a remote copy pair (Symmetrix/VMAX3) YES Remote copy pair is synchronous NO Remote copy pair is not synchronized	*SUM *ALL

(part 3 of 4)

Keyword	Meaning	with INF =
TAR UNIT	MN or internal number of the logical volume in the remote storage system (5-character if the 1st character is not 0 (VMAX3) or with prefix #)	*SUM *PAR *ALL *LINK-STA *PORT-STA *ASYNC-S
TARGET CONTR1 / SERIAL-NO	MN of the first simulated controller / serial number of the storage system with the target unit (Symmetrix/VMAX3)	*ALL *LINK-STA
TARGET :	This output column contains data of the remote storage system: see SERIAL-NO, PORT-NAME	*ALL *PORT-STA
TARGET ACCESS	Access path to the data of a remote copy pair. BY-SRC Access via the source path DIRECT Access via the target path NONE Access not possible	*SUM *ALL
TARGET-UNIT : PEND	Number of pending writes (PENDING-UPDATES) for the target unit of the remote copy pair (Symmetrix/VMAX3)	*ASYNC-S
TARGET-UNIT : LAG-T	Time period (format mm:ss) that the data on the target unit lags behind the data on the source unit (time difference of the remote copy pair) (Symmetrix/VMAX3)	*ASYNC-S
TARGET-UNIT : CONS	Data consistency of the remote copy pair (Symmetrix/VMAX3) N Data on the target unit is not consistent Y Data on the target unit is consistent	*ASYNC-S
TARGET-UNIT : PROT	Consistency protection of the remote copy pair (Symmetrix/VMAX3) DIS Disabled ENA Enabled	*ASYNC-S
VOLUME	VSN of the (logical) volume	*SUM *PAR *ALL
WR-BUFF	Noting of pending writes (Symmetrix/VMAX3) CACHE Noted in the cache DISK Noted on the volume - Irrelevant for the processing mode set	*PAR *ALL

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S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF=
State of the SRDF/A session. Only relevant for Symmetrix/VMAX3. *NONE: pair does not belong to any SRDF/A session *ACTIVE: SRDF/A session is active *INACTIVE: SRDF/A session is inactive	var(*LIST).ASYNC-SESSION.STA	S	*NONE *ACTIVE *INACTIVE	*ASYNC-S
Average duration of a cycle in the SRDF/A session in seconds Only relevant for Symmetrix/VMAX3.	var(*LIST).ASYNC-SESSION.AVG-CYCLE-TIME	S	<integer 0..268435456>	*ASYNC-S
Consistency protection Only relevant for Symmetrix/VMAX3. *DISABLED: *ENABLED:	var(*LIST).ASYNC-SESSION.CONSISTENCY-PROT	S	*DISABLED *ENABLED	*ASYNC-S
Consistency Only relevant for Symmetrix/VMAX3. *NO: data is not consistent *YES: data is consistent	var(*LIST).ASYNC-SESSION.CONSISTENT	S	*NO *YES	*ASYNC-S
Cycle number of the SRDF/A session Only relevant for Symmetrix/VMAX3.	var(*LIST).ASYNC-SESSION.CYCLE-NUMBER	S	<integer 0..268435456>	*ASYNC-S
Device-independent tracks, PENDING-UPDATES of the target units Only relevant for Symmetrix/VMAX3.	var(*LIST).ASYNC-SESSION.DEV-UNCOM-TRKS	S	<integer 0..268435456>	*ASYNC-S
Number of devices in the SRDF/A session	var(*LIST).ASYNC-SESSION.NUM-DEVS-IN-SESSION	S	<integer 0..268435456>	*ASYNC-S
Time difference of the source-target pair in seconds. Only relevant for Symmetrix/VMAX3.	var(*LIST).ASYNC-SESSION.R1-TO-R2-LAG-TIME	S	<integer 0..268435456>	*ASYNC-S
Session number of the SRDF/A session. Only relevant for Symmetrix/VMAX3.	var(*LIST).ASYNC-SESSION.SESSION-NUMBER	S	<integer 0..268435456>	*ASYNC-S
Session-uncommitted tracks, total number of PENDING-UPDATES of the SRDF/A session. Only relevant for Symmetrix/VMAX3.	var(*LIST).ASYNC-SESSION.SESSION-UNCOM-TRKS	S	<integer 0..268435456>	*ASYNC-S
Status of the link between the storage systems (ETERNUS DX) *UP: operational *DOWN: not operational *UNDEF: connection not defined (when NUM-OF-TARGET-PORTS is not zero)	var(*LIST).TARGET-PORT(*LIST).CONN-STA	S	*UP *DOWN *UNDEF	*PORT-S *ALL
MN of the first emulated controller (with the source unit).	var(*LIST).LINK.SOURCE-CONTR-UNIT1	S	" <mmemo-name>	*ALL *LINK-STA

(part 1 of 6)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF=
RA group of the source unit (decimal). Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.SRC-GROUP-NO-INT	I	<integer 0..250>	*ALL *LINK-STA
Name of the Remote Link Director. Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.SOURCE-DIR(*LIST).DIR-NO	S	" <1A....16A> <1B....16B> ... <1H....16H>	*ALL *LINK-STA
Port number. Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.SOURCE-DIR(*LIST).PORT-NO	I	<integer 0..31>	*ALL *LINK-STA
RA group of the source unit (hexadecimal, old layout). Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.SOURCE-DIR(*LIST).GROUP-NO	S	" <c-string 1..2>	*ALL *LINK-STA
Port connected. Only relevant for Symmetrix/VMAX3. Y: at least one port is connected N: no ports are connected	var(*LIST).LINK.SOURCE-DIR(*LIST).PORT-CONNECTION	S	" Y N	*ALL *LINK-STA
Status of the source unit's Remote Link Director. Only relevant for Symmetrix/VMAX3. *ENABLE: remote link directors activated and connected *DISABLE: remote link directors deactivated or not connected	var(*LIST).LINK.SOURCE-DIR(*LIST).STA	S	" *ENABLE *DISABLE	*ALL *LINK-STA
MN of the first emulated controller (with the target unit)	var(*LIST).LINK.TARGET-CONTR-UNIT1	S	" <mmemo-name>	*ALL *LINK-STA
RA group of the target unit (decimal). Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.TAR-GROUP-NO-INT	I	<integer 0..250>	*ALL *LINK-STA
Name of the Remote Link Director. Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.TARGET-DIR(*LIST).DIR-NO	S	" <1A....16A> <1B....16B> ... <1H....16H>	*ALL *LINK-STA
Port number. Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.TARGET-DIR(*LIST).PORT-NO	I	<integer 0..31>	*ALL *LINK-STA
RA group of the target unit (hexadecimal, old layout). Only relevant for Symmetrix/VMAX3.	var(*LIST).LINK.TARGET-DIR(*LIST).GROUP-NO	S	" <c-string 1..2>	*ALL *LINK-STA
Port connected. Only relevant for Symmetrix/VMAX3. Y: at least one port is connected N: no ports are connected	var(*LIST).LINK.TARGET-DIR(*LIST).PORT-CONNECTION	S	" Y N	*ALL *LINK-STA

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Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF=
Status of the target unit's Remote Link Director. Only relevant for Symmetrix/VMAX3. *ENABLE: remote link directors activated and connected *DISABLE: remote link directors deactivated or not connected	var(*LIST).LINK. TARGET-DIR(*LIST).STA	S	"" *ENABLE *DISABLE	*ALL *LINK-STA
Processing mode. Only relevant for Symmetrix/VMAX3. *SYNCH: target unit is updated before the next write access to the source unit *ADAPTIVE-COPY: the writes are processed asynchronously. *ASYNCH: the writes are processed asynchronously in a guaranteed order, i.e. data on the target unit is crash-consistent (SRDF/A)	var(*LIST).PAR.COPY-MODE	S	*SYNCH *ADAPTIVE-COPY *ASYNCH	*PAR *ALL
Specifies what happens if one part of the remote copy pair fails (see page 210) Only relevant for Symmetrix/VMAX3. *HOLD: if one part of the remote copy pair fails, the applications are stopped and wait for a reply *CONTI: if one part of the remote copy pair fails, processing continues with the remaining unit	var(*LIST).PAR.ON-ERROR	S	*HOLD *CONTI	*PAR *ALL
Transition to READY with pending writes. Only relevant for Symmetrix/VMAX3. *YES: transition permitted *NO: transition not permitted "": no information, since there is no access to the target unit	var(*LIST).PAR. PEND-UPD-ALLOWED	S	"" *YES *NO	*PAR *ALL
Max. number of pending writes for COPY-MODE=*ADAPTIVE-COPY Only relevant for Symmetrix/VMAX3. "": for COPY-MODE=*SYNCH, and *ASYNCHRONOUS	var(*LIST).PAR.PEND-UPD-LIMIT	I	"" <integer 0..65535>	*PAR *ALL
Current value of pending writes from the source unit on the target unit in MB. Only relevant for Symmetrix/VMAX3.	var(*LIST).PAR.PEND-UPD-SIZE	I	"" <integer 0..65535>	*PAR *ALL

(part 3 of 6)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF=
Noting of pending writes. Only relevant for Symmetrix/VMAX3. *CACHE: noted in the cache *DISK: noted on the volume ": for COPY-MODE=*SYNCH, and *ASYNCHRONOUS	var(*LIST).PAR.WRITE-BUF	S	" *CACHE *DISK	*PAR *ALL
Internal number of the logical volume	var(*LIST).SOURCE-LOGIC-VOL	S	" <c-string 1..5>	*LINK-STA *PAR *PORT-STA *SUM *ALL *ASYNCH-S
Port name in the storage system with the source unit (when NUM-OF-SOURCE-PORTS is not zero)	var(*LIST).SOURCE-PORT(*LIST).NAME	S	<c-string 1..24>	*PORT-STA *ALL
Serial number of the storage system with the source unit	var(*LIST).SOURCE-SERIAL-NO	S	" <c-string 1..14>	*LINK-STA *PAR *PORT-STA *SUM *ALL *ASYNCH-S
MN of the source unit	var(*LIST).SOURCE-UNIT	S	" <mnemo-name>	*LINK-STA *PAR *PORT-STA *SUM *ALL *ASYNCH-S
State of the remote links. *AVAIL: remote links activated and connected *NOT-AVAIL: remote links deactivated or not connected	var(*LIST).SUMM.LINK-STA	S	" *AVAIL *NOT-AVAIL	*SUM *ALL
concurrent remote copy *YES: used *NO: not used	var(*LIST).SUMM.CONCURR-TARGET	S	*YES *NO	*SUM *ALL
Is the data consistent after the split? (ETERNUS DX) *YES: data is consistent *NO: data is not consistent	var(*LIST).SUMM.CONSISTENT-DATA	S	*YES *NO	*SUM *ALL
cascaded remote copy *NO: not used *SRC: source unit cascaded *TAR: target unit cascaded *SDL: source unit cascaded diskless *TDL: target unit cascaded, diskless	var(*LIST).SUMM.CASCADED-RDF	S	*NO *SRC *TAR *SDL *TDL	*SUM *ALL

(part 4 of 6)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF=
Time since the last action for halting or resuming replication in the format DDDD.HH:MM:SS without leading zeros.	var(*LIST).SUMM. LAST-STA-CHANGE	S	<c-string 13..13>	*SUM *ALL
Remote copy status *ACTIVE: Remote copy mode active *IN-HOLD: Remote copy mode interrupted by /HOLD-REMOTE-COPY *ERROR: Remote copy mode interrupted due to an error *BROKEN: unrecoverable error state after a failure (ETERNUS DX)	var(*LIST).SUMM.REM-COPY-STA	S	*ACTIVE *IN-HOLD *ERROR *BROKEN	*SUM *ALL
State of synchronization. *YES: remote copy pair is synchronous *NO: remote copy pair is not synchronous	var(*LIST).SUMM. REM-COPY-SYNCH	S	*YES *NO	*SUM *ALL
Synchronization value (ETERNUS DX). Proportion of synchronous data of a remote copy pair in percent	var(*LIST).SUMM. PERCENT-COPIED	I	<integer 0..100>	*SUM *ALL
Remote copy mode: *SYNCH: target unit is updated before the next write access to the source unit *ADAPTIVE-COPY: the writes are processed asynchronously. Only relevant for Symmetrix/VMAX3. *ASYNCH: the writes are processed asynchronously in a guaranteed order, i.e. data on the target unit is crash-consistent. *ASYNC-STACK: the writes are processed asynchronously (ETERNUS DX, async REC, stack mode) *ASYNC-THROUGH: the writes are processed asynchronously (ETERNUS DX, async REC, through mode)	var(*LIST).SUMM. REM-COPY-MODE	S	*SYNCH *ASYNCH *ADAPTIVE-COPY *ASYNC-STACK *ASYNC-THROUGH	*SUM *ALL
State of the source units. Only relevant for Symmetrix/VMAX3. *IN-USE: used for SRDF *ERROR: error for SRDF *FREE: not used for SRDF	var(*LIST).SUMM. SOURCE-DEV-STA	S	*IN-USE *ERROR *FREE	*SUM *ALL
RA group of the source unit decimal (Symmetrix/VMAX3 only, otherwise zero)	var(*LIST).SUMM. SOURCE-RA-GROUP	I	<integer 0..250>	*SUM *ALL
Access path to the data of a remote copy pair. *BY-SOURCE: access via source path *DIRECT: access via target path *NONE: access not possible	var(*LIST).SUMM.TARGET-ACCESS	S	*BY-SOURCE *DIRECT *NONE	*SUM *ALL

(part 5 of 6)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF=
State of target units. Only relevant for Symmetrix/VMAX3. *IN-USE: used for SRDF *ERROR: error situation or remote copy status *IN-HOLD for SRDF *FREE: not used for SRDF	var(*LIST).SUMM.TARGET-DEV-STA	S	*IN-USE *ERROR *FREE	*SUM *ALL
Number of ports in the storage system with the source unit (ETERNUS DX)	var(*LIST).SUMM.NUM-OF-SOURCE-PORTS	I	<integer 0..4>	*SUM *ALL
Number of ports in the storage system with the target unit (ETERNUS DX)	var(*LIST).SUMM.NUM-OF-TARGET-PORTS	I	<integer 0..4>	*SUM *ALL
Internal number of the logical volume	var(*LIST).TARGET-LOGIC-VOL	S	" <c-string 1..5>	*LINK-STA *PAR *PORT-STA *SUM / *ALL *ASYNC-S
Port name in the storage system with the target unit (when NUM-OF-TARGET-PORTS is not zero), for ETERNUS DX	var(*LIST).TARGET-PORT(*LIST).NAME	S	" <c-string 1..24>	*PORT-STA *ALL
Serial number of the storage system with the target unit	var(*LIST).TARGET-SERIAL-NO	S	" <c-string 1..14>	*LINK-STA *PAR *PORT-STA *SUM / *ALL *ASYNC-S
MN of the target unit	var(*LIST).TARGET-UNIT	S	" <mmemo-name>	*LINK-STA *PAR *PORT-STA *SUM / *ALL *ASYNC-S
VSN of the volume	var(*LIST).VOL	S	" <vsn>	*LINK-STA *PAR *PORT-STA *SUM / *ALL

(part 6 of 6)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1024	Remote controller not found
	64	NDE1100	Invalid pubset state
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1125	Initialization of storage system information running
	64	NDE1126	Device unknown or storage system not supported
	64	NDE1127	Device of a storage system is not supported
	64	NDE1128	At least one unit from system is not Symmetrix/VMAX3
	64	NDE1150	No gatekeeper device found
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	64	NDE2011	Symmetrix license not entered
	64	NDE2012	Illegal parameter combination
	130	NDE1082	Memory bottleneck during processing of command

SHOW-SHC-ENVIRONMENT

Displays configuration of the external servers

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/SHOW-SHC-ENVIRONMENT` provides information on the configuration of the StorMan and SYMAPI servers and on the status and the valid settings of the CIMOM servers used by StorMan and their access data. The storage systems managed by the CIMOM servers are also displayed. This provides you with a detailed display of the StorMan environment which complements the `/SHOW-SHC-PROCESSING` command.

The information on the CIMOM servers which is displayed shows the settings and statuses which currently apply. It is determined dynamically by StorMan. It can differ from the static specifications in the SHC-OSD parameter file.

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-SHC-ENVIRONMENT
INFORMATION = <u>*STD</u> / *ALL

INFORMATION =

Determines the scope of the information which is output.

A header line is output followed by lines for each StorMan and SYMAPI server with the corresponding values for each unit, see the example on the next page.

INFORMATION = *STD

Information is output about the active StorMan server with its CIMOM servers and the active SYMAPI server.

INFORMATION = *ALL

Information is output about all StorMan servers defined in the SHC-OSD parameter file with their CIMOM server and all defined SYMAPI servers.

Example

```

/SHOW-SHC-ENVIRONMENT INFORMATION=*ALL
%-----
% SHOW-SHC-ENVIRONMENT                               (SHC-OSD VERSION 12.0A00)
%-----
% STORMAN(1) SERVER Settings and Status -----
%     HOST           = MCHXX.1
%     PORT-NUMBER    = 4178                SSL = *ENABLED
%     STATUS         = OK                  CONNECTED = *YES
%     VERSION        = 7.0.0-7
%
%--- STORMAN(1) CIMOM Settings: -----
% CIMOM(1) HOST = 172.11.22.11
%     PORT-NUMBER = 5988
%     USER       = root
%     STATUS     = OK
%     VERSION    = V04L60-100
%     VENDOR     = FUJITSU
%     MANAGED-STORAGE-SYSTEM(1) = 4531125002
%     STORAGE-STATUS = OK
% CIMOM(2) HOST = 172.11.22.22
%     PORT-NUMBER = 5988
%     USER       = root
%     STATUS     = OK
%     VERSION    = V04L60-100
%     VENDOR     = FUJITSU
%     MANAGED-STORAGE-SYSTEM(1) = 4531107011
%     STORAGE-STATUS = OK
%-----
% STORMAN(2) SERVER Settings and Status -----
%     HOST           = *MU1
%     PORT-NUMBER    = 4178                SSL = *ENABLED
%     STATUS         = NOT-AVAILABLE      CONNECTED = *NO
%     VERSION        = NOT-AVAILABLE
%-----
% SYMAPI (1) SERVER Settings and Status -----
%     HOST           = 172.11.22.33
%     PORT-NUMBER    = 2707
%     STATUS         = OK                  CONNECTED = *YES
%     VERSION        = V8.2-2054/0.13
%-----
% SYMAPI (2) SERVER Settings and Status -----
%     HOST           = 172.11.22.44
%     PORT-NUMBER    = 2707
%     STATUS         = NOT-YET-INITIALIZED CONNECTED = *NO
%     VERSION        = NOT-AVAILABLE
%-----

```

Meaning of the output lines (in the order of their occurrence)

Keyword	Meaning	Value
SHC-OSD VERSION	Version of SHC-OSD	<char 7..7>
STORMAN(m) SERVER Settings and Status	Settings and status of the mth (m=1..8) StorMan server. The StorMan servers are output in the order they are defined in the SHC-OSD parameter file.	
HOST	Host name or IP address of the StorMan server. For SE servers, *MU1(<MU-name>) or *MU2(<MU-name>) can also be output. If no StorMan server is defined, 'HOST= ' is output for the first StorMan server.	' ' <char 1..48>
PORT-NUMBER	Port number of the StorMan server. If no StorMan server is defined, 'PORT-NUMBER= UNDEFINED' is output for the first StorMan server.	UNDEFINED <char 1..16>
SSL	Use of secure data transfer with SSL *ENABLED SSL is used. *DISABLED SSL is not used.	*ENABLED *DISABLED
STATUS	Status of the StorMan server OK StorMan server running. NOT-AVAILABLE StorMan server is not available. NO-DATABASE StorMan server's repository is not available. NO-CIM-OM No CIMOM (SMI-S Provider) is entered in the StorMan repository. DISABLED-BY-SYSPAR No StorMan support is requested in the SYSPAR file with DISCOVER-MODE = *BY-SYMAPI. ERROR An error occurred. VERSION-NOT-SUPPORTED Version not supported NOT-YET-INITIALIZED Not yet initialized. DISABLED-BY-COMMAND The use of all StorMan servers was terminated with /MODIFY-SHC-ENVIRONMENT.	OK NOT-AVAILABLE NO-DATABASE NO-CIM-OM DISABLED-BY-SYSPAR ERROR VERSION-NOT-SUPPORTED NOT-YET-INITIALIZED DISABLED-BY-COMMAND
CONNECTED	Specifies whether the StorMan server is active	*YES *NO
VERSION	Version of the StorMan server (remains empty in the DISABLED-BY-COMMAND status).	' ' <char 1..16> NOT-AVAILABLE

(part 1 of 3)

Keyword	Meaning	Value
STORMAN (m) CIMOM Settings	CIMOM settings of the mth StorMan server	
CIMOM(n) HOST	Name or IP address of the nth CIMOM server for the corresponding StorMan server	<char 1..48>
PORT-NUMBER	Port number of the nth CIMOM server	<char 1..8>
USER	User ID on the nth CIMOM server	<char 1..32>
STATUS	Status of the nth CIMOM server. OK StorMan server running. NOT-AVAILABLE CIMOM server not available. AUTHORIZATION-FAILED User ID or password of CIMOM server incorrect ERROR An error occurred.	OK NOT-AVAILABLE AUTHORIZATION-FAILED ERROR
VERSION	Version of the nth CIMOM server	UNKNOWN <char 1..16>
VENDOR	Manufacturer of the nth CIMOM server	<char 1..16>
MANAGED-STORAGE-SYSTEM(o)	Serial number of the oth storage system which is managed by the corresponding CIMOM server	<char 1..16>
STORAGE-STATUS	Status of the storage system. OK Storage system being managed NOT-AVAILABLE Storage system not available ERROR An error occurred.	OK NOT-AVAILABLE ERROR
SYMAPI(p) SERVER Settings and Status	Settings and status of the pth (p=1..4) SYMAPI server. The SYMAPI servers are output in the order they are defined in the SHC-OSD parameter file.	
HOST	Host name or IP address of the SYMAPI server. If no SYMAPI server is defined, 'HOST= _' is output for the first SYMAPI server.	' ' <char 1..48>
PORT-NUMBER	Port number which the SYMAPI client uses. If no SYMAPI server is defined, 'PORT-NUMBER= UNDEFINED' is output for the first SYMAPI server.	UNDEFINED <char 1..16>

(part 2 of 3)

Keyword	Meaning	Value
STATUS	<p>Status of the SYMAPI server.</p> <p>OK SYMAPI server running.</p> <p>NOT-AVAILABLE SYMAPI server is not available.</p> <p>DISABLED-BY-SYSPAR No SYMAPI support is requested in the SYSPAR file with DISCOVER-MODE = *BY-SYMAPI.</p> <p>ERROR An error occurred.</p> <p>VERSION-NOT-SUPPORTED Version not supported</p> <p>NOT-YET-INITIALIZED Not yet initialized.</p> <p>DISABLED-BY-COMMAND The use of all SYMAPI servers was terminated with /MODIFY-SHC-ENVIRONMENT.</p> <p>DISCONNECTED The SYMAPI client is not connected.</p> <p>LICENSE-CHECK Versions of SYMAPI server and client do not match.</p> <p>SECURITY-LEVEL-MISMATCH Security setting NONSECURE missing on SYMAPI server.</p>	<p>OK</p> <p>NOT-AVAILABLE</p> <p>DISABLED-BY-SYSPAR</p> <p>ERROR</p> <p>VERSION-NOT-SUPPORTED</p> <p>NOT-YET-INITIALIZED</p> <p>DISABLED-BY-COMMAND</p> <p>DISCONNECTED</p> <p>LICENSE-CHECK</p> <p>SECURITY-LEVEL-MISMATCH</p>
CONNECTED	Specifies whether the SYMAPI server is active	*YES *NO
VERSION	<p>Version of the SYMAPI server</p> <p>NOT-AVAILABLE SYMAPI server is not available.</p> <p>VERSION-NOT-SUPP Version not supported</p>	<p><char 1..16></p> <p>NOT-AVAILABLE</p> <p>VERSION-NOT-SUPP</p>

(part 3 of 3)

S variables

For `INFORMATION=*STD`, the S variables are output only for the active StorMan server with its CIMOM servers and the SYMAPI servers.

For `INFORMATION=*ALL`, the S variables for all StorMan and SYMAPI servers are output in the order in which they are defined in the SHC-OSD parameter file. When CIMOM servers are defined for one of the StorMan servers, the relevant Svariables for the CIMOM servers are also output.

If no definition for a StorMan or SYMAPI server exists in the SHC-OSD parameter file, no S variables are output for StorMan or SYMAPI servers. If neither StorMan nor SYMAPI servers are defined, the S variables for a (an empty) StorMan server are output.

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Version number of SHC-OSD	var(*LIST).SHC-OSD-VERSION	S	<c-string 1..16>
Server type STORMAN: the S variables for a StorMan server are output. SYMAPI: the S variables for a SYMAPI server are output. UNKNOWN: the S variables for a (an empty) StorMan server are output.	var(*LIST).SERVER-TYPE	S	STORMAN SYMAPI UNKNOWN
Host name or IP address of the StorMan server (only with SERVER-TYPE=STORMAN/UNKNOWN)	var(*LIST).STORMAN-HOST	S	" <c-string 1..48>
Port number of the StorMan server	var(*LIST).STORMAN-PORT-NO	S	" <c-string 1..16>
Status of the StorMan server OK: the StorMan server is running NOT-AVAILABLE: torMan server not available NO-DATABASE: repository of StorMan server not available NO-CIM-OM: no CIMOM server (SMI-S Provider) entered in the StorMan repository DISABLED-BY-SYSPAR: the DISCOVER-MODE=BY-SYMAPI parameter does not result in StorMan usage ERROR: self-explanatory VERSION-NOT-SUPPORTED: StorMan version not supported NOT-YET-INITIALIZED: StorMan not yet initialized DISABLED-BY-COMMAND: The use of all StorMan servers was terminated with /MODIFY-SHC-ENVIRONMENT.	var(*LIST).STORMAN-STA	S	OK NOT-AVAILABLE NO-DATABASE NO-CIM-OM DISABLED-BY-SYSPAR ERROR VERSION-NOT-SUPPORTED NOT-YET-INITIALIZED DISABLED-BY-COMMAND
Use of secure data transfer *ENABLED: SSL is used *DISABLED: SSL is not used	var(*LIST).STORMAN-SSL	S	*ENABLED *DISABLED

(part 1 of 3)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Is the StorMan server active?	var(*LIST).STORMAN-CONNECT	S	*YES *NO
Version name of the StorMan server (remains empty in the DISABLED-BY-COMMAND status) NOT-AVAILABLE: the StorMan server is not available	var(*LIST).STORMAN-VERSION	S	" <c-string 1..16> NOT-AVAILABLE
Name or IP address of the CIMOM server (up to 99 CIMOM servers are possible)	var(*LIST).CIMOM(*LIST).HOST	S	" <c-string 1..48>
Port number of the CIMOM server	var(*LIST).CIMOM(*LIST).PORT-NO	S	" <c-string 1..16>
User ID of the CIMOM server.	var(*LIST).CIMOM(*LIST).USER-ID	S	" <c-string 1..32>
Status of the CIMOM server OK: the CIMOM server is running NOT-AVAILABLE: the CIMOM server is not running AUTHORIZATION-FAILED: user ID or password of CIMOM server incorrect ERROR: self-explanatory	var(*LIST). CIMOM(*LIST).STA	S	OK NOT-AVAILABLE AUTHORIZATION-FAILED ERROR
Version of the CIMOM server	var(*LIST). CIMOM(*LIST).VERSION	S	" <c-string 1..16>
Manufacturer of the CIMOM server.	var(*LIST). CIMOM(*LIST).VENDOR	S	" <c-string 1..16>
The following var(*LIST).CIMOM(*LIST).STORAGE-SYSTEMn and var(*LIST).CIMOM(*LIST).STORAGE-STAn outputs exist n times (n=1..8) per CIMOM server			
Serial number of the nth managed storage system	var(*LIST). CIMOM(*LIST).STORAGE-SYSTEMn	S	" <c-string 1..16>
Status of the nth managed storage system OK: storage system being managed NOT-AVAILABLE: storage system not available ERROR: self-explanatory	var(*LIST). CIMOM(*LIST).STORAGE-STAn	S	OK NOT-AVAILABLE ERROR
Host name or IP address of the SYMAPI server (for SERVER-TYPE=SYMAPI only)	var(*LIST).SYMAPI-HOST	S	" <c-string 1..48>
Port number of the SYMAPI server	var(*LIST).SYMAPI-PORT-NO	S	" <c-string 1..16>

(part 2 of 3)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Status of the SYMAPI server. OK: the SYMAPI server is running NOT-AVAILABLE: SYMAPI server not available DISABLED-BY-SYSPAR: the DISCOVER-MODE=BY-STORMAN parameter does not result in SYMAPI usage ERROR: self-explanatory VERSION-NOT-SUPPORTED: SYMAPI version not supported NOT-YET-INITIALIZED: SYMAPI not yet initialized DISABLED-BY-COMMAND: The use of all SYMAPI servers was terminated with /MODIFY-SHC-ENVIRONMENT. DISCONNECTED SYMAPI client not connected LICENSE-CHECK Versions of SYMAPI server and client do not match SECURITY-LEVEL-MISMATCH Security setting NONSECURE missing on SYMAPI server	var(*LIST).SYMAPI-STA	S	OK NOT-AVAILABLE DISABLED-BY-SYSPAR ERROR VERSION-NOT-SUPPORTED NOT-YET-INITIALIZED DISABLED-BY-COMMAND DISCONNECTED LICENSE-CHECK SECURITY-LEVEL-MISMATCH
Use of secure data transfer *ENABLED: SSL is used (not in SHC-OSD V12.0) *DISABLED: SSL is not used	var(*LIST).SYMAPI-SSL	S	*ENABLED *DISABLED
Is the SYMAPI server active?	var(*LIST).SYMAPI-CONNECT	S	*YES *NO
Version of the SYMAPI server NOT-AVAILABLE SYMAPI server not available VERSION-NOT-SUPP Version not supported	var(*LIST).SYMAPI-VERSION	S	<c-string 1..16> NOT-AVAILABLE VERSION-NOT-SUPP

(part 3 of 3)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2014	StorMan error in command
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	130	NDE1082	Memory bottleneck during processing of command

SHOW-SHC-PROCESSING

Displays settings of SHC-OSD

Storage system: ETERNUS DX, Symmetrix/VMAX3

Domain: DEVICE

Privileges: TSOS

`/SHOW-SHC-PROCESSING` displays information on the current maintenance and diagnostic settings of SHC-OSD. You can use `/MODIFY-SHC-PROCESSING` to change these settings (see [page 342](#)).

The information on the CIMOM servers which is displayed shows the settings and statuses which currently apply. It is determined dynamically by StorMan. It can differ from the static specifications in the SHC-OSD parameter file.

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-SHC-PROCESSING

Example

```

/SHOW-SHC-PROCESSING
%-----
% SHOW-SHC-PROCESSING                      (SHC-OSD VERSION 12.0A00)
%-----
%--- Version Information:                    (STORMAN CLIENT VERSION V7.0.0-0 )
%                                           (SYMAPI CLIENT VERSION V8.2-2051/0.0 )
%--- STORMAN SERVER Settings and Status (ETERNUS DX) -----
% STORMAN(1) HOST = MCHXX.1
%   PORT-NUMBER = 4178   VERSION = 7.0.0-7       SSL = *ENABLED
%   STATUS      = OK           CONNECTED = *YES
% STORMAN(2) HOST = *MU1
%   PORT-NUMBER = 4178   VERSION = NOT-AVAILABLE  SSL = *ENABLED
%   STATUS      = NOT-YET-INITIALIZED            CONNECTED = *NO
% STORMAN(3) HOST = *MU2
%   PORT-NUMBER = 4178   VERSION = NOT-AVAILABLE  SSL = *ENABLED
%   STATUS      = NOT-YET-INITIALIZED            CONNECTED = *NO
% STORMAN(4) HOST = G02XX.2
%   PORT-NUMBER = 4178   VERSION = NOT-AVAILABLE  SSL = *ENABLED
%   STATUS      = NOT-YET-INITIALIZED            CONNECTED = *NO
% STORMAN(5) HOST = esxXX.3
%   PORT-NUMBER = 4178   VERSION = NOT-AVAILABLE  SSL = *DISABLED
%   STATUS      = NOT-YET-INITIALIZED            CONNECTED = *NO
% STORMAN(6) HOST = DUCKXX.4
%   PORT-NUMBER = 4178   VERSION = NOT-AVAILABLE  SSL = *DISABLED
%   STATUS      = NOT-YET-INITIALIZED            CONNECTED = *NO
%
%--- SYMAPI SERVER Settings and Status (EMC SYMMETRIX) -----
% SYMAPI(1) HOST = 172.11.22.11
%   PORT-NUMBER = 2707   VERSION = NOT-AVAILABLE
%   STATUS      = NOT-AVAILABLE                   CONNECTED = *NO
% SYMAPI(2) HOST = 172.11.22.22
%   PORT-NUMBER = 2707   VERSION = V8.2-2054/0.13
%   STATUS      = OK           CONNECTED = *YES
% SYMAPI(3) HOST = 172.11.22.33
%   PORT-NUMBER = 2707   VERSION = NOT-AVAILABLE
%   STATUS      = NOT-YET-INITIALIZED            CONNECTED = *NO
%
%--- Subsystem Settings: -----
% USER-TASK-PRIO = 80
% FORK-ACTION    = *YES
%

```

```

%--- Monitoring Settings: -----
% STATE-CHANGE-POLLING:
% SHORT-INTERVAL=          60 s,NORMAL-INTERVAL=          600 s
% LONG-INTERVAL =          3600 s,SELECT-DEVICES=*ATTACHED
% LOG-CHANGES = *MAJOR-EVENTS          ,OPERATOR-ORDERS= *YES
% POLLING-MODE = *STD
% DISCOVER-MODE = *FULL
% REDISCOVER-TIME = *UNLIMITED
% THIN-POOL-MONITORING = *BS2000-VOLUMES
% FLEX-POOL-MONITORING = *BS2000-VOLUMES
%
%--- Security Settings: -----
% SYSTEM-ADMIN-SCOPE
% DETACHED-DEVICES = *REJECT
% NOT-DEFINED-DEVICES = *REJECT
% TASK-ADMIN-SCOPE
% DETACHED-DEVICES = *SYSTEM-ADMIN-SCOPE
% NOT-DEFINED-DEVICES = *SYSTEM-ADMIN-SCOPE
% DEVICE-PRESELECT = *ALL-DEFINED
%
%--- EMC SYMMETRIX specific Settings: -----
%--- Security Setting:
% UNIQUE-HOST-ID = 2C5C04AF-56408DCA-9E3E757C          (SYMACL)
%--- Maximum Saturation Levels:
% SNAP-SAVE-POOL-SATURATION = 89 PERCENT
% THIN-POOL-SATURATION = 30 PERCENT
% THIN-DEVICE-SATURATION = 20 PERCENT
%--- Mirroring Settings:
% PRESELECTED-SAVE-POOL-NAME = DEFAULT_POOL
% MULTI-SNAP = *ENABLED
% MAX-MULTI-BCV-PER-DEVICE = 8
%
%--- Diagnostical Settings: -----
% LOCK-RETRY:
% WAIT-TIME=          1 s,RETRY-COUNT=          30
% IO-RETRY:
% WAIT-TIME=          2 s,RETRY-COUNT=          30
% SYNCH-WAIT-RETRY:
% WAIT-TIME=          30 s,RETRY-COUNT=          20
% COMM-WAIT-RETRY:
% WAIT-TIME=          40 s,RETRY-COUNT=          60
% TRACE:
% EXTENDED-TRACE=*OFF,RELEASE-TRACE-AT-UNLOAD=*NO
% TRACE-SIZE=          32 kB, ERROR-TRACE-SIZE=          16 kB
% TU-TRACE-SIZE=          959 kB,TU-ERROR-TRACE-SIZE=          64 kB
% LOG-FILE-RETENTION= 61 DAYS
% SYMAPI-DEBUG = *OFF          , SYMAPI-LOG = *ON , SHC-OSD-LOG = *ON

```

Meaning of the output lines (in alphabetical order)

Keyword	Meaning	Operand value
COMM-WAIT-RETRY: RETRY-COUNT	Retry count for FITC communication of SHC-OSD	<integer 1..100>
COMM-WAIT-RETRY: WAIT-TIME	Wait time between retries for FITC communication	<integer 10..100>
CONNECTED	Specifies whether the StorMan or SYMAPI client is connected to the corresponding server	*YES *NO
DEVICE-PRESELECT	Default number of units for SHOW output	*ALL-DEFINED *ANY
FORK-ACTION	Setting specifying whether the SHC-OSD task operates with or without fork	*YES *NO
IO-RETRY: RETRY-COUNT	Retry count when an expected state change has not occurred in storage system	<integer 1..100>
IO-RETRY: WAIT-TIME	Wait time between retries when an expected state change has not occurred in storage system	<integer 1..10>
LOG-FILE-RETENTION	Number of days before an SHC-OSD log file is automatically deleted	<integer 1..999>
LOCK-RETRY: RETRY-COUNT	Retry count when a lock conflict occurs	<integer 1..100>
LOCK-RETRY: WAIT-TIME	Wait time between retries when a lock conflict occurs	<integer 1..10>
MAX-MULTI-BCV-PER- DEVICE	Maximum number of multi BCVs for a normal unit	<integer 1..16>
MULTI-SNAP	Setting to support the multi-snap function of TimeFinder/Snap with up to 127 snap units per original unit	*ENABLED *DISABLED
PORT-NUMBER	Port number of the StorMan or SYMAPI server	<char 1..16>
PRESELECTED-SAVE- POOL-NAME	Default of the save pool for TimeFinder/Snap	DEFAULT-POOL <name 1..32>
SHC-OSD-LOG	Shows whether SHC-OSD logging entries are written to the current log file /var/shcosd/log in the POSIX file system	*ON *OFF
SHC-OSD VERSION	Version of SHC-OSD	<char 7..7>
SNAP-SAVE-POOL- SATURATION	Warning limit for the occupancy level of the save pool	<integer 1..100>
SSL	Specifies whether secure data transfer (SSL) is used (in SHC-OSD V12.0, only for StorMan server)	*ENABLED *DISABLED

(part 1 of 6)

Keyword	Meaning	Operand value
STATE-CHANGE-POLLING: DISCOVER-MODE	Restricts the discover operation to one type of storage systems (performance)	*FULL *BY-STORMAN *BY-SYMAPI
STATE-CHANGE-POLLING: LOG-CHANGES	All state changes detected are output. Only global state changes are output	*ALL-EVENTS *MAJOR-EVENTS
STATE-CHANGE-POLLING: LONG-INTERVAL	Polling interval for checks at long intervals (i.e. a supported storage system was not found at the last polling)	<integer 360..86400>
STATE-CHANGE-POLLING: NORMAL-INTERVAL	Polling interval for checks at normal intervals (i.e. no problem occurred at the last polling)	<integer 60..7200>
STATE-CHANGE-POLLING: OPERATOR-ORDERS	Selected messages are output so that they can be answered. All messages are output asynchronously	*YES *NO
STATE-CHANGE-POLLING: POLLING-MODE	Scope of the periodic check	*NONE *PING *SYNC *STD *DISCOVER
STATE-CHANGE-POLLING: REDISCOVER-TIME	No check for rediscovery of a failed storage system Unlimited check for rediscovery Check time in hours	*NO *UNLIMITED <integer 1..9999>
STATE-CHANGE-POLLING: SELECT-DEVICES	State changes are output for all generated devices. State changes are output only for attached devices.	*ALL *ATTACHED
STATE-CHANGE-POLLING: SHORT-INTERVAL	Polling interval for checks at short intervals (i.e. a storage system was not accessible at the last polling)	<integer 30..3600>

(part 2 of 6)

Keyword	Meaning	Operand value
STATUS (STORMAN)	<p>Status of the StorMan server</p> <p>OK StorMan server running</p> <p>NOT-AVAILABLE StorMan server not available</p> <p>NO-DATABASE StorMan server's repository is not available</p> <p>NO-CIM-OM No CIMOM server (SMI-S Provider) is entered in the StorMan repository.</p> <p>CIMOM-NOT-ADDED-TO-DB CIMOM server defined in SHC-OSD parameter file, but not (yet) entered in StorMan repository</p> <p>DISABLED-BY-SYSPAR No StorMan support is requested in the SYSPAR file with DISCOVER-MODE = *BY-SYMAPI</p> <p>ERROR An error occurred</p> <p>VERSION-NOT-SUPPORTED Version not supported</p> <p>NOT-YET-INITIALIZED Not yet initialized.</p> <p>DISABLED-BY-COMMAND The use of all StorMan servers was terminated with /MODIFY-SHC-ENVIRONMENT.</p>	<p>OK</p> <p>NOT-AVAILABLE</p> <p>NO-DATABASE</p> <p>NO-CIM-OM</p> <p>CIMOM-NOT-ADDED-TO-DB</p> <p>DISABLED-BY-SYSPAR</p> <p>ERROR</p> <p>VERSION-NOT-SUPPORTED</p> <p>NOT-YET-INITIALIZED</p> <p>DISABLED-BY-COMMAND</p>

(part 3 of 6)

Keyword	Meaning	Operand value
STATUS (SYMAPI)	<p>Status of the SYMAPI server.</p> <p>OK SYMAPI server running.</p> <p>NOT-AVAILABLE SYMAPI server is not available.</p> <p>DISABLED-BY-SYSPAR No SYMAPI support is requested in the SYSPAR file with DISCOVER-MODE = *BY-SYMAPI.</p> <p>ERROR An error occurred.</p> <p>VERSION-NOT-SUPPORTED Version not supported</p> <p>NOT-YET-INITIALIZED Not yet initialized.</p> <p>DISABLED-BY-COMMAND The use of all SYMAPI servers was terminated with /MODIFY-SHC-ENVIRONMENT.</p> <p>DISCONNECTED The SYMAPI client is not connected.</p> <p>LICENSE-CHECK Versions of SYMAPI server and client do not match.</p> <p>SECURITY-LEVEL-MISMATCH Security setting NONSECURE missing on SYMAPI server.</p>	<p>OK</p> <p>NOT-AVAILABLE</p> <p>DISABLED-BY-SYSPAR</p> <p>ERROR</p> <p>VERSION-NOT-SUPPORTED</p> <p>NOT-YET-INITIALIZED</p> <p>DISABLED-BY-COMMAND</p> <p>DISCONNECTED</p> <p>LICENSE-CHECK</p> <p>SECURITY-LEVEL-MISMATCH</p>
STORMAN(n) HOST	<p>Host name or IP address of the nth StorMan server. The StorMan servers defined in the SHC-OSD parameter file are output. If no StorMan server is defined, 'STORMAN(1) HOST = _' is output.</p>	<p>' '</p> <p><char 1..48></p>
SYMAPI(n) HOST	<p>Host name or IP address of the nth SYMAPI server. The SYMAPI servers defined in the SHC-OSD parameter file are output. If no SYMAPI server is defined, 'SYMAPI(1) HOST = _' is output.</p>	<p>' '</p> <p><char 1..48></p>
SYMAPI-DEBUG	<p>Displays whether SYMAPI is running in debug mode, i.e. whether extended DEBUG entries will be written for SYMAPI.</p>	<p>*ON</p> <p>*OFF</p>
SYMAPI-LOG	<p>Displays whether SYMAPI logging entries are written to the current logging file</p>	<p>*ON</p> <p>*OFF</p>
SYNCH-WAIT-RETRY: RETRY-COUNT	<p>Retry count for queries about synchronous command termination when a lock conflict occurs.</p>	<p><integer 1..100></p>
SYNCH-WAIT-RETRY: WAIT-TIME	<p>Wait time between two queries about synchronous command termination.</p>	<p><integer 1..120></p>
SYSTEM-ADMIN-SCOPE: DETACHED-DEVICES	<p>System-wide security setting for detached devices.</p>	<p>*REJECT</p> <p>*ACCEPT</p>

(part 4 of 6)

Keyword	Meaning	Operand value
SYSTEM-ADMIN-SCOPE: NOT-DEFINED-DEVICES	System-wide security setting for devices which are not known to BS2000 (devices not generated)	*REJECT *ACCEPT
TASK-ADMIN-SCOPE: DETACHED-DEVICES	Task-specific security setting for detached units	*REJECT *ACCEPT *SYSTEM-ADMIN-SCOPE
TASK-ADMIN-SCOPE: NOT-DEFINED-DEVICES	Task-specific setting for units not recognized by BS2000 (devices not generated).	*REJECT *ACCEPT *SYSTEM-ADMIN-SCOPE
THIN-DEVICE-SATURATION	Warning limit for the occupancy level of the thin device	<integer 1..100>
THIN-POOL-MONITORING	Setting for the administration of thin pools	*ON *OFF *BS2000-VOLUMES *BY-AVOID-FILE
FLEX-POOL-MONITORING	Setting for the administration of flex pools.	*ON *OFF *BS2000-VOLUMES *BY-AVOID-FILE
THIN-POOL-SATURATION	Warning limit for the occupancy level of the thin pool	<integer 1..100>
TRACE: RELEASE-TRACE-AT-UNLOAD	Trace areas are released when SHC-OSD is unloaded Trace areas are not released when SHC-OSD is unloaded in order to facilitate diagnostics	*YES *NO
TRACE: ERROR-TRACE-SIZE	Size of the error trace area in Kbyte	<integer 1..4096>
TRACE: EXTENDED-TRACE	Controls the size of the entries in the normal trace of SHC-OSD. When EXT=*ON is specified, additional information is recorded in order to facilitate diagnostics. The initial setting is *OFF	*OFF *ON
TRACE: TRACE-SIZE	Size of the trace area in Kbyte	<integer 1..4096>
TRACE: TU-TRACE-SIZE	Size of the trace area (TU) in Kbyte	<integer 1..4096>
TRACE: TU-ERROR-TRACE-SIZE	Size of the error trace area (TU) in Kbyte	<integer 1..4096>

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Keyword	Meaning	Operand value
UNIQUE-HOST-ID	Unique host ID assigned by SYMACL	AAAAAAA- BBBBBBB- CCCCCCC
USER-TASK-PRIO	Priority of the SHC-OSD user task	<integer 80..255>
VERSION Information	Version of the StorMan and of the SYMAPI client	<char 0..15>
VERSION (STORMAN)	Version of the StorMan server (remains empty in the DISABLED-BY-COMMAND status)	' ' <char 0..16> NOT-AVAILABLE
VERSION (SYMAPI)	Version of the SYMAPI server	<char 0..16> NOT-AVAILABLE VERS-NOT-SUPP

(part 6 of 6)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Default number of units for SHOW information output *ALL-DEFINED: only units known in BS2000 *ANY: all units	var(*LIST).DEV-PRESELECT	S	*ALL-DEFINED *ANY
Maximum number of retries for communication	var(*LIST).COMM-RETRY.LIM	I	<integer 0..100>
Maximum number of retries for input/output	var(*LIST).IO-RETRY.LIM	I	<integer 0..100>
Wait time (in seconds) on communication retry	var(*LIST).COMM-RETRY.TIME	I	<integer 10..100>
Wait time (in seconds) on input/output retries	var(*LIST).IO-RETRY.TIME	I	<integer 0..120>
Maximum number of retries if lock conflicts occur	var(*LIST).LOCK-RETRY.LIM	I	<integer 0..100>
Wait time (in seconds) on retries caused by lock conflicts	var(*LIST).LOCK-RETRY.TIME	I	<integer 0..10>
Maximum number of days before an SHC-OSD log file is automatically deleted	var(*LIST).LOG-FILE-RETENTION	I	<integer 1..999>
Maximum number of multi BCVs per normal unit	var(*LIST).MAX-MULTI-BCV	I	<integer 0..16>
Logging of state changes. *ALL-EVENTS: all events *MAJOR-EVENTS: Global events only	var(*LIST).STA-CHA-POLLING.LOG-CHA	S	*ALL-EVENTS *MAJOR-EVENTS
Polling of state changes: Long interval in seconds	var(*LIST).STA-CHA-POLLING.LONG-INTERVAL	I	<integer 360..86400>
Polling of state changes: Normal interval in seconds	var(*LIST).STA-CHA-POLLING.NORMAL-INTERVAL	I	<integer 60..7200>
Polling of state changes: Output of operator orders	var(*LIST).STA-CHA-POLLING.OPERATOR-ORDER	S	*YES *NO
Logging of state changes: Units. *ATTACH: for attached units only *ALL: for all units	var(*LIST).STA-CHA-POLLING.SEL-DEV	S	*ATTACH *ALL
Polling of state changes: Short interval in seconds	var(*LIST).STA-CHA-POLLING.SHORT-INTERVAL	I	<integer 30..3600>
Scope of polling of status changes: *NONE: no check *PING: failure of the storage system *SYNC: failure and status of the storage system *STD: failure and status of the storage system and device status *DISCOVER: complete discover	var(*LIST).STA-CHA-POLLING.POLLING-MODE	S	*NONE *PING *SYNC *STD *DISCOVER
Polling of state changes: Recognition time (in hours) for a failed storage system	var(*LIST).STA-CHA-POLLING.REDISCOVER-TIME	I	*NO *UNLIMITED <integer 1..9999>
Polling of state changes: Threshold value for the occupancy level of the save pool	var(*LIST).STA-CHA-POLLING.SNAP-SAVE-POOL-SAT	I	<integer 1..100>

(part 1 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Polling of state changes: Threshold value for the occupancy level of the thin pool	var(*LIST).STA-CHA-POLLING. THIN-POOL-SAT	I	<integer 1..100>
Polling of state changes: Threshold value for the occupancy level of the thin device	var(*LIST).STA-CHA-POLLING. THIN-DEVICE-SAT	I	<integer 1..100>
SYMAPI-DEBUG trace *ON: switched on *OFF: switched off	var(*LIST).SYMAPI-DEBUG	S	*ON *OFF
SYMAPI logging *ON: switched on *OFF: switched off	var(*LIST).SYMAPI-LOG	S	*ON *OFF
SHC-OSD logging *ON: switched on *OFF: switched off	var(*LIST).SHC-OSD-LOG	S	*ON *OFF
MULTI-SNAP function *ENABLED: enabled *DISABLED: disabled	var(*LIST).MULTI-SNAP	S	*ENABLED *DISABLED
Threshold value monitoring of the thin pools *ON: all pools *OFF: no pools *BS2000 volumes: only pools with BS2000 volumes *BY-AVOID-FILE: only pools which are not contained in the AVOID file	var(*LIST).THIN-POOL-MONITORING	S	*ON *OFF *BS2000-VOLUMES *BY-AVOID-FILE
Threshold value monitoring of the flex pools *ON: all pools *OFF: no pools *BS2000 volumes: only pools with BS2000 volumes *BY-AVOID-FILE: only pools which are not contained in the AVOID file	var(*LIST).FLEX-POOL-MONITORING	S	*ON *OFF *BS2000-VOLUMES *BY-AVOID-FILE
DISCOVER restriction in accordance with the type of storage system *FULL: all types *BY-SYMAPI: SYMMETRIX/VMAX3 only *BY-STORMAN: ETERNUS DX only	var(*LIST).DISCOVER-MODE	S	*FULL *BY-SYMAPI *BY-STORMAN
Unique HOST-ID assigned by SYMACL	var(*LIST).UNIQUE-HOST-ID	S	<c-string 1..32>
Version number of the StorMan client	var(*LIST).STORMAN-CLIENT-VERS	S	NOT-AVAILABLE <c-string 1..16>
Version number of the SYMAPI client (for last time for compatibility reasons)	var(*LIST).SYMAPI-VERSION	S	<c-string 15..15>
Version number of the SYMAPI client	var(*LIST).SYMAPI-CLIENT-VERS	S	<c-string 1..16>
Maximum number of retries to check synchronization	var(*LIST).SYNCH-RETRY.LIM	I	<integer 0..100>

(part 2 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Wait time (in seconds) on retries to check synchronization	var(*LIST).SYNCH-RETRY.TIME	I	<integer 0..120>
Global security setting for detached units *REJECT: process rejected *ACCEPT: process accepted	var(*LIST).SYS-ADM-SCOPE. PROCESS-DET-DEV	S	*REJECT *ACCEPT
Global security setting for units not known in BS2000 *REJECT: process rejected *ACCEPT: process accepted	var(*LIST).SYS-ADM-SCOPE. PROCESS-UNDEF-DEV	S	*REJECT *ACCEPT
Task-specific security setting for detached units *SYS-ADM-SCOPE: global setting is valid locally *REJECT: process rejected *ACCEPT: process accepted	var(*LIST).TASK-ADM-SCOPE. PROCESS-DET-DEV	S	*SYS-ADM-SCOPE *REJECT *ACCEPT
Task-specific security setting for units not known in BS2000 *SYS-ADM-SCOPE: global setting is valid locally *REJECT: process rejected *ACCEPT: process accepted	var(*LIST).TASK-ADM-SCOPE. PROCESS-UNDEF-DEV	S	*SYS-ADM-SCOPE *REJECT *ACCEPT
Size of error trace	var(*LIST).TRACE.ERROR-SIZE	I	<integer 0..4096>
Extended trace *ON: switched on *OFF: switched off	var(*LIST).TRACE.EXT	S	*ON *OFF
Release of trace on unloading subsystem *YES or *NO	var(*LIST).TRACE.REL-AT-UNLOAD	S	*YES *NO
Size of trace	var(*LIST).TRACE.SIZE	I	<integer 0..4096>
Version number of the SHC-OSD subsystem	var(*LIST).VERSION	S	<c-string 7..7>
Priority of the SHC-OSD user task	var(*LIST).USER-TASK-PRIO		<integer 80..255>
Default of the save pool for TimeFinder/Snap	var(*LIST).PRESELECTED-SAVEPOOL	S	DEFAULT-POOL <c-string 1...32>
Index of the connected StorMan server in the order of the server details in the SHC-OSD parameter file	var(*LIST).STORMAN-CONN-INDEX	I	<integer 1..8>
Host name or IP address of the connected StorMan server	var(*LIST).STORMAN-HOST	S	*UNKNOWN <c-string 1..48>
Port number of the connected StorMan server	var(*LIST).STORMAN-PORT	S	<c-string 1..16>
Specifies whether the connected StorMan server uses secure data transfer (SSL) *ENABLED: SSL is used *DISABLED: SSL is not used	var(*LIST).STORMAN-SSL	S	*ENABLED *DISABLED
Version number of StorMan on the connected StorMan server (remains empty in the DISABLED-BY-COMMAND status)	var(*LIST).STORMAN-VERSION	S	 <c-string 1..16> NOT-AVAILABLE

(part 3 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Status of the connected StorMan server OK: the StorMan server is running NOT-AVAILABLE: torMan server not available NO-DATABASE: repository of StorMan server not available NO-CIM-OM: no CIMOM server (SMI-S Provider) entered in the StorMan repository DISABLED-BY-SYSPAR: the DISCOVER-MODE=BY-SYMAPI parameter does not result in StorMan usage DISABLED-BY-COMMAND: the /MODIFY-SHC-ENVIRONMENT command does not result in StorMan usage NOT-YET-INITIALIZED: Not initialized ERROR: self-explanatory VERSION-NOT-SUPPORTED: Version not supported	var(*LIST).STORMAN-STATUS	S	OK NOT-AVAILABLE NO-DATABASE NO-CIM-OM DISABLED-BY-SYSPAR DISABLED-BY-COMMAND NOT-YET-INITIALIZED ERROR VERSION-NOT-SUPPORTED
Host name or IP address of the nth StorMan server (n=1..8)	var(*LIST).STORMAN(*LIST).HOST	S	" <c-string 1..48>
Port number of the nth StorMan server (n=1..8)	var(*LIST).STORMAN(*LIST).PORT-NUMBER	S	" <c-string 1..16>
Specifies whether the nth StorMan server uses secure data transfer (SSL) (n=1..8) *ENABLED: SSL is used *DISABLED: SSL is not used	var(*LIST).STORMAN(*LIST).SSL	S	" *ENABLED *DISABLED
Version of StorMan on the nth StorMan server (n=1..8)	var(*LIST).STORMAN(*LIST).VERSION	S	<c-string 1..16> *NOT-AVAILABLE
Status of the nth StorMan server (n=1..8) OK: the StorMan server is running NOT-AVAILABLE: torMan server not available NO-DATABASE: repository of StorMan server not available NO-CIM-OM: no CIMOM server (SMI-S Provider) entered in the StorMan repository DISABLED-BY-SYSPAR: the DISCOVER-MODE=BY-SYMAPI parameter does not result in StorMan usage DISABLED-BY-COMMAND: the /MODIFY-SHC-ENVIRONMENT command does not result in StorMan usage NOT-YET-INITIALIZED: StorMan client not initialized ERROR: self-explanatory VERSION-NOT-SUPPORTED: Version not supported	var(*LIST).STORMAN(*LIST).STATUS	S	OK NOT-AVAILABLE NO-DATABASE NO-CIM-OM DISABLED-BY-SYSPAR DISABLED-BY-COMMAND NOT-YET-INITIALIZED ERROR VERSION-NOT-SUPPORTED

(part 4 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt
Specifies whether the nth StorMan server is connected (n=1..8) *YES or *NO	var(*LIST).STORMAN(*LIST).CONNECTED	S	*YES *NO
Host name or IP address of the nth SYMAPI server (n=1..4)	var(*LIST).SYMAPI(*LIST).HOST	S	" <c-string 1..32>
Port number of the nth CIMOM server (n=1..4)	var(*LIST).SYMAPI(*LIST).PORT-NUMBER	S	" <c-string 1..16>
Version of SYMAPI on the nth SYMAPI server (n=1..4)	var(*LIST).SYMAPI(*LIST).VERSION	S	<c-string 1..16> NOT-AVAILABLE VERSION-NOT-SUPP
Status of the nth SYMAPI server (n=1..4) OK: the SYMAPI server is running NOT-AVAILABLE: SYMAPI server not available DISABLED-BY-SYSPAR: the DISCOVER-MODE=BY-STORMAN parameter does not result in SYMAPI usage DISABLED-BY-COMMAND: the /MODIFY-SHC-ENVIRONMENT command does not result in SYMAPI usage NOT-YET-INITIALIZED: Not initialized ERROR: self-explanatory DISCONNECTED SYMAPI client not connected LICENSE-CHECK Versions of SYMAPI server and client do not match SECURITY-LEVEL-MISMATCH Security setting NONSECURE missing on SYMAPI server	var(*LIST).SYMAPI(*LIST).STATUS	S	OK NOT-AVAILABLE DISABLED-BY-SYSPAR DISABLED-BY-COMMAND NOT-YET-INITIALIZED ERROR DISCONNECTED LICENSE-CHECK SECURITY-LEVEL-MISMATCH
Specifies whether the nth SYMAPI server is connected (n=1..4) *YES or *NO	var(*LIST).SYMAPI(*LIST).CONNECTED	S	*YES *NO

(part 5 of 5)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	130	NDE1082	Memory bottleneck during processing of command

SHOW-SNAP-SESSION-STATUS

Displays the status of snap pairs

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
SW-MONITOR-ADMINISTRATION,
HSMS-ADMINISTRATION
Routing code: @

/SHOW-SNAP-SESSION-STATUS provides information on the status of snap pairs in the storage system.

When device selection takes place, SHC-OSD automatically determines the correct volumes on the storage system concerned and then outputs the data which is relevant for the system. Only snap pairs of one storage system type can be selected (i.e. Symmetrix/VMAX3 or ETERNUS DX).

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-SNAP-SESSION-STATUS

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER / *BY-SYMMETRIX(...) /
      *BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = list-poss(24): <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = list-poss(24): <cat-id 1..4>

*BY-CONTROLLER
  | CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = *ALL / <x-text 1..4>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = *ALL / <x-text 1..4>

,SELECT = *ALL-PRESELECTED / *BY-ATTRIBUTES(...)

*BY-ATTRIBUTES(...)
  | SNAP-STATUS = *ANY / *UNUSED / *IN-USE
  | ,REMOTE-COPY-USE = *STD / *TARGET-UNIT(...)
  | *TARGET-UNIT(...)
  |   | RA-GROUP = *UNIQUE / <integer 1..250>
  | ,DEVICE = *ALL-PRESELECTED / *ALL-DEFINED / *ATTACHED / *DETACHED / *ANY

,INFORMATION = *STD / *ALL

,UPDATE = *STD / *NO

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

At least one unit must be attached per emulated controller.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = list-poss(24): <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. Information is output for all volumes of the specified pubset. IDs of SF pubsets, volume sets or imported SM pubsets can be specified. No information is output for exported SM pubsets.

PUBSET = list-poss(24): <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the units by means of the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SELECT =

Units are selected by means of the snap unit status, their remote copy use or their status as seen by BS2000.

SELECT = *ALL-PRESELECTED

The set of units is not restricted further. The global setting for SHC-OSD applies (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

SELECT = *BY-ATTRIBUTES(...)

The set of units is restricted by means of selection criteria.

SNAP-STATUS =

Relevant only for Symmetrix and ETERNUS DX, not for VMAX3.
Units are selected by means of the snap unit status.

SNAP-STATUS = *ANY

Information is output for all units irrespective of the status of the snap unit.

SNAP-STATUS = *UNUSED

Information is output only for free snap units (virtual devices) in the `UNUSED` status.

SNAP-STATUS = *IN-USE

Information is output only for snap pairs in which the snap unit has a status other than `UNUSED`.

REMOTE-COPY-USE =

Units with the specified remote copy use are selected.

REMOTE-COPY-USE = *STD

Outputs information on all units regardless of their remote copy use.

REMOTE-COPY-USE = *TARGET-UNIT(...)

Selects the snap pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the `UNIT` operand.

Simultaneous entry of an emulated controller (`*BY-CONTROLLER`) in the `UNIT` operand is not supported.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Selects the target units of the specified source RA group.

DEVICE =

Selects the units by means of their status as seen by BS2000.

DEVICE = *ALL-PRESELECTED

Selects all units corresponding to the global setting for the SHC-OSD subsystem (value of `DEVICE-PRESELECT` in the output of `/SHOW-SHC-PROCESSING`).

DEVICE = *ALL-DEFINED

Selects all units generated in BS2000.

DEVICE = *DETACHED

Selects units which are generated in BS2000 but detached.

DEVICE = *ATTACHED

Selects all units attached in BS2000.

DEVICE = *ANY

Selects all units of the storage system which was specified in the `UNIT` operand.

INFORMATION =

Selects the information about the snap pairs.

INFORMATION = *STD

All assigned snap units are displayed.

INFORMATION = *ALL

Only relevant for Symmetrix.

All assigned snap units are displayed with the name of the save pool.

UPDATE =

Controls updating of the data provided.

UPDATE = *STD

The data is updated in SHC-OSD before the command is executed.

UPDATE = *NO

The command is executed without the data being updated in SHC-OSD.

Examples

```
/SHOW-SNAP-SESSION-STATUS UNIT=*BY-CONTR(CONTR-UNIT=5400)
```

```
/SHOW-SNAP-SESSION-STATUS UNIT=*BY-STORAGE(SERIAL-NUM=227, LOGICAL-VOLUME=100)
```

```
/SHOW-SNAP-SESSION-STATUS UNIT=*BY-SYMMETRIX(SERIAL-NUM=227,  
LOGICAL-VOLUME=100), REMOTE-COPY-USE=*TARGET-UNIT(RA-GROUP=*UNIQUE)
```

Output for snap pairs

The layout of the SYSOUT output differs because not all output fields are supplied with values by all storage systems. SHC-OSD automatically selects the correct output format.

Outputs for ETERNUS DX

```
/SHOW-SNAP-SESSION-STATUS UNIT=2040
```

```

%-----
% UNIT          VOLUME!          !          !SERIAL-NO          LOG-VOL
%-----
%          SNAP- VOLUME!STATE          !ACTIVE-FOR !SNAP-POOL-NAME !
%          UNITS          !          !DDD.HH:MM:SS!          !
%-----
% 2040          ET88.0!          !          ! 4531107005          00040
%          20D1 ET44.0!COPY-ON-WRITE!236.00:59:08!          !          001B6
%          20C9 ET88.0!COPY-ON-WRITE!236.01:30:14!SDP00          !          001AE
%          20E3 ET40.0!COPY-ON-WRITE!375.07:18:07!SDP00          !          001C8
%-----
%

```

Outputs for Symmetrix

```
/SHOW-SNAP-SESSION-STATUS UNIT=8208,INFORMATION=*STD
```

```

%-----
% UNIT          VOLUME!          !          !SERIAL-NO          LOG-VOL
%-----
%          SNAP- VOLUME!STATE          !ACTIVE-FOR !INDIRECT SIZE   PERCENT-   MULTI
%          UNITS          !          !DDD.HH:MM:SS!UNIT   SNAP   COPIED
%-----
% 8208          ETOU.0!          !          !000192601224          00240
%          8404 ETOU.0!COPY-ON-WRITE! 0.00:01:36!3840 MB 3840 MB 0 % 00400 Y
%          8400 ETOU.0!COPY-ON-WRITE! 0.00:10:08!3840 MB 3840 MB 0 % 003FC Y
%-----
%

```

```
/SHOW-SNAP-SESSION-STATUS UNIT=*BY-PUBSET(PUBSET=ETOU),INFORMATION=*ALL
```

```

%-----
% UNIT          VOLUME!          !          !SERIAL-NO          LOG-VOL
%-----
%          SNAP- VOLUME!STATE          !ACTIVE-FOR !INDIRECT SIZE   PERCENT-   MULTI
%          UNITS          !          !DDD.HH:MM:SS!UNIT   SNAP   COPIED
%          !          !          !SAVE-POOL-NAME
%-----
% 8208          ETOU.0!          !          !000192601224          00240
%          8400 ETS1.0!COPY-ON-WRITE! 3.00:01:57!3840 MB 3840 MB 0 % 003FC Y
%          !          !          !DEFAULT_POOL
%          8404 ETS2.0!COPY-ON-WRITE! 12.23:55:03!3840 MB 3840 MB 0 % 00400 Y
%          !          !          !DEFAULT_POOL
%-----
% 8209          ETOU.1!          !          !000192601224          00241
%          8401 ETS1.1!COPY-ON-WRITE! 3.00:01:57!3840 MB 3840 MB 0 % 003FD Y
%          !          !          !DEFAULT_POOL
%          8405 ETS2.1!COPY-ON-WRITE! 12.23:55:03!3840 MB 3840 MB 0 % 00401 Y
%          !          !          !DEFAULT_POOL
%-----
%

```

Outputs for VMAX3

```
/SHOW-SNAP-SESSION-STATUS UNIT=4960, INFORMATION=*STD
```

```

%-----
% UNIT          VOLUME!                               !SERIAL-NO          LOG-VOL
%-----
% SNAP- VOLUME! SNAPSHOT-NAME          GEN! STATUS !ACTIVE-FOR !SNAP-
% UNITS      !                               !           !DDD.HH:MM:SS! VOLS
%-----
% 4960  F-4960!                               !000296800294      001A0
%      4966  F-4966!SHC OSD-4960-4966      0! COPY-ON!  6.19:06:34!001A6
%      4967  F-4967!SHC OSD-4960-4967      0! COPY-ON!  6.23:11:52!001A7
%-----

```

```
/SHOW-SNAP-SESSION-STATUS UNIT=*BY-PUBSET(PUBSET=SNVX)
```

```

%-----
% UNIT          VOLUME!                               !SERIAL-NO          LOG-VOL
%-----
% SNAP- VOLUME! SNAPSHOT-NAME          GEN! STATUS !ACTIVE-FOR !SNAP-
% UNITS      !                               !           !DDD.HH:MM:SS! VOLS
%-----
% 4750  SNVX.0!                               !000296800293      00190
%      475C  SNXX.0!SHC OSD-4750-475C      0! COPY-ON!  35.20:55:14!0019C
%      4759  SNYY.0!SHC OSD-4750-4759      0! COPY-ON!  35.21:49:01!00199
%      4756  SNVZ.0!SHC OSD-4750-4756      0! COPY-ON!  35.22:02:11!00196
%      4753  SNVY.0!SHC OSD-4750-4753      0! COPY-ON!  35.22:03:24!00193
%-----
% 4751  SNVX.1!                               !000296800293      00191
%      475D  SNXX.1!SHC OSD-4750-475C      0! COPY-ON!  35.20:55:15!0019D
%      475A  SNYY.1!SHC OSD-4750-4759      0! COPY-ON!  35.21:49:01!0019A
%      4757  SNVZ.1!SHC OSD-4750-4756      0! COPY-ON!  35.22:02:12!00197
%      4754  SNVY.1!SHC OSD-4750-4753      0! COPY-ON!  35.22:03:25!00194
%-----
% 4752  SNVX.2!                               !000296800293      00192
%      475E  SNXX.2!SHC OSD-4750-475C      0! COPY-ON!  35.20:55:15!0019E
%      475B  SNYY.2!SHC OSD-4750-4759      0! COPY-ON!  35.21:49:01!0019B
%      4758  SNVZ.2!SHC OSD-4750-4756      0! COPY-ON!  35.22:02:12!00198
%      4755  SNVY.2!SHC OSD-4750-4753      0! COPY-ON!  35.22:03:25!00195
%-----

```

Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
ACTIVE-FOR	Time since activation (/ACTIVATE-SNAP or /START-SNAP-SESSION), format: DDD.HH:MM:SS	*STD *ALL
GEN	Snapshot generation (for VMAX3 only).	
INDIRECT SIZE	Still unchanged on the unit concerned / for the particular status (in MB or GB, for Symmetrix only)	*STD *ALL
UNIT	Still unchanged on the unit	
SNAP	Still unchanged on the snap unit (points to original)	
LOG-VOL	Internal number of the logical volume in the storage system (original and snap units)	*STD *ALL
MULTI	Multi-snap support (up to 127 snap units for one original, for Symmetrix only) Y Multi-snap support is enabled N No multi-snap support	*STD *ALL
PERCENT-COPIED	Data copied to the snap unit in percent (for Symmetrix only)	*STD *ALL
SAVE-POOL-NAME	Save pool of the snap pair (for Symmetrix only)	*ALL
SERIAL-NO	Serial number of the storage system	*STD *ALL
SNAP-POOL-NAME	Snap pool name of the snap pair (ETERNUS DX). Appears only when SDPEs are assigned to the SDV, i.e. after the capacity of the SDV has been exhausted and areas in the snap pool are being used.	*STD *ALL
SNAP-UNITS	MN of a snap unit or internal number of the logical volume in the storage system (with prefix #). VMAX3: No output for snapshots without a connection to a snap unit.	*STD *ALL
SNAP-VOLS	Internal number of the logical volume in the storage system (snap unit, for VMAX3 only). No output for snapshots without a connection to a snap unit.	*STD *ALL
SNAPSHOT-NAME	Name of the snapshot (for VMAX3 only)	*STD *ALL

(part 1 of 2)

Keyword	Meaning	with INF =
STATE	Device status CREATE-IN-PROG Virtual unit is being connected to a unit to form a snap pair (Symmetrix only) CREATED Virtual unit is connected to a unit but not yet activated (Symmetrix only) COPY-ON-WRITE Snap session is activated, the snap unit is READY, separate processing (VMAX3: COPY-ON) COPIED Snap session is activated, the snap unit is READY, separate processing - all data of the unit has been modified and the entire snap unit has been copied (Symmetrix only) REST-IN-PROG Unit being reconstructed from the snap unit, data being copied from the snap unit to the unit (Symmetrix only, VMAX3: REST-IN) RESTORED Unit has been reconstructed (Symmetrix) SNAP-RESTORED Unit has been reconstructed from a snapshot (VMAX3: SNAP-R) TERM-IN-PROG The snap pair is being canceled (Symmetrix, VMAX3: TERM-IN) UNUSED The snap unit is not connected to any original unit. FAILED Error state	*STD *ALL
UNIT	MN of a unit or internal number of the logical volume in the storage system (with prefix #).	*STD *ALL
VOLUME	VSN of a unit VMAX3: No output for snapshots without a connection to a snap unit	*STD *ALL

(part 2 of 2)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Unchanged data on the snap unit during the *COPY-ON-WRITE status (in MB)	var(*LIST).SNAP-UNIT(*LIST). SNAP-INDIRECT-SIZE	I	<integer 0..268435456>	*STD *ALL
Unchanged data on the unit (in MB) (Symmetrix)	var(*LIST).SNAP-UNIT(*LIST). UNIT-PROTECTED-SIZE	I	<integer 0..268435456>	*STD *ALL
Internal number of the logical volume	var(*LIST).SNAP-UNIT(*LIST). LOGIC-VOL	S	" <c-string 1..5>	*STD *ALL
Period in seconds since a snap unit was activated, format DDDD.HH:MM:SS without leading zeros	var(*LIST).SNAP-UNIT(*LIST). ACTIVE-FOR	S	" <c-string 13..13>	*STD *ALL
Save/snap pool name for a snap pair (ETERNUS DX and Symmetrix)	var(*LIST).SNAP-UNIT(*LIST). SAVE-POOL-NAME	S	" <c-string 1..32>	*STD *ALL
Multi-snap support (Y=YES, N=NO) (Symmetrix)	var(*LIST).SNAP-UNIT(*LIST). MULTI-SNAP	S	Y N	*STD *ALL
Snapshot name (VMAX3)	var(*LIST).SNAP-UNIT(*LIST). SNAPSHOT-NAME	S	" <c-string 1..32>	*STD *ALL
Number of snapshot generations (VMAX3)	var(*LIST).SNAP-UNIT(*LIST). GENERATIONS	I	<integer 0..255>	*STD *ALL
Device status of a snap unit *UNUSED: Virtual snap unit is not connected to a unit *CREATE-IN-PROGRESS: Snap pair being created (Symmetrix) *CREATED: Snap pair created (Symmetrix) *COPY-ON-WRITE: Snap pair activated, separate processing *COPIED: Snap pair activated, separate processing, but copied in full (Symmetrix) *RESTORE-IN-PROGRESS: Copying from the snap unit to the unit (after /RESTORE-FROM-SNAP, ETERNUS DX S3, Symmetrix) *RESTORED: Reconstruction of the unit from the snap unit completed (Symmetrix) *SNAP-RESTORED: Reconstruction from snapshot (not from snap unit) completed (VMAX3) *TERM-IN-PROGRESS: Snap pair being canceled (Symmetrix/VMAX3) *FAILED: Error state	var(*LIST).SNAP-UNIT(*LIST).STA	S	*UNUSED *CREATE-IN- PROGRESS *CREATED *COPY-ON-WRITE *COPIED *RESTORE-IN- PROGRESS *RESTORED *SNAP-RESTORED *TERM-IN- PROGRESS *FAILED	*STD *ALL
MN of a snap unit	var(*LIST).SNAP-UNIT(*LIST).UNIT	S	" <mnemo-name>	*STD *ALL

(part 1 of 2)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
VSN of a snap unit	var(*LIST).SNAP-UNIT(*LIST).VOL	S	" <vsn>	*STD *ALL
Volume of data copied to the snap unit (Symmetrix)	var(*LIST).SNAP-UNIT(*LIST). PERCENT-COPIED	I	<integer 0..100>	*STD *ALL
Internal number of the logical volume	var(*LIST).UNIT-LOGIC-VOL	S	<c-string 1..5>	*STD *ALL
MN of a unit	var(*LIST).UNIT	S	" <mnemo-name>	*STD *ALL
VSN of a unit	var(*LIST).UNIT-VOL	S	" <vsn>	*STD *ALL
Number of assigned snap units	var(*LIST).NUM-OF-SNAP-UNITS	I	<integer 0..65535>	*STD *ALL
Serial number of the storage system	var(*LIST).SERIAL-NO	S	" <c-string 3..14>	*STD *ALL

(part 2 of 2)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1119	No target unit found
	64	NDE1125	Initialization of storage system information running
	64	NDE1126	Device unknown or storage system not supported
	64	NDE1127	Device of a storage system is not accessible by SHC-OSD
	64	NDE1128	At least one unit from system is not Symmetrix/VMAX3
	64	NDE1150	No gatekeeper device found
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	64	NDE2011	Symmetrix license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command

SHOW-STORAGE-CONFIGURATION

Displays the configuration (ETERNUS DX)

Storage system: ETERNUS DX
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
 SW-MONITOR-ADMINISTRATION,
 HSMS-ADMINISTRATION
Routing code: @

/SHOW-STORAGE-CONFIGURATION provides information on the configuration of the ETERNUS DX storage system.

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-STORAGE-CONFIGURATION

UNIT = *ALL / *BY-STORAGE(...)

***BY-STORAGE(...)**

| **SERIAL-NUMBER = <alphanum-name 3..14>**

**,INFORMATION = *STD / *PORT-STATUS / *ALL / *SAVE-POOLS / *THIN-POOLS / *FLEX-POOLS /
 *REMOTE-COPY-BUFFERS**

,UPDATE = *STD / *NO / *DISCOVER

UNIT =

Selects the units by means of the serial number of the storage system (*BY-STORAGE) or selects all storage systems (*ALL).

UNIT = *ALL

Output for all systems known to the host.

UNIT = *BY-STORAGE(...)

Selects the units by means of the serial number of the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number (make sure it is unique!).

INFORMATION =

Determines the output volume, see the examples for the command.

INFORMATION = *STD

Global information on the storage system is output.

INFORMATION = *PORT-STATUS

Information about the external ports of the storage system is displayed.

INFORMATION = *ALL

Information about the storage systems (*STD) and the external ports (*PORT-STATUS) is displayed.

INFORMATION = *SAVE-POOLS

When SnapOPC+ is used, the information on the Snap Data Pool (SDP) is displayed.

INFORMATION = *THIN-POOLS

When thin provisioning is used, the information on the thin pools (TPPs) is displayed.

INFORMATION = *FLEX-POOLS

When Automated Storage Tiering (AST) is used, the information on the flex pools is displayed.

INFORMATION = *REMOTE-COPY-BUFFERS

When remote copy buffers are used, the information on these buffers is displayed.

UPDATE =

Controls updating of the configuration data provided.

UPDATE = *STD

The configuration data is updated in SHC-OSD before the SHOW command is executed.

UPDATE = *NO

The SHOW command is executed without the configuration data being updated in SHC-OSD.

UPDATE = *DISCOVER

Before the SHOW command is executed, the configuration data of the storage system and in SHC-OSD is updated. This enables you to recognize that it is available again after a crash and configuration changes to the storage system.

Examples

```
/SHOW-STORAGE-CONFIGURATION UNIT=*BY-STORAGE(SERIAL-NUMBER=1008),
INFORMATION=*STD
```

```
%
% -----
% CONTR-UNIT SERIAL-NO          CACHE-SIZE FW-VERSION          HOST- #LOG-#PHYS-
%              MODEL              ACCESS  VOLS  DISKS
% -----
% BD00, BD01      4621351008          192 GB  V10L33-0000          DIRECT  4111  72
% BD02, BD03 ETERNUS DX600 S3              UNIFIED
% BE00, BE01
% BE02, BE03
% -----
```

```
/SHOW-STORAGE-CONFIGURATION UNIT=*BY-STORAGE(SERIAL-NUMBER=7003),
INFORMATION=*PORT-STATUS
```

```
%
% -----
% SERIAL-NO      ! PORT-NAME          TYPE REM SPEED PORT-STA
%              ! REM: SERIAL-NO PORT-NAME          CONN-STA
% -----
% 4531107003!          FCP_CM00CA00P00          FC  N  8GB  OK
% 4531107003!          FCP_CM00CA00P01          FC  N  8GB  OK
% 4531107003!          FCP_CM00CA00P02          FC  Y  4GB  OK
%              ! 4531107005 FCP_CM00CA00P02          DOWN
%              ! 4531107025 FCP_CM00CA01P02          UP
% 4531107003!          FCP_CM00CA00P03          FC  N 16GB  OK
% 4531107003!          FCP_CM00CA01P00          FC  N  ERR
```

```
/SHOW-STORAGE-CONFIGURATION UNIT=*ALL, INFORMATION=*SAVE-POOLS
```

```
%
% -----
% SERIAL-NO      !SAVE-POOL NAME          !      !
%              ! ALARM-STATUS          ! FULL!TYPE          !TOTAL !ATT/WARN/CRI
%              !                        !                     !FREE !
% -----
% 4621347002 !SDP00          !      !
%              ! NORMAL          ! 4%!N-A          ! 200 GB! 50% 70% 99%
%              !                        !                     ! 192 GB!
```

```
/SHOW-STORAGE-CONFIGURATION UNIT=*ALL, INFORMATION=*FLEX-POOLS
```

```
%
% -----
% SERIAL-NO      !FLEX-POOL NAME          !#BS2V!MON          !TOTAL !ATT/WARN
%              ! ALARM-STATUS          ! FULL!RAID          !FREE !
%              !SUB-POOL(S)          !      ! TYPE! SIZE !
% -----
% 4621347002 !TierPool-1          ! 64!ON          !2101 GB! 75% 90%
%              ! NORMAL          ! 3%! - MIX !2038 GB!
%              !LowPool          !      ! 1 NSAS! 916 GB!
%              !MiddlePool          !      ! 1 SAS ! 819 GB!
%              !HighPool          !      ! 1 SSD ! 366 GB!
```

```
/SHOW-STORAGE-CONFIGURATION UNIT=*ALL, INFORMATION=*THIN-POOLS
```

```
%
%-----
% SERIAL-NO      !THIN-POOL NAME      !#BS2V!MON      !TOTAL  !ATT/WARN
%                !      ALARM-STATUS  ! FULL!RAID    !FREE   !
%                !RAID-GROUP(S)      !      !      TYPE! SIZE  !
%-----
% 4531107003    !VP01                ! 0!OFF         ! 273 GB! 75% 90%
%                !      NORMAL        ! 0%! 1 SAS ! 273 GB!
%                !VP01_0            !      ! 1 SAS !
%-----
% 4531107005    !TPP1                ! 8!ON          ! 545 GB! 75% 90%
%                !      NORMAL        ! 32%!10 SAS ! 367 GB!
%                !TPP1_0            !      !10 SAS !
%-----
% 4531107011    !TP01                ! 0!OFF         ! 273 GB! 75% 90%
%                !      NORMAL        ! 5%! 1 SAS ! 257 GB!
%                !TP01_0            !      ! 1 SAS !
%-----
% 4531107011    !TP02                ! 0!OFF         !1635 GB! 75% 90%
%                !      NORMAL        ! 0%! 5 SAS !1635 GB!
%                !TP02_0            !      ! 5 SAS ! 818 GB!
%                !TP02_1            !      ! 5 SAS ! 818 GB!
```

```
/SHOW-STORAGE-CONFIGURATION UNIT=*ALL, INFORMATION=*REMOTE-COPY-BUFFERS
```

```
%
%-----
% SERIAL-NO      !REM-SERIAL-NO REC-BUFFER-NAME  USAGE  STATUS  SIZE  INTERVAL
%-----
% 4621347002! 4621349005 00          SEND    OK      512 MB 1 sec
% 4621347002! 4621349005 01          RECEIVE OK      512 MB 1 sec
% 4621349005! 4621347002 00          RECEIVE OK      512 MB 1 sec
% 4621349005! 4621347002 01          SEND    OK      512 MB 1 sec
```

Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
ALARM-STATUS	Save Data Pool, thin pool, flex pools: Status of the occupancy level monitoring NORMAL No threshold value reached ATTENTION Threshold value for ATTENTION reached WARNING Threshold value for WARNING reached CRITICAL Threshold value for CRITICAL reached (Save Data Pool)	*SAVE-P *THIN-P *FLEX-P
ATT/WARN/CRI	Save Data Pool, thin pool (without CRI), flex pools (without CRI): Current threshold values Value for monitoring the occupancy level	*SAVE-P *THIN-P *FLEX-P
CACHE-SIZE	Cache size in MB or GB	*STD
CONN-STA	Status of the remote link between storage system ports UP Connection operational DOWN Connection severed UDEF Connection not defined	*PORT-S *ALL
CONTR-UNIT	MN of the emulated controller (only for /390 servers)	*STD
FLEX-POOL NAME	Flex pools: name of the central flex pool	*FLEX-P
FLEX-SUB-POOL	Flex pools: name of a flex subpool	*FLEX-P
FREE FREE SIZE	Save Data Pool, thin pools, flex pools: free capacity	*SAVE-P *THIN-P *FLEX-P
FULL	Save Data Pool, thin pool, flex pools: current occupancy level in percent	*SAVE-P *THIN-P *FLEX-P
FW-VERSION	Version of the firmware (and the specification UNIFIED if a NAS storage is involved)	*STD
HOST-ACCESS	Access from host DIRECT Direct access INITIAL. Sets up the data structures (initializing) NO No access UNMANAGE Storage system cannot be managed because the StorMan server is not accessible NO CIMOM The StorMan server cannot find a CIMOM server to manage the storage system IN-DELET No access and no BS2000 devices are configured on the storage system; the storage system is removed from the configuration if it is not made known to StorMan again within the wait time	*STD

(part 1 of 3)

Keyword	Meaning	with INF =
INTERVAL	Update interval of the remote copy buffer in seconds	*REMOTE-C-B
MODEL	Storage system model (type)	*STD
MON	Thin pool, flex pools: displays whether pool monitoring is enabled ON Monitoring enabled OFF Monitoring not enabled	*THIN-P *FLEX-P
PORT-NAME	Name of the local or remote port	*PORT-S *ALL
PORT-STA	Local port: status OK Port operational ERR Port not operational UNK Status information not available	*PORT-S *ALL
RAID	Thin pools, flex pools and also subpools: RAID level	*THIN-P *FLEX-P
RAID-GROUP(S)	Thin pools: RAID group(s)	*THIN-P
REC-BUFFER-NAME	Name of the remote copy buffer	*REMOTE-C-B
REM	Specifies whether the local port is used for a remote link Y Port in use - Port not in use	*PORT-S *ALL
REM:	The details of the remote storage system follow in this line	*PORT-S *ALL
REM-SERIAL-NO	Serial number of the remote storage system	*REMOTE-C-B
SAVE-POOL NAME	Save Data Pool: name	*SAVE-P
SERIAL-NO	Serial number of the local or remote storage system	*STD *SAVE-P *PORT-S *THIN-P *FLEX-P *R-C-BUF
SIZE	Size of the remote copy buffer in Mbytes	*REMOTE-C-B
SPEED	Local port: speed (in Gbits)	*PORT-S *ALL
STATUS	Status of the remote copy buffer OK Buffer ready LOST Connection loss ERROR Buffer not ready	*REMOTE-C-B
THIN-POOL NAME	Thin pools: name	*THIN-P

(part 2 of 3)

Keyword	Meaning	with INF =
TOTAL TOTAL SIZE	Save Data Pool, thin pools, flex pools: configured capacity	*SAVE-P *THIN-P *FLEX-P
TYPE	Local port: type FC Type Fibre Channel ISCSI Type iSCSI ETHE Type Ethernet FCOE Type FC over Ethernet INFI Type Infiniband NAS Type NAS UNKN Type cannot be ascertained	*PORT-S *ALL
	Save Data Pool, thin pools, flex pools: disk type SAS Type SAS NSAS Type NL-SAS SATA Type SATA SSD Type SSD MIX Type mixed N-A Not applicable (always for Save Data Pool)	*SAVE-P *THIN-P *FLEX-P
USAGE	Use of the remote copy buffer SEND Data transmission RECEIVE Data reception	*REMOTE-C-B
#BS2V	Thin pool, flex pools: Number of BS2000 volumes in the pool	*THIN-P *FLEX-P
#LOG-VOLS	Number of logical volumes	*STD
#PHYS-DISKS	Number of physical disks	*STD

(part 3 of 3)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Serial number of the storage system	var(*LIST).SERIAL-NO	S	<c-string 1..16>	*STD *PORT-S *ALL
Storage model	var(*LIST).MODEL	S	<c-string 1..24>	*STD *PORT-S *ALL
Access from host *DIRECT: direct access *INITIALIZING: sets up the data structures *UNMANAGEABLE: storage system cannot be managed *NO: no access *NO-CIMOM: CIM server not found *IN-DELETE: no access and no BS2000 devices are configured on the storage system	var(*LIST).HOST-ACCESS	S	*DIRECT *INITIALIZING *UNMANAGEABLE *NO *NO-CIMOM *IN-DELETE	*STD *PORT-S *ALL
Name of the operating system (obsolete)	var(*LIST).OS-NAME	S	"	*STD *PORT-S *ALL
Version of the firmware	var(*LIST).OS-VERSION	S	" <c-string 1..16>	*STD *PORT-S *ALL
Storage with additional NAS connection (UNIFIED)	var(*LIST).UNIFIED-STORAGE	B	*TRUE *FALSE	*STD *PORT-S *ALL
Cache size in Mbytes	var(*LIST).CACHE-SIZE	I	<integer 0..2147483647>	*STD *PORT-S *ALL
MN of the emulated controller	var(*LIST).CONTR-UNIT(*LIST)	S	" <mnemo-name>	*STD *PORT-S *ALL
Number of logical volumes	var(*LIST).NUM-OF-LOG-VOLS	I	<integer 0..2147483647>	*STD *PORT-S *ALL
Number of physical volumes	var(*LIST).NUM-OF-PHYS-VOLS	I	<integer 0..2147483647>	*STD *PORT-S *ALL
Number of ports	var(*LIST).NUM-OF-PORTS	I	<integer 0..2147483647>	*STD *PORT-S *ALL
Local port name	var(*LIST).PORT(*LIST). PORT-NAME	S	" <c-string 1..32>	*PORT-S *ALL

(part 1 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Unique port ID (WWPN) of the local port	var(*LIST).PORT(*LIST).PORT-ID	S	" <c-string 1..16>	*PORT-S *ALL
Type of local port *FC: type Fibre Channel *ISCSI: type iSCSI *ETHERNET: type Ethernet *FCOE: type FC over Ethernet *INFINIBAND: type Infiniband *NAS: type NAS *UNKNOWN: type unknown	var(*LIST).PORT(*LIST).TYPE	S	*FC *ISCSI *ETHERNET *FCOE *INFINIBAND *NAS *UNKNOWN	*PORT-S *ALL
Status of the local port *OK: port operational *ERROR: port not operational *UNKNOWN: no information available	var(*LIST).PORT(*LIST).STA	S	*OK *ERROR *UNKNOWN	*PORT-S *ALL
Speed of the local port, specified in Gbits	var(*LIST).PORT(*LIST).SPEED	S	" <c-string 1..4>	*PORT-S *ALL
Number of remote ports	var(*LIST).PORT(*LIST). NUM-OF-REM-PORTS	I	<integer 0..2147483647>	*PORT-S *ALL
Displays whether the port is used for a remote link	var(*LIST).PORT(*LIST). REMOTE-ENABLED	S	*YES *NO *UNDEF	*PORT-S *ALL
Serial number of the remote storage system	var(*LIST).PORT(*LIST). REM-PORT(*LIST).SERIAL-NO	S	" <c-string 1..16>	*PORT-S *ALL
Status of the remote link between the storage system ports *UP: operational *DOWN: not operational *UNDEF: status could not be determined	var(*LIST).PORT(*LIST). REM-PORT(*LIST).CONN-STA	S	*UP *DOWN *UNDEF	*PORT-S *ALL
Port name of the remote storage system port	var(*LIST).PORT(*LIST). REM-PORT(*LIST).PORT-NAME	S	" <c-string 1..32>	*PORT-S *ALL
Serial number of the storage system with Save Data Pool	var(*LIST).SAVE-POOL.SERIAL-NO	S	" <c-string 1..16>	*SAVE-P
Maximum available size of the Save Data Pool	var(*LIST).SAVE-POOL. ENABLED-SIZE	I	<integer 0..2147483647>	*SAVE-P
Free size of the Save Data Pool	var(*LIST).SAVE-POOL.FREE-SIZE	I	<integer 0..2147483647>	*SAVE-P
Occupancy level of the Save Data Pool in percent	var(*LIST).SAVE-POOL. PERCENT-FULL	I	<integer 0..100>	*SAVE-P
Name of the Save Data Pool	var(*LIST).SAVE-POOL.NAME	S	" <c-string 1..24>	*SAVE-P

(part 2 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Status of occupancy level monitoring for the Save Data Pool NORMAL: no threshold value reached ATTENTION: threshold value for ATTENTION reached WARNING: threshold value for WARNING reached CRITICAL: threshold value for CRITICAL reached	var(*LIST). SAVE-POOL.ALARM-STATUS	S	NORMAL ATTENTION WARNING CRITICAL	*SAVE-P
Disk type of the Save Data Pool	var(*LIST).SAVE-POOL.TECH-TYPE	S	NOT-AVAIL	*SAVE-P
Threshold value of the Save Data Pool (ATTENTION)	var(*LIST). SAVE-POOL.ATTENTION-LEVEL	I	<integer 0..100>	*SAVE-P
Threshold value of the Save Data Pool (WARNING)	var(*LIST). SAVE-POOL.WARNING-LEVEL	I	<integer 0..100>	*SAVE-P
Threshold value of the Save Data Pool (CRITICAL)	var(*LIST). SAVE-POOL.CRITICAL-LEVEL	I	<integer 0..100>	*SAVE-P
Serial number of the storage system with thin pools	var(*LIST).THIN-POOL.SERIAL-NO	S	" <c-string 1..16>	*THIN-P
Name of the thin pool	var(*LIST).THIN-POOL.NAME	S	" <c-string 1..32>	*THIN-P
Maximum available size of the thin pool in MB	var(*LIST). THIN-POOL.ENABLED-SIZE	I	<integer 0..2147483647>	*THIN-P
Free size of the thin pool in MB	var(*LIST).THIN-POOL.FREE-SIZE	I	<integer 0..2147483647>	*THIN-P
Occupancy level of the thin pool in percent	var(*LIST). THIN-POOL.PERCENT-FULL	I	<integer 0..100>	*THIN-P
Threshold value of the thin pool (ATTENTION)	var(*LIST). THIN-POOL.ATTENTION-LEVEL	I	<integer 0..100>	*THIN-P
Threshold value of the thin pool (WARNING)	var(*LIST). THIN-POOL.WARNING-LEVEL	I	<integer 0..100>	*THIN-P
Status of occupancy level monitoring for the thin pool NORMAL: no threshold value reached ATTENTION: threshold value for ATTENTION reached WARNING: threshold value for WARNING reached	var(*LIST). THIN-POOL.ALARM-STATUS	S	NORMAL ATTENTION WARNING	*THIN-P
Monitoring the thin pool	var(*LIST).THIN-POOL. THIN-POOL-MONITORING	S	ON OFF	*THIN-P
RAID level of the thin pool	var(*LIST).THIN-POOL.RAID	S	<c-string 1..2>	*THIN-P

(part 3 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Disk type of the thin pool	var(*LIST).THIN-POOL.TECH-TYPE	S	NOT-AVAIL SAS NL-SAS SSD SATA MIXED	*THIN-P
Number of generated BS2000 volumes in the thin pool	var(*LIST).THIN-POOL.NUM-BS2-THIN-DEVS	I	<integer 0..65535>	*THIN-P
Number of RAID groups in the thin pool	var(*LIST).THIN-POOL.NUM-OF-RAIDGROUPS	I	<integer 0..128>	*THIN-P
Name of the RAID group in the thin pool	var(*LIST).RAIDGROUP(*LIST).NAME	S	" <c-string 1..32>	*THIN-P
Disk type of the RAID group in the thin pool	var(*LIST).RAIDGROUP(*LIST).TECH-TYPE	S	NOT-AVAIL SAS NL-SAS SSD SATA MIXED	*THIN-P
RAID level of the RAID group in the thin pool	var(*LIST).RAIDGROUP(*LIST).RAID	S	<c-string 1..2>	*THIN-P
Total size of the thin pool in MB	var(*LIST).THIN-POOL.TOTAL-SIZE	I	<integer 0..2147483647>	*THIN-P
Serial number of the storage system with flex pools	var(*LIST).FLEX-POOL.SERIAL-NO	S	" <c-string 1..16>	*FLEX-P
Name of the flex pool	var(*LIST).FLEX-POOL.NAME	S	" <c-string 1..32>	*FLEX-P
Maximum available size of the flex pool in MB	var(*LIST).FLEX-POOL.ENABLED-SIZE	I	<integer 0..2147483647>	*FLEX-P
Free size of the flex pool in MB	var(*LIST).FLEX-POOL.FREE-SIZE	I	<integer 0..2147483647>	*FLEX-P
Occupancy level of the flex pool in percent.	var(*LIST).FLEX-POOL.PERCENT-FULL	I	<integer 0..100>	*FLEX-P
Threshold value of the flex pool (ATTENTION)	var(*LIST).FLEX-POOL.ATTENTION-LEVEL	I	<integer 0..100>	*FLEX-P
Threshold value of the flex pool (WARNING)	var(*LIST).FLEX-POOL.WARNING-LEVEL	I	<integer 0..100>	*FLEX-P
Status of occupancy level monitoring for the flex pool NORMAL: no threshold value reached ATTENTION: threshold value for ATTENTION reached WARNING: threshold value for WARNING reached	var(*LIST).FLEX-POOL.ALARM-STATUS	S	NORMAL ATTENTION WARNING	*FLEX-P

(part 4 of 5)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Monitoring the flex pool	var(*LIST).FLEX-POOL. FLEX-POOL-MONITORING	S	ON OFF	*FLEX-P
RAID level of the flex pool	var(*LIST).FLEX-POOL.RAID	S	"	*FLEX-P
Disk type of the flex pool	var(*LIST).FLEX-POOL.TECH-TYPE	S	NOT-AVAIL SAS NL-SAS SATA SSD MIXED	*FLEX-P
Number of flex volumes in BS2000	var(*LIST).FLEX-POOL. NUM-BS2-FLEX-DEVS	I	<integer 0..65535>	*FLEX-P
Number of subpools	var(*LIST).FLEX-POOL. NUM-OF-SUBPOOLS	I	<integer 0..256>	*FLEX-P
Name of the subpool in the flex pool	var(*LIST).SUB-POOL(*LIST). NAME	S	" <c-string 1..32>	*FLEX-P
Disk type of the flex subpool	var(*LIST).SUB-POOL(*LIST). TECH-TYPE	S	NOT-AVAIL SAS NL-SAS SATA SSD MIXED	*FLEX-P
RAID level of the flex subpool F: Flexible Tiered Volume	var(*LIST).SUB-POOL(*LIST).RAID	S	" <c-string 1..2>	*FLEX-P
Size of the flex subpool in MB	var(*LIST).SUB-POOL(*LIST). TOTAL-SIZE	I	<integer 0..2147483647>	*FLEX-P
Serial number of the storage system	var(*LIST).REC-BUFF.SERIAL-NO	S	" <c-string 1..16>	*REM-C-B
Serial number of the remote storage system	var(*LIST).REC-BUFF.REMOTE- SERIAL-NO	S	" <c-string 1..16>	*REM-C-B
Name of the remote copy buffer	var(*LIST).REC-BUFF.NAME	S	" <c-string 1..32>	*REM-C-B
Status of the remote copy buffer OK: buffer ready LOST: connection lost ERROR: buffer not ready	var(*LIST).REC-BUFF.STATUS	S	" <c-string 1..16>	*REM-C-B
Use of the remote copy buffer SEND: data transmission RECEIVE: data reception	var(*LIST).REC-BUFF.USAGE	S	" <c-string 1..7>	*REM-C-B
Size of the remote copy buffer in Mbytes	var(*LIST).REC-BUFF.SIZE	I	<integer 0..2147483647>	*REM-C-B
Update interval of the remote copy buffer in seconds	var(*LIST).REC-BUFF.INTERVAL	I	<integer 0..2147483647>	*REM-C-B

(part 5 of 5)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1807	No storage system found
	64	NDE1810	Operating system version not in storage system
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	130	NDE1082	Memory bottleneck during processing of command

SHOW-STORAGE-DEVICE-CONFIG

Displays the device configuration (ETERNUS DX)

Storage system: ETERNUS DX
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
SW-MONITOR-ADMINISTRATION,
HSMS-ADMINISTRATION
Routing code: @

/SHOW-STORAGE-DEVICE-CONFIG provides information on the logical devices of the ETERNUS DX storage system. At least one unit from the storage system must be attached to permit mapping to the BS2000 devices.

The command supports structured output to S variables (for further information, see the manual “Commands” [1]).

SHOW-STORAGE-DEVICE-CONFIG

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-STORAGE(...) /
    list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
    | VOLUME = list-poss(24): <vsn 1..6>

*BY-PUBSET(...)
    | PUBSET = list-poss(24): <cat-id 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | LOGICAL-VOLUME = *ALL / <x-text 1..4>

,SELECT = *ALL-PRESELECTED / *BY-ATTRIBUTES(...)

*BY-ATTRIBUTES(...)
    | CONFIGURATION = *STD / *STORAGE / *RAID-GROUP / *ALL-MIRRORS /
    | *SNAP-PAIRS / *CLONE-PAIRS / *REMOTE-COPY-PAIRS
    | ,DEVICE = *ALL-PRESELECTED / *ALL-DEFINED / *ATTACHED / *DETACHED / *ANY
    | ,TYPE = *ANY / <device>
    | ,RAID-LEVEL = *ANY / *YES / *RAID0 / *RAID1 / *RAID10 / *RAID5 / *RAID6 / *RAID6FR / *NO /
    | *FDEV / *TDEV / *VDEV
    | ,STATE = *ANY / *READY / *NOT-READY / *NO-ACCESS
    | ,SNAP-USE = *ANY / *YES / *ORIGINAL-UNIT / *SNAP-UNIT / *NO
    | ,CLONE-USE = *ANY / *YES / *ORIGINAL-UNIT / *CLONE-UNIT / *NO
    | ,REMOTE-COPY-USE = *ANY / *YES / *SOURCE-UNIT / *TARGET-UNIT / *NO /
    | *CONCURRENT-SOURCE-UNIT

,INFORMATION = *STD / *PHYSICAL / *ALL / *THIN-DEVICES / *FLEX-DEVICES

,UPDATE = *STD / *NO / *DISCOVER

```

UNIT =

Selects the units by means of a particular VSN (***BY-VOLUME**), a particular catalog ID (***BY-PUBSET**), by means of the serial number and the internal number of the logical volume in the storage system (***BY STORAGE**), or directly by means of the logical volume's mnemonic device name.

At least one unit must be attached per storage array.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = list-poss(24): <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. Information is output for all volumes of the specified pubset. IDs of SF pubsets, volume sets or imported SM pubsets can be specified. No information is output for exported SM pubsets.

PUBSET = list-poss(24): <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-STORAGE(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Selects units by means of the mnemonic names of the logical volume.

SELECT =

The set of units can be selected according to the configuration, devices, device type, status, RAID protection and use of local replication.

SELECT = *ALL-PRESELECTED

The set of units is not restricted further. The global setting for SHC-OSD applies (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

SELECT = *BY-ATTRIBUTES(...)

The set of units is restricted by means of selection criteria.

CONFIGURATION =

Selects the configuration to be output.

CONFIGURATION = *STD

If a mnemonic device name, a VSN or a catalog ID was specified for the `UNIT` operand, information is output only for the units specified.

CONFIGURATION = *STORAGE

Outputs information on all units belonging to the storage system selected with `UNIT`.

CONFIGURATION = *RAID-GROUP

Outputs information on the unit selected with `UNIT` and all other logical volumes contained in the same RAID group of a storage system.

This value may only be specified for individual units.

CONFIGURATION = *ALL-MIRRORS

Outputs information only on the unit selected with `UNIT` and its assigned local mirror pairs (clone and snap units), if any exist.

This value may only be specified for individual units.

CONFIGURATION = *SNAP-PAIRS

Outputs information on the unit selected with `UNIT`. If this is a unit from snap pairs, information on the original and snap units is output.

This value may only be specified for individual units.

CONFIGURATION = *CLONE-PAIRS

Outputs information on the unit selected with `UNIT`. If this is a unit from clone pairs, information on the original and clone units is output.

This value may only be specified for individual units.

CONFIGURATION = *REMOTE-COPY-PAIRS

Outputs information on the unit selected with `UNIT`. If this is a unit on remote copy pairs, information on the source and target units is output.

This value may only be specified for individual units.

DEVICE =

Outputs information on units with the specified status in BS2000.

DEVICE = *ALL-PRESELECTED

Outputs information on all units in accordance with the global setting for SHC-OSD (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

DEVICE = *ALL-DEFINED

Selects all units generated in BS2000.

DEVICE = *DETACHED

Selects all units generated in BS2000 which are detached.

DEVICE = *ATTACHED

Selects all units attached in BS2000.

DEVICE = *ANY

Selects all devices of the storage system specified with `UNIT`.

TYPE =

Outputs information only on units with the specified emulated device type.

TYPE = *ANY

Outputs information on all units regardless of their emulated device type.

TYPE = <device>

Outputs information only on specific device types.

Only device types known to the system are accepted. In dialog mode, the valid device types can be displayed with `TYPE=?`. Information can be output only for device types which are emulated in the storage system, in other words for `TYPE=D3435/D3475-8F/STDDISK`.

STATE =

Outputs information only on units with the specified state as seen by the storage system.

STATE = *ANY

Outputs information on all units regardless of their state as seen by the storage system.

STATE = *READY

Outputs information only on units with the state `*READY`.

STATE = *NOT-READY

Outputs information only on units with the state `*NOT-READY`.

STATE = *NO-ACCESS

Outputs information only on units with the `*NO-ACCESS` state.

RAID-LEVEL =

Outputs information only on units with the specified RAID protection.

RAID-LEVEL = *ANY

Outputs information on all units regardless of their RAID protection.

RAID-LEVEL = *YES

Outputs information only on units with RAID protection.

RAID-LEVEL = *RAID0/*RAID1/*RAID10/*RAID5/*RAID6/*RAID6FR

Outputs information only on units with RAID protection according to RAIDx.

RAID-LEVEL = *NO

Outputs information only on units without RAID protection.

RAID-LEVEL = *FDEV

Outputs information only on flex volumes.

RAID-LEVEL = *TDEV

Outputs information only on Thin Provisioned Volumes (TPVs).

RAID-LEVEL = *VDEV

Outputs information only on Snap Data Volumes (SDVs).

SNAP-USE =

Outputs information only on units with the specified use in snap pairs.

SNAP-USE = *ANY

Outputs information on all units irrespective of their use in snap pairs.

SNAP-USE = *YES

Outputs information only on units which form snap pairs (original units and snap units).

SNAP-USE = *ORIGINAL-UNIT

Outputs information only on original units.

SNAP-USE = *SNAP-UNIT

Outputs information only on snap units.

SNAP-USE = *NO

Outputs information only on units which are not used in snap pairs.

CLONE-USE =

Outputs information only on units with the specified use in clone pairs.

CLONE-USE = *ANY

Outputs information on all units irrespective of their use in clone pairs.

CLONE-USE = *YES

Outputs information only on units which form clone pairs (original units and clone units).

CLONE-USE = *ORIGINAL-UNIT

Outputs information only on original units.

CLONE-USE = *CLONE-UNIT

Outputs information only on clone units.

CLONE-USE = *NO

Outputs information only on units which are not used in clone pairs.

REMOTE-COPY-USE =

Outputs information only on units with the specified use in remote copy pairs.

REMOTE-COPY-USE = *ANY

Outputs information on all units irrespective of their use in remote copy pairs.

REMOTE-COPY-USE = *YES

Outputs information only on units which form remote copy pairs (source units and target units).

REMOTE-COPY-USE = *SOURCE-UNIT

Outputs information only on source units.

REMOTE-COPY-USE = *TARGET-UNIT

Outputs information only on target units.

REMOTE-COPY-USE = *NO

Outputs information only on units which are not used in remote copy pairs.

REMOTE-COPY-USE = *CONCURRENT-SOURCE-UNIT

Outputs information only on concurrent source units.

INFORMATION =

Determines the scope of the information which is output.

A header is always output followed by a line with the corresponding values for each unit, see the examples for the command. The information shown always relates to the units selected with `SELECT=`.

INFORMATION = *STD

Global device information is output, e.g. mnemonic name of the logical volume, VSN, BS2000 type, mnemonic name of the emulated controller, state, RAID level, local and remote replication, usable and maximum size of the volume.

INFORMATION = *PHYSICAL

Information on the mnemonic name of the logical volume and its VSN is output, plus information on the connection to the storage system, the channel address which is visible to the server and the affiliation to a RAID group.

The `OWNING CONTR` output displays, also in the case of multipath connection, the so-called "owning controller" of the RAID group (storage pool) to which the volume belongs. The I/Os are always directed over the "owning controller"; I/Os to a non-"owning controller" are forwarded internally to the "owning controller". In the case of thin provisioning there is no information for the "owning controller" as the data can be distributed over multiple pools.

INFORMATION = *ALL

The information on *STD and *PHYSICAL is output.

INFORMATION = *THIN-DEVICES

Outputs information on Thin Provisioned Volumes (TPVs).

INFORMATION = *FLEX-DEVICES

When Automated Storage Tiering (AST) is used, the information on the devices of the flex pools is displayed.

UPDATE =

Controls updating of the configuration data provided.

UPDATE = *STD

The configuration data is updated in SHC-OSD before the SHOW command is executed.

UPDATE = *NO

The SHOW command is executed without the configuration data being updated in SHC-OSD.

UPDATE = *DISCOVER

Before the SHOW command is executed, the configuration data of the storage system is updated in CIMOM, StorMan and SHC-OSD. This enables you to recognize that it is available again after a crash and configuration changes to the storage system. The update processes of the instances involved run asynchronously. The current configuration data may therefore possibly not be available when the command terminates, but only with a delay.

Examples

/SHOW-STORAGE-DEVICE-CONFIG UNIT=9A40, INFORMATION=*STD

UNIT	VOL	TYPE	SERIAL-NO	LOG- VOLUME	STA TYPE	TIER	RAID	REM COPY	LOC COPY	SIZE: CURR/MAX.
9A40	S3SN.0	D3435	4621347002	00102	RDY	SAS	1	C	U/U	3600/3600 MB

```
/SHOW-STORAGE-DEVICE-CONFIG UNIT=9A40, INFORMATION=*ALL
```

```
%-----
% UNIT VOL TYPE SERIAL-NO LOG- STA TIER RAID REM LOC SIZE:
% VOLUME TYPE COPY CURR/MAX.
%=====
% 9A40 S3SN.0 D3435 4621347002 00102 RDY SAS 1 C U/U 3600/3600 MB
%-----
% UNIT VOL !HOST-LUN! POOL-NAME !OWNING-CONTR
%=====
% 9A40 S3SN.0! 40 ! RG900_05 !CM01
```

```
/SHOW-STORAGE-DEVICE-CONFIG SERIAL-NUMBER=9005,
INFORMATION=*THIN-DEVICES
```

```
%-----
% UNIT VOL SERIAL-NO !THIN-POOL-NAME !STA!TIER! CAPACITY:
% ! !TYPE! ALLOC/CURR./CONFIG.
%=====
% 9C80 F-9C80 4621349005!TPP900_06 !RDY!SAS ! 0/ 3600/ 3600 MB
% 9C81 F-9C81 4621349005!TPP900_06 !RDY!SAS ! 3612/ 3600/ 3600 MB
% 9C82 4621349005!TPP900_06 !N-R!SAS ! 0/ - / 3600 MB
% 9C83 DK01.3 4621349005!TPP900_06 !RDY!SAS ! 84/ 2880/ 3600 MB
```

```
/SHOW-STORAGE-DEVICE-CONFIG SERIAL-NUMBER=9005,
RAID-LEVEL=*TDEV, DEVICE=*ANY
```

```
%-----
% UNIT VOL TYPE SERIAL-NO LOG- STA TIER RAID REM LOC SIZE:
% VOLUME TYPE COPY CURR/MAX.
%=====
% 9C80 F-9C80 D3435 4621349005 00142 RDY SAS T T -/- 3600/3600 MB
% 9C81 F-9C81 D3435 4621349005 00143 RDY SAS T - -/- 3600/3600 MB
% 9C82 D3435 4621349005 00144 N-R SAS T T -/- - /3600 MB
% 9C83 DK01.3 D3435 4621349005 00145 RDY SAS T - -/- 2880/3600 MB
```

```
/SHOW-STORAGE-DEVICE-CONFIG SERIAL-NUMBER=1008,
INFORMATION=*FLEX-DEVICES
```

```
%-----
% UNIT VOL SERIAL-NO !FLEX-POOL-NAME !STA!TIER! CAPACITY:
% ! !TYPE! ALLOC/CURR./CONFIG.
%=====
% BDF6 F-BDF6 4621351008!FTV_Poo1_1 !RDY!MIX ! 0/ 3600/ 3600 MB
% BDF7 F-BDF7 4621351008!FTV_Poo1_1 !RDY!MIX ! 0/ 3600/ 3600 MB
% BDF8 F-BDF8 4621351008!FTV_Poo1_1 !RDY!MIX ! 0/ 3600/ 3600 MB
```

```
/SHOW-STORAGE-DEVICE-CONFIG SERIAL-NUMBER=1008,
RAID-LEVEL=*FDEV, DEVICE=*ANY
```

```
%-----
% UNIT VOL TYPE SERIAL-NO LOG- STA TIER RAID REM LOC SIZE:
% VOLUME TYPE COPY CURR/MAX.
%=====
% BDF6 F-BDF6 D3435 4621351008 0043C RDY MIX F - -/- 3600/3600 MB
% BDF7 F-BDF7 D3435 4621351008 0043D RDY MIX F - -/- 3600/3600 MB
% BDF8 F-BDF8 D3435 4621351008 0043E RDY MIX F - -/- 3600/3600 MB
```


Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
CAPACITY_USED/ CURR./CONFIG.	Capacity of the device: used / available / configured	*THIN-D *FLEX-D
FLEXPOOLNAME	Name of the flex pool in which the device is located	*FLEX-D
HOST-LUN	Channel address visible to the server (host LUN)	*PHYS *ALL
LOC-COPY	Local unit U/- Original unit of a SNAP session S/- Snap unit of a SNAP session -/U Original unit of a clone session -/C Clone unit of a clone session -/B Original unit and clone unit of cascaded clone sessions U/U Original unit with snap and clone session	*STD *ALL
LOG-VOLUME	Internal number of the logical volume in the storage system	*STD *ALL
OWNING-CONTR	"Owning controller" of the RAID group to which the volume belongs	*PHYS *ALL
RAID-GROUP-ID	Affiliation to a RAID group	*PHYS *ALL
RAID	RAID level 0 RAID0 1 RAID1 3 RAID3 5 RAID5 6 RAID6 6F RAID6-FR (Fast Recovery) 10 RAID10 - No RAID protection F Flexible Tiered Volume (FTV) T Thin Provisioned Volume (TPV) V Snap Device Volume (SDV)	*STD *ALL
REM-COPY	Remote unit S source unit T target unit C Concurrent remote copy (more than one target unit) - No remote copy mode	*STD *ALL

(part 1 of 2)

Keyword	Meaning	with INF =
SERIAL-NO	Serial number of the storage system	*STD *ALL *THIN-D *FLEX-P
SIZE: CURR/MAX.	Usable and maximum size of the volume in MB or GB (from 10 GB)	*STD *ALL
STA	Device state of logical unit (as seen by the server) RDY Device ready N-R Device not ready R-O Only read access possible (read only, cannot be used in BS2000) DIS Neither read nor write access possible to device (disabled) NAC No access possible; previous state is displayed (no access)	*STD *ALL *THIN-D *FLEX-D
THINPOOLNAME	Name of the TPP in which the TPV is located	*THIN-D
TIER TYPE	Physical disk properties FC Fibre Channel SSD Solid State Disk (Flash Disk) SAS SAS Disk NSAS Nearline SAS Disk SATA SATA Disk - Type unknown	*STD *ALL *THIN-D *FLEX-D
TYPE	BS2000 device type (D3435 or D3475-8F)	*STD *ALL
UNIT	MN of the logical device or # followed by the 4-digit logical volume number if no assignment in BS2000 is possible.	*STD *PHYS *ALL *THIN-D *FLEX-D
VOL	VSN of the (logical) volume or <empty> if no assignment is possible in BS2000.	*STD *PHYS *ALL *THIN-D *FLEX-D

(part 2 of 2)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Clone functionality ORIGINAL-UNIT: unit CLONE-UNIT: clone unit CASCADING-CLONE: cascaded clone sessions; device is both original unit and clone unit	var(*LIST).CLONE-USE	S	" ORIGINAL-UNIT CLONE-UNIT CASCADING-CLONE	*STD / *ALL
Usable size of the volume in Mbytes	var(*LIST).CURR-SIZE	I	<integer 0..2147483647>	*STD / *ALL
LUN visible to the server LUN (host LUN)	var(*LIST).HOST-LUN	S	" <c-string 1..8>	*PHYS *ALL
Internal number of the logical volume	var(*LIST).LOGIC-VOL	S	" <c-string 1..5>	*STD / *ALL *THIN-D *FLEX-D
Maximum size of the volume in Mbytes	var(*LIST).MAX-SIZE	I	<integer 0..2147483647>	*STD / *ALL
RAID level 0: RAID0 1: RAID1 3: RAID3 5: RAID5 6: RAID6 6F: RAID6-FR (Fast Recovery) 10: RAID10 ": No RAID protection FDEV: Flexible Tiered Volume (FTV) TDEV: Thin Provisioned Volume (TPV) VDEV: Snap Device Volume (SDV)	var(*LIST).RAID	S	" RAID0 RAID1 RAID3 RAID5 RAID6 RAID6F RAID10 FDEV TDEV VDEV	*STD / *ALL *THIN-D *FLEX-D
RAID group F: Flexible Tiered Volume	var(*LIST).RAID-GROUP-ID	S	" <c-string 1..12>	*PHYS *ALL
Remote copy mode (REC) SOURCE-UNIT: source unit TARGET-UNIT: target unit ": No remote copy mode	var(*LIST).REM-COPY	S	" SOURCE-UNIT TARGET-UNIT	*STD / *ALL
Remote copy mode (REC) CONCURRENT-S: Source unit with multiple target units	var(*LIST).ADD-REM-COPY-FEAT	S	" CONCURRENT-S	*STD / *ALL
Serial number	var(*LIST).SERIAL-NO	S	" <c-string 1..14>	*STD / *ALL *PHYS *THIN-D *FLEX-D

(part 1 of 2)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Snap functionality ORIGINAL-UNIT: unit SNAP-UNIT: snap unit	var(*LIST).SNAP-USE	S	" ORIGINAL-UNIT SNAP-UNIT	*STD / *ALL
Device status *READY: Device ready for operation *NOT-READY: Device not ready for operation *READ-ONLY: Read access only (not usable in BS2000) *DISABLE: Neither read nor write access possible to device *NO-ACCESS: Access not possible; previous state is displayed	var(*LIST).STA	S	*READY *NOT-READY *READ-ONLY *DISABLE *NO-ACCESS *UNKNOWN	*STD / *ALL *THIN-D *FLEX-D
Physical disk properties (tiering)	var(*LIST).TIER-TYPE	S	Fibre-Channel SATA SSD SAS NL-SAS MIXED UNKNOWN	*STD / *ALL *THIN-D *FLEX-D
Emulated device type	var(*LIST).TYPE	S	D3435 D3475-8F	*STD / *ALL
MN of the logical volume	var(*LIST).UNIT	S	" <mnemo-name>	*STD / *ALL *PHYS *THIN-D *FLEX-D
VSN of the logical volume	var(*LIST).VOL	S	" <vsn>	*STD / *ALL *PHYS *THIN-D *FLEX-D
Controller of the storage system which uses the volume	var(*LIST).OWNING-CONTROLLER	S	" <c-string 1..6>	*PHYS *ALL
Used capacity of the device in MB	var(*LIST).USED-SIZE	I	<integer 0..2147483647>	*THIN-D *FLEX-D
Available capacity of the device in MB	var(*LIST).CURR-SIZE	I	<integer 0..2147483647>	*THIN-D *FLEX-D
Configured capacity of the device in MB	var(*LIST).CONFIG-SIZE	I	<integer 0..2147483647>	*THIN-D *FLEX-D
Name of the pool in which the device is located	var(*LIST).POOL-NAME	S	" <c-string 1..12>	*PHYS *ALL *FLEX-D

(part 2 of 2)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1001	Device not attached
	64	NDE1003	Volume not online
	64	NDE1004	Pubset not online
	64	NDE1100	Invalid pubset state
	64	NDE1125	Initialization of storage system information running
	64	NDE1126	Device unknown or storage system not supported
	64	NDE1127	Device of a storage system is not supported
	64	NDE1128	At least one unit from system is not of the type SymmetrixVMAX3
	64	NDE1800	Device not found or not in the storage system
	64	NDE1810	Operating system version not in storage system
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1828	At least one element found for a storage system
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	130	NDE1082	Memory bottleneck during processing of command

SHOW-SYMMETRIX-CONFIGURATION

Displays the configuration (Symmetrix/VMAX3)

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
 SW-MONITOR-ADMINISTRATION,
 HSMS-ADMINISTRATION
Routing code: @

/SHOW-SYMMETRIX-CONFIGURATION provides information on the configuration of the Symmetrix/VMAX3 storage systems.

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-SYMMETRIX-CONFIGURATION

UNIT = *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) / *ALL

***BY-CONTROLLER(...)**

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

***BY-SYMMETRIX(...)**

SERIAL-NUMBER = <alphanum-name 3..12>

,INFORMATION = *STD / *DIRECTORS / *LOCKS / *ALL / *REMOTE-LINK-DIRECTORS / *SAVE-POOLS / *THIN-POOLS

,REMOTE-CONFIGURATION = *NO / *YES

,UPDATE = *STD / *NO / *DISCOVER

UNIT =

Selects units by means of the mnemonic name of the emulated controller (***BY-CONTROLLER**) or the serial number of the storage system (***BY-SYMMETRIX**) or selection of all Symmetrix systems (***ALL**).

At least one unit must be attached per emulated controller.

UNIT = *BY-CONTROLLER(...)

Mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Selects the units by means of the serial number of the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

UNIT = *ALL

Output for all systems known to the host.

INFORMATION =

Determines the output volume, see the examples for the command.

INFORMATION = *STD

Outputs global information.

INFORMATION = *DIRECTORS

Outputs information on the directors and ports.

INFORMATION = *LOCKS

Outputs the global Symmetrix locks and associated RA groups. The **INFORMATION=*LOCKS** operand is supported only in combination with **UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=<alphanum-name 3..12>)**.

INFORMATION = *ALL

Outputs all information specified for ***STD** and ***DIRECTORS**.

INFORMATION = *REMOTE-LINK-DIRECTORS

Outputs information on the remote link directors. Information on all connected remote storage systems is output for each remote link director. This information is particularly important for supporting switched SRDF configurations in which several remote storage systems can be connected via a remote link director using several RA groups.

INFORMATION = *SAVE-POOLS

When TimeFinder/Snap (Symmetrix) is used, information about the save pools is output. VMAX3 has no save pools.

INFORMATION = *THIN-POOLS

When virtual provisioning is used, information on the thin pools is output.

REMOTE-CONFIGURATION =

Specifies whether information is output only for local or also for remote storage systems.

REMOTE-CONFIGURATION = *NO

The information is output only for local storage systems which can be reached directly.

REMOTE-CONFIGURATION =*YES

The information is output for local storage systems which can be reached directly and storage systems which can be reached over remote connections.

UPDATE =

Controls updating of the configuration data provided.

UPDATE = *STD

The configuration data is updated in SHC-OSD before the SHOW command is executed.

UPDATE = *NO

The SHOW command is executed without the configuration data being updated in SHC-OSD.

UPDATE = *DISCOVER

Before the SHOW command is executed, the configuration data of the storage system and in SHC-OSD is updated. This enables you to recognize that it is available again after a crash and configuration changes to the storage system.

Examples

```
/SHOW-SYMMETRIX-CONFIGURATION SERIAL-NUMBER=293, INFORMATION=*STD
```

```

% -----
% CONTR-UNIT TYPE          SERIAL-NO    CACHE-    EMUL-    ENGINEUITY  HOST-    #LOG-
%                               SIZE      TYPE      VERSION   ACCESS  VOLS
% =====
% 4600, 4601 VMAX100K 000296800293  225 GB   3860-51  5977/596  DIRECT  1079
% 4602, 4603
% 4700, 4701
% -----

```


/SHOW-SYMMETRIX-CONFIGURATION CONTROLLER-UNIT=293, INFORMATION=*DIRECTORS

```

% -----
% SERIAL-NO / !DIRECTOR:
% CONTR-UNIT !NO TYPE STATE PORT-CONNECTIONS (PORT 0-31)
% =====
% 000296800293! 1A IM ENABLE -----
% 4600, 4601 ! 2A IM ENABLE -----
% ! 1B ES ENABLE -----
% ! 2B ES ENABLE -----
% ! 1C DA ENABLE -----
% ! 2C DA ENABLE -----
% ! 1D FC ENABLE ----- YYY- -YY- ----- YYY YYYN
% ! 2D FC ENABLE ----- YYY- -YY- ----- YYY YYYN
% ! 1E RA ENABLE ----- Y--Y -----
% ! 2E RA ENABLE ----- Y--Y -----
% -----
    
```

/SHOW-SYMMETRIX-CONFIGURATION SERIAL-NUMBER=293,
INFORMATION=*REMOTE-LINK-DIRECTORS

```

% -----
% SERIAL-NO / !DIRECTOR: PORT: !RA-GROUP: !REMOTE
% CONTR-UNIT !DIR:PORT STATE CONN TYP!LABEL TYP LOC REM!SERIAL-NO
% =====
% 000296800293! 1E:8 ENABLE Y F ! - - - !
% 4600, 4601 ! 1E:11 ENABLE Y F !RDF293-294 D 1 1!000296800294
% ! !RDF293-225 D 22 22!000192601225
% ! !293-294-AS D 99 99!000296800294
% ! 2E:8 ENABLE Y F ! - - - !
% ! 2E:11 ENABLE Y F !RDF293-294 D 1 1!000296800294
% ! !RDF293-225 D 22 22!000192601225
% ! !293-294-AS D 99 99!000296800294
% -----
    
```

/SHOW-SYMMETRIX-CONFIGURATION SERIAL-NUMBER=224, INFORMATION=*SAVE-POOLS

```

% -----
% SERIAL-NO !SAVE-POOL NAME !DEV ENABLED FREE FULL STA
% ! !EMUL SIZE SIZE (%)
% =====
% 000192601224!DEFAULT_POOL !FBA 240 GB 240 GB 0 ENA
    
```

/SHOW-SYMMETRIX-CONFIGURATION SERIAL-NUMBER=293, INFORMATION=*THIN-POOLS

```

% -----
% SERIAL-NO ! POOL-NAME !EMUL TYPE!VIRTUAL REAL !#BS2-VOL #DATA-DEV!MON
% ! !RAID !ENABLED FREE !FULL #ENA-DEV !STA
% =====
% 000296800293!DG1_FBA10K !FBA FC ! 715 GB 4292 GB! 36 128 !ON
% ! ! 1 !4292 GB 3793 GB! 11% 128 !ENA
% 000296800293!DG2_FBA10K !FBA FC ! 0 MB 6438 GB! 0 64 !OFF
% ! ! 5 !6438 GB 6438 GB! 0% 64 !ENA
% 000296800293!DG3_FBA10K !FBA FC ! 0 MB 6438 GB! 0 32 !OFF
% ! ! 6 !6438 GB 6438 GB! 0% 32 !ENA
% 000296800293!DG4_FBA_F !FBA SSD ! 431 GB 1100 GB! 124 16 !ON
% ! ! 5 !1100 GB 942 GB! 14% 16 !ENA
    
```

Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
CACHE-SIZE	Cache size in MB or GB	*STD *ALL
CONTR-UNIT	MNs of the (first) emulated controller	*STD *DIR *ALL *R-L-DIR
DEV EMUL	Emulation type of the save pool FBA Save pool for FBA snap devices	*SAVE-P
DIRECTOR: DIR:PORT	Name of the director (1A...16A, 1B...16B, ..., 1H...16H) and the port number (0...31), separated by a colon	*R-L-DIR
DIRECTOR: STATE	State of the director. ENABLE: Director activated and connected DISABLE: Director deactivated or not connected	*ALL *DIR *R-L-DIR
DIRECTOR: NO	Name of the director (1A...16A, 1B...16B, ..., 1H...16H)	*DIR *ALL
DIRECTOR: PORT-CONNECTIONS (PORT 0-31)	Port connected (32 ports per director in groups of 4 ports) (Y / N / -)	*DIR *ALL
DIRECTOR: TYPE	Director type EF Adapter for type-F channel SA SCSI adapter RA Remote adapter DA Disk adapter FC Fibre Channel adapter MC Memory GE Gigabit Ethernet BC BCS Director ED External Director IM Infrastructure Manager Director (VMAX3) ES Enginuity Data Services Director (VMAX3)	*DIR *ALL
EMUL	Emulation type of the thin pool FBA Thin pool for FBA devices	*THIN-P
EMUL-TYPE	Type of the emulated controller	*STD *ALL
ENABLED	Available size of the thin pool in MB or GB	*THIN-P
ENABLED SIZE	Available size of the save pool in MB or GB (Symmetrix)	*SAVE-P

(part 1 of 3)

Keyword	Meaning	with INF =
ENGINUITY VERSION	Enginuity version (family/patch level)	*STD *ALL
FREE SIZE	Free size of the save pool in MB or GB (Symmetrix)	*SAVE-P
FREE	Free size of the thin pool in MB or GB	*THIN-P
FULL (%)	Occupancy level of the save pool or thin pool in percent	*SAVE-P *THIN-P
GR-NO	RA group of the remote link directors (decimal 1 through 250 or ' - ')	*LOCKS
HOST-ACCESS	Access from host to storage system DIRECT Directly via a connected unit REMOTE Via the SRDF partner's remote connection NO Access not currently possible IN-DEL No access possible and no BS2000 devices are configured on the storage system; the storage system is removed from the configuration if it is not made known to SYMAPI again within the wait time NO-SUP The storage system is not supported	*STD *ALL
LOCKED-SINCE	Time for which lock has been held, format: DDDD.HH:MM:SS	*LOCKS
MON	Monitoring display for the occupancy level of the thin pool ON Thin pool is monitored OFF Thin pool is not monitored	*THIN-P
POOL-NAME	Name of the thin pool	*THIN-P
PORT: CONN	Port connected (up to 32 per director) (Y / N / -)	*R-L-DIR
PORT: TYP	Type of the remote link director. F Fibre Channel adapter I SRDF over IP adapter	*R-L-DIR
RAID	RAID type of the thin pool	*THIN-P
REAL	Real total size of the thin pool in MB or GB	*THIN-P
RA-GROUP: LOC	Local RA group of the remote link (decimal 1 through 250 or ' - ')	*R-L-DIR
RA-GROUP: REM	Remote RA group of the remote link (decimal 1 through 250 or ' - ')	*R-L-DIR
RA-GROUP: LABEL	Internal label of the RA group	*R-L-DIR
RA-GROUP: TYP	Type of the RA group S Static RA group D Dynamically managed RA group	*R-L-DIR

(part 2 of 3)

Keyword	Meaning	with INF =
REMOTE SERIAL-NO	Serial number of the storage system connected via SRDF	*R-L-DIR
SAVE-POOL NAME	Name of the save pool (Symmetrix)	*SAVE-P
SERIAL-NO	Serial number of the storage system	*STD *ALL *LOCKS *R-L-DIR *SAVE-P *THIN-P
STA	Status of the save pool or thin pool ENA Enabled = Pool usable DIS Disabled = Pool not usable	*SAVE-P *THIN-P
TYP	see PORT:TYP	
TYPE	Type of storage system	*STD *ALL
	Disk type of the thin pool FC Fibre Channel SSD Solid State Disk (Flash Disk) SAS SAS Disk SATA SATA Disk MIX Mixed N-A Not applicable	*THIN-P
VIRTUAL	Virtual size of the thin pool in MB or GB	*THIN-P
#BS2-VOL	Number of BS2000 volumes in the thin pool "0" is output for VMAX3 as all Thin Provisioned Volumes without unique assignment are configured in thin pools.	*THIN-P
#DATA-DEV	Number of assigned data devices	*THIN-P
#ENA-DEV	Number of usable data devices (enabled)	*THIN-P
#LOG-VOLS	Number of BS2000 volumes in the storage system	*STD *ALL

(part 3 of 3)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Cache size in Mbytes	var(*LIST).CACHE-SIZE	I	<integer 0..2147483647>	*STD *ALL
MN of the first emulated controller or the channel	var(*LIST).CONTR-UNIT1	S	" <mnemo-name>	*DIR *ALL *R-L-DIR
MN of the second emulated controller or of the channel	var(*LIST).CONTR-UNIT2	S	" <mnemo-name>	*DIR *ALL *R-L-DIR
MN of the emulated controller	var(*LIST).CONTR-UNIT(*LIST)	S	" <mnemo-name>	*STD *ALL
Name of the director	var(*LIST).DIR(*LIST).DIR-NO	S	<1A...16A> <1B...16B> ... <1H...16H>	*DIR *LOCKS *ALL *R-L-DIR
The following var(*LIST).DIR(*LIST).PORT-CONNECTIONn output exists n times (n=0..32) per director				
Port n connected.	var(*LIST).DIR(*LIST). PORT-CONNECTIONn	S	" Y N	*DIR *LOCKS *ALL
Port connected with director	var(*LIST).DIR(*LIST). PORT-CONNECTION	S	" Y N	*R-L-DIR
State of the director. *ENABLE: director activated and connected *DISABLE: director deactivated or not connected.	var(*LIST).DIR(*LIST).STA	S	*ENABLE *DISABLE	*DIR *LOCKS *ALL *R-L-DIR
Remote serial number	var(*LIST).DIR(*LIST). REM-SERIAL-NO	S	" <c-string 1..12>	*DIR *LOCKS *ALL
Time since when the lock has been held DDDD:HH:MM:SS	var(*LIST).DIR(*LIST). LOCKED-SINCE	S	" <c-string 13..13>	*DIR *LOCKS *ALL
RA group(decimal)	var(*LIST).DIR(*LIST).GROUP-NO	I	<integer 0..250>	*DIR *LOCKS *ALL
Local RA group (decimal)	var(*LIST).DIR(*LIST). GROUP(*LIST).LOC-GROUP-NO	I	<integer 0..250>	*R-L-DIR
Remote RA group (decimal)	var(*LIST).DIR(*LIST). GROUP(*LIST).REM-GROUP-NO	I	<integer 0..250>	*R-L-DIR
Label of the RA group	var(*LIST).DIR(*LIST). GROUP(*LIST).RA-GROUP-LABEL	S	" <c-string 1..10>	*R-L-DIR

(part 1 of 4)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Type of the RA group	var(*LIST).DIR(*LIST). GROUP(*LIST).RA-GROUP-TYPE	I	STATIC DYNAMIC	*R-L-DIR
Serial number of the remote storage system	var(*LIST).DIR(*LIST). GROUP(*LIST).REM-SERIAL-NO	S	" <c-string 1..12>	*R-L-DIR
Type of the remote link director. *F: Fibre Channel *I: SRDF over IP	var(*LIST).DIR(*LIST).RLD-TYPE	S	" *F *I	*DIR *ALL *R-L-DIR
Director type *SA: SCSI adapter *RA: Remote adapter *DA: Disk adapter *FC: Fibre Channel adapter *MC: Memory *GE: Gigabit Ethernet *BC: BCS Director *ED: External Director *IM: Infrastructure Manager Director (VMAX3) *ES: Enginuity Data Services Director (VMAX3)	var(*LIST).DIR(*LIST).TYPE	S	*SA *RA *DA *FC *MC *GE *BC *ED *IM *ES	*DIR *LOCKS *ALL *R-L-DIR
Type of the emulated controller	var(*LIST).EMULATED-TYPE	S	3860-51 2105	*STD *ALL
Emulation type of the save pool (Symmetrix)	var(*LIST).SAVE-POOL.TYPE	S	FBA	*SAVE-P
Available size of the save pool in MB (Symmetrix)	var(*LIST).SAVE-POOL. ENABLED-SIZE	I	<integer 0..2147483647>	*SAVE-P
Free size of the save pool in MB (Symmetrix)	var(*LIST).SAVE-POOL.FREE-SIZE	I	<integer 0..2147483647>	*SAVE-P
Access from host *DIRECT: direct access *REMOTE: remote access *NO: no access *IN-DELETE: no access - will be terminated *NO-SUPPORT: Enginuity too low	var(*LIST).HOST-ACCESS	S	*DIRECT *REMOTE *NO *IN-DELETE *NO-SUPPORT	*STD *ALL
Enginuity version (family)	var(*LIST).MICROCODE-LEVEL	S	<c-string 1..4>	*STD *ALL
Enginuity version (patch level)	var(*LIST).PATCH-LEVEL	S	<c-string 1..4>	*STD *ALL
Occupancy level of the save pool in percent (Symmetrix)	var(*LIST).SAVE-POOL. PERCENT-FULL	I	<integer 0..100>	*SAVE-P
Status of the save pool (Symmetrix)	var(*LIST).SAVE-POOL.STA	S	ENABLED DISABLED	*SAVE-P
Name of the save pool (Symmetrix)	var(*LIST).SAVE-POOL.NAME	S	" <c-string 1..32>	*SAVE-P

(part 2 of 4)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Serial number	var(*LIST).SERIAL-NO	S	<c-string 1..12>	*STD *ALL *DIR *R-L-DIR
Serial number (Symmetrix)	var(*LIST).SAVE-POOL.SERIAL-NO	S	" <c-string 1..12>	*SAVE-P
Real total size of the save pool in MB (Symmetrix)	var(*LIST).SAVE-POOL.TOTAL-SIZE	I	<integer 0..2147483647>	*SAVE-P
Type of storage system	var(*LIST).TYPE	S	" <c-string 1..8>	*STD *ALL
Used size of the save pool (Symmetrix)	var(*LIST).SAVE-POOL.USED-SIZE	I	<integer 0..2147483647>	*SAVE-P
Number of logical volumes of the storage system	var(*LIST).NUM-OF-LOG-VOLS	I	<integer 0..1048575>	*STD *ALL
Emulation type of the thin pool	var(*LIST).THIN-POOL.TYPE	S	FBA	*THIN-P
Available size of the thin pool in MB	var(*LIST).THIN-POOL. ENABLED-SIZE	I	<integer 0..2147483647>	*THIN-P
Free size of the thin pool in MB	var(*LIST).THIN-POOL.FREE-SIZE	I	<integer 0..2147483647>	*THIN-P
Occupancy level of the thin pool in percent	var(*LIST).THIN-POOL. PERCENT-FULL	I	<integer 0..100>	*THIN-P
Status of the thin pool	var(*LIST).THIN-POOL.STA	S	ENABLED DISABLED	*THIN-P
Name of the thin pool	var(*LIST).THIN-POOL.NAME	S	" <c-string 1..32>	*THIN-P
Serial number	var(*LIST).THIN-POOL.SERIAL-NO	S	" <c-string 1..12>	*THIN-P
Real total size of the thin pool in MB	var(*LIST).THIN-POOL.TOTAL-SIZE	I	<integer 0..2147483647>	*THIN-P
Virtual size of the thin pool in MB	var(*LIST).THIN-POOL. VIRTUAL-SIZE	I	<integer 0..2147483647>	*THIN-P
RAID type of the thin pool *1 : RAID1 *5 : RAID5 *6 : RAID6	var(*LIST).THIN-POOL.RAID	S	" <c-string 1..2>	*THIN-P
Number of data devices	var(*LIST).THIN-POOL. NUM-OF-DATA-DEVS	I	<integer 0..65535>	*THIN-P
Number of available data devices	var(*LIST).THIN-POOL. NUM-ENA-DATA-DEVS	I	<integer 0..65535>	*THIN-P

(part 3 of 4)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Disk type of the thin pool	var(*LIST).THIN-POOL. TECH-TYPE	S	NOT-AVAIL SAS SATA SSD MIXED FIBRE-CHAN NL-SAS	*THIN-P
Number of generated BS2000 volumes in the thin pool	var(*LIST).THIN-POOL. NUM-BS2-THIN-DEVS	I	<integer 0..65535>	*THIN-P
Monitoring the thin pool	var(*LIST).THIN-POOL. THIN-POOL-MONITORING	S	ON OFF	*THIN-P

(part 4 of 4)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1002	Controller not found
	64	NDE1007	No controller found in the storage system
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1150	No gatekeeper device found
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command

SHOW-SYMMETRIX-DEVICE-CONFIG

Displays the device configuration (Symmetrix/VMAX3)

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS, OPERATING, HW-MAINTENANCE,
SW-MONITOR-ADMINISTRATION,
HSMS-ADMINISTRATION
Routing code: @

/SHOW-SYMMETRIX-DEVICE-CONFIG provides information on the logical devices of the Symmetrix/VMAX3 storage systems.

At least one unit of the storage system must be attached.

The command supports structured output to S variables (for further information, see the manual "Commands" [1]).

SHOW-SYMMETRIX-DEVICE-CONFIG

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
      list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = list-poss(24): <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = list-poss(24): <cat-id 1..4>

*BY-CONTROLLER(...)
  | CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | LOGICAL-VOLUME = *ALL / *BY-RA-GROUP(...) / *BY-POOLNAME(...) / <x-text 1..5>
    | *BY-RA-GROUP(...)
      | RA-GROUP = <integer 1..250>
    | *BY-POOLNAME(...)
      | POOLNAME = <name 1..32>

,SELECT = *ALL-PRESELECTED / *BY-ATTRIBUTES(...)

*BY-ATTRIBUTES(...)
  | CONFIGURATION = *STD / *CONTROLLER / *SUBSYSTEM / *REMOTE-COPY-PAIRS /
    | *MULTI-MIRROR-PAIRS / *ALL-MIRRORS / *PHYSICAL-DISK /
    | *META-MEMBERS / *SNAP-PAIRS / *CLONE-PAIRS
  | ,DEVICE = *ALL-PRESELECTED / *ALL-DEFINED / *ATTACHED / *DETACHED / *ANY
  | ,TYPE = *ANY / <device> / *GATE-KEEPER / *SAVE-DEV / *DATA-DEV
  | ,RAID-LEVEL = *ANY / *YES / *RAID1 / *RAID5 / *RAID6 / *RAID10 / *NO / *VDEV / *TDEV
  | ,STATE = *ANY / *READY / *NOT-READY / *DISABLE / *READ-ONLY / *NO-ACCESS
  | ,REMOTE-COPY-USE = *ANY / *YES / *SOURCE-UNIT / *TARGET-UNIT / *NO /
    | *CONCURRENT-SOURCE-UNIT / *DYNAMIC /
    | *DYNAMIC-IN-USE / *DYNAMIC-UNUSED
  | ,MULTI-MIRROR-USE = *ANY / *YES / *NORMAL-UNIT / *ADD-MIRROR-UNIT / *NO
  | ,SNAP-USE = *ANY / *YES / *ORIGINAL-UNIT / *SNAP-UNIT / *NO
  | ,CLONE-USE = *ANY / *YES / *ORIGINAL-UNIT / *CLONE-UNIT / *NO

,INFORMATION = *STD / *PHYSICAL / *ALL / *LOGICAL-VOLUME-NUMBER / *LOCKED-DEVICES /
              *THIN-DEVICES / *DATA-DEVICES

,UPDATE = *STD / *NO / *DISCOVER

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name. At least one unit must be attached per emulated controller.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = list-poss(24): <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. Information is output for all volumes of the specified pubset. IDs of SF pubsets, volume sets or imported SM pubsets can be specified. No information is output for exported SM pubsets.

PUBSET = list-poss(24): <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system or the logical volume's RA group.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL

Selects all logical volumes of the storage system.

LOGICAL-VOLUME = *BY-RA-GROUP(...)

Selects the units by means of the RA group.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the units.

LOGICAL-VOLUME = *BY-POOLNAME(...)

Selects the units by means of the associated thin pool for virtual provisioning.

POOLNAME = <name 1..32>

Specifies the pool names of the thin pools for selecting the units.

For VMAX3 only those volumes are selected which were supplied exclusively from the specified thin pool as no permanent assignment exists between volume and thin pool.

LOGICAL-VOLUME = <x-text 1..5>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(24): <alphanum-name 2..2> / <x-text 4..4>

Selects units by means of the mnemonic names of the logical volume.

SELECT =

The set of units can be selected on the basis of the configuration, device, device type, state, RAID protection, remote copy use and multi-mirror use.

SELECT = *ALL-PRESELECTED

The set of units is not restricted further. The global setting for SHC-OSD applies (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

SELECT = *BY-ATTRIBUTES(...)

The set of units is restricted by means of selection criteria.

CONFIGURATION =

Selects the configuration to be output.

CONFIGURATION = *STD

If a mnemonic device name, a VSN or a catalog ID was specified for the `UNIT` operand, information is output only for the units specified.

If an emulated controller was specified for the `UNIT` operand, information is output for all units that belong to the controller.

CONFIGURATION = *CONTROLLER

Outputs information on all units belonging to the controllers selected with `UNIT`.

This value must not be used in conjunction with `DEVICE=*ANY`.

CONFIGURATION = *SUBSYSTEM

Outputs information on all units belonging to the storage systems selected with `UNIT`.

CONFIGURATION = *REMOTE-COPY-PAIRS

Outputs information only on units selected with UNIT and on any remote copy pairs allocated to them.

This value must not be used in conjunction with UNIT=*BY-CONTROLLER or LOGICAL-VOLUME=*ALL.

CONFIGURATION = *MULTI-MIRROR-PAIRS

Outputs information only on units selected with UNIT and on any multi-mirror pairs allocated to them.

This value must not be used in conjunction with UNIT=*BY-CONTROLLER or LOGICAL-VOLUME=*ALL.

CONFIGURATION = *ALL-MIRRORS

Outputs information only on units selected with UNIT and on any remote copy pairs and TimeFinder pairs allocated to them.

This value must not be used in conjunction with UNIT=*BY-CONTROLLER or LOGICAL-VOLUME=*ALL.

CONFIGURATION = *PHYSICAL-DISK

Not relevant for VMAX3 and Symmetrix volumes with virtual provisioning (no assignment to a physical volume).

Outputs information on all physical volumes selected with UNIT and on all other logical volumes located on the same physical volume of the storage system. Output does not include any additional internal mirrored disks on the physical device.

This value must not be used in conjunction with UNIT=*BY-CONTROLLER or LOGICAL-VOLUME=*ALL.

CONFIGURATION = *META-MEMBERS

Not relevant for VMAX3.

Outputs information on all units selected with UNIT and all other units belonging to the same meta volume. This value may not be used in conjunction with UNIT=*BY-

CONTROLLER or LOGICAL-VOLUME=*ALL.

CONFIGURATION = *SNAP-PAIRS

The information is output by means of the units selected using UNIT. If units of snap pairs are involved, information for original and snap units is output.

This value must not be used in conjunction with UNIT=*BY-CONTROLLER or LOGICAL-VOLUME=*ALL.

CONFIGURATION = *CLONE-PAIRS

The information is output by means of the units selected using UNIT. If units of clone pairs are involved, information for original and clone units is output.

This value must not be used in conjunction with UNIT=*BY-CONTROLLER or LOGICAL-VOLUME=*ALL.

DEVICE =

Outputs information on units with the specified status in BS2000.

DEVICE = *ALL-PRESELECTED

Outputs information on all units in accordance with the global setting for SHC-OSD (value of `DEVICE-PRESELECTION` in the output of `/SHOW-SHC-PROCESSING`).

DEVICE = *ALL-DEFINED

Selects all units generated in BS2000.

DEVICE = *DETACHED

Selects all units generated in BS2000 which are detached.

DEVICE = *ATTACHED

Selects all units attached in BS2000.

DEVICE = *ANY

Selects all devices of the storage system specified with `UNIT`.

TYPE =

Outputs information only on units with the specified emulated device type.

TYPE = *ANY

Outputs information on all units regardless of their emulated device type.

TYPE = <device>

Outputs information only on specific device types.

Only device types known to the system are accepted. In dialog mode, the valid device types can be displayed with `TYPE=?`. Information can be output only for device types emulated in the storage system, i.e. for `TYPE=D3435/D3475-8F/STDDISK`.

TYPE = *GATE-KEEPER

Outputs information only on gatekeeper devices. These are configured only on the SYMAPI servers, not in BS2000.

This value can only be specified in conjunction with `DEVICE=*ANY`.

TYPE = *SAVE-DEV

Outputs information only on save devices (Symmetrix only).

This value can only be specified in conjunction with `DEVICE=*ANY`.

TYPE = *DATA-DEV

Outputs information only on data devices for virtual provisioning.

This value can only be specified in conjunction with `DEVICE=*ANY`.

RAID-LEVEL =

Outputs information only on units with the specified RAID protection. For VMAX3 all volumes are of the type TDEV. The operand is not relevant for VMAX3.

RAID-LEVEL = *ANY

Outputs information on all units regardless of their RAID protection.

RAID-LEVEL = *YES

Outputs information only on units with RAID protection.

RAID-LEVEL = *RAID1/*RAID5/*RAID6/*RAID10

Outputs information only on units with RAID protection according to RAIDx.

RAID-LEVEL = *NO

Outputs information only on units without RAID protection.

RAID-LEVEL = *VDEV

Outputs information only on units of the type VDEV (virtual devices for snap units).

RAID-LEVEL = *TDEV

Outputs information only on units of the type TDEV (thin devices for virtual provisioning).

STATE =

Outputs information only on units with the specified state as seen by the storage system.

STATE = *ANY

Outputs information on all units regardless of their state as seen by the storage system.

STATE = *READY

Outputs information only on units with the state *READY.

STATE = *NOT-READY

Outputs information only on units with the state *NOT-READY.

STATE = *DISABLE

Outputs information only on units with the state *DISABLE.

STATE = *READ-ONLY

Outputs information only on units with the state *READ-ONLY.

STATE = *NO-ACCESS

Outputs information only on units with the *NO-ACCESS state. These could also be alias units. For more information on alias devices and the Parallel Access Volume (PAV) function, see the “Introduction to System Administration” manual [5].

REMOTE-COPY-USE =

Outputs information only on units with the specified remote copy use.

REMOTE-COPY-USE = *ANY

Outputs information on all units regardless of their remote copy use.

REMOTE-COPY-USE = *YES

Outputs information only on remote copy units (source and target units).

REMOTE-COPY-USE = *SOURCE-UNIT

Outputs information only on source units.

REMOTE-COPY-USE = *TARGET-UNIT

Outputs information only on target units.

REMOTE-COPY-USE = *NO

Outputs information only on units that are not used for remote copy.

REMOTE-COPY-USE = *CONCURRENT-SOURCE-UNIT

Outputs information only on concurrent source units.

REMOTE-COPY-USE = *DYNAMIC

Outputs information only on units which can be used in dynamic remote copy pairs.

REMOTE-COPY-USE = *DYNAMIC-IN-USE

Outputs information only on units which are currently used in dynamic remote copy pairs.

REMOTE-COPY-USE = *DYNAMIC-UNUSED

Outputs information only on units which can be used in dynamic remote copy pairs and are currently free.

MULTI-MIRROR-USE =

Outputs information only on units with the specified multi-mirror use.

MULTI-MIRROR-USE = *ANY

Outputs information on all units regardless of their multi-mirror use.

MULTI-MIRROR-USE = *YES

Outputs information only on multi-mirror units (normal units and additional mirror units).

MULTI-MIRROR-USE = *NORMAL-UNIT

Outputs information only on normal units.

MULTI-MIRROR-USE = *ADD-MIRROR-UNIT

Outputs information only on additional mirror units.

MULTI-MIRROR-USE = *NO

Outputs information only on units that are not used for multi-mirroring.

SNAP-USE =

Outputs information only on units with the specified use in snap pairs.

SNAP-USE = *ANY

Outputs information on all units irrespective of their use in snap pairs.

SNAP-USE = *YES

Outputs information only on units which form snap pairs (original units and snap units).

SNAP-USE = *ORIGINAL-UNIT

Outputs information only on original units.

SNAP-USE = *SNAP-UNIT

Outputs information only on snap units.

For VMAX3 only snap units which belong to a snap pair are displayed here. On VMAX3 each free volume can be used as a snap unit. There are no free snap units (STATUS=UNUSED) on VMAX3.

SNAP-USE = *NO

Outputs information only on units which are not used in snap pairs.

CLONE-USE =

Outputs information only on units with the specified use in clone pairs.

CLONE-USE = *ANY

Outputs information on all units irrespective of their use in clone pairs.

CLONE-USE = *YES

Outputs information only on units which form clone pairs (original units and clone units).

CLONE-USE = *ORIGINAL-UNIT

Outputs information only on original units.

CLONE-USE = *CLONE-UNIT

Outputs information only on clone units.

CLONE-USE = *NO

Outputs information only on units which are not used in clone pairs.

INFORMATION =

Determines the scope of the information which is output.

A header line is output followed by a line with the corresponding values for each unit, see the examples for the command.

The information shown always relates to the units selected with `SELECT=...`

INFORMATION = *STD

Global device information is output, e.g. mnemonic name of the logical volume, VSN, BS2000 type, mnemonic name of the emulated controller, state, RAID level, remote copy mode (SRDF), multi-mirror use, usable or maximum volume size.

INFORMATION = *PHYSICAL

The mnemonic name of the logical volume and its VSN is output. The replication type (e.g. RAID1, TimeFinder, SRDF), the synchronization state, the location and the state are output for the associated physical volumes (up to 4 mirror disks).

The state refers to the internal replication method, i.e. the `READY` state means that the device is available for internal replication, and not that the device can be accessed from the host.



No physical properties are output for Thin Provisioned Volumes in Symmetrix/VMAX3. These volumes are configured in thin pools. Assignment to physical volumes is not possible.

INFORMATION = *ALL

Outputs all information specified for `*STD` and `*PHYSICAL`.

INFORMATION = *LOGICAL-VOLUME-NUMBER

Outputs the same information as for `INFORMATION=*STD`, except that the internal number of the logical volume in the storage system is output instead of the VSN. This information is of particular interest to customer support. No S variables are supported with this operand value.

INFORMATION = *LOCKED-DEVICES

Outputs information for all units for which a lock is set. The `SELECT` operand is then ignored. The `INFORMATION=*LOCKED-DEVICES` operand is supported only in combination with `UNIT=*BY-SYMMETRIX(...)`.

INFORMATION = *THIN-DEVICES

Outputs information for all units which are configured as "thin devices" for virtual provisioning. The layout contains information which is relevant specifically for virtual provisioning.

INFORMATION = *DATA-DEVICES

Outputs information for virtual provisioning data devices.

UPDATE =

Controls updating of the configuration data provided.

UPDATE = *STD

The configuration data is updated in SHC-OSD before the SHOW command is executed.

UPDATE = *NO

The SHOW command is executed without the configuration data being updated in SHC-OSD.

UPDATE = *DISCOVER

Before the SHOW command is executed, the configuration data of the storage system and in SHC-OSD is updated. This enables you to recognize that it is available again after a crash and configuration changes to the storage system.

Examples

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=823C,CONFIGURATION=*REMOTE-COPY-PAIRS,
INFORMATION=*STD
```

```
%-----
% UNIT   VOL   TYPE      CONTR-UNIT1 STA TIER- RAID  REM- TIME-   SIZE:
%         /SERIAL-NO  TYPE  /META COPY FINDER CURR./MAXIMUM
%-----
% 823C  DMOB.0 D3435      8200   RDY  FC    1/-  S/D -/-/-  3840/ 3840 MB
% 523C  DMOB.0 D3435      5200   RDY  FC    1/-  T/D -/-/U  3840/ 3840 MB
```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=823C,CONFIGURATION=*REMOTE-COPY-PAIRS,
INFORMATION=*PHYSICAL
```

```
%-----
% UNIT   VOL   !INTERNAL-DISK: PHYSICAL-INFORMATION
%         !TYPE      PENDING DA-NO DISK STA !TYPE      PENDING DA-NO DISK STA
%-----
% 823C  DMOB.0!LOCAL :    0 MB   8C  D8  READY!MIRROR:    0 MB   6C  D8  READY
%         !REMOTE:    1 MB           N-RDY
% 523C  DMOB.0!REMOTE:    1 MB           N-RDY!LOCAL :    0 MB   8C  D8  READY
%         !MIRROR:    0 MB   6C  D8  READY
```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=*BY-PUBSET(PUBSET=MAX3), INFORMATION=*ALL
```

```
%-----
% UNIT   VOL   TYPE      CONTR-UNIT1 STA TIER- RAID  REM- TIME-   SIZE:
%         /SERIAL-NO  TYPE  /META COPY FINDER CURR./MAXIMUM
%-----
% 4700  MAX3.0 D3435      4700   RDY  SSD  T/-  S/D N/-/U  3840/ 3840 MB
% 4701  MAX3.1 D3435      4700   RDY  SSD  T/-  S/D N/-/U  3840/ 3840 MB
% 4702  MAX3.2 D3435      4700   RDY  SSD  T/-  S/D N/-/U  3840/ 3840 MB
%-----
% UNIT   VOL   !INTERNAL-DISK: PHYSICAL-INFORMATION
%         !TYPE      PENDING DA-NO DISK STA !TYPE      PENDING DA-NO DISK STA
%-----
% 4700  MAX3.0!T-DEV :    0 MB           READY!REMOTE:    0 MB           READY
% 4701  MAX3.1!T-DEV :    0 MB           READY!REMOTE:    0 MB           READY
% 4702  MAX3.2!T-DEV :    0 MB           READY!REMOTE:    0 MB           READY
```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=8280,CONFIGURATION=*REMOTE-COPY-PAIRS,
INFORMATION=*LOGICAL-VOLUME-NUMBER
```

```
%-----
% UNIT   VOL   TYPE      SERIAL-NO  STA TIER- RAID  REM- TIME-   SIZE:
%         TYPE  /META COPY FINDER CURR./MAXIMUM
%-----
% 8280   2DC  D3435      000192601224 RDY  FC    1/-  S/- -/-/-  3840/ 3840 MB
% 5280   2DC  D3435      000192601225 N-R  FC    1/-  T/- -/-/-  - / 3840 MB
```

```
/SHOW-SYMMETRIX-DEVICE-CONFIG UNIT=8200,
      SELECT=*BY-ATTRIBUTES(CONFIGURATION=*CLONE-PAIRS)
```

UNIT	VOL	TYPE	CONTR-UNIT1 /SERIAL-NO	STA	TIER- TYPE	RAID /META	REM- COPY	TIME- FINDER	SIZE: CURR./MAXIMUM
8200	E370.0	D3435	8200	RDY	FC	1/-	-/-	N/-/U	3072/ 3840 MB
8210	E37X.0	D3435	8200	RDY	FC	1/-	-/-	-/-/C	3072/ 3840 MB

```
/SHOW-SYMMETRIX-DEVICE-CONFIG CONTROLLER-UNIT=4700,
      RAID-LEVEL=*TDEV,DEVICE=*ANY
```

UNIT	VOL	TYPE	CONTR-UNIT1 /SERIAL-NO	STA	TIER- TYPE	RAID /META	REM- COPY	TIME- FINDER	SIZE: CURR./MAXIMUM
4700	MAX3.0	D3435	4700	RDY	SSD	T/-	S/D	N/-/U	3840/ 3840 MB
4701	MAX3.1	D3435	4700	RDY	SSD	T/-	S/D	N/-/U	3840/ 3840 MB
4702	MAX3.2	D3435	4700	RDY	SSD	T/-	S/D	N/-/U	3840/ 3840 MB

```
/SHOW-SYMMETRIX-DEVICE-CONFIG SERIAL-NUMBER=293,INFORMATION=*THIN-DEVICES
```

UNIT	VOL	SERIAL-NO	POOL-NAME	! STA	TIER- TYPE	RAID	REM- USED	TIME- /ALLOC./	SIZE: CURR./CONFIG.
4700	MAX3.0	000296800293	DG4_FBA_F	! RDY	SSD		4/	4/	3840/ 3840 MB
4701	MAX3.1	000296800293	DG4_FBA_F	! RDY	SSD		1/	1/	3840/ 3840 MB
4702	MAX3.2	000296800293	DG4_FBA_F	! RDY	SSD		1/	1/	3840/ 3840 MB

```
/SHOW-SYMMETRIX-DEVICE-CONFIG SER=1224,TYPE=*DATA-DEV,DEVICE=*ANY
```

UNIT	VOL	TYPE	CONTR-UNIT1 /SERIAL-NO	STA	TIER- TYPE	RAID /META	REM- COPY	TIME- FINDER	SIZE: CURR./MAXIMUM
#057E		DATA-DEV	000192601224	RDY	FC	1/-	-/-	-/-/-	- / 1920 MB
#057F		DATA-DEV	000192601224	RDY	FC	1/-	-/-	-/-/-	- / 1920 MB
#0580		DATA-DEV	000192601224	RDY	FC	1/-	-/-	-/-/-	- / 1920 MB
#0581		DATA-DEV	000192601224	RDY	FC	1/-	-/-	-/-/-	- / 1920 MB

```
/SHOW-SYMMETRIX-DEVICE-CONFIG SERIAL-NUMBER=1224,INFORMATION=*DATA-DEVICES
```

UNIT	SERIAL-NO	POOL-NAME	!STATE	RAID	SIZE: ALLOC./TOTAL	FULL (%)
#05F6	000192601224	RDF_Poo1224	! ENA	1	175/ 960 MB	18
#05F7	000192601224	RDF_Poo1224	! ENA	1	175/ 960 MB	18
#05F8	000192601224	RDF_Poo1224	! ENA	1	175/ 960 MB	18
#05F9	000192601224	RDF_Poo1224	! ENA	1	175/ 960 MB	18
#0624	000192601224		! DIS	5	0/ 960 MB	0

Meaning of the output columns (in alphabetical order)

Keyword	Meaning	with INF =
CONTR-UNIT1	MN of the (first) emulated controller	*STD *ALL
DA-NO	Director name (DA) of physical devices	*PHYS *ALL
DISK	Physical device on director (DA)	*PHYS *ALL
FULL	Occupancy level of the data device in percent	*DATA-D
LOCKED-SINCE	Time for which lock has been held, format: DDDD.HH:MM:SS	*LOCKED
LOG-VOL	Internal number of the logical volume	*LOCKED
META	Meta volume (Symmetrix only) H/S Header of a striped meta volume M/S Member of a striped meta volume H/C Header of a concatenated meta volume M/C Member of a concatenated meta volume - No meta volume (always the case for VMAX3)	*STD *ALL
PENDING	Pending writes on the relevant physical device in Mbytes	*PHYS *ALL
POOL-NAME	Name of the thin pool .: Name not known	*THIN-D *DATA-D
RAID	RAID level 1 RAID1 5 RAID5 6 RAID6 10 RAID10 T Thin Volume (always the case for VMAX3) V VDEV (virtual volume - snap unit) - No RAID protection DL diskless device (semiconductor storage)	*STD *ALL *DATA-D

(part 1 of 4)

Keyword	Meaning	with INF =
REM-COPY	Remote copy mode (SRDF) S/- source unit T/- target unit S/D Source unit, dynamic SRDF-capable device T/D Target unit, dynamic SRDF-capable device S/S Source unit, dynamic SRDF-source-capable device T/T Target unit, dynamic SRDF-target-capable device -/S Dynamic SRDF-source-capable device -/T Dynamic SRDF-target-capable device -/D Dynamic SRDF-capable device C/D Concurrent SRDF (more than one target unit) Dynamic SRDF-capable device C/- Concurrent SRDF (more than one target unit) B/D Cascading SRDF - (target unit with source attribute) Dynamic SRDF-capable device B/- Cascading SRDF - (target unit with source attribute) -/- No remote copy mode	*STD *ALL
SERIAL-NO	Serial number of the storage system	*STD *ALL *LOCKED *THIN-D *DATA-D
SIZE: ALLOC.	Assigned size of a thin device in MB or GB	*THIN-D
SIZE: CONFIG.	Maximum available size of a thin device in MB or GB	*THIN-D
SIZE: CURR.	Usable size of the volume in Mbytes or Gbytes	*STD *ALL *THIN-D
SIZE: MAXIMUM	Maximum size of the volume in Mbytes or Gbytes	*STD *ALL
SIZE: TOTAL	Total size of a data device in MB or GB	*DATA-D
SIZE: USED	Used size of a thin device in MB or GB	*THIN-D
STA	State of the relevant physical device (internal view of original and mirror disks in the storage system). READY Device ready for operation N-RDY Device not ready for operation WR-D Write to device disabled	*PHYS *ALL

(part 2 of 4)

Keyword	Meaning	with INF =
STA	Device state of logical unit (as seen by the server) RDY READY: Device ready for operation N-R NOT-READY: Device not ready for operation R-O READ-ONLY: Read access only (not usable in BS2000) DIS DISABLE: Neither read nor write access possible to device NAC NO-ACCESS: Access not possible; previous state is displayed PAV NO-ACC-PAV: No access possible because alias device for Parallel Access Volume (PAV)	*STD *ALL *THIN-D
STATE	Device state of data devices ENA ENABLED: Device ready for operation DIS DISABLED: Device not ready for operation UNK UNKNOWN: State cannot be established	*DATA-D
TIER-TYPE	Physical disk properties (tiering) FC Fibre Channel SSD Solid State Disk (Flash Disk) SAS SAS Disk SATA SATA Disk MIX Mixed (VMAX3) - Type unknown	*STD *THIN-D *ALL
TIME-FINDER	TimeFinder functionality (TimeFinder/Mirror, -/Snap, -/Clone, TimeFinder SnapVX) N/./. Normal unit of a multi-mirror pair A/./. Additional mirror unit of a multi-mirror pair -/./. No multi-mirror functionality ./U/. Original unit of a snap pair (Symmetrix) Original unit with connection to snapshot (VMAX3) ./S/. Snap unit (Symmetrix) Snap unit with connection to snapshot (VMAX3) ./X/. Original unit with snapshot, but without connection to snap unit (VMAX3) ./-/. No snap functionality ././U Original unit of a clone pair ././C Clone unit ././B Cascaded clone unit ././- No clone functionality	*STD *ALL

(part 3 of 4)

Keyword	Meaning	with INF =
TYPE	BS2000 volume type (D3435 or D3475-8F) or DATA-DEV for data device	*STD *ALL *DATA-D
	Device usage LOCAL Local (primary) unit MIRROR Local replication (RAID1) RAID5 Local units and parity stripes RAID6 Local units and parity stripes REMOTE Remote replication (SRDF) SPARE Spare device ADD-M Multi-mirror device (TimeFinder) UNUSED unused T-DEV Thin Volume V-DEV Virtual unit (snap unit)	*PHYS *ALL
UNIT	<ul style="list-style-type: none"> – MN of the logical device or – 4-character internal number of the logical volume in the storage system with prefix # (#0000..#FFFF) or – 5-character internal number of the logical volume in the VMAX3 storage system (F0000..FFFFF) 	*STD *PHYS *ALL *LOG-VOL *LOCKED *THIN-D *DATA-D
VOL	Internal number of the logical volume	*LOG-VOL
	VSN of the (logical) volume	*STD *PHYS *ALL *THIN-D

(part 4 of 4)

S variables

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Clone functionality ORIGINAL-UNIT: unit CLONE-UNIT: clone unit CASCADING-CLONE: Original and clone units	var(*LIST).CLONE-USE	S	" ORIGINAL-UNIT CLONE-UNIT CASCADING-CLONE	*STD *ALL
MN of the first emulated controller	var(*LIST).CONTR-UNIT1	S	<mnemo-name>	*STD *ALL
Usable size of the volume in Mbytes	var(*LIST).CURR-SIZE	I	<integer 0..2147483647>	*STD *ALL
Time for which the lock has been held	var(*LIST).DIR(*LIST). LOCKED-SINCE	S	" <c-string 13..13>	*LOCKED
Internal number of the logical volume	var(*LIST).LOGIC-VOL	S	" <c-string 1..5>	*STD *ALL *LOCKED *LOG-VOL *THIN-D *DA-DEV
Maximum size of the volume in Mbytes	var(*LIST).MAX-SIZE	I	<integer 0..2147483647>	*STD *ALL
Meta volume functionality (Symmetrix) HEADER-STRIPED: striped meta volume header HEADER-CONCAT: concatenated meta volume header MEMBER-STRIPED: striped meta volume member MEMBER-CONCAT: concatenated meta volume member	var(*LIST).META-TYPE	S	HEADER-STRIPED HEADER-CONCAT MEMBER-STRIPED MEMBER-CONCAT	*STD *ALL
Multi-mirror functionality *NORMAL-UNIT: normal unit *ADD-MIRROR-UNIT: additional mirror unit	var(*LIST).MULTI-MIRROR	S	" NORMAL-UNIT ADD-MIRROR-UNIT	*STD *ALL
PAV alias unit	var(*LIST).PAV-ALIAS	B	*TRUE *FALSE	*STD
Base MN of the PAV alias unit	var(*LIST).PAV-BASE-MN	S	" <mnemo-name>	*STD
Director name (DA) of physical devices	var(*LIST).PEND-SYNCH(*LIST). DA-NO	S	" <1A...16A> <1B...16B>	*PHYS *ALL
Physical device on disk adapter (DA)	var(*LIST).PEND-SYNCH(*LIST). DISK	S	" <c-string 1..2>	*PHYS *ALL

(part 1 of 4)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Device usage *LOC: local (primary) unit *MIRROR: local replication (RAID1) *RAID5: local units and parity stripes *RAID6: local units and parity stripes *REM: remote replication (SRDF) *SPARE: spare device *ADD-MIRROR: multi-mirror unit (TimeFinder) *TDEV: thin device *VDEV: virtual unit UNUSED: not used	var(*LIST).PEND-SYNCH(*LIST). INTERNAL-DISK	S	*LOC *MIRROR *RAID5 *RAID6 *REM *SPARE *ADD-MIRROR *TDEV *VDEV *UNUSED	*PHYS *ALL
Pending writes on physical device (in Mbytes)	var(*LIST).PEND-SYNCH(*LIST). SIZE	I	<integer 0..2147483647>	*PHYS *ALL
State of the physical device (internal view of original and mirror disks in the storage system). *READY: Device ready for operation *NOT-READY: Device not ready for operation *WR-DISABLE: write to device disabled	var(*LIST).PEND-SYNCH (*LIST) STA	S	*READY *NOT-READY *WR-DISABLE	*PHYS *ALL
RAID level 1: RAID1 (replication) 5: RAID5 (striped 3 data volumes : 1 parity volume or 7:1) 6: RAID6 (striped 6 data volumes : 2 parity volumes or 14:2) 10: RAID10 (striped volume) T: TDEV ('thin provisioning' volume) V: VDEV (virtual volume) ": No RAID protection DLDEV: diskless device (semiconductor storage)	var(*LIST).RAID	S	" RAID1 RAID5 RAID6 RAID10 TDEV VDEV DLDEV	*STD *THIN-D *DATA-D *ALL
Remote copy mode (SRDF) SOURCE-UNIT: source unit TARGET-UNIT: target unit ": No remote copy mode	var(*LIST).REM-COPY	S	" SOURCE-UNIT TARGET-UNIT	*STD *ALL
Remote copy mode (SRDF) CONCURRENT-S: Source unit with multiple target units CASCADING-T: Target unit with simultaneous source property ": No additional attributes	var(*LIST).ADD-SRDF-FEAT	S	" CONCURRENT-S CASCADING-T	*STD *ALL

(part 2 of 4)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Dynamic remote copy capability (SRDF) ANY: source- and target-unit-capable SOURCE-UNIT: source-unit-capable TARGET-UNIT: target-unit-capable ": not dynamic SRDF-capable	var(*LIST).DYN-REM-COPY	S	" ANY SOURCE-UNIT TARGET-UNIT	*STD *ALL
Serial number of the storage system	var(*LIST).SERIAL-NO	S	" <c-string 1..12>	*STD *LOCKED *THIN-D *DATA-D *ALL
Snap functionality ORIGINAL-UNIT: unit SNAP-UNIT: snap unit	var(*LIST).SNAP-USE	S	" ORIGINAL-UNIT SNAP-UNIT NO-LINK	*STD *ALL
Device status *READY: Device ready for operation *NOT-READY: Device not ready for operation *READ-ONLY: Read access only (not usable in BS2000) *DISABLE: Neither read nor write access possible to device *NO-ACCESS: Access not possible; previous state is displayed	var(*LIST).STA	S	*READY *NOT-READY *READ-ONLY *DISABLE *NO-ACCESS *NONE	*STD *THIN-D *ALL
The following applies for data devices only: *ENABLED: data device ready *DISABLED: data device not ready			*ENABLED *DISABLED	*DATA-D
Stripe size	var(*LIST).STRIPE-SIZE	I	<integer 0..2147483647>	*STD *ALL
Emulated device type	var(*LIST).TYPE	S	D3435 D3475-8F	*STD *ALL
MN of the logical volume	var(*LIST).UNIT	S	<mnemo-name>	*STD *PHYS *LOCKED *ALL *THIN-D
VSN of the logical volume	var(*LIST).VOL	S	" <vsn>	*PHYS *STD *ALL *THIN-D
Name of the thin pool	var(*LIST).POOL-NAME	S	" <c-string 1..12>	*THIN-D *DATA-D

(part 3 of 4)

Ausgabe-Information	Name der S-Variablen	T	Inhalt	Bedingung INF =
Configured total size of the volume in MB	var(*LIST). CONFIG-SIZE	S	<integer 0..2147483647>	*THIN-D
Current usable size of the thin device in BS2000 in MB	var(*LIST). CURR-SIZE	I	<integer 0..2147483647>	*THIN-D
Space occupied by the volume in the thin pool in MB	var(*LIST). ALLOC-SIZE	I	<integer 0..2147483647>	*THIN-D *DATA-D
Total size of the data device in MB	var(*LIST). TOTAL-SIZE	I	<integer 0..2147483647>	*DATA- D
Used size of the thin device in MB	var(*LIST). USED-SIZE	I	<integer 0..2147483647>	*THIN-D
Physical disk properties (tiering)	var(*LIST). TIER-TYPE	S	" <c-string 1..13> Fibre-Channel SATA SAS SSD UNKNOWN	*STD *ALL *LOG-VOL
Occupied share of a data device	var(*LIST). PERCENT-FULL	I	<integer> 0...100	*DATA-D

(part 4 of 4)

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Volume not online
	64	NDE1004	Pubset not online
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1100	Invalid pubset state
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1125	Initialization of storage system information running
	64	NDE1126	Device unknown or storage system not supported
	64	NDE1127	Device of a storage system is not supported
	64	NDE1128	At least one unit from system is not Symmetrix/VMAX3
	64	NDE1150	No gatekeeper device found
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2006	No output information available
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command

START-CLONE-SESSION

Creates a clone pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/START-CLONE-SESSION` creates one or more clone pairs by assigning one device to each original unit as a clone unit. Any device can be used as a clone unit. The devices for the unit and clone unit must be located in the same storage system and have the same properties (type, size, etc.).

The clone unit cannot be accessed by the host after this command has been executed.

A `/START-CLONE-SESSION` command enables clone units to be generated for all units of a pubset. In this case the pubset is selected using `UNIT`. In `CLONE-UNIT` a list of devices is specified which are not yet being used as clone units and whose number matches the number of units in the pubset.

Before `/START-CLONE-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For EC on ETERNUS DX

Executing the command implicitly starts synchronization of the clone pair, and the clone pair assumes the `SYNCHRONIZING` status. After initial synchronization has been completed, the pair is in the `SYNCHRONIZED` status.

The clone unit can then be activated with `/ACTIVATE-CLONE`, which makes it accessible for the host. This is only possible in the `SYNCHRONIZED` status.

The maximum number of mirrors per unit in the storage system is 32.

Cancellation of the pair connection using `/STOP-CLONE` is only possible in the `SYNCHRONIZED` status.

For TimeFinder/Clone on Symmetrix/VMAX3

On command execution, the clone pair assumes the `CREATED` or `PRECOPY` state. The clone unit can then be activated using `/ACTIVATE-CLONE` (see [page 280](#)), thus making it accessible to the host.

TimeFinder clone units can be larger than the original unit.

The clone pair must be created using `DIFFERENTIAL=*YES` and `COPY-COMPLETE-DATA=*YES` if you wish to be able to restart or reconstruct it later (see `/RESTART-CLONE-SESSION` on [page 362](#) and `/RESTORE-FROM-CLONE` on [page 375](#)).

Up to 16 clone units can be configured for a unit. This maximum number is determined by the current storage systems, which are currently limited to a maximum of 16 copy sessions per original device. This value consists of the sum of the BCV, clone and snap sessions which are active at a given time. Clone sessions which are set up using `/START-CLONE-SESSION ... DIFFERENTIAL=YES` and the first snap session are counted twice here.

If snap or clone session in the `RESTORED` status already exist for the original unit, the `/START-CLONE-SESSION` command is rejected.

TimeFinder clone units can be cascaded, i.e. a clone unit can also be the original unit of another clone pair.

START-CLONE-SESSION

```

UNIT = *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = <x-text 1..4>

,CLONE-UNIT = *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | ,CLONE-LOGICAL-VOLUME = <x-text 1..4>

,DIFFERENTIAL = *STD / *NO / *YES

,COPY-COMPLETE-DATA = *STD / *NO / *YES(...)

*YES(...)
    | START = *AT-ACTIVATION / *IMMEDIATE

,SELECT = *STD / *TARGET-UNIT(...)

*TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>

,FORCE = *NO / *YES

,WAIT = *NO / *UNTIL-SYNCHRONIZATION

```

UNIT =

Selects the units by means of a particular catalog ID (*BY-PUBSET), via the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the mnemonic device name of the logical volume.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

CLONE-UNIT =

Selects the device for the clone unit by means of the mnemonic device name of the logical volume or by means of its internal number in the storage system.

CLONE-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume. A unit list is accepted only if a subset was specified in the UNIT operand.

DIFFERENTIAL =

Only relevant for Symmetrix/VMAX3.

Specifies whether the storage system should flag modified data (tracks) on the unit and clone unit.

DIFFERENTIAL = *STD

Equivalent to *NO.

DIFFERENTIAL = *NO

The storage system does not flag modified data (tracks). No reconstruction (/RESTORE-FROM-CLONE) or restart (/RESTART-CLONE-SESSION) is possible.

DIFFERENTIAL = *YES

The storage system flags modified data (tracks). This permits reconstruction of the original unit (/RESTORE-FROM-CLONE) and re-creation of the clone pair (/RESTART-CLONE-SESSION). This operand value can only be entered in conjunction with COPY-COMPLETE-DATA=*YES.

COPY-COMPLETE-DATA =

Only relevant for Symmetrix/VMAX3.

Specifies whether the storage system should copy the complete unit to the clone unit in the background.

In ETERNUS DX systems all data is always copied to the clone unit (implicit

*YES(START=*IMMEDIATE)).

COPY-COMPLETE-DATA = *STD

Equivalent to *NO.

COPY-COMPLETE-DATA = *NO

The storage system copies only those tracks to the clone unit which were accessed in write mode on a unit of the clone pair or in read mode on the clone unit.

COPY-COMPLETE-DATA = *YES(...)

The storage system copies all tracks of the unit to the clone unit.

START = *AT-ACTIVATION

When the clone pair is activated, the storage system copies all tracks onto the clone unit.

START = *IMMEDIATE

Upon command execution, the storage system immediately begins copying all tracks onto the clone unit. If required, the copy process is also continued after the clone pair has been activated.

SELECT =

Defines whether the unit specified in the UNIT operand or (when remote replication is used) the target unit of a remote copy pair is selected as the original unit of the clone pair.

SELECT = *STD

Selects the unit which was defined in the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selects the target unit of a remote copy pair as the original unit. The relevant source unit is specified in the UNIT operand. For ETERNUS DX the selection can only be made if the target unit is unique. Concurrent remote copy is not supported here.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

FORCE =

Only relevant for Symmetrix/VMAX3.

FORCE controls the start of a clone session with a clone unit which is also an SRDF source unit in the remote copy status **ACTIVE**.

FORCE = *NO

The clone session is not started.

FORCE = *YES

The clone session is started. The remote copy status changes to **ERROR**. To permit this, **COPY-COMPLETE-DATA=*YES(...)** must also be specified.

WAIT =

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

WAIT=*UNTIL-SYNCHRONIZATION simplifies the programming of test procedures because extensive queries regarding the synchronization progress are unnecessary.

Waiting can be aborted for Symmetrix/VMAX3 in dialog mode by hitting the **[K2]** key.

Command processing

Message **NDE1073** is output to **SYSOUT** for each device and distributed via routing code 0, i.e. it is logged in the **CONSLOG** file only. You will find detailed information on the **CONSLOG** file (logging file) in the "Introduction to System Administration" manual [5].

Examples

```
/START-CLONE-SESSION UNIT=5000,CLONE-UNIT=5040
```

```
/START-CLONE-SESSION UNIT=5001,CLONE-UNIT=5041,DIFFERENTIAL=*YES,  
COPY-COMPLETE-DATA=*YES
```

```
/START-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=TFC),  
CLONE-UNIT=(5100,5101,5102)  
(Pubset TFC consists of 3 units)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1006	Pubset/volume is allocated
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1052	Maximum number of TimeFinder mirrors exceeded
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1140	Duplicate MN in MN list
	64	NDE1142	Mirror pair already exists
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1155	RAID10 devices not supported
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1181	Maximum number of internal mirrors reached

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1435	Device is a virtual device
	64	NDE1510	DIFFERENTIAL=*YES option requires COPY-COMPLETE-DATA=*YES
	64	NDE1511	Clone pair is already cascaded
	64	NDE1531	Different number of devices for units and clone unit
	64	NDE1534	Clone unit used in other Snap or Clone pair
	64	NDE1535	Device is a clone unit
	64	NDE1537	MNs or device numbers of unit and Clone unit are dential
	64	NDE1538	Unit and Clone unit of different type or size
	64	NDE1539	Unit and Clone unit on different storage systems
	64	NDE1540	Incorrect state of unit
	64	NDE1541	Incorrect state of clone unit
	64	NDE1558	Unit and Clone unit meta volumes of different stripe size
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1839	Unit and Clone unit on different storage systems
	64	NDE1852	Maximum number of supported clone units exceeded
	64	NDE1853	Storage unit locked
	64	NDE1880	Copy license not installed (ETERNUS DX)
	64	NDE1881	Copy Table Size not configured (ETERNUS DX)
	64	NDE1882	Copy Table Size too small (ETERNUS DX)
	64	NDE1883	Advanced Copy operations for devices locked (ETERNUS DX)
	64	NDE1890	CIMOM not found
	64	NDE1891	Gatekeeper error on StorMan server
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

START-MULTI-MIRRORING

Creates a multi-mirror pair

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/START-MULTI-MIRRORING` creates one or more multi-mirror pairs by assigning an additional mirror unit to a normal unit. All data is copied either from the normal unit to the additional mirror unit or from the additional mirror unit to the normal unit depending on the setting of the `RESTORE` operand.

Writes from the host to the normal unit are mapped to the additional mirror unit. The additional mirror unit is not available to the host.

The normal unit and additional mirror unit must be on the same storage system and be of the same size and same type. The additional mirror unit can be assigned to any other normal unit as long as it has the `SPLIT` state. Similarly, the normal unit can be assigned to any other additional mirror unit as long as it has the `SPLIT` state. If the meta volumes function is used for the normal unit, the additional mirror unit must also be identical with respect to these properties, i.e. the meta-header volume pairs and all meta-member pairs must be the same size, have the same number and the same “stripe size” as the relevant meta-member volumes.

On command execution, the multi-mirror pair assumes the `ESTABLISHING` or `RECONSTRUCTING` state. When all data has been copied from the normal unit to the additional mirror unit, it assumes the `ESTABLISHED` state. The multi-mirror pair can be split using `/HOLD-MULTI-MIRRORING`.

You can specify a pubset to be mirrored and a list of additional mirror units that are all `UNUSED` or `SPLIT` and whose number must correspond to the number of units of the pubset.

If you issue the command only for individual units of a pubset, you must ensure that multi-mirror pairs are created for all the units of the pubset.

If the additional mirror unit was locked with `/HOLD-MULTI-MIRRORING LOCK-ADD-MIRROR=*YES`, you must specify `/START-MULTI-MIRRORING UNLOCK-ADD-MIRROR=*YES` to lift the lock.

If multi-mirror pairs which have already been assigned have the `SPLIT` state, the multi BCV function is used implicitly and changes to additional mirror units used earlier are noted in the storage system.

The concurrent BCV function is supported by `/START-MULTI-MIRRORING`. A concurrent BCV pair is set up by calling the function twice with the same normal unit and different additional mirror units. The concurrent BCV requires one of the up to four internal mirrors per volume.

The concurrent BCV function cannot be supported if the multi-mirror pair that is already in the `ESTABLISHED` state was created using `/START-MULTI-MIRRORING` and the copy direction `RESTORE=*TO-ORIGINAL`.

The command is rejected with the message `NDE1180` if a normal unit already has two assigned additional mirror units in the `ESTABLISHED` or `ESTABLISHING` state.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

If you try to generate more multi BCVs than are permitted with `/START-MULTI-MIRRORING`, e.g. because different additional mirror units have been assigned, the message `NDE1051` is output. (The maximum number of permitted multi BCVs is defined with `/MODIFY-SHC-PROCESSING` and the `MAX-MULTI-BCV` operand.) The multi BCVs which are no longer required must be canceled with `/STOP-MULTI-MIRRORING`.

START-MULTI-MIRRORING

```

NORMAL-UNIT = *BY-PUBSET(...) / *BY-SYMMETRIX(...) / <alphanum-name 2..2> / <x-text 4..4>
  *BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
  *BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>
,ADD-MIRROR-UNIT = *BY-SYMMETRIX(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>
  *BY-SYMMETRIX(...)
    | LOGICAL-VOLUME = <x-text 1..4>
,RESTORE = *FROM-ORIGINAL / *TO-ORIGINAL
,UNLOCK-ADD-MIRROR = *NO / *YES
,WAIT = *NO / *UNTIL-SYNCHRONIZATION
,SELECT = *STD / *TARGET-UNIT(...)
  *TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>

```

NORMAL-UNIT =

Selects the normal unit by means of a particular catalog ID (*BY-PUBSET), via the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the mnemonic device name of the logical volume.

NORMAL-UNIT = *BY-PUBSET(...)

Selects the normal unit by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

NORMAL-UNIT = *BY-SYMMETRIX(...)

Selects the normal unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

NORMAL-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the normal unit by means of the mnemonic device name of the logical volume of the normal unit.

ADD-MIRROR-UNIT =

Selects the additional mirror unit by means of the mnemonic device name of the logical volume.

ADD-MIRROR-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume. A unit list is not accepted unless a pubset has been specified in the NORMAL-UNIT operand.

ADD-MIRROR-UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the internal number of the logical volume in the storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

RESTORE =

Specifies the copy direction.

RESTORE = *FROM-ORIGINAL

Copies from the normal unit to the additional mirror unit. This is the normal case; an additional mirror unit is attached to a normal unit so that it can be used in parallel.

RESTORE = *TO-ORIGINAL

Copies from the additional mirror unit to the normal unit. This is useful if data on the additional mirror unit is to be copied to the normal unit during data migration (see also [page 162](#)).

UNLOCK-ADD-MIRROR =

Specifies whether or not a lock previously set with `/HOLD-MULTI-MIRRORING` and `LOCK-ADD-MIRROR=*YES` operand is lifted.

UNLOCK-ADD-MIRROR = *NO

No attempt is made to lift an existing lock.

If at least one additional mirror unit is still locked, the command is rejected and the message NDE1083 is issued.

UNLOCK-ADD-MIRROR = *YES

If there is a lock, it is released.

WAIT =

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

`WAIT=*UNTIL-SYNCHRONIZATION` simplifies the programming of test procedures for recovery because extensive queries regarding the synchronization progress of the remote copy pair are unnecessary.

Waiting can be terminated in dialog mode by hitting the `[K2]` key.

SELECT =

Defines whether the unit specified in the `NORMAL-UNIT` operand or (when SRDF is used) the target unit of a remote copy pair should be selected as the normal unit of a multi-mirror pair.

SELECT = *STD

Selects the unit which was defined using the `NORMAL-UNIT` operand.

SELECT = *TARGET-UNIT(...)

Selects the target unit of a remote copy pair as the normal unit. The corresponding source unit is specified in the `NORMAL-UNIT` operand.

RA-GROUP =

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

Command processing

Message `NDE1073` is output to `SYSOUT` for each device and distributed via routing code 0, i.e. it is logged in the `CONSL0G` file only. You will find detailed information on the `CONSL0G` file (logging file) in the “Introduction to System Administration” manual [5].

Examples

```
/START-MULTI-MIRRORING NORMAL-UNIT=5000,ADD-MIRROR-UNIT=5040
```

```
/START-MULTI-MIRRORING NORMAL-UNIT=5001,ADD-MIRROR-UNIT=5041
```

(there may be no more than one existing multi-mirror pair with normal unit 5001 with the `ESTABLISHED` state; the maximum number of the internal mirrors must not be exceeded)

```
/START-MULTI-MIRRORING NORMAL-UNIT=*BY-PUBSET(PUBSET=MMF),
```

```
ADD-MIRROR-UNIT=(5100,5101,5102)
```

(Pubset MMF consists of 3 units)

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1030	No multi-mirror function for the unit
	64	NDE1031	Different number of devices for normal units and additional mirror units
	64	NDE1034	Additional mirror unit is already being used in another pair
	64	NDE1035	Device is not a normal unit
	64	NDE1037	MNs or device numbers of normal unit and additional mirror unit are identical
	64	NDE1038	Normal unit and additional mirror unit of different type or size
	64	NDE1039	Normal unit and additional mirror unit on different storage systems
	64	NDE1040	Incorrect state of the normal unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1043	Pubset type not supported
	64	NDE1051	Too many additional mirror units
	64	NDE1052	Too many TimeFinder mirrors
	64	NDE1076	Additional mirror unit has pending writes, copy to normal unit rejected
	64	NDE1083	Additional mirror unit locked
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1140	Duplicate MN in MN list
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1158	Normal unit and additional mirror unit are meta volumes with different stripe size'
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1180	Too many concurrent additional mirror units
	64	NDE1181	Maximum number of internal mirrors reached
	64	NDE1182	Concurrent BCV not possible after RESTORE=*TO-ORIGINAL
	64	NDE1183	Combination of concurrent BCV and RESTORE=*TO-ORIGINAL not possible
	64	NDE1535	Device is a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

START-REMOTE-COPY

Creates a remote copy pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/START-REMOTE-COPY` creates one or more remote copy pairs by one device being assigned as the target unit and one as a source unit. Any device from another storage system of the same type can be used as the target unit.

The source unit is selected using the `UNIT` operand.

The target unit is selected using the `TARGET-UNIT` operand. When a pubset is selected as `UNIT`, a list of MNs whose number matches the number of volumes in the pubset must be specified as the target unit.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For REC on ETERNUS DX

For storage systems synchronization of the remote pairs is initiated immediately. The copy direction is always from the source unit to the target unit. You can wait for synchronization to be completed.

The following requirements must be satisfied before you enter `/START-REMOTE-COPY:`

- The devices for source unit and target unit are of the same size and type.
- The remote links between the two storage systems are defined.
- REC is licensed and configured in both storage systems (Copy Tables).

Synchronous and asynchronous replication is supported. Asynchronous replication is provided only for ETERNUS DX S3 and higher, see the [section “COPY-MODE \(processing mode\)” on page 183](#).

Additional requirements must be fulfilled for asynchronous replication:

- The source units and target units reside on ETERNUS DX S3 storage systems.
- The ETERNUS DX S3 storage systems involved require REC buffers (cache) which are suitably dimensioned.

Concurrent remote copy is supported with up to 4 simultaneous target units in different storage systems for a source unit. Concurrent remote copy with target units in the same remote storage system is not supported.

In cascaded remote copy configurations a target unit is used as the source unit of another remote copy pair.

In concurrent and cascaded remote copy configurations synchronous and asynchronous replication can be combined.

The command is executed only for source units.

For SRDF on Symmetrix/VMAX3:

The following requirements must be satisfied before you enter `/START-REMOTE-COPY`:

- The devices for `SOURCE-UNIT` and `TARGET-UNIT`
 - are configured in the storage system for dynamic use by SRDF (this condition is always satisfied for VMAX3)
 - are consistent.
- The SRDF connections are defined via the local and the remote RA group.
For information on dynamic definition of RA groups, see also the `...-SYMMETRIX-RA-GROUP` commands.

Both synchronous and asynchronous SRDF pairs can be configured. When specifying the RA group of the source unit it must be ensured that the RA group selected matches the desired SRDF usage (SRDF/S or SRDF/A).

The `START-SYNCHRONIZING` operand can be used to select the time when synchronization of the newly created SRDF pair is to begin:

- Synchronization can begin straight away (`*IMMEDIATE`). In this case the copying direction (to the source unit or to the target unit) and the status of the target unit are also selected. You can wait for synchronization to be completed.
- Synchronization begins at a later time using the `RESUME-REMOTE-COPY (*AT-RESUME)` command, e.g. in order to control the utilization of the SRDF link better. In this case the setting for the target unit can be predefined: `READY` (accessible for the server) or `NOT-READY` or `READ-ONLY` (not accessible).

The concurrent SRDF function is supported by another SRDF connection being set up for a source unit parallel to an existing SRDF connection.

Target units can be larger than the source units.

Management of SRDF/A is always performed for an entire RA group. The entry `UNIT=*BY-PUBSET` is possible if the volumes of the pubset match the volumes of the RA group exactly.

Dynamic generation of SRDF/A pairs is supported. For information on dynamic definition of RA groups, see also the `...-SYMMETRIX-RA-GROUP` commands.

An existing SRDF/A RA group can only be extended in the remote copy status `IN-HOLD`. As the new pair must also be in the `IN-HOLD` state and the target state when generating for individual asynchronous pairs cannot be changed, only `*AT-RESUME(TARGET-ACCESS=*BY-SOURCE(TARGET-STATE=READ-ONLY))` is permitted for `START-SYNCHRONIZING`. The target state can then be changed for the entire RA group using `SET-REMOTE-COPY-ACCESS`.

The cascaded SRDF function enables an SRDF target unit to be used as the source unit of another SRDF pair.

In the case of cascaded SRDF pairs, the second pair may not be in the `synchron` processing mode. Furthermore, both pairs may not be `asynchron`.

START-REMOTE-COPY

```

UNIT = *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = <x-text 1..4>

,SOURCE-RA-GROUP = *UNIQUE / <integer 1..250>

,TARGET-UNIT =*BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
    | TARGET-SERIAL-NUMBER = *UNIQUE <alphanum-name 3..12>
    | ,TARGET-LOGICAL-VOL = <x-text 1..4>

*BY-STORAGE(...)
    | TARGET-SERIAL-NUMBER = <alphanum-name 3..14>
    | ,TARGET-LOGICAL-VOL = <x-text 1..4>

,START-SYNCHRONIZING = *IMMEDIATE(...) / *AT-RESUME(...)

*IMMEDIATE(...)
    | COPY-DIRECTION = *FROM-SOURCE / *TO-SOURCE
    | ,TARGET-STATE = *STD / *NOT-READY / *READ-ONLY

*AT-RESUME(...)
    | TARGET-ACCESS = *BY-SOURCE(...) / *DIRECT
    | *BY-SOURCE(...)
    | | TARGET-STATE = *STD / *NOT-READY / *READ-ONLY

,WAIT = *NO / *UNTIL-SYNCHRONIZATION

,COPY-MODE = *SYNCHRONOUS / *ADAPTIVE-COPY(...) / *ASYNCHRONOUS / *ASYNC-STACK

*ADAPTIVE-COPY(...)
    | WRITE-BUFFER = *DISK / *CACHE

,FORCE = *NO / *YES

```

UNIT =

Selects the units by means of a particular catalog ID (*BY-PUBSET), via the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the mnemonic device name of the logical volume.

UNIT = *BY-PUBSET(...)

Selects the source units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the source unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the source unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the source unit by means of the mnemonic name of the logical volume.

TARGET-UNIT =

Selects the target units by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the mnemonic device name of the logical volume.

TARGET-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the target unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

TARGET-SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

TARGET-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

TARGET-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the target unit by means of the serial number and the internal number of the logical volume in the storage system.

TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

TARGET-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

TARGET-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the target units by means of the mnemonic device names of the logical volumes.

SOURCE-RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the SRDF connection used via the RA group.

SOURCE-RA-GROUP = *UNIQUE

The only unambiguous local RA group is used.

SOURCE-RA-GROUP = <integer 1..250>

The local RA group of the source unit(s) is specified.

START-SYNCHRONIZING =

Only relevant for Symmetrix/VMAX3.

Selects the time at which synchronization of the newly generated pair is to be started.

START-SYNCHRONIZING = *IMMEDIATE(...)

Synchronization is to be started immediately.

COPY-DIRECTION =

Selects the copy direction for synchronizing the newly generated pair.

COPY-DIRECTION = *FROM-SOURCE

Copying is to take place from the source unit to the target unit.

COPY-DIRECTION = *TO-SOURCE

Copying is to take place from the target unit to the source unit.

TARGET-STATE =

Specifies the state setting for the target units.

TARGET-STATE = *STD

The setting of the target units is specified in accordance with the generation in BS2000: To avoid ambiguous volume serial numbers in BS2000 operation, the NOT-READY state is set by default for generated target units. The READ-ONLY state is set for all other target units, e.g. all target units of non-BS2000 systems.

TARGET-STATE = *NOT-READY

Sets the NOT-READY state for all target units.

TARGET-STATE = *READ-ONLY

Sets the READ-ONLY state for all target units.

START-SYNCHRONIZING = *AT-RESUME(...)

Synchronization is to be started only when the /RESUME-REMOTE-COPY command is issued.

TARGET-ACCESS =

Accesses the new target units of the newly generated pair.

TARGET-ACCESS = *BY-SOURCE(...)

The target unit is to be accessed indirectly via the source units.

TARGET-STATE =

Specifies the state setting for the target units.

TARGET-STATE = *STD

The setting of the target units is specified in accordance with the generation in BS2000: To avoid ambiguous volume serial numbers in BS2000 operation, the NOT-READY state is set by default for generated target units. The READ-ONLY state is set for all other target units, e.g. all target units of non-BS2000 systems.

TARGET-STATE = *NOT-READY

Sets the NOT-READY state for all target units.

TARGET-STATE = *READ-ONLY

Sets the READ-ONLY state for all target units.

TARGET-ACCESS = *DIRECT

The target unit is to be accessed directly.

WAIT =

Specifies whether or not the command is to wait until synchronization is complete.

WAIT = *NO

The command does not wait until synchronization is complete.

WAIT = *UNTIL-SYNCHRONIZATION

The command waits until synchronization is complete.

WAIT=*UNTIL-SYNCHRONIZATION simplifies the programming of test procedures for recovery; extensive queries regarding the synchronization progress are unnecessary.

Waiting can be aborted for Symmetrix/VMAX3 in dialog mode by hitting the **[K2]** key.

May not be specified together with START-SYNCHRONIZING=*AT-RESUME.

COPY-MODE =

Defines the processing mode of remote copy mode, see the relevant section on [page 183](#) (ETERNUS DX) or [page 208](#) (Symmetrix/VMAX3).

COPY-MODE = *SYNCHRONOUS

Sets the processing mode to synchronous processing.

This mode ensures that data was written to both the source and target unit after every successful write.

COPY-MODE = *ADAPTIVE-COPY(...)

Only relevant for Symmetrix/VMAX3.

Sets the processing mode to asynchronous processing. In this mode, performance improves during write load but remote copy reliability is reduced because the source and target units may differ by several writes.

WRITE-BUFFER =

Specifies whether pending writes are to be noted on the source unit or in the cache of the local storage system.

WRITE-BUFFER = *DISK

Pending writes are noted on the source unit. If the unprotected source unit fails, all data that has not yet been transferred is lost.

WRITE-BUFFER = *CACHE

Pending writes are noted in the cache of the local storage system. This reduces the cache storage space available for the read buffer. Performance may be impaired if a higher value has been specified for the `PENDING-UPDATE-LIMIT` operand.



The command is rejected with the message `NDE1019` if the `COPY-MODE=*ADAPTIVE-COPY(WRITE-BUFFER=*CACHE)` operand is specified and the source unit resides on a `VMAX3`.

COPY-MODE = *ASYNCHRONOUS

Sets the processing mode to asynchronous processing (consistency mode for `REC` or `SRDF/A`).



Note for Symmetrix/VMAX3

After the new pair has been created, the target unit is in the `READ-ONLY` state. It can be placed in the `NOT-READY` state using the following command:

```
/SET-REMOTE-COPY-ACCESS
  UNIT=*BY-SYMMETRIX(SERIAL-NUMBER=...,
                    LOGICAL-VOLUME=*ALL-SOURCE-UNITS(RA-GROUP=...)),
  TARGET-ACCESS=*BY-SOURCE(TARGET-STATE=*NOT-READY)
```

Note for SRDF/A

`/START-REMOTE-COPY` with `COPY-MODE=*ASYNCHRONOUS` is only possible under the following conditions:

- The source RA group is in the remote copy status `IN-HOLD` and in the `ASYNCHRONOUS` copy mode.
- The following operand is specified.
`START-SYNCHRONIZING=`
`*AT-RESUME(TARGET-ACCESS=*BY-SOURCE(TARGET-STATE=READ-ONLY))`

Otherwise the command is rejected with `NDE2012`.

COPY-MODE = *ASYNC-STACK

Only relevant for `ETERNUS DX`.

Sets the processing mode to asynchronous processing (asynchronous `REC`, stack mode).

FORCE =

Only relevant for `Symmetrix/VMAX3`.

`FORCE` controls the start of a remote copy pair.

FORCE = *NO

The start of a remote copy pair is possibly be rejected with a message.

FORCE = *YES

The start of a remote copy pair is always executed.

Command processing

The following messages are output to SYSOUT for each device and distributed via routing code 0, i.e. they are logged in the `CONSLLOG` file only. You will find detailed information on the `CONSLLOG` file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1131	RA group not found in the storage system
	64	NDE1140	Duplicate MN in MN list
	64	NDE1141	Source unit and target unit on storage systems of different types
	64	NDE1142	Mirror pair already exists
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1144	Source unit(s) and target unit(s) are identical
	64	NDE1145	Source unit(s) and target unit(s) on the same storage system
	64	NDE1146	Source unit(s) and target unit(s) have different metatype or size
	64	NDE1147	Source unit(s) and target unit(s) are meta volumes with different stripe sizes
	64	NDE1148	Different number of devices for source unit(s) and target unit(s)
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1155	RAID10 devices not supported
	64	NDE1170	Source unit with concurrent target units
	64	NDE1177	Device is a source unit

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1178	Device is a target unit
	64	NDE1179	Device is a cascaded target unit
	64	NDE1186	Device has no or an incorrect dynamic SRDF property
	64	NDE1187	RA group of the source unit is not unambiguous
	64	NDE1188	RA group of the source unit not for the remote storage system
	64	NDE1189	Target unit is not contained in the storage system selected via the local RA group
	64	NDE1534	Device is a virtual unit
	64	NDE1535	Device is a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1841	No connection between the storage systems
	64	NDE1842	Configuration error in the REC buffer
	64	NDE1853	Storage unit locked
	64	NDE1866	No remote link available
	64	NDE1880	Copy license not installed (ETERNUS DX)
	64	NDE1881	Copy Table Size not configured (ETERNUS DX)
	64	NDE1882	Copy Table Size too small (ETERNUS DX)
	64	NDE1883	Advanced Copy operations for devices locked (ETERNUS DX)
	64	NDE1890	CIMOM not found
	64	NDE1891	Gatekeeper error on StorMan server
	64	NDE1893	Source units on different storage systems
	64	NDE1898	Concurrent target units in the same storage system
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	64	NDE2012	Illegal parameter combination
	64	NDE2021	No license for remote replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

START-SNAP-SESSION

Creates a snap pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/START-SNAP-SESSION` creates one or more snap pairs by assigning one virtual device to an original unit as a snap unit.

The original units of the snap pairs are specified in the `UNIT` operand.

A `/START-SNAP-SESSION` command enables snap units to be generated for all units of a pubset. In this case the pubset is selected using `UNIT`. In `SNAP-UNIT` a list of volumes is specified which are not yet being used as snap units and whose number matches the number of units in the pubset.

Before `/START-SNAP-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For SnapOPC+ on ETERNUS DX

The file consistency over multiple volumes must be ensured by the caller. For this purpose a synchronization point should be created for the data before the command is called, see [section “Synchronization point for the snapshot” on page 149](#).

The server itself can access the snap unit immediately.

The snap pairs are activated immediately. From the application’s viewpoint, the snap unit contains all the data of the original unit at command processing time. On command execution, the snap session assumes the `COPY-ON-WRITE` status.

The devices for the original unit and snap unit must be contained in the same storage system and be of the same type. The configured size of the snap unit must be greater than or equal to the size of the original unit.

A maximum of 256 snap units can be configured for an original unit.

The snap pubset on the snap units can be renamed directly using the `NEW-PUBSET` operand if an SF pubset is involved.

When the data backup with Snapsets is used for pubsets (see the “Introduction to System Administration” manual [5]), SnapOPC+ may **not** be used for this pubset.

For TimeFinder/Snap on Symmetrix

The server itself cannot access the snap unit.

The snap session assumes the `CREATED` status on command execution. The snap pair can then be activated using `/ACTIVATE-SNAP` (see [page 290](#)).

The devices for the original unit and the snap unit must be located in the same storage system, and be of the same type and have the same configured size.

Currently a maximum of 127 snap units can be configured for an original unit in the storage system. All these snap sessions together count as one copy session. The maximum value for pubsets can be reduced when data backup with Snapsets (see the “Introduction to System Administration” manual [\[5\]](#)) is used because a specific number of sessions can be reserved for Snapsets.

If snap or clone sessions in the `RESTORED` status already exist for the original unit, the `/START-SNAP-SESSION` command is rejected.

For TimeFinder SnapVX on VMAX3

The file consistency over multiple volumes must be ensured by the caller. For this purpose a synchronization point should be created for the data before the command is called, see [section “Synchronization point for the snapshot” on page 149](#).

The server itself can access the snap unit immediately.

The snap pairs are activated immediately. From the application’s viewpoint, the snap unit contains all the data of the original unit at command processing time. On command execution, the snap session assumes the `COPY-ON-WRITE` status.

The snapshot is identified by its snapshot name. The snapshot name can be specified explicitly or be created automatically by SHC-OSD.

The devices for the original unit and the snap unit must be located in the same VMAX3, and be of the same type and have the same configured size.

The snap pubset on the snap units can be renamed directly using the `NEW-PUBSET` operand if an SF pubset is involved.

A maximum of 127 snap units can be configured for an original unit. All these snap sessions together count as one copy session.

START-SNAP-SESSION

```

UNIT = *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) / <alphanum-name 2..2> / <x-text 4..4>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>
  | ,NEW-PUBSET = *SAME / *SPECIAL-VSN / <cat-id 1..4>
  | ,HOLD-IO = *NO / *UNTIL-ACTIVATED

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = <x-text 1..4>

,SNAP-UNIT = *BY-SYMMETRIX(...) / *BY-STORAGE(...) / *AUTO-SELECT /
  list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SNAP-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
  | SNAP-LOGICAL-VOLUME = <x-text 1..4>

,SNAPSHOT-NAME = *BY-RULE / <posix-filename_1..32>

,SAVE-POOL = *BY-PRESELECTION / *DEFAULT-POOL / <name 1..32 with-under with-low>

,SELECT = *STD / *TARGET-UNIT(...)

*TARGET-UNIT(...)
  | RA-GROUP = *UNIQUE / <integer 1..250>

```

UNIT =

Selects the original units by means of a particular catalog ID (***BY-PUBSET**), via the serial number and the internal number of the logical volume in the storage system (***BY-SYMMETRIX**/***BY-STORAGE**), or directly by means of the mnemonic device name of the logical volume.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

Only relevant for ETERNUS DX and VMAX3: When an SF pubset is selected, the volumes of the snap pubset generated can be renamed directly using **NEW-PUBSET**.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID. When **HOLD-IO=*UNTIL-ACTIVATED**, no volume set ID may be specified.

NEW-PUBSET =

Only relevant for ETERNUS DX and VMAX3.
Determines the catalog ID of the snap pubsets of the snap units.

NEW-PUBSET = *SAME

The snap pubset is not renamed, i.e. it retains the same name.

NEW-PUBSET = *SPECIAL-VSN

All volumes of the snap units are automatically renamed to prevent confusion with the original. For this purpose the period in a VSN in point notation is changed to a colon (e.g. AA.001 to AA:001), or in PUB notation the PUB string is changed to P:B (e.g. PUBA01 to P:BA01).

NEW-PUBSET = <cat-id 1..4>

An SF pubset's snap pubset is renamed by specifying the new catalog ID explicitly. The catalog ID can also differ in length from the `PUBSET` operand. The new snap pubset is also an SF pubset. An existing MRSCAT entry is used if it is of the correct type. If it is not, it is deleted and created again. See the notes in [section "Renaming SF pubsets with SHC-OSD" on page 77](#).

HOLD-IO =

Only relevant for ETERNUS DX and VMAX3.
Handles inputs/outputs on the snap pair during splitting (see ["Consistent splitting of a pubset in the shared pubset network" on page 151](#)).

HOLD-IO = *NO

The inputs/outputs on the original units are executed without any change. This can lead to data inconsistencies on the snap units for applications which are not suspended before splitting takes place.

HOLD-IO = *UNTIL-ACTIVATED

The inputs/outputs on the original units are suspended until all the imported pubset's snap pairs are in the `COPY-ON-WRITE` status. Subsequently inputs/outputs to the units are resumed. If an error occurs when inputs/outputs are suspended or resumed, the command is aborted. The input/output activity may need to be resumed using `/RESUME-IO`.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SNAP-UNIT =

Selects the snap units.

SNAP-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the virtual device. A list is accepted only if a subset was specified in the `UNIT` operand.

SNAP-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the snap unit by means of the the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the snap unit by means of the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = *AUTO-SELECT

Automatic selection of suitable snap units by SHC-OSD.

The snap units are selected in accordance with the storage system:

- For ETERNUS DX from the set of the existing free and attached Snap Data Volumes (SDV)
- For Symmetrix from the set of the existing free and attached virtual devices
- For VMAX3 from the set of the existing free and attached BS2000 volumes in special notation, see section [“Automatic selection of snap units” on page 146](#).

SNAP-UNIT=*AUTO-SELECT is not permitted for units which are not generated and not attached.

SNAPSHOT-NAME =

Only relevant for VMAX3.

Specifies the name for the snapshot, see section [“Snapshot name” on page 145](#).

The snapshot is connected with the snap unit specified in SNAP-UNIT=.

SNAPSHOT-NAME = *BY-RULE

The snapshot is given the name generated by SHC-OSD.

SNAPSHOT-NAME = <posix-filename_1..32>

The snapshot is given the specified name. Use of case sensitivity and uniqueness within the VMAX3 must be ensured.

SAVE-POOL =

Only relevant for Symmetrix.

Selects the save pool for the virtual devices to be assigned.

SAVE-POOL = *BY-PRESELECTION

The save pool which was selected using the SHC-OSD parameter file or the /MODIFY-SHC-PROCESSING command is used.

SAVE-POOL = *DEFAULT-POOL

The storage system's default pool is used as the save pool.

SAVE-POOL = <name 1..32 with-under with-low>

Specifies the name of the save pool.

This specification is case-sensitive.

SELECT =

Defines whether the unit specified in the `UNIT` operand or (when remote replication is used) the target unit of a remote copy pair is selected as the original unit of the snap pair.

SELECT = *STD

Selects the unit which was defined in the `UNIT` operand.

SELECT = *TARGET-UNIT(...)

Selects the target unit of a remote copy pair as the original unit. The relevant source unit is specified in the `UNIT` operand.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

Command processing

Message `NDE1073` is output to `SYSOUT` for each device and distributed via routing code 0, i.e. it is logged in the `CONSL0G` file only. You will find detailed information on the `CONSL0G` file (logging file) in the “Introduction to System Administration” manual [5].

Examples

```
/START-SNAP-SESSION UNIT=5000,SNAP-UNIT=5040
```

```
/START-SNAP-SESSION UNIT=5001,SNAP-UNIT=*AUTO-SELECT
```

```
/START-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=TFS),SNAP-UNIT=(5100,5101,5102)
(Pubset TFS consists of 3 units)
```

```
/START-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=A,NEW-PUBSET=C),
SELECT=*TARGET-UNIT
```

(see [page 247](#))

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1044	NEW-PUBSET already exists
	64	NDE1052	Maximum number of TimeFinder mirrors exceeded
	64	NDE1055	Function not supported for Symmetrix/VMAX3 storage systems
	64	NDE1058	All free snap units reserved for snapset
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1110	SELECT=*TARGET-UNIT: SRDF not synchronous or IN-HOLD
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1140	Duplicate MN in MN list
	64	NDE1142	Mirror pair already exists
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1410	No or too few free and matching Snap units

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1411	Save pool does not support device type of Snap pair
	64	NDE1412	Requested save pool does not exist
	64	NDE1430	No Snap function for device
	64	NDE1431	Different number of devices for units and snap units
	64	NDE1434	Virtual snap unit already used in other pair
	64	NDE1435	Device is a virtual unit
	64	NDE1437	MNs of the unit and of the snap unit are identical
	64	NDE1438	Unit and virtual snap unit are different types
	64	NDE1439	Unit and virtual snap unit on different storage systems
	64	NDE1440	Incorrect state of unit (of a snap pair)
	64	NDE1441	Incorrect state of snap unit
	64	NDE1458	Unit and Snap unit meta volumes of different stripe size
	64	NDE1535	Device is a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1820	Reconstruction in storage system not yet completed
	64	NDE1833	No suitable Storman server found
	64	NDE1840	Unit and Snap unit on different storage systems
	64	NDE1850	All mirror disks of the unit reserved for snapset use
	64	NDE1852	Maximum number of mirrors exceeded
	64	NDE1853	Storage unit locked
	64	NDE1870	Snap pair created
	64	NDE1872	Automatic attachment of snap unit(s) failed
	64	NDE1880	Copy license not installed (ETERNUS DX)
	64	NDE1881	Copy Table Size not configured (ETERNUS DX)
	64	NDE1882	Copy Table Size too small (ETERNUS DX)
	64	NDE1883	Advanced Copy operations for devices locked (ETERNUS DX)
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

STOP-CLONE-SESSION

Cancels a clone pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/STOP-CLONE-SESSION` terminates a clone session and cancels the assignment of one or more clone pairs.

On command execution, the clone unit again assumes the status of a normal device without clone function. The information function for the unit shows no clone use after the connection to the last clone unit has been canceled.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), clone units must exist for all units of the pubset.

When the clone session terminates, the clone unit can be destroyed if it is no longer needed (invalid VSN).

Before `/STOP-CLONE-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For EC on ETERNUS DX

If the clone session is in the `SYNCHRONIZING` status, it must be terminated using the `FORCE=*YES` operand.

For TimeFinder/Clone on Symmetrix/VMAX3

The clone session can be in any status (see the [section “Status of the clone session and of the devices” on page 105](#)). If the clone session is in the `COPY-IN-PROGRESS` status, it must be terminated using the `FORCE=*YES` operand.

STOP-CLONE-SESSION

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | LOGICAL-VOLUME = <x-text 1..4>

,CLONE-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *ALL / *RESTORED / *BY-PUBSET(...) /
    *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
    | POSITION = <integer 1..16> / *LAST

*BY-PUBSET(...)
    | CLONE-PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | CLONE-LOGICAL-VOLUME = <x-text 1..4>

,FORCE = *NO / *YES

,SELECT = *STD / *TARGET-UNIT(...)

*TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>

,CLONE-VSN = *KEEP / *DESTROY

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

CLONE-UNIT =

Selects the clone unit. If more than one clone unit exists for a unit, a specific clone unit must be selected.

CLONE-UNIT = *FIRST-POSSIBLE

Selects the first possible clone unit for the command.

CLONE-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the clone unit via its position in the output list of /SHOW-CLONE-SESSION-STATUS.

POSITION = <integer 1..16>

Specifies the position of the clone unit.

POSITION = *LAST

Selects the last clone unit in the output list.

CLONE-UNIT = *ALL

Selects all clone units.

CLONE-UNIT = *RESTORED

Only relevant for Symmetrix/VMAX3.

Selects the clone unit in the *RESTORED status.

CLONE-UNIT = *BY-PUBSET(...)

Selects the clone unit via the pubset ID of the activated and renamed pubset.

CLONE-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

CLONE-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the clone unit by means of the serial number and the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume.

A list is accepted only if a pubset was specified in the UNIT operand.

FORCE =

FORCE controls the termination of a clone session.

FORCE = *NO

Termination of a clone session in the COPY-IN-PROGRESS / SYNCHRONIZING status is rejected with a message.

FORCE = *YES

The clone session is terminated irrespective of its status. The clone pair is canceled.

SELECT =

Selects the clone pairs.

SELECT = *STD

Selects the clone pairs which were defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selects the clone pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the UNIT operand.

For ETERNUS DX the selection can only be made if the target unit is unique.

Concurrent remote copy is not supported here.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

CLONE-VSN =

Controls how the VSN is handled on the clone unit after the clone session has terminated. This is only possible for attached BS2000 devices.

CLONE -VSN = *KEEP

The VSN on the clone unit remains unchanged.

CLONE -VSN = *DESTROY

The VSN on the clone unit is deleted. It can then no longer be used in BS2000.

Command processing

The following messages are output to SYSOUT for each clone pair and distributed via routing code 0, i.e. they are logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/STOP-CLONE-SESSION UNIT=5000,CLONE-UNIT=*ALL
```

```
/STOP-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=TFC)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1006	Pubset/volume is allocated
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1530	No clone function for the unit
	64	NDE1531	Different number of devices in the unit and clone unit specifications
	64	NDE1535	Device is a clone unit
	64	NDE1540	Incorrect state of unit
	64	NDE1541	Incorrect state of clone unit
	64	NDE1549	No clone unit assigned for clone unit selection
	64	NDE1553	Device is not a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1890	CIMOM not found
	64	NDE1891	Gatekeeper error on StorMan server
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

STOP-MULTI-MIRRORING

Cancels a multi-mirror pair

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/STOP-MULTI-MIRRORING` terminates the assignment of one or more multi-mirror pairs with the `SPLIT` state.

When this command is executed, the additional mirror unit is assigned the `UNUSED` state and the normal unit indicates no further multi-mirror utilization once the connection to the last additional mirror unit has been closed.

If the additional mirror unit has been locked using the `LOCK-ADD-MIRROR=*YES` operand of `/HOLD-MULTI-MIRRORING`, you must specify the `UNLOCK-ADD-MIRROR=*YES` operand in `/STOP-MULTI-MIRRORING` to lift the lock.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING` (see also [page 473](#)). The security settings are defined by means of the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of `/MODIFY-SHC-PROCESSING` (see also [page 342](#)).

STOP-MULTI-MIRRORING

```

UNIT = *BY-PUBSET(...) / *BY-VOLUME(...) / *BY-SYMMETRIX(...) / <alphanum-name 2..2> / <x-text 4..4>
  *BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>
  *BY-VOLUME(...)
    | VOLUME = <vsn 1..6>
  *BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>
,SELECT = *STD / *TARGET-UNIT(...)
  *TARGET-UNIT(...)
    | RA-GROUP = *UNIQUE / <integer 1..250>
,SELECT-ADD-MIRROR = *CURRENT / *PREVIOUS / *OLDEST / *ALL / *BY-PUBSET(...) /
                    list-poss(256); <alphanum-name 2..2> / <x-text 4..4>
  *BY-PUBSET(...)
    | ADD-MIRROR-PUBSET = <cat-id 1..4>

```

UNIT =

Selects the normal unit by means of a particular catalog ID (*BY-PUBSET), a particular VSN (*BY-VOLUME), by means of the serial number of the storage system and the internal number of the logical volume in the storage system (*BY-SYMMETRIX), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-SYMMETRIX(...)

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the normal unit by means of the mnemonic device name of the logical volume.

SELECT =

Selection of the multi-mirror pairs.

SELECT = *STD

Selection of the multi-mirror pairs defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selection of the multi-mirror pairs assigned to the target unit of a remote copy pair.

RA-GROUP =

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

SELECT-ADD-MIRROR =

Selects the assigned additional mirror units for the multi-mirror pairs selected by means of the `SELECT` operand. Further details of the multi BCV function are described in the [section “Working with TimeFinder/Mirror” on page 166](#).

SELECT-ADD-MIRROR = *CURRENT

Selects the additional mirror unit currently attached.

SELECT-ADD-MIRROR = *PREVIOUS

Selects the second assigned additional mirror unit.

SELECT-ADD-MIRROR = *OLDEST

Selects the oldest additional mirror unit.

SELECT-ADD-MIRROR = *ALL

Selects all additional mirror units.

SELECT-ADD-MIRROR = *BY-PUBSET(...)

Selects the additional mirror unit using the pubset ID of the split and renamed pubset.

ADD-MIRROR-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

SELECT-ADD-MIRROR = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selection of the additional mirror unit by means of the mnemonic device name of the logical volume.

Command processing

Message `NDE1073` is output to `SYSOUT` for each device and distributed via routing code 0, i.e. it is logged in the `CONSL0G` file only. You will find detailed information on the `CONSL0G` file (logging file) in the “Introduction to System Administration” manual [5].

Examples

```
/STOP-MULTI-MIRRORING UNIT=5000,SELECT-ADD-MIRROR=*ALL
```

```
/STOP-MULTI-MIRRORING UNIT=*BY-PUBSET(PUBSET=MMF)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	32	NDE2013	SYMAPI error in command
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Engenuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1030	No multi-mirror function for the unit
	64	NDE1035	Device is not a normal unit
	64	NDE1040	Incorrect state of the normal unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1043	Pubset type not supported
	64	NDE1083	Additional mirror unit locked
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

STOP-REMOTE-COPY

Cancels a remote copy pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/STOP-REMOTE-COPY` terminates one or more remote copy pairs.

The source unit is selected using the `UNIT` operand.

The target unit is normally selected implicitly using the `UNIT` operand. When multiple remote replication of a source unit is used, the selection for Symmetrix/VMAX3 is performed by specifying the local RA group, and for ETERNUS DX directly by specifying the target unit.

All remote mirror pairs of a server or of an entire controller can be canceled via the qualitative selection of the source units.

The command is executed only if the remote copy pair is in the remote copy state `ERROR`, `IN-HOLD` or `BROKEN`.



An RA group can also contain units not defined in BS2000.

The command is executed only for source units.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

STOP-REMOTE-COPY

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
      *BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
|  VOLUME = <vsn 1..6>

*BY-PUBSET(...)
|  PUBSET = <cat-id 1..4>

*BY-CONTROLLER(...)
|  CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
|  SERIAL-NUMBER = <alphanum-name 3..12>
|  ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
|      *ALL-SOURCE-UNITS(...)
|      |  SELECT = *ANY / *ALL-DEFINED / *ATTACHED
|      |  ,RA-GROUP = *ANY / <integer 1..250>

*BY-STORAGE(...)
|  SERIAL-NUMBER = <alphanum-name 3..14>
|  ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
|      *ALL-SOURCE-UNITS(...)
|      |  SELECT = *ANY / *ALL-DEFINED / *ATTACHED

, TARGET-UNIT(...) = *UNIQUE / *ALL / *FIRST-POSSIBLE / *BY-RA-GROUP(...) / *BY-STORAGE(...)

*BY-RA-GROUP(...)
|  SOURCE-RA-GROUP = *UNIQUE / <integer 1..250>

*BY-STORAGE(...)
|  TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

, FORCE = *NO / *YES

, TARGET-VSN = *KEEP / *DESTROY

```


UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the mnemonic name of the emulated controller.

This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Only relevant for Symmetrix/VMAX3.
Selects all RA groups.

RA-GROUP = <integer 1..250>

Only relevant for Symmetrix/VMAX3.
Selects all source units of an RA group.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the source unit by means of the mnemonic name of the logical volume.

TARGET-UNIT =

Selects the target unit(s) of the remote copy pair.

TARGET-UNIT = *UNIQUE

Selects the only and unambiguous target unit(s). Always applies when there is only one single target unit for a source unit.

TARGET-UNIT = *ALL

All target units which are possibly assigned to one source unit are selected and the corresponding remote copy pairs are canceled.

TARGET-UNIT = *FIRST-POSSIBLE

Selects the first possible target unit for the command.

TARGET-UNIT = *BY-RA-GROUP(...)

Only relevant for Symmetrix/VMAX3.

Selects the remote copy pair via the RA group.

SOURCE-RA-GROUP =

Selects the SRDF connection used via the RA group.

SOURCE-RA-GROUP = *UNIQUE

The only unambiguous local RA group is used.

TARGET-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the target unit by means of the serial number and the internal number of the logical volume in the storage system.

TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!) with the target unit.

FORCE =

FORCE controls the termination of a remote copy pair.

FORCE = *NO

The termination of a remote copy pair is possibly be rejected with a message.

For ETERNUS DX the command is rejected if the remote copy pair is in `ERROR` status.

FORCE = *YES

The termination of a remote copy pair is always executed.

When only one storage system can be reached in ETERNUS DX (e.g. because of a failure), the remote copy pair can only be canceled on this system. If necessary the command must be repeated with `FORCE=*YES` when the failed system is available again.

TARGET-VSN =

TARGET-VSN controls how the VSN is handled on the target unit after the remote copy pair has terminated This is only possible for attached BS2000 devices.

TARGET-VSN = *KEEP

The VSN on the target unit remains unchanged.

TARGET-VSN = *DESTROY

The VSN on the target unit is deleted. The device is then no longer usable in BS2000.

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1021	Device is not a source unit
	64	NDE1041	Incongruous state of the additional mirror unit
	64	NDE1043	Pubset type not supported
	64	NDE1067	Remote copy pair not yet synchronized
	64	NDE1076	Local synchronization has not yet taken place
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1140	Duplicate MN in MN list
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1144	Source unit(s) and target unit(s) are identical
	64	NDE1145	Source unit(s) and target unit(s) on the same storage system
	64	NDE1148	Different number of devices for source unit(s) and target unit(s)
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1155	RAID10 devices not supported

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1171	Target unit not unique
	64	NDE1177	Device is a source unit
	64	NDE1178	Device is a target unit
	64	NDE1179	Device is a cascaded target unit
	64	NDE1187	RA group of the source unit is not unambiguous
	64	NDE1194	Command not allowed if SRDF Farpoint is in use
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1819	Command with UNIT=*BY-CONTROLLER not possible
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1866	No remote link available
	64	NDE1890	CIMOM not found
	64	NDE1891	Gatekeeper error on StorMan server
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered
	64	NDE2021	No license for remote replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

STOP-SNAP-SESSION

Cancels a snap pair

Storage system: ETERNUS DX, Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/STOP-SNAP-SESSION` terminates the snap session and cancels the assignment of one or more snap pairs. For this purpose the snap session must be in the `COPY-ON-WRITE` status or, for Symmetrix, in the `CREATED` or `RESTORED` status.

The information function for the original unit shows no snap use after the connection to the last snap unit has been canceled.

When the snap pair is canceled, the data on the snap unit is discarded. On command execution, the snap unit assumes the `UNUSED` status (not for VMAX3).

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), snap units must exist for all units of the pubset.

Before `/STOP-SNAP-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For SnapOPC+ in ETERNUS DX

If more than one snap session (snap unit) exists for an original unit, by default SnapOPC+ only enables the "oldest" snap session to be terminated.

"Younger" snap sessions can be terminated using the `FORCE=*YES` operand. In this case all other "older" snap sessions are also terminated implicitly.

For TimeFinder/Snap on Symmetrix/VMAX3

The first possible, a particular preceding, the oldest or all snap sessions for an original/unit can be canceled.

STOP-SNAP-SESSION

```

UNIT = *BY-PUBSET(...) / *BY-VOLUME(...) / *BY-SYMMETRIX(...) / *BY-STORAGE(...) /
    <alphanum-name 2..2> / <x-text 4..4>

*BY-PUBSET(...)
    | PUBSET = <cat-id 1..4>

*BY-VOLUME(...)
    | VOLUME = <vsn 1..6>

*BY-SYMMETRIX(...)
    | SERIAL-NUMBER = <alphanum-name 3..12>
    | ,LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SERIAL-NUMBER = <alphanum-name 3..14>
    | ,LOGICAL-VOLUME = <x-text 1..4>

,SNAP-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *ALL / *RESTORED / *BY-PUBSET(...) /
    *BY-SYMMETRIX(...) / *BY-STORAGE(...) / *BY-SNAPSHOT-NAME(...) /
    list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
    | POSITION = <integer 1..127> / *LAST

*BY-PUBSET(...)
    | SNAP-PUBSET = <cat-id 1..4>

*BY-SYMMETRIX(...)
    | SNAP-LOGICAL-VOLUME = <x-text 1..4>

*BY-STORAGE(...)
    | SNAP-LOGICAL-VOLUME = <x-text 1..4>

*BY-SNAPSHOT-NAME(...)
    | NAME = <posix-filename_1..32>

,FORCE = *NO / *YES

,SELECT = *STD / *TARGET-UNIT(...)

    *TARGET-UNIT(...)
        | RA-GROUP = *UNIQUE / <integer 1..250>

,SNAP-VSN = *DESTROY / *UNUSED

```

UNIT =

Selects the units by means of a particular catalog ID (*BY-PUBSET), via the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the mnemonic device name of the logical volume.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-VOLUME(...)

Selects the units by means of a particular VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the units by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the units by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

SNAP-UNIT =

Selects the snap units. If more than one snap unit exists for a unit, a specific snap unit must be selected.

SNAP-UNIT = *FIRST-POSSIBLE

Selects the first assigned snap unit possible for the command.

SNAP-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the snap unit via its position in the output list of /SHOW-SNAP-SESSION-STATUS.

POSITION = <integer 1..127>

Specifies the position of the snap unit.

POSITION = *LAST

Selects the last snap unit in the output list.

SNAP-UNIT = *ALL

Selects all snap units.

SNAP-UNIT = *RESTORED

Only relevant for Symmetrix.

Selects the snap unit in the *RESTORED status.

SNAP-UNIT = *BY-PUBSET(...)

Selects the snap unit via the pubset ID of the activated and renamed pubset.

SNAP-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

SNAP-UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the snap unit by means of the the internal number of the logical volume in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the snap unit by means of the internal logical number in the storage system.

SNAP-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

SNAP-UNIT = *BY-SNAPSHOT-NAME(...)

Only relevant for VMAX3.

Selects the snapshots by means of the snapshot name.

NAME = <posix-filename_1..32>

Specifies the snapshot name, see section ["Snapshot name" on page 145](#).

Use of case sensitivity and uniqueness within the VMAX3 must be ensured.

SNAP-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the snap units.

A list is accepted only if a subset was specified in the UNIT operand.

FORCE =

Only relevant for ETERNUS DX and Symmetrix.

FORCE controls the termination of a snap session.

FORCE = *NO

The "oldest" snap session is terminated (ETERNUS DX).

Termination of a snap session in the RESTORE-IN-PROG status (Symmetrix) is rejected with a message.

FORCE = *YES

The snap session is terminated irrespective of its status. For ETERNUS DX it is also terminated if a snap session which is not the "oldest" was selected. The snap pair is canceled. All "older" snap sessions are also terminated.

SELECT =

Selects the snap pairs.

SELECT = *STD

Selects the snap pairs which were defined using the UNIT operand.

SELECT = *TARGET-UNIT(...)

Selects the snap pairs which are assigned to the target unit of a remote copy pair. The relevant source unit is specified in the UNIT operand.

RA-GROUP =

Only relevant for Symmetrix/VMAX3.

Selects the target unit using the RA group in the case of concurrent target units.

RA-GROUP = *UNIQUE

Selects the one existing target unit.

RA-GROUP = <integer 1..250>

Specifies the RA group for selecting the target unit.

SNAP-VSN =

Only relevant for VMAX3. On other storage systems the VSN is discarded. Determines the VSN of the snap unit after the snap session has ended.

SNAP-VSN = *DESTROY

The VSN of the snap unit is discarded after the end of the snap session.

SNAP-VSN = *UNUSED

The VSN of the snap unit at the end of the snap session is *S#<mn>*. It can then be selected again as the snap unit with `/START-SNAP-SESSION` using the `SNAP-UNIT=*AUTO-SELECT` operand.

Command processing

Message `NDE1073` is output to `SYSOUT` for each device and distributed via routing code 0, i.e. it is logged in the `CONSLOG` file only. You will find detailed information on the `CONSLOG` file (logging file) in the “Introduction to System Administration” manual [\[5\]](#).

Examples

```
/STOP-SNAP-SESSION UNIT=5000,SNAP-UNIT=*ALL
```

```
/STOP-SNAP-SESSION UNIT=*BY-PUBSET(PUBSET=TFS)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset/volume in use
	64	NDE1006	Pubset not found or wrong pubset type
	64	NDE1008	Volume cannot be allocated
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1108	SELECT=*TARGET-UNIT: UNIT is not a source unit
	64	NDE1109	SELECT=*TARGET-UNIT: TARGET-UNIT not found
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1171	Target unit is not unique
	64	NDE1172	RA group invalid for the specified unit
	64	NDE1430	No Snap function for device
	64	NDE1431	Different number of devices in the unit and snap unit specifications
	64	NDE1435	Device is a virtual unit
	64	NDE1437	MNs of the unit and of the snap unit are identical
	64	NDE1438	Unit and virtual snap unit are different types
	64	NDE1440	Incorrect state of unit (of a snap pair)
	64	NDE1441	Incorrect state of snap unit

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1449	No snap unit assigned to specified snap unit
	64	NDE1453	Device is not a snap unit
	64	NDE1454	Device is unused snap unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1820	Reconstruction in storage system not yet completed
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1897	Command not permitted in current status, use FORCE=*YES
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2009	Command aborted with [K2] key
	64	NDE2011	Symmetrix license not entered
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

SWAP-CLONE-SESSION

Swaps original and clone attributes of a clone pair

Storage system: ETERNUS DX
Domain: DEVICE
Privileges: TSOS

The `/SWAP-CLONE-SESSION` command swaps the mirror properties of a clone pair. Before the command is entered, the replication must be interrupted (clone session status `SPLIT`).

`/SWAP-CLONE-SESSION` swaps the mirror properties of one or more clone pairs, each of which consists of an original unit and a clone unit. After a successful swap, the new original unit and the new clone unit remain in the `SPLIT` status. Both can be accessed for applications from the host. From the application's viewpoint, the clone unit contains all the data of the original unit at command processing time.

The original units of the clone pairs are specified in the `UNIT` operand.

When the original units are selected via a pubset (`UNIT=*BY-PUBSET`), clone units must exist for all units of the pubset. The clone pubset on the clone units can be renamed directly using the `RENAME-PUBSET` operand if an SF pubset is involved.

`/SWAP-CLONE-SESSION` for a unit which is also the source unit of a remote replication is rejected with message `NDE1177`.

Before `/SWAP-CLONE-SESSION` is executed, SHC-OSD checks the global and task-specific security settings. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

SWAP-CLONE-SESSION

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-STORAGE(...) / <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>
  | ,RENAME-PUBSET = *NO / *SAME / <cat-id 1..4>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = <x-text 1..4>

,CLONE-UNIT = *FIRST-POSSIBLE / *FROM-SHOW-OUTPUT(...) / *BY-PUBSET(...) / *BY-STORAGE(...) /
  list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*FROM-SHOW-OUTPUT(...)
  | POSITION = *LAST / <integer 1..16>

*BY-PUBSET(...)
  | CLONE-PUBSET = <cat-id 1..4>

*BY-STORAGE(...)
  | CLONE-LOGICAL-VOLUME = <x-text 1..4>

```

UNIT =

Selects the units by means of a particular VSN (***BY-VOLUME**), a particular catalog ID (***BY-PUBSET**), by means of the serial number and the internal number of the logical volume in the storage system (***BY-STORAGE**), or directly by means of the logical volume's mnemonic device name.

UNIT = *BY-VOLUME(...)

Selects the source units by means of a specific VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing. When an SF pubset is selected, the volumes of the clone pubset can be renamed using **RENAME-PUBSET**.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

RENAME-PUBSET =

Determines the catalog ID of the original (SF) pubset after the swap.

RENAME -PUBSET = *NO

The clone pubset is not renamed, i.e. it retains the same name.

RENAME-PUBSET = *SAME

Following the swap the pubset is renamed with the pubset ID or volume set ID of the original pubset (i.e. with the ID specified in `PUBSET`).

RENAME-PUBSET = <cat-id 1..4>

Explicit specification of the new pubset ID.

UNIT = *BY-STORAGE(...)

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

CLONE-UNIT =

Selects the clone unit. If more than one clone unit exists for a unit, a specific clone unit must be selected.

CLONE-UNIT = *FIRST-POSSIBLE

Selects the first possible clone unit.

CLONE-UNIT = *FROM-SHOW-OUTPUT(...)

Selects the clone unit via its position in the output list of `/SHOW-CLONE-SESSION-STATUS`.

POSITION = *LAST

Selects the last clone unit in the output list.

POSITION = <integer 1..16>

Specifies the position of the clone unit.

CLONE-UNIT = *BY-PUBSET(...)

Selects the clone unit via the pubset ID of the activated and renamed pubset.

CLONE-PUBSET = <cat-id 1..4>

Specifies the pubset ID.

CLONE-UNIT = *BY-STORAGE(...)

Selects the clone unit by means of the the internal number of the logical volume in the storage system.

CLONE-LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

CLONE-UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Specifies the mnemonic device name of the logical volume.

Command processing

The following messages are output to SYSOUT for each clone pair and distributed via routing code 0, i.e. they are logged in the CONSOLE file only. You will find detailed information on the CONSOLE file (logging file) in the “Introduction to System Administration” manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Examples

```
/SWAP-CLONE-SESSION UNIT=*BY-PUBSET(PUBSET=CLON)
```

```
/SWAP-CLONE-SESSION UNIT=8300,CLONE-UNIT=3800
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
	1	CMD0202	Syntax error
	1	NDE1036	PUBSET and RENAME-PUBSET have different lengths
	32	NDE2002	Internal error
	32	NDE2014	StorMan error in command
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1003	Device not attached
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1008	Volume cannot be allocated
	64	NDE1015	Device not defined in BS2000
	64	NDE1043	Pubset type not supported

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1044	RENAME-PUBSET already exists
	64	NDE1044	Pubset cannot be renamed
	64	NDE1100	Invalid pubset state
	64	NDE1101	More than one sharer for pubset
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1055	Function not supported for Symmetrix/VMAX3 storage system
	64	NDE1143	Error occurred during processing of mirror pair
	64	NDE1177	Unit is also a source unit for remote copy
	64	NDE1178	Device is a target unit
	64	NDE1530	No clone function for the unit
	64	NDE1531	Different number of devices in the unit and clone unit specifications
	64	NDE1535	Device is a clone unit
	64	NDE1540	Incorrect state of unit
	64	NDE1541	Incorrect state of clone unit
	64	NDE1549	No clone unit assigned for clone unit selection
	64	NDE1553	Device is not a clone unit
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1811	Function not supported for storage system
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1833	No suitable Storman server found
	64	NDE1853	Storage unit locked
	64	NDE1890	CIMOM not found
	64	NDE1891	Gatekeeper error on StorMan server
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2020	No license for local replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

SWAP-REMOTE-COPY

Swaps the source and target property of a remote copy pair

Storage system: ETERNUS DX, Symmetrix/VMAX3

Domain: DEVICE

Privileges: TSOS

The `/SWAP-REMOTE-COPY` command swaps the source and target property of a remote copy pair.

It can be used to swap the target unit for the source unit after a failover in order to continue working with the source unit with the same failsafe feature as before.

It cannot be used in configurations with concurrent remote copy.

Source and target units must be of the same size.

SHC-OSD checks the global and task-specific security settings before the command is executed. The current settings can be displayed with `/SHOW-SHC-PROCESSING`. The security settings are defined using the `TASK-ADMIN-SCOPE` and/or `SYSTEM-ADMIN-SCOPE` operand of the `/MODIFY-SHC-PROCESSING` command.

For REC on ETERNUS DX

Before entering the command, you must interrupt remote copy mode (remote copy status `IN-HOLD` or `ERROR`). Typically it is interrupted when a failure occurs (remote copy status `ERROR`). The command can be entered in both synchronous and asynchronous operating mode.

After the command has been executed successfully, no automatic resynchronization of the new source target pair takes place.

The `TARGET-UNIT` operand controls the selection of the target unit when switching from cascaded remote copy to concurrent remote copy or vice versa.

For SRDF on Symmetrix/VMAX3:

Before entering the command, you must interrupt remote copy mode and activate direct access to the target unit (`IN-HOLD` remote copy state and `DIRECT` target access).

With SRDF swap, both the source unit and the target unit must have the dynamic SRDF capability `*ANY`. The dynamic SRDF capability of units can be displayed using `/SHOW-SYMMETRIX-DEVICE-CONFIG`.

Concurrent remote copy must not be in progress when source and target unit are swapped, i.e. the source unit must have only one target unit.

SWAP-REMOTE-COPY

```

UNIT = *BY-VOLUME(...) / *BY-PUBSET(...) / *BY-CONTROLLER(...) / *BY-SYMMETRIX(...) /
*BY-STORAGE(...) / list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

*BY-VOLUME(...)
  | VOLUME = <vsn 1..6>

*BY-PUBSET(...)
  | PUBSET = <cat-id 1..4>

*BY-CONTROLLER(...)
  | CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

*BY-SYMMETRIX(...)
  | SERIAL-NUMBER = <alphanum-name 3..12>
  | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / *ALL-TARGET-UNITS(...) / <x-text 1..4>
  |   *ALL-SOURCE-UNITS(...)
  |     SELECT = *ANY / *ALL-DEFINED / *ATTACHED
  |     ,RA-GROUP = *ANY / <integer 1..250>
  |   *ALL-TARGET-UNITS(...)
  |     SELECT = *ANY / *ALL-DEFINED / *ATTACHED
  |     ,RA-GROUP = *ANY / <integer 1..250>

*BY-STORAGE(...)
  | SERIAL-NUMBER = <alphanum-name 3..14>
  | ,LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...) / <x-text 1..4>
  |   *ALL-SOURCE-UNITS(...)
  |     SELECT = *ANY / *ALL-DEFINED / *ATTACHED

,TARGET-STATE = *STD / *NOT-READY / *READ-ONLY

,TARGET-UNIT = *UNIQUE / *BY-STORAGE(...) / <alphanum-name 2..2> / <x-text 4..4>

*BY-STORAGE(...)
  | TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

```

UNIT =

Selects the units by means of a particular VSN (*BY-VOLUME), a particular catalog ID (*BY-PUBSET), an emulated controller (*BY-CONTROLLER), by means of the serial number and the internal number of the logical volume in the storage system (*BY-SYMMETRIX/*BY-STORAGE), or directly by means of the logical volume's mnemonic device name.

If *BY-VOLUME, *BY-PUBSET or *BY-CONTROLLER-UNIT is specified, the action is selected for the source unit automatically. If a mnemonic name or *BY-SYMMETRIX is specified, source units and target units are permitted.

UNIT = *BY-VOLUME(...)

Selects the source units by means of a specific VSN.

VOLUME = <vsn 1..6>

Specifies the volume's VSN.

UNIT = *BY-PUBSET(...)

Selects the source units by means of a pubset ID or volume set ID. The pubset is protected against reconfiguration during command processing.

PUBSET = <cat-id 1..4>

Specifies the pubset ID or volume set ID.

UNIT = *BY-CONTROLLER(...)

Only relevant for Symmetrix/VMAX3.

Selects source units by means of the mnemonic name of the emulated controller. This is not possible when the storage systems are connected to x86 servers. See also [section "Configuration on x86 servers" on page 36](#).

CONTROLLER-UNIT = <alphanum-name 2..2> / <x-text 4..4>

Mnemonic name of the emulated controller.

UNIT = *BY-SYMMETRIX(...)

Only relevant for Symmetrix/VMAX3.

Selects the source or target unit by means of the serial number of the storage system and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..12>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all source units of an RA group.

LOGICAL-VOLUME = *ALL-TARGET-UNITS(...)

Selects the target units of the storage system.

SELECT = *ANY

Selects all target units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all target units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all target units (attached in BS2000) of the specified storage system.

RA-GROUP = *ANY

Selects all RA groups.

RA-GROUP = <integer 1..250>

Selects all target units of an RA group.

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

UNIT = *BY-STORAGE(...)

Only relevant for ETERNUS DX.

Selects the unit by means of the serial number and the internal number of the logical volume in the storage system.

SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!).

LOGICAL-VOLUME = *ALL-SOURCE-UNITS(...)

Selects the source units of the storage system.

SELECT = *ANY

Selects all source units of the specified storage system.

SELECT = *ALL-DEFINED

Selects all source units (generated in BS2000) of the specified storage system.

SELECT = *ATTACHED

Selects all source units (attached in BS2000) of the specified storage system.

UNIT = list-poss(256): <alphanum-name 2..2> / <x-text 4..4>

Selects the unit by means of the mnemonic device name of the logical volume.

TARGET-STATE =

Only relevant for Symmetrix/VMAX3.
Specifies the state setting for the target units.

TARGET-STATE = *STD

The target unit setting depends on generation in BS2000. The NOT-READY state is set by default for generated target units to prevent ambiguous VSNs in BS2000 operation. The READ-ONLY state is set for all other target units, e.g. all target units of non-BS2000 systems.

TARGET-STATE = *NOT-READY

Sets the NOT-READY state for all target units.

TARGET-STATE = *READ-ONLY

Sets the READ-ONLY state for all target units.

TARGET-UNIT =

Only relevant for ETERNUS DX.
Controls the selection of the target unit when switching from cascaded remote copy to concurrent remote copy or vice versa.

TARGET-UNIT = *UNIQUE

Remote copy mode is started for the one existing target unit.

TARGET-UNIT = *BY-STORAGE(...)

Selects the target unit using the serial number in the storage system.

TARGET-SERIAL-NUMBER = <alphanum-name 3..14>

Specifies the serial number of the storage system (make sure it is unique!) with the target unit.

Command processing

The following messages are output to SYSOUT for each device and distributed via routing code 0, i.e. they are logged in the CONSOLE file only. You will find detailed information on the CONSOLE file (logging file) in the "Introduction to System Administration" manual [5].

- For successful processing NDE1073
- For unsuccessful processing NDE2007

Example

```
/SWAP-REMOTE-COPY UNIT=*BY-PUBSET(PUBSET=RDF)
```

Command return codes

(part 1 of 2)

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
1	0	NDE2003	Command successfully executed, no processing necessary
2	0	NDE2004	Command successfully executed but not yet completed
3	0	NDE1067	Remote copy pair not yet synchronized
3	0	NDE1069	No current information available about some remote copy pairs
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	32	NDE2014	StorMan error in command
	64	NDE2017	Command not possible due to the current state of the replication
	32	NDE2018	An error occurred in the SYMAPI server during current command processing
	64	CMD0087	Function not permitted in the current input mode or with the current task privileges
	64	CMD0216	Required privilege not available
	64	NDE1000	Device not found or not in the storage system
	64	NDE1001	Device not attached
	64	NDE1002	Controller not found
	64	NDE1003	Data medium not online or not unique
	64	NDE1004	Pubset not found or wrong pubset type
	64	NDE1005	Pubset not homogeneous
	64	NDE1010	Enginuity version is not supported (too low)
	64	NDE1015	Device not defined in BS2000
	64	NDE1020	No remote copy function for the specified unit
	64	NDE1028	Volume not unique in the unit
	64	NDE1041	Incorrect state of the additional mirror unit
	64	NDE1061	Remote copy state is not IN-HOLD
	64	NDE1063	Source unit does not have the state READY
	64	NDE1066	No remote link director available
	64	NDE1079	None of the selected devices is attached
	64	NDE1100	Invalid pubset state
	64	NDE1102	Not all volumes could be allocated
	64	NDE1103	No reconfiguration lock for pubset
	64	NDE1105	Inconsistent pubset
	64	NDE1107	No pubset allocation possible
	64	NDE1114	Serial number not found
	64	NDE1115	Serial number not unique
	64	NDE1116	Storage system's logical volume not found
	64	NDE1150	No gatekeeper device found
	64	NDE1153	Symmetrix device lock set
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1160	Access to target unit of the remote copy pair is BY-SOURCE
	64	NDE1162	Swap not possible

(part 2 of 2)

(SC2)	SC1	Maincode	Bedeutung
	64	NDE1164	Conflict between RESUME-PARAMETER and pending updates
	64	NDE1165	Swap *RESTORE-TO-SOURCE not possible in secure mode
	64	NDE1166	Swap with RESUME-PAR=*ANY not possible with static swap
	64	NDE1167	Configuration session lock is set
	64	NDE1168	Error during configuration change
	64	NDE1170	Source unit has concurrent target units
	64	NDE1179	Device is a cascaded target unit
	64	NDE1190	Command for COPY-MODE=ASYNCHRON for entire RA group only
	64	NDE1193	Command not allowed if target unit is larger than source unit
	64	NDE1194	Command not allowed if SRDF Farpoint is in use
	64	NDE1535	Device is a clone unit
	64	NDE1702	Connection to SYMAPI server aborted
	64	NDE1800	Device not found or not in storage system
	64	NDE1802	Error communicating with StorMan server
	64	NDE1803	CIMOM not available
	64	NDE1810	Storage system's operating system version not supported
	64	NDE1812	StorMan server switched off by command
	64	NDE1814	Storage system's serial number not found
	64	NDE1815	Storage system's serial number not unique
	64	NDE1816	Storage system's logical volume not found
	64	NDE1819	Command with UNIT=*BY-CONTROLLER not possible
	64	NDE1833	No suitable Storman server found
	64	NDE1842	Configuration error in the REC buffer
	64	NDE1853	Storage unit locked
	64	NDE1861	Remote copy pair not in IN-HOLD status
	64	NDE1866	No remote link available
	64	NDE1890	CIMOM not found
	64	NDE1891	Gatekeeper error on StorMan server
	64	NDE1899	Command not possible for current status of the mirror pair
	64	NDE2000	Execution partially successful
	64	NDE2001	Command not executed
	64	NDE2011	Symmetrix license not entered
	64	NDE2021	No license for remote replication (ETERNUS DX)
	130	NDE1082	Memory bottleneck during processing of command
	130	NDE2005	Command cannot be executed at the moment

UNLOCK-SYMMETRIX

Lifts global locks

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

/UNLOCK-SYMMETRIX lifts the global internal storage system locks for remote copy mode. These are valid for all RA groups. Actions which modify remote copy mode are serialized with this lock in the storage system.

The global locks currently set can be shown with /SHOW-SYMMETRIX-CONFIGURATION . . . , INFORMATION=*LOCKS.



CAUTION!

This command is provided only for emergencies and must be used with great care. The lock should be lifted only if it is certain that no other host is performing actions to control remote copy mode at this same time.

UNLOCK-SYMMETRIX

SERIAL-NUMBER = <alphanum-name 12..12>

SERIAL-NUMBER =

Selects the storage system by means of the serial number.

SERIAL-NUMBER = <alphanum-name 12..12>

Specifies the serial number (for reasons of security, this cannot be shortened).

Example

```
/UNLOCK-SYMMETRIX SERIAL-NUM=000184601234
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	64	CMD0216	Required privilege not available
	64	NDE1114	Serial number not found
	64	NDE1702	Connection to SYMAPI server aborted

UNLOCK-SYMMETRIX-DEVICE

Lifts device locks

Storage system: Symmetrix/VMAX3
Domain: DEVICE
Privileges: TSOS

`/UNLOCK-SYMMETRIX-DEVICE` lifts the unit-specific device locks of the storage system. These locks are used by SHC-OSD for all action commands to serialize actions on the units of the storage system.

The unit-specific device locks currently set can be shown with `/SHOW-SYMMETRIX-DEVICE-CONFIG ... ,INFORMATION=*LOCKED-DEVICES`.



CAUTION!

This command is provided only for emergencies and must be used with great care. The lock should be lifted only if it is certain that no other host is performing actions for the relevant devices at this time.

UNLOCK-SYMMETRIX-DEVICE

SERIAL-NUMBER = <alphanum-name 12..12>
,LOGICAL-VOLUME = <x-text 1..4> / *ALL

SERIAL-NUMBER =

Selects the storage system by means of the serial number.

SERIAL-NUMBER = <alphanum-name 12..12>

Specifies the serial number (for reasons of security, this cannot be shortened).

LOGICAL-VOLUME = <x-text 1..4>

Specifies the internal number of the logical volume in the storage system

LOGICAL-VOLUME = *ALL

Selects all units of the storage system.

Example

```
/UNLOCK-SYMMETRIX-DEVICE SERIAL-NUM=000184601234 ,LOGICAL-VOLUME=15
```

Command return codes

(SC2)	SC1	Maincode	Bedeutung
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	32	NDE2002	Internal error
	32	NDE2013	SYMAPI error in command
	64	CMD0216	Required privilege not available
	64	NDE1114	Serial number not found
	64	NDE1154	Disk belongs to a meta-disk
	64	NDE1702	Connection to SYMAPI server aborted

Glossary

additional mirror unit

Additional mirror disk that can be split and used for other purposes (testing, backup, parallel processing, etc.) without impairing current I/O operation. → TimeFinder/Mirror.
“Additional mirror unit” is synonymous with “Business Continuance Volume (BCV)”.

additional mirror pubset

Pubset on → additional mirror units

Automated Storage Tiering (ETERNUS DX)

Performance-dependent use of the capacity of storage systems by automatically controlled data migration. → Flexible Tier Pool. → Flexible Tier Volume. → tiering policies.

business continuance volume (BCV)

→ additional mirror unit

cascaded remote copy

→ remote copy configuration

catalog ID (<catid>)

Catalog ID used in fully qualified file names. The catalog ID is syntactically identical to the pubset ID.

channel adapter (CA)

→ channel adapter

channel adapter

The channel adapters process input/output requests from the host end and control access to the storage system cache.

clone pair, clone pubset, clone session, clone unit

A clone unit is the copy of an original unit at a particular time (“Point-in-Time copy”). The local replication functions of the storage systems create this copy optionally as a complete copy or as a “snapshot”.

After they have been activated, the original unit and clone unit are split; applications can access both.

The original unit and clone unit together form a clone pair and are managed in what is known as a clone session.

If clone units exist for all original units of a pubset, these clone units together form the clone pubset.

concurrent BCV

The concurrent BCV function allows two additional mirror units to be assigned to a normal unit concurrently, whereas both pairs then have the `ESTABLISHED` state simultaneously. Concurrent BCV is synonymous with concurrent additional mirror unit.

concurrent remote copy

→ remote copy configuration

concurrent target unit

→ target unit in a concurrent → remote copy configuration

data device

Internal devices which are configured in the Symmetrix storage system and provide storage space for storing the contents of the → thin devices.

data striping

Distribution of the individual data blocks of a file across the access systems.

director

Channel adapter of the Symmetrix/VMAX3 systems (e.g. remote link director). The channel adapters are of different types which match the different channel types.

disaster tolerant disk system (DTDS)

The highest level of security in the new system of classification of the RAB (Raid Advisory Board). This level is attained by storage systems that are protected against data loss and failure over a wide area by means of redundant, geographically distant data recording.

disk adapter (DA)

Disk adapters control access to the physical drives. Two microprocessors per disk adapter support a total of four SCSI paths. Simultaneous data transfer is possible on two SCSI paths per disk director (one path for each side). To ensure reliability, the disk adapters are interconnected in pairs internally.

Equivalent Copy (EC)

Replication function for ETERNUS DX which offers the clone functionality.

ETERNUS DX

ETERNUS DX systems are high-availability storage systems of FUJITSU.

failback

Failback denotes a return to recovered resources after a failover. In this manual, failback refers to the switching of applications from target units to source units in a remote copy configuration.

failover

In general, failover is the switching procedure from failed resources to redundant identical resources. In this manual, failover refers to the activation of the target units in a remote copy configuration.

FC channel (Fibre Channel, FCP)

Channel type on /390 servers.

file catalog

The file catalog TSOSCAT of an SF or SM pubset acts as a container for the catalog entries (e.g. files and job variables) of that pubset.

The files and job variables are identified by means of unique names in the format `:<cat-id>: $<userid>.<name>.` `<cat-id>` stands for the catalog ID and `<userid>` for the user ID.

The file catalog of an SM pubset consists of several catalog files depending on the number of volume sets.

flexible tier pool (flex pool for short)

Predefined pool for managing the → flexible tier volumes.

flexible tier subpool (flex subpool for short)

Performance-dependent pool containing → flexible tier volumes in the → flexible tier pool.

flexible tier volume (flex volume for short)

Generated volumes in the → flexible tier subpool.

gatekeeper devices

Gatekeeper devices are devices configured in the Symmetrix/VMAX3 storage systems and on the SYMAPI server for handling the SYMAPI inputs/outputs.

local storage system

The local storage system is located in the local Data Center and generally contains the source units. All I/Os are written to the source unit first.

main host

The main host is located in the local Data Center. The original processing takes place on the main host. In normal operation it sends the I/Os to the local storage system.

MASTER catalog

The MASTER catalog MRSCAT contains an index of all pubsets known to a BS2000 system. It also contains the static and dynamic operating parameters of the various pubsets. Previously known as an "MRS catalog".

meta volume

A meta volume is a correctly sequenced, linked set of logical volumes. As far as the host is concerned, these comprise a single logical unit. In fact, there is a meta header volume and all other volumes are meta member volumes. With TimeFinder and SRDF actions, it is always the meta header volume that is specified; the action is carried out automatically for the meta header volume and all associated meta member volumes.

Data addressing on meta-devices can be organized in two ways:

- "Concatenated devices": Bytes 1 to n are on the first meta-device, $n+1$ to $2n$ on the second, and so on. n is the size of a meta-device.
- "Striped devices": Data is divided into stripes of size s . Bytes 1 to s (i.e. the first stripe) are on the first meta-device, bytes $s+1$ to $2s$ on the second, and so on to the last device; the next stripe is again on the first meta-device, and so on.

multi BCV/multi additional mirror unit

With the multi BCV function it is possible to administer all assignments and change information of a normal unit for to up to 16 additional mirror units in the Symmetrix/VMAX3 storage systems. The terms "multi BCV" and "multi additional mirror unit" are synonymous.

multi-mirror pair

A multi-mirror pair consists of a normal unit and an → additional mirror unit.

normal unit

The unit of a multi-mirror pair that contains the original data

POSIX semaphores

Variables which control access to a shared resource.

pubset (public volume set, PVS)

A set of public disks that belong together with the same pubset ID. Pubset is the general name for a set of disks irrespective of the pubset type (SF or SM pubset).

Users address pubsets by the catalog ID (in the file catalog) for purposes of file access.

pubset ID

Name of a SF or SM pubset.

Redundant Array of Independent Disks (RAID)

RAID refers to a technological concept for improving data availability. RAID levels RAID0 through RAID10 exist.

RAID0

RAID0 implements the distribution of the individual data blocks of a file (“data striping”) without data backup.

RAID1

RAID1 fully duplicates data on double the number of disks.

RAID5

RAID5 implements joint parity checking for several disk drives with distribution of the individual data blocks of a file over the disk drives (no → data striping). RAID5 can be configured as 3+1 or 7+1.

RAID6

RAID6 implements joint parity checking for several disk drives with distribution of the individual data blocks of a file over the disk drives. The data is then also protected when a second drive fails during a “rebuild process”. RAID6 can be configured as 6+2 or 14+2.

RAID10

RAID10 implements the distribution of the individual data blocks of a file (→ data striping) and at the same time fully duplicates the data on double the number of disks (RAID1 and RAID0).

RA groups

RA groups determine the SRDF connection between two Symmetrix/VMAX3 storage systems. A local and a remote RA group are configured in an SRDF connection. An RA group consists of two or more remote adapters. A remote adapter can be assigned to several RA groups (→ remote copy configuration). Each volume used for SRDF can be assigned to up to two RA groups (→ concurrent remote copy)).

Remote Equivalent Copy (REC)

Function of ETERNUS DX for creating (additional) copies of application data of a local storage system in other, geographically distant storage systems.

remote copy configuration

Configuration when remote replication is used: The data of a local storage system is mirrored to one or more remote storage systems. There are the following configuration variants:

- Single remote copy configuration with → remote copy pairs
- Concurrent remote copy configuration with → remote copy pairs which operate simultaneously (concurrently)
- Switched remote copy configuration (SAN connection)
- Cascaded remote copy configuration (cascaded replication, Symmetrix/VMAX3)
- SRDF/A configuration: Asynchronous processing mode of SRDF with cross-disk consistency.

remote copy pair

A remote copy pair consists of a source unit (original, local storage system) and a target unit (data copy, remote storage system) that are connected to each other by means of a remote link.

remote adapter (RA)

→ remote link director

remote link director

The remote link director (remote adapter, RA) is an adapter for FC channels or Gigabit Ethernet. It is used to connect the local and remote Symmetrix/VMAX3 storage systems for remote copying.

remote storage system

The remote storage system is located in the remote Data Center and generally contains the target units. If the entire local Data Center fails (main host and local storage system), the target units are released for use by the standby host.

save device

Save devices save all original data which was modified on the original unit (and also on the snap unit) in the course of a snap session

Save Pool / Snap Data Pool (SDP)

→ snap pair

SF pubset (single-feature pubset)

An SF pubset consists of up to 255 disks. The format of all disks must be identical in terms of allocation unit, formatting, PAM key use, etc. Specific attributes are assigned to the SF pubset, e.g. high availability; these apply to all files in the pubset.

SF pubsets are addressed by users by means of their catalog ID only.

The pubset ID of an SF pubset is a syntax component of the VSN of all disks belonging to the pubset (PUB or point notation).

SM pubset (system-managed pubset)

Pubset consisting of several volume sets. The format and attributes of the various volume sets of an SM pubset may be different. Files with different requirements in terms of availability and performance can be stored in the SM pubset. Like SF pubsets, SM pubsets are addressed by users via their catalog ID only.

SMI-S

Storage Management Initiative Specification, the standard which is defined and supported by the SNIA (Storage Networking Industry Association) for non-proprietary, uniform management of storage systems.

SnapOPC+

Name of the snap function for ETERNUS DX with the option of creating and operating multiple snap sessions for one original unit.

**Snap Data Volume (SDV), Snap Data Pool Volume (SDPV),
Snap Data Pool Element (SDPE)**

SnapOPC+ uses specially configured devices in the storage system, which are known as Snap Data Volumes (SDVs), as snap units. If the capacity of the SDV has been exhausted, it is provided with further capacity from a central pool (Snap Data Pool, SDP) of the storage system by one or more Snap Data Pool Elements (SDPEs) being made available.

snap pair, snap pubset, snap session, snap unit

A snap unit is the copy of an original unit at a particular time (“Point-in-Time copy”). The local replication functions of the storage systems create this copy as a “snapshot” in accordance with the “Copy-On-First-Write strategy”: Only if data is modified is the original data concerned written beforehand into a snap save area (Save Pool / Snap Data Pool) of the storage system. The snap unit contains the references to the original data. In the case of unmodified data the references point to the original unit, in the case of modified data to the snap storage area.

After they have been activated, the original unit and snap unit are split; applications can access both.

The original unit and snap unit together form a snap pair and are managed in what is known as a snap session.

If snap units exist for all units of a pubset, these snap units together form the snap pubset.

source path

Input/output path from the main host to the → source unit

source unit

The source unit is generally located on the local storage system. All I/Os are written to the source unit first.

Standard Volume Label SVL

Standard volume label containing information required by the system for volume management.

standby host

The standby host is located in the remote Data Center. It takes over processing if the main host fails and normally uses the target path to the remote storage system.

switched remote copy

→ remote copy configuration

SYMAPI Symmetrix Application Programming Interface

Strategic interface of EMC for administering and controlling the storage systems which is used in the context of the partnership between FUJITSU and EMC² Corporation.

Symmetrix

Symmetrix systems are high-availability storage systems from EMC.



In this manual and in the EMC literature, "Symmetrix" refers only to the older storage systems DMX, VMAX1, and VMAX2. The latest storage system is called VMAX3.

Symmetrix Remote Data Facility (SRDF)

Function of the Symmetrix SRDF enables replication to another Symmetrix/VMAX3 storage system by means of remote copy. The second, remote system can be installed at any location. Thus failure recovery functionality is provided.
→ remote copy configuration

target path

Input/output path from the standby host to the → target unit

target unit

The target unit is usually located on the remote storage system. The target unit is a copy of the source unit and is synchronized with it. In the event of a failure, the target unit receives I/Os via the target path.

thin device

Virtual volume with a large capacity. Virtual volumes occupy physical storage from a jointly used storage pool as required. → thin pool

thin pool

Predefined pool for managing the → thin devices.

Thinpoolavoid file

Optional file `thinpoolavoid` in POSIX directory `var/shcosd/config` in which a list of thin pools can be specified which are not to be monitored by SHC-OSD when `THIN-POOL-MONITORING=BY-AVOID-FILE` or `FLEX-POOL-MONITORING=BY-AVOID-FILE` is specified in the SHC-OSD parameter file.

thin provisioning

Efficient use of the capacity of storage systems by virtual volumes with a large capacity. → Thin Provisioned Volume (TPV) → virtual provisioning.

Thin Provisioned Pool (TPP, thin pool for short)

Predefined pool (ETERNUS DX) of physical disks to provide the physical storage space for → Thin Provisioned Volumes (TPVs).

Thin Provisioned Volume (TPV)

Virtual volume (ETERNUS DX) with a large capacity. Virtual volumes occupy physical storage from a jointly used storage pool as required. → thin pool (TPP).

tiering policies

Rules for → Automated Storage Tiering. → Flexible Tier Pool.

TimeFinder, TimeFinder/Clone, TimeFinder/Snap, TimeFinder/Mirror (Symmetrix)

Product family of EMC whose functions permit (additional) copies of the application data to be created within a Symmetrix storage system. TimeFinder consists of three autonomous products:

TimeFinder/Clone creates, activates and reconstructs → clone pairs.

TimeFinder/Snap creates, activates and reconstructs → snap pairs.

TimeFinder/Mirror creates, splits and reconstructs → multi-mirror pairs.

TimeFinder SnapVX (VMAX3)

Product of EMC whose functions permit (additional) copies of the application data to be created within a VMAX3 storage system.

TimeFinder SnapVX creates, activates and reconstructs → snap pairs.

TimeFinder SnapVX emulates TimeFinder/Clone and TimeFinder/Mirror for VMAX3.

virtual provisioning

Efficient use of the capacity of Symmetrix/VMAX3 storage systems by virtual volumes with a large capacity. → thin device. → thin provisioning (generic term)

virtual device

The virtual device of the storage system is the → snap unit, which can be accessed from the server.

volume set ID

Name of a volume set.

The volume set ID is a syntax component of the VSN of all disks of the volume set (PUB or point notation).

Volume serial number VSN

Six-character alphanumeric identification stored in the → Standard Volume Label of a disk.

Abbreviations

BCV	Business Continuance Volume
AST	Automated Storage Tiering
CA	Channel Adapter (Channel Director)
DA	Disk Adapter (Disk Director)
DAB	Disk Access Buffer
Dir	Director
DR	Dynamic Reconfiguration
DSSM	Dynamic Subsystem Management
DTDS	Disaster Tolerant Disk System
EC	Equivalent Copy (for ETERNUS DX)
FBA	Fixed Block Architecture
FC	Fibre Channel adapter
FTDS	Failure Tolerant Disk System
GigE	Gigabit Ethernet
HA	High Availability
HBA	Host Bus Adapter
LUN	Logical Unit Number
MN	Mnemonic device name
MRSCAT	MASTER catalog
PAV	Parallel Access Volume
RA	Remote Adapter (Remote Link Director)
RAB	Raid Advisory Board
RAID	Redundant Array of Independent Disks
REC	Remote Equivalent Copy (for ETERNUS DX)
SDV	Snap Data Volume
SDP	Snap Data Pool
SDPV	Snap Data Pool Volume

Abbreviations

SF pubset	Single-Feature pubset
SHC-OSD	Storage Host Component for BS2000
SM pubset	System-Managed pubset
SRDF	Symmetrix Remote Data Facility
SRDF/A	Symmetrix Remote Data Facility / Asynchronous
SVC	Supervisor Call
SVL	Standard Volume Label
SYMAPI	Symmetrix Application Programming Interface
TPP	Thin Provisioned Pool
TPV	Thin Provisioned Volume
VDEV	Virtual Device
VSN	Volume Serial Number (archive number)
WWNN	World Wide Port Name (port WWN)

Related publications

You will find the manuals on the internet at <http://manuals.ts.fujitsu.com>. You can order printed versions of manuals which are displayed with the order number.

- [1] **BS2000 OSD/BC
Commands**
User Guide
- [2] **POSIX (BS2000)
Commands**
User Guide
- [3] **POSIX (BS2000)
POSIX Basics for Users and System Administrators**
User Guide
- [4] **C Library Functions (BS2000)**
for POSIX Applications
Reference Manual
- [5] **BS2000 OSD/BC
Introduction to System Administration**
User Guide
- [6] **BS2000 OSD/BC
System Installation**
User Guide
- [7] **BS2000 OSD/BC
Diagnostics Handbook**
User Guide
- [8] **BS2000 OSD/BC
Utility Routines**
User Guide
- [9] **FDDRL (BS2000)**
User Guide

- [10] **HSMS (BS2000)**
Hierarchical Storage Management System
User Guide
- [11] **IMON (BS2000)**
Installation Monitor
User Guide
- [12] **SESAM/SQL-Server (BS2000)**
Core Manual
User Guide
- [13] **SQ Server**
Operation and Administration
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