DRV V3.2

Dual Recording by Volume

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1 Preface

This chapter provides a brief description of the product DRV and general information about the manual.

1.1 Brief product description

DRV (Dual Recording by Volume) is a recording mode which allows data to be stored in duplicate on two disks. In order to make a distinction, the single recording mode is called SRV (Single Recording by Volume).

DRV is implemented in the I/O system of BS2000/OSD and runs independently of both Data Management System (DMS) and user programs. DRV is started, controlled, monitored and terminated using commands issued by the operator or system administrator.

Dual mode and mono mode

The DRV mode in which the data is stored in duplicate is called dual mode, and enhances the availability of the data stored on the disks. Each write job issued by the Data Management System is executed on both disks. Read jobs are distributed equally to both disks. Consequently, read jobs are executed faster than in SRV mode.

Dual mode offers more correction options for write errors. As long as the data records are readable on at least one disk, errors can be corrected by assigning an alternate track or block and by copying the data to there from the intact disk. Data duplication does not have to be terminated in order to do this.

If a disk fails, you can change to mono mode. You can specify the maximum length of time operations may be interrupted in the case of such a disk failure. If the error is not eliminated in this time, DRV switches to mono mode, providing the mirror disk is still available. Intervention by the operator is not necessary.

The operator or system administrator can replace the defective drive unit by a unit of the same type without interrupting applications. Mono mode differs from SRV in that dual mode can be resumed by linking in another disk with an identical VSN (volume serial number) in the course of operations. The changeover from mono to dual mode is called *reconstruction*. The data is copied onto the newly added disk. User inputs and outputs can still be processed while this is in progress. The added disk is called the mirror disk.

The original disk and the mirror disk are stored at separate locations. This means that even if one disk storage system is not available because of faults, maintenance, repair work, extensions, power supply failure, fire or flooding, uninterrupted data access will still be possible.

Data duplication also enables data from various types of disk to be copied to type D3435 disks without lengthy idle times. This disk migration is necessary if old disk controllers are to be replaced, or the Fibre Channel connection is to be switched to. For information on disk migration, see the section "Disk migration with DRV" on page 45.

When DRV is stopped, the mirror disks of pubsets can be renamed. The data on the mirror disks is then available separately from the data on the original disk, for example for extensive evaluations. The data on the original disk can be used again directly after the mirror disks have been separated. There is no need to wait for completion of the evaluation, which may take a long time. Once evaluation has been completed, the original and mirror disks can be rejoined again. For details, see the section "Separate processing of original and mirror disks" on page 39.

1.2 Target group

The manual is intended for system support and the operator in the data center who is responsible for setting and checking the DRV mode. It is also intended for BS2000 users who require information about their disk usage or who want to use the DRV macro interface.

1.3 Summary of contents

The "DRV" manual consists of the following chapters:

This chapter "Preface"
contains a brief description of DRV and notes on use of the manual.

The chapter "Use of DRV" on page 15
describes the prerequisites for DRV operation and the user interfaces DRV provides.

The chapter "Installation, startup and termination of DRV" on page 19
describes how you install, configure, start and terminate DRV.

The chapter "Working with DRV" on page 23
provides an introduction, explains the concepts DRV operates on and shows how you can
work with it. After the mode of operation of DRV and the basic terms have been explained,
the "Separate processing of original and mirror disks" and "Disk migration with DRV" are
focussed on and explained in detail.

The chapter "Error recovery" on page 63
describes error recovery in DRV.

The chapter "Conflicts and solutions" on page 79
describes the various conflicts which can occur while installing DRV and explains how the
operator should respond in these cases.

The chapter "Commands" on page 99
contains detailed information on the DRV commands.

The chapter "Procedure for disk migration with DRV" on page 155
describes the procedure which combines the commands for disk migration.

The chapter "Macro interface" on page 159
describes the macro interface of DRV.

The chapter "DRV accounting record" on page 163
describes the accounting record of DRV.

The chapter "Appendix" on page 165 contains the following sections:

–   The section "Output columns" on page 165
    is an alphabetic list of all output columns specific to DRV in SHOW commands.

–   The section "Layout of the DRV record" on page 175
    describes the layout of the DRV record in the `NKDINF` macro.

–   The section "IDFCB macro" on page 178
    contains a description of the `IDFCB` macro.

–   The section "IDPPL macro" on page 178
    contains a description of the IDPPL macro.

–   The section "Compatibility with other products" on page 179
    describes the compatibility of DRV with other operating system versions and products.

At the end of the manual you will find a list of abbreviations, technical terms and related publications, plus an index.

README file

Any additions to the manuals are described in the Readme files for the various product versions. These Readme files are available at *http://manuals.ts.fujitsu.com* under the various products.

Readme file under BS2000/OSD

On your BS2000 system you will find Readme files for the installed products under the file name:

```
SYSRME.<product>.<version>.E
```

Please refer to the appropriate system administrator for the user ID under which the required Readme file can be found. You can also obtain the path name of the Readme file directly by entering the following IMON command:

```
/SHOW-INSTALLATION-PATH INSTALLATION-UNIT=<product>,LOGICAL-ID=SYSRME.E
```

You can view the Readme file with/SHOW-FILE or by opening it in an editor or print it at a standard printer using the following command (e.g. DRV V3.2):

```
/PRINT-DOCUMENT FROM-FILE=SYSRME.DRV.032.E,
                LINE-SPACING=*BY-EBCDIC-CONTROL
```

Additional product informations

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 at *http://manuals.ts.fujitsu.com*.

1.4 Changes since the last version of the manual

Since the previous manual, a number of major changes have been made:

● The DRV README file has been integrated.

● The manual has been brought in line with BS2000/OSD V8.0.

● DRV can also be used on SQ servers.

● The installation files have the suffix "032".

● A subsystem configuration file can be specified to configure DRV.

● The SET-DRV-ENVIRONMENT command has been supplemented by the COPY-SPEED-PARAMETER and SERVER-TASK-LIMIT parameters.

● The SHOW-DRV-ENVIRONMENT command has been supplemented by the operand value INFORMATION=*COPY-SPEED-PARAMETER and also outputs information on the DRV server tasks.

● The section "Disk migration with DRV" has been updated.

The "Messages" section is no longer included.
You will find the messages using an HTML application on our manual server
(URL: *http://manuals.ts.fujitsu.com*) and on the DVD "BS2000/OSD SoftBooks".

1.5 Notational conventions

The metasyntax used in the chapter "Commands" on page 99 is described in the manual "Commands" [1].

Document references in the text are given in abbreviated form between quotation marks. The full title to which the specified number refers is listed under that number at the back of the manual in the related publications section, accompanied by a brief description.

References within this manual specify the page in question within the manual and, if appropriate, the name of the section or chapter. References to topics which are dealt within other manuals specify only the abbreviated name of the manual. You can then consult the index of the specified manual to find the correct location in the text.

The yyyy-mm-dd output in the examples represents a current date.

2 Use of DRV

This chapter describes the prerequisites for use of DRV, the DRV information stored on the disk and the user interfaces provided by DRV.

2.1 Prerequisites for DRV

DRV V3.2 can execute with BS2000/OSD V6.0 or higher (for SQ and SX servers in the software package OSD/XC V2.0 or higher).

Supported disks

DRV supports all private disks and pubsets (public volume sets) with the following restrictions:

– Private disks which are used as shared private disks (SPD) cannot be used for DRV.

– Disks of type D3409-GS which are emulated in global storage cannot be used for DRV.

– Shared pubsets (CCS and XCS) cannot be used for DRV.

Prerequisites for logical disks

In order for two disks to be used as one logical disk, the following requirements have to be fulfilled:

– Device, controller and channel types must be identical as, for performance reasons, only one channel program is created.
– The disk formats must be identical.
  This includes the partitioning into label, usable and alternate sectors as well as the attribute "with key" or "without key" and the type of formatting (2K or 4K).
– If FASTDISKs (device type D3409) are used, they must be configured in the same size.
– Both disks must have been initialized in the same operating system version.
– The VSN of both disks must be identical.
– The time stamps must match.

2.2 DRV information in the SVL

The standard volume label (SVL) contains the following information important for allocation of a disk for DRV or SRV operation.

– DRV indicator and DRV record
– inconsistency indicator
– time stamp

DRV indicator and DRV record

DRV sets the DRV indicator when the disk is reserved for DRV operation.

If the indicator is set, the local DRV data of the DRV record is regarded as valid. The DRV record contains information on the allocation and creation of disk pairs. In addition, it specifies whether operations in DRV mode were terminated normally and whether the two disks are identical.

Inconsistency indicator

DRV supports the inconsistency indicator. It is set if the data on a disk is inconsistent at the time of initializing or copying.

Time stamp

The time stamp specifies the last allocation time of the disk. It is used in the same way in both DRV and SRV mode.

In the case of DRV disk pairs, the time stamps on the two disks must be identical.

2.3 Overview of the user interfaces

The DRV user interfaces are of most importance to the operator and system administrator, who control and monitor DRV operation. The normal user usually works with the logical disk only. He/she always sees a single disk, regardless of whether the logical disk consists of one or two physical disks.

DRV provides the following interfaces:

– command interface
– macro interface

Command interface

The command interface provides DRV commands plus the DRV-specific extensions to the commands `/SHOW-DEVICE-STATUS` and `/SHOW-DISK-STATUS`.

The DRV commands are an extension of the operator interface. These allow the operator to administer DRV disks from the console.

The commands can also be input from a privileged terminal. However, the view from the terminal is not as complete as from the console. This applies to DRV messages and to relevant messages from other facilities such as Disk Monitor (NKV) and reconfiguration (NKR).

In the NDM commands `/SHOW-DEVICE-STATUS` and `/SHOW-DISK-STATUS`, the output has been expanded to include information specific to DRV. With limitations, these extensions are also available to normal users.

The command interface is described in detail in chapter "Commands" on page 99.

Macro interface

The macro interface is made up of DRV-specific extensions to macros. These enable the user to query DRV parameters and to ensure consistency of the data on a disk pair.

The macro interface is described in chapter "Macro interface" on page 159. The macros themselves can be found in the appendix.

3 Installation, startup and termination of DRV

This chapter describes how to install, configure, start and terminate DRV.

Installing DRV as a subsystem

DRV must be installed using the IMON installation monitor (see the "IMON" manual [3].

DRV consists of the following selectable units (<ver>=032):

– Structure and information file for installation: SYSSII.DRV.<ver>
   This contains the information required for installation with IMON.

– Subsystem catalog: SYSSSC.DRV.<ver>
   This is created using SSCM and contains (for DSSM) the links to the LMS module
   library and the REP file. DRV is loaded automatically at SYSTEM READY

– LMS module library for S servers: SYSLNK.DRV.<ver>
   LMS module library for SX servers: SPMLNK.DRV.<ver>
   LMS module library for SQ servers: SKMLNK.DRV.<ver>
   DRV is loaded by DSSM from the libraries.

– RMS delivery file: SYSRMS.DRV.<ver>

– Message files for message and help texts: SYSMES.DRV.<ver>
   This file must be merged into the system message files or activated by means of
   `/MODIFY-MESSAGE-FILE-ASSIGNMENT`.

– SDF syntax file: SYSSDF.DRV.<ver>
   This contains the syntax of the DRV commands. SDF requires this file in order to
   process the commands input from terminal or console. It must therefore be added to the
   system syntax file by means of SDF-I or SDF-U or activated by means of
   `/MODIFY-SDF-OPTIONS`.

– LMS procedure library: SYSPRC.DRV.<ver>
   This contains a template for using the DRV migration functions

– Library with DRV macros: SIPLIB.DRV.<ver>

– Symbol file for DAMP: SYDMP.DRV.<ver>

– Release Notice (German / English): SYSFGM.DRV.<ver>.D/E

– Readme file (German / English): SYSRME.DRV.<ver>.D/E

DRV is installed as a subsystem and loaded dynamically via DSSM (Dynamic Subsystem Management). The compatibility of DRV with other products is discussed in "Compatibility with other products" on page 179.

Subsystem configuration file

Startup parameters for DRV can be entered via a subsystem configuration file.

The subsystem configuration file can be specified in the DSSM subsystem catalog entry of DRV as SUBSYSTEM-INFO-FILE (/MODIFY-SUBSYSTEM-PARAMETERS command for the dynamic catalog or the //MODIFY-SUBSYSTEM-ATTRIBUTES statement for the static catalog) or as a subsystem parameter when starting DRV (/START-SUBSYSTEM command), in the form SUBSYSTEM-PARAMETER='FILE-NAME=<name>', where <name> is the name of the configuration file.

Specification as a subsystem parameter has priority over entry in the subsystem catalog. One of the following keywords can be specified instead of a file name:

*SYSTEM $TSOS.SYS.DRV-CONFIGURATION is used as the configuration file name

*DEFAULT $TSOS.SYSPAR.DRV.<ver> is used as the configuration file name

*NONE   No configuration file is used

File name

The configuration file can be stored with any desired name under any user ID, but must always be on the home pubset of the server. However, in this case the file name must be specified in full in the above commands.

If no user ID is specified, a search is made for the specified file first under the $TSOS ID, second under the system default ID

File attributes

The configuration file must be a SAM file with variable record length (FILE-STRUC=SAM, REC-FORM=V).
It should have the attributes USER-ACCESS=*OWNER-ONLY and ACCESS=*READ and, if necessary, be write-protected with a password.

Configuration file formats

All the DRV action commands are permitted in the configuration file, except for the SHOW commands:

– SET-DRV-ENVIRONMENT
– SET-DRV-PARAMETER
– START-DRV-DUAL-MODE
– STOP-DRV-DUAL-MODE
– PREPARE-PUBSET-MIGRATION
– FINISH-PUBSET-MIGRATION
– ABORT-PUBSET-MIGRATION

If an error occurs while a command is being during executed, the configuration file processing is not terminated. But processing is aborted if syntax errors are encountered.

Unique abbreviations are permitted for the commands.

The commands generally conform to the SDF rules.
Only the following points deviate from this:

– The continuation character "-" can be placed anywhere.

– Continuation lines must begin with "/".

– The maximum permitted record length is 256 bytes (including record length field).

– The maximum length permitted for each command is 4000 bytes.

Starting DRV

DRV is loaded automatically at SYSTEM READY.

After DRV has been installed, you load the subsystem with the command call:

```
/START-SUBSYSTEM SUBSYSTEM-NAME=DRV
```

All other operands are set to the default values.

A message informs the operator whether this command has been accepted or rejected.

The command is rejected if:

– the subsystem is not found in the static subsystem catalog

– a required file (e.g. message file, subsystem LLM) does not exist

– the version of the subsystem does not match the BS2000/OSD version.

Terminating DRV

As long as disks are being operated as DRV disks, the DRV subsystem cannot be unloaded. The availability of the disks monitored by DRV is possible only if the subsystem is likewise available.

This does not apply if only the home pubset is allocated by DRV as DRV-MONO and is not being used for paging.

You can keep a check on the current status by means of the /SHOW-DRV-STATUS command. DRV can be terminated provided all disks administered by DRV (with the exception of the home pubset) have the value FREE in the ALLOC-PHASE column in the SHOW-DRV output, and no task under the control of DRV is currently running.

You unload DRV with the command call:

/STOP-SUBSYSTEM SUBSYSTEM-NAME=DRV

All other operands are set to the default values.

DSSM terminates unloading only when no more tasks are linked with the DRV subsystem. You can find out which tasks are linked with DRV via the command call:

/SHOW-SUBSYSTEM-STATUS SUBSYSTEM-NAME=DRV

All other operands are set to the default values.

DRV actions at shutdown

In the case of an operating system shutdown, current reconstructions and equalizations are aborted; they are automatically started anew after the next BS2000/OSD startup. The time when the copying operation is started depends on the copying time which has been set. The copying operation can be started immediately after the disks have been mounted, or when they are first allocated. You can set the copying time with /SET-DRV-PARAMETER.

4 Working with DRV

This chapter explains the concepts underlying DRV and shows you how to work with it.

4.1 Logical disk and operating mode

The DRV concepts which are important for working with DRV are:

– logical disk
– operating mode

The operator creates a logical disk for DRV and sets the desired operating mode.

Logical disk

A logical disk is a disk used for DRV operation. Depending on the operating mode, it consists of one or two physical disks.

If it consists of two physical disks, disk format, disk parameters and the VSN (Volume Serial Number) are identical for both disks.

The logical disk is addressed via the VSN (volume serial number). The corresponding physical disks are addressed via the names of the devices on which they are mounted.

For the normal user, it is unimportant whether the logical disk consists of one or two physical disks. He/she only sees one disk, i.e. the logical disk.
The operator, on the other hand, who installs and administers the logical disk, has to know about the corresponding physical disks.

Operating mode

The operating mode determines how a logical disk is used and which role the corresponding physical disks play. The role is determined by the logical disk type which is stored in the SVL of the physical disks. There are corresponding logical disk types for every operating mode.

The possible operating modes in normal operation and the corresponding logical disk types are shown in the following table.

Operating mode	No. of physical disks	Logical disk type
SRV	1	SRV
Mono	1	MONO
Dual	2	(DUAL, DUAL)

In addition, there are two techniques for error recovery, namely reconstruction and equalization. Both techniques are lengthy transitions from single recording to data duplication. They are therefore regarded as independent operating modes in DRV.

Operating mode	No. of physical disks	Logical disk type
Reconstruction	2	(READ, RECONSTRUCT)
Equalization	2	(DUAL-CRASHED, DUAL-CRASHED) (READ, EQUALIZE)

4.1.1 Examples of operating modes

SRV mode

SRV mode is the conventional recording mode. There is only one physical disk. `SRV` is stored in the SVL of this disk. The data is stored once without use of DRV.

Example

Displaying the status of a SRV disk.

SRV allocation is indicated by the `SRV` value in the `SVL-DRV-INFO` column and the `SRV-USE` entry in the `AVAIL/ALLOC` column:

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%   VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000               FREE
%   VSN    RECORDING-MODE  EQUALIZE    COPY-START   DUAL-STOP
%  DRV000  FROM-DISK       ALL         AT-ALLOC   AT-ERROR(   10S)
%   VSN    COPY-SPEED
%  DRV000  MEDIUM
%   VSN     MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B0       SRV             SRV-USE    yyyy-mm-dd 13:45:24
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001
```

Mono mode

This is the DRV mode in which the data is recorded once only. There is only one physical disk, but it is operated as a logical disk. DRV creates the corresponding administration tables. MONO is stored in the SVL of this disk. The data is maintained once under participation of the DRV subsystem. A changeover to dual mode is possible at any time.

Example

Displaying the status of a mono disk.

Mono allocation is indicated by the MONO value in the SVL-DRV-INFO column. The value FREE-USE in the AVAIL/ALLOC column specifies that the disk is used for DRV mode.

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S   ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000   B0       IN-USE            MONO
%  VSN   RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
% DRV000     DRV        ALL        AT-ALLOC   AT-ERROR(   10S)
%  VSN   COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
% DRV000 B0      MONO           FREE-USE    yyyy-mm-dd 13:45:49
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

Dual mode

This is the DRV mode for data duplication. One logical disk comprises two physical disks. DUAL is stored in the SVL of the physical disks. The data is kept on both physical disks. Every DMS write job is carried out on both disks and every read job is executed on the disk with the shortest access.

Example

Displaying the status of a dual disk.

The disk pair is indicated by the two lines for the two physical disks, the dual allocation by the DUAL value in the SVL-DRV-INFO column.

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000 B2  ,B1     IN-USE          DUAL
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START  DUAL-STOP
%  DRV000       DRV         ALL       AT-ALLOC  AT-ERROR(   10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%  DRV000 B2        DUAL        FREE-USE    yyyy-mm-dd 13:46:23
%  DRV000 B1        DUAL        FREE-USE    yyyy-mm-dd 13:46:23
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

Reconstruction

Reconstruction takes place during the changeover from mono to dual mode. In order to switch to data duplication, a second disk is connected and the first disk is copied to the second disk. The change from mono to dual mode is normally made in the course of error recovery, when data duplication is reactivated after a disk failure. This change also takes place in cases where single data storage is first used and then a changeover to data duplication is made (see section "Installing a logical disk" on page 30).

Reconstruction is described in detail in chapter "Error recovery" on page 63.

Equalization

Equalization is a technique used in DRV error recovery. It reestablishes the identity of the two disks in a disk pair after an abnormal termination of dual operation.

Equalization is described in detail in chapter "Error recovery" on page 63.

4.1.2 Querying and changing the operating mode

If you specify in the /SHOW-DRV-STATUS call that the current parameters are to be output (INFORMATION=*PARAMETER), the current operating mode is output in the column RECORDING-MODE.

In addition, you can query the logical disk type by specifying INFORMATION=*VOLUMES in the command call. It is output in the column SVL-DRV-INFO for every physical disk.

The following diagram shows how the operator can change the operating modes using commands, and which changeovers DRV carries out automatically when errors are detected.
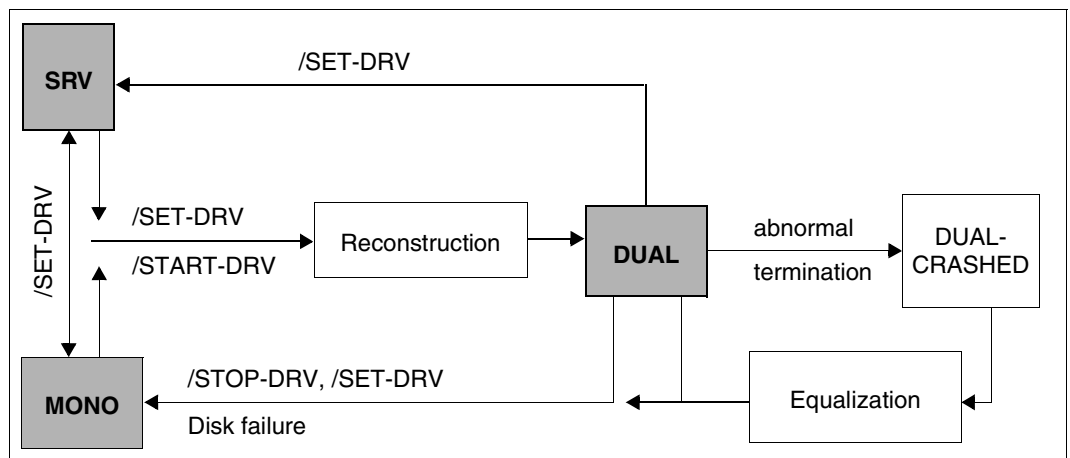
Figure 1: Changing the operating mode

Note on the home pubset

It is not possible to switch between SRV and DRV during current operation. The pubset or private disk must not have been allocated. However, since this is always the case with the home pubset, the options described under /SET-DRV-PARAMETER and /START-DRV-DUAL-MODE no longer apply. Nevertheless, the switch to DRV can be prepared in this way on another system.

If the home pubset is to be used with DRV, "CREATE-DRV" can be entered as the IPL option in response to message NSI1110 in the case of a dialog startup. The pubset will then be powered up in mono mode without further messages.

4.2 Startup for normal operation

Normal operation means that an operating mode has been set for the disks being used and no change of mode takes place. The operating mode can be SRV, mono or dual. The operator does not need to carry out any special DRV-specific activities during normal operation. The disks are put into operation and used in the normal way.

Putting the disks into operation

The disks do not have to be mounted in order to be put into operation. They are requested with the mount message NKVD013. This also applies to a second dual disk if only one is currently mounted.

– In the case of private disks, you initiate operation with:

    /SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=vsn),ASSIGN-TIME=OPERATOR

– In the case of public volume sets, you initiate operation with:

    /IMPORT-PUBSET PUB-ID=<catid>

The information for the operating mode is taken from the SVLs of the mounted disks.

Notes for the home pubset

– If DRV is used for the home pubset, it should be borne in mind that system initialization always takes place in DRV mode MONO in the case of normal operation.

– When "System ready" is reached and the DRV subsystem is started, the files changed at system initialization are copied to the second disk, provided this has been attached (ATTACHED and ONLINE) and the disks were identical at the time of the last shutdown (i.e. DRV-DUAL mode).

– If the second disk was not ATTACHED, the data that has changed can then be copied by means of /START-DRV-DUAL-MODE VOLUME=<list of VSNs of the home pubset>.

– If the system was terminated abnormally, equalization must be started explicitly by means of /START-DRV-DUAL-MODE to ensure that the status DRV-DUAL is restored.

```
            SVL                        SVL
            Disk type: xxx             Disk type: yyy




                              ┌───────▼──────┐
                              │   Resulting  │
                              │ operating mode│
                              │  (xxx[,yyy]) │
                              └──────────────┘
```
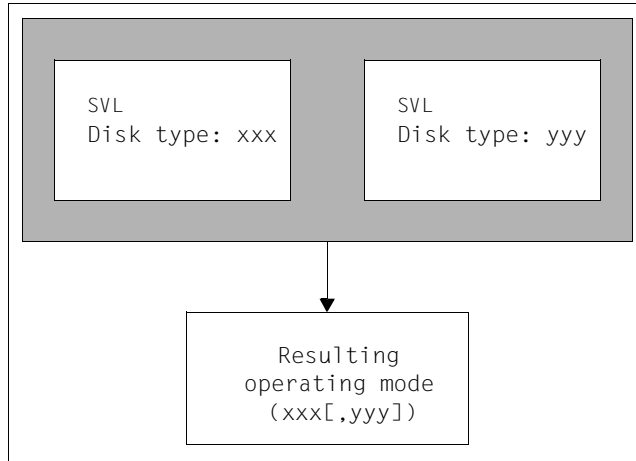
Figure 2: Operating mode in accordance with default value

Example

– If there is only one disk and this has disk type MONO, DRV sets mono mode by default.

– If there is a disk pair with the disk type (DUAL, DUAL), DRV sets dual mode by default.

In some cases, this information is ambiguous and the operator has to intervene. Such cases are described in detail in chapter "Conflicts and solutions" on page 79.

After the disks have been put into operation, the operating mode can no longer be changed with /SET-DRV-PARAMETER.

4.3 Installing a logical disk

This section describes how to install a logical disk. Problems which can occur here, and their solutions, are explained in detail in chapter "Conflicts and solutions" on page 79.

4.3.1 Initializing the disk and defining the operating mode

Initializing the disk

Every disk used for DRV operation must be initialized before use:

– Private disks are initialized using VOLIN.
  Entering /START-DRV-DUAL-MODE creates a DRV-DUAL pair. Since both disks initialized by VOLIN have the same time stamp, only the standard volume label (SVL) is updated.

– Pubset are initialized using SIR.
  If /SET-DRV-PARAMETER RECORDING-MODE=DRV is set for the pubset before the SIR run, the pubset-specific data is written to the disks while it is still in DRV-DUAL mode.
  Should you wish to create a logical disk made up of two disks, you must initialize the disk that was not initialized with SIR explicitly by calling VOLIN, since SIR does not support logical disks.
  To initialize both disks, the parameter AVAILABILITY=DRV must be set for SIR (see the "System Installation" manual [2]).

When setting up a logical disk, DRV only accepts disks with the current time stamp (highest value in the SVL of the mounted disks). The disks output with /SHOW-DRV-STATUS are sorted according to the time stamp.

Defining the operating mode

When setting the operating mode during installation of a logical disk, the following cases must be differentiated:

– initial setting of single recording
– changeover from single to dual recording
– immediate setting of dual recording

4.3.2 Setting single/double recording

Setting single recording

You have the option of initially using only a single disk for DRV operation.

To do this, set the operating mode `(RECORDING-MODE)` to `DRV` or `DRV-MONO` with the `/SET-DRV-PARAMETER` command. DRV will designate the disk as a DRV disk during the next allocation. However, the data is recorded only once.

If you have specified only `DRV` as operating mode, you also have to answer the `DRV0001` message with `M` during allocation.

Changing to dual recording

In this case, a single disk with data already exists. This data is to be kept in duplicate in the future.

It is important whether the original disk is set to SRV or mono mode:

– If the original disk is a SRV disk, it must not be allocated during the conversion.
– If the original disk is a mono disk, the allocation is unimportant.

You proceed with the conversion as follows:

1. Ensure that a second disk of the same type is mounted and, if it is an SRV disk, that it is not allocated.

2. Initialize the second disk so that disk format, disk parameters, and VSN match those of the first disk.

3. Create a logical disk from the two disks by switching to data duplication by means of the `/START-DRV-DUAL` command.
   If the disks are different, DRV initiates reconstruction for the added disk so that the data is copied from the first disk to the second disk. The first disk (to be copied from) is selected on the basis of the current time stamp. In the case of a public volume set, each disk in the set is reconstructed.

   If the disks are identical, DRV only updates the SVLs on the physical disks and does not carry out reconstruction.

   User allocation is possible during the reconstruction process.

4.3.3 Setting dual recording immediately

If you set up a logical disk from two physical disks from the very beginning, you must first initialize both disks so that the disk format, disk parameters and the VSNs of both disks are identical.

If you have two identical disks, you can set up a logical disk with either `/SET-DRV-PARAMETER` or `/START-DRV-DUAL-MODE`.

Initialization with /SET-DRV-PARAMETER

You set up a logical disk from two physical disks by calling the `/SET-DRV-PARAMETER` command and setting the operating mode (`RECORDING-MODE=DRV-DUAL` or `RECORDING-MODE=DRV`).

The disks do not have to be mounted. They are registered as dual or DRV disks, but this information is not yet stored on the disks. The information is entered in the SVL during the next allocation.

`RECORDING-MODE=DRV-DUAL` explicitly specifies dual mode. This is only possible in the case of private disks.
`RECORDING-MODE=DRV` specifies DRV operation only. Whether dual or mono mode is to be set remains open. In this case, the operator has to specify mono or dual mode at the time of allocation by responding to the `DRV0001` message with `M` or `D` (see chapter "Conflicts and solutions" on page 79).

If data already exists, you can subsequently write it onto the logical disk with ARCHIVE. If dual mode is set, the data is automatically copied onto both physical disks.

Example

You set up a logical disk with `/SET-DRV-PARAMETER` and set the DRV operating mode:

`/SET-DRV-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),RECORDING-MODE=DR`

```
%  DRV0049 COMMAND 'SET-DRV-PARAMETER' PROCESSED FOR DISK 'DRV000'
```

`%NBR0740 COMMAND 'SET-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)`

You can obtain information about the current logical disk status with `/SHOW-DRV-STATUS`.
The `BY-OPER(DRV0007)` entry in the `ALLOC-TYPE` column tells you that the logical disk
cannot be set up without operator intervention:

`/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL`

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE     RECOVER
% DRV000 B2 ,B1      FREE        BY-OPER(DRV0007)
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START  DUAL-STOP
% DRV000     DRV        ALL        AT-ALLOC   AT-ERROR(  10S)
%  VSN    COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC     TIMESTAMP
% DRV000 B2       SRV           ONLINE     yyyy-mm-dd 13:36:02
% DRV000 B1       SRV           ONLINE     yyyy-mm-dd 13:36:02
```

`%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)`

You can obtain information about the `DRV0007` message with `/HELP-MSG-INFORMATION`:

`/HELP-MSG-INFORMATION MSG-IDENTIFICATION=DRV0007,`
`                     INFORMATIONLEVEL=MAXIMUM,LANGUAGE=E`

```
% DRV0007 DRV CANNOT IDENTIFY RECORDING MODE FOR VSN '(&00)'
% - The specification FROM-DISK or DRV set for the recording mode by means of
% - the /SET-DRV-PARAMETER command is not specific enough for the mounted
% - disks, as allocation is possible in both DRV DUAL mode and DRV MONO mode.
% - The recording mode is set by the response to the subsequent DRV0001
% - message. It cannot be set right now by means of the /SET-DRV-PARAMETER
% - command.
```

You are trying to allocate the disk. As DRV cannot determine the operating mode itself,
you must first reply to message `DRV0001`:

`/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR`

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000 D3490-40  ALL      OPERATOR  ALL(D)   NO(D)   WRITE
%   DRV0007 DRV CANNOT IDENTIFY RECORDING MODE FOR VSN 'DRV000'
%   DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
          'DRV000'. REASON: DRV0007: R-MODE INSUFFICIENT. REPLY (R = RETRY;
          D = DUAL; M = MONO; T = TERMINATE, S = SRV)
```

You set dual mode by replying to the message with `D` at the console:

`<tsn>.D`

```
%  DRV0019 ALLOCATION OF DISK 'DRV000' ON DEVICE '(B2  ,B1  )' COMPLETED
%  NKA0007 DISK 'DRV000' WAS ALLOCATED BY MEANS OF  ASSIGN-TIME=OPERATOR
```

You obtain information about the status of the logical disk with /SHOW-DRV-STATUS:

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN     MNEM'S    ALLOC-PHASE      ALLOC-TYPE    RECOVER
%  DRV000  B2 ,B1    IN-USE              DUAL
%  VSN   RECORDING-MODE  EQUALIZE    COPY-START    DUAL-STOP
%  DRV000     DRV         ALL         AT-ALLOC   AT-ERROR(   10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN     MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2      DUAL            FREE-USE    yyyy-mm-dd 13:47:32
%  DRV000 B1      DUAL            FREE-USE    yyyy-mm-dd 13:47:32
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

Switching on using /START-DRV-DUAL-MODE

You set up a logical disk by calling the /START-DRV-DUAL-MODE command and specifying the VSN of the disk.

/START-DRV-DUAL-MODE is also possible if the disk is not in use.

DRV immediately identifies both physical disks as being dual disks in the SVL. This means these disks can now only be used in dual mode. This also applies to all later sessions until new settings are defined.

Example

You make sure that two disks are available:

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN     MNEM'S    ALLOC-PHASE      ALLOC-TYPE    RECOVER
%  DRV000            FREE
%  VSN   RECORDING-MODE  EQUALIZE    COPY-START    DUAL-STOP
%  DRV000  FROM-DISK    ALL         AT-ALLOC   AT-ERROR(   10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN     MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2      SRV             ONLINE      yyyy-mm-dd 13:36:02
%  DRV000 B1      SRV             ONLINE      yyyy-mm-dd 13:36:02
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

You set up the logical disk with `/START-DRV-DUAL-MODE`:

`/START-DRV-DUAL-MODE VOLUME=DRV000`

```
%  DRV0049 COMMAND 'START-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRV000'
%  DRV0060 DUAL START FOR DISK ‚DRV000' ON DEVICE PAIR '(B2  ,B1  )'
           COMPLETED. RECONSTRUCTION FROM DEVICE 'B2' TO DEVICE 'B1'.
           COPY MODE: 'LABEL'
```

`%NR0740 COMMAND 'STA-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)`

You obtain information about the logical disk. Note that the disk type `DUAL` is already recorded in the SVL.

```
%  VSN    MNEM'S   ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000 B2  ,B1      FREE             DUAL
%  VSN    RECORDING-MODE  EQUALIZE    COPY-START   DUAL-STOP
%  DRV000      DRV          ALL        AT-ALLOC   AT-ERROR(   10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2     DUAL           ONLINE     yyyy-mm-dd 13:48:36
%  DRV000 B1     DUAL           ONLINE     yyyy-mm-dd 13:48:36
```

`%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)`

4.4 Special features of the home pubset and paging

This section provides the special features arising from the use of DRV for the home pubset and for pubsets with active paging areas.

Preparing the home pubset for DRV

The home pubset is in use throughout the entire session and thus makes it impossible to switch from SRV to DRV. Consequently, the switch has to be made either when installing the pubset with SIR, by putting it into operation in another system, or by specifying the IPL option `CREATE-DRV`.

System initialization

In the course of system initialization, the mode is always switched to `DRV-MONO`. Once "System ready" has been reached, the second disk has been attached and the DRV subsystem has been started automatically, DRV copies the files which were changed at system initialization to the second disk either automatically or following input of the `/START-DRV-DUAL-MODE` command.
During system initialization, operator actions are not handled via message `DRV0001` as DRV is not yet available. Instead, messages `NSI2205` and `NSI220` are output on startup. The operator then has to select a disk.

If the home pubset is being used with DRV, `/DETACH-DEVICE mn,FORCE=YES` is not possible. If use of one of the disks is to be terminated (abnormally) in the `DRV-DUAL` status, `/STOP-DRV-DUAL-MODE UNIT-TO-REMOVE=mn` can be used. The idle device is then free (see the `/SHOW-DEVICE-STATUS` command) and can be released with `/DETACH-DEVICE`.

Snapshot

Snapshots are still possible in the DRV home pubset, with the restriction that the snap file is only written to one disk. Until the contents of the snap file have been written to a DMS file for CDUMP2, a switch to `DRV-MONO` (on the other disk) can make them invalid. After a crash, further processing of a snapshot dump started in the last session is not possible on a DRV home pubset.

Automatic restart following a crash or shutdown

Specifying the command `/SET-RESTART-OPTIONS MODE=*ON` makes an automatic restart
after abnormal system termination possible. If DRV is used for the home pubset, it is
possible that the IPL disk is detached because of errors or by means of `/STOP-DRV-DUAL-`
`MODE`. A subsequent startup will then automatically select the more up-to-date disk as the
home pubset. The mirror disk is set as the active boot disk by the BS2000/OSD operating
system.

Since the IPL disk may be so severely damaged that loading via boot, IPL exec, startup or
BS2000/OSD is no longer possible, `SHUTDOWN MODE=END(RESTART= *YES(IPL-`
`DEVICE=...))` can be used to start from the mirror disk. In this case, too, BS2000/OSD
automatically enters the IPL disk.

If the automatic restart function was deactivated after changing the IPL disk, it can be reacti-
vated by means of `/START-DRV-DUAL-MODE` once reconstruction has been completed.

SLED on DRV pubsets

If a SLED is written to a SLEDFILE on a DRV pubset, this is only possible in `DRV-MONO` mode.
In this case, as was the case before, the DRV flag in the SVL is changed, but not the time
stamp.
Consequently, when implementing a SLED on disk, you should make absolutely certain that
this pubset is not being used by another system. Otherwise writing the SLED will cause use
of the pubset in the other system to be aborted.
If an error occurs while writing the SLED to a DRV pubset, this error cannot be recovered
on the mirror disk (this corresponds to the behavior for system initialization).

Use of paging in the DRV pubset

Paging areas on DRV pubsets can be used. A distinction is made between use as a (DMS) pubset and as a paging disk: for user files and the system metadata on the pubset, full DRV functionality is available. However, paging only uses one disk (defined by DRV).
The paging area is set up on both disks by means of /CREATE-PAGING-FILE, but it can only be used on one of them.

If there is a fatal error for a block of a DMS file on the disk used for paging, DRV ceases to use this disk for DMS operation and a switch is made to DRV-MONO using the second disk. However, the errored disk remains occupied by paging and cannot therefore be reformatted by means of VOLIN. For this to be possible, use of the paging area must first be terminated by means of /REDUCE-PAGING-AREA VOLUME=vsn.

If a DRV pubset with active paging files is exported, both disks remain allocated in DRV-DUAL mode (even though paging only uses one of them). DRV mode for the pubset thus remains for the use of DMS and it is not possible for the pubset to be imported by another system.

If there is an error in the paging area of the disk, paging error recovery is instigated (in the same way as without DRV). If an unrecoverable read error occurs, paging aborts the task (as before for class 5 and class 6 memory) and, for class 2 or class 4 memory, a system dump is taken whenever an attempt is made to read the inaccessible pages.

If a specification in the parameter file causes a paging area on a disk that is not on the home pubset to be activated, this paging area cannot lie on a DRV pubset. This corresponds to previous behavior.

4.5 Separate processing of original and mirror disks

Separate processing of the original and mirror disks enables data to be processed by one application and to be simultaneously saved or made available to another application in parallel.

4.5.1 Usage scenarios

At a particular consistency point (the pubset has been exported) all disk pairs of the pubset are separated and the mirror disks are renamed. Subsequently an application can once more access and modify the data on the original pubset. The files on the mirror pubset are saved or made available to another application with ARCHIVE or HSMS. Reconstruction takes place when the save or application run has been completed. Here only the data the application has modified on the original pubset needs to be copied.

Example

A bank has a booking system, e.g. for cash dispensing machines for cash dispensing machines with a large amount of data, which must have high availability (no failures, used 23 hours per day). The pubset is called "A".

Accounting must be performed at the end of the month, but the data must be available as soon as possible, e.g for new bookings. Since accounting takes several hours, it has to be done using a copy of the data. Copying via a command or using the database takes far too long as the amount of data is fairly large.

The copy can be made in, say, 20 minutes by separating the DRV disks (`/EXPORT-PUBSET PUBSET=A`, `/STOP-DRV` and renaming them, `/IMPORT-PUBSET PUBSET=A`, `/IMPORT-PUBSET PUBSET=B`). The booking system is available again after this time. Accounting can be performed with the data on pubset B.

After the accounting run is finished, only the booking system data that has been modified in the meantime is copied, i.e. 10 MB instead of 20 GB. This only puts a minor load on the booking system.

Notes on saves using HSMS

– The separation of the original and mirror disks means that an incremental save is not possible: The corresponding indicator in the file catalog that the file has been saved is only written in the catalog of the mirror file. As this catalog is always taken over by the original pubset when rejoining takes place, the saved files are once again regarded as not saved the next time this happens. In the event of a full save it must also be noted that migrated files cannot be saved on the mirror pubset as HSMS only knows the original file names. If the aim is only to save the time required for the save operation, the use of Concurrent Copy is recommended.

– After a brief initialization, Concurrent Copy can be used for saving in parallel to the normal application without separating the DRV disk pairs. It must be noted here that additional disk space is needed when the volume of changes is large and that either the time required for saving will increase or that the applications must accept loss of performance. With Concurrent Copy, in contrast to saves with DRV, the consistency point is reached only when the save is completed successfully. If problems are encountered, the procedure must be restarted later.

4.5.2 Schematic illustration of the process

The designations below are used in the following sections:

– Original application:
Application(s) which normally (e.g. during the day) work with the data which is made highly available with DRV.

– Original pubset:
A pubset mirrored with DRV. "A" is used as the catalog ID in the example.

– Mirror pubset:
Pubset made up of the "separated" and renamed mirror disks. It contains the same data as the original pubset at the time of separation.

– Secondary application:
Application(s) which run on the mirror pubset. These can be saves or evaluations. The applications modify the data only slightly or not at all. The evaluation results are written to a third pubset as the changes on the mirror pubset are lost when the original pubset is rejoined to it.

– Monitoring the pubset with DRV:
DRV uses main memory to note which areas of the original and mirror pubsets were modified. This information is evaluated during rejoining.

Sequence

– The original application is terminated.

– The original pubset is exported.

– `/STOP-DRV-DUAL-MODE *BY-PUBSET(PUBSET=A,NEW-NAME-OF-REMOVED=B)`

The command executes the following actions:

– Check that all disks of the pubset are connected, unallocated and in `DRV-DUAL` mode

– Transition to the DRV mono mode.
The mirror disks are temporarily in the `DUAL-CRASHED` state

– Special allocation of the mirror disks

– Rename the VSN in the SVL, volume catalog and file catalog of the mirror disks

– Set the `DRV-MONO` indicator in the SVL of the mirror disks

– Set the monitoring indicator for all original and mirror disks

– Release the allocations of the mirror disks

– If necessary, create an MRSCAT entry for the mirror pubset

If the command has executed successfully, the two pubsets "A" and "B" now exist and both contain the same data. Changing the catalog ID on the mirror disks from A to B now makes all the original pubset files accessible separately with the catalog ID "B".

If errors occur, the mirror disks do not contain consistent data and are marked accordingly, and the data cannot be accessed. The disks must be reinitialized manually by systems support with the original VSN.

The `DRV-DUAL` state can then be restored with

`/START-DRV-DUAL-MODE *BY-PUBSET(FROM-PUBSET=*CURRENT,TO-PUBSET=A)`

and the

`/STOP-DRV-DUAL-MODE *BY-PUBSET(PUBSET=A,NEW-NAME-OF-REMOVED=B)`

command repeated.

– The original and mirror pubsets are imported by systems support.

– Since both pubsets are operated in `DRV` mode (mono), DRV can start monitoring the pubsets for changes. It uses main memory to store the information on which blocks are modified.

– Operate the original applications and secondary application

– Terminate the secondary application

– `/START-DRV *BY-PUBSET(FROM-PUBSET=A,TO-PUBSET=B)`

The command executes the following actions:

– Tests if both pubsets contain the same number of disks of the same type and DRV pairs can be formed with all disks (type, configuration and formatting are identical).
– Export the mirror pubset
– Special allocation of the mirror pubset disks
– Change the VSN in the SVL of the mirror disks
– Release the mirror pubset disks
– The metadata is copied for each disk
– If the tests were positive, the modified files are determined from the monitoring data and copied. Otherwise, all allocated blocks are copied.

If the command was completed successfully, the original state has now been restored: the original pubset is held highly available by DRV and the original application is running.

If errors occur, systems support must reinitialize the disks with the original VSNs (PUBAxx) and copy them with:

`/START-DRV-DUAL-MODE *BY-PUBSET(FROM-PUBSET=*CURRENT,TO-PUBSET=A)`
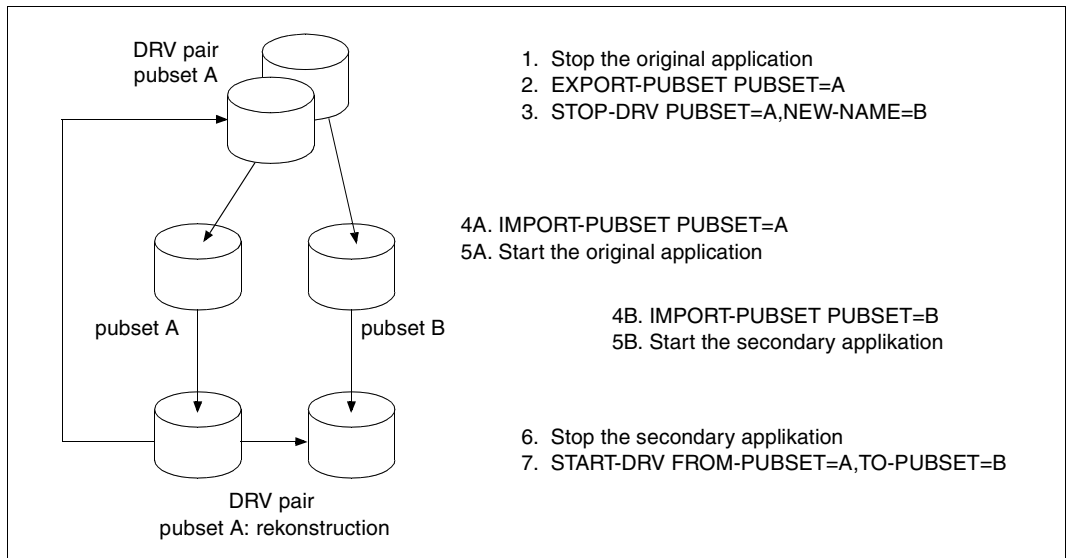
Figure 1: Separate processing of original and mirror disk

4.5.3 General conditions, restrictions and procedural specifications

In order to be able to utilize separate processing of the original and mirror disks, certain general conditions and procedural specifications must be observed.

General conditions for optimum performance

The time required for reconstruction when rejoining depends on the amount of modified data involved. The performance can be considerably improved if the following conditions are met:

– original and mirror pubsets are located in different disk subsystems

– separation, separate processing and rejoining take place during a low activity period

– optimum performance is achieved for saving or execution of the secondary application to minimize the separation period (possibly at the cost of main application throughput)

Restrictions

– Only SF pubsets are supported.
Private disks cannot be "renamed" as the catalog entries may be stored in several pubsets. For SM pubsets, DRV only supports mirroring of separate volume sets.
The files on these volume sets can, however, not be renamed if they remain in the same SM pubset.
It is, of course, possible to separate private disks or SM pubsets whose volume sets are all mirrored with DRV, and process them in another system. In this case, DRV cannot copy the modified blocks when rejoining, but must copy all allocated blocks as previously.

– The catalog ID of the mirror pubset must have the same length as the original pubset.

Actions allowed during separated processing

– Import original and mirror pubset.

– Change the data on the original pubset: modify, delete, create, migrate or reread files or JVs.

– Change the data on the mirror pubset:
  files can (theoretically) be deleted, modified or created. However, all changes are lost during rejoining.
  HSMS can be used for migrating and rereading files, but there is no point in this as the pubset only exists during the separation phase.
  Saved files are no longer usable after rejoining.
  Evaluation programs which work on the mirror pubset must store their results on other (original or third) pubsets.

– The following must be observed when the mirror pubset is processed on another server (virtual, native):
  In this case, DRV cannot store any information on modified data. For rejoining, the mirror pubset must be reimported to the server on which the original pubset is operational. DRV then tries to determine which files have been modified on the mirror pubset from its catalog. These are then completely reconstructed.

Actions not allowed and possible problems during separate processing

– The following must be observed when the mirror pubset is processed on another machine:
  – The system on which the mirror pubset is processed and the one on which the subsequent reconstruction takes place must have exactly the same system time, as the modification time is relevant in the mirror pubset catalog.
  – No data may be modified on the mirror pubset with special applications such as DPAGE, SIR, diagnostic programs or FDDRL.

– The DRV subsystem must not be unload and reload.

– Change the disk configuration:
  disks must not be removed or added with `/MODIFY-PUBSET-PROCESSING` on either the original or mirror pubset.

4.6 Disk migration with DRV

DRV enables data to be copied from various types of disk onto type D3435 disks without lengthy idle times. Type D3435 disks can be operated on S Servers via the channel type FC connection and on SQ or SX Servers via the Fibre Channel connection. DRV thus supports migration to these connections.

The following applies here:

– With DRV the data on CKD disks (for example D3490-xx disks) and FBA disks (for example D3475-8F disks) is copied to FBA disks of the type D3435.

– With the S Servers the D3435 disks are supported on the channel type S, the channel type 2 and, exclusively also on the channel type FC. With the SQ or SX Servers the D3435 disks are supported on the Fibre Channel.
In the event of disk migration the data previously stored on other disk types is therefore copied to D3435 disks. For this purpose the disks are initially connected via the channel type S or the channel type 2. Once the data has been copied, the channel type FC or Fibre Channel can be used for the D3435 disks.

– Using DRV equalization means that - except for brief idle times - the disks can continue to be utilized by the user while copying is in progress.

– To copy the disks, DRV requires the disk pairs to be of identical type and format. For migration this is achieved by the target disk type appearing to the system to be identical to that of the disks to be copied. Only when migration has been completed does the real type of the target disk appear (D3435).

4.6.1   Disk types and disk formats supported

Only disks and disk systems that are supported by DRV can be migrated. The following restrictions also apply:

1. The following target disks are supported

   – S Servers
     D3435 disks on a channel type S or a channel type 2 or a channel type FC

   – SQ or SX Servers:
     D3435 disks with fibre channel connection

2. The following disk types are supported as source disks:

   – D3490-xx disks on a channel type S or type 2

   – D3480, D348E or D348F disks on a channel type S or type 2

   – D3475-8F bus disk as an internal disk or with Fibre Channel connection

   – D3435 disks on a channel type S or type 2

3. For source disks the formats K2, NK2 and NK4 (not for D3435) are supported, for target disks the formats K2 and NK2. Migration is possible from K2 to K2 and from NK2 to NK2 with the same allocation unit (AU). However, migration from an NK4 source disk with AU=8 or AU=64 to an NK2 target disk with the same AU is also possible.

4. The following are not supported:

   – Migration of the home pubset

   – Migration from private disks

A source disk can be migrated to a target disk with a greater capacity. Here it must be borne in mind that after migration has been completed the target disk which was originally larger will only have the capacity data of the (smaller) source disk.

The migrated pubset can be expanded to the actual physical capacity of the disks again by means of SPACEOPT (/ADAPT-PUBSET-SIZE command).

Migration from disks in NK4 format

Migration from disks in NK4 format is a special case.

As this format is not offered for D3435 disks, disks in NK4 format are mapped onto NK2 format with NK4 orientation. For this purpose, the target disks must be formatted as NK2 disks, but the allocation unit must match that of the source disks (in other words the allocation unit = 8 / 64).

From the point of view of the Data Management System the transition from pubsets/volume sets in NK4 format to NK4-oriented pubsets/volume sets is subject to no restrictions. With regard to the file formats permitted, the NK4 disk format is the most restrictive: The only file formats permitted are DATA4K and NO with even blocking. These formats are also compatible with the NK2 disk format, so there are no problems for existing files.

When files are created the default formats differ (DATA2K even blocking for NK4 formatting, DATA2K for NK4 orientation). However, as long as no assumptions are made about the disk formatting in the applications or procedures, no incompatibilities arise when files are created.

4.6.2 Application scenarios

SAN integration

So far the data has been kept on D3490 disks and was connected to the BS2000 server via channels of type S. The data is to be copied to disks that are connected to BS2000/OSD via Fibre Channel in order to utilize a common SAN infrastructure (SAN = Storage Area Network) for BS2000/OSD and other servers and storage systems.

For this purpose D3435 disks are configured in a disk storage system which is connected via channels of both type S and type FC. Paths of type S are required for data migration. Once migration has been completed, the data can be accessed via paths of type FC.

4.6.3   Requirement for migration

No PFA cache may be configured for the pubset that is to be migrated (source pubset) (see the `/MODIFY-PUBSET-CACHE-ATTRIBUTES` command in the "Commands" manual [1]). It is irrelevant here whether DAB or PCA is used for caching. If this requirement is not observed, importing of the source pubset will be rejected with message `DMS035E`, error code 24. Releasing the PFA cache means that it is once more permissible to import the source pubset.

At the beginning and end of migration the disks involved are detached (`/DETACH DEVICE`). For this reason the disks may not contain a paging area.

4.6.4   Migration of an SF pubset

Preparing migration

To migrate an existing SP pubset, the target disks must first of all be initialized as an analogous target pubset using SIR.

The target pubset must have the same catalog ID as the pubset that is to be migrated. The formatting and allocation unit of the target pubset must match those of the pubset to be migrated.

Before migration begins the source pubset must be exported.

All disks in the source pubset and the target pubset must have the status `ATTACHED`.

Use of the `EXECUTE-PUBSET-MIGRATION` procedure is recommended for migration to prevent errors in the application and sequence of commands required.

Starting migration

Migration is started by calling the procedure

```
/CALL-PROC *LIB(SYSPRC.DRV.<ver>,EXECUTE-PUBSET-MIGRATION),
    PARAM=(PUBSET=<catid>,FUNCTION=*START,..
```

This procedure issues commands which have the following affect:

– The target disks appear to be of the same type as the source disks.

– The migration tool for converting the inputs/outputs for the target disks is called.

– Dual recording of the data is initialized and activated.

The following commands are involved here:

`/PREPARE-PUBSET-MIGRATION <catid>`
> Defines the allocation of source and target disks and checks whether the disk types are permissible.
> Implicitly detaches the target disks `(DETACHED)`.

`/ATTACH-DEVICE`
> Attaches all target disks.

`/SET-DRV-PARAMETER UNIT=*PUBSET(<catid>),RECORDING-MODE=*DRV-MONO`
> Sets the DRV parameters for starting equalization.

`/START-DRV-DUAL BY-PUBSET(*CURRENT,<catid>)`
> Starts equalization.

The data is now copied from the source disks onto the target disks. The progress of the copying procedure can be ascertained using the `/SHOW-DRV-STATUS INF=*ALL` command.

Parallel to this other applications can also run. To permit this, the source pubset must be imported using `/IMPORT-PUBSET <catid>` and the applications started.

The end of the copying procedure for each disk is indicated on the console by DRV message `DRV0060`.

Completing migration

After all the disks of the source pubset have been copied onto the target disks migration can be completed and terminated.

To do this, all active applications must be terminated and the pubset exported using `/EXPORT-PUBSET <catid>`.

Migration is terminated by calling the procedure

```
/CALL-PROC *LIB(SYSPRC.DRV.<ver>,EXECUTE-PUBSET-MIGRATION),
    PARAM=(PUBSET=<catid>,FUNCTION=*STOP,..
```

This procedure issues commands which have the following affect:

– The actual type of target disks is displayed.

– Inputs/outputs are once again performed on the target disks.

– The source disks are detached (`DETACHED`).

The following commands are involved here:

```
/STOP-DRV-DUAL BY-PUBSET(PUBS=<catid>,NEW-NAME-OF-REMOVED=*SAME,
   UNIT-TO-REMOVE=*MIGRATION-SOURCE)
```
> Dual recording of data is terminated; operation continues in DRV mono mode on the target disk.

```
/DETACH-DEVICE
```
> Detaches all source disks.

```
/FINISH-PUBSET-MIGRATION <catid>
```
> Enters the correct disk type for the target disks in the file catalog.
> Terminates the migration program for the target disks.
> Detaches the target disks (`DETACHED`).

```
/ATTACH-DEVICE
```
> Attaches the target disks.

Aborting migration

Migration can be terminated prematurely.

This can be done in two ways:

–   With the command
    ```
    /ABORT-PUBSET-MIGRATION PUBSET=<catid>
    ```

–   With the procedure
    ```
    /CALL-PROC *LIB(SYSPRC.DRV.<ver>,EXECUTE-PUBSET-MIGRATION),
        PARAM=(PUBSET=<catid>,FUNCTION=*ABORT,..
    ```

This procedure issues commands which have the following affect:

–   On the source disks operation continues in DRV mono mode.

–   The target disks are detached (`DETACHED`).

The following commands are involved here:

```
/STOP-DRV-DUAL BY-PUBSET(PUBS=<catid>,NEW-NAME-OF-REMOVED=*SAME,
   UNIT-TO-REMOVE=*MIGRATION-TARGET)
```
> Terminates dual recording of data; operation continues in DRV mono mode on the source disks.

```
/ABORT-PUBSET-MIGRATION PUBSET=<catid>
```
> Terminates migration of the target disk type.
> Detaches the target disks.

Operation with the source disks can then continue in DRV mono mode.

After migration has been aborted the target disks are in an inconsistent status. Before they are migrated again they must be reinitialized.

Ascertaining the migration status

The command

```
/SHOW-PUBSET-MIGRATION PUBSET=<catid>
```

can be used to ascertain the migration status.

Source and target disks are specified for all the VSNs of the catalog ID, as far as these exist. This enables users to check whether a suitable target disk exists for all source disks before migration is initiated.

Example

Pubset DRVC consisting of a VSN DRVC.0

```
/SHOW-PUBSET-MIGRATION PUBSET=DRVC
```

```
%  SHOW-PUBSET-MIGRATION-STATUS                    DATE: yyyy-mm-dd, TIME: 16:35:52
%   CATID VSN     SOURCE          TARGET          MIGR-STATE
%               MN     ALLOC    MN     ALLOC
%   DRVC  DRVC.0 5365    FREE     2257    FREE    NOT ACTIVE
%  NUMBER OF ACTIVE MIGRATIONS = 0
%  SHOW-PUBSET-MIGRATION-STATUS                                         END OF DISPL
```

4.6.5 Example of migrating a single-disk pubset

A pubset on a single disk is to be migrated:

Catid:
> DRVC

Pubset:
> DRVC.0

Source disk:
> 5365
> Type: D3490-10
> Format: K2

Target disk:
> 2257
> Type: D3435

Preparing the source and target disks

– The target disk is initialized with SIR. The procedure is described in the section "Installing a logical disk" on page 30; the target disk may not be of the same type as the source disk, but of type D3435.

– Pubset DRVC must be exported if it is still imported.

– Source and target disks are made available:
```
/ATTACH-DEVICE (5365,2257)
```

– Check the disks:
```
/SHOW-DISK-STATUS UNIT=(2257,5365)
```

```
%  MNEM VSN     USE    DEV-A    VOL-A    PHASE    ACTION
%  2257 DRVC.0          FREE     FREE     ONLINE   NO ACTION
%  5365 DRVC.0          FREE     FREE     ONLINE   NO ACTION
```

– Check the migration status:
```
/SHOW-PUBSET-MIGRATION PUBSET=DRVC
```

```
%  SHOW-PUBSET-MIGRATION-STATUS              DATE: yyyy-mm-dd, TIME: 14:30:19
%   CATID VSN    SOURCE        TARGET        MIGR-STATE
%                MN     ALLOC    MN    ALLOC
%   DRVC  DRVC.0 5365   FREE     2257  FREE     NOT ACTIVE
%   NUMBER OF ACTIVE MIGRATIONS = 0
%  SHOW-PUBSET-MIGRATION-STATUS                                END OF DISPL
```

Migration using the EXECUTE-PUBSET-MIGRATION procedure

– Start migration:
```
/CALL-PROC *LIB(SYSPRC.DRV.<ver>,EXECUTE-PUBSET-MIGRATION),
    PARAM=(PUBSET=DRVC,FUNCTION=*START,OPERATOR-ROLE=SYSADM)
```

```
%  DRV2500 BEGIN OF PUBSET-MIGRATION: FUNCTION = *START
%(MSG) %  %  POP9A01 PROP-XT ADMINISTRATION PROCESS 'DRV-MIG-PROCESS' STARTED
%(MSG) %  %  POP9A11 START-PROP-OBJECT-MONITORING EXECUTED FOR 'DRV-MIG-CONSOLE'
: PARTNER: $CONSOLE/*LOCAL
%  DRV2000 ACTIVATE MIGRATION FOR SOURCE DEVICE '5365' AND TARGET DEVICE '2257'
SUCCESSFUL
%(MSG) %  %  DRV2000 ACTIVATE MIGRATION FOR SOURCE DEVICE '5365' AND TARGET DEVI
CE '2257' SUCCESSFUL
%(MSG) %  %  POP9A02 PROP-XT ADMINISTRATION PROCESS 'DRV-MIG-PROCESS' TERMINATED
%  DRV2501 PUBSET-MIGRATION, FUNCTION = *START, FOR PUBSET (DRVC) SUCCESSFUL
```

– The target disk now seems to be of the same type as the source disk:
```
/SHOW-DEVICE-CONFIGURATION 2257
```

```
%  MNEM  UN-CLASS     UN-TYPE      CONF-STATE   POOL/SIDE
%  2257     DVC       D3490-10      ATTACHED      SH
```

– To continue the applications the pubset can be imported again.

– The progress of migration can be monitored:
   /SHOW-DRV-STATUS INFORMATION=*ALL

```
%    VSN    MNEM'S   ALLOC-PHASE      ALLOC-TYPE    RECOVER
%    DRVC.O 5365,2257  IN-USE           DUAL          RECONST(  5%)
%    VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%    DRVC.O      DRV         ALL       AT-ALLOC   BY-OPERATOR
%    VSN    COPY-SPEED
%    DRVC.O  MEDIUM
%    VSN    MNEM   SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%    DRVC.O 5365     READ          ONLINE     yyyy-mm-dd 11:05:42
%    DRVC.O 2257   RECONSTRUCT     ONLINE     yyyy-mm-dd 11:05:42
```

– Migration of the data for a disk is completed if it appears in the status DUAL:
   /SHOW-DRV-STATUS INFORMATION=*ALL

```
%    VSN    MNEM'S   ALLOC-PHASE      ALLOC-TYPE    RECOVER
%    DRVC.O 5365,2257  FREE             DUAL
%    VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%    DRVC.O      DRV         ALL       AT-ALLOC   BY-OPERATOR
%    VSN    COPY-SPEED
%    DRVC.O  MEDIUM
%    VSN    MNEM   SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%    DRVC.O 5365     DUAL          ONLINE     yyyy-mm-dd 11:05:42
%    DRVC.O 2257     DUAL          ONLINE     yyyy-mm-dd 11:05:42
```

– If this is the case for all disks in the pubset, migration can be terminated.
   To do this the active applications must first of all be terminated and the pubset exported.
   /CALL-PROC *LIB(SYSPRC.DRV.<ver>,EXECUTE-PUBSET-MIGRATION),
      PARAM=(PUBSET=<catid>,FUNCTION=*STOP, OPERATOR-ROLE=SYSADM)

```
%  DRV2500 BEGIN OF PUBSET-MIGRATION: FUNCTION = *STOP
(MSG) %  %  POP9A01 PROP-XT ADMINISTRATION PROCESS 'DRV-MIG-PROCESS' STARTED
(MSG) %  %  POP9A11 START-PROP-OBJECT-MONITORING EXECUTED FOR 'DRV-MIG-CONSOLE';
PARTNER: $CONSOLE/*LOCAL
%  DRV2001 DEACTIVATE MIGRATION FOR SOURCE DEVICE '5365' AND TARGET DEVICE
'2257' SUCCESSFUL
(MSG) %  %  DRV2001 DEACTIVATE MIGRATION FOR SOURCE DEVICE '5365' AND TARGET
DEVICE '2257' SUCCESSFUL
(MSG) %  %  POP9A02 PROP-XT ADMINISTRATION PROCESS 'DRV-MIG-PROCESS' TERMINATED
 %  DRV2501 PUBSET-MIGRATION, FUNCTION = *STOP, FOR PUBSET (DRVC) SUCCESSFUL
```

Dual recording of data is terminated. Disk 2257 once again appears with the correct type D3435.

After the pubset has been imported again operation proceeds in DRV mono mode on disk 2257.

Migration without the migration procedure

– Prepare migration:
```
/PREPARE-PUBSET-MIGRATION PUBSET=DRVC
```

```
% DRV2000 ACTIVATE MIGRATION FOR SOURCE DEVICE '5365' AND TARGET DEVICE '2257'
SUCCESSFUL
% NKR0048 *** 'DEVICE    =2257' DETACHED BY SYSTEM ***
```

Preparation of migration has been successfully completed. After this command target disk 2257 is in the DETACHED status.

– Check the migration status:
```
/SHOW-PUBSET-MIGRATION PUBSET=DRVC
```

```
% SHOW-PUBSET-MIGRATION-STATUS                  DATE: yyyy-mm-dd, TIME: 14:30:19
% CATID VSN    SOURCE           TARGET          MIGR-STATE
%              MN    ALLOC     MN    ALLOC
% DRVC  DRVC.0 5365  FREE      2257  FREE       ACTIVE
% NUMBER OF ACTIVE MIGRATIONS = 1
% SHOW-PUBSET-MIGRATION-STATUS                              END OF DISPL
```

– The DRV settings are now selected so as to permit a switchover from SRV or mono mode to DRV dual mode.
```
/SET-DRV-PARAMETER UNIT=*PUBSET(PUBSET=DRVC),
    RECORDING-MODE=*DRV-DUAL,DUAL-STOP=*BY-OPERATOR,
    COPY-START=*AT-ALLOCATION,EQUALIZE-DATA=*ALL
```

```
% DRV0049 COMMAND 'SET-DRV-PARAMETER' PROCESSED FOR DISK 'DRVC.0'
% DRV0080 COMMAND 'SET-DRV-PARAMETER' SUCESSFULLY PROCESSED
```

– Attach the target disk:
```
/ATTACH-DEVICE 2257
```

The target disk is now available. It appears with the same disk type as disk 5365.

– Query device information:
```
/SHOW-DEVICE-CONFIGURATION 2257
```

```
% MNEM    UN-CLASS       UN-TYPE        CONF-STATE   POOL/SIDE
% 2257     DVC           D3490-10       ATTACHED     SH
```

– Activating DRV dual mode starts migration (in other words reconstruction of the source disk data on the target disk(s)):
```
/START-DRV-DUAL-MODE VOLUME=*BY-PUBSET(FROM-PUBSET=*CURRENT,
    TO-PUBSET=DRVC)
```

```
% DRV0049 COMMAND 'START-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRVC.0'
% DRV0080 COMMAND 'START-DRV-DUAL-MODE' SUCESSFULLY PROCESSED
```

The following message appears on the console:

```
%  DRV0074 COPYING OF DISK 'DRVC.0' FROM DEVICE '5365' TO DEVICE '2257' STARTED
```

– During migration the pubset can be imported and the applications can be started again.
  /IMPORT-PUBSET PUBSET=DRVC

– The progress of migration can be monitored:
  /SHOW-DRV-STATUS INFORMATION=*ALL

```
%    VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRVC.0 5365,2257   IN-USE           DUAL        RECONST(  5%)
%    VSN   RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRVC.0      DRV          ALL       AT-ALLOC    BY-OPERATOR
%    VSN   COPY-SPEED
%  DRVC.0  MEDIUM
%    VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%  DRVC.0 5365      READ          ONLINE     yyyy-mm-dd 11:05:42
%  DRVC.0 2257    RECONSTRUCT     ONLINE     yyyy-mm-dd 11:05:42
```

– Migration is completed for a disk when the disk appears in the DRV status DUAL.
  /SHOW-DRV-STATUS INFORMATION=*ALL

```
%    VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRVC.0 5365,2257   FREE             DUAL
%    VSN   RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRVC.0      DRV          ALL       AT-ALLOC    BY-OPERATOR
%    VSN   COPY-SPEED
%  DRVC.0  MEDIUM
%    VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%  DRVC.0 5365      DUAL          ONLINE     yyyy-mm-dd 11:05:42
%  DRVC.0 2257      DUAL          ONLINE     yyyy-mm-dd 11:05:42
```

– ´The end of reconstruction for a disk pair is reported on the console with:

```
%  DRV0060 DUAL START FOR DISK 'DRVC.0' ON DEVICE PAIR '(5365,2257)' COMPLETED.
RECONSTRUCTION FROM DEVICE '5365' TO DEVICE '2257'. COPY MODE: 'ALLOCATED-
BLOCKS'
```

– When reconstruction has been completed for all disks of a pubset migration can be
  completed. To do this all applications must first of all be terminated and the pubset
  exported (/EXPORT-PUBSET PUBSET=DRVC). This is particularly recommended as data
  consistency is then ensured on both disks. In the event of an error recourse can then
  be made to the source disks.

– Dual recording of data is then terminated:
  /STOP-DRV-DUAL-MODE VOLUME=*BY-PUBSET(PUBSET=DRVC,
      NEW-NAME-OF-REMOVED=*SAME,UNIT-TO-REMOVE=*MIGRATION-SOURCE)

```
%  DRV0049 COMMAND 'STOP-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRVC.0'
%  DRV0080 COMMAND 'STOP-DRV-DUAL-MODE' SUCESSFULLY PROCESSED
```

The following message appears on the console:

```
%  DRV0061 DUAL STOP FOR DISK 'DRVC.O' ON DEVICE PAIR '(2257,5365)' COMPLETED.
'DRV-MONO' DISK CREATED ON DEVICE '2257'
```

– After this command the target disk is in the DRV status MONO and the source disk in the status DUAL-CRASHED:
/SHOW-DRV-STATUS INFORMATION=*ALL

```
%    VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRVC.O  2257        FREE             MONO
%    VSN   RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRVC.O      DRV         ALL        AT-ALLOC    BY-OPERATOR
%    VSN   COPY-SPEED
%  DRVC.O  MEDIUM
%    VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC     TIMESTAMP
%  DRVC.O 2257     MONO          ONLINE    yyyy-mm-dd 11:27:44
%  DRVC.O 5365   DUAL-CRASHED    ONLINE    yyyy-mm-dd 11:27:44
```

– Migration for disk 2257 is still active, however, which means that the target disk still appears with the source disk type.
/SHOW-PUBSET-MIGRATION PUBSET=DRVC

```
%  SHOW-PUBSET-MIGRATION-STATUS              DATE: yyyy-mm-dd, TIME: 14:30:19
%  CATID VSN     SOURCE        TARGET         MIGR-STATE
%             MN     ALLOC    MN     ALLOC
%  DRVC  DRVC.O 5365   FREE     2257   FREE     ACTIVE
%  NUMBER OF ACTIVE MIGRATIONS = 1
%  SHOW-PUBSET-MIGRATION-STATUS                            END OF DISPL
```

– Before migration can be terminated with the /FINISH-PUBSET-MIGRATION command, the source disks must be in the DETACHED status. If this is not the case, only the ABORT-PUBSET-MIGRATION function is executed implicitly and the disk type is not updated in the file catalog. The target disks are then in an inconsistent status. For details see .

/DETACH-DEVICE 5365
/FINISH-PUBSET-MIGRATION PUBSET=DRVC

```
%  DRV2001 DEACTIVATE MIGRATION FOR SOURCE DEVICE '5365' AND TARGET DEVICE
'2257' SUCCESSFUL
```

After this command migration is terminated for disk 2257 (for all disks of the pubset). The disk type is updated in the file catalog.

– After this disk has been attached again, the correct type is displayed.
```
/ATTACH-DEVICE 2257
/SHOW-DEVICE-CONFIGURATION 2257
```

```
% MNEM   UN-CLASS      UN-TYPE        CONF-STATE  POOL/SIDE
% 2257     DVC         D3435           ATTACHED      SH
```

The pubset can now be imported again. Operation continues normally on the D3435 disks in DRV mono mode.

4.6.6 Migration of an SM pubset

DRV does not recognize SM pubsets, only volume sets. SM pubsets can thus not be migrated as a unit. Instead, migration must cover all the individual volume sets of which an SM pubset consists. It must be taken into account here that mutual references exist between data structures on the control volume set and data structures on data volume sets. Consequently when a volume set is migrated data outside the volume set currently being processed must also be updated. The following applies here:

– When the control volume set is migrated, the main disks (Volres) of all data volume sets must be accessible.

– When a data volume set is migrated, the control volume set must also be accessible.

Furthermore, the individual steps involved in migration must be so arranged that if an error occurs a consistent status can always be restored on the basis of the source disks. This can then serve as the basis for repeating migration. If an SM pubset is to be migrated in full, the steps described below guarantee "secure" migration. The steps are illustrated by means of an example: The SM pubset with the catalog ID SMP consists of the control volume set CTRL and the data volume sets DAT1 and DAT2.

– Prepare migration for all volume sets
```
/PREPARE-PUBSET-MIGRATION PUBSET=CTRL
/PREPARE-PUBSET-MIGRATION PUBSET=DAT1
/PREPARE-PUBSET-MIGRATION PUBSET=DAT2
```

– Select the DRV settings for all volume sets so as to permit a switchover from SRV or mono mode to DRV dual mode.
```
/SET-DRV-PARAMETER UNIT=*VOL-SET(VOL-SET=(CTRL,DAT1,DAT2)),
   RECORDING-MODE=*DRV-DUAL,DUAL-STOP=*BY-OPERATOR,
   COPY-START=*AT-ALLOCATION,EQUALIZE-DATA=*ALL
```

– Attach target disks for all volume sets

–   Activating DRV dual mode starts migration (in other words reconstruction of the source disk data on the target disk(s)):

```
/START-DRV-DUAL-MODE VOLUME=*BY-PUBSET(FROM-PUBSET=*CURRENT,
   TO-PUBSET=CTRL)
/START-DRV-DUAL-MODE VOLUME=*BY-PUBSET(FROM-PUBSET=*CURRENT,
   TO-PUBSET=DAT1)
/START-DRV-DUAL-MODE VOLUME=*BY-PUBSET(FROM-PUBSET=*CURRENT,
   TO-PUBSET=DAT2)
```

–   After reconstruction of the target volume set has been terminated, dual recording of data is terminated:

```
/STOP-DRV-DUAL-MODE VOLUME=*BY-PUBSET(PUBSET=CTRL,NEW-NAME-OF-REMOVED=
   *SAME,UNIT-TO-REMOVE=*MIGRATION-SOURCE)
/STOP-DRV-DUAL-MODE VOLUME=*BY-PUBSET(PUBSET=DAT1,NEW-NAME-OF-REMOVED=
   *SAME,UNIT-TO-REMOVE=*MIGRATION-SOURCE)
/STOP-DRV-DUAL-MODE VOLUME=*BY-PUBSET(PUBSET=DAT2,NEW-NAME-OF-REMOVED=
   *SAME,UNIT-TO-REMOVE=*MIGRATION-SOURCE)
```

The status of the source disks is now consistent; if required this can be used as a basis for renewed migration.

–   Detach all source disks of the volume sets CTRL, DAT1 and DAT2 of the SM pubset SMP with
    `/DETACH-DEVICE`.

–   Terminate migration for all volume sets of the SM pubset with the following commands:
    –   `/FINISH-PUBSET-MIGRATION CTRL`
    –   `/ATTACH DEVICE` for the target disks of CTRL
    –   `/FINISH-PUBSET-MIGRATION DAT1`
    –   `/FINISH-PUBSET-MIGRATION DAT2`

Clearly the example can be generalized for any required number of volume sets. With this procedure (as mentioned above) the consistent status of the SM pubset's source disks is always available for a restart.

The procedure for migrating single volume sets is the same as for migrating a complete SM pubset. It is always important here that the control volume set is processed in DRV dual mode and included in the steps for terminating migration described above.

4.6.7　Error handling during migration

This section describes possible error situations and the measures required to correct them.

Error when initiating migration

The `/PREPARE-PUBSET-MIGRATION` command is rejected.
Message `DRV2xxx` provides more detailed error information if the requirements regarding disk type, disk format, channel type or operating system version are not satisfied.

Error in performing migration

Performing migration corresponds to reconstructing a disk when switching from mono mode to dual mode.

Possible errors and responses are described in the chapter "Error recovery" on page 63.

Migration can be aborted at any time using the `/ABORT-PUBSET-MIGRATION` command or by calling the `EXECUTE-PUBSET-MIGRATION` procedure. In this case the target disks are detached and DRV mono mode is switched to on the source disks. Operation can then continue as before on the source disks.

Error in completing migration

A distinction must be made here between the status of the source and target disks at the time the error occurred.

The following steps are required to successfully complete migration:

1. The data on the source disks has been copied in full onto the target disks (in other words reconstruction must have been completed for all disks in the pubset).

2. The switchover from DRV dual mode to DRV mono mode has taken place on the target disks.

3. The disk type for the target disks has been updated to match the correct type of the D3435 disk (successful execution of the `/FINISH-PUBSET-MIGRATION` command).

Possible errors, causes and responses:

– Reconstruction had not been completed when the switchover from DRV dual mode to DRV mono mode took place.

Response:
In this case recourse must be made to the source disks. Migration must be started again from the beginning.

– Migration is terminated, the disk type was not updated in the catalog of the target disk(s), but reconstruction was successfully completed.
Possible causes:
  – After the switchover from DRV dual mode to DRV mono mode on the target disks migration was aborted with `/ABORT-PUBSET-MIGRATION`.
  – The source disks were not in the `DETACHED` status when the `/FINISH-PUBSET-MIGRATION` command was issued.

Response:
If reconstruction of the data on the target disks was performed without error, migration for the pubset can be restarted with `/PREPARE-PUBSET-MIGRATION`. Subsequently the source disks are detached, the target disks attached, and the `/FINISH-PUBSET-MIGRATION` command executed again.

Error after terminating migration

After migration has been terminated the following situations can occur:

– Migration was terminated before all target disks were completely equalized with the data from the source disks.

Response:
In this case recourse must be made to the source disks. Migration must be started again from the beginning.

– After migration has been terminated recourse is again made to the source disks.

Response:
In a pubset the source disks are still in a consistent status if the pubset was exported prior to the `/STOP-DRV-DUAL-MODE UNIT-TO-REMOVE=*MIG-SOURCE` command and was not imported again before the `/FINISH-PUBSET-MIGRATION` command. This is especially the case if migration was terminated with the `EXECUTE-PUBSET-MIGRATION` procedure. In this event the target disks must be detached again and the source disks attached. When the `/IMPORT-PUBSET` command is issued an appropriate response must be given at the console to the message `DRV001` as the source disks are in the DRV status `DUAL-CRASHED` (see "Only one crash disk" on page 87). Before migration takes place again the target disks must be reinitialized with SIR.

4.6.8   Special features

Boot block

A boot block on the source disk is not copied to the target disk. Instead, an invalid pattern is stored there which leads to IPL abortion if an attempt is made to start up using this disk.

If an IPL is to be performed using the migrated pubset, the boot block must be set up again using SIR.

Paging areas

Paging areas are not duplicated by DRV.

The paging areas must be released with `/REDUCE-PAGING-AREA` at the latest after the pubset has been equalized and before export.

`/EXTEND-PAGING-AREA` can be used to create a paging area again on the migrated pubset.

4.6.9   DRV operation with migrated and non-migrated D3435 disks

The following must be observed when migrated D3435 disks are used with non-migrated D3435 disks in DRV dual mode:

If a migrated disk and a non-migrated disk are of the same size they can be operated directly as a DRV dual disk pair by DRV.

However, it is generally not possible to make a non-migrated disk the same size as a migrated disk. In this case a slightly larger disk can be created and DRV migration repeated. When migration is performed a second time, the migrated D3435 disk is copied onto the new D3435 disk1:1. After is has been copied successfully, the second migration can be terminated and the disk pair operated in DRV dual mode.

4.6.10   Influence on performance

Copying data to the D3435 disks and dual recording of data during migration calls for additional I/O operations and thus has a negative influence on I/O performance. The `COPY-SPEED` operand in the `/SET-DRV-PARAMETER` command enables a copying speed to be specified.

Recommendations for using `COPY-SPEED`:

`HIGH`

> For high-speed migration - applications can be severely restricted.

`LOW`

> If productive operation is on no account to be impaired.

`MED` (default)

> When the migration procedure is used the default value for the copying speed is used unless something else was defined beforehand with `COPY-SPEED`.

Performance is also influenced greatly by the load on the channels connected to the controllers. If the target disks are connected via the same channels as the source disks and these channels were already subject to a heavy load, migration can result in a significant reduction in performance.

Performance aspects are described in more detail in the Performance Handbook for BS2000/OSD [5].

5 Error recovery

This chapter explains the techniques of error recovery specific to DRV. It also lists possible errors and describes how to handle them.

5.1 DRV-specific error recovery techniques

The DRV techniques primarily used for error recovery are reconstruction, equalization and changeover from dual to mono mode.

5.1.1 Reconstruction

Reconstruction takes place during the change from mono to dual mode, when a second disk is connected for data duplication. `READ` is stored in the SVL of the disk containing the current data, while `RECONSTRUCT` is stored in the SVL of the other disk (write disk). The data is copied from the original disk to the second disk.

Reconstruction can take place while the system is in operation. User inputs and outputs are processed.

DRV recognizes the following types of reconstruction:

– ALL-BLOCKS
All blocks on the disk (with the possible exception of the paging area) are copied.

– ALLOCATED-BLOCKS
All blocks marked as allocated in the F5 label of the disk (with the possible exception of the paging area) are copied.

– MODIFIED-FILES
This mode is used only when copying the second disk of the home pubset if they were identical before `SHUTDOWN`. Only the files modified since system initialization and all open files are reconstructed.

The type of reconstruction involved is indicated in message `DRV0060 (DUAL START COMPLETED)`; with `/SHOW-DRV-STATUS`, `RECONSTRUCTION` is always displayed.In the case of `MODIFIED-FILES`, the percentage value does not correspond to the actual progress of reconstruction.

Initiating reconstruction

DRV initiates reconstruction automatically in the following cases:

– during switchover from mono to dual mode with `/START-DRV-DUAL-MODE`, if the two disks are not identical; the following changeovers result:

```
Modus:        Mono   ➡ Reconstruction     ➡ Dual
Disk type:  (MONO)   ➡ (READ,RECONSTRUCT) ➡ (DUAL,DUAL)
```

– on system restart after a system crash, if a reconstruction was aborted during this crash.

Time of copying

The copying operation starts (default value) on allocation of a disk pair. As one of the disks normally has to be copied completely, this leads to a considerable additional input/output load. DRV therefore offers the possibility of bringing forward the copy operation to the time when both disks are mounted. To do this, set the copying time (`COPY-START=AT-MOUNTING`) with the `/SET-DRV-PARAMETER` command.

Read error during reconstruction

If during read access by a user, a read error occurs in the part of the original disk not yet copied, an error code is returned.
If the read error occurs in the area of the disk already copied, DRV can read the duplicate and thus correct the error.

Example

Displaying the status of a disk which is being reconstructed.

You can identify the reconstruction by the `RECONST(n%)` value in the `RECOVER` column and by the `READ` and `RECONSTRUCT` entries in the `SVL-DRV-INFO` column.

`/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL`

```
% VSN    MNEM'S   ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000 B1 ,B2   IN-USE            DUAL        RECONST(100%)
% VSN    RECORDING-MODE EQUALIZE  COPY-START   DUAL-STOP
% DRV000     DRV        ALL       AT-ALLOC     AT-ERROR(   10S)
% VSN    COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM  SVL-DRV-INFO     AVAIL/ALLOC      TIMESTAMP
% DRV000 B1       READ          FREE-USE    yyyy-mm-dd 13:49:18
% DRV000 B2    RECONSTRUCT      FREE-USE    yyyy-mm-dd 13:49:18
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

5.1.2 Equalization

Equalization restores the equality of the two disks in a disk pair after an abortion of dual operation. Abortion may have been caused by a system crash or, in the case of private disks, by the command `/DETACH-DEVICE FORCE=YES` or `/CHANGE-DISK-MOUNT UNIT=*VOLUME(VOLUME=vsn),ACTION=CANCEL`.

If dual operation is aborted, the identity of the disks in the disk pair is no longer guaranteed. DRV detects this status on system restart on the basis of the information stored in the SVLs of the disks.

If you query the information on the physical disks with the `/SHOW-DRV-STATUS` command (`INFORMATION=*VOLUMES`), the value `DUAL-CRASHED` appears in the `SVL-DRV-INFO` column for both disks.

Equalization can take place while the system is running. User inputs/outputs are still processed. The difference between equalization and reconstruction lies in the fact that here only those blocks are unequal for which the user has issued a write job which was not terminated successfully before the abortion. As in SRV operation, the status of these blocks on the disks after a system crash is not clearly defined. For a write job in dual operation, one disk may contain the old block contents and the other disk the new block contents. For another write job, the opposite may apply. This means that both disks are equivalent and neither direction of copying is preferred. As long as the user has not yet commenced operations, both disks remain equivalent. After the user commences operations, one of the disks is marked as a read disk with `READ`. The other is marked as a write disk with `EQUALIZE`.

Only the read disk guarantees the user a consistent data view. The write disk can no longer be used as a mono disk.

If a pubset is being used exclusively via DMS access methods and if no special programs such as SIR, SPCCNTRL, PVSREN or DPAGE are being used (on a volume-specific basis), inequality in the event of a system crash is only possible in the files open at the time of the crash. In such a case, `/SET-DRV-PARAMETER EQUALIZE=OPEN-FILES` can be used before importing the pubset to stipulate that DRV equalizes only the system metadata and the open files. As a result, equalization can be speeded up and the I/O load reduced.

DRV recognizes the following types of reconstruction:

– ALL-BLOCKS
 All blocks on the disk (with the possible exception of the paging area) are copied.

– ALLOCATED-BLOCKS
 All blocks marked as allocated in the F5 label of the disk (with the possible exception of the paging area) are copied.

– OPEN-FILES
 This mode is only used in conjunction with `EQUALIZE=OPEN-FILES`. Only the files open in the last pubset session are equalized.

The type of equalization involved is indicated in message DRV0062 (EQUALIZATION COMPLETED); with /SHOW-DRV-STATUS, EQUALIZATION is always displayed.In the case of OPEN-FILES, the percentage value does not correspond to the actual progress of equalization.

Starting equalization

DRV automatically starts equalization in the following cases:

– on system restart after an abortion of dual operation, if the information DUAL-CRASHED appears in the SVL; the following changeovers result:

```
Mode:       Abort dual operation        ➥ Equalization      ➥ Dual
Disk type: (DUAL-CRASHED,DUAL-CRASHED) ➥ (READ,EQUALIZE) ➥ (DUAL,DUAL)
```

– on system restart after a system crash, if an equalization was aborted in the process.

Time of copying

As with reconstruction, the copy operation is started by default on allocation of the disk pair. Depending on the volume of data that has to be copied, this can lead to a considerable additional input/output load.
DRV therefore offers the possibility of bringing forward the copy operation to the time when both disks are mounted.
To do this, set the copying time (COPY-START=AT-MOUNTING) with the /SET-DRV-PARAMETER command. The load during user operation is thus reduced; this is an important factor because the start of copying is especially critical with regard to performance. At the beginning, all user read accesses are carried out on the read disk. If data has already been copied, read accesses are distributed over both disks.

Copy extent

During equalization, all data on the disks is copied, in accordance with the default value. However, DRV offers the possibility of copying the administration data only (F1 and F5 labels, TSOSCAT, user catalog).
In order to do this, you must specify only the administration data as copy extent in the /SET-DRV-PARAMETER command (EQUALIZE-DATA=NO-USER-FILES).

In this case, the user is responsible for the consistency of his/her data. DRV provides user support via the macro interface.

The limiting of the copy extent to the administration data is useful for database systems which restore the database files containing the user data to a consistent status by resetting non-completed transactions. The affected data blocks are rewritten. However, this does not apply to the backup and administration files belonging to the database.

This mode is only used in conjunction with `EQUALIZE=OPEN-FILES`. Only the files open in the last pubset session are equalized.

User-defined equalization

DRV provides the following support for user-defined equalization via the macro interface:

– The `VERIF` macro has been expanded so that the blocks belonging to a file can be equalized.
– The UPAM interface contains an additional function which permits reading with equalization.
– The FCB contains a DRV indicator.

These extensions are described in .

Read error during equalization

As long as user operation is not active, read errors during the copying function can be corrected.

If, during user operation, a read error occurs in the part of the read disk not yet copied, an error code is returned.
If the read error occurs in the area of the disk already copied, DRV can read the duplicate and can therefore correct the error.

Example

The reason for equalization is the abnormal termination of dual operation. This status can be identified by the DUAL-CRASHED entry in the SVL-DRV-INFO column of the SHOW-DRV output:

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000  B2 ,B1     FREE           DUAL          EQUAL-NECESS
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRV000      DRV          ALL       AT-ALLOC    AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN     MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2     DUAL-CRASHED      ONLINE      yyyy-mm-dd 13:36:02
%  DRV000 B1     DUAL-CRASHED      ONLINE      yyyy-mm-dd 13:36:02
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

During equalization, the value EQUALIZ*(n%)* appears in the RECOVER column. One of the disks is identified as the read disk. All user read accesses in the area which has not yet been copied are carried out on this disk.

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000  B2 ,B1     IN-USE         DUAL          EQUALIZ(100%)
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRV000      DRV          ALL       AT-ALLOC    AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN     MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2     READ            FREE-USE     yyyy-mm-dd 13:36:02
%  DRV000 B1     EQUALIZE        FREE-USE     yyyy-mm-dd 13:36:02
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

5.1.3   Changing from dual to mono mode (dual stop)

The change from dual to mono mode can be made for both free and reserved disks. It is intended primarily for error recovery, to allow uninterrupted operation even if one of the disks develops a fault.

If a disk breaks down, DRV changes to mono mode automatically or after operator intervention.

In addition, the operator can change from dual to mono mode by calling the `/STOP-DRV-DUAL-MODE` command or by disconnecting a disk with `/DETACH-DEVICE FORCE=YES` or `/CHANGE-DISK-MOUNT UNIT=*VOLUME(VOLUME=vsn), ACTION=CANCEL`.

> **i**   Note that the level of data security is reduced after changing over to mono mode.

You can return to dual mode again with `/START-DRV-DUAL-MODE`. A reconstruction is necessary in order to re-create the disk pair.

Examples

The following examples show three different events which lead to termination of dual mode. The disconnected disk is subsequently used for resumption of dual mode. As only two disks are mounted and the copying direction is unambiguous, the VSN is the only specification necessary with `/START-DRV-DUAL-MODE`.

1. Termination of dual mode with `REMOUNT` and time monitoring:

```
% NKVD011 DISK 'DRV000' DISMOUNTED FROM DEVICE 'B2'
% DRV0077 FOR DISK 'DRV000' ON DEVICE ' B2' EVENT 'REMOUNT_START' WITH
         ERROR CODE 'NONE' OCCURED
% NKVD014 REMOUNT DISK 'DRV000' ON DEVICE 'B2'; '(REASON :
         DEVICE_INOPERABLE)'; (SYS-ALLOC='EXCL'). '(ETX = YES; N = NO
         (CANCEL DISK))'
```

The `REMOUNT` of the Disk Monitor (NKV) implies activation of DRV. In the `SHOW-DRV-STATUS` output, the interruption of dual operation is indicated by the entry `SUSPENDED` in the columns `RECOVER` and `AVAIL/ALLOC`. `DUAL-STOP` is set to `AT-ERROR`. DRV therefore activates time monitoring.

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
% VSN    MNEM'S   ALLOC-PHASE      ALLOC-TYPE    RECOVER
% DRV000 B2 ,B1    IN-USE           DUAL             SUSPENDED
% VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
% DRV000     DRV         ALL        AT-ALLOC    AT-ERROR(   10S)
% VSN   COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC    TIMESTAMP
% DRV000 B1       DUAL          FREE-USE    yyyy-mm-dd 13:51:17
% DRV000 B2       DUAL          SUSPENDED   yyyy-mm-dd 13:51:17
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

After expiry of the waiting time, dual operation is terminated (DRV0061). The disk on B2 is released. This automatically answers the remount message (NKVD014).

```
% DRV0077 FOR DISK 'DRV000' ON DEVICE '(B2 ,B1 )' EVENT 'TIMER_EVENT'
          WITH ERROR CODE 'NONE' OCCURRED
          AUTOMATIC MESSAGE ANSWERING :  MSG7ANSW X038.B2(DM)
% NKVD080 MONITOR ACTION FOR DISK 'DRV000' ON DEVICE 'B2' FOR TASK 'X038'
          ABORTED, AS DISK IS NO LONGER IN USE
% DRV0061 DUAL STOP FOR DISK 'DRV000' ON DEVICE PAIR '(B1 ,B2 )'
          COMPLETED. 'DRV-MONO' DISK CREATED ON DEVICE 'B1'
```

As soon as the disk is available again, the /CHECK-DISK-MOUNT command leads to a further check of the mount status: /SHOW-DRV-STATUS shows a mono disk in the FREE-USE status and a free disk in the DUAL-CRASHED status. The mode is DRV-MONO.

```
/CHECK-DISK-MOUNT UNIT=B2
```

```
% NKVD010 DISK 'DRV000' MOUNTED ON DEVICE 'B2'
% NKVD052 UNLOCK REQUEST FOR DISK 'DRV000' ON DEVICE 'B2' FOR SYSTEM 'A'
          COMPLETED
```

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
% VSN    MNEM'S   ALLOC-PHASE      ALLOC-TYPE    RECOVER
% DRV000    B1    IN-USE           MONO
% VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
% DRV000     DRV         ALL        AT-ALLOC    AT-ERROR(   10S)
% VSN   COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC    TIMESTAMP
% DRV000 B1       MONO          FREE-USE    yyyy-mm-dd 13:51:17
% DRV000 B2    DUAL-CRASHED     ONLINE      yyyy-mm-dd 13:51:17
```

You return to dual mode with /START–DRV–DUAL–MODE. DRV initiates a reconstruction in order to ensure that the two disks have the same status:

/START–DRV–DUAL–MODE VOLUME=DRV000

```
%  DRV0049 COMMAND 'START–DRV–DUAL–MODE' PROCESSED FOR DISK 'DRV000'
%  DRV0074 COPYING OF DISK 'DRV000' FROM DEVICE 'B1' TO DEVICE 'B2' STARTED
```

%NBR0740 COMMAND 'STA–DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

/SHOW–DRV–STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN     MNEM'S    ALLOC–PHASE      ALLOC–TYPE    RECOVER
%  DRV000  B1 ,B2    IN–USE           DUAL          RECONST(100%)
%  VSN    RECORDING–MODE  EQUALIZE    COPY–START    DUAL–STOP
%  DRV000      DRV         ALL         AT–ALLOC     AT–ERROR(   10S)
%  VSN   COPY–SPEED
%  DRV000  MEDIUM
%  VSN     MNEM  SVL–DRV–INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B1       READ          FREE–USE    yyyy–mm–dd 13:51:17
%  DRV000 B2    RECONSTRUCT      FREE–USE    yyyy–mm–dd 13:51:17
```

%NBR0740 COMMAND 'SH–DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

```
%  DRV0060 DUAL START FOR DISK 'DRV000' ON DEVICE PAIR '(B1  ,B2  )'
           COMPLETED. RECONSTRUCTION FROM DEVICE 'B1' TO DEVICE 'B2'.
           COPY MODE: 'ALLOCATED–BLOCKS'
```

/SHOW–DRV–STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN     MNEM'S    ALLOC–PHASE      ALLOC–TYPE    RECOVER
%  DRV000  B1 ,B2    IN–USE           DUAL
%  VSN    RECORDING–MODE  EQUALIZE    COPY–START    DUAL–STOP
%  DRV000      DRV         ALL         AT–ALLOC     AT–ERROR(   10S)
%  VSN   COPY–SPEED
%  DRV000  MEDIUM
%  VSN     MNEM  SVL–DRV–INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2     DUAL           FREE–USE    yyyy–mm–dd 13:51:17
%  DRV000 B1     DUAL           FREE–USE    yyyy–mm–dd 13:51:17
```

%NBR0740 COMMAND 'SH–DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

2. Termination of dual operation with /DETACH-DEVICE FORCE=YES

/DETACH-DEVICE UNIT=B2,FORCE=YES

```
NKR0045 DEVICE    = B2  ******************************** DETACHED ****
****************
% NKVD030 DISK 'DRV000' WAS CANCELLED BY SYSTEM
% DRV0077 FOR DISK 'DRV000' ON DEVICE ' B2' EVENT 'PV_CANCEL_EVENT' WITH
         ERROR CODE 'NONE' OCCURED
% DRV0061 DUAL STOP FOR DISK 'DRV000' ON DEVICE PAIR '(B1  ,B2  )'
         COMPLETED. 'DRV-MONO' DISK CREATED ON DEVICE 'B1'
```

%NBR0740 COMMAND 'DETACH-DEVICE' COMPLETED (RESULT: SC2=000/SC1=000,
        MC=CMD0001)

/SHOW-DRV VOLUME=DRV000,INF=ALL

```
% VSN    MNEM'S   ALLOC-PHASE    ALLOC-TYPE   RECOVER
% DRV000   B1       IN-USE         MONO
% VSN   RECORDING-MODE EQUALIZE  COPY-START   DUAL-STOP
% DRV000     DRV        ALL       AT-ALLOC   AT-ERROR(  10S)
% VSN   COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
% DRV000 B1      MONO         FREE-USE   yyyy-mm-dd 13:53:20
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

/ATTACH-DEVICE UNIT=B2

```
NKR0042 DEVICE    = B2  ******************************** ATTACH ACCEPTED
NKR0040 DEVICE    = B2  ******************************** ATTACHED
% NKVD010 DISK 'DRV000' MOUNTED ON DEVICE 'B2'
% NKVD052 UNLOCK REQUEST FOR DISK 'DRV000' ON DEVICE 'B2' FOR SYSTEM 'A'
         COMPLETED
```

%NBR0740 COMMAND 'ATTACH-DEVICE' COMPLETED (RESULT: SC2=000/SC1=000
        MC=CMD0001)

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
% VSN    MNEM'S   ALLOC-PHASE    ALLOC-TYPE   RECOVER
% DRV000   B1       IN-USE         MONO
% VSN   RECORDING-MODE EQUALIZE  COPY-START   DUAL-STOP
% DRV000     DRV        ALL       AT-ALLOC   AT-ERROR(  10S)
% VSN   COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
% DRV000 B1      MONO         FREE-USE   yyyy-mm-dd 13:53:20
% DRV000 B2   DUAL-CRASHED     ONLINE   yyyy-mm-dd 13:53:20
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

```
/START-DRV-DUAL-MODE VOLUME=*BY-UNIT(FROM-UNIT=B1,TO-UNIT=B2)
```

```
%  DRV0049 COMMAND 'START-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRV000'
%  DRV0074 COPYING OF DISK 'DRV000' FROM DEVICE 'B1' TO DEVICE 'B2' STARTED
%  DRV0060 DUAL START FOR DISK 'DRV000' ON DEVICE PAIR '(B1  ,B2  )'
           COMPLETED. RECONSTRUCTION FROM DEVICE 'B1' TO DEVICE 'B2'.
           COPY MODE: 'ALLOCATED-BLOCKS'
```

```
%NBR740 COMMAND 'STA-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

```
/SHOW-DRV VOLUME=DRV000,INF=ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000 B1 ,B2    IN-USE          DUAL
%  VSN    RECORDING-MODE  EQUALIZE  COPY-START  DUAL-STOP
%  DRV000     DRV         ALL       AT-ALLOC  AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC    TIMESTAMP
%  DRV000 B2       DUAL            FREE-USE    yyyy-mm-dd 13:53:20
%  DRV000 B1       DUAL            FREE-USE    yyyy-mm-dd 13:53:20
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

3. Termination of dual operation with /STOP-DRV-DUAL-MODE

```
/STOP-DRV-DUAL-MODE VOLUME=*UNIT-TO-REMOVE(UNIT=B2)
```

```
%  DRV0049 COMMAND 'STOP-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRV000'
%  DRV0061 DUAL STOP FOR DISK 'DRV000' ON DEVICE PAIR '(B1  ,B2  )'
           COMPLETED. 'DRV-MONO' DISK CREATED ON DEVICE 'B1'
```

```
%NBR0740 COMMAND 'STO-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000    B1     IN-USE          MONO
%  VSN    RECORDING-MODE  EQUALIZE  COPY-START  DUAL-STOP
%  DRV000     DRV         ALL       AT-ALLOC  AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC    TIMESTAMP
%  DRV000 B1       MONO            FREE-USE    yyyy-mm-dd 13:54:54
%  DRV000 B2    DUAL-CRASHED       ONLINE      yyyy-mm-dd 13:54:54
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

```
/START-DRV-DUAL-MODE VOLUME=DRV000
```

```
%  DRV0049 COMMAND 'START-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRV000'
%  DRV0074 COPYING OF DISK 'DRV000' FROM DEVICE 'B1' TO DEVICE 'B2' STARTED
%  DRV0060 DUAL START FOR DISK 'DRV000' ON DEVICE PAIR '(B1  ,B2  )'
           COMPLETED. RECONSTRUCTION FROM DEVICE 'B1' TO DEVICE 'B2'.
           COPY MODE: 'ALLOCATED-BLOCKS'
```

```
%NBR0740 COMMAND 'STA-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

5.2 Correction of volume-related errors

Through use of data duplication, DRV can correct volume-related errors detected during reading, as long as the data blocks are readable on at least one of the disks. DRV corrects an error by assigning an alternate track or an alternate block and copying the data there.

Note on home pubsets and paging

For the home pubset, system initialization always takes place in DRV mono mode. This means that read errors cause system initialization to be aborted. System initialization can be continued (manually) by selecting the second disk (see section "Special features of the home pubset and paging" on page 36.

If paging is used on a DRV pubset, it only uses one of the two disks. As a result, read errors in this area cannot be corrected.

5.3 Disk failure

A disk failure leads to termination of dual operation. The cause may be a device error, or a /FORCE-JOB-CANCEL command for a write task which was interrupted during execution and resulted in unequal disk statuses.

In the case of some disk failures, the error can be corrected by the operator.

5.3.1 Unrecoverable errors

In the case of unrecoverable errors, DRV detaches the defective disk in dual operation and switches to mono mode. This changeover is stored in the SVL of the mono disk. The defective disk is released by DRV and is available again for SPECIAL allocation (by VOLIN, for example).

5.3.2 Recoverable errors

In the case of errors where operator intervention is possible, the remount message NKVD014 is output.

Error display

The interruption of operations is indicated in the output of the /SHOW-DRV-STATUS command when you request information about the physical disks (INFORMATION=*VOLUMES). The SUSPENDED value is shown as the status of the logical disk in the RECOVER column. The status of the defective physical disk in the AVAIL/ALLOC column is likewise SUSPENDED. The status of the remaining physical disk is FREE-USE.

Error handling

If the error only affects one of the disks, read jobs are still carried out on the unaffected disk. Further action depends on the response to the disk error. This can be defined with the /SET-DRV-PARAMETER command (DUAL-STOP parameter).

– DUAL-STOP=AT-ERROR(WAIT=number):

In this case, DRV responds to the disk error after expiry of the time specified in WAIT. During this waiting time, you can respond to the remount message or use /SET-DRV-PARAMETER to set DUAL-STOP=BY-OPER in order to avoid the automatic changeover to mono mode. If you do not respond to the message, DRV switches to mono mode after the waiting time expires.

– DUAL-STOP=BY-OPER:

The operator responds to the disk error.

He/she switches to mono mode by replying to the remount message with N.

If the same data block cannot be read on both disks, two remount messages are output. These must be answered by the operator, regardless of the DUAL-STOP setting. If he/she answers both messages with N, the allocation is aborted, as with SRV.

5.4 Resumption of dual operation

After elimination of a disk error, you can switch back to dual operation. To do this, you need to provide a second, initialized disk and call the /START-DRV-DUAL-MODE command.

Example

After a disk failure which led to termination of dual operation, dual operation is resumed with /START-DRV-DUAL-MODE:

/START-DRV-DUAL-MODE VOLUME=DRV000

```
%  DRV0049 COMMAND 'START-DRV-DUAL-MODE' PROCESSED FOR DISK 'DRV000'
%  DRV0074 COPYING OF DISK 'DRV000' FROM DEVICE 'B1' TO DEVICE 'B2' STARTED
```

%NBR0740 COMMAND 'STA-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN    MNEM'S   ALLOC-PHASE    ALLOC-TYPE    RECOVER
%  DRV000 B1 ,B2    IN-USE          DUAL        RECONST(100%)
%  VSN    RECORDING-MODE EQUALIZE  COPY-START   DUAL-STOP
%  DRV000     DRV        ALL        AT-ALLOC    AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%  DRV000 B1     READ          FREE-USE    yyyy-mm-dd 13:56:03
%  DRV000 B2   RECONSTRUCT     FREE-USE    yyyy-mm-dd 13:56:03
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

```
%  DRV0060 DUAL START FOR DISK 'DRV000' ON DEVICE PAIR '(B1 ,B2 )'
           COMPLETED. RECONSTRUCTION FROM DEVICE 'B1' TO DEVICE 'B2'.
           COPY MODE: 'ALLOCATED-BLOCKS'
```

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN    MNEM'S   ALLOC-PHASE    ALLOC-TYPE    RECOVER
%  DRV000 B1 ,B2    IN-USE          DUAL
%  VSN    RECORDING-MODE EQUALIZE  COPY-START   DUAL-STOP
%  DRV000     DRV        ALL        AT-ALLOC    AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%  DRV000 B2     DUAL          FREE-USE    yyyy-mm-dd 13:56:03
%  DRV000 B1     DUAL          FREE-USE    yyyy-mm-dd 13:56:03
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

5.5 Abnormal end of operation

Disks used by DRV have a special indicator in their SVL. On normal termination, DRV removes these indicators. On abnormal termination they remain in the SVL, and DRV thus senses during restart processing that the disks might not be equal any more and hence initiates equalization.

Example

Dual operation is abnormally terminated with CHANGE-DISK-MOUNT. If no user has reserved the disks, they are released (ALLOC-PHASE=FREE). The SVLs of the disks describe the abnormal termination status (DUAL-CRASHED).

```
/CHANGE-DISK-MOUNT UNIT=*VOLUME(VOLUME=DRV000),ACTION=CANCEL
```

```
%  DRV0077 FOR DISK 'DRV000' ON DEVICE '(B2  ,B1  )' EVENT
            'LV_CANCEL_REQUEST' WITH ERROR CODE 'NONE' OCCURED
%  DRV0064 DRV ALLOCATION FOR DISK 'DRV000' ON DEVICE '(B2  ,B1  )'
            CANCELLED
%  NKA0016 ASSIGN-TIME=USER  AND  USER-ALLOCATION=NO  DEFINED FOR DISK
            'DRV000'
%  NKA0037 DISK 'DRV000' AVAILABLE ONLY AFTER RELEASE BY ALL SHARING USERS.
            SUBSEQUENTLY ENTER /SET-DISK-PARAMETER WITH
            USER-ALLOCATION=ALL/SHARE/EXCL
```

```
%NBR0740 COMMAND 'CHANGE-DISK-MOUNT' COMPLETED (RESULT: SC2=000/SC1=000,
        MC=CMD0001)
```

```
 /SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000             IN-USE           DUAL          CANCELLED
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRV000      DRV        ALL        AT-ALLOC   AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
%  DRV000 B2    DUAL-CRASHED      ONLINE     yyyy-mm-dd 13:57:17
%  DRV000 B1    DUAL-CRASHED      ONLINE     yyyy-mm-dd 13:57:17
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

On resumption of operation with SET-DISK, DRV automatically initiates equalization.
Equalization begins with the DRV0074 message and terminates successfully with the
DRV0062 message.

```
/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR,
                    USER-ALLOCATION=ALL
```

```
%  NKA0017 DISK 'DRV000' NO LONGER ALLOCATED
```

```
/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR,
                    USER-ALLOCATION=ALL
```

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000 D3490-40  ALL     OPERATOR    ALL     NO(D)  WRITE
%  NKA0007 DISK ‚DRV000' WAS ALLOCATED BY MEANS OF  ASSIGN-TIME=OPERATOR
%  DRV0074 COPYING OF DISK ‚DRV000' FROM DEVICE ‚B2' TO DEVICE ‚B1' STARTED
%  DRV0062 EQUALIZATION OF DISK ‚DRV000' ON DEVICE PAIR ‚(B2  ,B1  )'
           COMPLETED. DATA COPIED FROM DEVICE ‚B2' TO DEVICE ‚B1'.
           COPY MODE: ‚ALLOCATED-BLOCKS'
```

```
%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,
         MC=CMD0001)
```

6 Conflicts and solutions

This chapter describes the various conflicts which may occur during installation of DRV, and exp2003lains how the operator should respond in these situations.
A distinction must be made during system initialization between the installation of "normal" pubsets and the installation of the home pubset.

6.1 Message DRV0001

When setting up SRV, any necessary operator actions are requested by the mount message NKVD013.

When setting up DRV, there are situations in which additional DRV-specific interventions by the operator are necessary. The operator is prompted to carry these out with the DRV0001 message.

The DRV0001 message is always preceded by another message explaining the respective conflict situation. The number of the preceding message is given again in the DRV0001 message.
By replying to this message, the operator can declare the operating mode and specify the disk to be used.
The permitted responses depend on the specific situation. Only permitted responses are offered. The following responses are possible:

Response	Effect

Operating mode
  D
  M
  S
	
	Set dual mode
	Set mono mode
	Set SRV mode

Disk *device* F[orce]	 Name of the disk device which is to be used Use proposed disk

Action
  R[etry]
  T[erminate]
	
	Retry process
	Terminate process

Example

A logical disk is to be allocated but the data on the physical disks does not match. The operator must therefore determine which operating mode is to be set:

```
/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR
```

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000 D3490-40  ALL     OPERATOR   ALL(D)    NO(D)   WRITE
%   DRV0014 TYPE OF VOLIN INITIALIZATION FOR DISKS 'DRV000' ON DEVICES
           '(B0,B6  )' NOT IDENTICAL OR FASTDISKS WITH DIFFERENT SIZE
%   DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
           'DRV000'. REASON: DRV0014:. REPLY (R = RETRY; D = DUAL; M = MONO;
           T = TERMINATE, S = SRV)
```

```
%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,
         MC=CMD0001)
```

6.2 Subsystem not loaded

At the operator interface, the effect of non-availability of DRV depends on the command used:

– DRV commands /SHOW-DRV-STATUS, /SET-DRV-PARAMETER, /START-DRV-DUAL-MODE, /STOP-DRV-DUAL-MODE:

   The command is rejected with message CMD0200 as "not available".

– commands /SET-DISK-PARAMETER ASSIGN-TIME=OPERATOR, IMPORT-PUBSET

   Input of these commands leads to setting of the SRV mode, even in the case of DRV disks. This is brought to the attention of the operator with the NKVD020 message. In answering the mount message NKVD013, the operator must either accept SRV mode or abort. Even if you call the subsystem with /START-SUBSYSTEM, you can no longer change over from SRV operation to DRV operation. You must first abort, change the operating mode and call /SET-DISK-PARAMETER or IMPORT-PUBSET again.

Possible cause

You have not executed /START-SUBSYSTEM SUBSYSTEM-NAME=DRV.

Information

/SHOW-SUBSYSTEM-STATUS SUBSYSTEM-NAME=DRV outputs information at the console about the availability of the DRV subsystem.

Example

DRV is not available, `SHOW-DRV-STATUS` **provides no output:**

`/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL`

`%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=065, MC=CMD2241)`

The disk is allocated for SRV operation with `/SET-DISK-PARAMETER`:

`/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR`

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000 D3490-40  ALL     OPERATOR  ALL(D)   NO(D)   WRITE
%  NKVD020 SRV-ALLOCATION-REQUEST FOR DRV-DISK 'DRV000' ON DEVICE 'B1'
%  NKVD013 MOUNT DISK 'DRV000' ON DEVICE 'B1'; '(REASON : VOLUME_APPROVAL)';
          (USE='DMS',SYS-ALLOC='ALL', ). '(ETX = YES; MN; N = NO )'
```

`%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,`
`        MC=CMD0001)`

You answer the mount message with `N`:

`<tsn>.N`

```
%  NKA0009 AN ALLOCATION OF DISK 'DRV000' BECAUSE OF DISK-PARAMETER
   ASSIGN-TIME=OPERATOR  COULD NOT BE PERFORMED
```

You start the subsystem:

`/START-SUBSYSTEM SUBSYSTEM-NAME=DRV`

You can then use the disk in DRV operation:

```
% NKA0007 DISK 'DRV000' WAS ALLOCATED BY MEANS OF ASSIGN-TIME=OPERATOR
```

6.3 Non-identical disks

DRV refuses to combine non-identical disks into a logical disk. It responds to the individual commands as follows:

–   After you have set dual mode with `/SET-DRV-PARAMETER`, you can determine the error by using the `SHOW-DRV-STATUS` command to query the summary information (`INFORMATION=*SUMMARY`). In this case, the `ALLOC-TYPE` output column contains the value `BY-OPER()` with the number of the message about the non-identical paths.
–   The commands `/SET-DISK-PARAMETER ASSIGN-TIME=OPERATOR` and `/IMPORT-PUBSET` for allocating the disk are rejected.
–   The `/START-DRV-DUAL` command is rejected.

Possible cause

The disks are not identical for one of the following reasons:

–   The configuration paths (device, controller and channel types) of the two physical disks are not identical.
–   The initialization with VOLIN is not identical for both disks.

The prerequisites for DRV are described in chapter "Use of DRV" on page 15.

Information

The device types can be queried with:

`/SHOW-DEVICE-STATUS` and `/SHOW-DEVICE-CONFIGURATION`

The paths can be queried with:

`/SHOW-DEVICE-CONFIGURATION UNIT=(<mn>,...),INF=PATH`

The types of all units which are part of the configuration path can be queried with:

`/SHOW-DEVICE-CONFIGURATION UNIT=*CONTROLLER(CONTROLLER-UNIT=(<mn>,...))`

or

`UNIT=*CHANNEL(CHANNEL-PATH-ID=(<mn>,...))`

Examples

1. Type of configuration paths not identical

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
% VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000 B1 ,L0     FREE       BY-OPER(DRV0015)
% VSN    RECORDING-MODE EQUALIZE   COPY-START   DUAL-STOP
% DRV000  DRV-DUAL      ALL        AT-ALLOC    AT-ERROR(  10S)
% VSN   COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
% DRV000 B1         SRV          ONLINE     yyyy-mm-dd 13:36:02
% DRV000 L0         SRV          ONLINE     yyyy-mm-dd 13:36:02
```

```
/START-DRV-DUAL-MODE VOLUME=DRV000
```

```
%  DRV0055 COMMAND 'START-DRV-DUAL-MODE': DISK 'DRV000' CANNOT BE ALLOCATED
           IN 'RECORDING-MODE DRV-DUAL' WITHOUT OPERATOR ASSISTANCE.
           REASON: 'DRV0015'
```

```
%NBR0740 COMMAND 'STA-DRV' COMPLETED (RESULT: SC2=000/SC1=064, MC=DRV0055)
```

```
/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR
```

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000          ALL     OPERATOR  ALL(D)   NO(D)   WRITE
%  NKA0043 DISK 'DRV000' MORE THAN ONCE MOUNTED WITH DIFFERENT DEVICE-TYPES.
           ALLOCATION BY /SET-DISK-PARAMETER IS POSSIBLE ONLY WHEN SPECIFYING
           THE DEVICE-TYPE
```

```
%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,
         MC=CMD0001)
```

>> Reservation by task<<

```
%  DRV0015 TYPE OF CONFIGURATION PATH FOR DISKS 'DRV000' ON DEVICES
           '(B1,L0  )' NOT IDENTICAL
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
           'DRV000'. REASON: DRV0015:. REPLY (R = RETRY; D = DUAL; M = MONO;
           T = TERMINATE, S = SRV)
```

```
/SHOW-DEVICE-CONFIGURATION UNIT=(B1,L0),INFORMATION=PATH
```

```
%DVC  DEV-TYPE CONF-STATE PID CTL CHPID IOS  SCD PORT SIDE DEV-ADDR PATH
%B1   D3490-40 ATTACHED   -  Z1   70   -   -   -    -   7001    AVAIL
%                            Z1   80   -   -   -    -   8001    AVAIL
%                            ZC   90   -   -   -    -   9001    AVAIL
%                            ZC   A0   -   -   -    -   A001    AVAIL
%L0   D3480    ATTACHED   -  Z1   70   -   -   -    -   7010    AVAIL
%                            Z1   80   -   -   -    -   8010    AVAIL
%                            ZC   90   -   -   -    -   9010    AVAIL
%                            ZC   A0   -   -   -    -   A010    AVAIL
```

```
%  NBR0740 COMMAND 'SHOW-DEVICE-CONFIGURATION' COMPLETED (RESULT: SC2=000/
           SC1=000, MC=CMD0001)
```

2. VOLIN initialization not identical

```
/SHOW-DRV VOLUME=DRV000,INF=ALL
```

```
%  VSN     MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000  B0 ,B6      FREE       BY-OPER(DRV0014)
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRV000    DRV-DUAL       ALL      AT-ALLOC   AT-ERROR(  10S)
%  VSN    COPY-SPEED
%  DRV000   MEDIUM
%  VSN     MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
%  DRV000 B0       SRV            ONLINE     yyyy-mm-dd 13:36:02
%  DRV000 B6       SRV            ONLINE     yyyy-mm-dd 13:36:02
```

```
/START-DRV-DUAL-MODE VOLUME=DRV000
```

```
%  DRV0055 COMMAND 'START-DRV-DUAL-MODE': DISK 'DRV000' CANNOT BE ALLOCATED
           IN 'RECORDING-MODE DRV-DUAL' WITHOUT OPERATOR ASSISTANCE.
           REASON: 'DRV0014'
```

```
%NBR0740 COMMAND 'STA-DRV' COMPLETED (RESULT: SC2=000/SC1=064, MC=DRV0055)
```

```
/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR
```

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
%  N   DRV000 D3490-40  ALL     OPERATOR  ALL(D)   NO(D)   WRITE
%  DRV0014 TYPE OF VOLIN INITIALIZATION FOR DISKS 'DRV000' ON DEVICES
          '(B0,B6  )' NOT IDENTICAL OR FASTDISKS WITH DIFFERENT SIZE
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
          'DRV000'. REASON: DRV0014:. REPLY (R = RETRY; D = DUAL; M = MONO;
          T = TERMINATE, S = SRV)
```

6.4 Operating mode or disk is ambiguous

When installing DRV, you may encounter problems if DRV cannot clearly identify either the operating mode or the disks to be used. The following table shows which situations can occur in connection with the available disks and the operating mode selected. The table lists the available physical disks together with the corresponding disk type. The disk type is shown as it is displayed in the output of the `/SHOW-DRV-STATUS` command in the `SVL-DRV-INFO` column. The columns contain the possible operating modes. The SRV mode is not listed, since it automatically implies SRV operation.

The table provides a brief overview of each possible situation. The shaded entries are cases of conflict where the operator has to intervene. They are explained beneath.

	Selected operating mode			
Mounted disks	**FROM-DISK**	**DRV**	**DRV-DUAL**	**DRV-MONO**
SRV + DRV disk	Mode cannot be determined	Mode cannot be determined	Disk pair incomplete	Mode cannot be determined
SRV	SRV operation	Mode cannot be determined	Disk pair incomplete	Mono operation
MONO	Mono operation	Mono operation	Disk pair incomplete	Mono operation
READ	Disk pair incomplete	Disk pair incomplete	Disk pair incomplete	Mono operation
DUAL	Disk pair incomplete	Disk pair incomplete	Disk pair incomplete	Mono operation
DUAL-CRASHED	Disk pair incomplete	Disk pair incomplete	Disk pair incomplete	Only one crash disk
EQUALIZE	Log. disk cannot be created	Log. disk cannot be created	Log. disk cannot be created	Log. disk cannot be created
RECONSTRUCT	Log. disk cannot be created	Log. disk cannot be created	Log. disk cannot be created	Log. disk cannot be created
(SRV,SRV) + DRV disk	Mode cannot be determined	Mode cannot be determined	Dual operation	Mono disk is ambiguous
(SRV,SRV)	SRV operation	Mode cannot be determined	Dual operation	Mono disk is ambiguous
(READ,READ)	Mode cannot be determined	Mode cannot be determined	Dual operation	Mono disk is ambiguous

	Selected operating mode			
Mounted disks	**FROM-DISK**	**DRV**	**DRV-DUAL**	**DRV-MONO**
(MONO,MONO)	Mode cannot be determined	Mode cannot be determined	Dual operation	Mono disk is ambiguous
(DUAL,DUAL)	Dual operation	Dual operation	Dual operation	Mono disk is ambiguous
(DUAL-CRASHED, DUAL-CRASHED)	Equalization	Equalization	Equalization	Mono disk is ambiguous
(READ, EQUALIZE)	Equalization	Equalization	Equalization	Mono operation Read disk
(READ, RECONSTRUCT)	Reconstruction	Reconstruction	Reconstruction	Mono operation Read disk

Mode cannot be determined

DRV cannot determine the operating mode in the following cases:

– `DRV` or `FROM-DISK` is specified as the operating mode and the mounted disks do not unambiguously define mono or dual operation: In the response to message `DRV0001`, the operator has to decide whether dual or mono mode is to be used.
– The current disk is a SRV disk:

If at least one DRV disk is mounted, DRV takes over control of the allocation. The operator has to confirm that the disk is correct.

Disk pair incomplete

If a disk pair is not complete because two disks are not yet mounted, the missing disks are requested with the mount message `NKVD013`. If the disk is to be used as a mono disk, the operator has to answer the message with `N` (`NO`).

An individual disk constitutes a complete logical disk if it was already used as a mono disk, or if a dual disk or read disk is mounted, and mono mode is set.

Only one crash disk

A dual crashed disk cannot form a complete logical disk without operator intervention (not even in mono mode).

The DRV0001 message is output and the operator has to respond with M (MONO). On its own, however, this response is not enough. DRV cannot tell whether the disk contains the most recent status of the data, because it cannot detect whether operation of this disk stopped as a result of a system crash or when dual operation was terminated. If the disk was detached when dual operation was terminated, the data stored on it will not be up-to-date. The operator is made aware of this fact and message DRV0001 is output. By answering with F (FORCE) you can force mono operation with the dual crashed disk.

Example

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S   ALLOC-PHASE     ALLOC-TYPE    RECOVER
%  DRV000    B0           FREE      BY-OPER(DRV0013)
%  VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
%  DRV000  FROM-DISK       ALL       AT-ALLOC  AT-ERROR(   10S)
%  VSN    COPY-SPEED
%  DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC      TIMESTAMP
%  DRV000 B0    DUAL-CRASHED       ONLINE      yyyy-mm-dd 13:36:02
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

Initiate allocation:

```
%  NKVD013 MOUNT DISK 'DRV000' ON DEVICE 'B1'; (USE='DMS',SYS-ALLOC='EXCL',).
           '(ETX = YES; MN; N = NO )'
```

```
<tsn>.N
```

```
%  DRV0013 DISK 'DRV000' ON 'B0' IS NOT COMPLETE DRV DISK
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
           'DRV000'. REASON: DRV0013: INCOMPLETE PV PAIR. REPLY (R = RETRY;
           D = DUAL; M = MONO; T = TERMINATE, S = SRV)
```

Since FROM-DISK is set, you first have to change to mono mode:

```
<tsn>.M
```

```
%  DRV0010 LAST USE OF DISK 'DRV000' ON DEVICE 'B0' CRASHED. CONFIRMATION
           FOR USE OF DISK IN RECORDING-MODE DRV-MONO REQUIRED
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
           'DRV000'. REASON: DRV0010: CRASH ACKNOWLEDGMNT. REPLY (R = RETRY;
           D = DUAL; M = MONO; T = TERMINATE, S = SRV; F = FORCE)
```

You can now use the disk in mono mode:

`<tsn>.F`

```
%  DRV0019 ALLOCATION OF DISK 'DRV000' ON DEVICE ' B0' COMPLETED
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% Y   DRV000 STDDISK  EXCL(A)  OPERATOR  ALL(D)   NO(D)   WRITE
```

%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,
        MC=CMD0001)

/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

```
%  VSN    MNEM'S   ALLOC-PHASE     ALLOC-TYPE     RECOVER
% DRV000   B0       IN-USE          MONO
%  VSN   RECORDING-MODE EQUALIZE   COPY-START   DUAL-STOP
% DRV000      DRV         ALL       AT-ALLOC   AT-ERROR(   10S)
%  VSN   COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC     TIMESTAMP
% DRV000 B0        MONO         FREE-USE    yyyy-mm-dd 14:01:06
```

%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

Logical disk cannot be created

The logical disk cannot be created if only one disk marked as write disk (`EQUALIZE` or `RECONSTRUCT`) is mounted, but no corresponding read disk.
Even if all disks required for a logical disk are mounted, this does not mean that DRV can create the logical disk without operator intervention:

● If only `DRV` is set, the operator still has to choose between dual and mono.

● Additional disk copies created for instance with FDDRL can also be mounted. There are two ways of ruling out ambiguity:

    – You detach, with `/DETACH-DEVICE FORCE=YES`, the disks you do not wish to use. This method is the simpler one.
    – You answer the `DRV0001` message by entering the device name of the disk to be used. Before you can do this, dual mode has to be set. If `FROM-DISK` or `DRV` is set, you first have to answer with `D` to select dual mode. The `DRV0001` message will then be output again. You respond with the device name.

Example

More than two disks with the same VSN are mounted:

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
% VSN     MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000  B0 ,B2      FREE        BY-OPER(DRV0008)
% VSN    RECORDING-MODE  EQUALIZE     COPY-START    DUAL-STOP
% DRV000  FROM-DISK      ALL         AT-ALLOC    AT-ERROR( 10S)
% VSN    COPY-SPEED
% DRV000  MEDIUM
% VSN     MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
% DRV000 B0         DUAL          ONLINE     yyyy-mm-dd 13:36:02
% DRV000 B2         DUAL          ONLINE     yyyy-mm-dd 13:36:02
% DRV000 B1         DUAL          ONLINE     yyyy-mm-dd 13:36:02
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

```
/SET-DISK-PARAMETER UNIT=*VOLUME(VOLUME=DRV000),ASSIGN-TIME=OPERATOR
```

```
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000          ALL     OPERATOR   ALL(D)    NO(D)    WRITE
%  DRV0008 MORE THAN TWO EQUIVALENT DISKS MOUNTED ON DEVICES '(B0 ,B2 )'
          FOR VSN 'DRV000'. LOGICAL DRV DISK NOT UNIQUE
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
          'DRV000'. REASON: DRV0008: LV NOT UNIQUE. REPLY (R = RETRY;
          D = DUAL; M = MONO; T = TERMINATE, S = SRV)
```

```
%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,
        MC=CMD0001)
```

You can find out with `/SHOW-DRV-STATUS` which mode is currently set:

`/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL`

```
%  VSN    MNEM'S    ALLOC-PHASE    ALLOC-TYPE    RECOVER
% DRV000            START      BY-OPER(DRV0008)
%  VSN   RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
% DRV000  FROM-DISK      ALL        AT-ALLOC   AT-ERROR(  10S)
%  VSN   COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
% DRV000 B0       DUAL          ONLINE    yyyy-mm-dd 13:36:02
% DRV000 B2       DUAL          ONLINE    yyyy-mm-dd 13:36:02
% DRV000 B1       DUAL          ONLINE    yyyy-mm-dd 13:36:02
```

`%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)`

Since `FROM-DISK` is set, you first have to set dual mode by answering the `DRV0001`
message:

```
%  DRV0008 MORE THAN TWO EQUIVALENT DISKS MOUNTED ON DEVICES '(B0  ,B2  )'
           FOR VSN 'DRV000'. LOGICAL DRV DISK NOT UNIQUE
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
           'DRV000'. REASON: DRV0008: LV NOT UNIQUE. REPLY (R = RETRY;
           D = DUAL;  M = MONO; T = TERMINATE, S = SRV; MN)
```

`<tsn>.B0`

```
%  DRV0013 DISK 'DRV000' ON 'B0' IS NOT COMPLETE DRV DISK
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
           'DRV000'. REASON: DRV0013: INCOMPLETE PV PAIR. REPLY (R = RETRY;
           D = DUAL; M = MONO; T = TERMINATE, S = SRV; MN)
```

`<tsn>.B2`

```
%  DRV0019 ALLOCATION OF DISK 'DRV000' ON DEVICE '(B0  ,B2  )' COMPLETED
%  NKA0007 DISK 'DRV000' WAS ALLOCATED BY MEANS OF  ASSIGN-TIME=OPERATOR
```

`/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL`

```
%  VSN    MNEM'S    ALLOC-PHASE    ALLOC-TYPE    RECOVER
% DRV000 B0  ,B2    IN-USE          DUAL
%  VSN   RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
% DRV000      DRV        ALL        AT-ALLOC   AT-ERROR(  10S)
%  VSN   COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
% DRV000 B2       DUAL          FREE-USE   yyyy-mm-dd 14:02:41
% DRV000 B0       DUAL          FREE-USE   yyyy-mm-dd 14:02:41
% DRV000 B1       DUAL          ONLINE    yyyy-mm-dd 13:36:02
```

`%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)`

Mono disk is ambiguous

If a correct disk pair is mounted and mono mode is set, the operator will be informed that dual operation is possible but that he/she must specify for mono mode which of the two disks is to be used as mono disk.

There are two ways of selecting the disk:

– Answer the message with the device name of the mono disk to be used.
– Detach the disk which you do not want to use with `/DETACH-DEVICE FORCE=YES`.

Example

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000   B1          FREE      BY-OPER(DRV0009)
%  VSN   RECORDING-MODE EQUALIZE   COPY-START   DUAL-STOP
% DRV000   DRV-MONO       ALL        AT-ALLOC   AT-ERROR(  10S)
%  VSN   COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM SVL-DRV-INFO   AVAIL/ALLOC     TIMESTAMP
% DRV000 B1        DUAL          ONLINE    yyyy-mm-dd 13:36:02
% DRV000 B2        DUAL          ONLINE    yyyy-mm-dd 13:36:02
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

```
%  DRV0009 TWO IDENTICAL DISKS MOUNTED ON DEVICES '(B1  ,B2  )' FOR VSN
            ,DRV000'. LOGICAL ,DRV-MONO' DISK NOT UNIQUE.
            'RECORDING-MODE DRV-DUAL' IS POSSIBLE
%  DRV0001 OPERATOR ACTION OR DECISION NEEDED FOR ALLOCATION OF DRV DISK
            'DRV000'. REASON: DRV0009: BUT DUAL POSSIBLE. REPLY (R = RETRY;
            D = DUAL; M = MONO; T = TERMINATE, S = SRV; MN)
```

```
/DETACH-DEVICE UNIT=M2,FORCE=YES
```

```
%  NKR0045 DEVICE  = M2  ******************************** DETACHED **********
```

```
%NBR0740 COMMAND 'DETACH-DEVICE' COMPLETED (RESULT: SC2=000/SC1=000,
        MC=CMD0001)
```

```
<tsn>.R
```

```
%  DRV0019 ALLOCATION OF DISK 'DRV000' ON DEVICE ' B1' COMPLETED
%ALLOC VSN    TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% Y   DRV000 STDDISK  EXCL(A)  OPERATOR   ALL(D)   NO(D)   WRITE
```

```
%NBR0740 COMMAND 'SET-DISK-PARAMETER' COMPLETED (RESULT: SC2=000/SC1=000,
        MC=CMD0001)
```

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
% VSN    MNEM'S   ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000   B1        IN-USE          MONO
% VSN    RECORDING-MODE  EQUALIZE   COPY-START   DUAL-STOP
% DRV000     DRV         ALL        AT-ALLOC   AT-ERROR(   10S)
% VSN    COPY-SPEED
% DRV000  MEDIUM
% VSN    MNEM  SVL-DRV-INFO   AVAIL/ALLOC    TIMESTAMP
% DRV000 B1       MONO          FREE-USE   yyyy-mm-dd 14:03:45
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

6.5 Operator actions during system initialization (DRV for the home pubset)

During system initialization, dual mode operation is not possible.
If faced with equivalent disks, startup selects one of them unless the DRV-SELECT option was specified in conjunction with a dialog startup, in which case the operator has to select a disk by making an appropriate response to message NSI2208. In the course of system initialization, DRV-MONO is then stored in the SVL of the selected disk again.

If an unrecoverable read or write error occurs during system initialization, system initialization is aborted.
For the next startup, a dialog startup and the DRV-SELECT option must be specified at the next startup in order to provide an operational pubset for each disk by means of replying to the NSI2208 message (i.e. a pubset which does not contain the disk that caused the error). In this case, the operator is responsible for ensuring that the specified disk is consistent and as up-to-date as possible. To help him do this, he is given the time stamp and the DRV flags of the disks in message NSI2205.

If there are more than two disks with the same VSN and if one disk has been replaced by another since the last system initialization, the DRV-SELECT option should be specified in the dialog startup to ensure that an up-to-date and error-free disk can be specified.
In general, it is a good idea to preclude ambiguity by using VOLIN to overwrite the VSN of the disk that is no longer being used.

6.6 Answers to frequently asked questions

Die folgenden Abschnitte geben Antworten zu den Fragen:

– How do I set DRV?

– What should I do in normal operation (operator, system administrator)?

– What is the difference between reconstruction and equalization?

– Does everything have to be reconstructed after starting up a pubset mirrored by means of DRV?

– Should equalization be delayed or postponed if it is running after a system failure and the applications can hardly process any I/O operations?

How do I set DRV?

The DRV subsystem must have been loaded. (By default DRV is loaded at "System ready"). Then the recording mode must be set appropriately for each private disk or pubset:

1. Data on pubsets or on private disk

   – Perform export for the pubset or release all allocations on private disk

   – `/SET-DRV-PARAMETER PUBSET=<catid>,RECORDING-MODE=DRV`
     `/SET-DRV-PARAMETER VOLUME=<vsn>,RECORDING-MODE=DRV-MONO`

   – `/IMPORT-PUBSET` **or** `/SET-DISK VOLUME=vsn,ASSIGN-TIME=OPERATOR`

   – With `RECORDING-MODE=DRV`: enter `M` (`MONO`) for each disk in response to message `DRV0001`.

   – Use VOLIN to format every second disk in the same format and with the same VSN (identical type, identical K/NK2/NK4, and - with private disks - identical F1 size)

   – `/START-DRV-PARAMETER VOLUME=(<list of VSNs>)`

   – `/SET-DRV-PARAMETER PUBSET=/VOLUME=,COPY-SPEED=*HIGH or *LOW`
     (`HIGH` copies more quickly at the expense of the applications, `LOW` copies more slowly but favors the applications)

2. Create new pubset

   – `/SET-DRV-PARAMETER`
     `PUBSET=<catid>/VOLUME-SET=<volsetid>,RECORDING-MODE=DRV`

   – `/START-SIR`
     `//DECLARE-PUBSET` **or** `//BEGIN-VOLUMESET-DECLARATION` with
     `ACTION=*INSTALL(..,AVAILABILITY=DRV)`
     `//CREATE-VOLUME DISK=<no>(UNIT=mn(SUBUNIT=mn2))`

    –   Response `D` (`DUAL`) to message `DRV001` for each disk

3. Home pubset

    –   Dialog startup: IPL option `CREATE-DRV`

    –   After „System ready": attach mirror disks and format them in the same way

    –   `/START-DRV-DUAL-MODE VOLUME=<list of VSNs>`

    –   `/SET-DRV-PARAMETER PUBSET=/VOLUME=,COPY-SPEED=*HIGH or *LOW`
        (`HIGH` copies more quickly at the expense of the applications, `LOW` more slowly)

What should I do in normal operation (operator, system administrator)?

1. System administrator: react to disk errors.

    If DRV detaches a disk because it is errored or not available, the following message

    `DRV0061 DUAL STOP COMPLETED. MONO DISK ON DISK <mn>`

    is displayed as an asynchronous query (operator order).

    The faulty disk is no longer in use (unless it contains an active paging file, see the `/SHOW-DRV-STATUS` command) and can be reformatted using VOLIN (either fully or on a section-specific basis). If this is not enough, it can be replaced by another disk.

    Instead of the failed disk, any other disk of the same type and with the same formatting can be used.

2. Operator: respond to messages in the event of conflicts that cannot be resolved.

    Such messages are output when DRV or BS2000/OSD is not able to continue working with the current disk configuration in the same mode as before. DRV stores the current status in the SVL (standard volume label) of the disks:

    –   `SRV`:
        no DRV operation (Single Recording by Volume, as before)

    –   `DRV-MONO`:
        dual recording possible, but only one disk currently in use

    –   `DRV-DUAL`:
        dual recording active, normal DRV status

The following conflicts may arise:

– DRV mode not compatible:
Either `/SET-DRV-PARAMETER` was used to set a mode that is not compatible with the mode stored on the disk, or the prevailing disk configuration is not compatible. In this case, message `DRV000x` is displayed, followed by a `DRV0001` message for which an answer is expected. Message `DRV0001` can be answered by `S` (`SRV`), `M` (`MONO`), `D` (`DUAL`) and, if appropriate, by `F` (`FORCE`), and specification of an MN.

Examples

– only one disk with the indicator `DUAL`:
either attach the second disk or enter `M` to switch to `MONO`

– two disks with the indicator `SRV` and the recording mode `DRV` (e.g. when setting up the pubset):
response `D`, if both disks are identical (same time stamp) or empty

– two disks with different time stamps:
this is probably an operator or system administrator error. The identity of the correct disk must be established, otherwise data may be lost.
The correct disk is selected by entering `M` and then specifying the `MN`.

– only one `DUAL-CRASHED` disk:
Either this disk has been detached because of errors or it is one of a pair whose last termination was abnormal.
If a pair is split deliberately by means of `/STOP-DRV-DUAL-MODE` so that the mirror disk can continue to be used, you should respond by entering `M` and then `F`.

– DRV not loaded:
Following `NKVD020 SRV FOR DRV ALLOCATION`, message `NKVD013` (which expects a response) is output. In this case, the allocation should be terminated by entering `N`, since what usually happens is an unintended switch to SRV. Otherwise the operator should check carefully whether the disks have different statuses. The best way to do this is to use
`/SHOW-DRV-STATUS VOLUME=<vsn>,INF=VOLUME` (load DRV).
`/SHOW-DISK-STATUS` cannot supply the information on `DUAL` or `MONO`.

Only if both disks have the same time stamps and are marked as `DUAL` is the selection arbitrary. Otherwise the `MONO` disk with the more up-to-date time stamp should be used. In the case of `/SHOW-DRV-STATUS` the preferred disk is then output in the first line.

– Startup cannot select disk:
During system initialization, only one of the disks in a disk pair is used in the home pubset. The time stamp and the DRV mode on the disk must be taken into account. If they are not unique, confirmation is requested. First of all the normal time stamp,

the DRV mode and the DRV time stamp of the disks are output.
It should be borne in mind that the load disk does not always have to be a valid disk; errors on the load disk may mean that DRV has switched to the mirror disk.

Care should be taken when selecting the disk as there is a danger that data from the last session could be lost:

– the most important criteria are the DMS and DRV time stamps. The DMS time stamp specifies when the disk was last allocated (or, in the case of pubsets, released). The DRV time stamp additionally indicates when the last switch to `MONO` or `DUAL` took place.

– If the time stamps are identical, which disk is selected is decided by the DRV recording mode of the disk:

– in the case of `DUAL` (and with identical time stamps), selection is random

– if there is a `MONO` disk, this is the correct one
(since, in the event of an error, DRV always writes `MONO` for the disk that can still be used, while `DUAL` is retained for the detached disk)

– in the case of `READ/RECON` or `READ/EQUAL` pairs, the `READ` disk should be used
(`MONO` and `READ` are virtually identical)

– in the case of two `MONO`, `READ` or `SRV` disks, the time stamp is the deciding factor. If these are identical, the origin of the disks must be checked (possibly copied by means of FDDRL, or the "wrong" disk was allocated by another system).
Similarly, in the case of a mixture of `MONO`, `DUAL`, `READ` and `SRV`, a check must be made to establish which disk is planned and how the mixture came about.

What is the difference between reconstruction and equalization?

Reconstruction takes place when a switch is made from DRV mono mode to DRV dual mode. By default all allocated blocks on the disk are copied from the mono disk to the second one.

Equalization is performed after a system crash. In such cases, it must be assumed that certain write operations were still accepted on one of the disks but not on the other. Consequently, the disk is equalized in a manner analogous to reconstruction.

A further difference is that, if equalization was started with `/IMPORT-PUBSET` or allocation before the disk was actually used, it can reverse the copy direction for a block in the event of a read error and that the scope of equalization can be restricted.

Does everything have to be reconstructed after starting up a pubset mirrored by means of DRV?

No.
If the last session was terminated normally (`DUAL` status on shutdown), only the files modified since system initialization and the open files are copied.

Should equalization be delayed or postponed if it is running after a system failure and the applications can hardly process any I/O operations?

– Equalization can be started earlier:
  `/SET-DRV-PARAMETER PUBSET=<CATID>,COPY-START=AT-MOUNTING`
  and enter `/ATTACH` for the disks well in advance of `/IMPORT-PUBSET`

– As of DRV V2.0A, it is possible to set the speed of equalization (and reconstruction) by means of `/SET-DRV-PARAMETER PUBSET=<catid>,COPY-SPEED=*LOW/*MEDIUM/*HIGH` for each pubset or private disk without interrupting operation. If `HIGH` is specified, equalization is performed at high speed and the applications cannot process I/O operations; if `LOW` is specified, equalization takes longer and the applications can handle more I/O operations.

– Equalization can be completely deactivated if

  – either only logging files of suitable databases with DRV were mirrored,
  – or all files are repaired with `VERIFY REPAIR=ABS` or `YES`.

– This means that only the relevant or unequal blocks of the logging files or all files open at the time of the crash are equalized. This is done by means of setting
  `/SET-DRV-PARAMETER PUBSET=<catid>,EQUALIZE=NO-USER-FILES`
  and carefully checking the recovery measures of the appropriate applications.

– The equalization can be restricted to the files opened in the last session by means of
  `/SET-DRV-PARAMETER PUBSET=<catid>,EQUALIZE=OPEN-FILES`.
  In this case, `OPEN VOLUME` (DPAGE for the whole disk, SIR, PVSREN) must not have been used in the last session.

7 Commands

This chapter describes the DRV commands and the DRV-specific parts of NDM commands.

The syntax used and the general command return codes are described in the "Commands" manual [1].

List of commands

DRV provides the following DRV commands for system administrators and operators:

Command	Brief description
SET-DRV-ENVIRONMENT	Sets general DRV environment
SET-DRV-PARAMETER	Sets operating mode and DRV parameters
SHOW-DRV-ENVIRONMENT	Queries DRV information
SHOW-DRV-STATUS	Shows DRV status
START-DRV-DUAL-MODE	Starts data duplication
STOP-DRV-DUAL-MODE	Stops data duplication
PREPARE-PUBSET-MIGRATION	Prepares disk migration
FINISH-PUBSET-MIGRATION	Completes disk migration
ABORT-PUBSET-MIGRATION	Aborts disk migration
SHOW-PUBSET-MIGRATION	Queries information on disk migration

The following device management commands (NDM commands) available to normal users have been extended to include DRV-specific information:

Command	Brief description
SHOW-DEVICE-STATUS	Shows device status
SHOW-DISK-STATUS	Shows disk status

The DRV commands and the DRV-specific parts of NDM commands are described below in alphabetical order.

ABORT-PUBSET-MIGRATION
Abort migration

Domain:	DEVICE
Privileges:	TSOS
Routing code:	D

Function

The `/ABORT-PUBSET-MIGRATION` command aborts disk migration for a pubset and executes a `/DETACH-DEVICE` command for the target disks.

The source pubset for migration is not modified by this operation.

The target disks for migration subsequently have an inconsistent status. They must be reinitialized with SIR, especially if they are to be used again for migration.

Notes

– Before the `/ABORT-PUBSET-MIGRATION` command is issued, DRV dual mode must be terminated using the following command:
```
/STOP-DRV-DUAL-MODE *BY-PUBSET(PUBSET=<catid>,
    NEW-NAME-OF-REMOVED=<new-catid/*SAME>,UNIT-TO-REMOVE=*MIGRATION-SOURCE)
```

– The target disks may not be allocated.

Format

ABORT-PUBSET-MIGRATION
PUBSET = list-poss(2000): <cat-id 1..4>

Operands

PUBSET = list-poss(2000): <cat-id 1..4>
Specification of the pubset or volume set for which migration is to be aborted.

Results and return codes

For commands from the console, a global completion message `NBR0740` is created, containing the return code.

The command is processed synchronously; it is considered complete when the prompt appears again.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
	3	CMD2203	Incorrect SDF version, command aborted
	32	DRV0084	Internal error, command aborted
	64	CMD2241	Command not available because DRV subsystem is not loaded
	64	CMD0216	Missing privilege
	64	DRV2100	At least one subjob was not executed
	64	DRV2104	Pubset is still in dual mode

FINISH-PUBSET-MIGRATION
Complete migration

Domain: DEVICE

Privileges: TSOS

Routing code: D

Function

The `/FINISH-PUBSET-MIGRATION` command completes migration of a pubset and executes a `/DETACH-DEVICE` command for the target disks.

The source pubset for migration is not modified by executing this command.

The target disks for migration are prepared in such a way that they can replace the source pubset.

After the `/ATTACH-DEVICE` command is issued again for the target disks, they once more appear with the correct disk type D3435.

Notes

– This command may only be entered when equalization by DRV has been completed.

– Before the `/FINISH-PUBSET-MIGRATION` command is issued, DRV dual mode must be terminated using the following command:
  `/STOP-DRV-DUAL-MODE *BY-PUBSET(PUBSET=<catid>,`
  `    NEW-NAME-OF-REMOVED=<new-catid/*SAME>,UNIT-TO-REMOVE=*MIGRATION-SOURCE)`

– The source and target disks may not be allocated.

Format

FINISH-PUBSET-MIGRATION
PUBSET = list-poss(2000): <cat-id 1..4>

Operands

PUBSET = list-poss(2000): <cat-id 1..4>
Specification of the pubset or volume set for which migration is to be aborted.

Results and return codes

For commands from the console, a global completion message `NBR0740` is created, containing the return code.

The command is processed synchronously; it is considered complete when the prompt appears again.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
	3	CMD2203	Incorrect SDF version, command aborted
	32	DRV0084	Internal error, command aborted
	64	CMD2241	Command not available because DRV subsystem is not loaded
	64	CMD0216	Missing privilege
	64	DRV2100	At least one subjob was not executed
	64	DRV2104	Pubset is still in dual mode
	64	DRV2105	Error in catalog update; `ABORT-PUBSET-MIGRATION` is initiated

PREPARE-PUBSET-MIGRATION
Prepare migration

Domain: DEVICE

Privileges: TSOS

Routing code: D

Function

The /PREPARE-PUBSET-MIGRATION command activates migration for the volume of a pubset and executes a /DETACH-DEVICE command for the target disks.

The source pubset for migration is not modified by this command.

The target disks for migration are prepared in such a way that they can replace the source pubset.

After the /ATTACH-DEVICE command has been issued again for the target disks, these once more appear with the disk type of the source pubset. This permits migration with DRV, which can then be activated using the /START-DRV-DUAL-MODE command.

Note

The target disks may not be allocated.

Format

PREPARE-PUBSET-MIGRATION
PUBSET = list-poss(2000): <cat-id 1..4>

Operands

PUBSET = list-poss(2000): <cat-id 1..4>
Specification of the pubset or volume set for which migration is to be activated.

Results and return codes

For commands from the console, a global completion message NBR0740 is created, containing the return code.

The command is processed synchronously; it is considered complete when the prompt appears again.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
	3	CMD2203	Incorrect SDF version, command aborted
	32	DRV0084	Internal error, command aborted
	64	CMD2241	Command not available because DRV subsystem is not loaded
	64	CMD0216	Missing privilege
	64	DRV2100	At least one subjob was not executed

SET-DRV-ENVIRONMENT
Define general DRV settings

Domain: DEVICE

Privileges: TSOS
                     OPERATING

Routing code: D

Function

The /SET-DRV-ENVIRONMENT command defines general settings for DRV. This command is used to define a set of devices as local devices. This makes sense when DRV is used for disaster prevention. In this way pubsets are created with the /STOP-DRV-DUAL-MODE command which consist exclusively of devices in the local data center or in remote data centers.

The COPY-SPEED-PARAMETER and SERVER-TASK-LIMIT operands are provided to control system loading when synchronizing / reconstructing disks.

Format

SET-DRV-ENVIRONMENT

 LOCAL-UNITS = <u>*UNCHA</u>NGED / ***ALL** /
                  list-poss(100): <alphanum-name 2..2> / <x-text 4..4)> / ***DEVICE-RANGE**(...)

   *DEVICE-RANGE(...)

     │ **FROM** = <alphanum-name 2..2> / <x-text 4..4)>
     │ **TO** = <alphanum-name 2..2> / <x-text 4..4)>

,**COPY-SPEED-PARAMETER = <u>*UNCHA</u>**NGED **/ *STD /** list-poss(3): ***LOW**(...) / ***MEDIUM**(...) / ***HIGH**(...)

   *LOW(...)

     │ **USER-ALLOCATION = <u>*UNCHA</u>**NGED / list-poss(2): ***YES**(...) / ***NO**(...)
     │   ***YES**(...)

     │   │ **WAIT-TIME = <u>*UNCHA</u>**NGED / ***STD** / <integer 0..999>
     │   │ ,**NUM-IOS = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..999>
     │   ***NO**(...)

     │   │ **WAIT-TIME = <u>*UNCHA</u>**NGED / ***STD** / <integer 0..999>
     │   │ ,**NUM-IOS = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..999>

   *MEDIUM(...)

     │ **USER-ALLOCATION = <u>*UNCHA</u>**NGED / list-poss(2): ***YES**(...) / ***NO**(...)
     │   ***YES**(...)

     │   │ **WAIT-TIME = <u>*UNCHA</u>**NGED / ***STD** / <integer 0..999>
     │   │ ,**NUM-IOS = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..999>
     │   ***NO**(...)

     │   │ **WAIT-TIME = <u>*UNCHA</u>**NGED / ***STD** / <integer 0..999>
     │   │ ,**NUM-IOS = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..999>

   *HIGH(...)

     │ **USER-ALLOCATION = <u>*UNCHA</u>**NGED / list-poss(2): ***YES**(...) / ***NO**(...)
     │   ***YES**(...)

     │   │ **WAIT-TIME = <u>*UNCHA</u>**NGED / ***STD** / <integer 0..999>
     │   │ ,**NUM-IOS = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..999>
     │   ***NO**(...)

     │   │ **WAIT-TIME = <u>*UNCHA</u>**NGED / ***STD** / <integer 0..999>
     │   │ ,**NUM-IOS = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..999>

,**SERVER-TASK-LIMIT = <u>*UNCHA</u>**NGED / ***STD** / <integer 1..500>

Operands

LOCAL-UNITS =
Specification of the devices in the local data center.

LOCAL-UNITS = *ALL
All devices are in the local data center (start value).

LOCAL-UNITS = list-poss(100): <alphanum-name 2..2> / <x-text 4..4)>
Mnemonic name of the device.
The list may contain a maximum of 100 entries.

LOCAL-UNITS = *DEVICE-RANGE(...)
Range of mnemonic device names.

    FROM = list-poss(100): <alphanum-name 2..2> / <x-text 4..4)>
    First mnemonic device name in the range.

    TO = list-poss(100): <alphanum-name 2..2> / <x-text 4..4)>
    Last mnemonic device name in the range.

COPY-SPEED-PARAMETER =
Defines the settings for the speed during synchronizing / reconstructing disks
(COPY-SPEED, see the /SET-DRV-PARAMETER command on).
DRV synchronizes volumes in cycles: in each cycle, a number of copy IOs are executed
initially followed by a wait period to allow the applications time to complete their disk opera-
tions. The number of executed IOs and the wait time differs for different COPY-SPEED
values and depends on the allocation state.

COPY-SPEED-PARAMETER = *STD
The default values are used.

COPY-SPEED-PARAMETER = list-poss(3): *LOW(...) / *MEDIUM(...) / *HIGH(...)
Defines the settings for the relevant COPY-SPEED.

    USER-ALLOCATION =
    Defines the settings dependent on the volume allocation.

    USER-ALLOCATION = list-poss(2): *YES(...) / *NO(...)
    *YES defines the settings for the allocated volumes (e.g. for imported pubsets).
    *NO defines the settings for non-allocated volumes.

WAITTIME =
Specifies the wait time in milliseconds in a DRV cycle.

WAITTIME = *STD
Sets the wait time to the default value for the corresponding COPY-SPEED and allocation state.

WAITTIME = <integer 0..999>
Sets the wait time for the corresponding COPY-SPEED and allocation state to the specified time in milliseconds.
By default, no wait time is set for non-allocated volumes.

NUM-IOS =
Specifies the number of I/Os in a DRV cycle.

NUM-IOS = *STD
Sets the number of I/Os to the default value for the relevant COPY-SPEED and allocation state.

NUM-IOS = <integer 1..999>
Specifies the number of I/Os in a DRV cycle for the relevant COPY-SPEED and allocation state.

SERVER-TASK-LIMIT = *STD / <integer 1..500>
Specifies the maximum number of concurrently active DRV server tasks.
The number is unlimited with the value *STD.

Results and return codes

For commands from the console, a global completion message `NBR0740` is created, containing the return code.

The command is processed synchronously; it is considered complete when the prompt appears again.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
	32	CMD0221	Interface error, command aborted
	32	DRV0084	Internal error, command aborted
	64	CMD2241	Command not available because DRV subsystem is not loaded
	64	CMD0216	Missing privilege

SET-DRV-PARAMETER
Set operating mode and DRV parameters

Domain:	DEVICE
Privileges:	TSOS
	OPERATING
Routing code:	D

Function

The `/SET-DRV-PARAMETER` command determines the operating mode for a pubset or a
private disk. You can choose between SRV and DRV mode. Additional parameters can be
set for DRV mode. The SVL (standard volume label) is not changed immediately. The
parameter settings do not take effect until the next allocation.
DRV mode is possible for private and SF pubsets and for volume sets of SM pubsets. If a
pubset or a volume set is specified, the command checks that the pubset type matches the
MRSCAT entry. The command will be accepted even if there is no MRSCAT entry (e.g.
when a pubset or volume set is being created).

Notes

–   If the disk is allocated, only the `DUAL-STOP` and `COPY-SPEED` operands are permitted. In
    the case of all other operands, the disk must not be allocated.

–   `/SET-DRV-PARAMETER` cannot be used to configure individual disks of a pubset.

Format

SET-DRV-PARAMETER
UNIT = ***VOL**UME(...) / ***PUBSET**(...) / ***VOL**UME-**SET**(...)
*VOLUME(...)
│   **VOLUME** = list-poss(10): <vsn 1..6>
*PUBSET(...)
│   **PUBSET** = list-poss(10): <catid-id 1..4>
*VOLUME-**SET**(...)
│   ***VOL**UME-**SET** = list-poss(10): <catid-id 1..4>
,**REC**ORDING-**MODE** = <u>***UNCHA**</u>NGED / ***FROM-DISK** / ***SRV** / ***DRV** / ***DRV-MONO** / ***DRV-DUAL**
,**DUAL-STOP** = <u>***UNCHA**</u>NGED / ***BY-OPER**ATOR / ***AT-ERROR**(...)
*AT-ERROR(...)
│   **WAIT** = <u>**10**</u> / <integer 1..999>(...)
│   <integer 1..999>(...)
│   │   **DIM**ENSION = <u>***SECOND**</u> / ***MINUTE**
,**COPY-START** = <u>***UNCHA**</u>NGED / ***AT-ALLOC**ATION / ***AT-MOUNT**ING
,**EQUAL**IZE-**DATA** = <u>***UNCHA**</u>NGED / ***ALL** / ***NO-USER-FILES** / ***OPEN-FILES**
,**COPY-SPEED** = <u>***UNCHA**</u>NGED / ***LOW** / ***MEDIUM** / ***HIGH**
,**DUAL-READ** = <u>***UNCHA**</u>NGED / ***STD** / ***FROM-LOCAL-DEVICE**

Operands

UNIT =
Specification of the disk, pubset or volume set for which the operating mode is to be set.

UNIT = *VOLUME(...)
Sets the operating mode of a private disk or a pair of private disks.
The following disks must not be specified:
– disks used as PPD (protected private disk)
– disks used as SPD (shared private disk)
– individual disks of a pubset or volume set

The /SET-DRV-PARAMETER command will be rejected in such cases.

   VOLUME = list-poss(10): <vsn 1..6>
   VSN of the private disk.
   Up to 10 VSNs may be specified in an input list.

UNIT = *PUBSET(...)
Sets the operating mode of an SF pubset.
No shared pubsets may be specified.

PUBSET = list-poss(10): <cat-id 1..4>
Pubset identifier.
Up to 10 pubsets may be specified in an input list.

UNIT = *VOLUME-SET(...)
Sets the operating mode of a volume set in an SM pubset.

VOLUME-SET = list-poss(10): <cat-id 1..4>
Volume set identifier.
Up to 10 volume sets may be specified in an input list.

RECORDING-MODE =
Specification of the operating mode.

RECORDING-MODE = *UNCHANGED
The mode previously set is left unchanged. If no mode has been set, the following default applies:
```
RECORDING-MODE = *FROM-DISK.
```

RECORDING-MODE = *FROM-DISK
The mode is set in accordance with the specifications in the SVL.

RECORDING-MODE = *SRV
SRV mode (Single Recording by Volume) is set.

RECORDING-MODE = *DRV
DRV mode (Dual Recording by Volume) is set.
The data is recorded in single or duplicate form depending on the entry in the SVL.

RECORDING-MODE = *DRV-MONO
Only for private disks.
Mono mode is set.
The data is recorded in single form. Using the `/START-DRV-DUAL-MODE` command you can switch to dual mode at any time during subsequent operation. a reconstruction will then be performed.

RECORDING-MODE = *DRV-DUAL
Only for private disks.
Dual mode is set.
The data is recorded in dual form on two disks.

DUAL-STOP =
Specifies whether the operator or the system responds to a single disk error in dual operation.
The error is displayed in the EXC0857 message and in a remount message which must be answered.

If the same data block on both disks cannot be read, two remount messages are issued, these messages have to be answered by the operator regardless of the DUAL-STOP setting. If the answer to both message is N, the allocation will be aborted as in the case of SRV.

You can find out that DRV operation has been suspended with the /SHOW-DRV-STATUS command, which displays information about the physical disks (INFORMATION=*VOLUMES). The output then includes an AVAIL/ALLOC column, which in this case contains the value SUSPENDED.

DUAL-STOP = *UNCHANGED
The existing setting is left unchanged. If no setting has been made, the following applies: DUAL-STOP=*AT-ERROR(WAIT=10).

DUAL-STOP = *BY-OPERATOR
The operator responds to a single disk error.
The program only switches to mono mode if the operator answers N to the remount message or enters the /STOP-DRV-DUAL-MODE command.

The *BY-OPERATOR setting is useful when only read access to a logical disk is required for a certain period (for example in the case of a read-only file) and the read error is on one disk only. In the case of read accesses, operation will not be suspended since read operations can still be carried out on the mirror disk. During this time the operator can thus eliminate the error, while avoiding an automatic switchover to mono mode. The operator still has the change to intervene in the case of a remount message.

If the operator does not respond to the remount message, DRV reads from the intact mirror disk in the case of a read access. In the case of a write access, operation is suspended until the error has been eliminated.

DUAL-STOP = *AT-ERROR(...)
DRV responds to a single disk error after the specified delay.
During the delay period, the operator can answer the remount message or set `DUAL-STOP=*BY-OPER` with `/SET-DRV-PARAMETER` in order to avoid the automatic switchover to mono mode.

If both disks fail simultaneously, the operator has to respond to the remount messages. The system does not automatically switch to mono mode in this case.

WAIT = 10 / <integer 1..999>(...)
Delay period within which the operator can eliminate an error.
The minimum delay is 1 second, the default is 10 seconds. Once the delay period has elapsed, the system automatically switches to mono mode.

DIMENSION = SECOND / MINUTE
Unit of measure for the delay period, either seconds or minutes.

COPY-START =
Specifies when copying of data for an equalization or reconstruction should begin.
Note that it is usually necessary to copy one of the two disks completely. This results in a considerable Input/Output overhead. For this reason, before setting the parameter you have to check when this overhead can best be supported.

COPY-START = *UNCHANGED
The existing setting is left unchanged. If no setting has been made, the following applies:
`COPY-START=*AT-ALLOCATION`.

COPY-START = *AT-ALLOCATION
Copying begins when the disk pair is first allocated.

COPY-START = *AT-MOUNTING
Copying begins as soon as the corresponding disks are mounted.
If the disks are already mounted, copying begins immediately.

EQUALIZE-DATA =
Specifies which data is to be copied during equalization guarantee that the data on a disk pair is identical after a system crash.

EQUALIZE-DATA = *UNCHANGED
The existing setting is left unchanged. If no setting has been made, the following applies:
`EQUALIZE-DATA=*ALL`.

EQUALIZE-DATA = *ALL
All data is copied and equalized.

EQUALIZE-DATA = *NO-USER-FILES
Only administration data is copied, not user data.
Equalization times can be reduced considerably if only the administration data has to be
equalized. The administration data consists of the following:

– SVL
– F1 and F5 labels
– boot record

In this case the user and/or the application are responsible for the consistency of the user
data. DRV-specific extensions are provided as support via the macro interface.

EQUALIZE-DATA = *OPEN-FILES
Only the administration and user data of open files is copied.
This setting is useful only if no work is being done on the pubset/volume set with special
programs which use OPEN VOLUME (such as DPAGE, SPCCNTRL, PVSREN or SIR). It
reduces equalization times if the *NO-USER-FILES setting is not possible or if the
pubset/volume set does not just contain a few large files.
This setting should be used together with COPY-START=*AT-MOUNTING, as this would cause
the whole pubset/volume set to be equalized regardless.

COPY-SPEED =
Specifies the speed at which reconstruction or equalization is performed. This allows
control to be exercised over the duration of the copying process and hence implicitly over
the user I/O load imposed by the copying process.

COPY-SPEED = *UNCHANGED
The existing setting is left unchanged. If no setting has been defined yet, it defaults to COPY-
SPEED=*MEDIUM.

COPY-SPEED = *LOW
Selects low copying speed, which means low user I/O delay and extended duration of the
copying process.

COPY-SPEED = *MEDIUM
Selects medium copying speed.

COPY-SPEED = *HIGH
Selects high copying speed, which means lengthy user I/O delay and reduced duration of
the copying process.

DUAL-READ =
Specifies whether reading should alternate between the two disks of a DRV disk pair (`*STD`) or whether for performance reasons only those disks are read from which are in the local data center.
Which disks are located in the local data center is defined using the `/SET-DRV-ENVIRONMENT` command.

DUAL-READ = *UNCHANGED
The setting specified earlier is retained. If no setting was specified, the default value (`*STD`) applies.

DUAL-READ = *STD
The disks of a DRV disk pair are regarded as equivalent and read operations alternate between the two devices.

DUAL-READ = *FROM-LOCAL-DEVICE
For performance reasons read operations are always to be performed on local disks, if any are available. If at the time the `/SET-DRV-PARAMETER` command is issued the disks of a logical volume are either both local disks or both remote disks, the procedure for `*STD` applies.

Results and return codes

For commands from the console, a global completion message `NBR0740` is created, containing the return code. For commands from the terminal (systems support), DRV itself creates a completion message because the return code is not automatically visible.

The command is considered processed if all subjobs have been executed and any follow-up actions (equalization) have been initiated. The result of the follow-up actions is not waited for and does not influence the command result.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
			(completion message `DRV0080` on terminal)
	1	DRV0030	Syntax error
			(e.g. WAIT-TIME not in permissible range or
			RECORDING-MODE=*DRV-MONO,DRV-DUAL for pubsets)
	32	DRV0084	Internal error, command aborted
	64	DRV0048	Command not processed for other reasons
	64	DRV0079	Wrong pubset type for specified pubset
	64	DRV0050	Public VSN specified for VSN parameter
	64	DRV0081	Command partly successful
	64	DRV0082	Command not successful
	65	CMD2241	Command not available because DRV subsystem is not loaded
	130	DRV0031	VSN/PVS already allocated, command not possible
	130	DRV0052	VSN/PVS already allocated as SRV
	130	DRV0053	VSN already assigned as PPD/SPD in NDM
	130	DRV0081	Command partly successful (delay period required)
	130	DRV0083	Command processing not possible at present.
			The delay period is unidentifiable; it may well not elapse in the current session. This applies to all return codes with subcode1=130.

SHOW-DEVICE-STATUS
Query device information

Domain:	DEVICE
Privileges:	STD-PROCESSING
	OPERATING
	HARDWARE-MAINTENANCE
	SAT-FILE-MANAGEMENT
	SAT-FILE-EVALUATION
	SW-MONITOR-ADMINISTRATION
	TAPE-ADMINISTRATION
Routing code:	E

Function

/SHOW-DEVICE-STATUS provides information about the data volumes which are physically online. If no volume is online, the output shows which volume has to be mounted on the device. The number of values in the DEV-A output column has been expanded for DRV.

The command is described in detail in the "Commands" manual [1].
Only the syntax and the DRV-specific output values are listed here.

Format

SHOW-DEVICE-STATUS

UNIT = ***STD** / ***SEL**ECT-TYPE(...) / ***SELECT-LOC**ATION(...) /
      list-poss(26): <alphanum-name 2..2 with-wild(20)> / <alphanum-name 4..4 with-wild(20)>

  *SELECT-TYPE(...)

    │ **TYPE** = ***ALL** / <composed-name 1..8> / <structured-name 1..8> / <device>
    │ ,**ATTR**IBUTE = ***ALL** / ***ATTACH**ED / ***DETACH**ED / ***DET**ACH-**PEND**ING / ***ATTACH-PENDING** /
    │   ***INVALID** / ***FREE** / ***DMS** / ***EXCL**USIVE / ***PUB**LIC / ***SWITCH** / ***SHARE**

  *SELECT-LOCATION(...)

    │ **LOCATION** = ***ALL** / list-poss(**10**): <alphanum-name 1..8 with-wild(40)>

,**INF**ORMATION = ***STD** / ***SUMM**ARY / ***TASK** / ***ALL** / ***LOCATION**

Restrictions for normal users

When normal users enter INFORMATION=*STD, the information they receive comprises only the output records for devices used by their current task. The task-specific information which can be obtained with INFORMATION=*TASK is not available to them. It is converted internally into INFORMATION=*STD.

Output columns

DEV-A
> Allocation status of the device.
>
> Command calls which create the output column:
>
> ```
> /SHOW-DEVICE-STATUS ... INFORMATION=*STD
> /SHOW-DEVICE-STATUS ... INFORMATION=*TASK
> /SHOW-DEVICE-STATUS ... INFORMATION=*ALL
> ```
>
> Possible output values are:

DMS	The device has been allocated to an application which is using the disk mounted on this device.
DMS-DRV	The device has been allocated to a DMS application which is using the disk mounted on this device in DRV mode.
DRV	DRV is currently executing an equalization or reconstruction on the disk which has been allocated to the device. There is no user allocation.
DRV-PAG	The device is being used for paging. The disk mounted on this device is used in DRV mode.
FREE	The device has not yet been allocated. It is still available.
PUBLIC	The device has been allocated because a pubset is mounted which was added to the system catalog by means of IMPORT-PUSET.
PUB-DRV	The device has been allocated because a pubset is mounted which was added to the system catalog by means of IMPORT-PUBSET and set for DRV operation.
tsn	The device is allocated exclusively to the task *tsn*. The task has requested the device in one of the two following ways: – with SECURE UNIT=... – for a USE=SPECIAL application.

SHOW-DISK-STATUS
Output information on allocation, disk parameters and monitoring of disks

Domain:	DEVICE
Privileges:	STD-PROCESSING
	HARDWARE-MAINTENANCE
	OPERATING
	SW-MONITOR-ADMINISTRATION
Routing code:	E

Function

`/SHOW-DISK-STATUS` provides information about the disk parameters, allocation and monitoring of a physical disk. The disk does not have to be online.

The number of values in the `DEV-A` output column has been extended for DRV. In addition, the system output (`INFORMATION=*SYSTEMS`) has been extended by the output column `SVL-RECORDING-MODE`.

The command is described in detail in the "Commands" manual [1].
Only the syntax and the DRV-specific output values are listed here.

Format

SHOW-DEVICE-**STA**TUS

UNIT = ***STD** / ***SEL**ECT-TYPE(...) / ***SELECT-LOC**ATION(...) / ***DEV**ICE-**RANGE**(...) /
        list-poss(26): <alphanum-name 2..2 with-wild(20)> / <alphanum-name 4..4 with-wild(20)>

  *SELECT-TYPE(...)

      TYPE = ***ALL** / <composed-name 1..8> / <structured-name 1..8> / <device>
      ,**ATTR**IBUTE = ***ALL** / ***ATTACH**ED / ***DETACH**ED / ***DET**ACH-**PEND**ING / ***ATTACH-PENDING** /
                  *INVALID / ***FREE** / ***DMS** / ***EXCL**USIVE / ***PUB**LIC / ***SWITCH** / ***SHARE**

  *DEVICE-**RANGE**(...)

      FROM = <alphanum-name 2..2> / <x-text 4..4>
      ,**TO** = <alphanum-name 2..2> / <x-text 4..4>

  *SELECT-LOCATION(...)

      LOCATION = ***ALL** / list-poss(10): <alphanum-name 1..8 with-wild(40)>

,**INF**ORMATION = ***STD** / ***SUMM**ARY / ***TASK** / ***ALL** / ***LOCATION**

Restrictions for normal users

When normal users enter `INFORMATION = *STD`, the information they receive comprises only the output records for devices used by their current task. The operands `INFOR-MATION=*SYSTEMS` and `INFORMATION=*ALL` are not available.

Output columns

`DEV-A`
    Allocation status of the device.
    Command calls which create the output column:

        /SHOW-DISK-STATUS ... INFORMATION=*STD
        /SHOW-DISK-STATUS ... INFORMATION=*ALL

    The possible output values are described in the description of `/SHOW-DEVICE-STATUS` and in chapter "Appendix" from page 165.

`SVL-RECORDING-MODE`
    Logical disk type.
    Command calls which create the output column:

        /SHOW-DISK-STATUS ... INFORMATION=*SYSTEMS
        /SHOW-DISK-STATUS ... INFORMATION=*ALL

    Possible output values are:

    `DRV`   DRV operation is set. The data is recorded in single or duplicate form, depending on the entry in the SVL.

    `DRV(INCONS)` DRV operation is set and an indicator showing that the disk is inconsistent appears in the SVL. This indicator is set when one of the disks in a DRV disk pair breaks down or is deactivated with `/STOP-DRV-DUAL-MODE`.

    `SRV(INCONS)` SRV operation is set and an indicator showing that the disk is inconsistent appears in the SVL. This indicator is set for instance during formatting or initialization.

    `SRV`   SRV operation is set. The data is recorded in single form.

Examples

1. Displaying information about a SRV disk with /SHOW-DISK-STATUS:

/SHOW-DISK-STATUS UNIT=*VOLUME(DRV000),INFORMATION=*ALL

```
%MNEM VSN     USE    DEV-A    VOL-A    PHASE    ACTION
%BO   DRV000         FREE     FREE     ONLINE  NO ACTION
%ALLOC VSN    TYPE   SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% N   DRV000         ALL      USER(D)   ALL(D)  NO(D)  WRITE
%MNEM     VSN   TSN'S
%BO       DRV000  NONE
%MNEM VSN   VTOC-SYS    TIME-STAMP SVL-RECORDING-MODE PAMKEY/FRMT
%BO   DRV000      yyyy-mm-dd 13:36:02 SRV           NO  2KB
%MNEM VSN    SVL-ALLOC  SYSTEMS
%BO   DRV0001)
```

%NBR0740 COMMAND 'SHOW-DISK-STATUS' COMPLETED(RESULT: SC2=000/SC1=000,
         MC=CMD0001)

2. Displaying information about a mono disk with /SHOW-DISK-STATUS.

   Entries specific to DRV are shaded:

/SHOW-DISK-STATUS UNIT=*VOLUME(DRV001),INFORMATION=*ALL

```
%MNEM VSN     USE    DEV-A    VOL-A    PHASE    ACTION
%BO   DRV000  DMS    DMS-DRV  FREE    IN-USE  NO ACTION
%ALLOC VSN    TYPE   SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% Y   DRV000 D3490-40 EXCL(A)  OPERATOR  ALL(D)  NO(D)  WRITE
%MNEM     VSN   TSN'S
%BO       DRV000  NONE
%MNEM VSN   VTOC-SYS    TIME-STAMP SVL-RECORDING-MODE PAMKEY/FRMT
%BO   DRV000      yyyy-mm-dd 14:04:41 DRV           NO  2KB
%MNEM VSN    SVL-ALLOC  SYSTEMS
%BO   DRV000  EXCL       A
```

%NBR0740 COMMAND 'SHOW-DISK-STATUS' COMPLETED (RESULT: SC2=000/SC1=000,
         MC=CMD0001)

3. Displaying information about a dual disk with /SHOW-DISK-STATUS.

   The line with the parameter settings and the line with the occupying tasks refer to the
   logical disk. They are output only once.

```
/SHOW-DISK-STATUS UNIT=*VOLUME(DRV002),INFORMATION=*ALL
```

```
%MNEM VSN     USE    DEV-A    VOL-A    PHASE    ACTION
%B1   DRV000  DMS    DMS-DRV  FREE     IN-USE   NO ACTION
%B2   DRV000  DMS    DMS-DRV  FREE     IN-USE   NO ACTION
%ALLOC VSN     TYPE    SYS-ALLOC ASS-TIME USER-ALLOC OP-CTL ACCESS
% Y   DRV000 D3490-40 EXCL(A)  OPERATOR  ALL(D)   NO(D)    WRITE
%MNEM       VSN    TSN'S
%B2   B1    DRV000  NONE
%MNEM VSN    VTOC-SYS      TIME-STAMP SVL-RECORDING-MODE PAMKEY/FRMT
%B1   DRV000        yyyy-mm-dd 14:05:23 DRV               NO    2KB
%B2   DRV000        yyyy-mm-dd 14:05:23 DRV               NO    2KB
%MNEM VSN    SVL-ALLOC  SYSTEMS
%B1   DRV000  EXCL       A
%B2   DRV000  EXCL       A
```

```
%NBR0740 COMMAND 'SHOW-DISK-STATUS' COMPLETED (RESULT: SC2=000/SC1=000,
         MC=CMD0001)
```

SHOW-DRV-ENVIRONMENT
Query information on general DRV settings

Domain: DEVICE

Privileges: TSOS
                       OPERATING

Routing code: D

Function

The `/SHOW-DRV-ENVIRONMENT` command is used to query information on general DRV
settings.

This command supports structured output in S-variables (for details on working with
S-variables, please refer to the "Commands" manual [1]).

Format

SHOW-DRV-ENVIRONMENT
INFORMATION = <u>***ALL**</u> / ***LOCAL-UNITS** / ***COPY-SPEED-PARAMETERS**
OUTPUT = ***SYSOUT** / ***SYSLST**(...)
*SYSLST(...)
| **SYSLST-NUM**BER = ***STD** / \<integer 1..99\>

Operands

INFORMATION =
Determines the general DRV settings that are to be output.

INFORMATION = *ALL
All global settings are output.

INFORMATION = *LOCAL-UNITS
The disks or disk ranges defined as local with the /SET-DRV-ENVIRONMENT command are
shown.

INFORMATION = *COPY-SPEED-PARAMETERS
Displays the settings of the parameters for COPY-SPEED that were specified with the /SET-DRV-ENVIRONMENT command.

OUTPUT =
Determines the output medium for the current /SHOW-DRV-ENVIRONMENT command.

OUTPUT = *SYSOUT
Default value. Output takes place via system file SYSOUT (thus in interactive mode at the
terminal).

OUTPUT = *SYSLST(...)
Output is to SYSLST, edited ready for printing.
The first byte of every output record is X'40'.

    SYSLST-NUMBER = *STD / <integer 1..99>
    Determines whether output is to take place to system file SYSLST or to a SYSLST file
    from the set SYSLST01 through SYSLST99.
    The default value is *STD, in other words output takes place to system file SYSLST.

Output columns

Local disk ranges

`/SHOW-DRV-ENVIRONMENT` outputs the information under the following header:

`LOCAL DEVICES`

If no devices were defined with `/SET-DRV-ENVIRONMENT`, this is followed by the line:

`*ALL`

Otherwise the list of ranges set is output:

`FROM   TO`

`FROM`
> Name of the first disk device in a range of local disks

`TO`
> Name of the last disk device in a range of local disks

If individual devices were entered with `/SET-DRV-ENVIRONMENT`, such devices appear in the `FROM` and `TO` columns.

COPY-SPEED settings

`/SHOW-DRV-ENVIRONMENT` outputs the information under the following heading:

`COPY PARAMETER`

The current settings for each combination of COPY-SPEED and allocation state are output in one line. Example (with default values):

```
SPEED   ALLOC   WAIT-TIME NUM-IO
LOW     FREE        0        10
LOW     IN-USE     500        1
MEDIUM  FREE         0       10
MEDIUM  IN-USE     500       10
HIGH    FREE         0       30
HIGH    IN-USE      50       30
```

Maximum number of DRV servers

`/SHOW-DRV-ENVIRONMENT` outputs the information in one line, for example:

`SERVER TASK LIMIT: *NONE      NUMBER OF SERVER: 2`

This means: the number of concurrently active DRV server tasks is unlimited (default value) and two servers are currently active.

Output in S-variables

Output information	Name of S-variable	T	Content
Number of local disk ranges. If this value is 0, all disks are local disks.	var(*LIST) .NUM-OF-DEV-RANGE	I	<integer 0..65535>
Mnemonic name of the first disk in a local disk range.	var(*LIST) .DEV-RANGE (*LIST) .FROM	S	<cstring 1..4>
Mnemonic name of the last disk in a local disk range.	var(*LIST) . DEV-RANGE (*LIST) .TO	S	<cstring 1..4>
COPY-SPEED of the parameter record	var(*LIST) .COPY-PARAM(*LIST) .SPEED	S	LOW MEDIUM HIGH
Allocation state of the parameter record	var(*LIST) .COPY-PARAM(*LIST) .ALLOC-STA	S	FREE IN-USE
Number of IOs in one cycle of the parameter record	var(*LIST) .COPY-PARAM(*LIST) .NUM-OF-IO	I	<integer 1..999>
Wait time in one cycle of the parameter record	var(*LIST) .COPY-PARAM(*LIST) .WAIT-TIME	I	<integer 0..999>
Maximum number of DRV server tasks	var(*LIST) .SERVER-LIM	I	<integer 1..500>
Current number of DRV server tasks	var(*LIST) .ACT-SERV-NUM	I	<integer 1..500>

Results and return codes

For commands from the console, a global completion message `NBR0740` is created, containing the return code.

The command is processed synchronously; it is considered complete when the prompt appears again.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
	32	CMD0221	Interface error, command aborted
	32	CMD2009	Internal error with OPS output
	32	DRV0084	Internal error, command aborted
	64	CMD2241	Command not available because DRV subsystem is not loaded
	64	CMD0216	Missing privilege

SHOW-DRV-STATUS
Query DRV information

Domain:	DEVICE
Privileges:	TSOS
	OPERATING
Routing code:	D

Function

The /SHOW-DRV-STATUS command provides information about logical disks and the corre-
sponding physical disks. The command reports on the DRV parameters which were set with
the /SET-DRV-PARAMETER command or by answering DRV message DRV0001. In addition, the
command specifies which physical disks can be used to create a DRV disk pair and how
the creation of a disk pair affects allocation.

Format

```
SHOW-DRV-STATUS

 UNIT = *ALL-DRV / *SELECT(...) / *VOLUME(...)

   *SELECT(...)

          ALLOCATION-TYPE = *ANY / *DRV-MONO / *DRV-DUAL / *MONO-POSSIBLE /
               *DUAL-POSSIBLE / *BY-OPER

          ,RECORDING-MODE = *ANY / *FROM-DISK / *SRV / *DRV / *DRV-MONO / *DRV-DUAL

          ,ALLOCATION-PHASE = *ANY / *FREE / *START / *IN-USE

          ,RECOVER-STATE = *ANY / *ANY-RECOVER / *SUSPENDED / *COPY / *COPY-NECESSARY /
                              *CANCELLED / *NONE

   *VOLUME(...)

          VOLUME = list-poss(10): <vsn 1..6> / <composed-name 1..6 with--wild(15)>

 ,INFORMATION = *SUMMARY / *PARAMETER / *VOLUMES / *ALL
```

Operands

UNIT =
Specification of the logical disks for which DRV information is to be output. The following possibilities are available:

–   all logical disks managed by DRV (`*ALL-DRV`)
–   all logical disks with specific attributes (`*SELECT`)
–   logical disks with a specified VSN (`*VOLUME`)

UNIT = <u>*ALL-DRV</u>
Output information about all logical disks managed by DRV.
`/SHOW-DRV-STATUS` reports on all disks which have been mounted as logical disks or have had their DRV mode set with `/SET-DRV-PARAMETER`.

Calling `/SHOW-DRV-STATUS` with `*ALL-DRV` is typically useful before terminating DRV, in order to find out whether any disks are still allocated.

UNIT = *SELECT(...)
Report on all disks managed by DRV which have selected attributes.
The following attributes can be specified:

–   current or possible operating mode (`ALLOCATION-TYPE`)
–   operating mode setting (`RECORDING-MODE`)
–   allocation status (`ALLOCATION-PHASE`)
–   recovery status (`RECOVER-STATE`)

The specified attributes are ANDed.

No attribute specified:
The default value `*ANY` applies to every attribute, and `/SHOW-DRV-STATUS` reports on all disks managed by DRV, as with `*ALL-DRV`.

   ALLOCATION-TYPE =
   The selection is based on the current or possible operating mode.

   ALLOCATION-TYPE = <u>*ANY</u>
   The selection is not restricted in any way with respect to the possible operating mode.

   ALLOCATION-TYPE = *DRV-MONO
   Only report on DRV disks currently being used as mono disks.

   ALLOCATION-TYPE = *DRV-DUAL
   Only report on DRV disks currently being used as dual disks.

   ALLOCATION-TYPE = *MONO-POSSIBLE
   Only report on DRV disks which will be used as mono disks when next allocated.

   ALLOCATION-TYPE = *DUAL-POSSIBLE
   Only report on DRV disks which will be used as dual disks when next allocated.

ALLOCATION-TYPE = *BY-OPER
Only report on disks for which the logical disk cannot be created without operator inter-
vention, even though the mount status and mode indicate a DRV disk.
The operator has to respond to message `DRV0001` in order to create the logical disk.

RECORDING-MODE =
The selection is based on the operating mode setting. The mode is set either with
`/SET-DRV-PARAMETER` or by responding to message `DRV0001`.

RECORDING-MODE = *ANY
The selection is not restricted in any way with respect to the operating mode setting.

RECORDING-MODE = *FROM-DISK
Only report on disks for which `RECORDING-MODE=*FROM-DISK` is set. These disks are
used in accordance with the mode setting in the SVL.

RECORDING-MODE = *SRV
Only report on disks for which `RECORDING-MODE=*SRV` is set. These disks are no longer
used as DRV disks.

RECORDING-MODE = *DRV
Only report on disks for which `RECORDING-MODE=*DRV` is set. These disks are used as
DRV disks.

RECORDING-MODE = *DRV-MONO
Only report on disks for which `RECORDING-MODE=*DRV-MONO` is set. With these disks, the
data is recorded only once on a single disk.

RECORDING-MODE = *DRV-DUAL
Only report on disks for which `RECORDING-MODE=*DRV-DUAL` is set. With these disks, the
data is recorded in duplicate on two disks.

ALLOCATION-PHASE =
The selection is based on the allocation status of the disk.

ALLOCATION-PHASE = *ANY
The selection is not restricted in any way with respect to the allocation status.

ALLOCATION-PHASE = *FREE
Only report on disks which are not allocated.

ALLOCATION-PHASE = *START
Only report on disks which are currently being allocated.

ALLOCATION-PHASE = *IN-USE
Only report on disks which are allocated.

RECOVER-STATE =
The selection is based on the recovery status.

RECOVER-STATE = <u>*ANY</u>
The selection is not restricted in any way with respect to the recovery status.

RECOVER-STATE = *ANY-RECOVER
Combination of `*COPY` and `*COPY-NECESSARY`:
Only report on disks for which equalization or reconstruction is currently in progress and for which copying is required in order to harmonize the data.

RECOVER-STATE = *SUSPENDED
Only report on disk pairs where either or both or the disks are currently not accessible.
Possible cause: no response to a remount message or message `DRV0001`.

RECOVER-STATE = *COPY
Only report on disks for which equalization or reconstruction is currently in progress.

RECOVER-STATE = *COPY-NECESSARY
Only report on disks for whose allocation a copy operation is required.

RECOVER-STATE = *CANCELLED
Only report on disks which are still allocated but can no longer be accessed.

RECOVER-STATE = *NONE
Only report on disks to which none of the other restrictions apply.
No copy operation is required, and there has been no interruption.

UNIT = *VOLUME(...)
Report on the disks with the specified VSNs.

VOLUME = listposs(10): <vsn 1..6>
VSN specification.
An input list may contain no more than 10 VSNs.
Either the full VSN of the disk for which the DRV information is to be checked, or a part of a VSN.

VOLUME = <composed-name 1..6 with-wild(15)>
Partial VSN specification.
In addition to the characters allowed for a VSN, an asterisk (*) can be specified for missing parts of the VSN. An asterisk can come at the beginning of and at the end of a VSN, but two asterisks must be separated by at least one other character. An asterisk on its own is also permitted. `/SHOW-DRV-STATUS` reports on all disks with a VSN containing the specified substring. If only an asterisk is specified, `/SHOW-DRV-STATUS` reports on all disks managed by DRV.

INFORMATION =
Defines how much information is to be reported:
The following options are available:

– a general overview (`*SUMMARY`)
– DRV parameter settings (`*PARAMETER`)
– overview and physical disks (`*VOLUMES`)
– combination of all options (`*ALL`)

`/SHOW-DRV-STATUS` supplies the selected information for the each of the disks specified with
the `UNIT`.

INFORMATION = *<u>SUMMARY</u>
`/SHOW-DRV-STATUS` outputs an overview of logical disks and the following header:

```
VSN       MNEM'S      ALLOC-PHASE      ALLOC-TYPE      RECOVER
```

`VSN`
Volume serial number

`MNEM'S`
Name of the disk devices.
The allocation status displayed in the `ALLOC-PHASE` column determines which disk
devices are listed:
– In the case of `ALLOC-PHASE=FREE`, the devices with disks which can be used for DRV
operation are listed.
– In the case of `ALLOC-PHASE=START` or `ALLOC-PHASE=IN-USE`, the devices that DRV
has already allocated are listed.

`ALLOC-PHASE`
Allocation status.
Possible output values are:

`FREE`	The disk is not allocated for DRV operation
`IN-USE`	The disk is allocated for DRV operation.
`START`	DRV operation is being initiated. The physical disks are being allocated and the SVLs updated.

`ALLOC-TYPE`
Possible allocation type.
Possible output values are:

`BY-OPER(`*mnr*`)`	The logical disk cannot be created without operator intervention. Message number `mnr` indicates the reason. The associated message text can be viewed with the help command.
`DRV-MONO`	The disk is currently being used as a mono disk.
`DRV-DUAL`	The disk is currently being used as a dual disk.

DUAL—POSSIBLE

> The disk can be used in dual mode without operator intervention.

MONO—POSSIBLE

> The disk can be used in mono mode without operator intervention.

RECOVER

Recovery status.
Possible output values are:

CANCELLED   Operation of the logical disk permanently disabled. No more read and
             write jobs can be accepted.

DUAL—STOP   Change from dual to mono mode.

EQUALIZE(xxx%)

> Equalization is in progress. The two disks are being given the same
> status. The number xxx indicates the percentage of the process that
> has been completed. If equalization is restricted to the blocks of open
> files, the value shown is always 0%.

EQUAL—NECESS

> Equalization is required in the event of a switch to dual mode to ensure
> that the disks have the same status.

RECONST(xxx%)

> Reconstruction is in progress. One of the two disks is being regen-
> erated. The number xxx indicates the percentage of the process that
> has been completed. The value shown for a delta reconstruction (in the
> home pubset after system startup) is always 0%.

RECON—NECESS

> Reconstruction of one of the disks is required in the event of a switch to
> dual mode.

SUSPENDED   Operation of both disks has been suspended. There has been no
             response to a REMOUNT message. You cannot switch to mono mode.
             No read and write jobs are being performed. The associated tasks are
             usually on hold.

WRITE—SUSPENDED

> Operation of one of the two disks has been suspended. There has been
> no response to a REMOUNT message. If DUAL-STOP= AT-ERROR
> has been set, DRV will switch to mono mode. Read jobs are still being
> performed. Tasks featuring write jobs will generally be put on hold.

INFORMATION = *PARAMETER

`/SHOW-DRV-STATUS` lists the current parameter settings of a logical disk under the following two headers:

```
VSN       RECORDING-MODE      EQUALIZE      COPY-START      DUAL-STOP

VSN      COPY-SPEED
```

VSN
>   Volume serial number.

RECORDING-MODE
>   Operating mode.
>   Possible output values are:

>   DRV   DRV operation is enabled. The entry in the SVL determines whether recording is in mono or dual mode.

>   DRV-DUAL   Dual mode recording is enabled.

>   DRV-MONO   Mono mode recording is enabled. You can switch to dual mode at any time. The associated disk will then be allocated for reconstruction.

>   FROM-DISK   The mode is governed by the entry in the SVL.

>   SRV   SRV operation is enabled. Recording is in mono mode.

EQUALIZE
>   Data which is harmonized during equalization.
>   Possible output values are:

>   ALL   All data is equalized.

>   NO-USER-FILES

>   Only the administration data is equalized, not the user data.

>   OPEN-FILES   Only the blocks of open files are equalized.

COPY-START
>   Starting time for copying in the event of reconstruction or equalization.
>   Possible output values are:

>   AT-ALLOCATION

>   Copying starts when the disk is first allocated.

>   AT-MOUNTING Copying starts when the disk is mounted.

DUAL-STOP
>   Switch from dual to mono mode in the event of disk errors.
>   Possible output values are:

>   AT-ERROR(*sek*)
>
>>   The system switches to mono mode after the delay period *sek* specified
>>   in parentheses. There is no need for operator intervention.

>   BY-OPER   The operator has to switch to mono mode.

COPY-SPEED
>   Speed at which reconstruction or equalization is performed (see also the
>   SET-DRV-PARAMETER **command**).
>   Possible output values are:

>   LOW   Low copying speed

>   MEDIUM   Medium copying speed

>   HIGH   High copying speed

INFORMATION = *VOLUMES

/SHOW-DRV-STATUS starts by reporting the same information as for SUMMARY. It then supplies
information about the associated physical disks.

– If the disk is an SRV disk selected by VSN with the VOLUME=operand, information about
  any DMS or SPECIAL allocation is output.
– If the disk is a DRV disk which has not yet been allocated, /SHOW-DRV-STATUS produces
  an output record for each physical disk which has the same VSN.
– If the disk is a DRV disk which is already allocated or is in the process of being allocated,
  /SHOW-DRV-STATUS produces an output record for each of the allocated physical disks.

The information about the physical disks appears under the following header:

VSN   MNEM   SVL-DRV-INFO   AVAIL/ALLOC   TIMESTAMP

VSN
>   Volume serial number of the physical disk.
>   Same as the VSN of the logical disk.

MNEM
>   Mnemonic name of the disk device on which the physical disk is mounted. In addition,
>   the character "P" is displayed if the device is used for paging.

SVL—DRV—INFO
DRV information entered in the SVL.
Possible output values are:

DUAL The disk was last allocated in dual mode.

DUAL—CRASHED

The system was not shut down correctly and the disk was allocated in dual mode, or one of the disks failed due to an error. In the first case equalization is required. In the second case the only possibility is to operate the other disk in mono mode.

EQUALIZE Equalization was aborted and the disk was used as a write disk. The disk therefore can no longer be operated in mono or SRV mode.

INCONSISTEN The disk is in the process of being allocated with USE=SPECIAL, or an allocation of this type has not been terminated properly. The disk can no longer be operated in SRV mode.

MONO The disk was last allocated in mono mode.

READ The disk was last used as a read disk during equalization or reconstruction. The disk can also be operated as a mono disk.

RECONSTRUCT Reconstruction was aborted and the disk was used as a write disk. The disk therefore can no longer be operated in mono or SRV mode.

SRV The disk was last allocated in SRV mode.

AVAIL/ALLOC
Availability of the physical disk.
Possible output values are:

ALLOCATED The disk is ready. For DRV operation, it only remains to update the SVLs.

CANCELLED DRV operation has totally aborted.

FREE—USE The disks are available for DRV operation.

MOUNTING The disk is about to be allocated for a DRV application. A mount message has prompted the operator to mount the disk.

ONLINE The disk is mounted and not allocated

PAGING—ONLY The disk has been removed from service by /STOP—DRV—DUAL—MODE or due to an I/O error, but it is still being used for paging.

PV—REMOVING /STOP—DRV—DUAL—MODE is being executed. The physical disk is being removed.

SPECIAL—USE The disk is allocated to a USE=SPECIAL application.

SPECIAL-MOUNTING

The disk is in the process of being allocated to a USE=SPECIAL appli-
cation.

SRV-USE   The disk is allocated to an SRV application.

SRV-MOUNTING   The disk is in the process of being allocated to an SRV application.

START-FOR-DUAL

/START-DRV-DUAL-MODE is being executed.

SUSPENDED   The disk is not accessible.

UPDATE   The disk's SVLs are being updated.

TIMESTAMP

Time stamp in the form *yyyy-mm-dd hh:mm:ss*, indicating the time when the disk was last
allocated.

yyyy-mm-dd   Year, month and day

hh:mm:ss   Hour, minute and second.

INFORMATION = *ALL

/SHOW-DRV-STATUS outputs a combination of the information produced by *SUMMARY,
*PARAMETER and *VOLUMES.

Results and return codes

With commands issued from the console, a global completion message NBR0740 containing
the return code is generated. With commands issued from an interactive task (systems
support), DRV itself generates a completion message, as the return code is not automati-
cally visible.

The command is processed synchronously; it is considered complete when the last output
line has been output.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command successfully processed
	1	DRV0030	Syntax error: specified VSN wildcard syntax not supported (no spin-off)
	32	DRV0084	Internal error, command aborted
	64	DRV0032	No information available, message depends on call parameters
	64	DRV0033	No information available, message depends on call parameters
	64	DRV0034	No information available, message depends on call parameters
	65	CMD2241	Command not available because the DRV subsystem is not loaded

Examples

1. Requesting overview information for logical disks WORK01 and WORK02:

    /SHOW–DRV–STATUS UNIT=*VOLUME(VOLUME=WORK01,WORK02)

2. Requesting overview information and physical disk information for all logical disks
   operated in DRV mode:

    /SHOW–DRV–STATUS UNIT=*SELECT(ALLOCATION–PHASE=*IN–USE),
                     INFORMATION=*VOLUMES

3. Displaying information about a free SRV disk.

    The AVAIL/ALLOC column contains the value ONLINE:

    /SHOW–DRV–STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

    ```
    %  VSN    MNEM'S   ALLOC–PHASE    ALLOC–TYPE    RECOVER
    % DRV000            FREE
    %  VSN   RECORDING–MODE  EQUALIZE    COPY–START   DUAL–STOP
    % DRV000  FROM–DISK      ALL         AT–ALLOC   AT–ERROR(   10S)
    %  VSN   COPY–SPEED
    % DRV000  MEDIUM
    %  VSN    MNEM SVL–DRV–INFO    AVAIL/ALLOC    TIMESTAMP
    % DRV000 B0      SRV            ONLINE    yyyy–mm–dd 13:36:02
    ```

    %NBR0740 COMMAND 'SH–DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

4. Displaying information about an allocated SRV disk.

    The AVAIL/ALLOC column contains the value SRV–USE:

    /SHOW–DRV–STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL

    ```
    %  VSN    MNEM'S   ALLOC–PHASE    ALLOC–TYPE    RECOVER
    % DRV000            FREE
    %  VSN   RECORDING–MODE  EQUALIZE    COPY–START   DUAL–STOP
    % DRV000  FROM–DISK      ALL         AT–ALLOC   AT–ERROR(   10S)
    %  VSN   COPY–SPEED
    % DRV000  MEDIUM
    %  VSN    MNEM SVL–DRV–INFO    AVAIL/ALLOC    TIMESTAMP
    % DRV000 B0      SRV            SRV–USE    yyyy–mm–dd 14:05:55
    ```

    %NBR0740 COMMAND 'SH–DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)

5. Displaying information about a free mono disk.

The `ALLOC-TYPE` column contains the value `MONO`; the `AVAIL/ALLOC` column contains the value `ONLINE`:

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000    BO         FREE            MONO
%  VSN   RECORDING-MODE  EQUALIZE    COPY-START   DUAL-STOP
% DRV000   DRV-MONO       ALL        AT-ALLOC   AT-ERROR(  10S)
%  VSN    COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
% DRV000 BO       MONO            ONLINE     yyyy-mm-dd 13:36:02
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

6. Displaying information about an allocated mono disk.

The `ALLOC-PHASE` column contains the value `IN-USE`; the `AVAIL/ALLOC` column contains the value `FREE-USE`:

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000    BO       IN-USE           MONO
%  VSN   RECORDING-MODE  EQUALIZE    COPY-START   DUAL-STOP
% DRV000     DRV         ALL         AT-ALLOC   AT-ERROR(  10S)
%  VSN    COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC     TIMESTAMP
% DRV000 BO       MONO           FREE-USE     yyyy-mm-dd 14:06:17
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

7. Displaying information about an allocated dual disk.

The `ALLOC-PHASE` column contains the value `IN-USE`, and there are two lines for the associated physical disks. In each case the `AVAIL/ALLOC` column contains the value `FREE-USE`:

```
/SHOW-DRV-STATUS UNIT=*VOLUME(VOLUME=DRV000), INFORMATION=*ALL
```

```
%  VSN    MNEM'S    ALLOC-PHASE     ALLOC-TYPE    RECOVER
% DRV000  B2  .B1    IN-USE          DUAL
%  VSN   RECORDING-MODE  EQUALIZE    COPY-START   DUAL-STOP
% DRV000     DRV         ALL         AT-ALLOC   AT-ERROR(  10S)
%  VSN    COPY-SPEED
% DRV000  MEDIUM
%  VSN    MNEM  SVL-DRV-INFO    AVAIL/ALLOC      TIMESTAMP
% DRV000 B2       DUAL           FREE-USE    yyyy-mm-dd 14:06:50
% DRV000 B1       DUAL           FREE-USE    yyyy-mm-dd 14:06:50
```

```
%NBR0740 COMMAND 'SH-DRV' COMPLETED (RESULT: SC2=000/SC1=000, MC=CMD0001)
```

SHOW-PUBSET-MIGRATION
Query information on disk migration

Domain:	DEVICE
Privileges:	TSOS
	OPERATING
Routing code:	D

Function

The /SHOW-PUBSET-MIGRATION command is used to query information on the status of disk migration for all volumes in a pubset.

This command supports structured output in S-variables (for details on working with S-variables, please refer to the "Commands" manual [1]).

Format

SHOW-PUBSET-MIGRATION

PUBSET = list-poss(2000): <cat-id 1..4>

OUTPUT = *SYSOUT / *SYSLST(...)

  *SYSLST(...)

    │   **SYSLST-NUM**BER = ***STD** / <integer 1..99>

Operands

PUBSET =
Specification of the pubset for which information on disk migration is to be shown.
A list may specify a maximum of 2000 pubsets by their catalog IDs.

OUTPUT =
Determines the output medium for the current /SHOW-PUBSET-MIGRATION command.

OUTPUT = *SYSOUT
Default value. Output takes place via system file SYSOUT (thus in interactive mode at the terminal).

OUTPUT = *SYSLST(...)
Output is to SYSLST, edited ready for printing.
The first byte of every output record is X'40'.

SYSLST-NUMBER = *STD/<integer 1..99>
Determines whether output is to take place to system file SYSLST or to a SYSLST file
from the set SYSLST01 through SYSLST99.
The default value is *STD, in other words output takes place to system file SYSLST.

Output columns

`/SHOW-PUBSET-MIGRATION` outputs the information under the following header:

```
CATID     VSN        SOURCE                  TARGET              MIGR-
                     MN       ALLOC          MN       ALLOC      STATE
```

`CATID`
Catalog ID of the pubset

`VSN`
Volume Serial Number

`SOURCE MN`
`TARGET MN`
Mnemonic names of the source disk and target disk if these exist in the volume.

`ALLOC`
Allocation status of the source/target disk.
Possible output values:

`FREE`   The disk is not allocated for DRV operation.

`IN-USE`   The disk is allocated for DRV operation.

`MIGR-STATE`
Migration status for a volume.
Possible output values:

`ACTIVE`   Migration has been activated for this volume.

`NOT ACTIVE`   Migration is possible for this volume but has not been activated.

`NOT UNIQUE`   Migration is not possible for this volume because the source/target disk
                cannot be determined unambiguously. Possible causes:
                – There are several potential target disks of a type other than D3435.
                – There are only two equally sized disks of the type D3435.

`NOT POSSIBLE`
                Migration is not possible for this volume. Possible causes:
                – There are less than two disks with this VSN.
                – There are no disks of the type D3435 with this VSN.

Output in S variables

Output information	Name of S-variable	T	Content
Number of pubsets for which information is output	var(*LIST) .NUM-OF-PUBSET	I	<integer 0..65535>
Catalog ID of the pubset	var(*LIST) .PUBSET(*LIST) .PUBSET-ID	S I	<cstring 1..4>
Number of logical volumes in the pubset	vsn(*LIST) .PUBSET(*LIST) .NUM-OF-LOGIC-VOL	S	<integer 0..65535>
VSN of a logical volume	var(*LIST) .PUBSET(*LIST) .LOGIC-VOL(*LIST) .VOL	S	'' - <vsn>
Migration status of the logical volume – *ACTIVE: Migration has been activated for the volume – *NOT-ACTIVE: Migration is possible for this volume but has not been activated – *NOT-UNIQUE: Source/target disk cannot be determined unambiguously – *NOT-POSSIBLE: Migration is not possible with the available physical volumes	var(*LIST) .PUBSET(*LIST) .LOGIC-VOL(*LIST) .MIGR-STA	S	*ACTIVE *NOT-ACTIVE *NOT-UNIQUE *NOT-POSSIBLE
Number of physical volumes in the logical volume	vsn(*LIST) .PUBSET(*LIST) .LOGIC-VOL(*LIST) .NUM-OF-PHYS-VOL	I	<integer 0..65535>
Mnemonic name of the physical volume	var(*LIST) .PUBSET(*LIST) .LOGIC-VOL(*LIST) .PHYS-VOL(*LIST) .UNIT	S	'' - <mnemo-name>
Allocation status – *FREE: The volume is not allocated – *IN-USE: The volume is being used	var(*LIST) .PUBSET(*LIST) .LOGIC-VOL(*LIST) .PHYS-VOL(*LIST) .ALLOC-STA	S	*FREE *IN-USE

Output information	Name of S-variable	T	Content
Volume type for migration – *NONE: The volume is not suitable for migration – *SOURCE: The volume is suitable as a source – *TARGET: The volume is suitable as a target	var(*LIST) .PUBSET(*LIST) .LOGIC-VOL(*LIST) .PHYS-VOL(*LIST) .TYPE	S	*NONE *SOURCE *TARGET

Results and return codes

For commands from the console, a global completion message `NBR0740` is created, containing the return code.

The command is processed synchronously; it is considered complete when the prompt appears again.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed
	3	CMD2203	SDF version not supported
	32	CMD0221	Interface error, command aborted
	32	CMD2009	Internal error with OPS output
	32	DRV0084	Internal error, command aborted
	64	CMD2241	Command not available because DRV subsystem is not loaded
	64	CMD0216	Missing privilege

START-DRV-DUAL-MODE
Start dual recording

Domain:	DEVICE
Privileges:	TSOS
	OPERATING
Routing code:	D

Function

The `/START-DRV-DUAL-MODE` command activates data duplication. The `RECORDING-MODE` parameter is implicitly set to DRV, and the two disks which make up the disk pair are harmonized.

If a disk pair is formed for the first time from two SRV disks, the disks must not have been allocated and only the SVLs are updated.
The allocation is of no relevance when changing from mono operation to dual operation.
`/START-DRV-DUAL-MODE` usually starts either a reconstruction or an equalization.

If the syntax `FROM-PUBSET=<original pubset CATID>,TO-PUBSET=<mirror pubset CATID>` is used, all disks in the mirror pubset are renamed to disks of the original pubset.
A prerequisite for this is that the mirror pubset was created with
`/STOP-DRV-DUAL-MODE ...,NEW-NAME-OF-REMOVED`.

Notes

– All specified disks must have been mounted. With the `/SHOW-DRV-STATUS` command, the operator can find out which disks are mounted and which are free (`UNIT=*SELECT(RECOVER-STATE=*NONE)`).

– SRV disks must not have been allocated.

– If the mirror pubset was only operated on the same server and in the same session as the original pubset, only the data modified on the original and mirror pubset is copied, i.e. the current state of the original pubset is copied to the mirror pubset. This nullifies all changes made to the mirror pubset since the separation.
If the mirror pubset was used in the meantime on another server, all modified data on the original pubset and all modified or deleted files on the mirror pubset are copied to the mirror pubset.

Format

START-DRV-DUAL-MODE
VOLUME = ***BY-UNIT**(...) / ***BY-PUBSET**(...) / list-poss(10): <vsn 1..6>
*BY-UNIT(...)
FROM-UNIT = ***CURR**ENT / <alphanum-name 2..2> / <x-text 4..4>
,**TO-UNIT** = <alphanum-name 2..2> / <x-text 4..4>
*BY-PUBSET(...)
FROM-PUBSET = ***CURR**ENT / <cat-id 1..4>
,**TO-PUBSET** = <cat-id 1..4>

Operands

VOLUME =
Specifies which disk or which pubset pair to switch to dual recording.
The method of specifying the disk pair depends on whether reconstruction, equalization or
SVL updating is to be performed. /SHOW-DRV-STATUS tells you which action is to be
expected (request information about the physical disk with INFORMATION=*VOLUMES).
If the disks separated with /STOP-DRV-DUAL-MODE PUBSET=<original pubset CATID>,
NEW-NAME-OF-REMOVED=<mirror pubset catid> are to be rejoined, they must be in DRV-
MONO mode and must have been imported. A check is made to determine if these are the
same disks that were separated. After command execution, the mirror pubset is exported
and its disks transferred to the original pubset, which is then in DRV-DUAL mode again. The
original pubset remains imported. The reconstruction may possibly not be completed at the
end of command execution.

VOLUME = *BY-UNIT(...)
Specifies the disk devices for the copy operation.
*BY-UNIT(...) has to be specified if the copy operation is to be set for equalization or if
DRV cannot automatically determine the disks.

   FROM-UNIT =
   Specifies the device which is to be read from when copying during reconstruction or
   equalization.

   FROM-UNIT = *CURRENT
   DRV determines the read disk automatically when there is a change from single to dual
   recording or when an interrupted reconstruction is restarted.
   The /SHOW-DRV-STATUS command informs you that this is the case. The command
   output, SVL-DRV-INFO column, contains the values READ and RECONSTRUCT for the two
   physical disks. DRV determines the VSN of the disk which is mounted on the device
   specified with TO-UNIT. The VSN allows DRV to find the read disk automatically.

FROM-UNIT = <alphanum-name 2..2> / <x-text 4..4>
Name of the device on which the read disk is mounted.

TO-UNIT = <alphanum-name 2..2> / <x-text 4..4>
Specifies the device which is to be written to when copying during reconstruction or equalization.

VOLUME = *BY-PUBSET(...)
Defines the original and mirror pubsets for the copy process.

FROM-PUBSET = *CURRENT
This does not join two pubsets, it starts a reconstruction or equalization for all disks of the pubset specified under TO-PUBSET. All blocks or all allocated blocks are copied.

FROM-PUBSET = <cat-id 1..4>
Name of the catalog ID of the pubset from which the modified blocks are to be copied to the TO-PUBSET. The pubset must be imported in DRV-MONO mode and monitored for changes by DRV. The catalog ID for FROM-PUBSET must have the same length as that for TO-PUBSET. See section "Separate processing of original and mirror disks" on page 39 for additional requirements.

TO-PUBSET = <cat-id 1..4>
Name of the catalog ID of the mirror pubset created by the separation or with FROM-PUBSET=*CURRENT of a normal pubset.
If two pubsets are to be joined, the one specified in TO-PUBSET must be imported in DRV-MONO mode. All changed data on this pubset is overwritten with the data from the pubset specified under FROM-PUBSET.

VOLUME = list-poss(10): <vsn 1..6>
VSN of the disk pair for which data duplication is activated.
In the following cases, which can be identified in the output of the /SHOW-DRV-STATUS command, the disk pair can be specified via the VSN:

– A disk pair is created for the first time from two identical SRV disks.
   If data is already available, it is copied with the FDDRL utility routine. Only the SVLs of the two disks are updated.

– Equalization is performed because the system has recently crashed and the disks were allocated at that time.
   The SVL-DRV-INFO column of the SHOW-DRV-STATUS output in this case contains the value DUAL-CRASHED.

– An interrupted equalization is restarted.
   The SVL-DRV-INFO column of the SHOW-DRV-STATUS output in this case contains the value EQUALIZE for the write disk of the disk pair and the value READ for the read disk.

– An interrupted reconstruction is restarted.
   The SVL-DRV-INFO column of the SHOW-DRV-STATUS output in this case contains the value RECONSTRUCT for the write disk of the disk pair and the value READ for the read disk.

Results and return codes

For commands from the console, a global completion message `NBR0740` containing the return code is created. For commands from the terminal (system administrators), DRV itself creates a completion message because the return code is not automatically visible.
The command is considered processed if all subjobs have been executed and any follow-up action (reconstruction, equalization) has been initiated. The result of the follow-up action is not waited for and does not influence the command result.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed (completion message DRV0080 on terminal)
1	0	DRV0043	All subjobs successfully executed Dual mode was already active, no action
	1	DRV0030	Syntax error, e.g. The catalog ID is not of the same length for `FROM-PUBSET` and `TO-PUBSET`
	32	DRV0084	Internal error, command aborted
	64	DRV0040	One or both disks not available
	64	DRV0041	VSN not identical on both MNs
	64	DRV0042	`FROM-UNIT` and `TO-UNIT` or `FROM-PUBSET` and `TO-PUBSET` are identical
	64	DRV0044	Two disks required
	64	DRV0045	VSN specification not sufficient
	64	DRV0051	Disk has recording mode SRV
	64	DRV0055	DRV disk pair cannot be set up
	64	DRV0059	Device not usable because paging is still active on another device
	64	DRV0081	Command partly successful
	64	DRV0082	Command not successful
	64	DRV0085	Prerequisites not fulfilled (enter reason as insert 2) *)
	64	DRV0086	Processing error (enter reason as insert 2)
	65	CMD2241	Command not available because DRV subsystem is not loaded
	130	DRV0031	VSN/PVS allocation canceled, no DRV action
	130	DRV0046	DRV action in progress
	130	DRV0052	VSN/PVS already allocated as SRV mode
	130	DRV0053	VSN already assigned as PPD/SPD in NDM
	130	DRV0054	DRV allocation active for disk
	130	DRV0083	Command processing not possible at present The waiting time is indefinite, it might not expire in this session. This applies to all return codes with subcode1=130

*)   Rejection grounds with `DRV0085` (Insert 2):

Insert text	Meaning
`NOT SINGLE FEATURE PUBSET`	`FROM-PUBSET` or `TO-PUBSET`: pubset type SM or volume set
`NOT ALLOCATED OR NOT MONO`	`FROM-PUBSET` or `TO-PUBSET`: not imported or incorrect DRV or allocation mode (e.g. allocated by paging)

`COPY-PUBSET DOES NOT MATCH`
 	
`VOLUMES DO NOT MATCH`
	`FROM-PUBSET` and `TO-PUBSET` do not contain the same number of disks or DRV state of at least one disk pair has been changed since switchoff

`VOLUME NOT MONITORED`	One or more of the `FROM-PUBSET` disks are not monitored
`NOT ORIGINAL PUBSET`	`FROM-PUBSET` was not the original pubset with `/STOP-DRV-DUAL-MODE`
`CANNOT OCCUPY PUBSET`	`FROM-PUBSET` or `TO-PUBSET` cannot be allocated (possibly incorrect pubset state)
`EXCAT NOT FINISHED`	The export process for `TO-PUBSET` is not completed in the specified time
`NOT SF PUBSET / VOLSET`	With syntax `FROM-PUBSET=*CURRENT`: Only SF pubsets or volume sets are possible
`NOT FOUND OR WRONG ALLOCATION`	With syntax `FROM-PUBSET=*CURRENT`: Pubset not found or incorrectly allocated

Examples

1. You activate dual recording for a disk pair. The data to be harmonized during recon-
   struction or equalization is to be copied to the disk on device H4. The corresponding disk
   is automatically determined by DRV:

   ```
   /START-DRV-DUAL-MODE VOLUME=*BY-UNIT(TO-UNIT=H4)
   ```

2. As in Example 1, you activate dual recording for a disk pair, but in this case you explicitly
   identify device H3 as the read disk:

   ```
   /START-DRV-DUAL-MODE VOLUME=*BY-UNIT(FROM-UNIT=H3,TO-UNIT=H4)
   ```

3. You create a disk pair for the first time from the two identical SRV disks with the VSN
   DISK02. In this case all you need to specify is the VSN:

   ```
   /START-DRV-DUAL-MODE VOLUME=DISK02
   ```

4. You restart an interrupted equalization on disk pair DISK01.
   As in Example 3, all you need to specify is the VSN:

   ```
   /START-DRV-DUAL-MODE VOLUME=DISK01
   ```

5. You terminate separate use of the original and mirror pubsets.
   These were created beforehand with
   ```
   /STOP-DRV-DUAL-MODE PUBSET=ORIG,NEW-NAME-OF-REMOVED=MIRR
   ```
   Both pubsets were then imported. Use of the mirror pubset has been completed, but it
   is still imported.
   You can rejoin and harmonize the data as follows:

   ```
   /START-DRV-DUAL-MODE FROM-PUBSET=ORIG, TO-PUBSET=MIRR
   ```

6. You want to start reconstruction for all disks in a pubset which are in DRV mono mode:

   ```
   /START-DRV-DUAL-MODE FROM-PUBSET=*CURRENT, TO-PUBSET=ORIG
   ```

STOP-DRV-DUAL-MODE
Switch off dual recording

Domain: DEVICE

Privileges: TSOS
                     OPERATING

Routing code: D

Function

The `/STOP-DRV-DUAL-MODE` command switches from dual recording to single recording.
`/STOP-DRV-DUAL-MODE` terminates use of the specified disk, marks it as inconsistent and
sets mono mode. It immediately aborts any reconstruction or equalization which is in
progress.

`/STOP-DRV-DUAL-MODE` can be called regardless of whether or not the disk pair is in use.

In order to change back to dual mode, a reconstruction involving copying of the entire disk
is necessary.

| i | Only switch to mono mode if absolutely necessary or if you want to use single recording permanently. |

The syntax `PUBSET=<original pubset CATID>,NEW-NAME-OF-REMOVED=<mirror pubset catid>` is used to generate a second (mirror) pubset from the original pubset, with the
catalog ID specified with `NEW-NAME-OF-REMOVED`.
Both pubsets are in `DRV-MONO` mode after the command is executed. DRV takes over the
functions of the utility PVSREN for renaming the disks and file names in the catalog. The
requirements described in section "Separate processing of original and mirror disks" on
page 39.

Notes

– All specified disks must have been mounted.
  With `/SHOW-DRV-STATUS`, you can find out which disks are mounted and which are free
  (`UNIT=*SELECT(RECOVER-STATE=*NONE)`).

– At least one disk of the pair must be available.
  With the `/SHOW-DRV-STATUS` command, you can check which disks are not available
  (`UNIT=*SELECT(RECOVER-STATE=*SUSPENDED)`).

– A disk used for paging which is removed with a `/STOP-DRV-DUAL-MODE` command is not
  released but continues to be used for paging. All that happens is that all the user files
  and the system metadata are maintained in mono mode on the remaining disk. The only
  way to release the paging area on the removed disk is to use the `REDUCE-PAGING-AREA`
  command.

–   A disk removed with `/STOP-DRV-DUAL-MODE` which is to be replaced with another disk
    should be reformatted under a different VSN using the VOLIN/SIR utility. Otherwise
    ambiguities may arise, typically causing the "old" disk to be selected automatically from
    the home pubset at system startup.

Format

STOP-DRV-DUAL-MODE

VOLUME = ***BY-UNIT**(...) / ***BY-PUBSET**(...) / list-poss(10): <vsn 1..6>
 	
   *BY-UNIT(...)
 	
     │   **UNIT** = <alphanum-name 2..2> / <x-text 4..4>
 	
   *BY-PUBSET(...)
 	
     │   **PUBSET** = <cat-id 1..4>
 	
     │   ,**NEW-NAME-OF-REMOVED** = <cat-id 1..4> / *SAME
 	
     │   ,**UNIT-TO-REMOVE** = *STD / *MIGRATION-SOURCE / *MIGRATION-TARGET /
     │   *LOCAL-UNIT / *REMOTE-UNIT

Operands

VOLUME =
Specifies the disk pair which is to be switched to single recording.

VOLUME = *BY-UNIT(...)
The disk on the specified disk device is to be removed from service.

    UNIT = <alphanum-name 2..2> / <x-text 4..4>
    Name of the device on which the disk is mounted. The disk device must be specified if
    DRV cannot determine the disk automatically.
    However, if you specify the disk device and DRV is actually able to determine the disk
    itself, the command is rejected

VOLUME = *BY-PUBSET(...)
All disks of the specified pubset are to be set to the DRV-MONO state. The removed disks
are either converted into a new pubset or not, depending on the value specified with `NEW-
NAME-OF-REMOVED`.

    PUBSET = <cat-id 1..4>
    Name of the pubset whose disks are to be set to DRV-MONO.
    If the mirror disks are to be renamed, all disks must be in DRV-DUAL mode and the
    pubset exported. Only SF pubsets can be renamed..

NEW-NAME-OF-REMOVED = <cat-id 1..4>
Name of the pubset that is to be created from the disks removed from the pubset
specified in PUBSET. No disks may exist for this pubset before the command is called.
If the catalog ID is entered in the MRSCAT, it is taken over as long as the pubset type
matches (SF). The catalog ID must have the same length as that specified in PUBSET.

NEW-NAME-OF-REMOVED = *SAME
The removed mirror disks are not renamed and remain in the DUAL-CRASHED state. This
form can be used to specify all volumes in a pubset instead of a list of VSNs.

UNIT-TO-REMOVE =
Permits the units to be grouped to the pubsets according to specified criteria.

UNIT-TO-REMOVE = *STD
The physical volumes of a logical volume are regarded as equivalent; there are no
special requirements.

UNIT-TO-REMOVE = *MIGRATION-SOURCE
If disk migration is active for a volume, the source disks are removed. If no migration is
active, *MIGRATION-SOURCE means the same as *REMOTE-UNIT.

UNIT-TO-REMOVE = *MIGRATION-TARGET
If disk migration is active for a volume, the target disks are removed. If no migration is
active, *MIGRATION-TARGET means the same as *REMOTE-UNIT.

UNIT-TO-REMOVE = *LOCAL-UNIT
If a physical volume is a local device at the time /STOP-DRV-DUAL-MODE is entered (see
the /SET-DRV-ENVIRONMENT command), this disk is removed. If no physical volume is a
local device, *LOCAL-UNIT means the same as *STD.

UNIT-TO-REMOVE = *REMOTE-UNIT
If a physical volume is not a local device at the time /STOP-DRV-DUAL-MODE is entered
(see the /SET-DRV-ENVIRONMENT command), this disk is removed. If both physical
volumes are local devices, the same procedure applies as for *STD.

VOLUME = list-poss(10): <vsn 1..6>
VSN of the disk pair to be switched to single recording.
In this case DRV must be able to determine which disk is to be removed from service.

In the following cases, the disk pair must be identified by its VSN because DRV determines
the disk automatically:

– A remount message for one of the disks has not been answered.
  DRV removes this disk from service..

– Equalization is in progress.
  DRV removes the disk being copied to from service.

– Reconstruction is in progress.
  DRV removes the disk being copied to from service.

/SHOW-DRV-STATUS shows such cases when overview information is requested
(INFORMATION=*SUMMARY).

Results and return codes

For commands from the console, a global completion message NBR0740 containing the
return code is created. For commands from the terminal (system administrators), DRV itself
creates a completion message because the return code is not automatically visible.

The command is considered processed if all subjobs have been executed and the follow-up
action (switchover to MONO) has been initiated. The result of the follow-up action is not
waited for and does not influence the command result.

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	All subjobs successfully executed (completion message DRV0080 on terminal)
1	0	DRV0047	All subjobs successfully executed. Mono mode was already active, no action
	1	DRV0024	Catalog IDs for PUBSET and NEW-NAME-OF-REMOVED are identical
	1	DRV0030	Syntax error, e.g. – Catalog IDs for NEW-NAME-OF-REMOVED and PUBSET are not of the same length – NEW-NAME-OF-REMOVED=PUB is not allowed
	32	DRV0084	Internal error, command aborted
	64	DRV0040	One or both disks not available
	64	DRV0044	Two disks required
	64	DRV0045	VSN specification not sufficient
	64	DRV0051	Disk has recording mode SRV
	64	DRV0057	Not a DRV disk
	64	DRV0058	VSN ambiguous or device cannot be removed
	64	DRV0059	Device is still used by PAGING
	64	DRV0081	Command partly successful
	64	DRV0082	Command not successful
	64	DRV0085	Prerequisites not fulfilled (enter reason as insert 2) *)
	64	DRV0086	Processing error (enter reason as insert 2)
	65	CMD2241	Command not available because DRV subsystem is not loaded
	130	DRV0031	VSN/PVS allocation canceled, no DRV action
	130	DRV0046	DRV action in progress
	130	DRV0052	VSN/PVS already allocated as SRV mode
	130	DRV0053	VSN already assigned as PPD/SPD in NDM
	130	DRV0054	DRV allocation active for disk
	130	DRV0083	Command processing not possible at present. The waiting time is indefinite, it might not expire in this session. This applies to all return codes with subcode1=130

*)   Rejection grounds with `DRV0085` (Insert 2):

Insert text	Meaning
NOT SINGLE FEATURE PUBSET	PUBSET: pubset type SM or volume set
ALLOCATED OR NOT DUAL	PUBSET: imported or incorrect DRV or allocation mode
LV NOT FREE	PUBSET: allocation exists (possibly cancelled via `/FORCE-PUBSET-EXPORT` or after `/DETACH, FORCE=YES`)
ONLINE	`NEW-NAME-OF-REMOVED`: some disks are online
CATALOG INCONSISTENT	PUBSET: file catalog $TSOS.TSOSCAT is inconsistent
STOP-DRV NOT FINISHED	PUBSET: DRV-MONO has not been achieved in the necessary time for a volume
NOT SF PUBSET / VOLSET	With syntax `FROM-PUBSET=*CURRENT`: Only SF pubsets or volume sets are possible
NOT FOUND OR WRONG ALLOCATION	With syntax `NEW-NAME-OF-REMOVED=*SAME`: pubset not found or is incorrectly allocated

8 Procedure for disk migration with DRV

The commands which permit and terminate disk migration with DRV are combined in the EXECUTE-PUBSET-MIGRATION procedure.

The behavior of the procedure is defined with the FUNCTION operand.

The following commands are issued at the console using PROP-XT:

– ATTACH-DEVICE and DETACH-DEVICE:
  If these commands were called in interactive mode, operator privilege would be required.

– All the DRV commands necessary to log the calls in the console log.

The function call is regarded as successfully executed if all commands are executed without error (the exception is described below). Errored commands result in the function being aborted and a message being issued.

Log file: SYSTRC.DRV.<date>.<time>.<tsn>.MIGRATION

Requirements:

– The procedure must be called under TSOS.

– The subsystems DRV, SDF-P and PROP-XT are available.

Format

EXECUTE-PUBSET-MIGRATION
,**PUBSET** = list-poss(2000): <cat-id 1..4>
,**FUNCTION** = *START / *STOP / *ABORT
,**OPERATOR-ROLE** = <name 1..8>
,**CMD-WAIT-TIME** = 100 / <integer 0..2147483647 seconds>

Operands

PUBSET = list-poss(2000): <cat-id 1..4>
Catalog ID of the pubset
Requirement: The pubset may not be imported. The source and target disks of the pubset
must be initialized and in the ATTACHED status.

FUNCTION =
Specifies the function for the procedure.

FUNCTION = *START
Disk migration with DRV is started, in other words all the commands are called which are
needed to permit migration:
–   Start disk migration (/PREPARE-PUBSET-MIGRATION)
–   Detach (/DETACH-DEVICE) and reattach (/ATTACH-DEVICE) the target disks. This ensures
    that source and target disks appear to be the same for future input/output operations.
    If the disks are already detached, they are merely attached.
    If errors occur when the disks are detached or attached, disk migration is aborted
    (/ABORT-PUBSET-MIGRATION).
–   Initialize and activate data duplication (/SET-DRV-PARAMETER, /START-DRV-DUAL-MODE)

After this procedure has run successfully the following situation exists:
–   Source and target disks appear to be of the same disk type.
–   Input/output operations to the target disks cause the migration tool to be called.
This enables data to be copied.

> *Note*
>
> The function is regarded as successfully completed as soon as the /START-DRV-
> DUAL-MODE command creates the global completion message NBR0740 with a
> positive return code. The result of the follow-up activities (reconstruction, equal-
> ization) initiated by the   /START-DRV-DUAL-MODE command is not waited for as this
> can take a very long time. Users themselves must therefore ensure that the follow-
> up activities for all the disks attached to the pubset run successfully.

FUNCTION = *STOP
Disk migration with DRV is terminated, in other words all the commands are called which
are needed to terminate migration:
–   Deactivate data duplication and remove source disks
    (/STOP-DRV-DUAL-MODE with UNIT-TO-REMOVE=*MIGRATION-SOURCE).
    If this command initiates follow-up activities, a positive result for these activities is
    waited for. If this is not achieved within the time defined by the CMD-WAIT-TIME
    parameter, the function is aborted and a message issued.
–   Detach the source disks (/DETACH-DEVICE) as disk migration can be terminated only if
    the source disks are detached.
–   Terminate disk migration (/FINISH-PUBSET-MIGRATION).

–   Detach the target disks (`/DETACH-DEVICE`) even if the `/FINISH-PUBSET-MIGRATION` command was errored and an `/ABORT-PUBSET-MIGRATION` has been initiated. This ensures that source and target disks no longer appear to be the same after disk migration has been terminated. If the disks are already detached, the procedure continues.

–   Attach the target disks (`/ATTACH-DEVICE`).

After this procedure has run successfully the following situation exists:
–   The target disks once more have their original disk type D3435.
–   All input/output operations to the target disks are once more executed normally.
–   The source disks are no longer attached.

Copying of data is thus completed.

Requirement: Migration must already have been started for the relevant pubset.

FUNCTION = *ABORT
Disk migration with DRV is aborted, in other words all the commands are called which are needed to abort migration.

–   Deactivate data duplication and remove target disks (`/STOP-DRV-DUAL-MODE` with `UNIT-TO-REMOVE=*MIGRATION-TARGET`)
    If this command initiates follow-up activities, a positive result for these activities is waited for. If this is not achieved within the time defined by the `CMD-WAIT-TIME` parameter, the function is aborted and a message issued.

–   Abort disk migration (`/ABORT-PUBSET-MIGGRATION`)

–   Detach the target disks (`/DETACH-DEVICE`) and attach the source disks (`/ATTACH-DEVICE`). This ensures that source and target disks no longer appear to be the same after disk migration has been aborted.
    If the disks are already detached, they are merely attached.

After this procedure has run successfully the following situation exists:
–   The target disks once more have their original disk type D3435.
–   All input/output operations to the source disks are once more executed normally.
–   The target disks are no longer attached.

Copying of data is then no longer possible.

Requirement: Migration must already have been started for the relevant pubset.

OPERATOR-ROLE = <name 1..8>
Operator role requested via PROP-XT.
The operator role is created with `/CREATE-OPERATOR-ROLE` and with `/MODIFY-OPERATOR-ATTRIBUTES` assigned to the execution ID under which the procedure is called (TSOS). Both commands must be entered under the administrator ID SYSPRIV. `/SHOW-OPERATOR-ROLE` provides information on whether `OPERATOR-ROLES` have already been created for the ID under which the command is called.

CMD-WAIT-TIME = 100 / <integer 0..2147483647 seconds>
Maximum time, in seconds, that termination of the commands `/DETACH-DEVICE`, `/ATTACH-DEVICE` and `/WAIT-FOR-PROP-EVENTS` is waited for.

9 Macro interface

This chapter describes the macro interface of DRV.

DRV provides the macro interface to support those users who want to guarantee the consistency of user data themselves in the case of equalization.

The user is responsible for consistency of user data if the /SET-DRV-PARAMETER command is used to specify that only administration data is to be equalized (EQUALIZE-DATA = NO-USER-FILES).

If this is done, only administration data is copied during equalization, no user data. Administration data includes:

– F1 and F5 labels
– TSOSCAT
– user catalog

The main advantage of this lies in the fact that equalization times are considerably shorter if only the administration data is copied.

DRV provides the following support for maintaining consistency:

– The VERIF macro has been expanded so that the blocks belonging to a file can be equalized.

– The UPAM interface contains an additional function for reading and equalizing.

– The FCB contains a DRV indicator.

– The NKDINF macro has been extended to include the DRV record.

9.1 VERIF macro

VERIF can be used to reconstruct files which have become inaccessible after a system crash. The VERIF macro has been extended for DRV so that dual disks are covered during reconstruction.

When opening an incorrectly closed file, you can call the VERIF macro via the EXLST exit OPENC. Depending on the access method (SAM, ISAM, PAM), the REPAIR parameter must be selected so that the file is read through completely or re-created:

–   In the case of SAM files, you set REPAIR=YES or REPAIR=ABS. The blocks belonging to the file are equalized during reconstruction.

–   In the case of ISAM files, you set REPAIR=YES or REPAIR=ABS.

–   The file is equalized by re-creation.

–   If you set REPAIR=NO or REPAIR=CHECK, the file is equalized if not marked as closed.

–   In the case of PAM files, the file is equalized in the case of an expanded reconstruction with REPAIR=ABS.

VERIF does not process the disk if it is equalized by DRV in accordance with the default value EQUALIZE-DATA=ALL.

The VERIF macro is described in detail in the manual "DMS Macros" [4].

9.2 UPAM interface with shared file update

As a DRV-specific extension, the UPAM interface contains the function with the opcode IDQRDEQU for reading with equalizing (READ AND EQUALIZE). This function permits user-controlled equalization at block level. Database systems use this function, for example, to equalize the backup files for which the file sections being processed at the time of the system crash are known.

In the case of SRV or mono operation, files are read but not equalized. The format of the IDPPL macro is described in the section "IDPPL macro" on page 178.

Shared file update (SHAREUPD=YES)

In UPAM there is no implicit locking or releasing of PAM blocks. LOCK and UNLOCK operations are provided for synchronizing accesses. The user is responsible for correct use in the case of SHAREUPD=YES. If the user permits simultaneous writing of a block, the result on the disk is ambiguous. Until the next write job is carried out, the results of any read jobs may alternate arbitrarily.

There is also ambiguity where single recording (SRV) is used. The result cannot alternate after completion of the write job, however.

9.3 Indicator in the FCB

In the case of PARMOD=31, the ID1DRVST field for the DRV indicator is added to the TU-FCB. This DRV indicator specifies the DRV status of the processed file after each input/output. It is not set when a file is opened.

The DRV indicator contains the following information about the disks of a file:

– change of DRV status since the last input/output
– specification whether all disks are operated in DRV mode
– specification whether at least one disk is operated in SRV mode
– specification whether all disks are used in dual mode

The format of the IDFCB macro is described in the section "IDFCB macro" on page 178.

9.4 NKDINF macro

The `NKDINF` macro provides the system or the user with allocation information. The macro has been extended for DRV. It now includes a DRV record with the information specific to DRV and, in the case of dual allocation, outputs the device designations of a device pair in the disk, device and task records.

The layout for the DRV record is generated by calling the `NKDINF` macro with `RECORD=DRV`.

The layout of the DRV record is described in the section "Layout of the DRV record" on page 175.

The combination `DRV-PAGING` is possible in the field `DEVA/DEVICE-ALLOCATION` of the `DISK/DEVICE` record.

10 DRV accounting record

This section describes the DRV accounting record.

All allocation times in dual mode are described by a pair of DRV events. They begin with `Dual-Allocation` or `Dual-Start` and end with `Dual-Deallocation` or `Dual-Stop`.
All four combinations are possible.

Maximum length of the DRV accounting record: 56 bytes

(A) Record description: record ID: "DRVR"

(B) ID section: DRV disk ID

Field number	Offset		Length (bytes)	Format	Meaning
	hex.	dec.			
1	00	0	6	C	VSN of the DRV disk
2	06	6	4	C	MN of the first device
3	0A	10	4	C	MN of the second device[1]
4	0E	4	8	X	- reserved-

Length of the DRV disk ID: 20 bytes

Note

[1] The MN of the second device is given a value only in the case of a switch to dual mode.

(C) Basic information

Field number	Offset		Length (bytes)	Format	Meaning
	hex.	dec.			
1	00	00	5	C	Type of event[1]
2	05	05	7	X	- reserved-

Length of the basic information: 12 bytes

Notes

[1] This field specifies the type of DRV event:

1. C'ALLOC': Dual_Allocation:
   A disk was reserved in DRV DUAL mode (disk pair).

2. C'DEALL': Dual_Deallocation:
   A disk was released in DRV DUAL mode (disk pair).

3. C'START': Dual_Start:
   While a DRV disk was in use, a change was made from mono mode to dual mode.

4. C'STOP␣': Dual_Stop:
   While a DRV disk was in use in dual mode, a disk was removed and there was a change to mono mode.

(D) Variable information

The variable information contains **no** record extensions.

11 Appendix

The appendix contains:

– a list of all DRV-specific output columns with their possible values

– a description of the layout of the DRV record

– the listings of the `IDFCB` and `IDPPL` macros.

– a short description of the compatibility of DRV with other products

11.1 Output columns

In this section, all the DRV-specific output columns of `SHOW` commands are listed alphabetically.

The command calls which create an output containing the respective columns are specified. In addition, all possible output values for the columns are listed and explained in alphabetical order.

ALLOC - Allocation status of the source or target device

Command calls which create the output column:

```
/SHOW-PUBSET-MIGRATION
```

Output values in alphabetical order:

Output value	Meaning
FREE	The disk is not allocated for DRV mode
IN-USE	The disk is allocated for DRV mode

ALLOC-PHASE - Allocation status

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*SUMMARY/*ALL
```

Output values in alphabetical order:

Output value	Meaning
FREE	The disk is not allocated for DRV mode.
IN-USE	The disk is allocated for DRV mode.
START	DRV mode is being started. The physical disk are being allocated and their SVLs updated.

ALLOC-TYPE - Logical disk type

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*SUMMARY/*ALL
```

Output values in alphabetical order:

Output value	Meaning
BY-OPER(mno)	The logical disk cannot be created without operator intervention. The message number mno specifies the reason. The associated message text can be read by using the help command.
DRV-MONO	The disk is currently being used as a mono disk.
DRV-DUAL	The disk is currently being used as a dual disk.
DUAL-POSSIBLE	The disk can be used in dual mode without operator intervention.
MONO-POSSIBLE	The disk can be used as a mono disk without operator intervention.

AVAIL/ALLOC - Availability of the physical disk

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*VOLUMES/*ALL
```

Output values in alphabetical order:

Output value	Meaning
ALLOCATED	The disk is allocated. The SVLs must still be updated for DRV mode.
CANCELLED	DRV mode is canceled.
FREE-USE	The disks are free for use in DRV mode.
MOUNTING	The disk is about to be allocated for DRV use. The operator has been requested by means of a MOUNT message to ready the disk.
ONLINE	The disk is mounted but not allocated.
PAGING-ONLY	The disk was detached with /STOP-DRV-DUAL-MODE or because of an I/O error. However, it is still being used for paging.
PV-REMOVING	/STOP-DRV-DUAL-MODE is being executed. The physical disk is being removed.
SPECIAL-USE	The disk is busy with a USE=SPECIAL application.
SPECIAL-MOUNTING	The disk is being allocated to a USE=SPECIAL process.
SRV-USE	The disk is busy with a SRV process.
SRV-MOUNTING	The disk is being allocated to a SRV process.
START-FOR-DUAL	/START-DRV-DUAL-MODE is being executed.
SUSPENDED	A disk is not accessible.
UPDATE	The SVLs on the disk are being updated.

CATID - Catalog ID of a pubset which is migrated

Command calls which create the output column:

```
/SHOW-PUBSET-MIGRATION
```

Output values in alphabetical order:

Output value	Meaning
catid	catalog ID

COPY-SPEED - Copy speed for data harmonization

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*PARAMETER/*ALL
```

Output values in alphabetical order:

Output value	Meaning
LOW	Low copy speed
MEDIUM	Medium copy speed
HIGH	High copy speed

COPY-START - Start of the copy operation for data harmonization

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*PARAMETER/*ALL
```

Output values in alphabetical order:

Output value	Meaning
AT-ALLOCATION	Copy operation begins with first allocation.
AT-MOUNTING	Copy operation begins with mounting.

DEV-A - Allocation status of the device

Command calls which create the output column:

```
/SHOW-DEVICE-STATUS ... INFORMATION=*STD/*TASK/*ALL
```

```
/SHOW-DISK-STATUS ... INFORMATION=*STD/*ALL
```

Output values in alphabetical order:

Output value	Meaning
DMS	The device is allocated to an application using the disk mounted on this device.
DMS-DRV	The device is allocated to a DMS application using the disk mounted on this device in DRV mode.
DMS-PAG	The device is allocated to a DMS application using the disk mounted on this device for paging and which is also allocated as shareable by tasks.
DRV	DRV is executing an equalization or reconstruction on the disk allocated to the device. There is no user assignment.
DRV-PAG	The device is allocated for paging; the disk mounted on this device is used in DRV mode.
FREE	The device is not yet allocated. It is still free.
PUBLIC	The device is busy because a public volume set which was taken over into the system catalog with IMPORT-PUBSET is mounted.
PUB-DRV	The device is busy because a public volume set which was added to the system catalog with IMPORT-PUBSET, set for DRV mode and used for paging is mounted.
tsn	The device is allocated exclusively to the *tsn* task. The task has requested the device in one of the following two ways: – with SECURE UNIT=,... – for a USE=SPECIAL application.

DUAL-STOP - Changeover from dual to mono mode

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*PARAMETER/*ALL
```

Output values in alphabetical order:

Output value	Meaning
AT-ERROR(*sec*)	The system sets mono mode after expiry of the waiting time *sec* given in brackets. The operator does not need to intervene.
BY-OPER	The operator must set mono mode.

FROM - Name of the first disk device in a range of local disks

Command calls which create the output column:

`/SHOW-DRV-ENVIRONMENT`

Output values in alphabetical order:

Output value	Meaning
mn	Mnemonic device name

EQUALIZE - Data to be equalized

Command calls which create the output column:

`/SHOW-DRV-STATUS ... INFORMATION=*PARAMETER/*ALL`

Output values in alphabetical order:

Output value	Meaning
ALL	All data is equalized.
NO-USER-FILES	Only the administration data, not the user data is equalized.
OPEN-FILES	Only blocks belonging to files that are still open are equalized.

MIGR STATE - Migration status

Command calls which create the output column:

`/SHOW-PUBSET-MIGRATION`

Output values in alphabetical order:

Output value	Meaning
ACTIVE	Migration has been activated for this volume.
NOT ACTIVE	Migration is possible for this volume but has not been activated.
NOT UN IQUE	Migration is not possible for this volume because the source/target disk cannot be determined unambiguously. Possible causes: – There are several potential target devices of a type other than D3435 – There are only two equally sized devices of the type D3435
NOT POSSIBLE	Migration is not possible for this volume. Possible causes: – There are less than two devices with this VSN – There is no device of the type D3435 with this VSN

RECORDING-MODE - Operating mode

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*PARAMETER/*ALL
```

Output values in alphabetical order:

Output column	Meaning
DRV	DRV mode is set. The data is recorded in single or duplicate form depending on the entry in the SVL.
DRV-DUAL	Dual mode is set. The data is recorded in duplicate form.
DRV-MONO	Mono mode is set. The data is recorded in single form. A change can be made to dual mode at any time. In this event, the added disk will be allocated by reconstruction.
FROM-DISK	The mode is set according to the entries in the SVL.
SRV	SRV mode is set. The data is recorded in single form.

RECOVER - Recovery status

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*SUMMARY/*ALL
```

Output values in alphabetical order:

Output value	Meaning
CANCELLED	Operation of the logical disk is permanently locked. No read or write jobs are possible.
DUAL-STOP	Change from dual to mono mode.
EQUALIZ(xxx%)	Equalization is currently being carried out. The two disks will soon have the same status. The number xxx shows the percentage which has already been equalized.
EQUAL-NECESS	During changeover to dual mode, an equalization is executed to give the disks the same status.
RECONST(xxx%)	Reconstruction is currently being executed. One of the two disks is being re-created. The number xxx specifies what percentage has already been reconstructed. In the case of a delta reconstruction (in the home pubset after system initialization), 0% is always displayed
RECON-NECESS	During changeover to dual mode, one of the disks is recreated by reconstruction.
SUSPENDED	Operation is suspended for both disks. There is no response to a REMOUNT message. No changeover to mono mode can be made. Read and write jobs are not executed. The associated tasks are usually in the wait state.

| WRITE-SUSPENDED | Operation has been suspended for one of the disks. A REMOUNT message has not been answered. If DUAL-STOP=AT-ERROR is set, DRV changes to mono mode. Read jobs are still executed. Tasks with write jobs are usually placed in the wait state. |

SOURCE MN - Mnemonic name of the source device

Command calls which create the output column:

```
/SHOW-PUBSET MIGRATION
```

Output values in alphabetical order:

Output value	Meaning
mn	Mnemonic device name

SVL-DRV-INFO - Logical disk type

Command calls which create the output column:

```
/SHOW-DRV-STATUS ... INFORMATION=*VOLUMES/*ALL
```

Output values in alphabetical order:

Output column	Meaning
DUAL	The disk was last assigned in dual mode.
DUAL-CRASHED	The system has not been correctly shut down and the disk was assigned in dual mode, or one of the disks failed due to an error. In the first case, equalization is required. In the second case, only the other disk can be used in mono mode.
EQUALIZE	In an interrupted equalization, the disk has been used as a write disk. It can therefore no longer be used in mono or SRV mode.
INCONSISTENT	The disk is being allocated for USE=SPECIAL, or such an allocation has not been terminated correctly. It can no longer be used in SRV mode.
MONO	The disk was last allocated in mono mode.
READ	In an equalization or reconstruction, the disk was last used as a read disk. It can also be used in mono mode.
RECONSTRUCT	In an interrupted reconstruction, the disk was used as a write disk. It can therefore no longer be used in mono or SRV mode.
SRV	The disk was last assigned in SRV mode.

SVL-RECORDING-MODE - Operating mode

Command calls which create the output column:

`/SHOW-DISK-STATUS ... INFORMATION=*SYSTEMS/*ALL`

Output values in alphabetical order:

Output value	Meaning
DRV	DRV mode is set. The data is recorded in single or duplicate form, depending on the entry in the SVL.
DRV(INCONS)	DRV mode is set, and the indicator is set in the SVL to show that the disk is inconsistent. This indicator is set if one of the disks of a DRV disk pair has failed or has been deactivated with /STOP-DRV-DUAL-MODE.
SRV(INCONS)	SRV mode is set, and the indicator is set in the SVL to show that the disk is inconsistent. This indicator is set for example during formatting or initialization.
SRV	SRV mode is set. The data is recorded in single form.

TARGET MN - Mnemonic name of the target device

Command calls which create the output column:

`/SHOW-PUBSET MIGRATION`

Output values in alphabetical order:

Output value	Meaning
mn	Mnemonic device name

TO - Name of the last disk device in a range of local disks

Command calls which create the output column:

`/SHOW-DRV-ENVIRONMENT`

Output values in alphabetical order:

Output value	Meaning
mn	Mnemonic device name

VSN - Virtual Serial Number

Command calls which create the output column:

```
/SHOW-PUBSET-MIGRATION
```

Output values in alphabetical order:

Output value	Meaning
vsn	Virtual Serial Number

11.2 Layout of the DRV record

The layout of the DRV record is described below.

```
          NKDINF MF=D,RECORD=DRV
1              *,NKDINF VERSION 500
1         #INTF INTNAME=NKDINF,REFTYPE=REQUEST,INTCOMP=1
1 *
1 *        GENERATION OF OUTPUT−LAYOUTS
1 *
1 *
1 *         C/DSECT FOR DRV_RECORD
1 *
1         MFCHK MF=D,PREFIX=N,SUPPORT=(C,D),MACID=KDI,                C
1               DMACID=KDV,DNAME=KDVENT
2 NKDVENT  DSECT ,
2                *,##### PREFIX=N, MACID=KDV #####
1 NKDVENTR NKLINF MF=C,PREFIX=N,MACID=KDV,GENOUT=YES
2                *,NKLINF VERSION 102
2 *
2 *        GENERATION OF OUTPUT−LAYOUTS
2 *
2 *
2 *        C/DSECT FOR OUT_RECORD
2 *
2 NKDVENTR NKLOUT PREFIX=N,SECT=C,MACID=KDO
3                *,NKLOUT VERSION 207
3 NKDVENTR MFCHK MF=C,                                                C
3               PREFIX=N,                                            C
3               SUPPORT=(C,D),                                       C
3               MACID=KDO,                                           C
3               DMACID=KLO,                                          C
3               DNAME=KLTENT
4 NKDVENTR DS    OF
4                *,##### PREFIX=N, MACID=KDO #####
3 NKDOSUMI EQU   *                 2 SUMMARY_INFO
3 NKDOVSN  DS    CL6               3 VSN
3 *
3 NKDOMNS  EQU   *                 3 PV_MNEMONICS
3 NKDOMN1  DS    CL4                4 DEVICE_MNEMONIC_OF_PV
3 NKDOMN2  DS    CL4                4 DEVICE_MNEMONIC_OF_PV
3 NKDOLMNS EQU   *−NKDOMNS         LENGTH OF PV_MNEMONICS
3 *
3 NKDODRVA DS    XL1               3 DRV_ALLOCATION_PHASE
3 NKDOFREE EQU   X'01'                 (FREE,
3 NKDOSTRT EQU   X'02'                  START,
3 NKDOIUSE EQU   X'03'                  IN_USE)
```

```
3 NKDOALLO DS    OX               3 ALLOCATABILITY
3 NKDOAFLG DS    X                 4 FLAGBYTE
3 NKDOMSGY EQU   X'80'               MESSAGE_VALID        (BIT)
3 NKDOAMSG DS    CL7              4 ALLOCATION_MESSAGE
3 NKDOATYP DS    XL1              4 ALLOCATION_TYPE
3 NKDONONE EQU   X'00'              (NONE,
3 NKDOADRM EQU   X'01'               DRV_MONO,
3 NKDOADRV EQU   X'02'               DRV_DUAL,
3 NKDOAMPO EQU   X'03'               MONO_POSSIBLE,
3 NKDOADPO EQU   X'04'               DUAL_POSSIBLE,
3 NKDOABYO EQU   X'05'               OPERATOR_DECISION_NECC)
3 NKDORECS DS    XL1              3 DRV_RECOVER_STATE
3 *   NONE   EQU X'00'              (NONE,
3 NKDORREC EQU   X'01'               RECON,
3 NKDOREQU EQU   X'02'               EQUALIZE,
3 NKDORDUS EQU   X'03'               DUAL_STOP,
3 NKDORSUS EQU   X'04'               USE_SUSPENDED,
3 NKDORRCN EQU   X'05'               RECON_NECCESSARY,
3 NKDOREQN EQU   X'06'               EQUAL_NECCESSARY,
3 NKDORCAN EQU   X'07'               USE_CANCELLED)
3 NKDOVERY DS    XL1              3 VERIFY_EQUALIZATION_FLAGS
3 NKDOVEQU EQU   X'80'             4  EQUAL_FOR_VERIFY_NECC
3 NKDOCOPC DS    H                3 COPY_PERCENTAGE
3         DS     XL1               3 RESERVED_SUMMARY
3 NKDOCSPE DS    X                 3 (PARAMETER): COPY_SPEED
3 NKDOCSPL EQU   X'01'               (LOW,
3 NKDOCSPM EQU   X'80'               MEDIUM,
3 NKDOCSPH EQU   X'FF'               HIGH)
3 NKDOLSUM EQU   *-NKDOSUMI       LENGTH OF SUMMARY_INFO
3 *
3 NKDOPARI EQU   *                2 PARAMETER_INFO
3 NKDORMST DS    XL1              3 RECORDING_MODE
3 NKDOFDIS EQU   X'01'               (FROM_DISK
3 NKDOSRV  EQU   X'02'               SRV,
3 NKDODRV  EQU   X'03'               DRV,
3 NKDODRVM EQU   X'04'               DRV_MONO,
3 NKDODRVD EQU   X'05'               DRV_DUAL)
3 NKDOEQUM DS    XL1              3 EQUALIZE_MODE
3 NKDOQALL EQU   X'01'               (ALL,
3 NKDOQCAT EQU   X'02'               CATALOG,
3 NKDOQOPF EQU   X'03'                OPENFILES)
3 NKDOCSTM DS    XL1              3 COPY_START_MODE
3 NKDOAMNT EQU   X'01'               (AT_MOUNTING,
3 NKDOAALL EQU   X'02'               AT_ALLOCATION)
3 NKDODUST DS    XL1              3 DUAL_STOP_MODE
3 NKDOBYOP EQU   X'01'               (BY_OPERATOR,
3 NKDOATER EQU   X'02'               AT_ERROR)
3 NKDOWAIT DS    H                3 ERROR_WAIT_TIME
```

```
3 NKDOLPAR EQU   *-NKDOPARI              LENGTH OF PARAMETER_INFO
3 *
3 NKDOVOLI EQU   *                    2 VOLUME_INFO_TABLE
3 *
3 NKDOMNPV DS    CL4                    2 MN_OF_PV
3 NKDOAVAL DS    XL1                    2 AVAIL_ALLOC_STATE
3 NKDONOSP EQU   X'00'                     (NOT_SPECIFIED,
3 NKDOONLI EQU   X'01'                      ONLINE,
3 NKDOSPMO EQU   X'02'                      SPECIAL_MOUNTING,
3 NKDOSPUS EQU   X'03'                      SPECIAL_IN_USE,
3 NKDOSMOU EQU   X'04'                      SRV_MOUNTING,
3 NKDOSUSE EQU   X'05'                      SRV_IS_USE,
3 NKDODMOU EQU   X'06'                      DRV_MOUNTING,
3 NKDODALL EQU   X'07'                      DRV_ALLOCATED,
3 NKDODUPD EQU   X'08'                      DRV_UPDDATE,
3 NKDODFRE EQU   X'09'                      DRV_FREE_USE,
3 NKDODSUS EQU   X'0A'                      DRV_SUSPENDED,
3 NKDODCAN EQU   X'0B'                      DRV_CANCELLED,
3 NKDODSDU EQU   X'0C'                      DRV_START_FOR_DUAL,
3 NKDODRMP EQU   X'0D'                      DRV_PV_REMOVING,
3 NKDOPAGO EQU   X'0E'                        DRV_PAGING_ONLY)
3 NKDOSVLP EQU   *                    2 SVL_DRV_INFO_OF_PV
3 NKDOINFO DS    XL1                    3 INFO_STATE
3 *  NOSP  EQU   X'00'                     (NOT_SPEC,
3 NKDOSVMO EQU   X'01'                      MONO,
3 NKDOSVDU EQU   X'02'                      DUAL,
3 NKDOSVRE EQU   X'03'                      READ,
3 NKDOSVEQ EQU   X'04'                      EQUALIZE,
3 NKDOSVRC EQU   X'05'                      RECON,
3 NKDOSVCR EQU   X'06'                      DUAL_CRASHED,
3 NKDOSVLI EQU   X'07'                      INCONSISTENT)
3 NKDOTIME DS    CL12                   3 TIME_STAMP
3 NKDOVFLG DS    X                      2 VOLUME_FLAGS (BITS)
3 NKDOVPAG EQU   X'80'                     PAGING_VOLUME
3         DS    XL1                    2 RESERVED_VOLUME
3 NKDOLSVL EQU   *-NKDOSVLP             LENGTH OF SVL_DRV_INFO_OF_PV
3 *
3 *
3 NKDOLVOE EQU   *-NKDOVOLI             LENGTH OF VOLUME_INFO_ELEMENT
3         ORG   NKDOVOLI
3 NKDOVOIT DS    5XL(NKDOLVOE)        3 VOLUME_INFO (1:5)
3 NKDOLVOT EQU   *-NKDOVOLI             LENTH OF VOLUME_INFO_TABLE
3 *
3 NKDOLOUT EQU   *-NKDVENTR         LENGTH_OF_OUTPUT_RECORD
1 NKDVENT# EQU   *-NKDVENTR    LENGTH_OF_DRV_RECORD
```

11.3 IDFCB macro

The DRV-specific lines of the IDFCB macro are described below.

```
          IDFCB D,PARMOD=31
. . .

1 ID1DRVST DS   X              DRV-STATUS OF FILE
1 ID1DRVNS EQU  X'80'          -- A NEW AVAILABILITY STATUS IS
1 ID1NAVST EQU  X'80'             REPORTED
1 ID1DRVMO EQU  X'40'          -- ALL VOLUMES OF A FILE CAN HAVE HIGH
1 ID1HAVPO EQU  X'40'             AVAILABILITY
1 ID1DRVDU EQU  X'20'          -- ALL VOLUMES OF A FILE HAVE HIGH
1 ID1HIAV  EQU  X'20'             AVAILABILITY
1 ID1AVHHW EQU  X'10'          -- AVAILABILITY HANDLER IS
1 *                              HW(RAID1, RAID5)
1 *                           -R AVAILABILITY HANDLER IS SW (DRV)

. . .
```

11.4 IDPPL macro

The DRV-specific lines of the IDPPL macro are described below.

```
. . .

1 IDQOP    DS   AL1            opcode/function code
...
1 IDQRDEQU EQU  X'0D'          -- READ AND EQUALIZE

. . .
```

11.5 Compatibility with other products

This section describes the compatibility of DRV with other operating system versions and products.

11.5.1 BS2000/OSD without DRV

A DRV disk cannot be allocated as a SRV disk without operator intervention. If DRV is not loaded, the operator is asked by the Disk Monitor whether the DRV disk should be allocated as a SRV disk. If the operator confirms the mount message, the SRV attribute is stored in the SVL. The time stamp is updated when the disk is allocated. In another system with the DRV subsystem, this disk can only be allocated as a SRV disk or mono disk.

DRV recognizes this disk as being more up-to-date than any existing DRV disk.

DRV indicator and DRV record

DRV sets the DRV indicator when the disk is allocated for DRV operation.

If the disk is later allocated for SRV operation under DMS (Data Management System), the DRV indicator is reset by the NKV Disk Monitor as of V10.0.

11.5.2 Allocation of DRV disks by utility routines

When using the utility routines DPAGE, SPCCNTRL and FDDRL, DRV disks can be allocated in ways other than the normal DMS mode. These cases are:

– allocation in USE=SPECIAL mode

– allocation of a non-imported public disk as a private disk

Allocation in USE=SPECIAL mode

A SPECIAL allocation always leads to allocation of a single disk. The mode of the disk (RECORDING–MODE) is not changed. Depending on how the utility routine uses the disk, the time stamp may or may not be modified.

In the case of private disks, a time stamp modification means that a reconstruction is necessary before DRV operation can be resumed. The time stamps of the disk pair must be identical.

In the case of an individual disk belonging to a public volume set, modification of the time stamp causes an error message to be output during subsequent allocation with IMPORT–PUBSET. The operator must decide how to respond to the error message. If the allocation of the disk has not been changed, the error message can be ignored.

Allocation as a private disk

The operating mode set with /SET–DRV–PARAMETER (RECORDING–MODE) is ineffective in cases where individual disks of a public volume set are reserved for SPCCNTRL or DPAGE, for example, but the public volume set has not been allocated with /IMPORT–PUBSET. In this case the disk is allocated as a private disk for the DRV mode stored in the SVL from the last allocation. Any allocation-dependent equalization will be postponed. Instead, merely a read disk is designated to ensure consistency. Only upon termination of the allocation can the public volume set be incorporated into the system catalog and thus made available for general use. After this, the required equalization or reconstruction will be activated.

11.5.3 DRV and DAB

The use of DAB (disk access buffer) is compatible with DRV. DRV operation does not affect the system administrator's DAB interface. The buffer size does not change. The buffer is assigned to the logical disk.

However, you should not use DAB in the following cases:

– during an equalization
– after a system crash
– when reconstructing an entire disk

In these cases, using DAB decreases the performance.

11.5.4 DRV and VOLIN

VOLIN (volume initializer) does not distinguish between SRV and DRV disks. One individual disk is always allocated with USE=SPECIAL. The initialized disk is a SRV disk.

11.5.5 DRV and Snapsets

DRV mirroring and Snapset operation for a pubset are mutually exclusive.

No Snapset operation (Snapset limit not equal to 0) may be started on a pubset with DRV operation (*DRV / *DRV-DUAL / *DRV-MONO) and vice versa.

11.5.6   DRV and FDDRL

FDDRL copies and saves the DRV indicator and the DRV parameters in the SVL but does not interpret them. FDDRL only processes single disks with `USE=SPECIAL`.

In this way, the DRV allocation is maintained for an input disk. The time stamp is also not modified. Dual operation can continue if the disk is part of a disk pair.

Both products recognize an inconsistency indicator which has been set by the other product and which is retained after abnormal termination.

11.5.7   DRV, DPAGE and SPCCNTRL

DPAGE and SPCCNTRL use the DMS function `OPEN VOLUME` for allocation:

– The specification `EXCLUSIVE` results in a SPECIAL allocation where only single disks are processed.

– The specification `SHARE` results in a normal allocation in the case of private disks and cataloged public volume sets. Other users are not excluded and the disk can be used as part of a disk pair for DRV operation.

– Public volume sets which have not yet been allocated with `/IMPORT-PUBSET` are allocated as private disks and for the duration of the allocation cannot then be cataloged with `/IMPORT-PUBSET`.

– The UPAM access method is used for access to the data. The use of disk pairs is transparent.

– When reading the SVLs with DPAGE, you should note that there can be differences between the SVL entries on dual disks. These differences affect the:

  – Pointer to the first free alternate track

  – DRV record and inconsistency indicator during an equalization or reconstruction.

Glossary

data duplication
$\rightarrow$ dual recording

DRV disk
Logical disk allocated for DRV operation.

DRV operation
Normal operation in either mono or dual mode.

dual disk
Logical disk allocated for dual operation.

dual mode
Recording mode whereby the data is stored in duplicate on two disks.

dual operation
Normal operation in dual mode.

dual recording
Technique making it possible to store data in duplicate on two different physical disks and to maintain data consistency.

Dual Recording by Volume (DRV)
$\rightarrow$ dual recording

dual stop
Change from dual to mono mode. The primary function of this changeover is to maintain uninterrupted operation in the event of disk failure.

equalization
DRV technique which ensures that the disks of a disk pair have the same status after a system crash.

logical disk
$\rightarrow$ logical volume

logical volume (LV)
> Disk used for DRV operation. A logical volume consists of one or two physical volumes, depending on the mode setting. It is addressed via a volume serial number (VSN).

mirror disk
> Disk of a disk pair on which the data is stored in duplicate.

mono disk
> Logical disk allocated for mono operation.

mono mode
> Recording mode where there is one logical disk consisting of one physical disk on which the data is stored in single form.

mono operation
> Normal operation in mono mode.

operating mode
> → recording mode

physical disk
> → physical volume

physical volume (PV)
> Disk mounted on a disk device. The physical volume is addressed via the name of the device on which it is mounted.

public volume set (PVS)
> Shared storage space. Memory area on disk storages which is available to all users.

read disk
> Disk used for reading during a reconstruction or equalization.

reconstruction
> DRV technique which, when a second disk is added to the first disk to form a disk pair, ensures that both disks have the same status.

recording mode
> The recording mode determines how a logical disk is used and defines the role of the corresponding physical disks.

single recording

Technique which stores the data on a physical disk only once.

Single Recording by Volume (SRV)

→ single recording

SRV disk

Disk allocated for SRV operation.

SRV mode

Conventional recording mode where there is one physical disk on which the data is stored in single form.

SRV operation

Normal operation in SRV mode.

standard volume label (SVL)

Contains the attributes of the disk. These include:

→ volume serial number (VSN)

→ device type

→ address references to F1 and F5 labels

→ number of tracks and cylinders

→ possible uses of the device (PUBLIC, PAGING, etc.)

→ DRV parameters

Abbreviations

DAB	Disk Access Buffer
DMS	Data Management System
DPAGE	Display PAGE
DRER	Dual Recording Error Recovery
DRV	Dual Recording by Volume
DSSM	Dynamic SubSystem Management
FDDRL	Fast Disk Dump and ReLoad
LV	Logical Volume
NDM	Nucleus Device Management
PV	Physical Volume
PVS	Public Volume Set
SPCCNTRL	SPaCe CoNTRoL facility
SPD	Shared Private Disk
SRV	Single Recording by Volume
SVL	Standard Volume Label
VOLIN	VOLume INitializer
VSN	Volume Serial Number

Related publications

The manuals listed below are available from these sources:

- On the Internet from our manual server (URL: *http://manuals.ts.fujitsu.com*)

- On the DVD "BS2000/OSD SoftBooks".
  This CD contains practically all the manuals and readme files for the
  BS2000 system software of the latest BS2000/OSD version.

Printed copies of the manuals can be purchased separately over the Internet from:
http://manualshop.ts.fujitsu.com.

[1] **BS2000/OSD-BC**
    Commands
    User Guide

[2] **BS2000/OSD-BC**
    System Installation
    User Guide

[3] **IMON** (BS2000/OSD)
    Installation Monitor
    User Guide

[4] **BS2000/OSD-BC**
    DMS Macros
    User Guide

[5] **BS2000/OSD-BC**
    Performance Handbook
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