StorageTek™ Shared Virtual Array (SVA)

V2X/V2X2 Reference

Part Number : 96219
Revision N

StorageTek™ Shared Virtual Array (SVA)

V2X/V2X2

Reference

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Preface

Notices

Please read the following compliance and warning statements for this product.

Caution: Potential equipment damage: Cables that connect peripherals must be shielded and grounded; refer to cable descriptions in the instruction manuals. Operation of this equipment with cables that are not shielded and not correctly grounded might result in interference to radio and TV reception.

Changes or modifications to this equipment that are not expressly approved in advance by Sun Microsystems Inc. will void the warranty. In addition, changes or modifications to this equipment might cause it to create harmful interference.

United States FCC Compliance Statement

The following compliance statement pertains to Federal Communications Commission Rules 47 CFR 15.105:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

Agency Compliance Statement

The SVA complies with the following agencies:

UL–Recognized Component by Underwriters Laboratories Inc. to Standard UL 60950, Information Technology Equipment.

CE–Mark to show compliance to European Union Directives (European Union: Safety & EMC).

CISPR 22 and EN55022 Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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The following compliance statement in Japanese pertains to VCCI EMI regulations:

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English translation: This is a Class A product based on the Technical Requirement of the Voluntary Control Council for Interference by Information Technology (VCCI). In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective actions.

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The following warning label statement (in Kanji) pertains to BSMI regulations in Taiwan, R.O.C.:

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English translation: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

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Alert Messages

Alert messages call your attention to information that is especially important or that has a unique relationship to the main text or graphic.

Note: A note provides additional information that is of special interest. A note might point out exceptions to rules or procedures. A note usually, but not always, follows the information to which it pertains.

Caution: *informs you of conditions that might result in damage to hardware, corruption of data, or corruption of application software. A caution always precedes the information to which it pertains.*

WARNING:A warning alerts you to conditions that might result in long-term health problems, injury, or death. A warning always precedes the information to which it pertains.

Mensajes de alerta

Los mensajes de alerta llaman la atención hacia información de especial importancia o que tiene una relación específica con el texto principal o los gráficos.

Nota: Una nota expone información adicional que es de interés especial. Una nota puede señalar excepciones a las normas o procedimientos. Por lo general, aunque no siempre, las notas van después de la información a la que hacen referencia.

Precaución: Una precaución informa sobre situaciones que podrían conllevar daños del hardware, de los datos o del software de aplicación. Las precauciones van siempre antes de la información a la que hacen referencia.

Advertencia: Una advertencia llama la atención sobre condiciones que podrían conllevar problemas de salud crónicos, lesiones o muerte. Las advertencias van siempre antes de la información a la que hacen referencia.

Related Documents

The following publications comprise the SVA document set available to Sun Microsystems Inc. customers.

Shared Virtual Array (SVA) Subsystem

Note: The book part numbers changed. The old numbers are shown in parenthesis.

- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 Introduction 96216 (MO9135)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 Operation and Recovery 96217 (MO9137)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 Planning 96218 (MO9136)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 Reference 96219 (MO9139)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 System Assurance 96220 (MO9138)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 System Assurance Tables 96223 (MO9169)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 General Information 96221 (MO9134)*
- *StorageTek Shared Virtual Array (SVA) V2X/V2X2 Peer-to-Peer Copy Configuration User's Guide 96225 (MO9211)*

Shared Virtual Array Administrator (SVAA) for OS/390

- *SVAA for OS/390 Configuration and Administration PN 3112905xx*
- *SVAA for OS/390 Reporting PN 3112906xx*
- *SVAA for OS/390 Installation, Customization, and Maintenance PN 3112908xx*
- *SVA SnapShot for OS/390 Installation, Customization, and Maintenance PN 3112913xx*

Shared Virtual Array Administrator (SVAA) for VM

- *SVAA for VM Configuration and Administration PN 3134629xx*
- *SVAA for VM Reporting PN 3134630xx*
- *SVAA for VM Installation, Customization, and Maintenance PN 3134631xx*

Shared Virtual Array Administrator (SVAA) for OS/390 and VM

- *SVAA for OS/390 and VM Messages and Codes PN 3112907xx*

Shared Virtual Array Administrator (SVAA) for Solaris

- *SVAA for Solaris User's Guide PN 3112909xx*
- *SVAA for Solaris Messages PN 3112910xx*
- *SVAA for Solaris Installation PN 3112911xx*
- *SVAA for Solaris Quick Start Guide PN 3134509xx*
- *SVAA for Solaris Command Quick Reference PN 3134119xx*

Shared Virtual Array Administrator (SVAA) for HP-UX

- *SVAA for HP-UX User's Guide PN 3134257xx*
- *SVAA for HP-UX Messages PN 3134244xx*
- *SVAA for HP-UX Installation PN 3134254xx*
- *SVAA for HP-UX Quick Start Guide PN 3134512xx*
- *SVAA for HP-UX Command Quick Reference PN 3134253xx*

Shared Virtual Array Administrator (SVAA) for AIX

- *SVAA for AIX User's Guide PN 3134602xx*
- *SVAA for AIX Messages PN 3134600xx*
- *SVAA for AIX Installation PN 3134599xx*
- *SVAA for AIX Quick Start Guide PN 3134601xx*
- *SVAA for AIX Command Quick Reference PN 3134598xx*

Shared Virtual Array Administrator (SVAA) for Windows 2000 Server and Windows NT Server

- *SVAA for Windows 2000 Server and Windows NT Server User's Guide PN 3134573xx*
- *SVAA for Windows 2000 Server and Windows NT Server Messages PN 3134571xx*
- *SVAA for Windows 2000 Server and Windows NT Server Installation PN 3134570xx*
- *SVAA for Windows 2000 Server and Windows NT Server Quick Start Guide PN 3134572xx*
- *SVAA for Windows 2000 Server and Windows NT Server Command Quick Reference PN 3134569xx*

Shared Virtual Array Console (SVAC) for Windows NT

- *SVAC for Windows NT Quick Start Guide PN 3112993xx*

Other Documents

- *Peer to Peer Remote Copy Configuration Guide MP4007x*
- *Planning For IBM Remote Copy SG24-2595-xx* (IBM document)
- *Remote Copy Administrator's Guide and Reference SC35-0169-xx* (IBM document)

Viewing and Printing Web-Based Electronic Documents

Publications listed in “Related Documents” can be viewed and printed from the Sun Microsystems Inc. Customer Resource Center (CRC) Web site at:

`http://www.support.storagetek.com`

History of Changes

Rev A – Initial release. September, 2002.

Rev B – Second release. December, 2002

Minor changes involved edits and corrections. Major changes include:

- Added “Low Capacity FSC 3E41 Messages” section to chapter four.

Rev C – Third release. March, 2003. Minor changes involving edits and corrections.

Rev D – Fourth release. March, 2003. Minor changes involving edits and corrections.

Rev E – Fifth release. May, 2003. Minor changes involving edits and corrections.

Rev F – Sixth release. December, 2003. Minor changes involving edits and corrections.

Rev G – Seventh release. April, 2004. Minor changes involving edits and corrections.

Rev H – Eighth release. February, 2005. Minor changes involving edits and corrections.

Rev J – Nineth release. December 2005. Minor changes and corrections.

Rev K – Tenth release. May 2006. Minor changes and corrections.

Rev L – Eleventh release. June 2006. Minor changes and edits.

Rev M – Twelfth release. Late July 2006. Minor changes and corrections.

Rev N – Thirteenth release. November 2006. Minor changes and corrections.

Addressing, Commands, and Status

1

Attachments

Sun Microsystems's advanced Shared Virtual Array (SVA®) attaches to all IBM 370 equivalent data streaming channel architectures including IBM or compatible 30XX, 43XX, 9370, and ES/9000 series CPUs. The SVA also supports ESCON channels with data transfer rate of 17 megabytes per second.

Channel Addressing

At the OEMI channel interface to a host CPU, SVA presents a functional device image of one to sixteen 3990s operating in DLSE mode and supporting a total of up to 4096 functional 3380 and/or 3390 devices. Up to 1365 3390-9 devices can be defined. The SVA supports 3380J, 3380K, 3380KE, 3390-1, 3390-2, 3390-3, and 3390-9 device emulation. The functional device exhibits the external characteristics of the DASD device type that it emulates.

The SVA does not impose limitations on intermixing functional device types within the subsystem configuration. However, host operating system limitations for intermixing device types apply to the SVA.

Note: All devices referred to in this chapter are functional devices unless otherwise noted.

Subsystem Identifier

Each functional storage control unit that the SVA emulates must have a unique subsystem identifier (SSID). A SSID is a hexadecimal number (up to 4 digits) assigned by the user that identifies the functional storage control unit.

Functional Device Identifier

Each functional 3380 or 3390 device that SVA emulates must have a unique functional device identifier (FDID). A FDID is an integer from 0 through 4095 that is assigned by the subsystem.

The base functional device identifier (BFDID) is the FDID of the lowest (base) interface address on a given channel.

Interface Device Identifier

The SVA also maintains an interface device identifier (IDID). The IDID is a combination of the control unit cluster identifier, the channel port identifier, and the 8-bit address that is present on the interface bus lines at initial selection. The IDID uniquely identifies all of the addresses that can be presented to the subsystem at the OEMI channel interfaces. There are potentially 8192 unique IDs per subsystem.

Channel Address Configuration

When configuring an SVA subsystem, each channel is assigned a BFDID and a range of interface addresses, which is specified by the BIDID and the address range. In this way, the subsystem constructs an address map from the OEMI interface to a specific functional device. This addressing scheme supports all requirements for DASD controllers.

When configuring SVA, the following rules apply to the value of the BIDID and the BFDID:

- They must be zero or a multiple of the address range
- They cannot be greater than 248
- The sum of the BIDID and the address range cannot exceed 4096
- The sum of the BFDID and the address range cannot exceed 4096.

When configuring SVA, the rules for assigning the channel address range are:

- Each channel interface may have only one address range specified
- The number of addresses in the address range must be 8, 16, 32, 64, 128, 256, 512 or 1024 (decimal).

Table 1 on page 17 demonstrates the correlation between the number of addresses configured in the subsystem and the acceptable address ranges (in hexadecimal).

I/O Channel Interface

The SVA completes initial selection within the times specified by the *IBM System/360 and System/370 I/O Interface Channel to Control Unit Original Equipment Manufacturer's Information*. Initial selection is measured from the rise of Select Out (with Address Out up) to the rise

of Status In, and only includes time contributed by the Controller. Initial selection typically

completes within the following time frames:

- 85 microseconds for control units with one to eight channels per cluster
- 170 microseconds for control units with nine to 16 channels per cluster.

Propagation of Select Out may be delayed up to 25 microseconds for channel-initiated selections and up to 30 microseconds for Controller-initiated selections.

Table 1 Channel Addressing (Maximum 4096 Configurable)

Number of Continuous Addresses dec	**hex**	**Number of Valid Base IDID/FDIDs**	**Valid Base IDID/FDIDs (hexadecimal)**
8	8	128	000 008 010 018 020 028 ... 390 398 0A0 0A8 0B0 0B8 0C0 0C8 0D0 0D8 0E0 0E8 0F0 0F8 1A0 1A8 1B0 1B8 1C0 1C8 1D0 1D8 1E0 1E8 1F0 1F8 2A0 2A8 2B0 2B8 2C0 2C8 2D0 2D8 2E0 2E8 2F0 2F8 3A0 3A8 3B0 3B8 3C0 3C8 3D0 3D8 3E0 3E8 3F0 3F8
16	10	64	000 010 020 030 ... 390 0A0 0B0 0C0 0D0 0E0 0F0 1A0 1B0 1C0 1D0 1E0 1F0 2A0 2B0 2C0 2D0 2E0 2F0 3A0 3B0 3C0 3D0 3E0 3F0
32	20	32	000 020 040 060 ... 380 0A0 0C0 0E0 1A0 1C0 1E0 2A0 2C0 2E0 3A0 3C0 3E0
64	40	16	000 040 080 100 140... 380 0A0 1A0 2A0 3A0
128	80	8	000 080 100 180 200 280 300 280
256	100	4	000 100 200 300
512	200	2	000 200
1024	400	1	000

Note:

- Maximum 1024 channel addressing applies ONLY to SRLs ≥ K05.00.xx
- Only decimal address ranges are displayed on subsystem operator panels.

Processing Commands

Asynchronous Operations

Certain sub-commands of the Set Subsystem Mode (SSM) command and certain orders of the Perform Subsystem Function (PSF) command specify operations that potentially take more than 15 seconds to complete. By default, these sub-command and orders are processed asynchronously (i.e. channel end and device end status are presented before the specified operation completes). Exception: the PSF Commit order can be specified to be synchronous or asynchronous.

In processing asynchronous commands, the host program may or may not require that a completion message be returned to the channel. If the control unit receives an asynchronous command with the Message Required bit set in the command parameters, it assigns a message ID to the operation, presents channel end and device end status to the channel, and continues processing the requested operation asynchronously.

If the Message Required bit is set in the Set Subsystem Mode or Perform Subsystem Function command parameters and a Read Message ID (RMID) command is not chained from the SSM or PSF command, then a completion message does not get returned to the channel.

The RMID command retrieves the message ID assigned to the asynchronous operation. If the operation is completed before the RMID command is processed, the message ID in the data returned for the RMID command is zero.

If an RMID command was received in the chain that specified the asynchronous operation, and the operation was not complete when the RMID was processed, the Controller presents unsolicited attention (80) status, when the operation is complete, to the channels in the path group of the channel that the asynchronous operation request was received on. The first channel that responds to the attention status receives an Attention Message that contains the completion status of the operation.

The host responds to the attention status with the following chain:

- Suspend Multipath Reconnection (recommended on an MVS system)
- PSF with a Prepare for Read Subsystem Data order with an Attention Message suborder (03)

- Read Subsystem Data (RSSD).

This chain can be used to query the completion status of the asynchronous operation before the attention status is presented.

The Attention Message returned indicates the completion status of the operation. The completion status field of the Attention Message indicates operation is “pending” until it has successfully completed, completed with errors, or failed.

Channel Path Group ID

The channel path group ID contains the channel path ID (CHPID) for a channel. The channel path group ID also identifies the system control program that governs the channel and allows channel paths with the same channel path group ID to be grouped together, thus defining dynamic path reconnect.

When the command processor executes a set path group ID command, a channel path group ID for the channel path is established. When the channel path group ID for a new channel path matches a previously defined channel path group ID, it is grouped with the previously defined channel(s). Only a system reset or channel disable on a channel clears the channel path group ID value for that channel.

Channel Exception Conditions

System Reset Processing

The host initiates system reset to reset all operations, status, mode settings, and allegiances associated with the channel path and all attached devices.

In a system reset, channel interface hardware detects the system reset, automatically inactivates operational-in, and sends an interrupt to the control unit. The control unit microcode processes the interrupt and allows the channel to accept another system I/O to the point of presenting initial status. Then the microprocessor holds all subsequent channel operations until the system reset is completely processed, or it moves the operation to an available channel in the same channel path group. However:

- If a channel operation is in progress when the channel receives the system reset command, the control unit attempts to continue processing the operation until it reaches a normal end.
- If the resetting channel path is grouped with other channel paths, its channel path group ID is cleared and is removed from the channel path groupings for all of the allied functional devices.

- If the resetting channel path is the only channel path available to a device, and if the device is reserved to an operation that is part of a chain of operations that are already in progress, the system reset command breaks the chain. However, if the resetting channel is a member of a path group and the chained operation was in the disconnected state when the reset was received, the chained operation continues on another member of the path group.
- If the resetting channel path has a device reserved to it, and if it is the only channel path to that device, the device is released from the reserved condition. If the resetting channel path is a member of a path group, the device remains reserved to the other members of the path group.

Selective Reset Processing

When the host channel detects certain equipment malfunctions (such as a Controller that presents an unexpected internal error while connected to the channel), it initiates selective reset processing. When Controller hardware detects the selective reset, it aborts the specific sequence in progress, and sets a selective reset condition. When control unit microcode detects the selective reset, it completes selective reset processing.

The way that selective reset affects a channel path and its associated device depends on the circumstances.

- Any operations in progress are allowed to complete to a normal ending point, before selective reset processing begins.
- Device busy is presented to any channel path of a different path group that attempts to select the device during selective reset processing.
- If status is pending or is stacked on the resetting channel, the status is cleared (even if there is an available channel path in the same path group).
- If selective reset is received on one channel path while the device is connected to another channel path, selective reset has no effect.
- Selective reset has no effect on any path groupings or device reserve conditions that exist in the control unit at the time of the reset.

Interface Disconnect Processing

In an interface disconnect, a host channel signals the Controller to end the execution of the operation in progress and to disconnect from the channel. When channel hardware detects the interface disconnect, it

inactivates operation-in and sets a bit to indicate the interface disconnect condition.

The way that interface disconnect affects operations in progress depends on the circumstances.

- If an operation is in progress, the Controller allows the operation to continue to normal completion.
- If a data transfer operation from the host is in progress, data transfer hardware automatically pads the rest of the transfer with zeros until the end of transfer interrupt indicates that the data transfer is completed.
- If a data transfer to the host is in progress, the rest of the data transfer operation is scrapped until an end of transfer interrupt indicates that the data transfer is complete. If ending status is owed to the host for the operation, the Controller initiates a selection sequence to present the status.

Owed Device End

When a channel attempts to select a device that is not currently available to its selection sequence (when the device is busy processing another channel operation for a different path group), the owed device end bit is set for the device. Then, when the device is no longer busy, the Controller initiates the selection and presents the owed device end status to notify the host that the device is available for processing.

Channel Error Management

This section describes some of the methods that may be employed as part of a channel path error recovery process.

Channel Command Retry

The Controller may request that the host retry a previously issued command. The Controller calls for a channel command retry (CCR) when it seeks to recover from a temporary error condition or when certain conditions prevented the execution of the command.

Disconnect-in

When the Controller detects an internal error, it may issue a disconnect-in to the specified channel, which causes the channel to undergo a selective reset. Two possible situations exist:

- If operation-in is active to the host, disconnect-in is asserted on the current channel path. A 12-second time-out is initiated. If the channel path fails to respond with either selective or system reset

within 12 seconds, the Controller performs an internal selective reset, which clears the pending device status and returns the device to its pre-existing available or reserved status.

- If the device is not connected, the channel reconnects to the device, and then disconnect-in is asserted. A 14-second time-out period is initiated. If the channel path fails to respond to request-in within the time-out period, the time-out conditions are disabled.

Disconnected Device Status Time-out

To ensure that the host receives disconnected device status in a timely manner, the Controller monitors the progress of disconnected status. When a request to present disconnected status is initiated, a bit is set that

indicates that the device must present disconnected status. When the Controller determines that a device has not experienced this device specific bit set before, it sets another device specific bit that indicates that the device should present disconnected status and reset the device specific bits by the next time the disconnected device status is queried.

If despite these efforts, the device has not presented disconnected device status, the Controller initiates an internal selective reset. The internal reset clears the pending device status and returns the device to its pre-existing available or reserved status.

Path Control

Dynamic Path Reconnect

In an XA or ESA environment, V2X SVA supports dynamic path reconnect. Dynamic path reconnect allows the subsystem to reconnect to the host system through any channel of a logically defined group rather than limiting reconnection to the channel that initiated the operation.

Dynamic path reconnect is enabled by a system control program that defines the logical group of channels. When the device is ready to reconnect to the host system, any available channel in that group may transfer the data to the host.

Single Path Mode

In single path mode, when a channel path obtains device selection, that device is now locked in to connecting or reconnecting to the host via that one channel path.

Single path mode is the default mode for the subsystem. On powering up the subsystem, all channel paths are set to operate in single path mode. Single path mode is also designated in the following conditions:

- When a Set Path Group ID command specifying single path mode is received for a channel path
- When a system reset is received for a channel path
- When a channel is disabled, it is set to resume operations in single path mode.

Single path mode is reset when a set path group ID command specifying multipath mode is received for a channel path. This command clears the single path mode for the particular channel path that receives the command.

Multipath Mode

In multipath mode, when a channel path initiates a device selection and the device disconnects from the channel, it may reconnect to any channel path that is part of the same path group as the initiating channel path.

The multipath mode is enabled by resetting a bit in the single path mode data structure for the channel path. When in multipath mode, grouping applies to both device reservation and reconnection.

Path Control Commands

This section describes the path control commands and how they are processed in the SVA.

Suspend Multipath Reconnection

The host issues the Suspend Multipath Reconnection command to facilitate recovery operations when the subsystem is in the multipath mode. This command suspends the multipath mode for the channel path that receives the command. When successfully completed, channel and device end status are presented to the host, and multipath mode is suspended until the host accepts ending status for the command chain.

The Suspend Multipath Reconnection command has no effect on device reservation or channel path groupings, and is not valid in the domain of a Locate Record or Locate Record Extended command.

Set Path Group ID

The Set Path Group ID command controls the allocation and de-allocation of individual channel paths into logical groups. This

command sends 12 bytes of data from the host to the Controller. The Controller then returns channel and device end status to the host.

The Set Path Group ID command must be the only command in the channel program. If this command is chained from another command, the Set Path Group ID command is rejected and unit check status is presented to the host.

Table 2 Set Path Group ID Control Byte 0

Bit	Value	Definition
0	0 1	Single path mode is specified Multiple path mode is specified
1-2	00 01 10 11	Establish path group Disband path group Resign from path group Invalid
3-7	00000	These bits must all be zero

Sense Path Group ID

The host issues the Sense Path Group ID command to obtain the channel path group ID value and the addressed device's group status for the channel path receiving the command. When executed, the Sense Path Group ID command sends path group data to the host, and then presents channel and device end status to the host.

The Sense Path Group ID command is executed even if the device is busy or not ready, and the command must be the only command in the channel program. If this command is chained to any other command, the Sense Path Group ID command is rejected, and unit check status is presented.

Device Reserve

The host issues a Device Reserve command to obtain the long term allegiance of a specified device. As long as a command previous to the Device Reserve command did not receive a unit check, the Controller sends the host unsolicited sense data for the specified device. Then channel and device end are presented as status to the host. However, the Device Reserve command is not executed if the Controller determines that the device is busy with a previous operation or that the device is reserved to another channel or group of channels. Instead, owed device end is queued on the channel path, and device busy is presented to the host as status. If the device is available for

processing, the Device Reserve command begins even if the device is not ready.

When the Device Reserve command is successfully executed, only the channel path or path group specified by the reserve command may access the device.

The Device Reserve command must always be the first command in a channel command program. If a command precedes it, the Device Reserve command is rejected and unit check status is presented to the host.

When a device is reserved, it remains reserved until one of the following occurs to clear it:

- A Device Release command is successfully executed on any member of a path group.
- An Unconditional Reserve command is successfully executed on a channel path that is not a member of the path group that holds the device reserve.
- A system reset or channel disable is successfully executed on the channel path (in single path mode).

If a device is reserved to a path group and system reset or a channel disable occurs on one of the members, the device remains reserved to the remaining members.

Device Release

The host issues a Device Release command to release a specified device from the reserved status. As long as a command previous to the Device Release command did not receive a unit check, the control unit sends the host unsolicited sense data for the specified device. Then channel and device end are presented as status to the host.

The Device Release command is not executed if the device is busy with a previous operation. In this case, an owed device end is queued for the channel path that initiated the operation, and device busy status is presented to the host. However, if the device is available for processing, the Device Release command begins even if the device is not ready.

When successfully executed, the Device Release command releases the device from the reserve status.

The Device Reserve command must be the first command in a channel command program. If this command is preceded in a channel program by a define extent, space count, or set file mask command,

the Device Release command is rejected and unit check status is presented to the host.

Unconditional Reserve

The host issues an Unconditional Reserve command to obtain the long term allegiance of a specified device. As long as a command previous to the Unconditional Reserve command did not receive a unit check, the control unit sends the host unsolicited sense data for the specified device. Then channel and device end are presented as status to the host. The Unconditional Reserve command begins even if the device is busy, not ready, or reserved by another channel path or path group.

When successfully executed, the Unconditional Reserve command reserves a device to the channel path or path group that executes the command, regardless of any other prior device reserve conditions. If the device was reserved by another channel path or path group, that device reservation is reset and the device is reserved by the channel path or path group that executed the Unconditional Reserve command.

The Unconditional Reserve command must be the first command in a channel command program. If a command precedes it, the Unconditional Reserve command is rejected and unit check is presented to the host.

Reset Allegiance

The Reset Allegiance command terminates a device's allegiance (contingent or implicit) to a channel path or channel path group.

The Reset Allegiance command must be the first command executed in a channel command program. If any command has preceded this command, the Reset Allegiance command is rejected and unit check status is presented to the host.

The Reset Allegiance command executes even if the device is busy or not ready. In its execution, the device's status is tested to determine if it is allied or reserved to another path group. The Reset Allegiance command may encounter three situations:

- If the device is reserved to another channel or path group, the Reset Allegiance command returns reservation and allegiance data but does not alter any device allegiances. Any command that is chained to the Reset Allegiance command is rejected, and unit check status is presented.
- If the device is not reserved but has an allegiance (implicit or contingent) to another path group, the Reset Allegiance command terminates that allegiance.

- If the device is not reserved by any other channel path or is reserved to the channel path or path group that issued the Reset Allegiance command, all CCW chains are terminated, status for the CCW chain is cleared, and reservation and allegiance data is sent.

Command Description

2

The SVA supports most count-key-data (CKD) and extended count-key-data (ECKD) commands and subcommands. The SVA checks all commands and subcommands for validity. If the command or subcommand is not valid, the SVA presents a unique fault symptom code (FSC) in the command reject sense data. For an unsupported command, the sense indicates an ‘Invalid Command’. For an unsupported subcommand, the sense indicates an ‘Invalid Parameter’

Each command is described in a channel command word (CCW). A channel command word is 8 bytes of information that:

- Identifies the command
- Designates the processor storage area associated with the operation
- Describes the result of the operation.

CCWs can have one of two formats: format 0 or format 1. The formats differ only in the arrangement of the fields within the CCW and the size of the data address field.

Refer to the following table for a comparison of the two formats.

Table 3 CCW Formats

Format 0 (System/370, 370-XA)		**Format 1 (370-XA Mode)**	
Bit	**Meaning**	**Bit**	**Meaning**
0-7	Command Code	0-7	Command Code
8-31	Data Address	8-15 16-31	Flags Count
32-39	Flags		
40-47	Not Used	32-63	Data Address
48-63	Count		

CCW Flags

The flags, bit 32 through 39 for format 0 or bits 8 through 15 for format 1, are described in the following paragraphs.

Chain Data (CD)

Bit 32 (format 0) or bit 8 (format 1) is the chain data bit. When this bit is ‘1’, it specifies that the storage area designated by the next CCW is to be used with the current I/O operation.

Chain Command (CC)

Bit 33 (format 0) or bit 9 (format 1) is the chain command bit. When this bit is ‘1’ and the chain data and suspend flag are both ‘0’, it specifies that the operation in the command code in the next CCW is to start following the normal completion of the current operation.

Suppress Length Indicator (SLI)

Bit 34 (format 0) or bit 10 (format 1) is the suppress length indicator bit, which controls whether or not an incorrect length indication is to be sent to the program. When this bit is ‘1’ and the chain data flag is ‘0’, the incorrect length indication is suppressed. When the chain command and the suppress length indicator flags are ‘1’ and the chain data flag is ‘0’, command chaining takes place regardless of an incorrect length indication.

Skip (SKIP)

Bit 35 (format 0) or bit 11 (format 1) is the skip flag bit. When this bit is ‘1’, it suppresses the transfer of information to the processor storage during read and sense operations.

Program-Controlled Interruption (PCI)

Bit 36 (format 0) or bit 12 (format 1) is the program-controlled interruption flag bit. When this bit is ‘1’, it causes the channel to generate an intermediate interruption condition by sending the appropriate subchannel when the CCW takes control of the I/O operation.

Indirect Data Address (IDA)

Bit 37 (format 0) or bit 13 (format 1) is the indirect data address flag bit. When this bit is ‘1’, it specifies indirect data addressing.

Suspend (S)

Bit 38 (format 0) or bit 14 (format 1) is the suspend flag bit. When this bit is ‘1’, it suspends the processing of the channel program.

Flag bit 39 or 15

Except for a Transfer in Channel (TIC) command, flag bit 39 (format 0) or bit 15 (format 1) must be ‘0’. For a TIC command, this flag bit is ignored.

Exception Conditions

The command descriptions found in this chapter include the criteria for checking and reporting I/O program exceptions. Exception conditions are identified by exception type and format or by message codes. “24-Byte Compatibility Sense Data” on page 151, provides more information about how exception conditions are reported. Exception conditions are described in order of priority unless otherwise specified. Command reject with format 0, message 1 is the highest priority exception.

Table 4 on page 34 lists the commands that the SVA accepts and restrictions on those commands. Any command issued that is not listed in this table is rejected and the sense data returned is format 0, message 1. Any command issued that does not adhere to the stated restrictions is rejected and the sense data returned is format 0, message 1.

Multitrack Operations

Multitrack operations are those in which the specified operation continues past the end of a functional track. In such cases, the storage path advances to the next functional track and continues the operation.

Multitrack operations are either in or outside of a Locate Record or Locate Record Extended domain.

In a Locate Record or Locate Record Extended Domain

Most data transfer operations (read or write operations between the storage path and the device) in a Locate Record or Locate Record Extended domain are multitrack operations.

An operation is a multitrack operation when the Locate Record operation is determined to be explicitly multitrack or when bit 0 of the data transfer command is ‘1’.

When a valid end-of-track is detected during a data transfer operation between the storage path and the functional device (other than a Read

Any or Write Any operation) and multitrack mode is specified, the following conditions apply to the operation:

- If the next functional track is in the defined extent, the operation continues at that functional track. If the current functional track is the last track of the cylinder, the operation continues at the first functional track of the next cylinder, provided it is a primary cylinder. If the cylinder is not a primary cylinder, the operation ends and unit check status (command reject and file protected) is presented.
- If the next functional track of the cylinder is not in the defined extent, the operation is terminated and unit check status (file protected) is presented.
- If the next functional track of the cylinder in the defined extent is defective, the operation continues on an alternate functional track assigned by the Controller. If an alternate functional track is not assigned or if the assignment is not valid, the operation is terminated and unit check status (command reject) is presented.

When a valid end-of-track is detected during a Read Any or Write Any operation, the operation continues on the same functional track.

Outside the Locate Record or Locate Record Extended Domain

When an operation is outside the Locate Record or Locate Record Extended domain and bit 0 in the command code is ‘1’, all read and search operations are multitrack operations.

When a read or search command returns to index or when an end-of-track is detected while orienting to a count area, the multitrack operation continues uninterrupted. Multitrack operations do not continue if:

- The file mask inhibit (bits 3 and 4) are set. The operation is terminated and unit check status (file protected) is presented.
- The next functional track is not in the defined extent. The operation is terminated and unit check status (file protected) is presented.
- The current functional track is the last track in the functional cylinder. The operation is terminated and unit check status (end-of-cylinder) is presented.

Command Suspension or Resumption

The SVA may suspend processing a command or command chain and resume the process at a later time, possibly with a different microprocessor. The SVA may do this to avoid tying up. Certain

information is necessary for a processor to resume processing a command that has been suspended. All of the information associated with processing a chain, i.e. command parameters, orientation information, cache track information, etc. is initially written into local memory. When a command is suspended this information is stored in shared memory where the information is available to all of the microprocessors so that the microprocessor that processes the channel reconnection has access to the data.

Command Summary

Those CKD and ECKD commands supported by the SVA are summarized in Table 4 on page 34 along with their command codes. Because of major architectural advances in the subsystem, the SVA may execute certain commands differently than other storage subsystems. Any command code received that is not included in this table is rejected, unit check status is presented, and the sense data returned is format 0, message 1.

The 3990-3 commands not supported by the SVA include:

- Diagnostic Control with the following subcommands:
  - Select Subsystem Data
  - Select Trace
  - Locate Data Checks
  - Start Application
  - Remote Service Access
  - Unfence
  - 3380 Track Compatibility Mode
- Set Subsystem Mode with the following subcommands:
  - Force Cache Unavailable to Subsystem
  - Force Deactivate DASD Fast Write for Device
  - Diagnostic Write

The SVA executes ESCON-related commands in the same manner that other non-ESCON capable subsystems do.

Table 4 Summary of the SVA Channel Commands

Command	Mnemonic	Hex Code	Multitrack Command
Addressing and Control Commands			
Define Extent	DX	63	
Locate Record	LR	47	
Locate Record Extended	LRE	4B	
Seek	SK	07	
Seek Cylinder	SKC	0B	
Seek Head	SKHD	1B	
Recalibrate	RCAL	13	
Set File Mask	SFM	1F	
Set Sector	SS	23	
Read Sector	RS	22	
Read Device Characteristics	RDC	64	
Read Commands			
Read Special Home Address	RSHA	0A	
Read Home Address	RHA	1A	9A
Read Record Zero	RRO	16	96
Read Count, Key, and Data	RCKD	1E	9E
Read Key and Data	RKD	0E	8E
Read Data	RD	06	86
Read Count	RC	12	92
Read Multiple Count, Key, and Data	RMCKD	5E	
Read Track	RT	DE	
Read Initial Program Load (IPL)	RIPL	02	
Search Commands			
Search Home Address Equal	SHA	39	B9
Search ID Equal	SIDE	31	B1
Search ID High	SIDH	51	D1
Search ID Equal or High	SIDEH	71	F1
Search Key Equal	SKE	29	A9
Search Key High	SKH	49	C9
Search Key Equal or High	SKEH	69	E9

Table 4 Summary of the SVA Channel Commands (Continued)

Command	Mnemonic	Hex Code	Multitrack Command
Write Commands			
Write Special Home Address	WSHA	09	
Write Home Address	WHA	19	
Write Record Zero	WR0	15	
Write Count, Key, and Data	WCKD	1D	
Write Count, Key, and Data Next Track	WCKDNT	9D	
Write Update Key and Data	WUKD	8D	
Write Key and Data	WKD	0D	
Write Update Data	WUD	85	
Write Data	WD	05	
Erase	ERAS	11	
Sense Commands			
Sense	SNS	04	
Sense ID	SNSID	E4	
Path Control Commands			
Device Reserve	RES	B4	
Device Release	REL	94	
Unconditional Reserve	UR	14	
Reset Allegiance	RSTA	44	
Set Path Group ID	SPID	AF	
Sense Path Group ID	SNID	34	
Suspend Multipath Reconnection	SMR	5B	
Subsystem Commands			
Set Subsystem Mode	SSM	87	
Perform Subsystem Function	PSF	27	
Sense Subsystem Status	SNSS	54	
Read Subsystem Data	RSSD	3E	
Read Message ID	RMID	4E	

Table 4 Summary of the SVA Channel Commands (Continued)

Command	Mnemonic	Hex Code	Multitrack Command
Miscellaneous Commands			
Test I/O	TIO	00	
No-Operation	NOP	03	
Read and Reset Buffered Log	RRBFL	A4	
Diagnostic Control	DCTL	F3	
Diagnostic Sense/Read	DSNSR	C4	
Diagnostic Write	DWRT	73	
Read Configuration Data	RCD	FA	
Space Count	SPCNT	0F	
Restore	RSTOR	17	

Status Presented To Commands

The *Status Presented To* commands depends on the status of the subsystem and of the device addressed. Table 5 on page 37 summarizes the status presented to commands when the subsystem or device is in one of the conditions described in the following text.

- **State-change-pending** The functional device or storage control is performing an operation that exceeds the time for normal busy states.
- **Busy** status.
- **Device reserved** The device is reserved to another interface as the result of the processing of a Device Reserve command.
- **Channel end and device end split** (Start I/O only) Channel end has been presented, but device end has not been presented on this path group. Busy status is normally presented to a Start I/O.
- **Device not available** The device is not ready or is not installed.
- **Contingent allegiance** The device and/or subsystem is in a contingent allegiance state for another interface.
- **Chain unconditional reserved** The device had allegiance to an interface, and another interface issued an Unconditional Reserve command. The allegiance is broken and sense is built. If status is owed (if status and Unconditional Reserve is received on the same or different interface path or group) then unit check is added to owed status.
  - If the allegiance is explicit, unit check is presented to the next initial selection (Start I/O).

- If implicit allegiance and Unconditional Reserve is received on another interface:
- Then unit check is presented to the next command in the chain during the chained reselection
- The command is allowed to complete (ending status is presented)

  I. If it is the last command in the chain, the chain completes normally and the unit check is presented at the next Start I/O.

  If contingent allegiance and Unconditional Reserve is received on another interface:

  II. If device level allegiance and the Sense command are not received yet, the Sense command is unit checked at the next Start I/O, and allegiance is established again

  III. If channel level allegiance and the Sense command are not received yet, the Sense command is accepted.

- **Reset notify** (Start I/O only) A system reset has been received. Unit check status is normally presented to the next Start I/O on the reset interface.
- **Reset time-out** A channel check condition was detected and the channel has not responded. Unit check status is normally presented to the next Start I/O from that channel, when a Start I/O of all other commands in the table is issued or if unit checked, as shown in the following table.

Table 5 Effect of Subsystem and Device Status on the Status Presented to Commands

Command Mnemonic	Subsystem or Device Status								
	State-Change Pending	(SIO only) Busy	Device Reserved	Channel End/Device End Split	Device Not Available[a]	Contingent Allegiance (on a different interface)	Chain Unconditional Reserved (allegiance terminated)	(SIO only) Reset Notify	Reset Time-out
TIO	Unit check	Busy	Busy	Busy	Unit check	Busy	Unit check	Unit check	Unit check
NOP	Accepted	Busy	Busy	Busy	Unit check	Busy	Unit check	Unit check	Unit check
SPID	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Unit check	Accepted

Table 5 Effect of Subsystem and Device Status on the Status Presented to Commands

Command Mnemonic	Subsystem or Device Status								
	State-Change Pending	(SIO only) Busy	Device Reserved	Channel End/Device End Split	Device Not Available[a]	Contingent Allegiance (on a different interface)	Chain Unconditional Reserved (allegiance terminated)	(SIO only) Reset Notify	Reset Time-out
SNID	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Unit check	Accepted
UR	Accepted	Accepted	Accepted	Accepted	Unit check	Accepted	Accepted	Unit check	Accepted
RSTA	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Unit check	Accepted
RIPL	Unit check	Busy	Busy	Busy	Unit check	Busy	Unit check	Accepted[b]	Accepted
RES	Accepted	Busy	Busy	Busy	Unit check[c]	Busy	Accepted	Unit check	Accepted
REL	Accepted	Busy	Busy	Busy	Unit check[c]	Busy	Accepted	Unit check	Accepted
SNS[d]	Accepted	Busy	Busy	Accepted	Unit check	Busy	Unit check	Unit check	Accepted
SNS[e]	Accepted	Busy	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted
SNS[f]	Accepted	Busy	Accepted	Accepted	Accepted	Accepted	Unit check	Accepted	Unit check
DCTL	Unit check	Busy	Accepted	Busy	Accepted[g]	Busy	Unit check	Unit check	Unit check
SNSS	Accepted	Busy	Accepted	Busy	Accepted	Busy	Unit check	Unit check	Unit check
RDC	Accepted	Busy	Accepted	Busy	Accepted	Busy	Unit check	Unit check	Unit check
SNSID	Accepted	Busy	Accepted	Busy	Accepted	Accepted	Unit check	Unit check	Unit check
RCD	Accepted	Busy	Accepted	Busy	Accepted	Busy	Unit check	Unit check	Unit check
PSF	Unit check	Busy	Busy	Busy	Accepted[h]	Busy	Unit check	Unit check	Unit check
RSSD	Unit check	Busy	Busy	Busy	Accepted[i]	Busy	Unit check	Unit check	Unit check
RMID	Unit check	Busy	Busy	Busy	Accepted[j]	Busy	Unit check	Unit check	Unit check
SSM	Unit check	Busy	Busy	Busy	Accepted	Busy	Unit check	Unit check	Unit check

Table 5 Effect of Subsystem and Device Status on the Status Presented to Commands

Command Mnemonic	Subsystem or Device Status								
	State-Change Pending	(SIO only) Busy	Device Reserved	Channel End/Device End Split	Device Not Available[a]	Contingent Allegiance (on a different interface)	Chain Unconditional Reserved (allegiance terminated)	(SIO only) Reset Notify	Reset Time-out
SMR	Accepted	Busy	Busy	Busy	Accepted	Busy	Unit check	Unit check	Unit check
All Others	Unit check	Busy	Busy	Busy	Unit check	Busy	Unit check	Unit check	Unit check

a For the SVA, device not available indicates the functional device is not configured or it has been logically disabled.
b The reset notification mark is reset.
c Accepted if the functional device has been logically disabled. Unit checked if the functional device is not configured.
d No contingent allegiance for this interface.
e Contingent allegiance at the subsystem level for this interface.
f Contingent allegiance at the device level for this interface.
g Only the Diagnostic Initialize Subsystem order of the Diagnostic Control command is accepted.
h Only the Discard, Prepare for Read Subsystem Data, and Set Interface Identifier orders of the Perform Subsystem Function command are accepted. Read Subsystem Data command is accepted when chained from the Prepare for Read Subsystem Data order.
i Only the Access Device in Unknown Condition order is accepted. The Diagnostic Initialize Subsystem order receives a unit check in ending status, *except* in one case: format D, message F, Reason ID. The exception was: issued to non-existent device (no config) accepted.
j Accepted only if chained from the appropriate subcommand. Otherwise, the SVA issues a channel command retry and then unit check (intervention required) is presented.

Addressing and Control Commands

Basic Address And Control Commands

The basic address and control commands are listed below. Refer to "Channel Commands and Parameter Information" on page 213 for information about how the SVA processes these commands as compared to the way an IBM 3990 handles them. For specific details of these commands, refer to the IBM manual *IBM 3990 Storage Control Reference*, GA32-0099.

Table 6 Addressing Commands, Mnemonics and Hex Codes

Command	Mnemonic	Hex Code
Define Extent	DX	63
Locate Record	LR	47
Locate Record Extended	LRE	4B
Seek	SK	07
Seek Cylinder	SKC	0B
Seek Head	SKHD	1B
Recalibrate	RCAL	13
Set File Mask	SFM	1F
Set Sector	SS	23
Read Sector	RS	22
Read Device Characteristics	RDC	64

Read Device Characteristics

The Read Device Characteristics command sends the channel 64 bytes of device characteristics about the functional device being addressed. The format of this functional device information is described in the following table:

Table 7 Read Device Characteristics Format

Bytes	Contents
0-1	Functional storage control type
2	Functional storage control model number
3-4	Functional device type
5	Functional device model
6-9	Functional device and storage control facilities
10	Functional device class code
11	Functional device type code
12-13	Number of functional primary cylinders
14-15	Functional tracks per functional cylinder
16	Number of sectors emulated
17-19	Total functional track length usable for user data records
20-21	Length of functional HA and record zero tracks

Table 7 Read Device Characteristics Format (Continued)

Bytes	Contents
22	Functional track capacity calculation formula code
23-27	Functional track capacity calculation factors
28-29	Address of the first alternate functional cylinder
30-31	Number of alternate functional tracks
32-33	Address of first diagnostic functional cylinder
34-35	Number of diagnostic functional tracks
36-37	Address of the first device support functional cylinder
38-39	Number of device support functional tracks
40	MDR record ID
41	OBR record ID
42	Functional storage control type code
43	Read trackset parameter length
44-45	Maximum record zero data length
46	Binary zeros (reserved)
47	Track set size
48	Additional functional track capacity calculation factors
49-50	RPS sector calculation factors
51-53	Binary zeros (reserved)
54	Generic functional device and storage control functions and features
55	Always set to zero (reserved)
56	“Real” functional storage control code
57	“Real” functional device OBR code
58-63	Always set to zero (reserved)

The following condition applies to a Read Device Characteristics command; if the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Refer to “Status Presented To Commands” on page 36, which describes the actions of this command when other subsystem and device status conditions occur.

Ending Status

The storage path presents channel end and device end status when the data transfer operation is complete. The Read Device Characteristics (RDC) command resets the orientation of the storage path.

RDC Bytes 0 and 1

Contain the four-digit functional storage control type number as four hexadecimal digits.

RDC Byte 2

Identifies the functional storage control model number and the supported architecture. The active bits specify:

Table 8 RDC Byte 2

Bits	Meaning
0-1	Architecture support
2	Non synchronous support
3	Not used
4	Cache information
5-7	Functional storage control model information

RDC Bytes 3 and 4

Contain the four-digit functional device type number as four hexadecimal digits.

RDC Byte 5

Contains the functional device model and features.

RDC Bytes 6 through 9

Show the program-visible facilities in the functional device and the functional storage control.

Table 9 RDC Byte 6

Bits	Meaning
0	Multiple burst ECC (always set to ’1’)
1	Subsystem supports Read Track operations in a Locate Record domain (always set to ’1’)
2	Reserved (always set to ’0’)
3	Subsystem supports Read operations in a Locate Record domain (always set to ’1’)

Table 9 RDC Byte 6 (Continued)

Bits	Meaning
4-5	Reserved (always 00)
6	Prefix command supported (always set to 0 since a Prefix command issued by a Subsystem Host is rejected)
7	Reserved (always set to ’0’)

Table 10 RDC Byte 7

Bits	Meaning
0-7	Reserved (always zero)

Table 11 RDC Byte 8

Bits	Meaning
0	Defective primary track (always set to ’0’)
1	XRC supported (always set to ’0’)
2	PPRC supported (set to 1 if PPRC is enabled)
3	Striping/Compaction on parallel channels (always set to ’1’)
4	Not used (always set to ’0’)
5	Deactivate cache not required on Establish Duplex Pairs (always set to ’0’)
6-7	Reserved (always 00)

Table 12 RDC Byte 9

Bits	Meaning
0	Cache fast write (always set to ’1’)
1	Multipath Lock Facility (always set to ’0’)
2	Record cache (always set to ’0’)
3	Track cache (always set to ’1’)
4	Dual copy (always set to ’0’)
5	DASD fast write (always set to ’1’)
6	Reset allegiance (always set to ’1’)
7	24-Byte compat sense format (set to ‘1’ for 3380s, and ‘0’ for 3390s)

RDC Byte 10

Contains an eight-bit functional device class code.

RDC Byte 11

Contains an eight-bit functional device type code.

RDC Bytes 12 and 13

Contain an unsigned, 16-bit binary value that indicates the number of primary cylinders on the functional device. The highest primary cylinder address on the device is one less than the value in Bytes 12 and 13.

RDC Bytes 14 and 15

Contain an unsigned, 16-bit binary value that indicates the number of functional tracks in a functional cylinder. The highest valid functional track address in any functional cylinder is one less than the value in Bytes 14 and 15.

RDC Byte 16

Contains an unsigned, eight-bit binary value that indicates the number of sectors in a track. The highest valid sector number for the device (excluding X'FF') is one less than the value in Byte 16.

RDC Bytes 17 through 19

Contain an unsigned, 24-bit binary value that indicates the total number of usable bytes on each functional track. This value is valid after the track has been formatted with a home address and a standard record zero. This value is the maximum number of bytes available for formatting user data

records, and includes all space that the count areas occupy, and device dependent recording items (such as gaps and ECC bytes) that are associated with the records.

Note: A set of user data records can be written on a functional track if the sum of the space values of the records calculated by the formula specified in Byte 22 is equal to or less than the value in Bytes 17 through 19.

RDC Bytes 20 and 21

Contain an unsigned, 16-bit binary value that indicates the total amount of bytes used for a home address and a standard record zero. This value includes the space occupied by device-dependent recording items (such as gaps and ECC bytes) that are associated with home address and record zero.

RDC Byte 22

Contains an unsigned, eight-bit binary value that specifies the formula to perform track capacity calculations for the device. When Byte 22 is

’1’, the amount of space occupied by a record is calculated by the formula:

Example:

```
SPACE = (F2 + DL) + (F3 + KL)
```

Where:

- DL is the data length and KL is the key length
- F2 is the unsigned, 16-bit binary value contained in Bytes 24 and 25
- F3 is the unsigned, 16-bit binary value contained in Bytes 26 and 27
- Each term in parentheses is rounded up to an integral multiple of F1, the unsigned, eight-bit binary value contained in Byte 23
- The second term in parentheses (i.e., F3 + KL) is zero when the key length is zero.

When Byte 22 is ’2’, the amount of space occupied by a record is calculated by the formula:

Example:

```
SPACE = FL1 + FL2
```

Where:

- FL1 = (F1 x F2) + DL + F6 + (F4 x INT1)
- FL2 = (F1 x F3) + KL + F6 + (F4 x INT2), except when the key length is zero
- FL2 = 0 when the key length is zero
- FL1 and FL2 are rounded up to an integral multiple of F1
- DL is data length and KL is key length
- F1 is the unsigned, eight-bit binary value contained in Byte 23
- F2 is the unsigned, eight-bit binary value contained in Byte 24
- F3 is the unsigned, eight-bit binary value contained in Byte 25
- F4 is the unsigned, eight-bit binary value contained in Byte 26
- F5 is the unsigned, eight-bit binary value contained in Byte 27
- F6 is the unsigned, eight-bit binary value contained in Byte 48
- INT1 = the smallest integer that is greater than or equal to (DL + F6) - (F5 x 2)
- INT2 = the smallest integer greater than or equal to (KL + F6) - (F5 x 2)

RDC Bytes 23 through 27

Contain the factors that are used in the functional track capacity calculation formulas. Refer to “RDC Byte 22” on page 44.

RDC Bytes 28 and 29

Contain an unsigned, 16-bit binary value that is the address (CC) of the first functional cylinder that contains alternate functional tracks.

RDC Bytes 30 and 31

Contain an unsigned, 16-bit binary value that is the number of alternate functional tracks on the functional device.

RDC Bytes 32 and 33

Contain an unsigned, 16-bit binary value that is the address (CC) of the first functional cylinder that contains diagnostic tracks.

RDC Bytes 34 and 35

Contain an unsigned, 16-bit binary value that is the number of diagnostic tracks on the device.

RDC Bytes 36 and 37

Contain an unsigned, 16-bit binary value that is the address (CC) of the first functional cylinder that contains device-support tracks.

RDC Bytes 38 and 39

Contain and unsigned, 16-bit binary value that is the number of device-support functional tracks on the functional device.

RDC Byte 40

Contains an eight-bit miscellaneous data recorder (MDR) ID for the functional device.

RDC Byte 41

Contains an eight-bit outboard recorder (OBR) ID for the functional device.

RDC Byte 42

Contains an eight-bit binary value that specifies the functional storage control type, model, and features.

RDC Byte 43

Contains an unsigned, eight-bit binary value that is the maximum length (in bytes) supported by this functional device for the extended parameter of the Read Trackset extended operation of the Locate Record Extended command.

RDC Bytes 44 and 45

Contain an unsigned, 16-bit binary value that is the maximum data area length for a record zero when the key length is zero.

RDC Byte 46

Always set to zero (reserved)

RDC Byte 47

Contains an unsigned, eight-bit binary value. This byte is “0” when the subsystem does not support the Write Any and Read Any (roll-mode) operations of the Locate Record Extended command. This byte is “1” when the subsystem does support these roll-mode operations, which performed on a single functional track.

RDC Byte 48

Contains F6, which is a factor used in the functional track capacity calculation formula. Refer to “RDC Byte 22” on page 44.

RDC Bytes 49 and 50

Byte 49 contains the unsigned, eight-bit binary value of F7, which is one-half the sum of the number of bytes between the end of record zero and the cell containing the start of record one plus the difference in length (in bytes) between a standard RPS sector and RPS sector zero.

Byte 50 contains the unsigned, eight-bit binary value of F8, which is the number of cells per RPS sector. The factors in Bytes 49 and 50 are used in the RPS sector calculation formula. The appropriate sector number for a Locate Record or a Set Sector command is the smallest integer that is equal to or less than the result of the following formula:

Example:

```
Sector = CO + (2 x F7) + NetSpace - (F1 x F8)
```

Where:

- CO is the unsigned, 16-bit binary value contained in Bytes 20 and 21
- F7 is the unsigned, eight-bit binary value contained in Byte 49
- NetSpace is the sum of the space values for all of the records on the functional track prior to the target record, excluding record zero. NetSpace is calculated by the formula in “RDC Byte 22” on page 44.
- F1 is the unsigned, eight-bit binary value contained in Byte 23
- F8 is the unsigned, eight-bit binary value contained in Byte 50.

RDC Bytes 51-53

Always set to zeros (reserved)

RDC Byte 54

Contains an 8-bit binary value that indicates the generic functional device and storage control functions and features that are supported.

RDC Byte 55

Always set to zeros (reserved)

RDC Byte 56

Contains an 8-bit “real” functional storage control code. When this byte is non-zero, Byte 42 contains the “emulated” functional storage control code.

RDC Byte 57

Contains an 8-bit “real” functional device OBR code. When this byte is non-zero, Byte 41 contains the “emulated” functional device OBR code.

RDC Bytes 58-63

Always set to zeros (reserved)

Read Commands

Refer to “Channel Commands and Parameter Information” on page 213 for information about how the SVA processes these commands as compared to the IBM 3990.

Table 13 Read Commands, Mnemonics, and Hex Codes.

Command	Mnemonic	Hex code
Read Special Home Address	RSHA	0A
Read Home Address	RHA	1A
Read Record Zero	RR0	16
Read Count, Key, and Data	RCKD	1E
Read Key and Data	RKD	0E
Read Data	RD	06
Read Count	RC	12
Read Multiple Count, Key, and Data	RMCKD	5E
Read Track	RT	DE
Read Initial Program Load	RIPL	02

Search Commands

Refer to "Channel Commands and Parameter Information" on page 213 for information about how the SVA processes these commands as compared to the IBM 3990.

Table 14 Search Commands, Mnemonics, and Hex Codes

Command	Mnemonic	Hex code
Search Home Address Equal	SHA	39
Search ID Equal	SIDE	31
Search ID High	SIDH	51
Search ID Equal or High	SIDEH	71
Search Key Equal	SKE	29
Search Key High	SKH	49
Search Key Equal or High	SKEH	69

Write Commands

Refer to "Channel Commands and Parameter Information" on page 213 for information about how the SVA processes these commands as compared to the IBM 3390.

Table 15 Write Commands, Mnemonic, and Hex Codes

Command	Mnemonic	Hex code
Write Padding	The SVA does not write pad.	
Write Special Home Address	WSHA	09
Write Home Address	WHA	19
Write Record Zero	WR0	15
Write Count, Key, and Data	WCKD	1D
Write Count, Key, and Data Next Track	WCKDNT	9D
Erase	ERAS	11
Write Update Key and Data	WUKD	8D
Write Key and Data	WKD	0D
Write Update Data	WUD	85
Write Data	WD	05

Sense Commands

Sense

Table 16 Sense Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Sense	SNS	04

The Sense command causes 32 bytes of error information to be sent to the channel.

Note: The SVA also returns “informational SIMs” in response to a sense command. These SIMs are not related to hardware failures, but, rather, are used to convey certain SVA-specific information to the customer.

If the Sense command is not preceded by unit check status for this device on this interface, it is “unsolicited” and the 32 bytes of sense data returned are format 0, message 0, and Bytes 0 through 3, 5 through 10, 22 through 25, and 28 and 29 are zeros. Refer to “24-Byte Compatibility Sense Data” on page 151 for information on 24-byte compatibility sense data formats and messages.

After the transfer of data, channel end and device end are presented to the channel by the storage path.

The following conditions apply to a Sense command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If a Sense command is issued and is followed by other commands, the device does not accept the chained commands.

Refer to “Status Presented To Commands” on page 36 for more information about this command during other subsystem and device conditions.

Sense ID

Table 17 Sense ID Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Sense ID	SNSID	E4

The Sense ID command causes 24 bytes of specific subsystem information to be transferred to the channel. This information identifies

the control unit, device type, and special command usage. A parallel channel transfers 12 bytes of information, while an ESCON channel transfers 20 bytes.

If a device has never been available to the subsystem, the device model cannot be determined. In this case, or if the device is absent, Bytes 4 through 6 (device type and model number bytes) contain zeros. After the data is transferred, channel end and Device End are presented to the channel by the storage path.

Bytes 8-19 contain 4-byte CIW fields.

- CIW #1 (Bytes 8-11) indicates to the channel that the Read Configuration Data function is performed on this device with a CCW command code of 0xFA (Read Configuration Data) using a byte count of 0x0100. The value of Bytes 8-11 is 0x40FA0100.
- CIW #2 (Bytes 12-15) indicates to the channel that the Set Interface Identifier function is performed on this device with a CCW command code of 0x27 (Perform Subsystem Function) using a byte count of 0x0004. The value of Bytes 12-15 is 0x41270004.
- CIW #3 (Bytes 16-19) indicates to the channel that the Read Node Identifier function is performed on this device with a CCW command code of 0x3E (Read Subsystem Data) using a byte count of 0x0080. The value of Bytes 16-19 is 0x423E0080.

The following table describes the data that is sent to the channel when a Sense ID command is received.

The following condition applies to a Sense ID command: if the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Table 18 Sense ID Status Bytes

Bytes	Value (Hexadecimal)	Description
0	FF	
1-2	3990	Functional storage control type
3	Functional Storage Control Module	
	CC	Functional 3990-3 (synchronous)
	EC	Functional 3990-3 (non synchronous)

Table 18 Sense ID Status Bytes (Continued)

Bytes	Value (Hexadecimal)	Description
4-5	Functional Device Type	
	3380	Functional 3380
	3390	Functional 3390
6	Functional Device Model	
	Functional 3380	
	16	3380-J (AJ4/BJ4)
	1E	3380K, 3380(6EA)K (AK4/BK4)
	Functional 3390 (3390 Mode)	
	02	3390-1 (A18/B1C)
	06	3390-2 (A28/B2C)
	0A	3390-3 (A38/B3C)
	0C	3390-9 (A98/B9C)
7	00	Not used
8	40	Read Configuration Data command information
9	FA	Read Configuration Data command code
10-11	0100	Number of bytes transferred by the Read Configuration Data command
12	41	Set Interface Identifier (SIID) Information
13	27	Perform Subsystem Function command code (command code for SIID order)
14-15	0004	Number of parameters required for SIID order of PSF command
16	42	Read Node Identifier Information
17	3E	Read Node Identifier command code
18-19	0080	Number of bytes transferred for a Read Node Identifier request

Miscellaneous Commands

Test I/O

Table 19 Test I/O Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Test I/O	TIO	00

The Test I/O command reports device status and identifies any errors or unusual conditions to the channel. In addition, the Test I/O command may be self-initiated by the channel to end or suspend a channel program.

The channel uses the Test I/O command when immediate device status information is required. It appears to the storage path as a command byte of all zeros and is given priority status.

Any stacked or pending sense information is presented to the channel during initial status, and does not change unless a unit check occurs. If a unit check occurs, new channel path sense information (related to the unit check) replaces the previous sense information.

The following condition applies to the Test I/O command: if the command is issued to a nonparallel (ESCON) channel, the command is rejected, unit check status is presented, and the sense data returned is format 1 (invalid command).

No-Operation

Table 20 No-Operation Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
No-Op	NOP	03

The No-Operation command must be used carefully. It checks the logical device status, but also resets orientation when operating with cache or DASD. A No-Operation command within a CCW chain may skip one or more records or parts of records depending on variables such as record lengths and channel processing times. If, for example, a No-Operation command is issued between a Read Count and a Read Data command, the data area of the following record is read.

The storage path processes a No-Operation command immediately and presents channel end and device end during initial status.

Any stacked or pending sense information is presented to the channel during initial status, and does not change unless a unit check occurs. If a unit check occurs, new channel path sense information (related to the unit check) replaces the previous sense information.

The following conditions apply to a No-Operation command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the byte count is zero, a program check may occur on some systems.
- If the SLI bit is not ‘1’ when a nonzero byte count is specified in the command, an incorrect length exception occurs.

Read and Reset Buffered Log

Table 21 Read and Reset Buffered Log Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Read and Reset Buffered Log	RRBFL	A4

The Read and Reset Buffered Log command causes 32 bytes of usage information to be sent to the channel. The usage information pertains to the functional device addressed by the Start I/O. The format of the 32 bytes is device-dependent. Refer to “24-Byte Compatibility Sense Data” on page 151 for functional 3380 device type byte format information or “ECKD 32-Byte Sense Data” on page 129 for functional 3390 device type byte format information.

Note: Format 6 sense data is returned for 3380-type devices; Exception class 6 sense data is returned for 3390-type devices.

SVAThe usage information is reset to zero after the data is transferred to the channel. Channel and device end status is presented to the channel when the data transfer is complete and the usage information is reset.

The following condition applies to a Read and Reset Buffered Log command: if the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Diagnostic Control

The Diagnostic Control command sends four bytes of parameter data to the storage path. The parameters specify a service or information

request. The mnemonic for this command is DCTL, and the hex code is F3. Refer to the subcommand descriptions for parameter descriptions, and parameter dependent ending status presentation.

Table 22 Diagnostic Control Parameters

Byte	Parameter	Function
0	Subcommand Byte	
	01[1]	Locate Data Checks
	02[2]	Inhibit Write
	04[2]	Set Guaranteed Path
	06[1]	Select Subsystem Data
	07[1]	Select Trace
	08[2]	Enable Write
	09[1]	3380 Track Compatibility Mode Control
	0A[2]	Prepare Remote Support Access Code
	0B	Diagnostic Initialize Subsystem
	0C[1]	UnFence
	0D[1]	Start Application
	0F	Access Device in Unknown Condition
	10[2]	Media Maintenance Reserve
	11[2]	Media Maintenance Release
	12[2]	Media Maintenance Query
	13[1]	Remote Service Access
1	Subcommand modifier[3]	
2-3	0000	Always set to zeros

Notes:

1. Unit check with format 0, message 4 (invalid parameter)
2. Treated as a No-Operation, so no operation is performed. The subcommand validation is performed as for the 3390.
3. Refer to the subcommand descriptions for more detailed information about the subcommand modifiers.

The following conditions apply to a Diagnostic Control command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the special intercept condition is in effect, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F. Refer to the Set Special Intercept Condition order of the Perform Subsystem Function command.
- If the channel sends fewer than four bytes, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 3.
- The command is rejected, unit check status is presented, and the sense data returned is format 0, message 4, if the subcommand is:

Code	Subcommand
(01)	Locate Data Checks
(06)	Select Subsystem Data
(07)	Select Trace
(09)	3380 Track Compatibility
(0C)	Unfence
(0D)	Start Application
(13)	Remote Service Access

- If byte 0 does not contain a valid value (refer to Table 22 on page 55), or Bytes 2 and 3 are not zeros, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If the subcommand is ‘0F’ (access device is in an unknown condition), the command is rejected, unit check status is presented, and the sense data returned is format 0, message F, reason code 0x1E.
- If the command is preceded by a Seek, Seek Cylinder, Read IPL, or Recalibrate command and the subcommand is not ‘10’ or ‘11’, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- The command is rejected, unit check status is presented, and the sense data returned is format 0, message 5, if the following

subcommands do not have either a diagnostic authorization or device support authorization. See the table below.

Code	Subcommand
(02)	Inhibit Write
(04)	Set Guaranteed Path
(08)	Enable Write
(10)	Media Maintenance Reserve
(11)	Media Maintenance Release
(12)	Media Maintenance Query

- The command is rejected, unit check status is presented, and the sense data returned is format 0, message 2, if the following subcommands are not the first command in the command chain or are not chained directly from a Suspend Multipath Reconnection command that is the first command in the command chain:

Code	Subcommand
(0A)	Prepare Remote Support Access Code
(0B)	Diagnostic Initialize Subsystem
(0F)	Access Device in Unknown Condition

Byte 0 - Subcommand Byte

The subcommand byte parameter specifies a service or information request. The following values are the only valid values for byte 0.

Note: In the following descriptions of the subcommands, “Treated as a No-Operation” means that the subcommand has no effect on subsystem operations.

Locate Data Checks - ‘01’ Subcommand

Records the location of data checks for functional 3380J, 3380K, and 3390 devices. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Inhibit Write - ‘02’ Subcommand

Allows the storage director to reject further write operations through the path specified in the subcommand modifier. The SVA treats this command as a No-Operation. Channel end and device end status is

presented to the channel. Exception: If the subcommand modifier is not valid, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

Table 23 '02' - Inhibit Write Subcommand Modifiers

Byte 1	Modifier Description
80	Inhibit Write operations to all devices through the specified storage director
40	Inhibit Write operations to all devices through the specified storage director for the specified channel path.
20	Inhibit Write operations through the specified DASD controller for the specified channel path.

Set Guaranteed Path - '04' Subcommand

Specifies the internal path the selected storage director is to use for the remainder of the channel program. The subcommand modifier (byte 1) specifies the storage path for the selected storage director.

The SVA treats this command as a No-Operation. Channel end and device end status is presented to the channel. Exception: If the subcommand modifier is not valid, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

Table 24 '04' - Set Guaranteed Path Subcommand Modifiers

Byte 1	Modifier Description
00	DLSE Mode: selects Path 0 in Cluster 0 or Path 2 in Cluster 1
01	DLSE Mode: selects Path 1 in Cluster 0 or Path 3 in Cluster 1

Select Subsystem Data - '06' Subcommand

Specifies the type of the subsystem trace or log data that is to be sent to the channel. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Select Trace - '07' Subcommand

Specifies that a trace is to be sent to the channel. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Enable Write - ‘08’ Subcommand

Resets all Inhibit Write subcommands previously set by the storage director receiving the Enable Write command. The SVA treats this command as a No-Operation. Channel end and device end status is presented to the channel. Exception: If the subcommand modifier is not ‘0’, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

3380 Track Compatibility Mode Control - ‘09’ Subcommand

Switches a specified function 3390 device between 3390 Mode and 3380 Track Compatibility Mode, and is used on non synchronous channels only. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Prepare Remote Support Access Code - ‘0A’ Subcommand

SVAIndicates a request for a remote support access code. The access code is generated and returned to the channel during processing for the immediately following Diagnostic Sense/Read. The Diagnostic Sense/Read command is placed in retry status until the access code is received from the support processor. The access code authorizes remote maintenance attachment to the support processor. The storage path presents channel end and device end after it accepts the parameters.

If byte 1, bits 1 through 7 are not zeros, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

Table 25 ‘0A’ - Prepare Remote Access Code Subcommand

Byte 1	Modifier Description
Bit 0	‘0’ - Storage cluster 0 ‘1’ - Storage cluster 1
Bits 1-7	Always zeros

Note: Remote support access codes are not cluster-specific for the SVA. The access code returned is for the subsystem, not for the specified cluster. However, for compatibility with certain host applications, the cluster number specified by the subcommand modifier is imbedded in the access code returned. The most recent access code returned supersedes all preceding access codes. For example, if two requests for access codes are received in rapid succession, the access code

returned for the second request is valid and invalidates the access code returned for the first request.

Diagnostic Initialize Subsystem - ‘0B’ Subcommand

This command resets the functional storage control caching status to its defaults, which are cache available, NVS available, DFW active, device caching active, and CFW active. It also causes all modified tracks in cache, for all functional devices of the functional storage control, to be destaged, sets all PPRC devices of the functional storage control to the simplex state, and removes all PPRC paths from the functional storage control to any secondary functional storage controls. The storage path presents channel end and device end after it accepts the parameters.

Note: The SVA presents the image of up to sixteen 3390 storage controls. Each of these images is referred to as a “functional storage control”. When processing a Diagnostic Initialize Subsystem command, “subsystem” refers to a functional storage control. The specific functional storage control affected is determined by the functional device addressed by the command.

The functional devices of the functional storage control are state-change-pending for the duration of the operation.

A state-change-interruption is set pending for all devices in the subsystem when the operation completes.

The requested action is specified by the subcommand modifier (Byte 1). The table below describes the Diagnostic Initialize Subsystem subcommand modifier parameter.

Table 26 ‘0B’ - Diagnostic Initialize Subsystem Subcommand

Byte 1	Modifier Description
00	Conditional Reset/Establish Subsystem Status: *Use only if the subsystem does not have valid status tracks.* (Not applicable with the SVA.)
01	Unconditional Reset/Establish Subsystem Status: Resets functional storage control caching status to default (installation) values. All modified tracks in cache for the functional devices of the functional storage control are destaged and all PPRC volumes are terminated.
02-FF	Not Valid

The following conditions apply to a Diagnostic Control command with a Diagnostic Initialize Subsystem (0B) subcommand:

- If byte 1 is ‘00’, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F, reason code 0x20.
- If byte 1 is not valid, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If all PPRC primary devices in the functional storage control other than the device addressed by the Diagnostic Control command are not offline (i.e. cannot be allocated by the Controller), or if there are any asynchronous channel command operations in progress in the functional control unit, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F, reason code 00.

Unfence - ‘0C’ Subcommand

The Unfence subcommand removes a fence from the storage path or individual devices. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Start Application - ‘0D’ Subcommand

The Start Application subcommand prepares the subsystem for a Diagnostic Write command. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Access Device in Unknown Condition - ‘0F’ Subcommand

The Access Device in Unknown Condition subcommand allows status recovery of the selected device when the status is not known because the status track is unreadable or invalid.

This condition does not exist with the SVA. The command is rejected, unit check status is presented, and the sense data returned is format 0, message F, reason code 0x1E. (The command is supported, but always unit checked. Functional device status is always available to the SVA.)

Media Maintenance Reserve - ‘10’ Subcommand

The Media Maintenance Reserve subcommand reserves a selected device for media maintenance and is active only during the channel program that issues it. The SVA treats this command as a No-Operation. Channel end and device end status is presented to the channel. Exceptions:

- If the subcommand modifier is not ‘0’, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If the subcommand is not chained directly from a successful search command, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Media Maintenance Release - ‘11’ Subcommand

The Media Maintenance Release subcommand either releases the selected device from the “Media Maintenance Reserve” state, or ends the ”transition” state to or from the 3380 track compatibility mode. The SVA treats this command as a No-Operation. Channel end and device end status is presented to the channel. Exception: If the subcommand modifier is not ‘0’, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

Media Maintenance Query - ‘12’ Subcommand

The Media Maintenance Query subcommand checks the selected device returning “normal status” if the device is not in the “Media Maintenance Reserve” state or in transition to or from 3380 Track Compatibility Mode. The SVA treats this command as a No-Operation. Channel end and device end status is presented to the channel. Exception: If the subcommand modifier is not ‘0’, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

Remote Service Access - ‘13’ Subcommand

The Remote Service Access subcommand checks the preceding Define Extent command parameters, restricts the type of Diagnostic Control subcommands that are accepted, and allows update writes to functional 3390 device support tracks. The SVA does not support this command. The command is rejected; channel end, device end, and unit check status are presented; and the sense data returned is format 0, message 4.

Diagnostic Sense/Read

Table 27 Diagnostic Sense/Read Command

Command	Mnemonic	Hex Code
Diagnostic Sense/Read	DSNSR	C4

For the SVA, the Diagnostic Sense/Read command sends 12 bytes of remote support access information to the channel and must be

preceded by a Diagnostic Control command in the same CCW chain that specifies “Prepare Remote Support Access Code” Refer to “Diagnostic Control” on page 54 for an explanation of this subcommand.

Since the remote support access code is generated by the support processor, the Diagnostic Sense/Read command is kept in retry status until the storage path receives the information. Channel end and device end are presented to the channel by the storage path when the transfer of data is complete.

The table below describes the Diagnostic Control command subcommands relevant to the Diagnostic Sense/Read command for the SVA.

Note: Refer to Table 22 on page 55 for the complete list of Diagnostic Control command subcommands.

Table 28 Byte 0 - Diagnostic Control Command Subcommands

Byte 1	Bit Value	Function
0-7	0A	Prepare Remote Support Access Code

The following conditions apply to a Diagnostic Sense/Read command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is first in a chain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is not immediately preceded by a Diagnostic Control command that specifies Prepare Remote Support Access Code, the command is rejected, unit check status is presented, and the sensed data returned is format 0, message 2.

Diagnostic Write

Table 29 Diagnostic Write Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Diagnostic Write	DWRT	73

The Diagnostic Write command transfers up to 258 bytes of information from the channel to the subsystem. A Diagnostic Control command with a Start Application (0D) subcommand must precede the

Diagnostic Write command. However, since a Diagnostic Control command with a Start Application subcommand is invalid for the SVA, the Diagnostic Write command is also invalid for the SVA.

If this command is chained to a Diagnostic Control command with a Start Application subcommand, it is not processed; the Diagnostic Control command is rejected.

If this command is not chained from a Diagnostic Control command, or if it is issued as the only command in a chain, the command is rejected and the sense data returned is format 0, message 1.

Read Configuration Data

Table 30 Read Configuration Data Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Read Configuration Data	RCD	FA

The Read Configuration Data command causes 256 bytes of configuration information to be sent to the channel.

The command is organized into four node element descriptors (NEDs) and one node element qualifier (NEQ) that help make it easier to identify and track a physical subsystem and its components as well as its addresses and logical paths.

Because of architectural differences between an SVA subsystem and an IBM 3990-3 subsystem, the SVA returns slightly different information in response to a Read Configuration Data command than a 3390-3 does. The following sections, which are separated according to the NEDs and the NEQ, describe the data that the SVA subsystem returns in response to this command.

The following condition applies to a Read Configuration Data command: if the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2. Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Bytes 0 through 31 - NED 1

Bytes 0 through 31 are described as Node Element Descriptor 1 (NED 1) and contain head-disk assembly (HDA) information..

Table 31 Read Configuration Data Bytes 0 through 31

Byte	Hex Value	Meaning
0	CC	Flags **Bit** **Meaning** 0-1 Field identifier (always ‘11’ = NED) 2 Token indicator (always set to ’0’) 3 Serial number valid (always set to ’0’) 4 Substitute serial number (always set to ’1’) 5 Reconfiguration NED (always set to ’1’) 6-7 Reserved (always ’00’)
1	01	NED Type (01 = I/O Device)
2	01	Class (01 = DASD)
3	00	Reserved
4-9	 4040F3F3F8F0 4040F3F3F9F0 4040F0F0F0F0	Functional device type in EBCDIC: for 3380-type device for 3390-type device for undefined device
10-12	Refer to page 72	Functional device model in EBCDIC
13-15	E2E3D2	HDA manufacturer in EBCDIC (E2E3D2 = STK)
16-17	F0F1 or F0F2	HDA manufacturing location in EBCDIC: • F0F1 = Louisville, Colorado • F0F2 = Puerto Rico
18-29		Unit sequence number in EBCDIC: the Controller assembly serial number, which is riveted to the front of the frame in the upper right corner.
30-31	0000-0FFF	HDA ID tag - the functional device ID (FDID). Each functional device is considered to be a unique HDA.

Bytes 32 through 63 - NED 2

Bytes 32 through 63 are described as Node Element Descriptor 2 (NED 2) and contain DASD string information.

Table 32 Read Configuration Data Bytes 32 through 63

Byte	Hex Value	Meaning
32	CC	Flags **Bit** **Meaning** 0-1 Field identifier (always ‘11’ = NED) 2 Token indicator (always set to ’0’) 3 Serial number valid (always set to ’0’) 4 Substitute serial number (always set to ’1’) 5 Reconfiguration NED (always set to ’1’) 6-7 Reserved (always ’00’)
33	00	NED Type (00 = unspecified type)
34-35	0000	Reserved (always set to ’0’)
36-41	 4040F3F3F8F0 4040F3F3F9F0 4040F0F0F0F0	Functional device type in EBCDIC: for 3380-type device for 3390-type device for undefined device
42-44	 C1E7F4 C1E7F8 C1E7F0	Functional device model in EBCDIC: for 3380-type device (AX4) for 3390-type device (AX8) for undefined device (AX0)
45-47	E2E3D2	DASD manufacturer in EBCDIC (E2E3D2 = STK)
48-49	F0F1 or F0F2	DASD manufacturing location in EBCDIC • F0F1 = Louisville, Colorado • F0F2=Puerto Rico
50-61		DASD sequence number in EBCDIC: the Controller assembly serial number, which is riveted to the front of the frame in the upper right corner.

Table 32 Read Configuration Data Bytes 32 through 63 (Continued)

Byte	Hex Value	Meaning
62-63		DASD string ID tag - the most significant 7 bits of the 12-bit FDID, to uniquely identify 1 of 128 possible "DASD strings:"
	0000	for functional devices 00-1F
	0020	for functional devices 20-3F
	0040	for functional devices 40-5F
	0060	for functional devices 60-7F
	0080	for functional devices 80-9F
	00A0	for functional devices A0-BF
	00C0	for functional devices C0-DF
	00E0	for functional devices E0-FF
	0100	for functional devices 100-11F
	0120	for functional devices 120-13F
	.	.
	.	.
	.	.
	0FC0	for functional devices FC0-FDF
	0FE0	for functional devices FE0-FFF

Bytes 64 through 95 - NED 3

Bytes 64 through 95 are described as Node Element Descriptor 3 (NED 3) and contain storage director information.

Table 33 Read Configuration Data Bytes 64 through 95

Byte	Hex Value	Meaning
64	D4	Flags **Bit** **Meaning** 0-1 Field identifier (always '11' = NED) 2 Token indicator (always set to '0') 3 Serial number valid (always set to '1') 4 Substitute serial number (always set to '0') 5 Reconfiguration NED (always set to '1') 6-7 Reserved (always set to '00')
65	02	NED Type (00 = unspecified type)
66-67	0000	Reserved
68-73	F0F0F0E5F2E7	Storage control type in EBCDIC (V2X/V2X2)

Table 33 Read Configuration Data Bytes 64 through 95 (Continued)

Byte	Hex Value	Meaning
74-76	E7xxF3	Storage control model in EBCDIC (E7xxF3 for extended capacity) Where: • Byte 74 = X in EBCDIC • Byte 75 = xx, which is the size of subsystem cache. Refer to Table 36 on page 74. • Byte 76 = 3 in EBCDIC
77-79	E2E3D2	Storage control manufacturer in EBCDIC (E2E3D2 = STK)
80-81	F0F1 or F0F2	Storage control manufacturing location in EBCDIC • F0F1 = Louisville, Colorado • F0F2=Puerto Rico
82-93		Storage control sequence number in EBCDIC: the Controller assembly serial number, which is riveted to the front of the frame in the upper right corner.
94-95		Storage director ID tag - the most significant 4 bits of the 12-bit FDID correlated with the storage cluster number, to uniquely identify 1 of 32 possible Storage Directors.
	0000	For Functional Devices:
	0001	00-FF with the command issued to cluster 0
	0100	00-FF with the command issued to cluster 1
	0101	100-1FF with the command issued to cluster 0
	.	100-1FF with the command issued to cluster 1
	.	
	.	
	0F00	
	0F01	F00-FFF with the command issued to cluster 0
		F00-FFF with the command issued to cluster 1

Bytes 96 through 223 - NED 4

Bytes 96 through 223 are described as Node Element Descriptor 4 (NED 4) and contain subsystem information.

Table 34 Read Configuration Data Bytes 96 through 223

Byte	Hex Value	Meaning
96	F0	Flags **Bit** **Meaning** 0-1 Field identifier (always ‘11’ = NED) 2 Token indicator (always set to ’1’) 3 Serial number valid (always set to ’1’) 4 Substitute serial number (always set to ’0’) 5 Reconfiguration NED (always set to ’0’) 6-7 Reserved (always ’00’)
97	00	NED Type (00 = unspecified type)
98-99	0001	Set to ‘0001’
100-105	F0F0F0E5F2E7	Storage control type in EBCDIC (SVA)
106-108	F0F0F0	Zeros in EBCDIC
109-111	E2E3D2	Storage control manufacturer in EBCDIC (E2E3D2 = STK)
112-113	F0F1 or F0F2	Storage control manufacturing location in EBCDIC • F0F1 = Louisville, Colorado • F0F2=Puerto Rico
114-125		Storage control sequence number in EBCDIC: the Controller assembly serial number, which is riveted to the front of the frame in the upper right corner.
126-127	0000 0100 . . . 0F00	Subsystem ID tag, the most significant 4 bits of the 12-bit FDID, to uniquely identify 1 of 16 possible functional storage controls: for functional devices 00-FF for functional devices 100-1FF . . . for functional devices F00-FFF
128-223	00	Zeros

Bytes 224 through 255 - NEQ

Bytes 224 through 255 are described as the Node Element Qualifier (NEQ) and contain path and address information.

Note: “Port Pair“ refers to the two ports associated with each Channel Interface Processor (CIP) on an ICE3 ESCON channel card.

Table 35 Read Configuration Data Bytes 224 through 255

Byte	Hex Value	Meaning
224	80	Flags **Bit** **Meaning** 0-1 Field identifier (always ‘10’ = NEQ) 2-7 Reserved (always ’000000’)
225	00	Record selector (always ‘00’)
226-227	00xx	Interface ID: Where xx = **Bit** **Meaning** 0 Port Pair ID or Reserved. For ICE3 cards: •0 = bottom port •1 = top port See “Note” above. For other ESCON channel cards: reserved (0). 1-2 Card slot location 00-11(0-3) in cluster 3 Cluster (0 - 1) 4 Reserved (0) 5-7 Physical Interface (CIP ID on card)(000 or 001) •000 = Upper CIP on card •001 = Lower CIP on card
228	FA	Device-dependent time-out
229	00	Zeros
230	59	Primary MIH Interval (250 seconds; 4 minutes, 10 seconds)
231	00	Secondary MIH Interval
232-233	0001-FFFF	Subsystem ID (SSID) - there are 16 SSIDs per SVA subsystem; one SSID for each functional storage control.

Table 35 Read Configuration Data Bytes 224 through 255 (Continued)

Byte	Hex Value	Meaning
234	 C0 C1	Paths/storage cluster ID Cluster 0 with both storage paths configured Cluster 1 with both storage paths configured **Bit** **Meaning** 0 Storage path 0 for this cluster is configured in this subsystem (always set to ’1’) 1 Storage path 1 for this cluster is configured in this subsystem (always set to ’1’) 2-6 Zeros 7 Storage cluster number (’0’ or ’1’)
235	00-FF	Unit address - the address the storage director uses on the channel interface (IDID or Interface Device ID)
236	00-3F	Logical device address - the device portion of the unit address in byte 235
237	00-3F	Physical device address - the address a storage path uses to address a device (same as byte 236 for the SVA)
238		System Adapter ID (same as byte 227-Interface ID)
239	00	Zeros
240	00-0F	Channel Logical Address (CIP number in subsystem)
241	40	Interface Protocol Type (ESCON)
242-255	00	Zeros

Functional Device Model (RCD Bytes 10-12)

Functional Device Number	3380-type Device[1]	3390-type Device[1]
0	Ay4	Az8
1	Ay4	Az8
2	Ay4	Az8
3	Ay4	Az8
4	By4	Az8
5	By4	Az8
6	By4	Az8
7	By4	Az8
8	By4	BzC
9	By4	BzC
A	By4	BzC
B	By4	BzC
C	By4	BzC
D	By4	BzC
E	By4	BzC
F	By4	BzC
10	By4	BzC
11	By4	BzC
12	By4	BzC
13	By4	BzC
14	By4	BzC
15	By4	BzC
16	By4	BzC
17	By4	BzC
18	By4	BzC
19	By4	BzC
1A	By4	BzC
1B	By4	BzC
1C	By4	BzC
1D	By4	BzC

Functional Device Number	3380-type Device[1]	3390-type Device[1]
1E	By4	BzC
1F	By4	BzC

Notes:

1. y = ’J’ or ’K’ and z = ’1’, ’ 2’, ‘3’, or ’9’
2. For an unknown device type, A00 is returned for Device Model (EBCDIC C1F0F0)

The following notes apply to the data returned in Bytes 10-12 (Table 31 on page 65) for the Read Configuration Data command (RCD).

Note: The SVA emulates four full DASD strings. A full DASD string consists of eight strings of 32 devices. The values in the table above are for the first string. The values are repeated for the remaining thirty-one strings.

For example:

For device 0x20:	Ay4 if it is a 3380-type device Az8 if it is a 3390-type device
For device 0xFF:	By4 if it is a 3380-type device BzC if it is a 3390-type device

- The first EBCDIC character of the functional device model (byte 10) indicates whether the functional device is considered to be in an A-Unit or a B-Unit.
- The second EBCDIC character of the device model (byte 11) indicates the functional device type. The SVA supports the following functional device types: 3380 J, 3380 K, 3380 K with 6EA cylinders, 3390-1, 3390-2, 3390-3, and 3390-9.
- The third EBCDIC character of the device model (byte 12) indicates the number of functional devices considered to be in the A- or B-Unit.
- The last functional device in an A-Unit is device 3 (for strings of 3380 devices) or device 7 (for strings of 3390 devices). The remainder of the devices in each string are considered to be in B-Units.

- The values in the table above are in EBCDIC. The data returned for the Read Configuration Data command is in hex. For example:

Functional Device Type	Functional Device Model (from previous list)	Functional Device Model (returned to Host)
3380J	AJ4	C1D1F4
3380K	BK4	C2D2F4
3390-3	B3C	C2F3C3
3390-9	A98	C1F9F4

Subsystem Physical Cache Size (RCD Byte 75)

Table 36 Subsystem Physical Cache Size

Byte 75 Hex Value	Byte 75 EBCDIC Value	Subsystem Cache Size
81	a	8,192 MB (8 GB)
82	b	16,384 MB (16 GB)
83	c	32,768 MB (32 GB)

Path Control Commands

Device Reserve

Table 37 Path Control Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Path Control	RES	B4

The Device Reserve command reserves a device to the channel path of the channel sending the command. The command also causes 32 bytes of sense data to be transferred to the channel. After the transfer, channel end and device end are presented to the channel by the storage path.

The device reservation lasts until that channel (or any channel in the channel path group) successfully completes a Device Release command to the device, or until all paths on which the device is reserved are reset by a system reset or a subsystem IML.

When a Device Reserve command is sent to a device in a contingent allegiance state, normal device status testing performed during initial

selection, is bypassed so that the storage path can present error information from the last unit check.

Note: If a device is reserved to a channel path or channel path group, the existing device reservation is reset for that channel path or channel path group when any channel successfully completes the Unconditional Reserve command. The device then becomes reserved to the channel path or channel path group that sent the Unconditional Reserve command.

The following conditions apply to a Device Reserve command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is preceded in the channel program by any other command, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Device Release

Table 38 Read Configuration Data Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Device Release	REL	94

The Device Release command terminates a device's reservation. If the command is received for a device in a *grouped* state, the device reservation is terminated for the channel path group of the channel path sending the command.

If the command is received for a device in an *ungrouped* state, the device reservation is terminated for that channel path.

The command also causes 32 bytes of sense data to be transferred to the channel. After the transfer of data, channel end and device end are presented to the channel by the storage path.

When a Device Reserve command is sent to a device in a contingent allegiance state, normal device status testing performed during initial selection, is bypassed so that the storage path can present error information from the last unit check.

The following conditions apply to a Device Release command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check is presented, and the sense data returned is status format 0, message 2.
- If the command is preceded in the channel program by a Define Extent, Space Count, or Set File Mask command, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is preceded in the channel program by a Read IPL command (functional 3390 devices only), the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Unconditional Reserve

Table 39 Unconditional Reserve Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Unconditional Reserve	UR	14

***Caution: Potential Data Loss* - This command can interrupt operations on other systems. Before issuing the Unconditional Reserve Command, establish control of the device for which the command is to be issued.**

This command can interrupt operations on other systems. *Before* issuing the Unconditional Reserve command, establish control of the device for which the command is to be issued.

The Unconditional Reserve command terminates a device's allegiance to a channel path or path group and establishes a device reservation to the channel path group of the channel sending the command.

If the command is received for a device in a *grouped* state, (single or multipath mode) the device is reserved to that path group. If the command is received for a device in an *ungrouped* state, the device is reserved for that channel path.

The device reservation lasts until that channel (or any channel in the channel path group) successfully completes a Device Release command to the device, or until all paths on which the device is reserved are reset by a system reset or a subsystem IML.

This command also causes 32 bytes of sense data to be transferred to the channel. After the transfer of data, channel end is presented by the storage path. device end is presented when the operation is complete.

If the device is waiting for an asynchronous operation to complete, the storage path presents channel end to the Unconditional Reserve command, disconnects, and then waits for the asynchronous operation to complete before presenting device end.

If a second Unconditional Reserve command, a Reset Allegiance command, or a selective reset is received while waiting for the asynchronous operation to complete, the asynchronous operation is terminated by re initializing cache.

Device control must be established prior to issuing the Unconditional Reserve command. Establishing device control is obtained when the host has the device reserved *or* the host has a CCW chain in progress.

When the host sends an Unconditional Reserve command to a device that is *not* assigned to it, the *other* system may experience one of the following conditions if the device is:

- Reserved. In this case, the reservation is reset and the device becomes reserved to the channel.
- Disconnected between chained commands. In this case, an interruption is lost.
- Active. In this case, the storage path presents a recoverable equipment check.
- Idle and not reserved. In this case, there is no effect.

Note: In a functional 3380 Model AA4, devices share internal paths. When two devices share the same internal path in a string, issuing an Unconditional Reserve command on one controller path may terminate an unrelated operation on the *other* path.

The following conditions apply to an Unconditional Reserve command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is preceded in the channel program by any other command, the Unconditional Reserve command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If any I/O chain is interrupted by issuing this command, the operation is terminated, unit check status is presented, and the sense data returned is format 0, message F.

- If the channel has a reservation for the device but does not have an active command chain, unit check status is presented, and the sense data returned is equipment check with format 3, message F. The unit check is pending to the next Start I/O.
- If the channel has a contingent allegiance for the device, and sent a Sense command for that device after the Unconditional Reserve command was received, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F.

Note: The Unconditional Reserve command resets contingent allegiance for the affected device on all interfaces.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Reset Allegiance

Table 40 Reset Allegiance Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Reset Allegiance	RSTA	44

The Reset Allegiance command terminates a device's allegiance to a channel path or path group. It does not reset any device allegiance when the device is reserved to another channel or path group.

This command also causes 32 bytes of data to be transferred to the channel.

Table 41 Data Returned for Reset Allegiance

Byte	Definition	
0	**Status**	
	Bits	**Description**
	0	Device selection successful. When this bit is ’0’ (device selection failed) and bits 2 and 3 are not ’01’, the storage director tried device selection and failed. The failure that prevented the selection is presented as environmental-data present sense data to the next initial selection to the failing device.
	1	Reserved; set to zero
	2-3	Reservation Status **Value** **Definition** 00 Device is not reserved 01 Device is reserved to another channel or path group 10 Device is reserved to this channel or path group 11 Reserved
	4-5	Allegiance reset for the Addressed Device **Value** **Definition** 00 No allegiance was reset for the addressed device 01 Implicit allegiance was reset for the addressed device 10 Contingent allegiance was reset for the addressed device 11 Reserved
	6	Contingent allegiance was reset on another device
	7	Implicit allegiance was reset on another device
1	**Bits** 0-1 2 3-7	**Description** Reserved for the SVA Path Group Identifier supported; set to ’1’ Reserved; set to zeros
2-4	Reserved; set to zeros	
5-15	Path Group Identifier If byte 0, bits 2-3 are set to ’01’ and a Path Group Identifier exists (the channel or path group that the device is reserved to has a valid Path Group Identifier), these bytes contains the Path Group Identifier. Otherwise, these bytes contain zeros.	
16-31	Reserved; set to zeros	

After the transfer of data, channel end is presented by the storage path. Device end is presented when the operation is complete.

If the device is waiting for an asynchronous operation to complete, the storage path presents channel end to the Reset Allegiance command, disconnects, and then waits for the asynchronous operation to complete before presenting device end.

If a second Reset Allegiance command, an Unconditional Reserve command, or a selective reset is received while waiting for the asynchronous operation to complete, the asynchronous operation is terminated by re initializing cache.

The following conditions apply to a Reset Allegiance command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is preceded in the channel program by any other command or if it was not chained directly from a Suspend Multipath Reconnection command that was the *first* CCW in the command chain, the Reset Allegiance command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If a device is either not reserved or reserved to a channel or a channel path group,
  - If any CCW chain is in progress on this device for this channel or channel path, it is terminated and status for the CCW chain is reset.

Note: Multi-tagged or un-tagged status for this device is not reset.

  - If any CCW chain is in progress on this device for another channel or channel path group, the command is terminated, unit check status is presented, and the sense data returned is format 3, message F.
  - If a device is reserved to another channel or channel path group, any other command chained to the Reset Allegiance command, the command is rejected, unit check status is presented, and the sense data returned is format 0F, message 2F.
  - If any other channel is currently trying to select the device, that channel may experience either unit check status or a disconnect-in sequence.
  - If any sense data pending on this device for another channel or channel path group changes, an equipment check is presented, and the sense data returned is format 3, message F.

- If device selection fails, any command chained to the Reset Allegiance command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Note: In a functional 3380 Model AA4, devices share internal paths. When two devices share the same internal path in a string, issuing an Unconditional Reserve command on one Controller path may terminate an unrelated operation on the *other* path.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Set Path Group ID

Table 42 Set Path Group ID Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Set Path Group ID	SPID	AF

The Set Path Group ID command identifies the system control program controlling a group of channels and defines the paths associated with a processor for the purpose of device reservation and/or dynamic path reconnection.

Each host system must have a unique channel path group ID. If the same channel path group ID is assigned to more than one host system, a reserved device would be available to every host system with the same ID.

The Set Path Group ID command sends 12 bytes of information to the storage path. The storage path presents channel end and device end after it validates the 12 bytes of information and performs the operation specified in the Control Byte (byte 0). Bytes 1 through 11 contain the channel path group ID for the channel interface.

The following conditions apply to a Set Path Group ID command:

- If the command is preceded or followed by any other command in the channel program, the Set Path Group ID command or the command that follows it is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the channel sends fewer than 12 bytes of parameters, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 3.

- If the channel sends an invalid parameter, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If the path group ID contains 11 bytes of zeros, the command is rejected.
- If a path group ID is established and the following path group ID is not the same, the command is rejected.
- If a mode bit is established for a path group and the following mode bit is not the same, the command is rejected.
- If byte 0, bits 1 and 2 are '11', the command is rejected.
- If byte 0, bits 3 through 7 are not zeros, the command is rejected.
- If the command attempts to group different channel types (ESCON and parallel), the operation is terminated and unit check status (command reject) is presented.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Byte 0 - Function Control byte

Byte 0 is the Function Control byte and has the following format:

Table 43 Byte 0 - Function Control Byte

Bits	Bit Value	Function
0	Path Mode	
	0	Single Path Mode
	1	Multipath Mode
1-2	Group Status	
	00	Establish Group
	01	Disband Group
	10	Resign from Group
	11	Not valid
3-7	00000	Always set to zeros

Byte 0, Bit 0 - Single Path Mode

I/O operations must be confined to the specific channel path over which the Start I/O was initiated. "Grouping" applies to device reservation and release only.

Byte 0, Bit 1 - Multipath Mode

SVAI/O operations initiated on one channel path may be completed on another channel path within the group used by 370-XA.

Byte 0, Bits 1 and 2

- If these bits are ’00’, **establish group** is designated. The storage director compares the ID (Bytes 1 through 12) with all other IDs received for the same device over other channel paths. A “group” is created for the device consisting of all channel paths with identical IDs.
- If these bits are ’01’, **disband group** is designated. Each channel path in the original group dedicated to a device is first put into an ungrouped state. If the device was reserved to the channel path group at the time the command was processed, the device remains reserved only to the channel path that *issued* the command.
- If these bits are ’10’, **resign from group** is designated. The channel issuing the command is removed from the channel path group dedicated to a device becoming a “stand alone channel”. If the device is reserved to the channel path group at the time the command is processed, the reservation remains with the channel path members left in the group.
- If these bits are ’11’, **not valid** is designated.

Byte 0, Bits 3 through 7

These bits are always set to zeros.

Sense Path Group ID

Table 44 Set Path Group ID Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Sense Path Group ID	SNID	34

The Sense Path Group ID command identifies the path group of the device associated with the channel path sending the command.

The Sense Path Group ID command causes 12 bytes of data to be sent from the storage path to the channel. The storage path presents channel end and device end after it sends the 12 bytes of information. Bytes 1 through 11 contain the current path group ID associated with the addressed device for the channel interface. If a Set Path Group ID command has not been issued for any device in the subsystem since

the last system reset, Bytes 1 through 11 contain zeros. Byte 0 is the Path State byte and has the format specified in the table below.

The following condition applies to a Sense Path Group ID command:

- If the command is preceded or followed in the channel program by any other command or if it was not chained directly from a Suspend Multipath Reconnection command that was the *first* CCW in the command chain, the Sense Path Group ID command or the command that follows it is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Refer to See “Status Presented To Commands” on page 36. for more information about this command during other subsystem and device conditions.

Byte 0 - Path State Byte

Table 45 Byte 0 - Path State Byte

Bits	Bit Value	Function
0-1	Group Status	
	00	Reset
	01	Reserved
	10	Not grouped
	11	Grouped
2-3	Reservation Status	
	00	Not currently reserved
	01	Allegiance exists
	10	Reserved but not to this channel
	11	Reserved to this channel
4	Path Mode	
	0	Single Path Mode
	1	Multipath Mode
5-7	000	Always set to zeros

Byte 0, Bits 0 and 1

- If these bits are ’00’, **reset** is designated. No Set Path Group ID command has been accepted on this channel since the last system reset or subsystem power-on reset.
- If these bits are ’01’, **reserved** is designated.

- If these bits are ’10’, **not grouped** is designated. A valid path group ID for this channel exists, but the addressed device does not belong to any group. This state exists when a device is not grouped or a Set Path Group ID command is presented to the channel for *another* device.
- If these bits are ’11’, **grouped** is designated. A valid path group ID exists for a device on the channel and the device is shared by a group.

Byte 0, Bits 2 and 3

- If these bits are ’00’, **not reserved** is designated. The addressed device is currently not reserved.
- If these bits are ’01’, **Allegiance exists** is designated. The addressed device is not currently reserved, but there is contingent or implicit allegiance to another member of the channel group (when a channel group exists).
- If these bits are ’10’, **reserved to another channel** is designated. The addressed device is reserved, but not to the requesting channel.
- If these bits are ’11’, **reserved to this channel**, is designated. The addressed device is reserved to the requesting channel and to the other members of a channel group (when a channel group exists).

Byte 0, Bit 4

- If this bit is ’0’, **single path mode** is designated. In single path mode, an operation may be initiated on any path; however, that operation must be performed and completed on the initiating path.
- If this bit is ’1’, **multipath mode** is designated. In multipath mode, when a device is reserved, operations can be initiated on any path in the path group. Operations initiated on any path in the group may be performed and completed on any path in the group.

Suspend Multipath Reconnection

Table 46 Suspend Multipath Reconnection Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Suspend Multipath Reconnection	SMR	5B

The Suspend Multipath Reconnection command is used for operations recovery in a multipath mode. The command restricts a channel

program to operating on only the channel path that sends the command without having to restructure an existing path group.

This command does not affect device reservations, path groups or channel paths operating in single path mode or channel paths operating in multipath mode when a device is not grouped.

The channel program is restricted to the channel path receiving the command until the channel accepts final status for the command chain. Channel end and device end are presented to the channel by the storage path when the command is completed.

The Suspend Multipath Reconnection command is not valid in the following condition; if the command is issued in a Locate Record or Locate Record Extended domain. In this case, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Refer to "Status Presented To Commands" on page 36 for more information about this command during other subsystem and device conditions.

Subsystem Commands

Set Subsystem Mode

Table 47 Set Subsystem Mode Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Set Subsystem Mode	SSM	87

The Set Subsystem Mode command performs cache control functions, and cache fast write activation and deactivation. It also provides nonvolatile storage control functions, including controlling activation and availability of NVS and DASD fastwrite.

Notes:

1. The caching and NVS status that is controlled by this command is "logical status" for the SVA. With the SVA, subsystem and device caching and NVS are always active and available, and all writes are handled as DASD fast writes. Host programs can issue a Set Subsystem Mode command with any valid subcommand, but the command has no net effect on the subsystem's operation or performance.
2. The SVA presents the image of up to four 3390 storage controls. These images are referred to as "functional storage controls." When processing a Set Subsystem Mode command with a subcommand that affects the subsystem (e.g. Make Cache

Available to Subsystem), “subsystem” refers to a functional storage control. The functional storage control affected is determined by the functional device addressed by the command.

3. A Set Subsystem Mode command causes the logical status of caching or NVS to be updated in Controller memory, on the physical drives, and on the support processor hard drives. For SSM subcommands that specify an “activate” or “make available” operation, the operation is complete when the status has been updated in these three locations.
4. A Set Subsystem Mode command that specifies a “deactivate” or “make unavailable” operation causes modified data (cache fast write and DASD fast write data) to be queued for destage from volatile cache. When the destage is complete, the copies of the data that was destaged are deleted from NVS. The operation is complete when the data has been queued for destage and the status has been updated in the 3 locations specified above. The actual destage of modified data and deletion of copies of the modified data in NVS may occur after the Controller responds that the operation is complete.

Two parameter bytes that are received with the Set Subsystem Mode command determine the scope of the command.

For a description of the operation of this command when other subsystem and device status conditions occur, refer to “Status Presented To Commands” on page 36.

The following conditions apply to a Set Subsystem Mode command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is not in a valid chain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

  To be valid, the command must be either the first command in a chain, or must immediately follow a Suspend Multipath Reconnection command that is the first command in a chain.
- If the Message Required bit (byte 0, bit 7) is ’0’, the Set Subsystem Mode command must be the last command in a chain. Any command chained from this command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the Message Required bit is ’1’, a Read Message ID command can be chained from this command. If the Message Required bit is ’1’ and the Set Subsystem Mode Command is *not* followed by

Read Message ID, the operation is performed but no ending notification occurs.

- If the Message Required bit is ’1’ and a command other than Read Message ID is chained from the Set Subsystem Mode command, that command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If more than two parameter bytes are received, only the first two bytes are accepted by the storage path. If fewer than two bytes are received, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 3.
- If the parameter bytes are invalid, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4. Valid parameters are:
  - An operation can be specified for only one control field: cache control, cache fast write control, or nonvolatile storage control. Other control fields must contain all zeros.
  - Byte 0, bit 6 and byte 1, bits 11 through 15 must be all zeros.
  - Message Required (byte 0, bit 7) is valid only with operations that are asynchronous.

Ending Status

All conditions set by the Set Subsystem Mode command remain intact after a subsystem Initial Microprogram Load (IML).

For a description of the completion status of operations that require a long time period to complete, refer to “Asynchronous Operations” on page 18.

The storage path presents the following status in response to the Set Subsystem Mode command:

- If a buffer is not available in memory to process the requested asynchronous operation, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F.
- If the condition requested by the command already exists, no operation is performed. Successful completion is shown in the ending status (channel end and device end) or in the message.
- The storage path presents device end with channel end when all operation codes are ’000’, or when two operation codes are ’000’ and the third is a reserved value.

- The storage path presents channel end if it receives valid parameter bytes that specify a single operation and all conditions for processing the command are met.
- For synchronous operations, device end is presented when the requested operation is complete.
- For asynchronous operations, device end is presented when the requested operation is started.
- For asynchronous operations, device end is presented with channel end when the requested operation is already in progress because another Set Subsystem Mode command specified the same operation.

SSM Byte 0 - Cache Control, CFW Control, and Message Required Bit

Byte 0 of the command parameters can specify a cache or cache fast write operation, but only if no NVS operation is specified in byte 1 of the command parameters. Byte 0, bit 7 specifies whether or not an attention message is required for an asynchronous operation specified in byte 0 or 1, when the operation is completed.

Byte 0 has the following format:

Table 48 Byte 0 - Cache Control and Message Required Bit

Bits	Bit Value	Function
0-2	Cache Control	
	000	No Cache Operation
	001	Activate caching for addressed device
	010	Deactivate caching for addressed device[1]
	011	Make cache available to subsystem[1, 2]
	100	Make cache unavailable to subsystem[1, 2]
	101	Force cache unavailable to subsystem[1]
	110	Reserved
	111	Reserved

Table 48 Byte 0 - Cache Control and Message Required Bit (Continued)

Bits	Bit Value	Function
3-5	Cache Fast Write Control	
	000	No cache fast write operation
	001	Reserved
	010	Reserved
	011	Activate cache fast write for subsystem[2]
	100	Deactivate cache fast write for subsystem [1, 2]
	101	Reserved
	110	Reserved
	111	Reserved
6	Not Used	
	0	Always set to zeros
7	Message Required	
	0	No message
	1	A message is required when all asynchronous processing associated with this operation is completed.

Note:

1. Asynchronous.
2. Rejected if '*Special Intercept Condition*' is in effect.

SSM Byte 0, Bits 0 through 2

These bits specify a cache control operation.

- If these bits are '000', **no cache operation** has been selected.
- If these bits are '001', **activate caching for addressed device** has been selected.

  This subcommand causes the logical caching status for the addressed functional device to be changed to "active", in controller memory which indicates that the device's tracks are promotable to cache. Refer to Note 1. on page 86.

  This subcommand is processed synchronously. Channel and device end are presented when the operation completes. Caching remains active for the device until another Set Subsystem Mode command is received that deactivates caching for the device.

Caching can be activated for a device whether or not caching is logically available for the subsystem.

The following conditions apply to this subcommand:

- If cache is pending-off for the subsystem, the subcommand is rejected, unit check is presented, and the sense data returned is format 0 message F.
- If caching is already activated for the device, no further processing occurs and device end is presented with channel end.

- If these bits are ’010’, **deactivate caching for addressed device** has been selected.

This subcommand causes the logical caching status for the addressed functional device to be changed to “deactivated”, which indicates that the device’s tracks must bypass cache. Refer to Note 1. on page 86.

This subcommand also causes all of the modified tracks for the device to be queued for destage.

This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18.

Caching remains inactive for the device until another Set Subsystem Mode command is received that activates caching for the device or until a Diagnostic Control command with a Diagnostic Initialize Subsystem subcommand is received that affects the device.

The addressed device is put in a state-change-pending state for the duration of the operation. Upon completion of the operation, a state-change-interrupt (85 status) is presented to each channel path group with which the addressed device is grouped, and to each ungrouped channel that has access to the device.

This condition applies to this subcommand; if caching is already deactivated for the device, no further processing occurs, and device end is presented with channel end.

- If these bits are ’011’, **make cache available to subsystem** has been selected.

  This subcommand causes the logical caching status for the functional storage control to be changed to “available”, which indicates that the tracks of the 64 functional devices that comprise the functional storage control are promotable to cache. Refer to Note 1. on page 86.

  This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18.

Caching remains available for the subsystem until another Set Subsystem Mode command is received that makes caching unavailable for the subsystem.

The following conditions apply to this subcommand:

- If cache is pending-off for the subsystem, the subcommand is rejected, unit check status is presented, and the sense data returned is format 0 message F.
- If caching is already available for the subsystem, no further processing occurs and device end is presented with channel end.

- If these bits are ’100’, **make cache unavailable to subsystem** has been selected.

  This subcommand is treated as a no-operationcauses the logical cache fast write status for the functional storage control to be changed to “unavailable”, which indicates that access to the tracks of the 64 functional devices that comprise the functional storage control must bypass cache. Refer to Note 1. on page 86.

  This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18.

  This subcommand also causes all of the modified tracks for the functional storage control’s 64 functional devices to be queued for destage.

  Caching remains unavailable for the subsystem until another Set Subsystem Mode command is received that makes cache available for the subsystem or until a Diagnostic Control command with a Diagnostic Initialize Subsystem subcommand is received for this functional storage control.

  The following conditions apply to this subcommand:

  - If the Special Intercept Condition is in effect, this subcommand is rejected.
  - If cache is pending-on for the subsystem, the subcommand is rejected, unit check status is presented, and the sense data returned is format 0, message F.
  - If cache is already unavailable for the subsystem, no further processing occurs and device end is presented with channel end.

- If these bits are ’101’, **force cache unavailable to subsystem** has been selected. The SVA does not support this subcommand; it is

rejected, unit check status is presented, and the sense data returned is format 0 message 4.

SSM Byte 0, Bits 3 through 5

These bits specify a cache fast write control operation.

- If these bits are ’000’, **no cache fast write operation** has been selected.
- If these bits are ’011’, **activate cache fast write for subsystem** has been selected.

  This subcommand causes the logical cache fast write status for the functional storage control to be changed to “active”, which indicates that cache fast write operations for the 64 functional devices that comprise the functional storage control are allowed. Refer to Note 1. on page 86.

  This subcommand is processed synchronously. Device end is presented when the operation completes.

  Cache fast write remains active for the subsystem until another Set Subsystem Mode command is received that deactivates cache fast write for the subsystem.

  The following conditions apply to this subcommand:

  - If the Special Intercept Condition is in effect, this subcommand is rejected.
  - If cache fast write is pending-off for the subsystem, the subcommand is rejected, unit check status is presented, and the sense data returned is format 0, message F.
  - If caching fast write is already active for the subsystem, no further processing occurs, and device end is presented with channel end.
- If these bits are ‘100’, **deactivate cache fast write for subsystem** has been selected. This subcommand causes the logical cache fast write status for the functional storage control to be changed to “deactivated”, which indicates that cache fast write operations for the 64 functional devices that comprise the functional storage control are disallowed. Refer to Note 1. on page 86.

  This subcommand also causes all of the modified tracks for the functional storage control’s 64 functional devices to be queued for destage.

  This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18. Cache fast write remains deactivated for the subsystem until another Set Subsystem Mode

command is received that activates cache fast write for the subsystem or until a Diagnostic Control command with a Diagnostic Initialize Subsystem subcommand is received for this functional storage control.

The following conditions apply to this subcommand:

- If the Special Intercept Condition is in effect, this subcommand is rejected.
- If cache fast write is already deactivated for the subsystem, no further processing occurs, and device end is presented with channel end.

SSM Byte 1 - Nonvolatile Storage Control

This byte can specify an NVS or DASD fast write operation, but only if no cache or cache fast write operation is specified in byte 0 of the command parameters.

Byte 1 has the following format:

Table 49 Byte 1 - Nonvolatile Storage Control Byte

Bits	Bit Value	Function
8-10	NVS Control	
	000	No nonvolatile storage operation
	001	Activate DASD fast write for the device
	010	Deactivate DASD fast write for the device[1]
	011	Force deactivate DASD fast write for the device[2]
	100	Make nonvolatile storage available to subsystem[1, 2]
	101	Make nonvolatile storage unavailable to subsystem[1, 2]
	110	Reserved
	111	Reserved
11-15	Not used (always set to ‘0’)	

Table 49 Byte 1 - Nonvolatile Storage Control Byte

Bits	Bit Value	Function

Notes:

1. Asynchronous.
2. Invalid for SVA.

SSM Byte 1, Bits 0 through 2

These bits specify an NVS control operation.

- If these bits are ’000’, **no NVS operation** has been selected.
- If these bits are ’001’, **activate DASD fast write for device** has been selected.

  This subcommand causes the logical DASD fast write status for the addressed functional device to be changed to “active”, which indicates that the device’s tracks are eligible for DASD fast write operations. Refer to Note 1. on page 86.

  This subcommand is processed synchronously. Device end is presented when the operation completes.

  DASD fast write remains active for the device until another Set Subsystem Mode command is received that deactivates DASD fast write for the device.

  DASD fast write remains active for the device until another Set Subsystem Mode command is received that deactivates DASD fast write for the device.

  This condition applies to this subcommand; if DASD fast write is already activated for the device, no further processing occurs and device end is presented with channel end.
- If these bits are ’010’, **deactivate DASD fast write for device** has been selected.

  This subcommand causes the logical DASD fast write status for the addressed functional device to be changed to “deactivated”, which indicates that the device’s tracks are not eligible for DASD fast write operations. Refer to Note 1. on page 86. This subcommand also causes all of the modified tracks for the device to be queued for destage. This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18.

DASD fast write remains inactive for the device until another Set Subsystem Mode command is received that activates DASD fast write for the device or until a Diagnostic Control command with a Diagnostic Initialize Subsystem subcommand is received that affects the device.

The addressed device is put in a state-change-pending state for the duration of the operation. Upon completion of the operation, a state-change-interrupt (85 status) is presented to each channel path group that the addressed device is grouped with, and to each ungrouped channel that has access to the device.

This condition applies to this subcommand; if DASD fast write is already deactivated for the device, no further processing occurs and device end is presented with channel end.

- If these bits are ’011’, **force deactivate DASD fast write for device** has been selected. The SVA does not support this subcommand; it is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If these bits are ’100’, **make NVS available to subsystem** has been selected.

  This subcommand causes the logical NVS status for the functional storage control to be changed to “available”, which indicates that NVS is available for DASD fast write operations for the 64 functional devices that comprise the functional storage control. Refer to Note 1. on page 86. This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18.

  NVS remains available for the subsystem until another Set Subsystem Mode command is received that makes NVS unavailable for the subsystem.

  The following conditions apply to this subcommand:

  - If the Special Intercept Condition is in effect, this subcommand is rejected.
  - If NVS is pending-off for the subsystem, the subcommand is rejected, unit check status is presented, and the sense data returned is format 0, message F.
  - If NVS is already available for the subsystem, no further processing occurs and device end is presented with channel end.
- If these bits are ’101’, **make NVS unavailable to subsystem** has been selected.

This subcommand causes the logical NVS status for the functional storage control to be changed to “unavailable”, which indicates that NVS is unavailable for DASD fast write operations for the 64 functional devices that comprise the functional storage control. Refer to Note 1. on page 86.

This subcommand also causes all of the modified tracks for the functional storage control’s 64 functional devices to be queued for destage. This subcommand is processed asynchronously. Refer to “Asynchronous Operations” on page 18.

NVS remains unavailable for the subsystem until another Set Subsystem Mode command is received that makes NVS available for the subsystem or until a Diagnostic Control command with a Diagnostic Initialize Subsystem subcommand is received for this functional storage control.

The following conditions apply to this subcommand:

If the Special Intercept Condition is in effect, this subcommand is rejected.

- If NVS is pending-on for the subsystem, the subcommand is rejected, unit check status is presented, and the sense data returned is format 0, message F.
- If NVS is already unavailable for the subsystem, no further processing occurs, and device end is presented with channel end.

Perform Subsystem Function

Table 50 Perform Subsystem Function Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Perform Subsystem Function	PSF	27

Refer to the following table for the specific functions of the Perform Subsystem Function command. The following two bytes are common to all orders.

Table 51 Perform Subsystem Function Orders and Flags

Bytes	Description	Function	
0	Order	Hex Value	Name of Order
		00-0F	Not Valid
		10	Commit (asynchronous - see note below)
		11	Discard
		12	Not valid for the SVA
		13	Not valid for the SVA
		14	Not valid for the SVA
		15	Reserved, not valid
		16	Not valid for the SVA
		17	Reserved, not valid
		18	Prepare for Read Subsystem Data
		19	Destage Modified Tracks (asynchronous)
		1A	Reserved, not valid
		1B	Set Special Intercept Condition
		1C-AF	Reserved, not valid
		B0	Set Interface Identifier
		B1-FF	Reserved, not valid
1	Flags	Bits 0	Description: Message required when the asynchronous processing associated with this order is complete.
		1-7	See the specific order

Notes: This order is asynchronous if the Message Required bit is set on; otherwise, this order operates synchronously.

The following conditions apply to a Perform Subsystem Function command:

- If the command is issued in a Locate Record or Locate Record Extended domain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- The command is accepted when the device is not available (i.e. not defined or disabled) if the order is Discard or Prepare for Read

Subsystem Data. However, if the command is accepted with either of these conditions and the order in byte 0 is not X'11' or X'18', the command is rejected, unit check status is presented, and the sense data returned includes Intervention Required, and is format 1, message 0 for 3380-type devices, or exception class E for 3390-type devices.

- The Perform Subsystem Function command with a Destage Modified Tracks order must be one of the following:
  - The first command in the chain
  - Chained directly from a Suspend Multipath Reconnection command that is first in the chain
  - Immediately preceded by a Define Extent command with the authorization set to diagnostic or device support authorization.

If these requirements are not met, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

- The orders have different parameter lengths. If the channel sends more bytes than the order requires, the storage path accepts only the number of bytes required by the order. If the channel sends fewer bytes than the order requires, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 3. (Refer to the description of the specific order for any additional requirements.)
- If a buffer is not available in memory to process the requested asynchronous operation, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F.

  Refer to the specific order for additional information, and for those orders that are specified as "asynchronous", refer to "Asynchronous Operations" on page 18.

Commit X'10'

This order causes the modified data on the functional tracks specified within the extent range for the addressed device to be queued for destage. The data on the specified tracks is between the specified beginning and

ending extents.

The Commit order requires 14 parameter bytes, including the order, byte 0. The following table lists the definitions of Bytes 1 through 13.

Table 52 Byte 0 - Parameter Bytes for Commit X'10'

Byte	Parameter	Function
1	Flag Byte	**Bits** **Description** 0 Message Required: •'0' for synchronous operation •'1' for asynchronous operation. 1-7 Must be zeros.
2-5	Beginning extent address	Specifies the track address, in cylinder and head format, of the first track in the range of tracks specified by this order.
6	Not Used	Always set to zero.
7-10	Ending extent address	Specifies the track address, in cylinder and head format, of the last track in the range of tracks specified by this order.
11	Not used	Always set to zero
12-13	Cache fast write ID	

If the operation is specified to be asynchronous, the device is put in a state-change-pending condition until the operation is complete.

Note: If a large number of cylinders are included in the extents, the operation should be asynchronous to prevent the operating system from timing out.

Refer to "Asynchronous Operations" on page 18 for the description of the presentation of channel end and device end.

This order must be in one of the following CCW chains:

- The first command in the chain
- Chained directly from a Suspend Multipath Reconnection command that is first in the chain
- Chained directly from a Define Extent command
- Chained directly from another Perform Subsystem Function command with a Commit order.

If it is not in a valid chain, the Perform Subsystem Function command with a Commit order is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

- Only a Perform Subsystem Function command with a Commit order or a Read Message ID command can be chained after a Commit order. A Read Message ID command can be chained only if the Message Required bit is set on for at least one of the Commit orders in the chain. If any command other than a Perform Subsystem Function with a Commit order or a Read Message ID is chained after this order, the command is terminated, unit check status is presented, and the sense data returned is format 0, message 2.
- The cylinder and head values in Bytes 2 through 5 (the beginning extent) and 7 through 10 (the ending extent) must be valid primary track addresses for the addressed device. The ending extent must be greater than or equal to the beginning extent. Bits 1 through 7 in the flag byte are always set to zero. If these conditions are not met, the Perform Subsystem Function command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If this order is preceded by a Define Extent command and the tracks specified in this command are not within the extent defined by the Define Extent command, this command is terminated and unit check status (file protected) is presented.
- The cache fast write ID (Bytes 12 and 13) must contain the current cache fast write ID of the subsystem. If Bytes 12 and 13 are zero, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If Bytes 12 and 13 are not zero, but do not contain the current cache fast write ID for the subsystem, the command is rejected, unit check status is presented, and the sense data returned is format F, message 6.
- If the chain has only one Commit order, the Message Required bit (byte 1, bit 0) determines if the order is synchronous or asynchronous. If the Message Required bit is ’0’ the operation is synchronous. If the Message Required bit is ’1’ the operation is asynchronous.
- If there are multiple Commit orders in a chain, the Message Required bit determines which of the Commit orders in the chain are synchronous or asynchronous. If the Message Required bit is ’1’ in any Commit order, the remainder of the Commit orders in the chain run asynchronously.

Discard X‘11’

For the SVA, this order causes the specified data for the addressed device to be discarded from cache. Any unmodified tracks in the specified extents are discarded immediately. Any modified tracks in the specified extents are queued for destage. When the modified tracks have actually been destaged, they are discarded from cache and the modified portions of those tracks are discarded from NVS.

This order requires 12 parameter bytes, including the order, byte 0.

Table 53 Parameter Bytes for Discard X‘11’

Byte	Parameter	Function
1	Flag Byte	**Bits** **Description** 0 Message Required (always set to zero) 1 When this bit is ’1’, the entire functional volume is discarded. The beginning and ending extents in the parameters must be zero. When this bit is ’0’, only those functional tracks specified between the beginning and ending extents are discarded. The cylinder and head values in Bytes 2 through 5 (the beginning extent) and 7 through 10 (the ending extent) must be valid primary track addresses for the device type and the ending extent must be greater than or equal to the beginning extent. 2 When this bit is ’1’, all tracks within the specified area are discarded. When this bit is ’0’, the SVA performs no action. The SVA does not experience pinned tracks. 3 When this bit is ’0’ or ’1’, cache fast write and DASD fast write tracks are discarded (made invalid) from nonvolatile storage and cache. 4-7 Not used. These bits are always set to zero.
2-5	Beginning extent address	Specifies the track address, in cylinder and head format, of the first track in the range of tracks specified by this order.
6	Not Used	Always set to zero.
7-10	Ending extent address	Specifies the track address, in cylinder and head format, of the last track in the range of tracks specified by this order.
11	Not used	Always Set To Zero

The storage path presents channel end when it validates the parameters. Device end occurs when all of the unmodified tracks in the specified extents have been discarded from cache and all of the modified tracks in the specified extents have been queued for destage.

This order must be in one of the following CCW chains:

- The first command in the chain
- Chained directly from a Suspend Multipath Reconnection command that is first in the chain
- Chained directly from a Define Extent command
- Chained directly from another Perform Subsystem Function Command with a Discard order.

If it is not in a valid chain, the Perform Subsystem Function command with a Discard order is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

- Only another Perform Subsystem Function command with a Discard order may be chained from a Perform Subsystem Function command with a Discard order. If any other command is chained from this command, the command is terminated, unit check status is presented, and the sense data returned is format 0, message 2.
- The flag byte and the extent addresses must be valid, or the Perform Subsystem Function command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If this order is preceded by a Define Extent command and the specified extent is not in the extent defined by the Define Extent command, this command is terminated and unit check status (file protected) is presented.

Prepare for Read Subsystem Data X‘18’

This order specifies the data that is returned for the next command in the chain (a Read Subsystem Data command). This order requires 12 parameter bytes, including the order, byte 0. The following table defines Bytes 1 through 11.

Table 54 Parameter Bytes for Prepare for Read Subsystem Data X'18'

Byte	Parameter	Function
1	Flag Byte	Must be zero.
2-5	Reserved	Must be zeros.
6	Suborder that defines the data to be returned	**Value Description** 00 The status of the storage paths in the subsystem. 01 The subsystem statistics. 02 The current cache fast write ID. 03 An attention message for this path group for the addressed device. If the message identifier is zero, the message returned is any message waiting to be sent to the host. If the message identifier in parm Bytes 8 through 11 is not zero, the storage path returns the current state of the asynchronous operation associated with the message identifier, if it finds one that matches. If the storage path does not have a message. it returns a 'no message' message. 04 Not Used 05 The addresses of the next eight pinned tracks on the addressed device started at the track specified in Bytes 8 through 11. The SVA accepts this order, but indicates "no pinned tracks." 06-FF Not Used
7		Depends upon the value in Byte 6: **Byte 6 Description** 00 Must be zero 01 Scope of statistics to be returned. If zero, the storage path prepares only a set of statistics for the addressed device. If X'FF', the storage path prepares statistics for all the devices in the subsystem. 02-FF Must be zeros

Table 54 Parameter Bytes for Prepare for Read Subsystem Data X'18' (Continued)

Byte	Parameter	Function
8-11		Depends upon the value in Byte 6: **Byte 6 Description** 00 Must be zero 01 0x00000000 - requests 96-byte records 0x01000000 - requests 192-byte records 02 Must be zeros 03 Message identifier 04 Must be zeros 05 The CCHH of the track used to start the search for the next eight pinned tracks. The SVA accepts this order, but indicates "no pinned tracks". 06-FF Must be zeros

The storage path presents channel end and device end when it validates and stores the parameters.

The following conditions apply to this order:

- The parameters for the Prepare to Read Subsystem Data order must be valid. Valid parameters are as follows:
  - The flag byte must be zero.
  - Parameter byte 6 must contain a valid suborder. If the suborder is not X'01', byte 7 must be X'00'. If the suborder is X'01', byte 7 must be either X'00' or X'FF'.
  - For suborders other than X'03' or X'05', Bytes 8 through 11 must be zero. If the suborder is X'05', Bytes 8 through 11 must contain a valid user address (cylinder and head) for the device. If the device type is unknown, this check is bypassed and any value is accepted.

    If any of these conditions are not met, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.
- If the suborder is X'05', cache must be available or pending. If this condition is not met, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F.
- Only a Read Subsystem Data command can be chained from the Perform Subsystem Function command with this order. If any other command is chained from the command with this order, it is rejected, unit check status is presented, and the sense data

returned is format 0, message 2. Refer to "Read Subsystem Data" on page 115 for the contents of each message.

Destage Modified Tracks X'19'

This order causes the SVA to destage all modified data in cache and NVS for the 64 functional devices of the functional storage control that contains the addressed device. Because the SVA consists of four functional storage controls, to destage all modified data in cache and NVS for the entire subsystem, the command must be issued to one functional device in each functional storage control.

Note: This order can be used before subsystem shutdown to ensure that all modified data is destaged. However, this is not necessary for the SVA.

This order requires two parameter bytes, the order byte 0 and the flag byte 1. The following table defines the flag byte.

Table 55 Parameter Bytes for Destage Modified Tracks Order

Byte 1 Bits	Function/Description
0	If this bit is 'on' and a Read Message ID command is chained from this command, the host making the request receives an attention interruption and a message.
1-7	Must be zeros.

Refer to "Asynchronous Operations" on page 18 for the description of the

presentation of channel end and device end.

The following conditions apply to this order:

- If the special Intercept condition is in effect, this order is rejected.
- If bit 0 is 'on', any command other than a Read Message ID chained after this order is terminated, unit check status is presented, and the sense data returned is format 0, message 2.
- If bit 0 is 'off', any command chained after this order is terminated, unit check status is presented, and the sense data returned is format 0, message 2).
- If bits 1 through 7 are not zeros, the command is terminated, unit check status is presented, and the sense data returned is format 0, message 4.

Set Special Intercept Conditions X'1B'

This order sets a condition for the SVA that causes it to reject specific commands for the addressed device.

This order applies only to those paths with the same path group ID (regardless of the grouping status) and for the addressed device that receives the next specific command. Only the next specific command received for this address on a path with the specified path group ID is rejected, unit check status is presented, and the sense data returned is format 0, message F.

When the host operating system has conditioned a device on a path group with this order, the SVA rejects the following commands for this address on a path with the specified path group identifier.

- Set Subsystem Mode with one of the following subcommands:
  - Make Cache Available to the Subsystem
  - Make Cache Unavailable to the Subsystem
  - Activate Cache Fast Write Data for the Subsystem
  - Deactivate Cache Fast Write Data for the Subsystem
  - Make Nonvolatile Storage Available for the Subsystem
  - Make Nonvolatile Storage Unavailable for the Subsystem.
- Perform Subsystem Function with one of the following orders:
  - Destage Modified Tracks
  - Set Special Intercept Condition.
- Diagnostic Control with any option.

If a device is operating in this condition for a channel path, and the status includes attention for this device for this path, the storage path adds unit check to that status. This added unit check status does not reset the device to normal operation. This order requires two parameter bytes, the order byte and the flag byte.

Table 56 Parameter Bytes for Set Special Intercept X'1B'

Byte	Parameter	Function
1	Flag byte	Must be zero

The storage path presents channel end and device end after processing is completed. System resets follow normal path group rules for resetting the device to normal conditions. Processing a selective reset, a Set Path Group ID or a Suspend Multipath Reconnection command does not reset the device address to normal conditions.

The following conditions apply to this order:

- This command must be the first command in the chain or must be immediately preceded by a Suspend Multipath Reconnection command that is first in a chain. If this requirement is not met, the command is terminated and unit check status (invalid sequence) is presented.
- If any command is chained from this command, it is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If this command addresses a device on an interface for which a path group has not been established, the command is rejected, unit check status is presented, and the sense data returned is format 0, message F.
- If the SVA receives less than two parameter bytes, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 3.
- If the flag byte is not zero, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 4.

SVA**Set Interface Identifier X‘B0’**

This order identifies the channel interface for which the SVA subsystem is to prepare a ’node-descriptor’ record. The record is read by a Read Subsystem Data command chained from this Perform Subsystem Function command.

This command order is accepted if the addressed device is not installed or is not available. This order requires four parameter bytes, including the order and flag bytes.

Table 57 Parameter Bytes for Set Interface Identifier X'B0'

Byte	Parameter	Function
1	Flag byte	**Bits** **Meaning** 0 Message Required = 0 1-5 Reserved 6-7 Node Selector: 00A Node Descriptor for the interface processing this command and 3 subsystem node qualifier records is prepared for transfer. (The Interface ID in bytes 2-3 is ignored.) 01Only a Node Descriptor for the interface identified in parameter Bytes 2 and 3 is prepared for transfer. 10-11 Reserved
2-3	Interface ID	Bits Meaning 0-7 Must be zero 8 Port Pair ID or Reserved. For ICE3 cards, Port Pair ID (0=bottom port, 1=top port). For all other channel cards - Reserved (0). 9-10 Card Slot Location in cluster (00-11) 11 Cluster: 0 or 1 12 Reserved = 0 13-15 Physical Interface: 000 or 001

The following conditions apply to this order:

- Flag byte bits 0-5 must be all zeroes.
- Flag byte bits 6 and 7 must be '00' or '01'.
- If flag byte bits 6 and 7 are '01,' bytes 2 and 3 must contain a valid Interface ID.

If all parameter conditions are met with parameter Byte '1' equal '01' and parameter Bytes 2 and 3 are found to contain an interface ID that is invalid for the receiving subsystem, the command is rejected (format 0, message F - Status Not as Required).

Any other parameter condition violations results in the command being rejected with format 0, message 4 - invalid parameter. The Set Interface Identifier order is accepted on parallel or ESCON channels.

This command and suborder can only be followed by a Read Subsystem Data command in the same command chain. If followed by any other command in the same command chain, that command is

rejected with format 0, message 2. If all chaining and parameter conditions are satisfied, a status of channel end and device end are presented.

Sense Subsystem Status

Table 58 Sense Subsystem Status Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Sense Subsystem Status	SNSS	54

The Sense Subsystem Status command causes the SVA to send 40 bytes of information to the channel. If the CCW count is more than 40, only 40 bytes are transferred. If the CCW count is fewer than 40 bytes, only the specified number of bytes are transferred. The information contained in these bytes describes the status of the SVA subsystem and the addressed device.

This command is accepted even if the device is not ready. Refer to "Status Presented To Commands" on page 36 for the operation of this command when other subsystem and device status conditions exist.

Table 59 Sense Subsystem Status Parameters

Byte	Parameter	Function
0	Not Used	Always zero
1	Device Unit Address	Device Unit Address
2	Number of Devices	The number of devices for which the subsystem is maintaining statistics.
3	Number of Statistics sets per device	This byte contains X'01'
4	Overall caching status	Refer to page 112.
5	Overall nonvolatile storage status	Refer to page 113.
6-7	Length of performance statistics	The length in bytes of data read by a Read Subsystem Data command requesting performance data. **Note:** For non-ESCON channels, these bytes contain zeros, denoting that the length is 96 bytes. For ESCON channels, these bytes contain 0x00C0, denoting that the length is 192 bytes.

Table 59 Sense Subsystem Status Parameters (Continued)

Byte	Parameter	Function
8-9	Not Used	Always zero
10-13	Configured cache capacity	Configured cache capacity in kilobytes.
14-17	Available cache capacity	The number of bytes of cache available to this subsystem for cache space in kilobytes. This is the total online space available to this subsystem for caching.
18-21	Pinned cache space	The number of bytes of pinned data in cache (data that cannot be transferred to DASD because of an error), in kilobytes.
22-25	Offline cache capacity	The number of bytes of cache unavailable to the storage director because of cache read failures in kilobytes. **Note:** The sum of the available cache capacity, pinned cache capacity, and offline cache capacity is always less than the configured cache capacity. The difference in these two values reflects the amount of cache capacity that is never available for caching. This space is the space for subsystem control data and the space remaining after the storage director allocates as many track-slot segments as possible.
26-27	Addressed device status (Part 1)	Refer to page 113.
28-31	Configured nonvolatile storage capacity	Configured nonvolatile storage capacity available to this subsystem in kilobytes.
32-35	Pinned nonvolatile storage space	Nonvolatile storage capacity in bytes that is currently used by pinned data (data that cannot be transferred to DASD because of an error.)SVA
36	Addressed device status (Part 2)	Refer to page 114.
37	Reserved	Always zero
38-39	Subsystem identifier	The subsystem identifier (SSID) for the functional storage control.

The Sense Subsystem Status command is not valid in the following conditions:

- If the command is issued in a Locate Record or Locate Record Extended domain. In this case, the command is rejected, unit

check status. is presented, and the sense data returned is format 0, message 2.

- If the command is not the first command in a chain or chained directly from a Read Device Characteristics, a Read Configuration Data, or a Suspend Multipath Reconnection command. If it is preceded by a Suspend Multipath Reconnection command, the Suspend Multipath Reconnection command must be the first command in the chain. In any of these cases, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If any command is chained from the Sense Subsystem Status command. In this case, that command is rejected, unit check status is presented, and the sense data returned is format 0, message 2. However, the rejection of this chained command reject does not affect the operation of the Sense Subsystem Status command.

Ending Status

Channel end and device end are presented when data transfer is completed.

SNSS Byte 4 - Overall Caching Status

Two fields define the subsystem caching status conditions that are associated with the caching status of the storage path receiving the command.

Table 60 Subsystem Caching Status

Bits	Description
0-2	Subsystem Caching Status **Bit Value** — **Description** 000 — Active: cache is active. 001 — Pending active: cache is being activated. 010 — Offline: an internal error has made cache unavailable. (Not applicable for the SVA.) 100 — Deactivated: cache has been deactivated at the request of the host program or the SVA support processor. 110 — Pending-off in process: a command to deactivate cache was received, but an operation is still in process. 111 — Pending off failure: a command to deactivate cache was received, but destaging failed. (Not applicable for the SVA.)
3	On — Disabled for maintenance: cache is offline. (Not applicable for the SVA.)

Table 60 Subsystem Caching Status

Bits	Description
4-5	Not used (always zeros)
6	On IML device is not available. (Not applicable for the SVA.)
7	ON Cache fast write has been deactivated.

SNSS Byte 5 - Overall Nonvolatile Storage (NVS) Status

Two fields show the status of nonvolatile storage.

Bits	Bit Value	Description
0-1	Subsystem NVS Status	
	00	Active: NVS is activated.
	01	Failed: an internal error has made NVS unavailable. (Not applicable for the SVA.)
	10	Unavailable: NVS has been deactivated at the request of the host program or the SVA support processor. All data has been discarded or successfully destaged.
	11	Pending: a request to make NVS unavailable has been received, but an operation is in process.
2	Not Used	Always zero
3	On	Disable for maintenance: NVS is offline. (Not applicable for the SVA.)
4	On	Pending: NVS is unavailable because of an error. (Not applicable for the SVA.)
5-7	Not Used	Always set to zero

SNSS Bytes 26 and 27 - Addressed Device Status (Part 1)

These bytes define the caching status and DASD fast write status for the addressed device. This status information is also in the data returned by the Read Subsystem Data command, if that command is preceded in the chain by a Perform Subsystem Function command

with the Prepare for Read Subsystem Data order with a Subsystem Statistics suborder.

Bits	Bit Value	Description
0-1	Device Caching Status for the Device	
	00	Activated: cache is activated for the device.
	01	Not used
	10	Deactivated pending: the deactivate operation is in progress.
	11	Deactivated: cache is deactivated for the device.
2-3	DASD Fast Write Status for the Device	
	00	Activated: DASD fast write is allowed for the device.
	01	Not used
	10	Deactivated pending: the deactivate operation is in progress.
	11	Deactivated: DASD fast write is deactivated for the device.
4	Not Used	Always zero
5	Not Used	Always zero
6-7	Not Used	Always zero
8-9	Not Used	Always zero
10-15	Not Used	Always zero

SNSS Byte 36 - Addressed Device Status (Part 2)

This byte contains additional status information for the addressed device. This status information is also in the data returned by the Read Subsystem Data command, if that command is preceded in the chain by a Perform Subsystem Function command with the Prepare for Read Subsystem Data order with a Subsystem Statistics suborder.

Bits	Meaning
0-1	Reserved; always set to zeros
2	Data exists in the failed nonvolatile storage for this device. (Not applicable for the SVA.)
3-7	Reserved; always zeros

Read Subsystem Data

Table 61 Read Subsystem Data Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Read Subsystem Data	RSSD	3E

The Read Subsystem Data command causes the SVA to send the data requested by the Perform Subsystem Function command that immediately preceded the Read Subsystem Data command in the chain.

The data sent to the channel is what was requested by the Perform Subsystem Function command from which this command is chained. Subsystem data requests can be made by the Perform Subsystem Function command with either a 'Set Interface Identifier' order (0xB0) or a Prepare for Read Subsystem Data order (0x18). The following table indicates the type of data requested and the method used to request it.

Table 62 Read Subsystem Data Suborders

Order (Byte 0)	Suborder (Byte 6)	Requested Data Type	Refer to page:
0x18	00	Storage path status	116
	01	Subsystem statistics	117
	02	Cache fast write identifier	121
	03	Message buffer	121
	04	Not used	
	05	Pinned track data	123
0xB0		Node descriptor and qualifiers	123

The Read Subsystem Data command is not valid in the following conditions:

- If the command is issued in a Locate Record or Locate Record Extended domain. In this case, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.
- If the command is not chained from a Perform Subsystem Function command with a Prepare for Read Subsystem Data order. If the command is not so chained, the command is rejected, unit check

status is presented, and the sense data returned is format 0, message 2.

If the CCW count is more than the number of bytes specified for the data, only the number of data bytes are transferred. If the CCW count is fewer than the number of bytes specified for the requested data, only the specified number of bytes are transferred.

Only a Perform Subsystem Function command with a Prepare for Read Subsystem Data order can be chained from this command. If any other command is chained from this command, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Ending Status

Channel end and device end are presented when the data transfer is completed.

Storage Path Status

When the Perform Subsystem Function command has the order Prepare for Read Subsystem Data with Byte 6 equal to X'00', a 16-byte record containing four bytes of path status for each storage path is read. The following table defines the contents of a record.

Table 63 Storage Path Status

Byte	Parameter	Function
0-3	Status of Storage Path 0	**Byte Meaning** 0 Storage Path/Device Status **Bit Meaning** 0When this bit is '1', Bytes 1 through 3 contain valid values. When this bit is '0', this storage path is not installed on this subsystem. 1The device attaches through this storage path. 2This storage path is disabled. When this bit is '1', Bytes 1 through 3 are invalid. 3The device has a permanent or internal fence from this storage path. Always 0 for the SVA. 4-7The ID of the channel requesting status (0 for channel A, 1 for channel B, etc.) (channel number in cluster). 1-2 Bit map of channels enabled in this storage cluster. 3 Reserved; always set to zero.

Table 63 Storage Path Status

4-7	Status of Storage Path 1	Same byte/bit description as Bytes 0-3 described above.
8-11	Status of Storage Path 2	Same byte/bit description as Bytes 0-3 described above.
12-15	Status of Storage Path 3	Same byte/bit description as Bytes 0-3 described above.

Subsystem Statistics

When the Perform Subsystem Function command has the order Prepare for Read Subsystem Data with Byte 6 equal to X'01', the statistics record for one or all the devices attached to the functional storage control is read. The following description of the data represents a single record. If a Perform Subsystem Function command with a Prepare for Read Subsystem Data order requests multiple records, those records return as a single entity.

Note: The number of devices and the length of the record are included in Bytes 2, 6, and 7 of the data read by the Sense Subsystem Status command. Non-ESCON channels transfer only 96 bytes, ESCON channels transfer 96 or 192 bytes.

The records are in ascending sequence by channel address with a record for each address (the device does not have to exist or have any data).

For these statistics, a channel operation is defined to start at a Locate Record or Seek command and continue until the next Locate Record or Seek command, or until the end of the CCW chain.

When the Define Extent command in a channel operation specifies inhibit cache loading, how the channel operation is counted depends on whether or not the operation accesses DASD. If DASD is not accessed because the operation is a read or write hit or a predictable write, the operation is not counted as inhibit cache loading but is counted as either a normal cache replacement or a cache fast write operation. If the operation accesses DASD, the operation is counted as an inhibit cache loading request.

If the channel operation specifies sequential access with cache fast write data, the operation is counted as a cache fast write data operation instead of a sequential access operation.

This data is kept in shared memory. If cache is made unavailable (logically) to the subsystem with a Set Subsystem Mode, or if a Diagnostic Control or Diagnostic Initialize Subsystem command is

received, the counters are reset to zero. If cache is unavailable (logically) to the subsystem, only Bytes 0 through 3 and bytes 94 and 95 are valid.

Note: Refer to , "Read Subsystem Data (RSSD) Differences" on page 233, for additional details concerning the statistics record that the SVA returns versus the statistics record that an IBM 3390 returns.

Table 64 Subsystem Statistics

Bytes	Description	Refer to Page:
0	When Byte 0, bit 0 is '1', cache is not available and all counts are zero.	
1	Device unit address to which the data pertains.	
2-3	Addressed Device Status - Part 1. The same data as Bytes 26 and 27 of the Sense Subsystem Status command.	113
4-7	*Search or read normal I/O requests*. The number of channel operations that had at least one search or read command, but no write commands. If the operation had a Define Extent command, it specified either normal cache replacement or inhibit cache loading, which did not access DASD. The Define Extent command, if present, did not include a cache fast write attribute.	237
8-11	*Search or read normal I/O request hits*. The number of search or read caching channel operations that did not move any data to or from a device. If the operation had a Define Extent command, it specified either normal cache replacement or inhibit cache loading. The Define Extent command, if present, did not include a cache fast write attribute.	239
12-15	*Write normal I/O request*s. The number of channel operations that had at least one write command. If the operation had a Define Extent command, it did not include a cache fast write attribute.	240
16-19	*DASD fast write I/O request hits*. The number of channel operations that had at least one write command. The operation did not cause the concurrent transfer of data to or from a device. If the operation had a Define Extent command, it did not include a cache fast write attribute.	242
20-23	*Search or read sequential I/O requests*. The number of channel operations that had at least one search or read command and no write commands. The Define Extent command specified sequential access and not cache fast write.	237

Table 64 Subsystem Statistics (Continued)

Bytes	Description	Refer to Page:
24-27	*Search or read sequential I/O request hits*. The number of channel operations that had at least one search or read command and no write commands. The operation did not cause the concurrent transfer of data to or from a device. The Define Extent command specified sequential access and not cache fast write.	239
28-31	*Write sequential I/O requests*. The number of channel operations that had at least one write command. The Define Extent command specified sequential access and not cache fast write.	240
32-35	*DASD fast write sequential I/O request hits*. The number of channel operations that had at least one write command. The operation did not cause the concurrent transfer of data to or from a device. The Define Extent command specified sequential access and not cache fast write.	242
36-39	*Search or read cache fast write I/O requests*. The number of channel operations that had at least one search or read command and no write commands. The Define Extent command specified cache fast write and did not specify bypass cache. If the Define Extent command specified inhibit cache loading, DASD was not accessed.	243
40-43	*Search or read cache fast write I/O request hits*. The number of channel operations that had at least one search or read command and no write commands. The Define Extent command specified cache fast write and did not specify bypass cache. The operation did not cause the concurrent transfer of data to or from a device.	250
44-47	*Cache fast write I/O requests*. The number of channel operations that had at least one write command. The Define Extent command specified cache fast write and did not specify bypass cache. If the Define Extent command specified inhibit cache loading, DASD was not accessed.	252
48-51	*Cache fast write I/O request hits*. The number of channel operations that had at least one write command. The Define Extent command specified cache fast write and did not specify bypass cache. The operation did not cause the concurrent transfer of data to or from a device.	254

Table 64 Subsystem Statistics (Continued)

Bytes	Description	Refer to Page:
52-55	*Inhibit cache loading I/O requests*. The number of channel operations that had at least one search, read, or write command that operated directly with DASD. The Define Extent command specified inhibit cache loading.	256
56-59	*Bypass cache I/O requests*. The number of channel operations that had at least one search, read, or write command. The Define Extent command specified bypass cache.	257
60-63	*Sequential DASD-to-cache transfer operations*. The number of tracks transferred from DASD to cache when sequential access was specified.	258
64-67	*DASD-to-cache transfer operations*. The number of tracks or partial tracks transferred from DASD to cache. Sequential access was not specified.	260
68-71	*Cache-to-DASD transfer operations*. The number of tracks transferred from cache to DASD asynchronous to transfer from the channel. The transfer operations were caused by Set Subsystem Mode or Perform Subsystem Function commands, or by anticipatory destage.	262
72-75	For the SVA, always set to zero.	
76-79	*DASD fast write normal write operation counts*. The number of operations that had at least one write command to a device using DASD fast write. If the chain had a Define Extent command, it specified normal cache replacement and did not inhibit DASD fast write.	263
80-83	*DASD fast write sequential write operation counts*. The number of operations that had at least one write command to a device using DASD fast write. The chain had a Define Extent command that specified sequential access and did not inhibit DASD fast write.	265
84-87	Reserved; always set to zeros.	
88	Addressed Device Status - Part 2. The same data as Byte 36 of the Sense Subsystem Status command.	114
89-93	Reserved; always set to zeros.	
94-95	Subsystem identifier (SSID)	
96-191	Not used for the SVA	

Cache Fast Write Identifier

When the Perform Subsystem Function command has the order *Prepare for Read Subsystem Data* with Byte 6 equal to X' 02', the current two-byte cache fast write ID for the subsystem is read. This ID is in the Define Extent command and the Commit order of the Perform Subsystem Function command to ensure that the cache fast write access is valid.

Message Buffer

When the Perform Subsystem Function command has the order Prepare for Read Subsystem Data with Byte 6 equal to X'03', the attention message for this path group is read. The message is a variable length field of up to 4095 bytes. The table below defines the message format. This table defines the contents of the SVA message (Byte 2 is X'02'). This message is returned from a Read Message ID command.

Table 65 Message Format

Bytes	Description	Function
0-1	Length	
2	Format	Value Description 00 Reserved 01 Reserved 02 SVA message (refer to Table 66) 03-FF Reserved
3	Message Code	
4-7	Message Identifier (ID)	If the request wasn't by a message ID, these bytes contain the requested ID even if Byte 2 contains no message.
8	Flags X'00'	
9-4095		Depends upon the format and message

Table 66 SVA Message (Sheet 1 of 2)

Bytes	Description	Function
0-1	Length; X'000B'	
2	Format; X'02'	
3	Message Codes (Hex)	

Table 66 SVA Message (Sheet 2 of 2)

Bytes	Description	Function
3	Message Code	Value Description 00 Not used 01 Delayed response message 02-FF Reserved
4-7	Message Identifier (ID)	If the request was sent by a message ID, these bytes contain the requested ID. If the specific asynchronous operation completed before device end was presented, these bytes are zeros.
8	Flags X‘00’	
9	Operation Completion Status	See Table 67
10		If the message is in response to a Make Cache Available order, bits 0 through 3 are a bit map of caching storage paths. Each bit is ’1’ to show what physical path is caching. For example, if bit 0 is ’1’, storage path 0 is caching.

Table 67 Operation Completion Status

Value	Description
00	Successful completion of a host-initiated asynchronous operation associated with the message ID specified in Bytes 4 through 7. All modified data has been queued for destage and the “no modified data” indicator is set.
01	Completion with errors of a host-initiated asynchronous operation associated with the message ID specified in Bytes 4 through 7. The resources necessary to start the operation are available, but portions of the operation failed.Errors were reported by a unit check of an I/O operation to the device that was performing the asynchronous operation. The sense information from this unit check defines the data associated with the asynchronous error. Examine a merged EREP report for all attached systems to determine the significance of the failure(s).

Table 67 Operation Completion Status (Continued)

02	A failed operation from a host-initiated asynchronous operation associated with the message ID specified in Bytes 4 through 7. The host's request for information is on a specific message, but the operation that owes the message is still in progress. The errors were reported by a unit check of an I/O operation to the device that was doing the asynchronous operation. The sense information from this unit check defines the data associated with the asynchronous error. Examine a merged EREP report for all attached systems to determine the exact failure.
03	Pending status returned by the Read Message ID command. This message code is returned if the operation for which the host has requested information is still in progress, or if the host requested information for the specified ID with a Perform Subsystem Function and the Read Subsystem Data command.
04	Reserved.
05	The 'no modified data' indicator is not set (due to activity during destage), although a Destage Modified Tracks order completed successfully.
06-FF	Not used.

Pinned-Track Data

When the Perform Subsystem Function command has the order Prepare for Read Subsystem Data with Byte 6 equal to X'05', pinned-track data is returned. The SVA does not have pinned data. Thirty-two bytes of 0xF are returned.

Node Descriptor

When the Perform Subsystem Function command has the order of "Set Interface Identifier" (order 0xB0), a 32-byte Node Descriptor of the identified interface is sent to the channel. The following table defines the format of the Node Descriptor.

Note: "Port Pair" refers to the two ports associated with each Channel Interface Processor (CIP) on an ICE3 ESCON channel card.

Table 68 Node Descriptor Record

Bytes	Description	Function
0	Flags	Bits Description 0-2 Node ID Validity: 000 Node ID is valid 001 Node ID is valid, but may not be current 010 Node is not valid 011-111 Reserved 3 Node Type 4-7 Reserved
1-3	Node Parameters	Byte Description 1 Reserved: 0x00 2 Node Class: SVA = 0x01 (DASD) 3 Reserved: 0x00
4-9	Storage Control Type	F0F0F0E5F2E7 (SVA in EBCDIC)
10-12	Model Number	0xF0F0F2 (002)
13-15	Manufacturer	0xE2E3D2 - (STK)
16-17	Plant of Manufacture	0xF0F1- (01-Louisville) 0xF0F2 - (02-Puerto Rico)
18-29	Sequence Number	Unit sequence number in EBCDIC - the control unit assembly serial number, which is riveted to the front of the frame in the upper right corner.
30-31	Tag ID (Interface)	00xx, where xx: **Bit Meaning** 0 Port Pair ID or Reserved. For ICE3 cards: •0 = bottom port •1 = top port See “Note” above. For other ESCON channel cards: reserved (0). 1-2 Card slot location 00-11(0-3) in cluster 3 Cluster (0 - 1) 4 Reserved (0) 5-7 Physical Interface (CIP ID on card)(000 or 001) •000 = Upper CIP on card •001 = Lower CIP on card

Node Qualifiers

If the flag byte of the Perform Subsystem Function command was ‘00’, three 32-byte Node Qualifiers are also sent to the channel. A Node Qualifier uses ranges to describe the protocol for each interface on the subsystem. These ranges are described with 8 bytes; the first 4 bytes describe the first interface of a range, the second 4 bytes describe the last interface of a range. All fields that are not required by the configuration is set to zeros.

Note: “Port Pair” refers to the two ports associated with each Channel Interface Processor (CIP) on an ICE3 ESCON channel card.

Table 69 Node Qualifiers

Bytes	Description	Values
32	Flags	Zeros
33-39	Reserved	Zeros

Table 69 Node Qualifiers (Continued)

Bytes	Description	Values
40-43	Range #1HI	First Interface ID in Range (first entry) **Bytes** **Bits** **Meaning** 0 0-1 Entry Type (ET): 00 No meaning 01 Interface ID 10 Part of range 11 Model information 2-3 Reserved 4-7 Interface Protocol: 0000 Unspecified 0010 ESCON I/O (SVA) 0011 Fiber Extended (9034) 0100 Fiber Extended CU (9035) 1 0-3 Reserved: 000 4-7 Subassembly Type: 0000 Unspecified 0001 LED (SVA) 0010 Laser 2 High byte of Interface Tag (ID): = ‘0x00’ 3 Low byte of Interface Tag (ID): **Bit** **Meaning** 0 Port Pair ID or Reserved. For ICE3 cards: •0 = bottom port •1 = top port See “Note” above. For other ESCON channel cards: reserved (0). 1-2 Card slot location 00-11(0-3) in cluster 3 Cluster (0 - 1) 4 Reserved (0) 5-7 Physical Interface (CIP ID on card)(000 or 001) •000 = Upper CIP on card •001 = Lower CIP on card

Table 69 Node Qualifiers (Continued)

Bytes	Description	Values
44-47	Range #1 LO	Last Interface ID in Range (second entry)
48-55	Range #2 HI/LO	See Range #1 HI and LO definitions
56-63	Range #3 HI/LO	See Range #1 HI and LO definitions
64	Flags	Zeros
65-71	Reserved	Zeros
72-79	Range #4HI/LO	See Range #1 HI and LO definitions
80-87	Range #5HI/LO	See Range #1 HI and LO definitions
88-95	Range #6 HI/LO	See Range #1 HI and LO definitions
96	Flags	Zeros
97-103	Reserved	Zeros
104-111	Range #7 HI/LO	See Range #1 HI and LO definitions
112-119	Range #8HI/LO	See Range #1 HI and LO definitions
120-127	Not Used	Zeros

Read Message ID

Table 70 Set Path Group ID Command, Mnemonic, and Hex Code

Command	Mnemonic	Hex Code
Read Message ID	RMID	4E

The Read Message ID command sends 11 bytes of data to the channel. Refer to Table 147 on page 257 for the message contents. The message format is the same, whether this command is chained from a *Set Subsystem Mode* or a *Perform Subsystem Function* command.

This command is used to read the message identifier. The subsystem assigns the message identifier when a Set Subsystem Mode or a Perform Subsystem Function command requests notification when an asynchronous operation is complete. If the message identifier is zero, the asynchronous operation completed before device end was presented.

This command is not valid in a Locate Record command or Locate Record Extended domain. If this command is received in a Locate Record or Locate Record Extended domain, the command is rejected,

unit check status is presented, and the sense data returned is format 0, message 2.

This command can be chained directly from a Set Subsystem Mode or a Perform Subsystem Function command that requests a message. If not in a specified chain, the command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

This command must be the last command in the chain. Any command chained from a Read Message ID command is rejected, unit check status is presented, and the sense data returned is format 0, message 2.

Channel end and device end status is presented when the message ID transfer is completed.

ECKD 32-Byte Sense Data

3

The SVA sense data consists of 32 bytes of information that identifies the cause of the last unit check status presented for a functional device on a channel interface. Sense data also contains information that may be required for system error recovery initiated by host error recovery procedures (ERPs).

When sense byte 27, bit 0 is “0”, the sense data is formatted as ECKD 32-byte sense data. ECKD 32-byte sense data is the new generation of sense data designed to accommodate new storage subsystem features and conditions.

The SVA employs ECKD 32-byte sense data to report:

- All SIMs on all device addresses
- All equipment checks, data checks, and usage statistics for a functional device configured as a 3390-type device.

Sense Byte Structure and Description

The SVA sends sense data to the channel when it receives a Sense command. If the Sense command is not preceded by a unit check status for the same device on the same channel interface, the sense is 24-byte compatibility, format 0 message 0, with sense bytes 0 through 3 equal to zero (refer to , “24-Byte Compatibility Sense Data” on page 151.)

In ECKD 32-byte sense data, the general error classification is identified by an exception class identified in the high nibble of sense byte 22. Host error recovery procedures are determined by the contents of sense byte 25, which contains the program action code that indicates the type of action to take.

The Controller reports all specific back-end errors to the SVA support processor (ISP) in a failure report. The ISP logs the errors and generates service information messages (SIMs), as necessary. A SIM may identify a primary suspect field-replaceable unit (FRU) — the FRU that may have caused the error condition. If an error condition is detected while the SVA is not communicating with a channel or after ending status is presented for a CCW (channel command word) chain,

the errors are reported with a subsequent channel-initiated selection. SIMs are reported in this fashion.

Note: All devices referred to in this chapter are functional devices unless they are otherwise specified as physical devices. All tracks referred to in this chapter are functional tracks unless they are otherwise specified as physical or array tracks.

ECKD 32-Byte Sense Data Summary

Table 71 ECKD 32-Byte Sense Information Summary

Byte	Bit	Meaning
0	0	Reserved for the SVA
	1	Intervention Required
	2.	Reserved
	3	Equipment Check
	4	Data Check
	5	Reserved
	6	Not used
	7	Reserved for the SVA
1	0	Permanent Error
	1	Reserved for the SVA
	2	Reserved
	3	Message to Operator
	4	Reserved
	5-7	Reserved for the SVA
2	—	Functional storage control type code, or, for certain SIMs, Environment Data Present
3	—	Remaining intent count (all exception classes except class 6) Reserved for the SVA (exception class 6)
4	—	Device Address
5	—	Device type code

Table 71 ECKD 32-Byte Sense Information Summary (Continued)

Byte	Bit	Meaning
6	0	Reporting unit
	1	Device address valid
	2	Track address valid
	3	Reserved
	4-7	Format
7	—	Sector number (exception class 4, format 1) Data overrun flag (exception class 6) Reserved for the SVA (exception class E)
8-9	—	Record ID (exception class 4, format 1) Number of motion seeks (exception class 6) Reserved for the SVA (exception class E)
10-12	—	Record ID continued (exception class 4, format 1) Time-of-day (exception class 6) Reserved for the SVA (exception classes 6 and E)
13-14	—	Time-of-day (exception class 6). Reserved for the SVA (exception class 4, format 1 and exception classes 6 and E)
15-16	—	Manufacturer, Product, and Plant ID
17-19	—	Controller Serial Number
20-21	—	Subsystem ID
22-23	—	Fault symptom code
24	—	Logging and message control
25	—	Program action code (PAC)
26-27	—	Configuration data
28	—	Bytes read or searched (exception class 6). Reserved for the SVA (all other exception classes)
29	—	High cylinder address. Bytes read or searched continued (exception class 6)
30	—	Low cylinder address
31	—	Head address

ECKD 32-Byte Sense Data Definitions

This section defines the contents of sense bytes reported in ECKD 32-byte sense data.

Those bytes or bits that are defined for a 3990-3, but do not apply in the SVA subsystem, are “Reserved for the SVA”. Those bytes or bits that are reserved for a 3990-3 and the SVA, are “Reserved”.

For an actual 3990-3, non-SIM exception classes B, C, D, and E, bytes 7 through 14 contain DASD specific information that is not applicable in an SVA subsystem. Exception class E is the only one of these four exception classes that is reported by the SVA in non-SIM sense data. In these latter situations, sense bytes 7 through 14 are “Reserved for the SVA.”

Some bits in bytes 0 and 1, and bytes 2, 7 through 16, and 28 through 31 have unique definitions for SIMs (refer to Chapter 7, “SIM Sense Data.”)

Sense Bytes 0 and 1 - Unit Check Description

These bytes describe the type of error.

Byte 0, Bit 0

This bit is not used by the SVA and is always set to zero.

Byte 0, Bit 1 - Intervention Required

The following conditions cause an intervention required exception:

- The addressed functional device was disabled.

Note: A configured functional device can be logically enabled and disabled via the ECAM software interface or from one of the subsystem operator panels.

- A write command was received for a functional device associated with a Production or Test partition and the partition was out of conditional capacity.

Note: An Erase command is rejected, since initially additional storage space is required to process the command.

- A SVA Controller-to-disk array communication error occurred.
- The subsystem is in Data Assurance Check (DAC) mode. Refer to Appendix H, “Non-SIM Sense Data for SVA back-End Errors.”
- The addressed function device is not configured (has an unknown device type)

Byte 0, Bit 2

This bit is reserved for the SVA and is always set to zero.

Byte 0, Bit 3 - Equipment Check

An equipment check occurs if an unusual hardware condition originated in the subsystem.

Byte 0, Bit 4 - Data Check

The following conditions cause a data check exception:

- If the PCI Fetch Mode was “1” in the file mask and the data to the channel was corrected by retry.
- If a functional track could not be staged because:
  - Drives within redundancy groups were removed or moved without authorization
  - A triple drive failure occurred within a redundancy group
  - Secondary (redundancy grouping) tables were unrecoverable
  - Mapping tables were unrecoverable
  - Data was unreadable and unrecoverable (redundancy was unreadable)

  In any of these cases, the fault symptom code indicates a home address area error. Permanent Error (byte 1, bit 0) is also set to ‘1’.
- If a functional track in cache was unreadable due to a cyclic redundancy check mismatch. The fault symptom code indicates a key or data area error. Permanent Error (byte 1, bit 0) is also set to ‘1’.
- If a data error caused by a previous incomplete write operation was detected during a subsequent read operation. Permanent Error (byte 1, bit 0) is also set to “1.”

  An incomplete write may occur if a processor failed during the write operation, and the write was not retried by the host following internal recovery for that processor failure.

  This data check does not occur if the host follows normal re-drive procedures. The fault symptom code (FSC) indicates a key or data area error.

Byte 0, Bit 5

This bit is reserved and is always set to zero.

Byte 0, Bit 6

This bit is not used and is always set to zero.

Byte 0, Bit 7

This bit is reserved for the SVA and is always set to zero.

Byte 1, Bit 0 - Permanent Error

This bit indicates that host program error recovery procedures are not required on this path.

The following condition causes a permanent error exception:

- Internal retry was not applicable and no other path in either storage cluster was available for retry
- Internal retry was not successful in either storage cluster
- System error recovery was not possible or not desirable on this path.

Byte 1, Bit 1

This bit is reserved for the SVA and is always set to zero.

Byte 1, Bit 2

This bit is reserved and is always set to zero.

Byte 1, Bit 3 - Message to Operator

For Controller SIMs, this bit indicates that a message should be sent to the host operator. Otherwise, this bit is zero.

Byte 1, Bit 4

This bit is reserved and is always set to zero.

Byte 1, Bits 5 through 7

These bits are reserved for the SVA and are always set to zeros.

Sense Byte 2 - Storage Control Type

For non-SIM sense, this byte contains the storage control type code. For the SVA, the only valid value is X’06.’

For SIM Sense Byte 2, refer to Chapter 7, “SIM Sense Data.”

Sense Byte 3 - Remaining Intent Count

A remaining intent count exception condition occurs if the error occurred in a Locate Record or Locate Record Extended domain, this byte contains the value of the count parameter from the preceding Locate Record command less the number of transfer units (records or tracks) that were successfully transferred to the device or to the channel within the interrupted domain of the Locate Record or Locate Record Extended command.

For ***Exception Class 6***, this byte is reserved for the SVA and is always set to zero.

For ***SIM sense***, this byte is not used and is always set to zero.

Sense Byte 4 - Device Address

If the storage path is reporting functional device status, this byte contains the functional device ID. If a functional device cannot be associated with the error, this byte contains zeros (refer to byte 6, bit 1). See the following table

Table 72 Sense Byte 4

Bits	Meaning
0	Device address 128
1	Device address 64
2	Device address 32
3	Device address 16
4	Device address 8
5	Device address 4
6	Device address 2
7	Device address 1

Sense Byte 5 - Device Type Code

The information contained in this byte is dependent upon the exception class of the sense data:

- For ***exception classes 1, 2, 3, 7, and F***, this byte is always set to zero.
- For ***non-SIM exception classes 4, 6, and E***, this byte contains the “real device” OBR code of the functional device being addressed when the error was detected.
- For ***SIM exception class 4***, this byte contains the “real device” OBR code of the functional device being addressed when the error was detected.
- For ***SIM exception classes B, C, D, and E***, this byte is reserved for the SVA and is always set to zero. A functional device cannot be associated with back-end SIMs in an SVA subsystem.

This byte, if non-zero, indicates the functional device type with the following values:

Table 73 Sense Byte 5

Hex Code	Meaning
x’60’	3390 device
x’26’	Unknown device type

Sense Byte 6 - Content and Format

Byte 6, Bit 0 - Reporting Unit

The information in this bit is dependent upon the exception class of the sense data:

- For ***exception classes 4, 6, B, C, D, and E***, when this bit is set to “0”, it indicates that the reporting unit is the unit identified in byte 2.
- For ***non-SIM exception classes 4 and E***, when this bit is set to “1”, it indicates that the reporting unit is the unit identified in byte 5.
- For ***exception classes 1, 2, 3, 7, and F:*** when this bit is set to “1”, it indicates that the serial number in bytes 17 through 19 is valid. (This bit is always set to “1” for exception classes 1, 2, 3, 7, and F, which are Controller SIMs.)
- For ***exception classes 4, B, C, D, and E***, which are device SIMs, this bit is always set to zero.

Byte 6, Bit 1 - Device Address is Valid

This bit indicates that the device address in byte 4 is valid. This bit is set to “1” if a functional device can be associated with the error.

Byte 6, Bit 3

This bit is reserved and is always set to zero.

Byte 6, Bits 4 through 7

These bits indicate the format of the sense data.

- For ***all exception classes except exception class 6***, the sense data returned can be format F (SIM-format) sense. Specific formats are defined for exception classes 4 and 6.
- For ***non-SIM exception class 4***, the sense data returned is format 1.
- For ***exception class 6***, the sense data returned is format 1.
- For ***non-SIM exception class E***, these bits are always set to zero.

These bits are always 0xF for SIMs.

Sense Byte 7 - Sector Number or Data Overrun Flag

The information in this byte is dependent upon the exception class of the sense data.

- For ***exception class 4, format 1***, this byte contains the sector number of the record in error.
- For ***exception class 6***, this byte contains the data overrun flag, and is set to 0x01 when reporting that the data overrun threshold has been exceeded on this interface.
- For ***exception class E***, this byte is reserved for the SVA and is always set to zero.

Sense Bytes 8 and 9 - Record ID or Number of Motion Seeks

The information in these bytes is dependent upon the exception class of the sense data.

- For ***exception class 4, format 1***, these bytes and bytes 10 through 12 contain the record ID from the count area that had the error.
- For ***exception class 6***, these bytes contain the accumulated number of access actions from Seek, Seek Cylinder, Locate Record, Locate Record Extended, Read IPL, and Re-calibrate CCWs, including seeks for transfers to and from cache. Retries are not in the count.
- For ***exception class E***, these bytes are reserved for the SVA and are always set to zero.

Sense Bytes 10 through 12 - Record ID or Time-Of-Day

The information in these bytes is dependent upon the exception class of the sense data.

- For ***exception class 4, format 1***, these bytes and bytes 8 and 9 contain the record ID. (Refer to bytes 8 and 9.)
- For ***exception class 6***, these bytes are reserved for the SVA and are always set to zero.

Note: text='Exception'.When the Controller uses exception class 6 sense to report the Controller time-of-day, these\ bytes and byte 13 contain the time-of-day in BCD format (HHMMSSCC - hours, minutes, seconds, and hundredths of a second).

- For ***exception class E***, these bytes are reserved for the SVA and are always set to zero.

Sense Bytes 13 and 14 - Time-of-Day

The information in these bytes is dependent upon the exception class of the sense data.

- For ***exception class 4, format 1***, these bytes reserved for the SVA and are always set to zero.
- For ***exception class 6***, these bytes are reserved for the SVA and are always set to zero.

Note: text='Exception'.When the Controller uses exception class 6 sense to report the Controller time-of-day, byte 13 and bytes 10 through 12 contain the time-of-day in BCD format (HHMMSSCC - hours, minutes, seconds, and hundredths of a second).

- For ***exception class E***, these bytes are reserved for the SVA and are always set to zero.

Sense Bytes 15 and 16 - Manufacturer, Product, and Plant ID

These bytes contain the manufacturer, product, and plant ID for the control unit reporting the sense data.

Sense Byte 15

Table 74 Sense Byte 15

Bits	Meaning
0-5	Manufacturer ID (Sun Microsystems = 000100)
6-7	Product ID (high bits) (currently not used)

Sense Byte 16

Table 75 Sense Byte 16

Bits	Meaning
0-2	Product ID (low bits). Values currently defined: • Reserved = 001 • Iceberg = 010
3	Reserved
4-7	Plant ID. Values currently defined: • Louisville = 0001 • Puerto Rico = 0010

Sense Bytes 17 through 19 - Frame Serial Number

These bytes contain the low three bytes of the frame serial number (converted to hexadecimal) for the Controller reporting the exception condition.

Sense Bytes 20 and 21 - SSID

These bytes contain the SSID of the storage path affected by the exception condition. The information contained in these bytes is dependent upon the exception class of the sense data.

Sense Byte 20

- For ***exception class 0***, this byte contains the DASD Controller ID. For the SVA, the DASD Controller ID is the string id, which is also the low byte of the subsystem ID (SSID).
- For ***exception class 1***, this byte is reserved for the SVA and is always set to zero.
- For ***exception classes 2, 3, 4, 5, 6, and F:***, this byte and byte 21 contain the SSID of the storage path affected by the exception condition.

Sense Byte 21

- For ***exception classes 0 and 1***, this byte contains the low byte of the SSID.
- For ***exception classes 2, 3, 4, 5, 6, and F***, this byte and byte 20 contain the SSID of the storage path affected by the exception condition.

Sense Bytes 22 and 23 - Fault Symptom Code (FSC)

These bytes contain a fault symptom code that provides specific information about the error.

- For ***exception class 6***, sense byte 23 identifies the physical cluster and channel for which the Controller presented the exception condition.

Table 76 Byte 23 Physical Cluster And Channel

Value	Channel	Value	Channel
x0	A	x8	I
x1	B	x9	J
x2	C	xA	K
x3	D	xB	L

Table 76 Byte 23 Physical Cluster And Channel (Continued)

Value	Channel	Value	Channel
x4	E	xC	M
x5	F	xD	N
x6	G	xE	O
x7	H	xF	P

Where: x = 0 or 1 (cluster 0 or 1)

Note: The fault symptom codes defined for the SVA are unique to the SVA. However, in general, the high nibble of the SVA's fault symptom codes is compatible with the high nibble of the 3990 fault symptom codes.

Sense Byte 24 - Logging and Message Control

Byte 24, Bits 0 through 2

These bits are reserved and are always set to zero.

Byte 24, Bit 3

This bit is reserved for the SVA and is always set to zero.

Byte 24, Bit 4 and 5 - Logging Action

These bits show the host error recovery procedures how to log the error.

Table 77 Logging Action

Bit Value	Meaning
00	Do not log
01	Log unconditionally
10	Log only once. In this case, the sense data is logged once within a retry sequence on a path whether or not the retry action is successful.
11	Log only if the error persists on this path. In this case, the sense data is logged only if the error condition persists through all host retry actions on a path.

The logging action is performed in addition to any other program action that is specified. Bits 4 and 5 are the only means to request host sense data logging. A program is not required to interpret other sense data to

determine if logging is required, but may interpret other bits to determine the format of the data to be logged.

Byte 24, Bits 6 and 7 - Operator Message Control

These bytes define the handling of operator messages and are the only means to request a specific message action. A host program is not required to interpret additional sense to determine if an operator message is required.

Table 78 Operator Message Control

Bit Value	Meaning:
00	Send no message
01	Send a message unconditionally These bits are set to “01” when an “intervention required” condition occurs.
10	Send a message once. In this case, a message is sent only once within a retry sequence on a path whether or not the retry action is successful.
11	Send a message only if the error persists on this path. In this case, a message is sent only if the error condition persists through all retry actions on a path.

Sense byte 24 is an extension of the program action code contained in sense byte 25 to the extent that the logging bits in byte 24 invoke the creation of one of the following records:

- MDR (Type 90) for Read/Reset Buffered Log
- MDR (Type 91) for Unit Check Records
- ASYNC (Type A3) for SIM records
- OBR (Type 30) for all other records.

Sense byte 28 contains a message code (x’01’ or x’21’) that, in combination with the exception class in sense byte 22, identifies a unique message to be sent *except* when sense byte 6, bits 4 through 7 are xF’, SIM format.

Sense Byte 25 - Program Action Code

The program action code (PAC) instructs the host ERPs what actions to take. If byte 25, bit 0 is set to “0”, bits 1 through 7 identify a single PAC that describes an error recovery action for one specific condition. If byte 25, bit 1 is set to “0”, bits 1 through 7 identify a compound PAC that describes one or more common error recovery actions.

Single Program Action Codes

Table 79 Single Program Action Codes

Bits 1-7 Value	Meaning
00	No program action required; exit with no error indication.
01	A retry is not recommended; exit with a permanent error indication. This mode is invoked on a functional device failure which cannot be recovered on any path.
02	An intervention required condition has been detected on the reporting unit. Issue a message to the operator indicating intervention is required on the reporting device. Then queue the I/O request until an interrupt is received from the functional device indicating that it is ready.
03-0F	Not used
10	The condition that caused the unit check to be presented is not related to the channel program that is being processed. After performing the logging and message action shown in sense byte 24, bits 4 through 7, restart the channel program.
11-1B	Not used
1C	During a channel program in PCI Fetch Mode, the subsystem did a retry action. The data transferred to the channel may not be valid. The user should take action if the data was accessed before the channel program finished.
1D-7F	Not used

Additional single PACs have been defined for the 3990 that are used when dealing with errors or conditions associated with non synchronous ESCON operations which are not currently supported by the SVA.

Compound Program Action Codes

Table 80 Byte 25 - Compound Program Action Codes

Bit	Error	Error Condition
1	Configuration-dependent function	When this bit is set to “0”, sense bytes 26 and 27 do not specify any configuration-dependent error recovery actions. Currently, this bit is never set to “1”.
2	Reserved for the SVA	Always set to zero
3	Alternate path retry	When this bit is set to “0”, do not retry the operation on other channel paths to the device. When this bit is set to “1”, the Controller has exhausted all internal retries. Retry the operation on each additional channel path to the device other than the channel path on which the exception condition occurred. If the exception condition persists on all paths, perform any other error recovery action indicated. If no other error recovery action is indicated, exit with a permanent error indication. Bit 3 is set to “1” if: • The error occurred on an un-grouped channel on which internal retries (CCRs) have been exhausted. • A Suspend Multipath Reconnection command was issued to the channel path on which the error occurred. • The host is in selector mode.
4-5	Not used	Always set to zero in the SVA.

Table 80 Byte 25 - Compound Program Action Codes (Continued)

Bit	Error	Error Condition
6-7	Retry Count	Specifies the number of retries the host ERPs are to attempt using the same channel path on which the exception condition occurred. Bit Value Meaning 00 Do not retry 01 Retry twice 10 Retry ten times 11 Retry 255 times. If the exception condition persists and bit 3 is set to “0”, perform any other recovery action indicated. If no other error recovery action is indicated, exit with a permanent error indication. If the exception condition persists and bit 3 is set to “1”, attempt the operation on each additional channel path until the operation is completed successfully or until all channel paths have been tried. If the exception condition exists on all paths, perform any other error recovery action indicated. If no other action is indicated, exit with a permanent error condition. Bits 6 and 7 are always set to ’00’ for the Controller, unless the host is in selector mode or if the error occurred on an un-grouped channel on which internal retries have been exhausted.

Sense Bytes 26 and 27 - Configuration Data

Sense Byte 26

Table 81 Sense Byte 26 Bit Meaning

Bits	Meaning
0	Reserved for the SVA and is always set to zero.
1	DLSE Mode. Always set to “1” for the SVA.
2-3	Reserved for the SVA and are always set to zeros.
4	Non synchronous operation. Set to “1” if a channel-connect operation.
5	Not used and is always set to zero.
6	Add the record to the system exception report. Set to “1” for exception class 6 and SIM sense data. This bit is not set in SIMs that report that a partition is low on conditional capacity.
7	Reserved for the SVA and is always set to zero.

Sense Byte 27

Table 82 Sense Byte 27 Error Condition Data

Bit	Error	Error Condition
0	24-byte compatibility	Set to “0” if the sense data is ECKD 32-byte sense data. Set to “1” if the sense data is 24-byte compatibility sense data.
1-3	Reserved	Always set to zero in the SVA
4	Reserved for the SVA	Always set to zero in the SVA
5	Reserved	Always set to zero in the SVA
6	Storage cluster	The storage cluster in use when the error was detected and/or reported. For exception class 4, B, C, D, and E SIMs, bit 6 is the reporting cluster. For non-SIM exception classes 4, 6, B, C, D, and E, bit 6 is not used and is always set to zero. For exception class 1, 2, 3, 7, and F SIMs (Controller SIMs), bit 6 is the storage cluster associated with the error or reporting the error.

Table 82 Sense Byte 27 Error Condition Data

Bit	Error	Error Condition
7	Storage path	The storage path in use when the error was detected. For exception classes 4, 6, B, C, D, and E, bit 7 is not used and is always set to zero. For exception classes 1, 2, 3, and F, bit 7 is the storage path associated with the error or reporting the error.

Sense Byte 28 - Message Code or Bytes Read and Searched

The information contained in this byte is dependent upon

The exception class of the sense data.

- For ***exception class 6***, this byte and sense bytes 29 through 31 contain the number of bytes read or searched. This is an accumulation byte count of all of the fields (including ECC) read from the device.
- For ***all other exception classes***, this byte is reserved for the SVA and is always set to zero.

Sense Byte 29 - 31 - Track Address or Bytes Read and Searched

The information contained in these bytes is dependent upon the exception class of the sense data.

- For ***exception class 6***, these bytes and byte 28 contain the number of bytes read and searched. Refer to byte 28.
- For ***non-SIM exception classes 4 and E***, these bytes contain the functional cylinder and head address (functional track address) of the most recent seek argument accepted from the channel since IML. If sense byte 6, bit 2 is set to “1”, the functional track address is valid. If sense byte 6, bit 2 is set to “0”, a functional track address cannot be associated with the error or condition and these bytes contain zeros.

Byte 29 - High Cylinder Address

Table 83 High Cylinder Address

Bits	Meaning
0-1	Not used (’00’)
2	Cylinder 8192
3	Cylinder 4096
4	Cylinder 2048
5	Cylinder 1024
6	Cylinder 512
7	Cylinder 256

Byte 30 - Low Cylinder Address

Table 84 Low Cylinder Address

Bits	Meaning
0	Cylinder 128
1	Cylinder 64
2	Cylinder 32
3	Cylinder 16
4	Cylinder 8
5	Cylinder 4
6	Cylinder 2
7	Cylinder 1

Byte 31 - Head Address

Table 85 Head Address

Bits	Meaning
0-3	Not used (’0000’)
4	Head 8
5	Head 4
6	Head 2

Table 85 Head Address

Bits	Meaning
7	Head 1

ECKD 32-Byte Sense Exception Classes

ECKD 32-byte sense data uses 12 exception classes to report error conditions associated with functional 3390 devices, non synchronous ESCON operations, and to report SIMs. Bits 0 through 3 of sense byte 22 contain the exception class of the error.

Table 86 Exception Classes

Exception Class	Category or Condition	Refer to Page:
0-2	Reserved for the SVA	
3	Storage path checks (SIM only)	148
4	Data Checks	148
6	Subsystem information	149
7	Sun Microsystems support facility errors (SIM only)	149
B	Controller-to-disk array interface errors (SIM only)	149
C	Head-of-string (A-Disk Array Unit) errors (SIM only)	149
D	Head-of-string-to-device interface errors (SIM only)	149
E	Device errors	150
F	Cache and NVS Checks	150

When byte 6, bits 4 through 7 are set to X'F', the sense data is a SIM.

Exception Class 3 - Storage Path Checks

The subsystem uses exception class 3 for errors or conditions associated with the storage path. These errors are reported to the host as a SIM only.

Exception Class 4 - Data Checks

The subsystem uses exception class 4 to report data checks for functional devices configured as 3390-type devices. This exception class is only reported as format 1. Refer to the description for the Data

Check bit in sense byte 0 for the situations in which data checks can occur in an SVA.

Exception Class 6 - Subsystem Information

The subsystem uses exception class 6 to report:

- Functional device usage counts when the Controller receives a Read and Reset Buffered Log command from the host. In this case, only the device usage counters are read and reset.
- That a functional device usage count requires off-loading because a counter overflowed. In this case, unit check is presented to a subsequent initial selection for that device, over any channel path. The sense data includes the usage count from the counter that overflowed.
- That a channel-interface's data overrun count exceeded a threshold. When the interface's counter exceeds the data overrun threshold, unit check is presented to a subsequent initial selection on that interface.
- Controller time-of-day. The time reported in bytes 10 through 13 is used to synchronize the Controller time with that of attached hosts. This sense data is reported once a day, around midnight, to each attached host. Usage counters are not reset, and the associated bytes are filled with zeros.

Exception Class 7 - Support Facility Errors

The subsystem uses exception class 7 to report support facility errors. These errors are reported to the host as a SIM only.

Exception Class B - Controller-to-Head-of-String Interface Errors

The subsystem uses exception class B to report errors that occur on the interface between the Controller and the head-of-string (HOS) A-Disk Array Unit. These errors are reported to the host as a SIM only.

Exception Class C - Head-of-String Errors

The subsystem uses exception class C to report errors that occur in the head-of-string (HOS) A-Disk Array Unit. These errors are reported to the host as a SIM only.

Exception Class D - Head-of-String to Device Interface Errors

The subsystem uses exception class D to report errors that occur on the interface between the HOS A-Disk Array Unit and a physical device. These errors are reported to the host as a SIM only.

Exception Class E - Device Errors

The subsystem uses non-SIM exception class E to report a functional device intervention required condition. For the SVA, such errors are only reported when:

- An attempt was made to address a functional device that is disabled (either by an operator or a host program)
- There is a Controller-to-disk array communication failure
- The subsystem is operating in data assurance check mode
- An attempt was made to perform a write operation to a functional device that is part of a Production or Test partition that is out of conditional capacity

An attempt was made to address an un-configured functional device.

In all of the preceeding cases, Intervention Required (byte 0, bit 1) is set to “1”.

The subsystem also uses exception class E to report physical device errors. These errors are reported to the host as a SIM only. For additional information on data assurance check mode, out of conditional capacity, and controller-to-disk array communication failure, refer to Appendix H, “Non-SIM Sense Data for Sun Microsystems Back-End Errors.”

Exception Class F - Cache and NVS Checks

The subsystem uses exception class F to report SIMs related to cache and/or nonvolatile storage errors.

24-Byte Compatibility Sense Data

4

The SVA sense data consists of 32 bytes of information that identifies the cause of the last unit check status presented for a functional device on a channel interface. Sense data also contains information that may be required for system error recovery initiated by host error recovery procedures (ERPs).

When sense byte 27, bit 0 is ‘1’, the sense data is formatted as 24-Byte Compatibility Sense. In this format, the first 24 bytes of the 32-byte sense data are compatible with the 24 bytes of sense data returned by pre-3990 subsystems.

The SVA employs 24-byte compatibility sense data to report:

- All Controller equipment checks
- All program checks on all device addresses (format 0)
- All equipment checks, data checks, and usage statistics for a functional device configured as a 3380-type device.

Sense Byte Structure and Meaning

The SVA sends sense data to the channel when it receives a Sense command. If the Sense command is not preceded by a unit check status for the same device on the same channel interface, the sense data returned is format 0, message 0, with Bytes 0 through 3 equal to zero.

In 24-byte compatibility sense data, the general exception condition is identified by the format and message found in sense Byte 7. Sense byte 7, bits 0 through 3 identify the format of the error message. Sense Byte 7, bits 4 through 7 specify the message that describes the exception condition. Host error recovery procedures are determined by the contents of sense bytes 0 through 2 (the unit check description bytes). Refer to “Sense Byte Structure and Meaning” on page 151.

The Controller reports all specific back-end errors to the SVA support processor (ISP) in a failure report. The ISP logs the errors and generates service information messages (SIMs), as necessary. SIMs may identify a primary suspect field-replaceable unit (FRU) - the FRU

that may have caused the error condition. If an error condition is detected while the is not communicating with a channel or after ending status is presented for a CCW (channel command word) chain, errors are reported with a subsequent channel-initiated selection. SIMs are reported in this fashion.

Refer to "ECKD 32-Byte Sense Data" on page 129 and "SIM Sense Data" on page 189 for a description of SIM sense data format and contents.

24-Byte Compatibility Sense Data Summary

The following table is a summary of the 24-Byte Compatibility sense bytes.

Table 87 24-Byte Compatibility Sense Information Summary

Bytes	Bits	Meaning
0	0	Command Reject
	1	Intervention Required
	2	Bus Out Parity Check
	3	Equipment Check
	4	Data Check
	5	Overrun
	6-7	Not used
1	0	Permanent Error
	1	Invalid Track Format
	2	End-of-Cylinder
	3	Message to Operator
	4	No Record Found
	5	File Protected
	6	Reserved for the SVA
	7	Reserved for the SVA
2	0	Reserved for the SVA
	1	Correctable
	2	Reserved for the SVA
	3	Environmental Data Present
	4	Not used
	5	Reserved for the SVA
	6-7	Not used
3		Residual count or ECAM message (format 0), Controller ID (Format 2 and F), or Not used or reserved (all other formats)
4		Device address

Table 87 24-Byte Compatibility Sense Information Summary (Continued)

Bytes	Bits	Meaning
5		Data overrun (format 6) or Low cylinder address (all other formats)
6		Reserved for the SVA (format 6) or Head and high cylinder address (all other formats)
7		Format and Message
8-14		Format-dependent error information Subsystem information
15-16		Manufacturer, product, and plant ID
17-19		Controller serial number
20-23		Format-dependent error information Subsystem information
24		Not used
25		Program action code (PAC)
26-27		Configuration data
28		Time-of-day (format 6) Not used (all other formats)
29-31		Time-of-day (format 6) Cylinder and head address

24-Byte Compatibility Sense Data Definitions

This section defines the contents of sense bytes reported in 24-byte compatibility sense data. Those bytes or bits that are defined for a 3990-3, but do not apply in an SVA subsystem, are “Reserved for the SVA”. Those bytes or bits that are reserved for a 3990-3 and the SVA, are “Reserved”.

Sense Bytes 0, 1, and 2 - Unit Check Description

These bytes describe the type of exception condition experienced and identify the specific action to take for error recovery.

Note: All devices referred to in this chapter are functional devices unless they are otherwise specified as physical devices. All tracks referred to in this chapter are functional tracks unless they are otherwise specified as physical or array tracks.

Byte 0, Bit 0 - Command Reject

The following conditions cause a command reject exception:

- A command or sequence of commands was not valid.

- An argument in a command was not valid or not complete.
- A write command violated the file mask.
- A command in a Locate Record or Locate Record Extended domain did not conform to the operation parameter(s).
- The operation parameter of a Locate Record or Locate Record Extended command specified an operation that the file mask inhibits.
- A multitrack operation in a Locate Record or Locate Record Extended domain tried to access a track that is outside the primary track group.
- Cache, NVS, or the device was not in the state required for the Set Subsystem Mode or the Perform Subsystem Function command.
- A Write Data command in CKD conversion mode presented channel end and then found that the transfer length factor did not match the formatted record length. Invalid Track Format is also set to ‘1’.
- The subsystem detected an unauthorized modification of the subsystem configuration. Message to Operator is also set to ‘1’.
- A Write Special Home Address or Write Home Address command specified a write operation to a diagnostic, alternate, or device support cylinder, and the data being written did not indicate a normal error-free track with a standard HA.
- A Write Record Zero command specified a write operation to a diagnostic, alternate, or device support cylinder, and the data being written did not indicate a normal, error-free track with a standard record zero.
- A read command, other than Read Special Home Address, Read Home Address, or Read Record Zero, specified a read from a diagnostic, alternate, or device support cylinder.
- A Search HA command specified a search to a diagnostic, alternate, or device support cylinder.
- A write command was issued to a functional device that was in a logical ‘read-only’ state.

The unsupported 3990 commands and subcommands described in “Command Summary” on page 4-4 receive Command Reject in a the SVA subsystem.

Byte 0, Bit 1 - Intervention Required

The following conditions cause an intervention required exception:

- The addressed functional device was disabled.

Note: A configured functional device can be logically enabled and disabled via the ECAM software interface or from one of the subsystem operator panels.

- A write command was received for a functional device associated with a Production or Test partition and the partition was out of conditional capacity.

Note: An Erase command is rejected, since initially additional storage space is required to process the command.

- An SVA controller-to-disk array communication error occurred.
- The subsystem is in Data Assurance Check (DAC) mode. Refer to "Non-SIM Sense Data for Back-End Errors" on page 225.

Byte 0, Bit 2 - Bus Out Parity Check

A bus out parity check exception occurs if the Controller detected a data parity error during the transfer of information from the channel. A parity error that occurs during command transfer is a bus out parity check and not a command reject.

Byte 0, Bit 3 - Equipment Check

A data check exception occurs if an unusual hardware condition originated in the channel, Controller, disk array string, or Controller-to-disk array interface.

Byte 0, Bit 4 - Data Check

The following conditions cause a data check exception:

- If the PCI Fetch Mode was '1' in the file mask and the data to the channel was corrected by retry. Correctable (Byte 2, bit 1) is also set to '1'.
- If a functional track could not be staged because:
  - Drives within redundancy groups were removed or moved without authorization
  - A triple drive failure occurred within a redundancy group
  - Secondary (redundancy grouping) tables were unrecoverable
  - Mapping tables were unrecoverable
  - Data was unreadable and unrecoverable (redundancy was unreadable)

  In any of these cases, the fault symptom code indicates a home address area error. Permanent Error (Byte 1, Bit 0) is also set to '1'.
- If a functional track in cache was unreadable due to a cyclic redundancy check mismatch. The fault symptom code indicates a

key or data area error. Permanent Error (Byte 1, Bit 0) is also set to ‘1’.

- If a data error caused by a previous incomplete write operation was detected during a subsequent read operation. Permanent error (Byte 1, Bit 0) is also set to ‘1’

An incomplete write may occur if a processor failed during the write operation, and the write was not retried by the host following internal recovery for that processor failure.

This data check does not occur if the host follows normal re-drive procedures. The fault symptom code (FSC) indicates a key or data area error.

Byte 0, Bit 5 - Overrun

The following condition causes:

- An overrun exception occurs if a data overrun occurred during an attempt to transfer data from the channel and the error could not be corrected after ten channel command retries. The sense data returned is format 2.

Byte 0, Bits 6 and 7

These bits are not used by the SVA and are always set to zeros.

Byte 1, Bit 0 - Permanent Error

This is a modifier bit that overrides any other possible bit settings, and indicates that host program error recovery procedures are not required on this path.

The following conditions cause a permanent error exception:

- Internal retry was not applicable and no other path in either storage cluster was available for retry Internal retry was not successful in either storage cluster System error recovery was not possible or not desirable on this path.
- If the operation is not associated with the current channel program, and internal retry was not successful, Environmental Data Present (Byte 2, Bit 3) is also set to ‘1’.

Byte 1, Bit 1 - Invalid Track Format

The following conditions cause an invalid track format exception:

- The host program tried to write data that exceeded the capacity of a functional track.
- The host program tried to perform an update write operation on a record that had a different size than the record size parameter.

- The host program tried to perform a Write Track operation on a record zero data field that was not eight bytes in length.
- A track format error prevented the staging or de-staging of data. The sense data returned is format F, message 7.

Byte 1, Bit 2 - End of Cylinder

An end of cylinder exception occurs if a read multitrack or search multitrack operation outside a Locate Record or Locate Record Extended domain tried to continue past the last track on the cylinder. This exception condition can be caused by a programming error or by an expected end-of-cylinder condition.

Byte 1, Bit 3 - Message to Operator

When set, this bit indicates that a message should be sent to the host operator.

Byte 1, Bit 4 - No Record Found

A no record found exception occurs if the specified record (record zero or a user record) could not be found on the track. This exception condition is usually caused by a programming error or an expected programming condition.

Byte 1, Bit 5 - File Protected

The following conditions cause a file protected exception:

- A seek operation, Re-calibrate command, or a multitrack operation outside a Locate Record or Locate Record Extended domain violated the seek controls of the file mask.
- An operation tried to access or operate on a track outside the boundaries established by a Define Extent command.
- A multitrack operation in a Locate Record or Locate Record Extended domain tried to access a track outside of the primary track group. Command Reject (Byte 0, Bit 0) is also set to ‘1’.
- A Re-calibrate command was received with diagnostic authorization specified in the file mask. This exception condition can be caused by a programming error or an expected programming condition.

Byte 1, Bits 6 and 7

These bits are reserved for the SVA and are always set to zeros.

Byte 2, Bit 0

This bit is reserved for the SVA and is always set to zero.

Byte 2, Bit 1 - Correctable

A correctable exception occurs if incorrect data was sent to the channel, and corrected data was resent. Data check (Byte 0, Bit 4) is also set to ‘1’. This exception condition occurs only if PCI Fetch Mode is active.

Byte 2, Bit 2

This bit is reserved for the SVA and is always set to zero.

Byte 2, Bit 3 - Environmental Data Present

An environmental data present exception occurs if the Controller has sense information to send to the host operating program, but the sense information is not associated with the current CCW string.

Byte 2, Bit 4

This bit is not used and is always set to zero.

Byte 2, Bit 5

This bit is reserved for the SVA and is always set to zero.

Byte 2, Bits 6 and 7

These bits are not used and are always set to zeros.

Sense Byte 3 - Residual Count, ECAM Message ID, or Controller ID

The information contained in this byte is dependent upon the format of the sense data:

- For **format 0 with File Protected** (byte 1, bit 5 set to ‘1’), this byte contains the number of records remaining to be processed in the Locate Record or Locate Record Extended domain.
- For **format 0 errors detected by the Controller ECAM code**, this byte contains the ECAM message ID (the low byte of the fault symptom code).
- For **formats 1, 2, and F**, this byte contains the Controller ID, which is equal to the string ID, which is also the low byte of the subsystem ID.
- For **all other formats**, this byte is not used or reserved and is always set to zero.

Sense Bytes 4, 5, and 6

Sense bytes 4, 5 and 6 identify the specific device address, the low-order and high-order cylinder address, and the head address of the

most recent seek argument from the channel for the current command chain.

Sense Byte 4 - Device Address

If the storage path is reporting functional device status, this byte contains the functional device ID. If a functional device cannot be associated with the error, this byte contains zeros (refer to Byte 27, Bit 1).

Table 88 Device Address

Bits	Meaning
0	Device Address 128
1	Device Address 64
2	Device Address 32
3	Device Address 16
4	Device Address 8
5	Device Address 4
6	Device Address 2
7	Device Address 1

Sense Byte 5 - Low-Order Cylinder Address

For **all formats except format 6**, this byte contains the low-order cylinder address of the most recent seek argument from the channel. If the error was on an alternate track, this byte contains the low-order functional cylinder address of the defective track. ***Exception:*** if the sense data is for a 3390-9 device type, this byte contains the value 0xFF. The track address is in sense bytes 29-31. See the following table.

Table 89 Low Order Cylinder Address Bits

Bits	Meaning
0	Cylinder Address 128
1	Cylinder Address 64
2	Cylinder Address 32
3	Cylinder Address 16
4	Cylinder Address 8
5	Cylinder Address 4
6	Cylinder Address 2
7	Cylinder Address 1

If a seek argument has not been received since IML, this byte contains zeros. For **format 6**, this byte is reserved for the SVA and is always set to zero.

Sense Byte 6 - Head and High-Order Cylinder Address

For **all formats except format 6**, this byte contains the high-order cylinder address (bits 0 through 3), and the head address (bits 4 through 7) of the most recent seek argument from the channel. If the error was on an alternate track, this byte contains the high-order functional cylinder address and the head address of the defective track. ***Exception:*** if the sense data is for a 3390-9 device type, this byte contains the value 0xFF. The track address is in sense bytes 29-31. If a seek argument has not been received since IML, this byte contains zeros.

Table 90 High Order Cylinder Address Bits

Bits	Meaning
0	Cylinder address 2048
1	Cylinder address 1024
2	Cylinder address 512
3	Cylinder address 256
4	Head address 8
5	Head address 4
6	Head address 2

Table 90 High Order Cylinder Address Bits

Bits	Meaning
7	Head address 1

For **format 6**, this byte contains the data overrun flag, and is set to 0x01 when reporting that the data overrun threshold has been exceeded for this interface.

Sense Byte 7 - Format and Message

Byte 7, bits 0 through 3 identify the format of an error message (refer to "24-Byte Compatibility Sense Formats Summary" on page 170), and Byte 7, Bits 4through 7 specify a message that describes the specific error condition (refer to "24-Byte Compatibility Sense Formats and Messages" on page 170). The exception condition being reported in Bits 4 through 7 depend on the sense format contained in Bits 0 through 3. For those formats that have no defined messages, their value is zero.

Sense Byte 8 - Reason Code, Record ID, or Bytes Read/Searched

The information contained in this byte is dependent upon the format of the sense data.

- For **format 0 message F, and format F messages 2, 6, 9, B, and D**, this byte contains a reason code that gives additional information on the error identified in sense byte 7. (Refer to "Reason Codes" on page 178.)
- For **format 0 messages 0 through E (with Message to Operator, Byte 1, Bit 3 set to '0'), format 2 messages A through E, format 3 (all messages), and format F message 0**, this byte is not used and is always set to zero.
- For **format 0 (with Message to Operator, Byte 1, Bit 3 set to '1')**, this byte is reserved for the SVA and is always set to zero.
- For **formats 4 and 5**, this byte and Bytes 9 through 12 contain the record ID from the count field of the record that experienced the exception condition.
- For **format 6**, this byte and Bytes 9 through 11 contain the number of bytes read or searched, which is an accumulated byte count of all the fields (including ECC) read for the functional device. (If the sense is for a Seek CCW counter overflow, Bytes 8 through 11 are zeros.)

- For **format 1 (all messages), format 2 message F, and format F messages 1, 3, 4, A, and C**, this byte is reserved for the SVA and is always set to zero.

Sense Bytes 9 and 10

The information contained in these bytes is dependent upon the format of the sense data.

- For **formats 0, 2, and 3**, these bytes are not used and are always set to zeros.
- For **format 1**, these bytes are reserved for the SVA and are always set to zeros.
- For **formats 4 and 5**, these bytes and Bytes 8, 11, and 12 contain the record ID (refer to "Sense Byte 8 - Reason Code, Record ID, or Bytes Read/Searched" on page 161).
- For **format 6**, these bytes and Bytes 8 and 11, contain the number of bytes read or searched (refer to "Sense Byte 8 - Reason Code, Record ID, or Bytes Read/Searched" on page 161).
- For **format F messages 0, 2, 6, 9, B, and D**, these bytes are not used and are always set to zeros.

  Exception: For format F message 0, when the fault symptom code is FFF1, these bytes contain the reason that the functional device is in a state-change pending condition. Refer to "Reason Codes for State-Change Pending Sense Data" on page 183.
- For format F, message 1, these bytes are reserved for the SVA and are always set to zeros.

Sense Byte 11

The information contained in this byte is dependent upon the format of the sense data.

- For **formats 4 and 5**, this byte and Bytes 8 through 10, and 12 contain the record ID (refer to "Sense Byte 8 - Reason Code, Record ID, or Bytes Read/Searched" on page 161).
- For **format 6**, this byte and Bytes 8 through 10 contain the number of bytes read or searched (refer to "Sense Byte 8 - Reason Code, Record ID, or Bytes Read/Searched" on page 161).
- For **format 1**, this byte is reserved and is always set to zero.
- For **formats 0, 2, 3, and F**, this byte and sense Byte 12 contain the Cluster/Path/ Hardware Level ID, which identifies the cluster and path on which the error condition occurred; the number of installed

channels per cluster; the installed cache size; and the installed NVS size.

Refer to following table for bit level information for Byte 11 with these formats.

Table 91 Sense Byte 11, Formats 0, 2, 3, and F

Bits	Bit Value	Meaning
0-1	Not used	Always set to zero
2-3	Cluster and Storage Path 00 = Cluster 0 Path 0 01 = Cluster 0 Path 1 10 = Cluster 1 Path 2 11 = Cluster 1 Path 3	Cluster and storage path on which the error condition occurred.
4-6	Channels per cluster 000 = Reserved 001 = 4 010 = Reserved 011 = 8 100 = Reserved 101 = 12 110 = Reserved 111 = 16	The number of installed channels per cluster. This reflects the number of ICE or ICF cards installed.
7	Reserved	Always set to zero

Sense Byte 12

The information contained in this byte is dependent upon the format of the sense data.

- For **formats 4 and 5**, this byte and Bytes 8 through 11 contain the record ID (refer to Byte 8).
- For **format 6**, this byte and Byte 13 contain the accumulated number of Seek, Seek Cylinder, Locate Record or Locate Record Extended, Read IPL, and Re-calibrate CCWs, including seeks for transfers to and from Cache. Retries are not in the count. If the sense is for a Bytes Read/Searched counter overflow, sense bytes 12 and 13 contain zero.
- For **format 1**, this byte is reserved and is always set to zero.
- For **formats 0, 2, 3, and F,** this byte and Byte 11 contain the Cluster/Path/Hardware Level ID, which identifies the cluster and path on which the error condition occurred; the number of installed

channels per cluster; the installed cache size; and the installed NVS size.

Refer to the following table for bit level information for Byte 12 with these formats.

Table 92 Sense Byte 12, Formats 0, 2, 3, and F

Bits	Bit Value	Meaning
0-5	Cache Size (MB) 100000 = 8192 (8 GB) 100010 = 16384 (16 GB) 100101 = 32768 (32 GB)	Contains the size of the installed cache memory.
6-7	00 = Reserved 01 = Reserved 10 = 1 GB 11 = Reserved	Contains the size of the installed NVS.

Sense Byte 13

The information contained in this byte is dependent upon the format of the sense data.

- For **formats 4 and 5**, this byte contains the sector number of the record in error.
- For **format 6**, this byte and Byte 12 contain the number of seek CCWs (refer to "Sense Byte 12" on page 163).
- For **formats 0, 1, 2, 3, and F**, this byte is reserved for the SVA and is always set to zero.

Exception: For **format F message 0, when the fault symptom code is FFF0 or FFF1**, these bytes contain the reason that the subsystem or the functional device is in a state-change pending condition. Refer to "Reason Codes for State-Change Pending Sense Data" on page 183.

Sense Byte 14

The information contained in this byte is dependent upon the format of the sense data.

- For **formats 4 and 5**, this byte contains the DASD Controller ID. For the SVA, the DASD Controller ID is the string id, which is found in the low byte of the subsystem ID (SSID).
- For **format 6**, this byte is reserved and is always set to zero.
- For **formats 0, 1, 2, 3, and F**, this byte is reserved for the SVA and is always set to zero.

Exception: For **format F, message 0, when the fault symptom code is FFF0 or FFF1**, these bytes contain the reason that the subsystem or functional device is in a state-change pending condition. Refer to "Reason Codes for State-Change Pending Sense Data" on page 183.

Sense Bytes 15 and 16 - Manufacturer, Product, and Plant ID

These bytes contain the manufacturer, product, and plant ID for the control unit reporting the sense data.

Sense Byte 15

Table 93 Sense Byte 15

Bits	Meaning
0-5	Manufacturer ID (Sun Microsystems = 000100)
6-7	Product ID (high bits) (currently not used)

Sense Byte 16

Table 94 Sense Byte 16

Bits	Meaning
0-2	Product ID (low bits) Values currently defined: Reserved = 001 Iceberg = 010
3	Reserved
4-7	Plant ID Values currently defined: Louisville = 0001 Puerto Rico = 0010

Sense Bytes 17 through 19 - Frame Serial Number

These bytes contain the low three bytes of the frame serial number (converted to hexadecimal) for the Controller reporting the exception condition.

Sense Bytes 20 and 21 - SSID

These bytes contain the SSID of the storage path affected by the exception condition. The information contained in these bytes is dependent upon the format of the sense data.

Sense Byte 20

- For **format 0**, this byte contains the DASD Controller ID. For the SVA, the DASD Controller ID is the string id, which is also the low byte of the subsystem ID (SSID).
- For **format 1**, this byte is reserved for the SVA and is always set to zero.
- For **formats 2, 3, 4, 5, 6, and F**, this byte and byte 21 contain the SSID of the storage path affected by the exception condition.

Sense Byte 21

- For **formats 0 and 1**, this byte contains the low byte of the SSID.
- For **formats 2, 3, 4, 5, 6, and F**, this byte and byte 20 contain the SSID of the storage path affected by the exception condition.

Sense Bytes 22 and 23 - Fault Symptom Code (FSC)

These bytes contain a fault symptom code that provides specific information about the error.

Exception: A fault symptom code is not reported with format 5 (these bytes are not used and are always set to zeros for format 5).

For **format 6**, sense byte 23, identifies the physical cluster and channel for which the Controller presented the exception condition. See Table 76, “Byte 23 Physical Cluster And Channel,” on page 139.

Sense Byte 24

This byte is not used and is always set to zero.

Sense Byte 25 - Program Action Code

This byte contains the program action code, which provides information to host error recovery procedures (ERPs) about what action to take. If the exception is not associated with one of the conditions identified in the following list, this byte contains zero.

Table 95 Sense Byte 25 Program Action Codes (Sheet 1 of 2)

Bits	Bit Value	Meaning
0	0	Reserved for the SVA and is always set to zero.
	16	Reset notification. Equipment Check is set to ‘1’ and Byte 7 is X’08’.
	1D	A state-change pending condition exists in the subsystem or device. Environmental Data Present is set to ‘1’ and Byte 7 contains X’F0’.

Table 95 Sense Byte 25 Program Action Codes (Sheet 2 of 2)

Bits	Bit Value	Meaning
1-7	70	A command was rejected because the interface was disabled for specific commands by the Set Special Intercept Condition order of the Perform Subsystem Function command. The interface does not stay disabled; therefore, a retry is not rejected.
	71	Attention was presented with unit check status because the interface was disabled for specific commands by the Set Special Interrupt Condition order of the Perform Subsystem Function command. The interface stays disabled.

Sense Bytes 26 and 27 - Configuration Data

These bytes contain the SVA configuration data.

Sense Byte 26

Table 96 Sense Byte 26

Bits	Meaning
0	Reserved for the SVA and is always set to zero.
1	DLSE Mode. Always ‘1’ for SVA.
2-3	Reserved for the SVA and are always set to zeros.
4	Non synchronous operation. Set to ‘1’ if a channel-connected operation.
5-6	Not used and are always set to zeros.
7	Reserved for the SVA and is always set to zero.

Sense Byte 27

This byte contains more the SVA configuration data. Refer to the following table for the configuration data contained in this byte.

Table 97 Sense Byte 27

Bits	Description	Meaning
0	24-byte compatibility sense	• Set to ‘1’ if the sense data is 24-byte compatibility sense data. • Set to ‘0’ if the sense data is ECKD 32-byte sense data.
1	Device address in Byte 4 is valid.	Set to ‘1’ if a functional device can be associated with the error.

Table 97 Sense Byte 27

Bits	Description	Meaning
2	Track address in Bytes 29 through 31 is valid.	Set to ‘1’ if a functional track address can be associated with the error.
3	Not used	Always set to zero
4	Reserved for the SVA	Always set to zero
5	Reserved	Always set to zero
6-7	Storage path affected	The storage path in use when the error was detected and/or reported.

Sense Byte 28

The information contained in this byte is dependent upon the format of the sense data.

When the SVA is reporting time-of-day using format 6 sense, this byte and Bytes 29 through 31 contain, the time-of-day in HHMMSSCC format (hours, minutes, seconds, and hundredths of a second).

In all other cases, this byte is not used and is always set to zero.

Sense Bytes 29, 30, and 31

The information contained in these bytes is dependent upon the format of the sense data.

When the SVA is reporting time-of-day using format 6 sense, these bytes and byte 28 contain the time-of-day in HHMMSSCC format (hours, minutes, seconds, and hundredths of a second).

In all other cases, these bytes contain the functional cylinder and head address (functional track address) of the most recent seek argument accepted from the channel since IML. If Byte 27 bit 2 is set to ‘1’, this is a valid track address. If Byte 27 bit 2 is set to ‘0’, a track address cannot be associated with the exception condition and these bytes are zeros.

Byte 29 - High Cylinder Address

Table 98 Sense Byte 29

Bits	Meaning
0-1	Not used (‘00’)
2	Cylinder 8192
3	Cylinder 4096
4	Cylinder 2048
5	Cylinder 1024
6	Cylinder 512
7	Cylinder 256

Byte 30 - Low Cylinder Address

Table 99 Sense Byte 30

Bits	Meaning
0	Cylinder 128
1	Cylinder 64
2	Cylinder 32
3	Cylinder 16
4	Cylinder 8
5	Cylinder 4
6	Cylinder 2
7	Cylinder 1

Byte 31 - Head Address

Table 100 Sense Byte 31

Bits	Meaning
0-3	Not used (‘0000’)
4	Head 8
5	Head 4
6	Head 2
7	Head 1

24-Byte Compatibility Sense Formats Summary

24-Byte Compatibility sense data uses 11 formats to report error conditions associated with the Controller and the functional devices configured as 3380-type devices. Bits 0 through 3 of sense byte 7 contain the format of the sense data. The following table summarizes the formats of 24-Byte Compatibility sense data.

Table 101 24-Byte Compatibility Sense Formats

Format	Category or Condition	Refer to Page:
0	Program or System Checks	170
1	Functional Device Equipment Checks	172
2	Controller Equipment Checks	173
3	Controller Control Checks	173
4	Data Checks	174
5	Data Checks in PCI Mode	174
6	Usage Statistics and Time-of-Day	174
7	Reserved for the SVA	
8	Reserved for the SVA	
9	Reserved for the SVA	
F	Cache and NVS Checks	176

24-Byte Compatibility Sense Formats and Messages

Bits 0 through 3 of sense byte 7 identify the format of the sense data. Bits 4 through 7 of sense byte 7 contain a message that describes the error condition in general terms. The meaning of the message depends on the format of the sense data. The following sections correlate the format with the message.

Format 0 Messages - Program or System Checks

The subsystem uses format 0 sense data to report program or system checks. The meaning of a format 0 message depends on the setting of the Message to Operator bit (Byte 1, Bit 3). The SVA does not currently report any format 0 sense data with the Message to Operator bit set to ‘1’, and there are currently no messages defined for this case. Refer to

the following table for a list of messages defined for format 0 sense data with the Message to Operator bit set to 0.

Table 102 Format 0 Messages - Program or System Checks

Hex Code	Message	Meaning
0	No message	No additional information is available, or a SVS specific error or condition occurred. The program check is defined in sense bytes 0 through 2.
1	Invalid command	The command in the CCW is not supported by the SVA.
2	Invalid command sequence	Commands in the CCW chain are not in the correct sequence.
3	CCW count less than required	The byte count in the CCW is less than required.
4	Invalid parameter	An input value for the command in the CCW is not valid.
5	Diagnostic or special command violates file mask	A command in the CCW is not allowed the access authorization specified by the file mask.
6	Not used	
7	Channel returned with incorrect retry CCW	The command portion of the CCW returned after a command retry sequence does not match the command for which retry was signalled.
8	Reset notification	A system reset (or its equivalent, e.g., a power on reset) was received on an interface. The unit check that causes this sense data to be generated is presented to the next channel initiated selection following the resetting event. For the first selection to the reset interface, the unit check description (Bytes 0 through 2) is Environmental Data Present and Equipment Check, and the program action code (sense byte 25) is X’16’. For the first selection of other devices on the reset interface, the unit check description is Equipment Check and the program action code (sense byte 25) is X’16’.
9	Reserved for the SVA	

Table 102 Format 0 Messages - Program or System Checks (Continued)

Hex Code	Message	Meaning
A	Not used	
B	Reserved for the SVA	
C	Installation check	A device type specified in the configuration is not supported by the current microcode. This error is presented with Equipment Check and Permanent Error set to ‘1’.
D	Not used	
E	Reserved for the SVA	
F	Status not as required	The status of a subsystem component (cache, NVS, interface device, etc.) is not the status required for the requested operation.

Format 1 Messages - Device Equipment Checks

The subsystem uses format 1 sense data to report the following intervention-required conditions for functional devices:

- An attempt to address a device that has been disabled by a subsystem operator or host program
- Controller-to-Disk Array communication failure data assurance check mode
- A write was attempted to a functional device that is part of a production partition or a test set partition that is out of conditional capacity.

In all cases, INTERVENTION REQUIRED (Byte 0, Bit 1) is set to ‘1’.

For additional information on data assurance check mode, out of conditional capacity and controller-to-disk array failure, refer to “Non-SIM Sense Data for Back-End Errors” on page 225.

Table 103 Format 1 Messages - Device Equipment Checks

Hex Code	Message	Meaning
0	No message	A functional device intervention required condition
1	Reserved for the SVA	
2	Not used	
3-6	Reserved for the SVA	

Table 103 Format 1 Messages - Device Equipment Checks

Hex Code	Message	Meaning
7	Not used	
8-9	Reserved for the SVA	
A	Not used	
B-D	Reserved for the SVA	
E	Not used	
F	Reserved for the SVA	

Format 2 Messages - Controller Equipment Checks

The subsystem uses format 2 sense data to report a Controller failure that is not associated with Cache or NVS, such as Check 2 errors, IUP-to-ISP interface errors, and microcode detected errors.

Most of these errors are internally recoverable and are only reported as SIMs when error thresholds are exceeded.

Table 104 Format 2 Messages

Hex Code	Message
0-7	Reserved
8	Controller check 2 errors
9-D	Not used
E	IUP-to-ISP interface errors
F	Microcode-detected errors

Format 3 Messages - Controller Control Checks

The subsystem uses format 3 sense data to report that an Unconditional Reserve or Reset Allegiance command ended a channel operation and the channel's allegiance.

Table 105 Format 2 Messages

Hex Code	Message
0-7	Reserved
8-E	Not Used
F	Allegiance terminated

Format 4 Messages - Data Checks

The subsystem uses format 4 sense data to report permanent data checks for functional devices configured as 3380-type devices. Refer to the description for the data check bit in sense byte 0 for the situations in which permanent data checks can occur within the subsystem.

Table 106 Format 4 Messages

Hex Code	Message
0	Home address area error
1	Reserved for the SVA
2	Key area error
3	Data area error
4-7	Reserved for the SVA
8-F	Not used

Format 5 Messages - Data Checks in PCI Mode

The subsystem uses format 5 sense data to report that read data was corrected by the Controller using channel command retry (CCR) while the PCI fetch mode was active. A bit in the file mask byte activates the PCI fetch mode. If the PCI fetch mode is active, data transferred to the host may be processed by host programs before the final status is presented for the transfer (i.e. the host may have processed invalid data).

Table 107 Format 5 Messages

Hex Code	Message
0-2	Reserved for the SVA
3	Data Check in the Data Area
4-F	Not used

Format 6 Messages - Usage Statistics and Time-of-Day

The subsystem uses format 6 sense data to report:

- Functional device usage counts when the Controller has received a Read and Reset Buffered Log command from the host. When the Controller receives a Read and Reset Buffer Log command, only the device usage counters are read and reset.

- That a functional device usage count needs to be off-loaded because a counter overflowed. When a device usage counter overflows, a unit check is presented to a subsequent initial selection for that device, over any channel path. The sense data includes the usage count from the counter that overflowed.
- That a channel-interface's data overrun count exceeded a threshold. When the interface's counter exceeds the data overrun threshold, unit check is presented to a subsequent initial selection on that interface.
- Controller time-of-day. The Controller time-of-day reported in Bytes 28 through 31 is used to synchronize the Controller time with that of the attached hosts. The time-of-day is reported daily (around midnight). Usage counters are not reset, and the associated bytes are filled with zeros.

The message for format 6 identifies the physical channel where the Controller presented the unit check. The same information is reported in the low nibble of the fault symptom code (FSC).

Table 108 Format 6 Messages

Hex Code	Message	Hex Code	Message
0	Channel A	8	Channel I
1	Channel B	9	Channel J
2	Channel C	A	Channel K
3	Channel D	B	Channel L
4	Channel E	C	Channel M
5	Channel F	D	Channel N
6	Channel G	E	Channel O
7	Channel H	F	Channel P

Format F Messages - Cache and NVS Checks

The subsystem uses format F sense data to report errors associated with cache or nonvolatile storage.

Table 109 Format F Messages

Hex Code	Message	Meaning
0	Operation Terminated	This message occurs when the subsystem rejects or terminates an operation related to an active channel program as a result of: • Re-initiating or terminating caching as the result of an error. • The storage path attempts to transfer a channel program to another storage path using channel command retry, and determines that the channel is in selector mode. • An emergency destage is required because of a fault in NVS. • The subsystem or device is in a state-change pending condition. The request should be queued and re-driven by the host system. The subsystem signals the end of the state-change pending condition with a state-change interruption. Sense byte 25 contains X'1D'. Sense data with this message causes attaching host to reissue the request. For a state-change pending condition, this sense record causes the host to queue and redrive the request on a periodic basis. Environmental Data Present is set to '1'.
1	Subsystem Processing Error	This message occurs when the microcode has detected a subsystem processing error in the internal control information for cache, or NVS. If the error is associated with the current channel program, Equipment Check is set to '1'. The error can cause caching to re-initiate. If the error was from an operation other than the current operation, Equipment Check and Environmental Data Present are set to '1'.

Table 109 Format F Messages (Continued)

Hex Code	Message	Meaning
2	Cache or NVS Equipment Failure	Cache or NVS has an unrecoverable error. If the error is not recovered by the storage path's internal recovery procedures, Equipment Check is set to '1'. If system retry is not desirable, Permanent Error and Equipment Check are set to '1'. Environmental Data Present is set to '0' in either case. Permanent Error is set to '1' with Environmental Data Present set to '0', if the failure prevents successful ending of a command chain that must operate with cache. If the error was from an operation other than the current operation, Permanent Error and Environmental Data Present are set to '1'.
3-4	Reserved for the SVA	
5	Not used	
6	Cache Fast Write Access Not Authorized	This message occurs when a Define Extent command specifies cache fast write or a Perform Subsystem Function command has a Commit order, and the cache fast write ID in the command parameters is not the current cache fast write ID for the subsystem. Command Reject is set to '1'.
7	Reserved for the SVA	
8	Not used	
9	Caching Re-initiated	This message occurs when the storage director automatically reestablishes the caching function following a failure or condition. If the cause was a failure, another Equipment Check sense message defining the failure that caused the caching to re-initiate occurs with this sense message. The message occurs only if caching was active before the failure. Environmental Data Present is set to '1' in either case.
A-C	Reserved for the SVA	
D	Caching Status Reset to Default	Occurs when a storage path to shared memory error is detected.

Table 109 Format F Messages (Continued)

Hex Code	Message	Meaning
E-F	Not used	

Reason Codes

Sense Byte 8 in 24-Byte Compatibility sense contains a reason code for certain Format/Message combinations. The reason code provides additional details on the cause of an error.

Note: For the SVA, sense bytes 8-10, 9-10, and 13-14 may contain reason codes for state-change pending (format F, message 0). Refer to "Reason Codes for State-Change Pending Sense Data" on page 183. for a description of these reason codes.

Reason Codes for Format 0 Message

Table 110 Reason Codes For Format 0 Message F

Hex Code	Message	Meaning
00	No Message	Occurs in the following conditions: • During the processing of a Diagnostic Control command with a Diagnostic Initialize Subsystem subcommand. The Controller determined that one or more of the devices in the functional storage control was not offline when the command was issued. • The addressed functional device is in a read-only state.
01	Cache Status Pending	Trying to make cache available, and cache status is pending.
02-03	Reserved for the SVA	Always set to zero
04	Cache Fast Write Status Pending	Trying to activate cache fast write, and cache fast write status is pending.
05	Cache Status Pending	Trying to activate caching for a device, and cache status pending.
06	NVS Failure	Trying to destage modified tracks, and the status of NVS is failed; or trying to discard DASD fast write data, and the data for the device exists in the failed NVS.

Table 110 Reason Codes For Format 0 Message F (Continued)

Hex Code	Message	Meaning
07	NVS Initializing	Trying to make NVS unavailable, and NVS is initializing.
08	DASD Fast Write Failure or Pending Status	Trying to deactivate caching for the device, deactivate DASD fast write for the device, or discard data, and DASD fast write status is failed or pending for that device.
09	Reserved for the SVA	Always set to zero
0A	DASD Fast Write Failure or Pending Status	Trying to make NVS available, and at least one device has DASD fast write status that is pending or failed. **Note:** Set Subsystem Mode command with make NVS available subcommand requires all DASD fast write volumes to be active or inactive.
0B	NVS Status Pending	Trying to make NVS available, and NVS status is pending.
0C	NVS Failure/ Pinned Data	Trying to deactivate caching for the addressed device or deactivate DASD FW for a device when NVS is failed, and data for the device exists in NVS but not in cache.
0D	NVS Not Available	Command requires NVS, and NVS is not available.
0E	Cache Not Available	Command requires cache, and cache is not available.
0F-1D	Reserved for the SVA	Always set to zero
1E	Device Not in Unknown State	Trying to do an Access Device in Unknown Condition subcommand for a device not in an unknown state with an unreadable status track.
1F	Not used	Always set to zero
20	Subsystem Status Track Valid	A Diagnostic Control command has a ‘conditional’ Diagnostic Initialize Subsystem subcommand, and the subsystem has a valid subsystem status track.
21-24	Reserved for the SVA	Always set to zero
25	Cache/NVS Initializing	Trying to make cache unavailable or make NVS unavailable while that storage is initializing.

Table 110 Reason Codes For Format 0 Message F (Continued)

Hex Code	Message	Meaning
26-28	Reserved for the SVA	Always set to zero
29	No Path Group for this Interface	Trying to do a Perform Subsystem Function command with the Set Special Intercept Condition order on an interface on which no path group has been established.
2A	Not used	Always set to zero
2B	No Space In Message Buffer	Space in the message buffer cannot be made available.
2C-31	Reserved for the SVA	Always set to zero
2F	Unsuccessful Reset Allegiance	A command was chained for a Reset Allegiance that was unsuccessful.
30	Not used	Always set to zero
31	Reserved for the SVA	Always set to zero
32-34	Not used	Always set to zero
35	Path is Fenced	A Set Guaranteed Path subcommand of the Diagnostic Control was received for a fenced path.
3B-3F	Reserved for the SVA	Always set to zero
41	Command Authorization Error	A command chain operating with normal authorization was received on a device that is in media maintenance reserve state.
42	Media Maintenance Query	Subcommand Error A Media Maintenance Query subcommand was received for a device that was in media maintenance reserve state.
43-7F	Not used	Always set to zero
80	Interface Disabled For Certain Commands	Trying to do a specific command on an interface that was disabled for specific commands by the Perform Subsystem Function command with the Set Special Intercept Condition order.

Table 110 Reason Codes For Format 0 Message F (Continued)

Hex Code	Message	Meaning
81	Attention Presented To	Disabled Interface An attention was presented on an interface that was disabled for specific commands by a Perform Subsystem Function command with a Set Special Intercept Condition order.
82-FF	Not used	Always set to zero

Reason Codes for Format F, Message 2

Table 111 Reason Codes For Format F Message 2

Byte	Bits	Error/Operation Code
8	0-3	0 Not used 1 Cache Control Check 2 Reserved for the SVA 3 Cache Port Register Check 4 Cache Storage Check 5 NVS Check 6 Reserved for the SVA 7 Not used 8 Reserved for the SVA 9 Not used A Cache Power Check B NVS Battery Check C-E Not used F Microcode Detected Error
8	4-7	0 No Operation 1 Cache Directory Read 2 Cache Directory Write 3 Cache Read 4 Cache Write 5-8 Reserved for the SVA 9 Not used A NVS Directory Read B NVS Directory Write C NVS Read D NVS Write E-F Not used

Reason Codes for Format F, Message 6

Table 112 Reason Codes for Format F, Message 6

Hex Code	Message
00	Not used
01	Cache fast write ID is not the current ID
02	Reserved for the SVA
03-FF	Not used

Reason Codes for Format F, Message 9

Table 113 Reason Codes for Format F, Message 9

Hex Code	Message
00	No message
01	Diagnostic Initialize Subsystem subcommand received
02	Cache failure
03	NVS failure
04-05	Not used
06	Old cache fast write data exists for a new device
07-09	Not used
0A	Storage path to cache equipment check. Failure of a cache memory interface card and subsequent un-fencing after replacement of the cache memory interface card does not require a cache restart.
0B	Reserved for the SVA
0C	Storage path to NVS equipment check
0D	Not used
0E	Internal microcode restart of the storage path. A Controller control region IML is not reported in sense.
0F-FF	Not used

Reason Codes for State-Change Pending Sense Data

When sense byte 7 is 0xF0 and sense byte 25 is 0x1D, a state-change-pending (SCP) condition is being reported. If the fault symptom code is:

Table 114 FSC FFFx Meanings

FSC	Meaning
FFF0	**Subsystem State-Change-Pending**. Sense bytes 13 and 14 contain the reason(s) that the subsystem is in a state-change-pending condition.
FFF1	**Functional Device State-Change-Pending**. Sense bytes 8-10 contain the reason(s) that the functional device is in a state-change-pending condition. Sense bytes 13 and 14 may contain additional reasons.

Sense Bytes 13 and 14 - Subsystem State-Change-Pending Reason Codes (FSC FFF0)

Table 115 State-Change-Pending Reason Codes

Bytes 13 - 14	Meaning
0001	A warm start is in progress.
0002	Cache is being re initialized.
0008	Virtual Track Directory recovery in progress.

Sense Bytes 8-10 - Functional Device State-Change-Pending Reason Codes (FSC FFF1)

Table 116 Sense Bytes 8-10 Functional Device State-Change-Pending Reason Codes

Bytes 8 - 10	Meaning
400000	An internal condition caused this PPRC primary device to be suspended. Since the automation bit is set, the device is SCP for up to two minutes, starting at the time of the internal suspension, to allow system host automation code time to issue a Freeze PPRC Group order. The SCP condition is cancelled when a Freeze PPRC Group order is received for this device's virtual control unit or after two minutes have expired.
200000	A Freeze PPRC Group order was received from a system host. Since the automation bit is set, all PPRC primary devices of the PCU that the Freeze order was issued to the SCP for up to two minutes, starting at the time the Freeze order was received, to allow system host automation code time to issue a PPRC Consistency Group Created order. The SCP condition is cancelled when the Consistency Group Created order is received or after two minutes have expired.
080000	A system host issued a selective or system reset during processing of a host write chain to this PPRC primary device. The device is SCP until all tracks related to this write have been transferred from the PCU to the SCU.
040000	If a CHK0 or cache re-init occurs when a host write to one or more PPRC primary devices in the subsystem is in progress, at the tail end of the warm start or cache re-init, all devices in the subsystem, other than PPRC secondary devices and PPRC data and status bridge devices, is SCP until the tracks associated with the host write have been transferred from this subsystem to the associated SCUs.
008000	A configuration change request is in progress.
004000	A partition change request is in progress.

Table 116 Sense Bytes 8-10 Functional Device State-Change-Pending Reason Codes

Bytes 8 - 10	Meaning
002000	A Set Subsystem Mode operation with a Deactivate Cache for Addressed Device or a Deactivate DASD Fast Write for Device subcommand is in progress.
001000	An asynchronous Perform Subsystem Function operation with a Commit subcommand is in progress.
000800	A Diagnostic Control operation with a Diagnostic Initialize Subsystem subcommand is in progress for the functional storage control.
000400	A write was attempted to a track that is a target of a snapshot copy operation.
000100	Owed DE and chain time-out. An approaching chain time-out was detected following device busy presentation on another path group or selector mode channel.
000080	Chain time-out. An approaching chain time-out was detected.
000050	Disconnected device time-out. A disconnected device operation did not complete within an internal time-out period. The operation that is in progress, or the reason the operation has not been completed, is contained in sense bytes 13 and 14.
000048	Disconnected device time-out. One or more subsystem-level error conditions caused an internal time-out to occur. The error condition(s) that existed at the time the unit check was presented for the state-change pending condition are contained in sense bytes 13 and 14.
000042	Disconnected device time-out. Error recovery retry threshold exceeded. One of the SVA's microprocessors has been overloaded with internal error recovery retries.
000041	Disconnected device time-out. No reason for the disconnection was found, but the reason has been resolved. This indicates that no disconnected device operation reason flags or subsystem-level error condition flags were set when the internal time-out monitor checked for them, but at least one of those flags had been set and cleared within the internal time-out period.

Sense Bytes 13 and 14 - Functional Device State-Change-Pending Reason Codes (when bytes 8-10 contain 000050 (FSC FFF1))

Table 117 Sense Bytes 13-14 Functional Device State-Change-Pending Reason Codes when bytes 8-10 contain 000050

Bytes 13 - 14	Meaning
8001	Multiple physical track recoveries in progress.
8000	Physical track recovery in progress.
4000	Processing for a Diagnostic Control operation with a Prepare Remote Support Access Code subcommand is in progress.
2000	Processing for a synchronous Set Subsystem Mode operation is in progress.
1000	Processing for a synchronous Perform Subsystem Function operation is in progress.
0400	Track being sent to the SCU during a host write to a PPRC primary device.

Sense Bytes 13 and 14 - Functional Device State-Change-Pending Reason Code (when Bytes 8-10 contain 000048 (FSCFFF1))

These values represent flags stored in memory. Since more than one flag can be set at a time, the value of bytes 13 and 14 may be a combination of the values shown. For example, if the value of these bytes is 3000, both the disk array command link and the disk array status link were lost.

Table 118 Sense Bytes 13 and 14 - Functional Device State-Change-Pending Reason Code (when Bytes 8-10 contain 000048 (FSCFFF1))

Bytes 13 - 14	Meaning
8000	A functional track directory recovery operation is in progress.
4000	A physical drive reconstruction operation is in progress.
2000	A disk array command link was lost.
1000	A disk array status link was lost.
0800	The disk array links are being reconfigured because of a microprocessor quiesce.
0400	The disk array links are being reconfigured because of a microprocessor unquiesce.
0200	The microprocessor performing the disk array status link is overloaded.

Table 118 Sense Bytes 13 and 14 - Functional Device State-Change-Pending Reason Code (when Bytes 8-10 contain 000048 (FSCFFF1))

Bytes 13 - 14	Meaning
0100	The disk array links are being reconfigured because a diagnostic fence of a functional command status card was imposed.
0080	The disk array links are being reconfigured because a functional fence of a functional command status card was imposed.
0040	The disk array links are being reconfigured because a functional fence of a functional command status card was released.
0020	A back-end error recovery operation is in progress because of an error communicating with a physical device.
0008	The destage task is blocked because the subsystem is out of collected free space.

SIM Sense Data

5

Service Information Messages (SIMs) are a special class of ECKD 32-byte sense data. Many of the SIM bytes and bits have the same meaning as for ordinary sense data. These is not described in this chapter. Only the sense bytes and bits that are unique to SIM sense are described. The sense bytes and bits not described here are the same as those for non-SIM ECKD 32-Byte sense (refer to "ECKD 32-Byte Sense Data" on page 129).

SIM Sense Byte 1 - Unit Check Description

SIM Sense Byte 1, Bit 0 - Permanent Error: The following conditions cause a permanent error:

- A failure report was sent to the support facility
- Failure recovery was not possible or desirable for the failure.

SIM Sense Byte 1, Bit 3 - Message to Operator: This bit is set when the subsystem determines that a failure (as specified in the following) is severe enough that an operator must be notified.

- For Exception Classes 4, 6, B, C, D, and E, this bit is not used.
- For Exception Classes 1, 2, 3, 7, and F, this bit is set to '1' if:
  - The SIM severity code (SIM sense byte 9, bits 0, 1) is greater than the severity reporting option parameter in the VPD

  and:
  - SIM sense byte 28 is F1 (storage control failure), F2 (cache failure), or FE (device failure)

  or:
  - SIM sense byte 28 is F3 (storage control failure - remote access) and the code in SIM sense byte 8, bits 0-3 is '4'.

  In these conditions, if ServiceTek Plus attempts a remote connection, SIMs are generated to show that:
  - A connection is being attempted
  - Communication is not possible because SIM sense byte 8, bits 0-3 are set to '4'

- The operator is notified. (When Message to Operator is set to ‘1’, SIM sense byte 24, bits 6 and 7 are set to 01 to indicate Operator Message Unconditional.)

SIM Sense Byte 2 - Storage Control Type or Environmental Data Present

For Exception Classes 4, B, C, D, and E, SIM sense byte 2 contains an 8-bit code that identifies the storage control type, model, and features. For the SVA Controller, the only valid storage control type is X’06’.

For Exception Classes 1, 2, 3, 7, and F, SIM sense byte 2 is reserved, except for bit 3, which is always set to indicate Environmental Data Present.

SIM Sense Byte 6 - Content and Format

For Exception Classes 1, 2, 3, 7, and F, the value of SIM sense byte 6 is always X’8F’, which indicates that the serial number of the reporting unit in SIM sense bytes 15-19 is valid. The one exception to this rule is that certain FSCs of Exception Class 7 results in Bit 1 of Byte 6 being set. These are ECAM-related FSCs which indicates a device ID following the completion of a Mat or Drain Operation.

For Exception Classes 4, B, C, D, and E (Device SIMs), this byte is the same as that of non-SIM ECKD sense.

SIM Sense Byte 7 - SIM Sense Record ID or Not Used

For Exception Classes 1, 2, 3, 7, and F, this byte is always X’EO’.

For Exception Classes 4, B, C, D, and E, this byte is not used and set to X’00’.

SIM Sense Byte 8 - Exception or Service Message Codes

The message contained in this byte depends on the SIM code defined for SIM sense byte 28. Valid SIM codes are F1, F2, F3, FE.

Bits 0-3 of this byte contain the Exception Message, which lists the source of a failure. Bits 4-7 of this byte contain the Service Message, which indicates the effect of the repair.

The following table summarizes the SIM codes, the Exception Messages, and the Service Messages.

Table 119 SIM Sense Byte 8 - Exception and Service SIM Codes

Bits	Hex Value	Meaning
0-3	F1 - Storage Control Exception and Service Message Codes	
	0	Not used
	1	The effect of the failure is unknown
	2	An error exists on the storage path(s) for the SSID(s)
	3	An error exists on channel interface for the SSID(s)
	4	An error exists in the storage controller that has no effect on performance
	5	An error exists in the support facility that has only minimal effect on performance
	6	An error exists in the subsystem, possibly a power outage. **Note:** Currently the only condition that causes this message is having selected an invalid customer option.
	7-F	Not Used
4-7	0	Not used
	1	The effect of the repair is unknown
	2	The repair does not effect the subsystem performance
	3	The repair disables the storage path(s) for the SSID(s)
	4	The repair disables access to the SSID(s)
	5-F	Not used
0-3	F2 - Caching Exception and SIM Codes	
	0	Not used
	1	The effect of the failure is unknown
	2	An error exists on the storage path(s) to cache for the SSID(s)
	3	An error exists in cache for the SSID(s)
	4	An error exists in NVS for the SSID(s) (during a fast write or dual copy)
	5	An error exists in NVS for the SSID(s) (during a fast write)
	6	No impact. Threshold crossed. Severe condition if uncorrected.
	7	Severe impact. Write operations are prevented until corrected.
	8-F	Not used

Table 119 SIM Sense Byte 8 - Exception and Service SIM Codes (Continued)

Bits	Hex Value	Meaning
4-7	0	Not used
	1	The effect of the repair is unknown
	2	The repair does not effect the subsystem performance
	3	The repair disables the cache storage path(s) for the SSID(s)
	4-5	Not used
	6	The repair disables access to the SSID(s)
	7-F	Not used
0-3	F3 - Remote Session SIM Codes	
	0	Not used
	1	Remote session enabled
	2	A remote session is established
	3	A remote session has been terminated
	4	There have been three unsuccessful attempts to establish a remote session
	5-F	Not used
4-7		Not used
0-3	FE - Device SIM Code	
	0-2	Not used
	3	No impact; information SIM only
	4	No impact; threshold crossed. If uncorrected, the subsystem is vulnerable to customer data loss.
	5	DASD has been installed or the configuration has been changed on the SSID
	6-8	Not used
	9	An error exists on a single internal path to a device
	A	An error exists on two internal paths to a device
	B	A device HDA power sequence fault exists on the SSID
	C	An error exists on the physical devices on the SSID
	D-F	Not used

Table 119 SIM Sense Byte 8 - Exception and Service SIM Codes (Continued)

Bits	Hex Value	Meaning
4-7	0	Not used
	1	The repair disables a device controller
	2	The repair disables two device controllers
	3	The repair disables a physical device
	4	The repair disables a physical device that has a dual copy volume
	5	The repair disables more than one physical device
	6	The unit is over-temperature; check the unit temperature before calling for service
	7	The repair disables a device controller and a physical device
	8	The repair disables two device controllers and physical devices
	9-A	Not used
	B	Only trained service personnel should power off the devices
	C	No service action is required
	D	Service is required, but there is no impact to operations
	E-F	Not used

SVA experiences several unique conditions that fit loosely into the categories defined in SIM sense byte 28. The following table lists the conditions, the value that is set in SIM sense byte 28, and the value that is set in SIM sense byte 8.

Table 120 Sense Byte 8

Message	Value of SIM Sense Byte 28	Value of SIM Sense Byte 8
Low on spares	FE (a device SIM)	Bits 0-3 = 4 Bits 4-7 = D
Low NVS battery voltage	F2 (a cache exception)	Bits 0-3 = 6 Bits 4-7 = 2

Table 120 Sense Byte 8 (Continued)

Message	Value of SIM Sense Byte 28	Value of SIM Sense Byte 8
Physical device failure: reconstruction started *and* physical device failure: reconstruction completed	FE (a device SIM)	Bits 0-3 = C Bits 4-7 = C
Low on conditional capacity	F2 (a caching exception)	Bits 0-3 = 6 Bits 4-7 = 2
Media acceptance test completed *and* drain operation completed	FE (a device SIM)	Bits 0-3 = 3 Bits 4-7 = C
Out of conditional capacity	F2 in byte 28 a caching exception	Bits 0-3 = 7 Bits 4-7 = 2
Asynchronous processing error	F2 in byte 28 a caching exception	Bits 0-3 = 1 Bits 4-7 = 1
Triple device failure	FE in byte 28 a device SIM	Bits 0-3 = C Bits 4-7 = 5

SIM Sense Bytes 9 and 10 - Message Modifiers

SIM sense bytes 9 and 10 describe the severity of a failure, other information about the failure and the effect of repair. The specific codes depend on the value of SIM sense byte 28 (F1, F1, F3, or FE).

Table 121 SIM Sense Byte 9 - Message Modifier

Bit	Error	Condition (SIM Use)
0-1	SIM Severity Code	When the value of SIM sense byte 28 is F1, F2, or FE, the four defined meanings of bits 0 and 1 are: 00 Service alert, but no impact to performance 01 Moderate alert, but not an operational hit 10 Serious alert that may cause an operational hit 11 Acute alert with the potential to cause a loss of data when the value of SIM sense byte 28 is F3 (indicating a remote session SIM), the four defined meanings of bits 0 and 1 are: 00 All remote session SIMs except “3 invalid attempts.” 01 Not used 10 Not used 11 Three invalid attempts were made to connect from a remote site.
2	Storage Path or Volume Affected	When the value of SIM sense byte 28 is F1, F2, or F3, the two defined meanings of bit 2 are: 0 One storage path was affected by the failure 1 Two or more storage paths were affected by the failure When the value of SIM sense byte 28 is FE, the two defined meanings of bit 2 are: 0 A primary volume was affected 1 A secondary volume was affected
3	Storage Paths in the SSID	When the value of SIM sense byte 28 is F1, F2, or F3, the two defined meanings of bit 3 are: 0 Two storage paths in the SSID 1 Four storage paths in the SSID In SVA the value of SIM sense byte 9, bit 3 is always ’1’. When the value of SIM sense byte 28 is FE, this bit is not used and is set to ’0’.

Table 121 SIM Sense Byte 9 - Message Modifier

Bit	Error	Condition (SIM Use)
4-7	Dependent on Value of SIM Sense Byte 28	When the value of SIM sense byte 28 is FE, **bits 4 and 5** indicate: • First device path number (0-3) • Second device path number (0-3) When the value of SIM sense byte 28 is F1, F2, or F3, the two defined meanings of :hp2.bit 4:ehp2. are: 0 One SSID is affected by the failure 1 Two SSIDs are affected by the failure **Note:** In SVA the value of SIM sense byte 9, bit 4 is always ’0’. When the value of SIM sense byte 28 is F1, F2, or F3, the two defined meanings of **bit 5** are: 0 One SSID is affected by the repair 1 Two SSIDs are affected by the repair **Note:** In SVA the value of SIM sense byte 9, bit 5 is always ’0’. When the value of SIM sense byte 28 is F1, F2, or F3, the two defined meanings of **bit 6** are: 0 Upgraded 1 Terminated When the value of SIM sense byte 28 is F1, F2, or F3, **bit 7** is set to ’0’.

Table 122 SIM Sense Byte 10 - Message Modifier

Bit	Error	Condition (SIM Use)
0	Repeated SIM	When this bit is set to ’1’, this SIM is a repeat of an earlier SIM. SIMs are reported twice at eight hour intervals.
1-7	Reserved	Always set to ’0’ in SVA.

SIM Sense Byte 11 - 14 - ECAM SIMs

If the fault symptom code (FSC) in SIM sense bytes 22-23 is 730C, 730D, 7328, or 7329 (“MAT or DRAIN Complete” SIMs), these bytes contain an ECAM process ID. Otherwise these bytes are as described in the following sections.

SIM Sense Byte 11 - Same as Previous Error or Feature Code

Table 123 SIM Sense Byte 11 - Same as Previous Error or Feature Code

Bit	Error	Condition (SIM Use)
0	Reserved	Always set to ’0’
1	Same as Previous Error	When this bit is set to ’1’, it indicates that a SIM for the same error was sent previously. The SVA uses this SIM to indicate the reoccurrence of a prior problem.
2-3	Control Region affected	If SIM sense byte 28 is F1, this bit indicated the affected control region. If SIM sense byte 28 is other than F1, this bit is ’0’
4-7	Model and Feature code	These bits contain the first four bits of the hardware model and feature code of the machine. The balance of the hardware model and feature code is contained in SIM sense byte 12. Bits 4 through 7 indicate the following: The two defined meanings of **bit 4** are: 0 Standard SVA subsystem 1 Extended SVA subsystem Bits 5 through 7 and SIM sense byte 12 indicate the installed customer cache size in 32 megabyte increments.

SIM Sense Byte 12 - Available Cache

This byte, along with bits 5-7 of SIM sense byte 11, indicates the amount of cache available to the customer in 32 MB increments.

SIM Sense Byte 13 - Unit Address

- For Exception Classes 1, 2, 3, 7, and F, the value of SIM sense byte 13 is always “0”.
- For Exception Classes 4, B, C, D, and E (Device SIMs), this byte contains the physical device address of the defective physical device.

SIM Sense Byte 14 - Machine-Initiated Maintenance Information

Table 124 SIM Sense Byte 14 - Machine-Initiated Maintenance Information

Bit	Error	Condition (SIM Use)
0	Sense Data from the Control Region or ISP	If this bit is ’1’, the SIM was generated by the IUP. If this bit is ’0’, the SIM was generated by the support facility. **Note:** SIMs generated by IUPs (functional code) include: • low on conditional capacity • out of conditional capacity • triple drive failure • the IUPs cannot communicate with the support processors • asynchronous channel command processing error
1-3	Machine-Initiated Maintenance Category - 0, 1, or 2	The settings of these bits indicate the category of machine-initiated maintenance. 000 Category 0 001 Category 1 010 Category 2 011 Category 3 100 Not used 101 Category 5 (*CSC Installation and Operation* off-load) 110 Category 6 (Trace and State Save off-load) 111 Category 7 (Customer Service Engineer test)
4-6	Machine-Initiated Maintenance Status	The settings of these bits indicate the status of machine-initiated maintenance. 001 The maintenance file is open 010 A service representative closed the maintenance file 011 The maintenance file is closed completely 100 The maintenance file is reopened 101 An engineering maintenance file; assistance is required 110 Not used 111 An informational SIM with no associated machine-initiated maintenance.
7	Support Facility ID	This bit indicates the identity of the “master” support facility that is creating the SIM

SIM Sense Byte 28 - SIM Code

The SIM code defines the message to be sent when the operator message control (SIM sense byte 24, bits 6-7) is not zero.

Note: The SIM code is set no matter what the value of the operator message control is.

The following SIM codes are defined:

10	Reserved for ESCON
F1	Storage control and service representative SIM
F2	Cache and service representative SIM
F3	Storage control and remote session SIM
FE	Device and service representative SIM
FF	Not used

SIM Sense Bytes 29-31 - SIM Modifiers

The messages contained in these bytes are unique to SVA. Therefore, SIM sense byte 6, bit 2 is always set to “0”, so that they are not misinterpreted by IBM’s error recovery programs.

For ECAM SIMs (FSCs 730C, 730D, 7328, or 7329), and informational SIMs (SIM sense byte 14 bits 4-6 =’111’), these bytes are always’0’. Otherwise, they have the following meaning:

- SIM sense byte 29 and SIM sense byte 30, bits 0-3 contain the machine-activated sequence number, which includes the composite failure event identifier (CFE-ID) for the error indicated by the SIM. The subsystem can then match the CFE-ID to the incident log, the FRU change events, and the machine-activated maintenance events. Together, these provide a history of the error for the customer service engineer.
- SIM sense byte 30, bits 4-7, and byte 31 contain the index value that identifies the primary suspect FRU. If the value is 0xFFF, there is no suspect FRU associated with the SIM.

Any FRU with an index value greater than 100 and less than 900 is located in the disk array string. In this case, the first digit of the three digit number indicates in which Disk Array Unit it resides. Therefore:

- All FRUs with an index value between 100 and 199 are in the A-Disk Array Unit
- All FRUs with an index value between 200 and 299 are in the first C-Disk Array Unit
- All FRUs with an index value between 300 and 399 are in the B-Disk Array Unit

- All FRUs with an index value between 400 and 499 are in the second C-Disk Array Unit.

Host Error Recovery Procedures

6

Whenever possible, recovery actions are executed within an SVA subsystem, and host error recovery procedure (ERP) involvement is avoided in most cases until after the failing component has been isolated within the subsystem. However, in the following conditions, the SVA subsystem may require host ERP actions to their full extent:

1. Both data paths in a cluster are defective and there are no path groups established from which internal subsystem recovery could be invoked through a channel in the other cluster.
2. The circuit card processing the command chain is defective and no path group has been established with other channels. If another path is available, it must be tried through host error recovery procedures.
3. Host programming errors, file protect faults, etc. are conditions over which the subsystem has no control. Host ERP actions are invoked and the required action is taken to handle these errors.

Error Recovery Actions Supported for 24-Byte Compatibility Sense

ERP actions for 24-byte compatibility sense data are invoked based on the contents of sense bytes 0-2. The SVA supports 11 host error recovery processes. The following sections describe the error recovery action taken and the conditions within an SVA subsystem that invoke the action.

Error Recovery Action 1

1. If all alternate channel paths have not been tried, repeat the operation on a different channel path.
2. If all alternate channel paths have been tried and byte 25, bits 0 and 1 are not ’11’, post the job with a permanent error.
3. If all alternate channel paths have been tried, byte 25 bits 0 and 1 cannot be ’11’.

The SVA invokes this recovery action in the following conditions:

- The three conditions described in the introduction of this chapter.
- During a read operation when a previous write operation failed and the host did not follow the recovery actions requested by the Controller following a Channel Command Retry or Disconnect In sequence
- When a Controller-to-disk array communication failure has made the back-end storage temporarily unavailable.

Error Recovery Action 2

Exit with programming error or unusual condition indication.

The SVA invokes this recovery action whenever a host programming type error exists.

Error Recovery Action 3

1. Repeat the operation once.
2. If the error is intervention required (byte 0, bit 1), issue a message to the operator indicating that intervention is required on the reporting device. Then queue the I/O request until an interrupt is received from the device indicating that the device has been made ready.
3. If the error condition continues, do Error Recovery Action 1.

The SVA invokes this recovery action in the following conditions:

- When a condition requiring operator intervention is detected and the addressed device is configured as a 3380-type device.
- When a channel bus out parity error is detected for any type of addressed device.

Error Recovery Action 4

1. If sense byte 25 is X’1D’, the functional storage control or device is in a “state-change pending” condition. Re-drive the request when the subsystem presents a state-change interruption (the pending condition exists).

Note: If the host is timing I/O operations, the request may be re-driven at some period greater than 15 seconds. The subsystem continues to return state-change pending sense data while the operation is in progress.

2. Repeat the operation 256 times.
3. If the error condition continues, do Error Recovery Action 1.

The SVA invokes this recovery action in the following conditions:

- A state-change-pending
- Reset notification
- A virtual device usage overflow.
- Conditions 1 and 2 described in the introduction of this chapter.

Error Recovery Action 5

1. If the ERP does not support reset notification, go to step 3.
2. If sense byte 7 is X'08', the path group ID for this path has been reset, but not by a Set Path Group ID command. The host system must ensure that this device is still grouped as expected for this system before the current task is reissued.
3. If the chain has not been retried 10 times, repeat the command chain.
4. If the error condition continues after 10 retries, determine if the request inhibit write (byte 2, bit 0) was '0' for all operations in the command chain. If it was '0' for all operations in the command chain, go to step 4.
5. The ERP must issue a Diagnostic Control command with an Inhibit Write subcommand X'02'. The contents of the program action code (byte 25) defines the path to inhibit as follows:
   A. If sense byte 25 is X'17' or x'57', set the subcommand modifier to X'20' (Controller).
   B. If sense byte 25 is X'18' or x'58', set the subcommand modifier to X'40' (channel path).
   C. If sense byte 25 is X'19' or x'59', set the subcommand modifier to X'80' (storage director).
4. Do Error Recovery Action 1.

SVA invokes this recovery action in the following conditions:

- The conditions described in the introduction of this chapter
- If a path grouping has been affected by a system reset.

Error Recovery Action 6

Return an indication to the application that the data has been corrected. (The application is operating in PCI fetch mode; thus the application must supply the restart recovery action.

The SVA invokes this recovery action when the subsystem is operating in PCI mode and the addressed device is configured as a 3380-type

device. The application program must provide any required recovery actions.

Error Recovery Action 7

1. Increment the cylinder address of the seek argument in sense bytes 5 and 6 (or 29 and 30) by one.
2. Reset the head address to zero.
3. If the incremented cylinder address is still in the current extent, go to step 4. Otherwise, determine the seek address by locating the next extent. If no seek address exists, do Error Recovery Action 2.
4. If a Define Extent command was performed, go to step 6. Otherwise, go to step 5.
5. Continue the operation with the following command chain:

Table 125 Error Recovery Action 7 Command Chain

Command	Meaning
Seek	Argument from step 1
Set File Mask	Same as original
Set Sector	Argument 0
Read Home Address	Skip bit on
TIC	To the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user's TIC command, the TIC command by the ERP must specify the command address specified in the application's TIC. This prevents a program check that occurs when a TIC follows a TIC.

6. Continue the operation with the following CCW chain:

Table 126 Additional Error Recovery Action 7 CCW Chain Commands

Command	Meaning
Define Extent	The application's new extent is compatible with the seek argument from step 1. The other parameters are the same as the original parameters.

Table 126 Additional Error Recovery Action 7 CCW Chain Commands (Continued)

Command	Meaning
Locate Record	Bytes Contents 0 X'40' 1-3 Zero 4-7 The seek address from step 1 8-11 The seek address from step 1 12-15 Zero
TIC	To the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user's TIC command, the TIC command by the ERP must specify the command address specified in the application's TIC. This prevents a program check that occurs when a TIC follows a TIC.

7. Conditions:

The SVA invokes this recovery action when an end-of-cylinder is detected during a multitrack operation, which indicates a host programming type error.

Error Recovery Action 8

This is a file protected error.

1. Examine the interrupted CCW to select the appropriate step in the following recovery actions.
2. If the interrupted CCW is a Perform Subsystem Function command, do Error Recovery Action 2.
3. If the interrupted CCW is not a Seek, Seek Cylinder, Seek Head, or Recalibrate command *and* the seek address is still in the current extent, go to step 4. (The seek address for a Recalibrate command is '0'.) Otherwise, determine the seek address by locating the next extent. If no seek address exists, do Error Recovery Action 2.
4. If a Define Extent command was performed, go to step 5. Otherwise, go to step 6.

5. Continue the operation with the following CCW chain:

Table 127 Error Recovery Acton 8 CCW Chain

Command	Meaning
Seek	Argument from step 3.
Set File Mask	Same as the original
TIC	The first non-TIC CCW following the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user's TIC command, the TIC command by the ERP must specify the command address specified in the application's TIC. This prevents a program check that occurs when a TIC follows a TIC.

6. Continue the operation with the following CCW chain:

Table 128 Additional Error Recovery Acton 8 CCW Chains

Command	Meaning
Seek	Argument from step 3.
Define Extent	The application's new extent is compatible with the seek argument from step 3. on page 205. The other parameters are the same as the original parameters.
TIC	The first non-TIC CCW following the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user's TIC command, the TIC command by the ERP must specify the command address specified in the application's TIC. This prevents a program check that occurs when a TIC follows a TIC.

7. If the interrupted CCW was a Locate Record or Locate Record Extended command, determine if the seek address is in the application's extents. If no seek address exists, do Error Recovery Action 2.

8. Continue the operation with the following CCW chain:

Table 129 Additional Error Recovery Acton 8 CCW Chains

Command	Meaning
Define Extent	The application's new extent is compatible with the seek argument from step 3. on page 205. The other parameters are the same as the original parameters.
TIC	The first non-TIC CCW following the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user's TIC command, the TIC command by the ERP must specify the command address specified in the application's TIC. This prevents a program check that occurs when a TIC follows a TIC.

9. This is either a multitrack CCW or the domain of a Locate Record or Locate Record Extended command has gone beyond the current extent. Therefore:
   A. Increment the seek address in sense bytes 5 and 6 by one.
   B. If the incremented seek address is still in the current application's extent, go to step 9 C. Otherwise, determine the seek address by locating the next extent. If no seek address exists, do Error Recovery Action 2.
   C. If a Define Extent command was performed, go to step 6. on page 208. Otherwise, continue with step 9 D.
   D. Continue the operation with the following CCW chain:

Table 130 Additional Error Recovery Acton 8 CCW Chains

Command	Meaning
Seek	Argument from steps 9 A or 9 B.
Set File Mask	Same as the original
Set Sector	Argument 0
Read Home Address	Skip bit on

Table 130 Additional Error Recovery Acton 8 CCW Chains

Command	Meaning
TIC	The first non-TIC CCW following the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user's TIC command, the TIC command by the ERP must specify the command address specified in the application's TIC. This prevents a program check that occurs when a TIC follows a TIC.

E. If the modified seek argument is not in the application's extent, IOS must supply the correct seek argument before doing a seek. If that is not possible, IOS must do Error Action 2.

6. Continue the operation with the following CCW chain:

Table 131 Additional Error Recovery Acton 8 CCW Chains

Command	Meaning
Define Extent	The application's new extent is compatible with the seek argument from steps 9 A. and 9 B. The other parameters are the same as the original parameters.

Table 131 Additional Error Recovery Acton 8 CCW Chains

Command	Meaning
Locate Record	Bytes Contents 0 Same as in the original Locate Record or Locate Record Extended command, except: • If sense byte 3 is ’01’ and the original Locate Record or Locate Record Extended command byte 1, bit 7 was ’1’, then set byte 0, bits 2 through 7 to ’16’ and set byte 1 to ’0’. • If the original byte 0 was ’01’, set byte 0 to ’81’. 1 Same as in the original Locate Record or Locate Record Extended command, except as described in the preceeding for byte 0. 2 Zero 3 The number of CCWs to process, which is contained in sense byte 3. 4-7 The seek address from steps 9 A and (B. 8-11 The seek address from steps 9 A and (B. 12-15 Zero **Note:** 1. If one CCW remains and the original Locate Record or Locate Record Extended command specified Read Count suffix (byte 1, bit 7 was ’1’), then the Locate Record or Locate Record Extended command in this step must specify Read (16) and no Read Count suffix. 2. If the original Locate Record or Locate Record Extended command had a Write Data operation, then the Locate Record or Locate Record Extended command in this step must have data area orientation.
TIC	The first non-TIC CCW following the interrupted CCW. If a Transfer in Channel (TIC) command is specified, the ERP must test the CCW to which the CSW is pointing. If the CSW is pointing to a user’s TIC command, the TIC command by the ERP must specify the command address specified in the application’s TIC. This prevents a program check that occurs when a TIC follows a TIC.

7. Conditions: The SVA invokes this recovery action when a file mask or extent limits setup has been violated. It indicates a host programming type error.

Error Recovery Action 9

1. Present an operation message showing the path is write-inhibited, the functional device address, and the path.
2. Vary the path to the device offline. Present a console message showing the functional device address, the path, and what path has been varied offline.
3. If any alternate path to the device is available, repeat the operation using an alternate path; otherwise, do Error Recovery Action 1.

The SVA subsystem does not invoke this recovery action. In a 3990-3 subsystem, this recovery action is invoked when a data path to a device has been previously write inhibited by an Inhibit Write subcommand of a Diagnostic Control command. This subcommand is processed as a No-Operation by SVA.

Error Recovery Action 10

A specific command was rejected because the interface was disabled for the specific command by the Set Special Intercept Condition order of the Perform Subsystem Function command. The interface on which the command was rejected is no longer disabled; therefore, a retry is not rejected. The recovery action is used as an operating system interception by VM; therefore, the recovery is operating-system dependent.

The SVA invokes this recovery action when a command is rejected as specified by the Set Special Intercept condition order of a Perform Subsystem Function command.

Error Recovery Action 11

Attention was presented with unit check status, because the interface was disabled for the specific command by the Set Special Intercept Condition order of the Perform Subsystem Function command. The interface on which the attention and unit check was presented is still disabled. The recovery action is used as an operating system interception by VM; therefore, the recovery is operating-system dependent.

The SVA invokes this recovery action when Attention status is presented on an interface that was disabled by a Perform Subsystem Function command with the Set Special Intercept order.

In summary, SVA supports all ERP Actions except ERP Action 9 for 24-byte compatibility sense. The specific recovery methods used for retrying the same or different paths are used less frequently in the SVA

Controller than they are in the IBM 3990. The SVA places more emphasis on internal subsystem recovery.

Error Recovery Actions Supported for ECKD 32-Byte Sense

ERP Actions for ECKD 32-byte sense data (SIMs and 3390 device sense) are invoked based on the contents of sense byte 25 - the program action code (PAC). If bit 0 (the high bit) of byte 25 is ’0’, the hex value in bits 1 through 7 specify a single PAC. If bit 0 is ’1’, the hex value in bits 1 through 7 specify a compound PAC.

The SVA supports all single PACs defined for a 3990-3. The following sections describe the error recovery action taken and the conditions within the SVA subsystem that invoke the action.

Release 1 of SVA does not use compound PACs in sense data.

Action 00

No program action is required; exit with no error indication.

The SVA invokes this recovery action when no program action is required. In an SVA subsystem, no conditions have been identified that generate this action.

Action 01

Retry is not recommended. Exit with a permanent error indication.

The SVA invokes this recovery action in the following conditions:

- During a read operation when a previous write operation failed and the host did not follow the recovery actions requested by the Controller following a Channel Command Retry or Disconnect In sequence.
- When a Controller-to-disk array communication error has made the back-end storage temporarily unavailable.

Action 02

An intervention required condition has been detected on a reporting functional storage control.

- Issue a message to the operator indicating that intervention is required on the reporting device.
- Queue the I/O request until an interrupt is received from the device indicating that the device is ready.

The SVA invokes this recovery action when a condition requiring operator intervention is detected and the addressed device is configured as a 3390-type device.

Action 10

The condition that caused the unit check to be presented is not related to the channel program that is being processed.

- Perform the logging and/or message action shown in sense byte 24, bits 4 through 7.
- Restart the channel program.
- If the exception condition persists after 255 retries, exit with a permanent error condition.

The SVA invokes this recovery action when reporting SIMs.

Action 1C

During a channel program in PCI fetch mode, the subsystem did a retry action. The data transferred to the channel may not be valid. The user should take action if the data was accessed before the channel program completed.

The SVA invokes this recovery action when the subsystem is operating in PCI mode and the addressed device is configured as a 3390-type device.

Channel Commands and Parameter Information

A

The SVA supports all of the channel commands and the parameters of channel commands that are supported by the IBM 3990, except for those listed in "Command Summary" on page 33. The SVA differs from the 3990 in the following ways:

- The SVA presents different status to the host than the 3990 does, but only when the differences cannot be detected by a program running at the "370 instruction set" layer of the host system i.e., host channel hardware or microcode may detect a difference in status presentation, but the host operating system or application software does not.
- The SVA does not always present Control Unit Busy in the same circumstances that IBM 3990 does.

For comparison, refer to the *IBM 3990 Storage Control Reference*, GA32-0099.

The following section provides a detailed description of how the SVA differs from the IBM 3390 in processing certain channel commands.

Write Special Home Address Command (X09)

The SVA permits writes to the alternate cylinder and diagnostic cylinder when the data being written indicates a normal, error-free track with a standard home address. This is the same data content that the subsystem produces when it emulates reads from the home address of these tracks. If the data written to the home address is different from the data that would be returned when emulating reads, the command is rejected and unit check status (invalid parameter) is presented.

No writes are permitted to the device support cylinders, and Write Special Home Address does not cause record zero to be erased.

Read Special Home Address Command (X0A)

The SVA emulates reads to the alternate cylinder and diagnostic cylinder for the Read Special Home Address command. However, for

other read commands (except Read Home Address and Read Record Zero), the command is rejected and unit check status is presented.

Space Count Command (X0F)

The SVA requires that the key length and data length Space Count parameters must match the key length and data length of the record on the track. If this is not the case, the command is rejected, and the sense data returned is format 0, message 0. If the parameters are truncated, the command is rejected, and the sense data returned is format 0, message 3 (incorrect parameter bytes received). In contrast, the 3990 would pad the missing parameter bytes.

For the following chain, the SVA presents “invalid track format” on the Space Count.

Seek

Side to the last record on the track

Space Count (no record exists)

Read Data

The the SVA presents “invalid track format” because there is no count field to compare to the key length and data length parameters; therefore, the Space Count cannot be processed. In contrast, the 3390 would accept the Space Count command and present “invalid track format” on the Read Data command.

Write Record Zero Command (X15)

The SVA permits writes to the alternate cylinder and diagnostic cylinder when the data being written indicates a normal, error free track with a standard record zero. This is the same data content that the subsystem produces when it emulates reads from the record zero of these tracks. If the data written to the record zero is different from the data that would be returned when emulating reads, the command is rejected and unit check status (invalid parameter) is presented.

Read Record Zero Command (X16)

The SVA emulates reads to a standard record zero of the alternate cylinder and diagnostic cylinder for the Read Record Zero command. However, for other read commands (except Read Special Home Address and Read Home Address), the command is rejected and unit check status is presented.

Write Home Address Command (X19)

The SVA permits a write of standard home address to the alternate cylinder and diagnostic cylinder. Write Home Address does not cause record zero to be erased when directed to the alternate cylinder and diagnostic cylinder.

Read Home Address Command (X1A)

The SVA emulates reads to the alternate cylinder and diagnostic cylinder for the Read Home Address command. However, for other read commands (except Read Special Home Address and Read Record Zero), the command is rejected and unit check status is presented.

Perform Subsystem Function Command With:

Commit Order (X27/X10)

The SVA processes this command and order in the same way that the 3390 does, except that the asynchronous de-staging of the modified tracks is deferred.

Discard Order (X27/X11)

The SVA processes this command and order in the same way that the 3390 does.

Establish Duplex Pair Order (X27/X12)

The SVA does not support a Perform Subsystem Function command with this order. The command is rejected, unit check status (invalid parameter) is presented.

Terminate Duplex Pair Order (X27/X13)

The SVA does not support a Perform Subsystem Function command with this order. The command is rejected, unit check status (invalid parameter) is presented.

Terminate Suspend Pair Order (X27/X14)

The SVA does not support a Perform Subsystem Function command with this order. The command is rejected, unit check status (invalid parameter) is presented.

Direct I/O Order (X27/X16)

The SVA does not support a Perform Subsystem Function command with this order. The command is rejected, unit check status (invalid parameter) is presented.

Prepare for Read Subsystem Data Order & Read Storage Path Status Suborder (X27/X18/X00)

The SVA processes this command and order in the same way that the 3390 does. However, because of architectural differences, the data returned as storage path status is not compatible with the data that the what the 3990 returns. The four bytes of data for each storage path includes the following information:

1st Byte:

Bit 0 (MSB)	-Storage Path Installed
Bit 1	-Device attaches through this path
Bit 2	-Storage Path disabled
Bit 3	-Device fenced from this storage path
Bits 4 - 7	-Channel ID (0 - F)

2nd and 3rd Bytes: Bit map of channels enabled in this cluster

4th Byte: Reserved

Prepare for Read Subsystem Data Order & Read Statistics Suborder (X27 / X18 / X01)

The the SVA processes this command and order in the same way that the 3390 does.

Prepare for Read Subsystem Data Order & Read Current Cache Fast Write ID (X27 / X18 / X01)

The SVA processes this command and order in the same way that the 3390 does.

Prepare for Read Subsystem Data Order & Read Message (X27 / X18 / X03)

The SVA processes this command and order in the same way that the 3390 does.

Prepare for Read Subsystem Data Order & Read Un-synchronized Cylinders (X27 / X18 / X04)

The SVA does not support a Perform Subsystem Function command with a Prepare for Read Subsystem Data Order and this suborder. The command is rejected, unit check status (invalid parameter) is presented.

Prepare for Read Subsystem Data Order and a Read Pinned Tracks (X27 / X18 / X05)

Because the SVA does not experience pinned tracks, the subsystem responds with “no data pinned.”

Set Special Intercept Order (X27 / X1B)

The SVA processes this command and order in the same way that the 3390 does.

Perform Subsystem Function Command with a destage.

Modified Tracks Order (X27 / X19)

The SVA processes this command and order in the same way that the 3390 does, except that the modified tracks are queued for deferred, asynchronous destage.

Search Home Address (X39)

The SVA does not permit searches to the alternate cylinder or the diagnostic cylinder. The command is rejected and unit check status is presented.

Read Subsystem Data Order (X3E)

The SVA processes this command and order in the same way that the 3390 does.

Locate Record (X47)

The operation byte specifies the orientation that is to be established when a track access is complete (bits 0 and 1). It also specifies the operations to perform in the Locate Record domain (bits 2 through 7). The SVA only accepts the following operation byte values when directed to the alternate and diagnostic cylinders:

- Index orientation and a Format Write operation (XC3)
- Index orientation and a Read operation (XD6)
- Home address orientation and a Format Write operation (X43)
- Home address orientation and a Read Data operation (X46)
- Home address orientation and a Read operation (X56)
- Home address orientation and a Orient operation (X40).

The SVA only accepts the following operation byte values when directed to the device support cylinders:

- Index orientation and a Read operation (XD6)
- Home address orientation and a Read Data operation (X46)

- Home address orientation and a Read operation (X56)
- Home address orientation and a Orient operation (X40).

Read Message ID (X4E)

The SVA processes this command in the same way that the 3390 does.

Sense Subsystem Status (X54)

The following cache information may be returned:

- The configure cache capacity or user cache is the amount of customer cache in the subsystem.
- The available cache capacity is the amount of unfenced cache that is not customer cache and not cache required by the functional track directory (FTD). The FTD may consume up to 128 megabytes of cache; the actual size of the FTD is determined by the configuration of the functional devices, and is independent of the physical configuration of the subsystem.
- Pinned cache space is always set to zero.
- Offline cache capacity is the amount of cache (in bytes) that is unavailable to the storage director.
- The sum of the available cache capacity and pinned cache space is always less than or equal to the configured cache capacity.

Read Device Characteristics (X64)

The SVA responds with the alternate cylinder and diagnostic cylinder as configured. In release 1 of the SVA, the Read Device Characteristics specifies that dual copy is not supported.

Diagnostic Write (X73)

This command is rejected and unit check status (invalid command) is presented.

Set Subsystem Mode (X87/X0000)

When the Set Subsystem Mode command specifies no cache operation, no cache fast write operation, no message, and no nonvolatile storage operation, this command is processed as a No-Operation command. The SVA processes a No-operation command in the same way that the 3390 does.

Set subsystem Mode With:

Cache Control - Activate Device (X87/X2000)

When the Set Subsystem Mode command specifies an activate device operation, the SVA processes this command in the same way that the 3390 does.

Cache Control - Deactivate Device (X87/X4000)

When the Set Subsystem Mode command specifies a deactivate device operation, the caching algorithms for the functional device tracks are modified to minimize their use of cache. Therefore, modified tracks are immediately queued for de-staging, and unmodified tracks are discarded as soon as the cache capacity that they occupy is needed to store other tracks. However, cache sequential, look-ahead algorithms are not affected, IBM dual copy groups are not suspended, but CacheGuard immunity for the least-recently used algorithm is suspended. Also, “cache inactive for the functional device” is returned in response to a Read Subsystem Status command.

Cache Control - Activate Subsystem (X87/X6000)

The SVA processes this command with this operation in the same way that the 3390 does.

Cache Control - Deactivate Subsystem (X87/XA000)

When cache is deactivated for the subsystem, the caching algorithms used for the functional devices that are addressed in the functional storage control are modified as to minimize their use of cache. Therefore, modified tracks are immediately queued for de-staging, and unmodified tracks are discarded as soon as the cache capacity that they occupy is needed to store other tracks. However, cache sequential, look-ahead algorithms are not affected, IBM dual copy groups are not suspended, but CacheGuard immunity for the least-recently used algorithm is suspended. Also, “cache inactive for the functional device” is returned in response to a Read Subsystem Status command. The Read Subsystem Data counters are zeroed for the functional devices that are addressed in functional storage control. Cache inactive for the subsystem is returned in response to a Read Subsystem Status command.

Cache Control - Force Deactivate Subsystem (X87/X9000)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Cache Fast Write Control - Activate CFW for the Subsystem (X87/X0C00)

The SVA processes this command with this operation in the same way that the 3390 does.

Cache Fast Write Control - Deactivate CFW for the Subsystem (X87/X1000)

The SVA processes this command with this operation in the same way that the 3390 does.

Asynchronous Message Required (X87/X0100)

The SVA processes this command with this operation in the same way that the 3390 does.

DASD Fast Write Control - Activate (X87/X0020)

The SVA processes this command with this operation in the same way that the 3390 does.

DASD Fast Write Control - Deactivate (X87/X0040)

This command with this operation cause the DASD fast write status to be reported as inactive in response to a Read Subsystem Status command, and modified tracks are queued for destage. However, DASD fast write status has no permanent effect on caching algorithms.

DASD Fast Write Control - Force Deactivate (X87/X0060)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Nonvolatile Storage Control - Activate (X87/X0080)

The SVA processes this command with this operation in the same way that the 3390 does.

Nonvolatile Storage Control - Deactivate (X87/X00A0)

When nonvolatile storage is deactivated for the subsystem, the caching algorithms used for the functional devices that are addressed in the functional storage control are modified as to minimize their use of cache. Therefore, modified tracks are immediately queued for de-staging, and unmodified tracks are discarded as soon as the cache capacity that they occupy is needed to store other tracks. However, cache sequential, look-ahead algorithms are not affected, IBM dual copy groups are not suspended, but CacheGuard immunity for the least-recently used algorithm is suspended. NVS inactive for the

subsystem is returned in response to a Read Subsystem Status Command.

Note: The NVS battery is only be disconnected in response to a controlled power-down from the operator panel or the remote operator panel.

Diagnostic Sense/Read Preceded by a Diagnostic Control

Locate Data Checks (XC4/X01)

If this command is received in an invalid command chain, the command is rejected and unit check status (invalid command sequence) is presented. If this command is received in a valid command chain, the Diagnostic Sense/Read command is still rejected, because the Diagnostic Control/Locate Data Checks command is rejected and unit check status (invalid parameter) is presented.

Select Subsystem Data (XC4/X06)

If this command is received in an invalid command chain, the command is rejected and unit check status (invalid command sequence) is presented. If this command is received in a valid command chain, the Diagnostic Sense/Read command is still rejected, because the Diagnostic Control/Select Subsystem Data command is rejected and unit check status (invalid parameter) is presented.

Read Remote Support Access Code (XC4/X0A)

This command is processed through the SVA's support processors.

Start Application (XC4/X07)

If this command is received in an invalid command chain, the command is rejected and unit check status (invalid command sequence) is presented. If this command is received in a valid command chain, the Diagnostic Sense/Read command is still rejected, because the Diagnostic Control/Start Application command is rejected and unit check status (invalid parameter) is presented.

Diagnostic Control With:

Locate Data Checks (XF3/X01)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Inhibit Write (XF3/X02)

The SVA processes this command as a No-Operation command.

Set Guaranteed Path (XF3/X04)

The SVA processes this command as a No-Operation command.

Select Subsystem Data (XF3/X06)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Select Trace (XF3/X07)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Enable Write (XF3/X07)

The SVA processes this command as a No-Operation command.

3380 Track Compatibility Mode (XF3/X09)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Read Remote Support Access Code (XF3/X0A)

This command is processed through the SVA's support processors.

Diagnostic Initialize Subsystem (XF3/X0B)

Note: The SVA subsystem defaults are not the same as those for the 3390.

In the SVA, a Diagnostic Control command with the Diagnostic Initialize Subsystem subcommand is viewed as a functional storage control reset, and the subsystem defaults (cache available, NVS available, DFW active, device caching active, CFW active, dual copy simplex) are reestablished for the functional devices addressed by the functional storage control. In this case, modified tracks are immediately queued for de-staging, and unmodified tracks are discarded as soon as the cache capacity that they occupy is needed for other tracks. Also, CacheGuard is terminated for the functional storage control. The interface device ID and functional device ID for each channel interface are not reset, and path groupings of secondary members of duplex pairs is reset.

Note: This command causes the entire subsystem to experience CU Busy for a brief period, while the Controller verifies that the functional storage control being addressed by the command is not active.

Un-fence Storage Path (XF3/X0C)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Start Application (XF3/X0D)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Access Device in Unknown Condition (XF3/X0F)

This command is processed as defined by IBM; this command with this operation is rejected and unit check status (status not as required) is presented.

Media Maintenance Reserve (XF3/X10)

The SVA processes this command as a No-Operation command and presents channel end and device end.

Media Maintenance Release (XF3/X11)

The SVA processes this command as a No-Operation command and presents channel end and device end.

Media Maintenance Query (XF3/X12)

The SVA processes this command as a No-Operation command and presents channel end and device end.

Remote Service Access (XF3/X13)

This command with this operation is rejected and unit check status (invalid parameter) is presented.

Read Configuration Data (XFA)

The SVA processes this command with this operation in the same way that the 3390 does, but specific SVA information is substituted as required.

No-Operation Commands

Commands that are processed as “no-operation” commands use the minimum processing resources possible. Chaining requirements are verified.

Unit Check, Invalid Command

When the SVA rejects those commands that are accepted by the 3990-3, the subsystem returns format 0 sense data with a unique fault symptom code. Chaining requirements for invalid commands are not verified.

Unit Check, Invalid Parameter

When the SVA rejects those parameters that are accepted by the 3990-3, the subsystem returns format 0 sense data with a unique fault symptom code. Chaining requirements for the SVA-specific, invalid commands are not verified.

Subcommands

If at least one subcommand is accepted for a command, the command's chaining requirements are verified, but chaining requirements unique to invalid subcommands and parameters for invalid subcommands are not verified.

Device Busy at End of Chain

The SVA can present device busy status when the same channel path or group presents a TIO or NOP command before the completion of end of chain processing by the Controller.

Orientation Error Reporting for Locate Record

The SVA can present detectable orientation errors such as no record found and invalid track format when processing a Locate Record command, without waiting for a subsequent data transfer command. In some cases, the 3390 waits for a subsequent data transfer command before presenting this kind of error.

Incomplete Domain Error Reporting

The SVA does not check for or report Incomplete Domain Error, exception class 0, category 2.

Non-SIM Sense Data for Back-End Errors

B

Non-SIM sense data for the SVA back-end errors is reported to the host only in the following cases:

1. Data is unreadable due to a permanent data check. Refer to the description for Format 4 or Exception Class 4 sense and the Data Check bit in sense byte 0 for the situations in which permanent data checks can occur with the SVA. A SIM may be generated by the support facility as a result of this error.
2. The control unit cannot communicate with a disk array unit. This can occur for the following reasons:
   A. both fibre channel loops inoperable
   B. fibre channel links plugged in wrong or not connected
   C. disk array unit not powered up.

When a Controller-to-Disk Array Unit communication failure is detected, the subsystem rejects all channel commands that access data or that affect subsystem or device configuration, until communications have been re-established. Format 1 Msg 0 sense is reported if the addressed virtual device is configured as a 3380-type device, and ECKD 32-byte Exception Class E sense data is reported, if the addressed virtual device is configured as a 3390-type device. Functional code reports ALL other back-end specific errors to the support facility in a failure report. The support facility logs the errors and generates SIMs as necessary. The SIMs provide information regarding suspect FRUs that may have caused the error condition.

3. The subsystem has entered data assurance check mode. This occurs when certain mapping table exceptions are detected. When in this state, the subsystem rejects all channel commands that access data or that affect subsystem or device configuration, until the data assurance check mode has been cleared at a subsystem operator panel.
4. The addressed device is a member of a production partition that is out of conditional capacity. In this case, the subsystem rejects all

write commands until storage space has been freed up on the back-end. SIMs are also generated when the subsystem is out of or low on conditional capacity.

Standard Device Characteristics

C

Table 132 **3390 Device Characteristics**

Bytes	Description	3390 Model 1	3390 Model 2	3390 Model 3	3390 Model 9
0-1	Storage control type	3990	3990	3990	3390
2	Storage Control Model				
	Mod 3 sync	CC	CC	CC	CC
	Mod 3 nonsync	EC	EC	EC	EC
3-4	Device type	3390	3390	3390	3390
5	Device model	02	06	0A	0C
6-9	Storage Control and Device Facilities, Mod 3 (NVS)	D0 00 10 96 (or D0 00 30 96 if PPRC is enabled)	D0 00 10 96 (or D0 00 30 96 if PPRC is enabled)	D0 00 10 96 (or D0 00 30 96 if PPRC is enabled)	D0 00 10 96 (or D0 00 30 96 if PPRC is enabled)
10	Device class code	20	20	20	20
11	Device type code	26	27	24	32
12-13	Primary cylinders	0459	08B2	0D0B	2721
14-15	Tracks per cylinder	000F	000F	000F	000F
16	Number of sectors	E0	E0	E0	E0
17-19	Track length	00E5A2	00E5A2	00E5A2	00E5A2
20-21	Length of HA and RO	0594	0594	0594	0594
22	Track capacity formula	02	02	02	02
23	Factor F1	22	22	22	22
24-25	Factor F2 or F2F3 [a]	1309	1309	1309	1309
26-27	Factor F3 or F4F5[b]	0674	0674	0674	0674
28-29	First alternate cylinder	0459	08B2	0D0B	2721

Table 132 **3390 Device Characteristics** ***(Continued)***

Bytes	Description	3390 Model 1	3390 Model 2	3390 Model 3	3390 Model 9
30-31	Number of alternate tracks	000F	000F	000F	00B4
32-33	First Diagnostic Cylinder	045B	08B4	0D0D	2727
34-35	Number of diagnostic tracks	000F	000F	000F	00B4
36-37	First device support cylinder	0481	08D9	0D19	274B
38-39	Number of device support tracks	001E	001E	001E	005A
40	MDR record ID[c]	26	27	24	32
41	OBR record ID[d]	26	27	24	32
42	Control unit type code, Model 3	06	06	06	06
43	Param. Length				
	Sync	00	00	00	00
	Nonsync	02	02	02	02
44-45	Maximum record zero length	DFEE	DFEE	DFEE	DFEE
46	Reserved	Zeros	Zeros	Zeros	Zeros
47	Track set[e]	01	01	01	00
48	Factor F6	06	06	06	06
49-50	RPS Factor	7708	7708	7708	7708
51-53	Reserved	Zeros	Zeros	Zeros	Zeros
54	Generic Functions and Features[f]	Content varies	Content varies	Content varies	Content varies
55	Reserved	Zeros	Zeros	Zeros	Zeros
56	“Real” Storage Control Code	21	21	21	21
57	“Real” Device OBR Code	60	60	60	60
58-63	Reserved	Zeros	Zeros	Zeros	Zeros

a. Factor F2 when byte 22 is X'01'. Factors F2 and F3 (F2F3) when byte 22 is X'02').
b. Factor F3 when byte 22 is X'01'. Factors F4 and F5 (F4F5) when byte 22 is X'02').
c. Miscellaneous data recorder (MDR) record ID.
d. Outboard recorder (OBR) record ID.
e. This byte is zeros on parallel channels and X'01' on ESCON channels.
f. Bits that are set to '1' in this byte indicate the function or feature is supported.

Bits	**Meaning**
0	Mirroring active for device
1	RAID device architecture
2	Subsystem/device compression
3	Transparent subsystem cache
4	Split CE/DE (set to '1' if PPRC is enabled)
5	Mirroring capable
6	Reserved
7	SnapShot enabled

Table 133 3380 Device Characteristics

Bytes	**Description**	**3380-6EA K[a]**	**3380J**	**3380K**
0-1	Storage control type	3990	3990	3990
2	Storage Control Model			
	Mod 3 sync	CC	CC	CC
	Mod 3 nonsync	EC	EC	EC
3-4	Device type	3380	3380	3380
5	Device model	1E	16	1E
6-9	Storage control and device facilities, Model 3 with NVS	D0 00 10 97 (or D0 00 30 97 if PPRC is enabled)	D0 00 10 97 (or D0 00 30 97 if PPRC is enabled)	D0 00 10 97 (or D0 00 30 97 if PPRC is enabled)
10	Device class code	20	20	20
11	Device type code	0E	0E	0E
12-13	Primary cylinders	06EA	0375	0A5F
14-15	Tracks per cylinder	000F	000F	000F
16	Number of sectors	DE	DE	DE
17-19	Track length	00BB60	00BB60	00BB60
20-21	Length of HA and RO	0440	0440	0440
22	Track capacity formula	01	01	01
23	Factor F1	20	20	20
24-25	Factor F2 or F2F3[b]	01EC	01EC	01EC

Table 133 3380 Device Characteristics (Continued)

Bytes	Description	3380-6EA K[a]	3380J	3380K
26-27	Factor F3 or F4F5[2]	00EC	00EC	00EC
28-29	First alternate cylinder	06EA	0375	0A5F
30-31	Number of alternate tracks	000F	000F	000F
32-33	First Diagnostic cylinder	06EB	0376	0A62
34-35	Number of diagnostic tracks	000F	000F	000F
36-37	First device support cylinder	06F4	FFFD	0A6B
38-39	Number of device support tracks	001E	000F	002D
40	Miscellaneous data record (MDR) record ID	23	21	23
41	Outboard recorder (OBR) record ID	23	21	23
42	Control unit type code, Model 3	06	06	06
43	Param. Length			
	Sync interface	00	00	00
	Non-sync interface	02	02	02
44-45	Maximum record zero length	BB74	BB74	BB74
46	Reserved	Zeros	Zeros	Zeros
47	Track set[2]	01	01	01
48	Factor F6	00	00	00
49-50	RPS Factor	5007	5007	5007
51-53	Reserved	Zeros	Zeros	Zeros
54	Generic Functions and Features[c]	Content varies	Content varies	Content varies
55	Reserved	Zeros	Zeros	Zeros
56	“Real” Storage Control Code	21	21	21
57	“Real” Device OBR Code	60	60	60

Table 133 3380 Device Characteristics (Continued)

Bytes	Description	3380-6EA K[a]	3380J	3380K
58-63	Reserved	Zeros	Zeros	Zeros

a. The SVA provides a virtual device image for a 3380E device and refers to it as a 6EA K device (where 6EA is the number of primary cylinders for a 3380E). Note that the storage control and device facilities, Device Model, MDR record ID, and OBR record ID of this device type are reported as those of a 3380K device type, whereas the remaining characteristics are reported as those of a 3380E device type.

b. Value when Locate Record Extended Write Any or Read Any are available. Otherwise, set to zero.

c. Bits that are set to ‘1’ in this byte indicate the function or feature is supported:

BitsMeaning

0Mirroring active for device
1RAID device architecture
2Subsystem/device compression
3Transparent subsystem cache
4Split CE/DE (set to ‘1’ if PPRC is enabled)
5Mirroring capable
6Reserved
7SnapShot enabled

Read Subsystem Data (RSSD) Differences

D

Differences Between IBM RSSD and the SVA RSSD

The SVA's fully buffered architecture requires different caching algorithms than those used by the 3990-3. Consequently, some of the cache hits, pre-stages and destages that occur in an SVA subsystem cannot be represented in the IBM-compatible statistical counters. In addition, the SVA does not treat some exception conditions in the Read Subsystem Data (RSSD) counters in the same way as the 3990-3.

The following paragraphs describe the major differences between 3990 RSSD and the SVA RSSD when using a program designed to collect and report 3990 subsystem data. The RSSD columns of the counter update tables describe when counters are updated. These RSSD columns are found in Table 134 on page 237 through Table 152 on page 265.

Hits and Misses

In the SVA, all hits and misses are counted as they occur, as long as they are within the constraints for counting hits and misses as described in the RSSD column of the counter update tables. (Refer to pages 237 to 265.) This rule includes Format Write operations for which the SVA may perform stages in some instances in which the 3990 does not. The SVA never stages the following writes, instead they are always counted as hits.

- Predictable write operations
- Write Count, Key, and Data Next Track commands with a standard Record Zero. The 3990 counts neither hits nor misses, only writes.
- Locate Record or Locate Record Extended commands with a Write Track operation and a standard Record Zero
- Locate Record or Locate Record Extended commands with a Format Write operation that has Index or Home Address orientation.

Pre-staging

All Read Track, Read Multiple Count, Key, and Data, or Read or Update Write operations with a Locate Record count large enough to span multiple tracks may cause within-chain pre-staging in the SVA. Note that the SVA never pre-stages on Format Write operations. The SVA counts sequential pre-stages only (both within-chain and end-of-chain). This count is found in Bytes 60-63. The 3990 does not perform within-chain pre-staging. The net result of counting the SVA-unique pre-stages is that, all else being equal, the SVA reports a higher pre-stage count than does the 3990.

Search counts incremented at Locate Record

The SVA, unlike the 3990, initiates a search at the time a Locate Record or Locate Record Extended command is processed (unless Index orientation is specified), and increments the search counts if the first command in the domain of the Locate Record operation fails. If the result of the search is a hit (including those operations enumerated in the preceeding, which are always hits), the search hit counts are incremented. If it is a miss, the stage counts are incremented. If the Locate Record command is followed by a successful write operation, the write counts are incremented, rather than the search counts.

Destages

All else being equal, the SVA reports a higher destage count than the 3990, since the history of destaged tracks is not easily known: tracks that were never counted as staged can be included in the destaged count.

NVS constraint

The SVA always reports zeros in this counter because all writes must go through cache. The 3990 can have positive values in this count.

Force Bypass Cache

The SVA never forces bypass cache mode, and never updates the RSSD counters as if it had. The 3990 forces bypass cache mode for certain commands (e.g., a Read IPL, Space Count, or Recalibrate command), and certain Define Extent options (e.g., when the file mask specifies “permit all writes”).

Non-primary cylinders

Accesses to non-primary cylinders are always counted as hits by the SVA, as long as the rules for the type of access and current caching

status (as described in the table for the counter) allow recording of hits. The 3990 always goes to DASD to access non-primary cylinders.

C0H0

The SVA does not treat accesses to C0H0 differently from accesses to other tracks. The 3990 always goes to DASD to access C0H0.

Major Differences between the SVA RSSD and ECAM

The preceding paragraphs described the major differences between 3990 RSSD and the SVA RSSD when using a program designed to collect and report 3990 subsystem data. However, there are programs, such as SVAA Subsystem Reporting, specifically designed to collect and report data for an SVA subsystem. These programs receive their data through the SVA's Extended Control and Monitoring (ECAM) interface. In some cases, the data provided by programs using the ECAM interface is different from the SVA RSSD data. The following paragraphs describe the major differences between the SVA RSSD and the data provided through the ECAM interface. The ECAM columns of the counter update tables on pages 237 to 265 describe when counters are updated.

Write hits and misses

All write hits and misses are counted in ECAM as they occur, not just those with CFW or DFW on; and irrespective of device or functional control unit (FCU) caching status.

Cache Fast Write

The SVA treats all writes, including those with cache fast write in the define extent CCW, as DASD fast writes. The four CFW counters (reads, read hits, writes, write hits) are always set to zero in ECAM, and operations specifying CFW are counted as if CFW was not specified.

Write Operations

In ECAM, all writes are counted as DFW writes. Therefore, the normal writes counter is always identical to the DFW normal writes counter, and the sequential writes counter is always identical to the DFW sequential writes counter.

Bypass cache and ICL operations

Since bypass cache and inhibit cache loading operations use sequential caching algorithms in the SVA, they are counted as

sequential operations. Therefore, ECAM always reports zero in the bypass and ICL counters.

Effect of cache status

Depending on the cache status, the SVA RSSD and ECAM may increment counters differently.

- If cache is deactivated for the FCU, all counters reported by the RSSD command are zeros. However, the ECAM counters continue to be incremented, and are reported as actuals.
- If cache is deactivated for the device, ECAM reports the actual counts regardless of the device caching status; however, the following counts are not incremented in RSSD if caching is deactivated for the device:
  - Read normal hits (8-11)
  - DFW normal hits (16-19)
  - Read sequential hits (24-27)
  - DFW sequential hits (32-35)
  - Search/read CFW reqs (36-39)
  - Search/read CFW hits (40-43)
  - Write CFW reqs (44-47)
  - Write CFW hits (48-51)
  - Sequential stages (60-63)
  - Stages (64-67)
  - destages (68-71)
  - DFW normal writes (76-79)
  - DFW sequential writes (80-83)
- If DFW is deactivated for the device or NVS is deactivated for the FCU (DFW disabled), device DFW status and FCU NVS status have no effect on caching algorithms for the SVA or for ECAM. However, in the 3990, DFW writes are counted as non-DFW writes when DFW is disabled.

  The following counts are not incremented in RSSD if DFW is disabled:
  - DFW normal hits (16-19)
  - DFW sequential hits (32-35)
  - DFW normal writes (76-79)
  - DFW sequential writes (80-83)

- The SVA treats all write operations that specify CFW as DASD fast writes, and the CFW does not affect the SVA caching algorithms. CFW status does not affect the ECAM counters either; however, CFW status does affect 3990 behavior. If CFW is deactivated for the FCU in the 3990, CFW reads are counted as if CFW were not specified, and CFW writes are counted as if neither CFW nor DFW were specified.
- If CFW is deactivated for the FCU in the SVA, the following RSSD counts are not incremented:
  - CFW read reqs (36-39)
  - CFW read hits (40-43)
  - CFW write reqs (44-47)
  - CFW write hits (48-51)
- If DFW is deactivated for the device or NVS is deactivated for the FCU, and CFW is deactivated for the FCU, the destages count (68-71) is incremented in ECAM but not in RSSD.

Pre-staging

All pre-stages are counted in ECAM. In RSSD, only pre-stages for sequential reads and sequential fast write operations are counted. In addition, pre-stages are not counted in RSSD if there are any Format Write operations in the chain.

Search or Read Normal I/O Requests

Bytes 4 through 7 of the subsystem data contains the counter for the number of search or read normal I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 134 Counters for Search or Read Normal I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
No Define Extent	X	X			X	X		
Normal, CFW off, DFW off	X	X			X	X		
Normal, CFW off, DFW on	X	X			X	X		
Normal, CFW on and enabled and device caching on, DFW off					X	X		
Normal, CFW on and disabled or device caching off, DFW off	X	X			X	X		

Table 134 Counters for Search or Read Normal I/O Requests (Continued)

Conditions	RSSD				ECAM			
Normal, CFW on and enabled and device caching on, DFW on					X	X		
Normal, CFW on and disabled or device caching off, DFW on	X	X			X	X		
ICL, CFW off, DFW off, device caching on		X						
ICL, CFW off, DFW off, device caching off								
ICL, CFW off, DFW on, device caching on		X						
ICL, CFW off, DFW on, device caching off								
ICL, CFW on and enabled and device caching off, DFW off								
ICL, CFW on and disabled or device caching on, DFW off		X						
ICL, CFW on and enabled or device caching off, DFW on								
ICL, CFW on and disabled and device caching on, DFW on		X						

3990 and the SVA RSSD:

Increment:

1. On all normal reads with CFW off.
2. On normal reads with CFW on but disabled for the FCU, or with device caching disabled.
3. If device caching is active, on ICL read hits with CFW off, and on ICL read hits with CFW on but disabled for FCU.

ECAM: Increment on all normal reads including CFW normal reads. Do not increment on ICL read hits. (ICL is counted as sequential.)

Abbreviations:

RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

Search or Read Normal I/O Request Hits

Bytes 8 through 11 of the subsystem data contains the counter for the number of search or read normal I/O request hits. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 135 Counters for Search or Read Normal I/O Request Hits

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
No Define Extent		X				X		
Normal, CFW off, DFW off		X				X		
Normal, CFW off, DFW on		X				X		
Normal, CFW on and enabled, DFW off						X		
Normal, CFW on and disabled, DFW off		X				X		
Normal, CFW on and enabled, DFW on						X		
Normal, CFW on and disabled, DFW on		X				X		
ICL, CFW off, DFW off		X						
ICL, CFW off, DFW on		X						
ICL, CFW on and enabled, DFW off								
ICL, CFW on and disabled, DFW off		X						
ICL, CFW on and enabled, DFW on								
ICL, CFW on and disabled, DFW on		X						

SVA RSSD:

Increment:

1. On normal reads with CFW off or with CFW on but disabled for the FCU.
2. On ICL read hits with CFW off or with CFW on but disabled for the FCU.

ECAM: Increment on all normal reads including CFW normal reads. Do not increment on ICL read hits. (ICL is counted as sequential.)

Abbreviations:

RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

Write Normal I/O Requests

Bytes 12 through 15 of the subsystem data contains the counter for the number of write normal I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 136 Counters for Write Normal I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
No Define Extent			X	X			X	X
Normal, CFW off, DFW off			X	X			X	X
Normal, CFW off, DFW on			X	X			X	X
Normal, CFW on and enabled and device caching on, DFW off							X	X
Normal, CFW on and disabled or device caching off, DFW off			X	X			X	X
Normal, CFW on and enabled or device caching on, DFW on							X	X
Normal, CFW on and disabled or device caching off, DFW on			X	X			X	X
ICL, CFW off, DFW on and enabled and NVS enabled and device caching on				X				
ICL, CFW off, DFW on and disabled or NVS disabled or device caching off								

SVA RSSD:

Increment:

1. On normal writes with CFW off.
2. On normal writes with CFW on but disabled for the FCU, or with device caching disabled.
3. If device caching is active, on ICL write hits with CFW off and DFW on and enabled for the device and NVS is enabled for the FCU.

ECAM: Increment on all normal write hits. (The SVA treats all writes, including CFW writes, as DFW writes). This counter always equals the DFW normal writes. Do not increment on ICL write hits. (ICL is counted as sequential.)

Table 136 Counters for Write Normal I/O Requests

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

DASD Fast Write I/O Request Hits

Bytes 16 through 19 of the subsystem data contains the counter for the number of DASD fast write I/O request hits. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 137 Counters for DASD Fast Write I/O Request Hits

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
No Define Extent, DFW enabled and NVS enabled				X				X
No Define Extent, DFW disabled and NVS disabled								X
Normal, CFW off, DFW off								X
Normal, CFW off, DFW on and enabled and NVS enabled				X				X
Normal, CFW off, DFW on and disabled or NVS disabled								X
Normal, CFW on, DFW off								X
Normal, CFW on, DFW on								X
ICL, CFW off, DFW on and enabled and NVS enabled				X				
ICL, CFW off, DFW on and disabled or NVS disabled								

SVA RSSD:
Caching and DFW must be enabled for the device and NVS enabled for the FCU for this counter to increment. Increment on normal or ICL DFW write hits with CFW off.
ECAM: Increment on all normal write hits. (The SVA treats all writes, including CFW writes, as DFW writes). Do not increment on ICL write hits. (ICL is counted as sequential.)

Abbreviations:
RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

Search or Read Sequential I/O Requests

Bytes 20 through 23 of the subsystem data contains the counter for the number of search or read sequential I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 138 Counters for Search or Read Sequential I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
Sequential, CFW off, DFW off	X	X			X	X		
Sequential, CFW off, DFW on	X	X			X	X		
Sequential, CFW on and enabled and device caching on, DFW off					X	X		
Sequential, CFW on and disabled or device caching off, DFW off	X	X			X	X		
Sequential, CFW on and enabled and device caching on, DFW on					X	X		
Sequential, CFW on and disabled or device caching off, DFW on	X	X			X	X		
Bypass, CFW off, DFW off					X	X		
Bypass, CFW off, DFW on					X	X		
Bypass, CFW on, DFW off					X	X		
Bypass, CFW on, DFW on					X	X		
ICL, CFW off, DFW off					X	X		
ICL, CFW off, DFW on					X	X		
ICL, CFW on, DFW off					X	X		
ICL, CFW on, DFW on					X	X		

SVA RSSD:

Increment:

1. On sequential reads with CFW off.
2. On sequential reads with CFW on but disabled for the FCU or with device caching disabled.

ECAM: Increment on all sequential, bypass, and ICL reads.

Table 138 Counters for Search or Read Sequential I/O Requests

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Search or Read Sequential I/O Request Hits

Bytes 24 through 27 of the subsystem data contains the counter for the number of search or read sequential I/O request hits. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 139 Counters for Search or Read Sequential I/O Request Hits

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
Sequential, CFW off, DFW off		X				X		
Sequential, CFW off, DFW on		X				X		
Sequential, CFW on and enabled, DFW off						X		
Sequential, CFW on and disabled, DFW off		X				X		
Sequential, CFW on and enabled, DFW on						X		
Sequential, CFW on and disabled, DFW on		X				X		
Bypass, CFW off, DFW off						X		
Bypass, CFW off, DFW on						X		
Bypass, CFW on, DFW off						X		
Bypass, CFW on, DFW on						X		
ICL, CFW off, DFW off						X		
ICL, CFW off, DFW on						X		
ICL, CFW on, DFW off						X		

Table 139 Counters for Search or Read Sequential I/O Request Hits

Conditions	**RSSD**				**ECAM**			
ICL, CFW on, DFW on						X		

SVA RSSD:
Caching for the device must be enabled for this counter to increment. Increment on all sequential read hits with CFW off or with CFW on but disabled for the FCU.
ECAM: Increment on all sequential, bypass, and ICL read hits.

Abbreviations:

RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

Write Sequential I/O Requests

Bytes 28 through 31 of the subsystem data contains the counter for the number of write sequential I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 140 Counters for Write Sequential I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
Sequential, CFW off, DFW off			X	X			X	X
Sequential, CFW off, DFW on			X	X			X	X
Sequential, CFW on and enabled and device caching on, DFW off							X	X
Sequential, CFW on and disabled and device caching off, DFW off							X	X
Sequential, CFW on and disabled and device caching on, DFW on							X	X
Sequential, CFW on and disabled and device caching off, DFW on							X	X
Bypass, CFW off, DFW off							X	X
Bypass, CFW off, DFW on							X	X
Bypass, CFW on, DFW off							X	X
Bypass, CFW on, DFW on							X	X
ICL, CFW off, DFW off							X	X
ICL, CFW off, DFW on							X	X
ICL, CFW on, DFW off							X	X
ICL, CFW on, DFW on							X	X

SVA RSSD:
Increment:

1. On sequential writes with CFW off.
2. On sequential writes with CFW on but disabled for FCU or with device caching disabled.

ECAM: Increment on all sequential, bypass, and ICL writes.

Table 140 Counters for Write Sequential I/O Requests

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

DASD Fast Write Sequential I/O Request Hits

Bytes 32 through 35 of the subsystem data contains the counter for the number of DASD fast write sequential I/O request hits. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 141 Counters for DASD Fast Write Sequential I/O Request Hits

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
Sequential, CFW off, DFW off								X
Sequential, CFW off, DFW on and enabled and NVS enabled				X				X
Sequential, CFW off, DFW on and disabled or NVS disabled								X
Sequential, CFW on, DFW off								X
Sequential, CFW on, DFW on								X
Bypass, CFW off, DFW off								X
Bypass, CFW off, DFW on								X
Bypass, CFW on, DFW off								X
Bypass, CFW on, DFW on								X
ICL, CFW off, DFW off								X
ICL, CFW off, DFW on								X
ICL, CFW on, DFW off								X
ICL, CFW on, DFW on								X

Table 141 Counters for DASD Fast Write Sequential I/O Request Hits

Conditions	RSSD	ECAM
SVA RSSD: Caching and DFW must be enabled for the device and NVS enabled for the FCU for this counter to increment. Increment on sequential DFW write hits with CFW off. **ECAM**: Increment on all sequential, bypass, and ICL write hits.		
Abbreviations:		
RSSD = Read Subsystem Data		
ECAM = Extended Control and Monitoring	**WH** = write hit	
RM = read miss	**CFW** = cache fast write	
RH = read hit	**DFW** = DASD fast write	
WM = write miss	**ICL** = inhibit cache loading	
	FCU = Functional Control Unit	

Search or Read Cache Fast Write I/O Requests

Bytes 36 through 39 of the subsystem data contains the counter for the number of search or read cache fast write I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 142 Counters for Search or Read Cache Fast Write I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
Normal, CFW on and enabled, DFW off	X	X						
Normal, CFW on and disabled, DFW off								
Normal, CFW on and enabled, DFW on	X	X						
Normal, CFW on and disabled, DFW on								
Sequential, CFW on and enabled, DFW off	X	X						
Sequential, CFW on and disabled, DFW off								
Sequential, CFW on and enabled, DFW on	X	X						
Sequential, CFW on and disabled, DFW on								
ICL, CFW on and enabled, DFW off		X						
ICL, CFW on and disabled, DFW off								
ICL, CFW on and enabled, DFW on		X						
ICL, CFW on and disabled, DFW on								

SVA RSSD: Caching must be enabled for the device and CFW enabled for the FCU for this counter to increment.

Increment:

1. On normal reads with CFW on.
2. On sequential reads with CFW on.
3. On ICL read hits with CFW on.

ECAM: Always set to zero.

Table 142 Counters for Search or Read Cache Fast Write I/O Requests

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Search or Read Cache Fast Write I/O Request Hits

Bytes 40 through 43 of the subsystem data contains the counter for the number of search or read cache fast write I/O request hits. The following table describes when this counter is updated.

Table 143 Counters for Search or Read Cache Fast Write I/O Request Hits

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
Normal, CFW on and enabled, DFW off		X						
Normal, CFW on and disabled, DFW off								
Normal, CFW on and enabled, DFW on		X						
Normal, CFW on and disabled, DFW on								
Sequential, CFW on and enabled, DFW off		X						
Sequential, CFW on and disabled, DFW off								
Sequential, CFW on and enabled, DFW on		X						
Sequential, CFW on and disabled, DFW on								
ICL, CFW on and enabled, DFW off		X						
ICL, CFW on and disabled, DFW off								
ICL, CFW on and enabled, DFW on		X						
ICL, CFW on and disabled, DFW on								

Table 143 Counters for Search or Read Cache Fast Write I/O Request Hits

Conditions	RSSD	ECAM
SVA RSSD: Caching must be enabled for the device and CFW enabled for the FCU for this counter to increment. **Increment**: 1. On normal read hits with CFW on. 2. On sequential read hits with CFW on. 3. On ICL read hits with CFW on. **ECAM**: Always set to zero.		
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Cache Fast Write I/O Requests

Bytes 44 through 47 of the subsystem data contains the counter for the number of cache fast write I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 144 Counters for Cache Fast Write I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
Normal, CFW on and enabled, DFW off			X	X				
Normal, CFW on and disabled, DFW off								
Normal, CFW on and enabled, DFW on			X	X				
Normal, CFW on and disabled, DFW on								
Sequential, CFW on and enabled, DFW off			X	X				
Sequential, CFW on and disabled, DFW off								
Sequential, CFW on and enabled, DFW on			X	X				
Sequential, CFW on and disabled, DFW on								
ICL, CFW on and enabled, DFW off				X				
ICL, CFW on and disabled, DFW off								
ICL, CFW on and enabled, DFW on				X				
ICL, CFW on and disabled, DFW on								

SVA RSSD: Caching must be enabled for the device and CFW enabled for the FCU for this counter to increment.

Increment:

1. On normal writes with CFW on.
2. On sequential writes with CFW on.
3. On ICL write hits with CFW on.

ECAM: Always set to zero. (The SVA treats all writes, including CFW writes, as DFW writes).

Table 144 Counters for Cache Fast Write I/O Requests

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Cache Fast Write I/O Request Hits

Bytes 48 through 51 of the subsystem data contains the counter for the number of cache fast write I/O request hits. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 145 Counters for Cache Fast Write I/O Request Hits

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
Normal, CFW on and enabled, DFW off				X				
Normal, CFW on and disabled, DFW off								
Normal, CFW on and enabled, DFW on				X				
Normal, CFW on and disabled, DFW on								
Sequential, CFW on and enabled, DFW off				X				
Sequential, CFW on and disabled, DFW off								
Sequential, CFW on and enabled, DFW on				X				
Sequential, CFW on and disabled, DFW on								
ICL, CFW on and enabled, DFW off				X				
ICL, CFW on and disabled, DFW off								
ICL, CFW on and enabled, DFW on				X				
ICL, CFW on and disabled, DFW on								

SVA RSSD: Caching must be enabled for the device and CFW enabled for the FCU for this counter to increment.

Increment:

1. On normal write hits with CFW on.
2. On sequential write hits with CFW on.
3. On ICL write hits with CFW on.

ECAM: Always set to zero. (The SVA treats all writes, including CFW writes, as DFW writes).

Table 145 Counters for Cache Fast Write I/O Request Hits

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Inhibit Cache Loading I/O Requests

Bytes 52 through 55 of the subsystem data contains the counter for the number of inhibit cache loading requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 146 Counters for Inhibit Cache Loading I/O Requests

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
ICL, CFW off, DFW off, device caching on	X		X	X				
ICL, CFW off, DFW off, device caching off	X	X	X	X				
ICL, CFW off, DFW on and enabled and NVS enabled, device caching on	X		X					
ICL, CFW off, DFW on and disabled or NVS disabled, device caching on	X		X	X				
ICL, CFW off, DFW on, device caching off	X	X	X	X				
ICL, CFW on and enabled and device caching on, DFW off	X		X					
ICL, CFW on and disabled and device caching on, DFW off	X		X	X				
ICL, CFW on and device caching off, DFW off	X	X	X	X				
ICL, CFW on and enabled and device caching on, DFW on	X		X					
ICL, CFW on and disabled and device caching on, DFW on	X		X	X				
ICL, CFW on and device caching off, DFW on	X	X	X	X				

Table 146 Counters for Inhibit Cache Loading I/O Requests

Conditions	RSSD	ECAM
SVA RSSD: **Increment**: 1. On all ICL misses 2. On all ICL reads or writes with device caching off. 3. On ICL write hits with DFW off and CFW off. 4. On ICL write hits with DFW on and CFW off and either DFW disabled for the device or NVS disabled for the FCU. 5. On ICL write hits with CFW on but disabled for the FCU. **ECAM**: Always set to zero (counted with sequential).		
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss **WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit		

Bypass Cache I/O Requests

Bytes 56 through 59 of the subsystem data contains the counter for the number of bypass cache I/O requests. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 147 Counters for Bypass Cache I/O Requests

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
Bypass cache, CFW off, DFW off	X	X	X	X				
Bypass cache, CFW off, DFW on	X	X	X	X				
Bypass cache, CFW on, DFW off	X	X	X	X				
Bypass cache, CFW on, DFW on	X	X	X	X				
SVA RSSD: Increment on all bypass cache requests. **ECAM**: Always set to zero (counted with sequential).								

Table 147 Counters for Bypass Cache I/O Requests

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Sequential DASD-to-Cache Transfer Operations

Bytes 60 through 63 of the subsystem data contains the counter for the number of sequential DASD-to-cache transfer operations. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 148 Counters for Sequential DASD-to-Cache Transfer Operations

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
Normal, CFW off, DFW off					X	X	X	X
Normal, CFW off, DFW on					X	X	X	X
Normal, CFW on, DFW off					X	X	X	X
Normal, CFW on, DFW on					X	X	X	X
Sequential, CFW off, DFW off	X	X						
Sequential, CFW off, DFW on and enabled and NVS enabled	X	X	X	X	X	X	X	X
Sequential, CFW off, DFW on and disabled or NVS disabled	X	X			X	X	X	X
Sequential, CFW on and enabled, DFW off	X	X	X	X	X	X	X	X
Sequential, CFW on and disabled, DFW off	X	X			X	X	X	X
Sequential, CFW on and enabled, DFW on	X	X	X	X	X	X	X	X
Sequential, CFW on and disabled, DFW on	X	X			X	X	X	X
Bypass, CFW off, DFW off					X	X	X	X

Table 148 Counters for Sequential DASD-to-Cache Transfer Operations (Continued)

Conditions	RSSD				ECAM			
Bypass, CFW off, DFW on					X	X	X	X
Bypass, CFW on, DFW off					X	X	X	X
Bypass, CFW on, DFW on					X	X	X	X
ICL, CFW off, DFW off					X	X	X	X
ICL, CFW off, DFW on					X	X	X	X
ICL, CFW on, DFW off					X	X	X	X
ICL, CFW on, DFW on					X	X	X	X

RSSD: Caching for the device must be enabled for this counter to increment.

Increment:

1. On sequential read pre-stages.
2. On sequential write pre-stages with CFW off and DFW on and enabled for the device and NVS enabled for the FCU.
3. On sequential write pre-stages with CFW on and CFW enabled for the FCU.

ECAM: Increment for within-chain and end-of-chain sequential pre-stages. Otherwise, the same rules for incrementing the counter apply as for the IBM RSSD.

SVA RSSD: Increment for all pre-stages (both within-chain and end-of-chain).

Abbreviations:

RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

DASD-to-Cache Transfer Operations

Bytes 64 through 67 of the subsystem data contains the counter for the number of DASD-to-cache transfer operations. The following table describes when this counter is updated.

Table 149 Counters for DASD-to-Cache Transfer Operations (Sheet 1 of 3)

Conditions	**RSSD**				**ECAM**			
	RM	RH	WM	WH	RM	RH	WM	WH
No Define Extend, DFW enabled and NVS enabled	X		X		X		X	
No Define Extent, DFW disabled or NVS disabled	X				X		X	
Normal, CFW off, DFW off	X				X		X	
Normal, CFW off, DFW on and enabled and NVS enabled	X		X		X		X	
Normal, CFW off, DFW on and disabled or NVS disabled	X				X		X	
Normal, CFW on and enabled, DFW off	X		X		X		X	
Normal, CFW on and disabled, DFW off	X				X		X	
Normal, CFW on and enabled, DFW on	X		X		X		X	
Normal, CFW on and disabled, DFW on	X				X		X	
Sequential, CFW off, DFW off	X				X		X	
Sequential, CFW off, DFW on and enabled and NVS enabled	X		X		X		X	
Sequential, CFW off, DFW on and disabled or NVS disabled	X				X		X	
Sequential, CFW on and enabled, DFW off	X		X		X		X	
Sequential, CFW on and disabled, DFW off	X				X		X	
Sequential, CFW on and enabled, DFW on	X		X		X		X	
Sequential, CFW on and disabled, DFW on	X				X		X	

Table 149 Counters for DASD-to-Cache Transfer Operations (Sheet 2 of 3)

Conditions	RSSD	ECAM
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

Table 149 Counters for DASD-to-Cache Transfer Operations (Sheet 3 of 3)

Conditions	RSSD				ECAM			
Bypass, CFW off, DFW off					X		X	
Bypass, CFW off, DFW on					X		X	
Bypass, CFW on, DFW off					X		X	
Bypass, CFW on, DFW on					X		X	
ICL, CFW off, DFW off					X		X	
ICL, CFW off, DFW on					X		X	
ICL, CFW on, DFW off					X		X	
ICL, CFW on, DFW on					X		X	

SVA RSSD: Caching for the device must be enabled for this counter to increment.

Increment:

1. On normal and sequential read misses.
2. On normal and sequential write misses with CFW off and DFW on and enabled for the device and NVS enabled for the FCU.
3. On normal and sequential write misses with CFW on and CFW enabled for the FCU.

ECAM: Increment for all read and write misses.

SVA RSSD: Increment for all pre-stages (both within-chain and end-of-chain).

Abbreviations:

RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

Cache-to-DASD Transfer Operations

Bytes 68 through 71 of the subsystem data contains the counter for the number of cache-to-DASD transfer operations.

Table 150 Counters for Cache-to-DASD Transfer Operations

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
(See the following notes.)								

Table 150 Counters for Cache-to-DASD Transfer Operations

Conditions	RSSD	ECAM
SVA RSSD: All writes can result in a destage. Otherwise, the same rules for incrementing the counter apply as for IBM RSSD. ECAM: All writes can result in a destage. **NVS Constraints**: Bytes 72 through 75 of the subsystem statistics are to contain the counter for the number times a DASD fast write operation was forced to access DASD directly because of NVS constraints. **SVA RSSD**: Always set to zero. **ECAM**: Always set to zero.		

DASD Fast Write Normal Write Operation Counts

Bytes 76 through 79 of the subsystem data contains the counter for the number of DASD fast write normal write operation counts. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 151 Counters for DASD Fast Write Normal Write Operation Counts

Conditions	RSSD				ECAM			
	RM	RH	WM	WH	RM	RH	WM	WH
No Define Extent, DFW enabled and NVS enabled			X	X			X	X
No Define Extent, DFW disabled or NVS enabled							X	X
Normal, CFW off, DFW off							X	X
Normal, CFW off, DFW on and enabled and NVS enabled			X	X			X	X
Normal, CFW off, DFW on and disabled or NVS disabled							X	X
Normal, CFW on, DFW off							X	X
Normal, CFW on, DFW on							X	X
ICL, CFW off, DFW on and enabled and NVS enabled				X				
ICL, CFW off, DFW on and disabled or NVS disabled								

Table 151 Counters for DASD Fast Write Normal Write Operation Counts

Conditions	RSSD	ECAM
SVA RSSD: Caching and DFW must be enabled for the device and NVS enabled for the FCU for this counter to increment. **Increment**: 1. On normal writes with DFW on and CFW off 2. On ICL write hits with DFW on and CFW off. **ECAM**: Increment on all normal writes. (The SVA treats all writes including CFW writes as DFW writes.) This counter always equals the number of DFW writes. Do not increment on ICL write hits. (ICL is counted as sequential.)		
Abbreviations: **RSSD** = Read Subsystem Data **ECAM** = Extended Control and Monitoring **RM** = read miss **RH** = read hit **WM** = write miss	**WH** = write hit **CFW** = cache fast write **DFW** = DASD fast write **ICL** = inhibit cache loading **FCU** = Functional Control Unit	

DASD Fast Write Sequential Write Operation Counts

Bytes 80 through 83 of the subsystem data contains the counter for the number of DASD fast write sequential write operation counts. The following table describes when this counter is updated and when the corresponding ECAM counter is updated.

Table 152 Counters for DASD Fast Write Sequential Write Operation Counts

Conditions	**RSSD**				**ECAM**			
Sequential, CFW off, DFW off	RM	RH	WM	WH	RM	RH	WM	WH
Sequential, CFW off, DFW on and enabled and NVS enabled							X	X
Sequential, CFW off, DFW on and disable or NVS disabled			X	X			X	X
Sequential, CFW on, DFW off							X	X
Sequential, CFW on, DFW on							X	X
Bypass, CFW off, DFW off							X	X
Bypass, CFW off, DFW on							X	X
Bypass, CFW on, DFW off							X	X
Bypass, CFW on, DFW on							X	X
ICL, CFW off, DFW off							X	X
ICL, CFW off, DFW on							X	X
ICL, CFW on, DFW off							X	X
ICL, CFW on, DFW on							X	X

SVA RSSD: Caching and DFW must be enabled for the device and NVS enabled for the FCU for this counter to increment. Increment on sequential writes with DFW on and CFW off.
ECAM: Increment on all sequential, bypass, and ICL writes.

Abbreviations:
RSSD = Read Subsystem Data
ECAM = Extended Control and Monitoring
RM = read miss
RH = read hit
WM = write miss
WH = write hit
CFW = cache fast write
DFW = DASD fast write
ICL = inhibit cache loading
FCU = Functional Control Unit

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