To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 4 December 2007
Subject: 07-459r2 SAM-4 SPC-4 SBC-3 Unit attention condition queuing

Revision history

Revision 0 (2 November 2007) First revision

Revision 1 (19 November 2007) Incorporated comments from November 2007 CAP WG.

Revision 2 (4 December 2007) More changes after discussion with Mark Evans, WD. Added text explaining that vendor-specific power on events are what causes the DEVICE INTERNAL RESET unit attention (from 96-192). Clarified that only mode 0Eh deferred microcode is activated by FORMAT UNIT and START STOP UNIT, not pending unactivated microcode from modes 06h, 07h, et al. Made the list of commands that activate deferred microcode be owned by the command set standard (e.g. SBC-3), not SPC-4 (but leave FORMAT UNIT and START STOP UNIT as examples).

Related documents

sam4r13 - SCSI Architecture Model (SAM-4) revision 13
spc4r11 - SCSI Primary Commands - 4 (SPC-4) revision 11
sbc3r11 - SCSI Block Commands - 3 (SBC-3) revision 11
ssc3r03e - SCSI Stream Commands - 3 (SSC-3) revision 3e
smc3r08 - SCSI Media Changer Commands - 3 (SMC-3) revision 8
mmc6r01 - Multi-Media Commands - 6 (MMC-6) revision 1
osd2r02 - Object Storage Device - 2 (OSD-2) revision 2
scc2r04 - SCSI Controller Commands - 2 (SCC-2) revision 4
sas2r12 - Serial Attached SCSI - 2 (SAS-2) revision 12
96-192r0 Request for Firmware Boot/Restart ASC/ASCQ (Charles Monia, Digital Equipment)

Overview

SAM-4 currently says “logical units may queue unit attention conditions” but does not mandate that they do so. However, throwing out certain unit attention conditions doesn't make any sense. If a logical unit has LOG PARAMETERS CHANGED pending to be reported and a mode parameter change occurs, the MODE PARAMETERS CHANGED shouldn’t cause the pending LOG PARAMETERS CHANGED to disappear. Any software that cares about log pages will not be notified of the change.

As Bob Snively (Brocade) commented, "if they require the same behavior from a host" then clearing a unit attention to make room for the other is adequate; if different host actions are required, then lumping them together will lead to functional problems.

There are several cases in SCSI where more than one unit attention conditon can be created because of a single event (or a series of related events):

a) in block devices, if a change occurs in data that is accessible via both the READ CAPACITY data and the mode parameter block descriptor (i.e., the NUMBER OF BLOCKS field changes), both CAPACITY DATA HAS CHANGED and MODE PARAMETERS CHANGED are reported
b) if the task priority setting is changed by a MODE SELECT command, both PRIORITY CHANGED and MODE PARAMETERS CHANGED are reported
c) the PERSISTENT RESERVE OUT command PREEMPT AND ABORT service action can yield both a reservation-related unit attention condition and COMMANDS CLEARED BY ANOTHER INITIATOR

Unit attention conditons with ASCQ=00h often (always?) serve as less-specific replacements for those with ASCQ>00h; for example, 2Ah/00h PARAMETERS CHANGED means both 2Ah/01h MODE PARAMETERS CHANGED and 2Ah/02h LOG PARAMETERS CHANGED might have occurred. A general rule for unit attention condition queuing is proposed based on this - a unit attention condition with ASCQ=00h can clear unit attention conditions withASCQ>00h .

The reset unit attention conditions (mostly ASC=29h) have specific priorities between themselves and pretty clearly can bump out all the non-reset unit attention conditions, since they mean "everything."

This proposal suggests:

a) mandate unit attention condition queuing (although the queue depth and order is vendor-specific)

b) define a precedence list for most of the reset unit attention conditions (mostly ASC=29h)
c) define that all the reset unit attention conditions have precedence over all the non-reset unit attention conditions.
d) define that unit attention conditions with ASCQ=nnh, ASCQ=00h have precedence over those with ASCQ=nnh, ASCQ>00h
e) allow higher-precedence unit attention conditions to clear lower-precedence unit attention conditions without being considered an overflow
   A) reset unit attention conditions may clear lower-precedence reset unit attention conditions
   B) reset unit attention conditions may clear non-reset unit attention conditions
   C) non-reset unit attention conditions shall not clear unrelated non-reset unit attention conditions (unless an overflow occurs)
   D) non-reset unit attention conditions with ASCQ=00h may clear non-reset unit attention conditions with the same ASC but with ASCQ>00h
f) define new sense-key specific data for the UNIT ATTENTION sense key containing an OVERFLOW bit to report when the unit attention condition queue oveflows
g) add a UASK_SUP bit to the Extended INQUIRY VPD page reporting that sense-key specific data is supported for the UNIT ATTENTION sense key.

Additionally, some clarifications are included concerning microcode downloads, since that may cause multiple unit attention conditions to occur.

Table 1 lists the unit attention conditions mentioned in normative text in SAM-4, SPC-4, SBC-3, SSC-3, SMC-2, MMC-6, OSD-2, SCC-2, and SAS-2 (listed to provide background; this does not cover all SCSI standards). If an additional sense code is in the list, then all the additional sense codes sharing its ASC are also listed (to highlight the impact of special proposed rules for ASCQ=00h). Yellow highlights mean the additional sense code is not used for unit attentions; it might be used with other sense keys such as ILLEGAL REQUEST.

NOTE 1 - MMC-6 section F.3.1 table F.1 and F.10 mention 37 total unit attention conditions with ASC values 28h, 29h, 2Ah, 2Eh, 3Bh, 3Fh, 5Ah, 5Bh, 5Eh. They are not shown in parenthesis in this table since it is not clear that all of them are actually used by MMC-6 logical units; only those referenced by normative text are considered real.

Table 1 — Unit attention condition additional sense codes (part 1 of 5)

ASC/ASCQ	**Additional sense code**	**Reference(s) for use *as a unit attention condition***
0Bh/xxh	Informational exceptions - ADDITIONAL SENSE CODE field set to 0Bh (i.e., WARNING)	SPC-4 7.4.11 (Informational Exceptions)
1Dh/00h	MISCOMPARE DURING VERIFY OPERATION	SCC-2 6.6.1.8 (VERIFY CHECK DATA), 6.8.1.10
28h/00h	NOT READY TO READY CHANGE, MEDIUM MAY HAVE CHANGED	SAT-2 11.1 (Error translation), MMC-5 4.12.2.3 (Sided discs)
28h/01h	IMPORT OR EXPORT ELEMENT ACCESSED	SMC-3 5.2.4 (Import/export element), 6.7 (OPEN/CLOSE IMPORT/EXPORT ELEMENT)(MMC-5 F.3.1)
28h/02h	FORMAT-LAYER MAY HAVE CHANGED	MMC-5 4.13.3 (Format-layer selection)
29h/00h	POWER ON, RESET, OR BUS DEVICE RESET OCCURRED	SAM-4 6.2, SAT-2 5.2 (Unit attention condition), 5.5 (ATA hardware and software reset), (MMC-6 F.3.1)
29h/01h	POWER ON OCCURRED (power on)	SAM-4 6.2, (MMC-6 F.3.1)

Table 1 — Unit attention condition additional sense codes (part 2 of 5)

ASC/ASCQ	Additional sense code	Reference(s) for use *as a unit attention condition*
29h/02h	SCSI BUS RESET OCCURRED (hard reset)	SAM-4 6.2, SAS-2 4.4.2.2 (Hard reset processing), (MMC-6 F.3.1)
29h/03h	BUS DEVICE RESET FUNCTION OCCURRED (logical unit reset)	SAM-4 6.2, (MMC-6 F.3.1)
29h/04h	DEVICE INTERNAL RESET (power on)	SAM-4 6.2, (MMC-6 F.3.1)
29h/05h	TRANSCEIVER MODE CHANGED TO SINGLE-ENDED (“protocol specific”)	SAM-4 6.2
29h/06h	TRANSCEIVER MODE CHANGED TO LVD (“protocol specific”)	SAM-4 6.2
29h/07h	I_T NEXUS LOSS OCCURRED	SAM-4 6.2, SAT-2 6.5 (I_T nexus loss)
2Ah/00h	PARAMETERS CHANGED	none (MMC-6 F.3.1)
2Ah/01h	MODE PARAMETERS CHANGED	SPC-4 6.9 (MODE SELECT (6)), 7.4.4.1 (General block descriptor format), 7.4.6 (Control), 7.4.7 (Control Extensions), 7.4.13 (Protocol Specific Logical Unit), 7.4.14 (Protocol Specific Port), SSC-3 7.10 (SET CAPACITY), (MMC-6 F.3.1)
2Ah/02h	LOG PARAMETERS CHANGED	SPC-4 7.2.1 (Log page structure) SSC-3 8.3.8 (Device Configuration Extension mode page), (MMC-6 F.3.1)
2Ah/03h	RESERVATIONS PREEMPTED	SPC-4 5.6.10.6 (Clearing)
2Ah/04h	RESERVATIONS RELEASED	SPC-4 5.6.10.2 (Releasing), 5.6.10.3 (Unregistering), 5.6.10.4.3 (Preempting)
2Ah/05h	REGISTRATIONS PREEMPTED	SPC-4 5.6.10.4.3 (Preempting), 5.6.10.4.4 (Removing)
2Ah/06h	ASYMMETRIC ACCESS STATE CHANGED	SPC-4 5.8.2.5 (Transitions)
2Ah/07h	IMPLICIT ASYMMETRIC ACCESS STATE TRANSITION FAILED	SPC-4 5.8.2.5 (Transitions)
2Ah/08h	PRIORITY CHANGED	SPC-4 6.33, 7.4.7 (Control Extensions)
2Ah/09h	CAPACITY DATA HAS CHANGED	SBC-3 4.7 (Initialization)
2Ah/10h	TIMESTAMP CHANGED	SPC-4 5.12 (Device clocks), 6.35 (SET PRIORITY)
2Ah/11h	DATA ENCRYPTION PARAMETERS CHANGED BY ANOTHER (*~~INITIATOR~~* or *I_T NEXUS*)	SSC-3 4.2.20.6
2Ah/12h	DATA ENCRYPTION PARAMETERS CHANGED BY VENDOR SPECIFIC EVENT	SSC-3 4.2.20.6

Table 1 — Unit attention condition additional sense codes (part 3 of 5)

ASC/ASCQ	Additional sense code	Reference(s) for use *as a unit attention condition*
2Ah/13h	DATA ENCRYPTION KEY INSTANCE COUNTER HAS CHANGED (SSC-3 ABORTED COMMAND)	none
2Ch/00h	COMMAND SEQUENCE ERROR	none (MMC-6 F.3.1)
2Ch/01h	TOO MANY WINDOWS SPECIFIED (scanner obsolete)	none
2Ch/02h	INVALID COMBINATION OF WINDOWS SPECIFIED (scanner obsolete)	none
2Ch/03h	CURRENT PROGRAM AREA IS NOT EMPTY (MMC-6 obsolete?)	none (MMC-6 F.3.1)
2Ch/04h	CURRENT PROGRAM AREA IS EMPTY (MMC-6 obsolete?)	none (MMC-6 F.3.1)
2Ch/05h	ILLEGAL POWER CONDITION REQUEST (RBC - ILLEGAL REQUEST)	none
2Ch/06h	PERSISTENT PREVENT CONFLICT (MMC-6 obsolete?)	none
2Ch/07h	PREVIOUS BUSY STATUS	SAM-4 5.3, SPC-4 7.4.6 (Control)
2Ch/08h	PREVIOUS TASK SET FULL STATUS	SAM-4 5.3, SPC-4 7.4.6 (Control)
2Ch/09h	PREVIOUS RESERVATION CONFLICT STATUS	SAM-4 5.3, SPC-4 7.4.6 (Control)
2Ch/0Ah	PARTITION OR COLLECTION CONTAINS USER OBJECTS (OSD2 - ILLEGAL REQUEST)	none
2Ch/0Bh	NOT RESERVED (SSC-3 - ILLEGAL REQUEST)	none
2Eh/00h	INSUFFICIENT TIME FOR OPERATION	MMC-5 4.1.9.2 (Group 1 timeouts)
2Fh/00h	COMMANDS CLEARED BY ANOTHER INITIATOR	SPC-4 7.4.6 (Control), SAT-2 6.2.5 (Collateral abort), SAT-2 6.3.5 (ABORT TASK SET), 6.3.7 (CLEAR TASK SET), (MMC-6 F.3.1)
2Fh/01h	COMMANDS CLEARED BY POWER LOSS NOTIFICATION (power loss expected)	SAM-4 6.2, SAS-2 7.2.5.11.3 (NOTIFY (POWER LOSS EXPECTED))
2Fh/02h	COMMANDS CLEARED BY DEVICE SERVER	SAT-2 6.3.4 (ABORT TASK)
38h/00h	EVENT STATUS NOTIFICATION	none
38h/02h	POWER MANAGEMENT CLASS EVENT	RBC 7.4.1, 7.4.6
38h/04h	MEDIA CLASS EVENT	RBC 4.1, 5.1 (FORMAT UNIT), 7.4.1, 7.4.6
38h/06h	DEVICE BUSY CLASS EVENT	RBC 7.4.1
3Bh/00h	SEQUENTIAL POSITIONING ERROR	(MMC-6 F.3.1)
3Bh/nnh	<various MEDIUM MAGAZINE codes>	(MMC-6 F.3.1)

Table 1 — Unit attention condition additional sense codes (part 4 of 5)

ASC/ASCQ	Additional sense code	Reference(s) for use *as a unit attention condition*
3Fh/00h	TARGET OPERATING CONDITIONS HAVE CHANGED	none (MMC-6 F.3.1)
3Fh/01h	MICROCODE HAS BEEN CHANGED (hard reset)	SAM-4 6.2, SPC-4 5.15 (Downloading and activating), SAT-2 8.13.2.3 (Download microcode mode), RBC 6.7.1, (MMC-6 F.3.1)
3Fh/02h	CHANGED OPERATING DEFINITON	none (MMC-6 F.3.1)
3Fh/03h	INQUIRY DATA HAS CHANGED	SPC-4 6.4.1 (INQUIRY command intro), 7.6.7 (SCSI Ports VPD page), SAT-2 5.4 (ATA nexus loss), (MMC-6 F.3.1)
3Fh/04h	COMPONENT DEVICE ATTACHED	SCC-2 6.4.1.2
3Fh/05h	DEVICE IDENTIFIER CHANGED	SPC-4 6.32 (SET IDENTIFYING INFORMATION), SCC-2 6.4.1.8 (SET DEVICE IDENTIFIER)
3Fh/06h	REDUNDANCY GROUP CREATED OR MODIFIED	SCC-2 6.6.1.2, 6.6.1.3
3Fh/07h	REDUNDANCY GROUP DELETED	SCC-2 6.6.1.4
3Fh/08h	SPARE CREATED OR MODIFIED	SCC-2 6.10.1.1, 6.10.1.2,
3Fh/09h	SPARE DELETED	SCC-2 6.10.1.3
3Fh/0Ah	VOLUME SET CREATED OR MODIFIED	SCC-2 6.8.1.4, 6.8.1.5, 6.8.1.6
3Fh/0Bh	VOLUME SET DELETED	SCC-2 6.8.1.8
3Fh/0Ch	VOLUME SET DEASSIGNED	SCC-2 6.8.1.7
3Fh/0Dh	VOLUME SET REASSIGNED	SCC-2 6.8.1.1
3Fh/0Eh	REPORTED LUNS DATA HAS CHANGED	SAM-4 4.5.19, SPC-3 8.3.3.3 (DISABLE ACCESS CONTROLS), SAT-2 5.4 (ATA nexus loss)
3Fh/0Fh	ECHO BUFFER OVERWRITTEN	none
3Fh/10h	MEDIUM LOADABLE	none
3Fh/11h	MEDIUM AUXILIARY MEMORY ACCESSIBLE	SSC-3 7.2 (LOAD UNLOAD)
3Fh/12h	iSCSI IP ADDRESS ADDED (from 05-406)	none
3Fh/13h	iSCSI IP ADDRESS REMOVED (from 05-406)	none
3Fh/14h	iSCSI IP ADDRESS CHANGED (from 05-406)	none
44h/00h	INTERNAL TARGET FAILURE	SAT-2 5.4 (ATA nexus loss)
44h/71h	ATA DEVICE FAILED SET FEATURES	none
47h/00h	SCSI PARITY ERROR	none
47h/01h-47h/06h	<several error ones>	none

Table 1 — Unit attention condition additional sense codes (part 5 of 5)

ASC/ASCQ	Additional sense code	Reference(s) for use *as a unit attention condition*
47h/7Fh	SOME COMMANDS CLEARED BY ISCSI PROTOCOL EVENT	iSCSI
5Ah/00h	OPERATOR REQUEST OR STATE CHANGE INPUT	none (MMC-6 F.3.1)
5Ah/01h	OPERATOR MEDIUM REMOVAL REQUEST	SAT-2 11.1 (Error translation), (MMC-6 F.3.1)
5Ah/02h	OPERATOR SELECTED WRITE PROTECT	SCC-2 6.8.1.3 (CONTROL WRITE OPERATIONS), (MMC-6 F.3.1)
5Ah/03h	OPERATOR SELECTED WRITE PERMIT	SCC-2 6.8.1.3 (CONTROL WRITE OPERATIONS), (MMC-6 F.3.1)
5Bh/00h	LOG EXCEPTION	none
5Bh/01h	THRESHOLD CONDITION MET	SPC-4 7.2.1 (Log page structure) SSC-3 8.3.8 (Device Configuration Extension mode page)
5Bh/02h	LOG COUNTER AT MAXIMUM	none
5Bh/03h	LOG LIST CODES EXHAUSTED	none
5Dh/xxh	Informational exceptions - ADDITIONAL SENSE CODE field set to 5Dh (i.e., FAILURE PREDICTION THRESHOLD EXCEEDED)	SPC-4 7.4.11 (Informational Exceptions)
5Eh/00h	LOW POWER CONDITION ON	none (MMC-6 F.3.1)
5Eh/01h	IDLE CONDITION ACTIVATED BY TIMER	none (MMC-6 F.3.1)
5Eh/02h	STANDBY CONDITION ACTIVATED BY TIMER	none (MMC-6 F.3.1)
5Eh/03h	IDLE CONDITION ACTIVATED BY COMMAND	none (MMC-6 F.3.1)
5Eh/04h	IDLE CONDITION ACTIVATED BY COMMAND	none (MMC-6 F.3.1)
5Eh/41h	POWER CONDITION CHANGE TO ACTIVE	RBC 7.1.1
5Eh/42h	POWER CONDITION CHANGE TO IDLE	RBC 7.1.1
5Eh/43h	POWER CONDITION CHANGE TO STANDBY	RBC 7.1.1
5Eh/45h	POWER CONDITION CHANGE TO SLEEP	RBC 7.1.1
5Eh/47h	POWER CONDITION CHANGE TO DEVICE CONTROL	RBC 7.1.1
6Bh/00h	STATE CHANGE HAS OCCURRED	SCC-2 5.2.4 (SCSI storage array states)
6Bh/01h	REDUNDANCY LEVEL GOT BETTER	none
6Bh/02h	REDUNDANCY LEVEL GOT WORSE	none
~~??h/??h~~	~~DRIVE NOT PRESENT~~	~~SAT-2 5.4 (ATA nexus loss)~~

Editor's Note 1: 2Ch/00h and 2Fh/00h are the worst representatives of their non-zero counterparts.

Suggested changes to SAM-4

4.5.19 Logical unit class

4.5.19.1 Logical unit class overview

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If the logical unit inventory changes for any reason (e.g., completion of initialization, removal of a logical unit, or creation of a logical unit), then the device server shall establish a unit attention condition (see 5.8.7) for the initiator port associated with every I_T nexus, with the additional sense code set to REPORTED LUNS DATA HAS CHANGED.

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5.3 Status

5.3.1 Status codes

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BUSY. This status indicates that the logical unit is busy. This status shall be returned whenever a logical unit is temporarily unable to accept a command. The recommended application client recovery action is to issue the command again at a later time.

If the UA_INTLCK_CTRL field in the Control mode page contains 11b (see SPC-4), termination of a command with BUSY status shall cause a unit attention condition to be established for the SCSI initiator port that sent the command with an additional sense code set to PREVIOUS BUSY STATUS ~~unless a PREVIOUS BUSY STATUS unit attention condition already exists~~.

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RESERVATION CONFLICT. This status shall be returned whenever a command attempts to access a logical unit in a way that conflicts with an existing reservation. (See the PERSISTENT RESERVE OUT command and PERSISTENT RESERVE IN command in SPC-4.)

If the UA_INTLCK_CTRL field in the Control mode page contains 11b (see SPC-4), termination of a command with RESERVATION CONFLICT status shall cause a unit attention condition to be established for the SCSI initiator port that sent the command with an additional sense code set to PREVIOUS RESERVATION CONFLICT STATUS ~~unless a PREVIOUS RESERVATION CONFLICT STATUS unit attention condition already exists~~.

TASK SET FULL. When the logical unit has at least one task in the task set for an I_T nexus and a lack of task set resources prevents accepting a received task from that I_T nexus into the task set, TASK SET FULL status shall be returned. When the logical unit has no task in the task set for an I_T nexus and a lack of task set resources prevents accepting a received task from that I_T nexus into the task set, BUSY status should be returned.

The logical unit should allow at least one command in the task set for each supported I_T nexus (i.e., for each SCSI target port, allow at least one command from each SCSI initiator port that has identified itself to the SCSI target port in a SCSI transport protocol specific manner (e.g., login), or by the successful transmission of a c command).

Retry delay timer, when supported by a protocol, may provide the SCSI initiator port with more information on when the command should be retransmitted (see table 26).

If the UA_INTLCK_CTRL field in the Control mode page contains 11b (see SPC-4), termination of a command with TASK SET FULL status shall cause a unit attention condition to be established for the SCSI initiator port that sent the command with an additional sense code set to PREVIOUS TASK SET FULL STATUS ~~unless a PREVIOUS TASK SET FULL STATUS unit attention condition already exists~~.

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5.3.3 Status precedence

If a device server detects that more than one of the following conditions applies to a completed task, it shall select the condition to report based on the following precedence:

1) An ACA ACTIVE status;
2) A CHECK CONDITION status for any of the following unit attention conditions (i.e., with a sense key set to UNIT ATTENTION and one of the following additional sense codes):
   A) POWER ON, RESET, OR BUS DEVICE RESET OCCURRED;
   B) POWER ON OCCURRED;
   C) SCSI BUS RESET OCCURRED;
   D) MICROCODE HAS BEEN CHANGED;
   E) BUS DEVICE RESET FUNCTION OCCURRED;
   F) DEVICE INTERNAL RESET; or
   G) I_T NEXUS LOSS OCCURRED;
3) A RESERVATION CONFLICT status;

   and

4) A status of:
   A) CHECK CONDITION, for any reason not listed in 2);
   B) GOOD;
   C) CONDITION MET; or
   D) TASK ABORTED.

Editor's Note 2: Note that COMMANDS CLEARED BY POWER LOSS NOTIFICATION is not included in the list in 2). It is not considered to be special.

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5.5 Task and command lifetimes

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Command SCSI transport protocol service request is invoked until it receives one of the following SCSI target device responses:

a) A service response of TASK COMPLETE for that task;
b) Notification of a unit attention condition with one of the following additional sense codes;
   A) Any additional sense code whose ADDITIONAL SENSE CODE field contains 2Fh (e.g., COMMANDS CLEARED BY ANOTHER INITIATOR, ~~or~~ COMMANDS CLEARED BY POWER LOSS NOTIFICATION, or COMMANDS CLEARED BY DEVICE SERVER), if in reference to the task set containing the task;
   B) Any additional sense code whose ADDITIONAL SENSE CODE field contains 29h (e.g., POWER ON, RESET, OR BUS DEVICE RESET OCCURRED; POWER ON OCCURRED; SCSI BUS RESET OCCURRED; BUS DEVICE RESET FUNCTION OCCURRED; DEVICE INTERNAL RESET; or I_T NEXUS LOSS OCCURRED); or
   C) MICROCODE HAS BEEN CHANGED.

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5.6 Aborting tasks

A task is aborted when an SCSI device condition (see 6.3), command, or task management function causes termination of the task prior to its completion by the device server.

Table 2 lists the SCSI device conditions that cause tasks to be aborted in a SCSI initiator device.

Table 2 — SCSI device conditions that abort tasks in a SCSI initiator device

SCSI device condition	Scope	Reference(s)
Power on	All tasks in the SCSI initiator device	6.3.1
Hard reset	All tasks with an I_T nexus involving the SCSI initiator port	6.3.2
I_T nexus loss	All tasks associated with the lost I_T nexus	6.3.4
SCSI transport protocol specific conditions	As defined by the applicable SCSI transport protocol standard	

Table 3 lists the SCSI device conditions that cause tasks to be aborted in a SCSI target device.

Table 3 — SCSI device conditions that abort tasks in a SCSI target device

SCSI device condition	Scope	Unit attention condition (see 5.8.7) additional sense code, if any	TASK ABORTED status [a]	Reference(s)
Power on	All tasks in the SCSI target device	See table 33 in 6.2	No	6.3.1
Hard reset	All tasks in all logical units to which the SCSI target port has access in the SCSI target device		Yes or no [c]	6.3.2
Logical unit reset [b]	All tasks in the logical unit		Yes or no [d]	6.3.3 and 7.7
I_T nexus loss [b]	In each logical unit to which the SCSI target port has access, all tasks associated with the lost I_T nexus		No	6.3.4 and 7.6
Power loss expected	All tasks in the SCSI target device	~~See table 33 in 6.2~~ COMMANDS CLEARED BY POWER LOSS NOTIFICATION	No	6.3.5
SCSI transport protocol specific conditions	As defined by the applicable SCSI transport protocol standard			

[a] "Yes" indicates that each task that is aborted on an I_T nexus other than the one that caused the SCSI device condition is terminated with TASK ABORTED status, if the TAS bit is set to one in the Control mode page (see SPC-4). "No" indicates that no status is returned for aborted tasks.
[b] This SCSI device condition is able to be invoked by a task management function listed in table 4.
[c] If the hard reset is caused by a particular I_T nexus (e.g., by a SCSI transport protocol-specific task management function), then "yes" applies". Otherwise, "no" applies.
[d] If the logical unit reset is caused by a particular I_T nexus (e.g., by a LOGICAL UNIT RESET task management function), then "yes" applies". Otherwise (e.g., if triggered by a hard reset), "no" applies.

Table 4 lists the task management functions that cause tasks to be aborted.

Table 4 — Task management functions that abort tasks

Task management function	Scope	Unit attention condition (see 5.8.7) additional sense code, if any [a]	TASK ABORTED status [b]	Reference(s)
ABORT TASK (I_T_L_Q Nexus)	Task specified by the I_T_L_Q nexus argument	None	No	7.2
ABORT TASK SET (I_T_L Nexus)	All tasks in the task set with the same I_T nexus as that specified by the I_T_L Nexus argument	None	No	7.3
CLEAR TASK SET (I_T_L Nexus)	All tasks in the task set [c]	COMMANDS CLEARED BY ANOTHER INITIATOR	Yes	7.5
LOGICAL UNIT RESET (I_T_L nexus)	See table 3 description of the logical unit reset condition			
I_T NEXUS RESET (I_T nexus)	See table 3 description of the I_T nexus loss condition			

[a] If if the TAS bit is set to zero in the Control mode page (see SPC-4), the device server creates this unit attention condition for each I_T nexus that had task(s) aborted other than the I_T nexus that delivered the task management function. If the TAS bit is set to one in the Control mode page (see SPC-4), the device server does not create this unit attention condition.

[b] "Yes" indicates that each task that is aborted on an I_T nexus other than the one that delivered the task management function is terminated with TASK ABORTED status, if the TAS bit is set to one in the Control mode page. "No" indicates that no status is returned for aborted tasks.

[c] If the TST field is set to 001b (i.e., per-I_T nexus) in the Control mode page (see SPC-4), there is one task set per I_T nexus, so no other I_T nexuses are affected and CLEAR TASK SET is equivalent to ABORT TASK SET.

Table 5 lists the command-related conditions that cause tasks to be aborted.

Table 5 — Command-related conditions that abort tasks (part 1 of 2)

Command-related condition	Scope	Unit attention condition (see 5.8.7) additional sense code, if any [a]	TASK ABORTED status [b]	Reference(s)
Completion of a command with a CHECK CONDITION status if: the QERR field is set to 01b; and the TST field is set to 000b (i.e., shared) in the Control mode page (see SPC-4)	All tasks in the task set	COMMANDS CLEARED BY ANOTHER INITIATOR	Yes	5.8.1.3 and 5.8.2.2
Completion of a command with a CHECK CONDITION status if: the QERR field is set to 01b; and the TST field is set to 001b (i.e., per-I_T nexus)) in the Control mode page (see SPC-4)	All tasks in the task set [c]	None	No	5.8.1.3 and 5.8.2.2
Completion of a command with a CHECK CONDITION status if the QERR field is set to 11b in the Control mode page (see SPC-4)	All tasks in the task set with the same I_T nexus as the command that was terminated	None	No	5.8.1.3 and 5.8.2.2
Processing of a PERSISTENT RESERVE OUT command with a PREEMPT AND ABORT service action with a reservation key that is associated with the I_T nexus on which the task was received (see SPC-4)	All tasks from all I_T nexuses with the specified reservation key	COMMANDS CLEARED BY ANOTHER INITIATOR	Yes	SPC-4
The return of an Execute Command service response of SERVICE DELIVERY OR TARGET FAILURE	The indicated task	None	No	5.1

[a] If if the TAS bit is set to zero in the Control mode page (see SPC-4), the device server creates this unit attention condition for each I_T nexus that had task(s) aborted other than the I_T nexus that delivered the task management function. If the tas bit is set to one in the Control mode page (see SPC-4), the device server does not create this unit attention condition.

[b] "Yes" indicates that each task that is aborted on an I_T nexus other than the one that delivered the command is terminated with TASK ABORTED status, if the tas bit is set to one in the Control mode page (see SPC-4). "No" indicates that no status is returned for aborted tasks.

[c] Since the TST field is set to 001b, there is one task set per I_T nexus, so no other I_T nexuses are affected.

Table 5 — Command-related conditions that abort tasks (part 2 of 2)

Command-related condition	Scope	Unit attention condition (see 5.8.7) additional sense code, if any [a]	TASK ABORTED status [b]	Reference(s)
Termination of an overlapped command	All tasks with the same I_T nexus as the command that was terminated	None	No	5.8.3

[a] If if the TAS bit is set to zero in the Control mode page (see SPC-4), the device server creates this unit attention condition for each I_T nexus that had task(s) aborted other than the I_T nexus that delivered the task management function. If the tas bit is set to one in the Control mode page (see SPC-4), the device server does not create this unit attention condition.

[b] "Yes" indicates that each task that is aborted on an I_T nexus other than the one that delivered the command is terminated with TASK ABORTED status, if the tas bit is set to one in the Control mode page (see SPC-4). "No" indicates that no status is returned for aborted tasks.

[c] Since the TST field is set to 001b, there is one task set per I_T nexus, so no other I_T nexuses are affected.

If one or more tasks are cleared or aborted, the affected tasks are also cleared from the initiator ports in a manner that is outside the scope of this standard.

When a device server receives a command or task management function on an I_T nexus that causes tasks on the same I_T nexus to be aborted, the device server shall not return any notification that those tasks have been aborted other than:

a) the completion response for the command or task management function that caused the task(s) to be aborted; and
b) notification(s) associated with related effects of the command or task management function (e.g., a reset unit attention condition).

When a device server receives a command or task management function on an I_T nexus that causes tasks on other I_T nexuses to be aborted, the device server shall return notifications for those tasks based on the setting of the TAS bit in the Control mode page (see SPC-4):

a) If the TAS bit is set to zero, the device server:
   A) shall not return status for the tasks that were aborted; and
   B) shall establish a unit attention condition for the SCSI initiator port associated with each I_T nexus containing tasks that were aborted with an additional sense code set as defined in table 27;
b) If the TAS bit is set to one, the device server:
   A) shall return TASK ABORTED status for each aborted task; and
   B) shall not establish a unit attention condition for this reason.

When a logical unit is aborting one or more tasks received on an I_T nexus using the TASK ABORTED status it should complete all of those tasks before entering additional tasks received on that I_T nexus into the task set.

5.8.6 Sense data

...

When a command completes with a CHECK CONDITION status, sense data shall be returned in the same I_T_L_Q nexus transaction (see 3.1.53) as the CHECK CONDITION status. After the sense data is returned, it shall be cleared except when it is associated with a unit attention condition and the UA_INTLCK_CTRL field in the Control mode page (see SPC-4) contains 10b or 11b.

5.8.7 Unit Attention condition

Each logical unit shall ~~generate~~establish a unit attention condition whenever one of the following events occurs:

a) A hard reset (see 6.3.2), logical unit reset (see 6.3.3), ~~or~~ I_T nexus loss (see 6.3.4), or power loss expected (see 6.3.5) occurs;
b) A removable medium may have been changed;
c) The mode parameters associated with this I_T nexus have been changed by a task received on another I_T nexus (i.e., SCSI initiator ports share mode parameters, see SPC-4);
d) The log parameters associated with this I_T nexus have been changed by a task received on another I_T nexus (i.e., SCSI initiator ports share log parameters, see SPC-4);
e) The ~~version or level of~~ microcode has been changed (see SPC-4);
f) Tasks received on this I_T nexus have been cleared by a task or a task management function associated with another I_T nexus and the TAS bit was set to zero in the Control mode page associated with this I_T nexus (see SPC-4);
g) INQUIRY data has been changed (see SPC-4);
h) The logical unit inventory has been changed (see 4.5.19.1);
i) The mode parameters in effect for the associated I_T nexus have been restored from non-volatile memory (see SPC-4); or
j) Any other event requiring the attention of the SCSI initiator device.

~~Logical units may queue unit attention conditions. After the first unit attention condition is cleared, another unit attention condition may exist (e.g., a unit attention condition with an additional sense code set to POWER ON OCCURRED may be followed by one with an additional sense code set to MICROCODE HAS BEEN CHANGED).~~

Unit attention conditions are classified by precedence levels. Table 33 defines the unit attention condition precedence levels.

Table 33 — Unit attention condition precedence level

Unit attention condition additional sense code	Unit attention condition precedence
POWER ON, RESET, OR BUS DEVICE RESET OCCURRED [29h/00h]	1 (i.e., highest)
POWER ON OCCURRED [29h/01h][power on] and DEVICE INTERNAL RESET [29h/04h][power on]	2
SCSI BUS RESET OCCURRED [29h/02h][hard reset] and MICROCODE HAS BEEN CHANGED [3Fh/01h] [hard reset] and protocol specific [protocol specific means:] [29h/05h TRANSCEIVER MODE CHANGED TO SINGLE-ENDED] [29h/06h TRANSCEIVER MODE CHANGED TO LVD]	3
BUS DEVICE RESET FUNCTION OCCURRED [29h/03h][logical unit reset]	4
I_T NEXUS LOSS OCCURRED [29h/07h][I_T nexus loss]	5
All others [a] [includes the following that share ASC values with those above:] [3Fh/00h TARGET OPERATING CONDITIONS HAVE CHANGED] [3Fh/02h CHANGED OPERATING DEFINITION] [3Fh/03h INQUIRY DATA HAS CHANGED] [3Fh/05h DEVICE IDENTIFIER CHANGED] [3Fh/0Eh REPORTED LUNS DATA HAS CHANGED] [3Fh/many others]	6 (i.e., lowest)
[a] This includes COMMANDS CLEARED BY POWER LOSS NOTIFICATION. [2Fh/01h][power loss expected] [it also includes:] [2Fh/00h COMMANDS CLEARED BY ANOTHER INITIATOR] [2Fh/02h COMMANDS CLEARED BY DEVICE SERVER (used by SAT-2)]	

For unit attention conditions with precedence level 6 (i.e., lowest) with a given ADDITIONAL SENSE CODE field value, the unit attention condition with the ADDITIONAL SENSE CODE QUALIFIER field set to 00h has higher precedence level than the unit attention conditions with the ADDITIONAL SENSE CODE QUALIFIER field set to value other than 00h (e.g., PARAMETERS CHANGED has precedence over MODE PARAMETERS CHANGED and LOG PARAMETERS CHANGED). A unit attention condition with precedence level 6 has equal priority with all unit attention conditions with precedence level 6 with different ADDITIONAL SENSE CODE field values.

NOTE 2 - The unit attention additional sense code specificity order defined in 6.2 determines which unit attention condition is allowed to be established when certain conditions occurs. The unit attention condition precedence defined in this subclause determines which unit attention conditions are allowed to clear other unit attention conditions if they have not yet been reported.

The device server shall maintain a queue of unit attention conditions of unspecified order for each I_T nexus. The queue should be large enough to hold every unit attention condition that the device server is capable of reporting.

When a device server establishes a unit attention condition:

1) the device server may clear unit attention conditions from the queue that are no longer needed as follows:

A) the device server may clear any pending unit attention conditions in the queue that have lower precedence levels (e.g., BUS DEVICE RESET FUNCTION OCCURRED may clear I_T NEXUS LOSS OCCURRED and all unit attention conditions with precedence level 6); and
B) the device server should clear pending unit attention conditions that have the same additional sense code (i.e., it should not add the same unit attention condition twice).

2) if a queue slot is available, then:
   A) if a higher precedence unit attention condition is not in the queue, the device server shall add the unit attention condition to the queue; and
   B) if a higher precedence unit attention condition is in the queue, the device server should add the unit attention condition to the queue;

   The device shall either not include sense-key specific sense data or shall set the OVERFLOW bit to zero in the sense-key specific sense data (see SPC-4) for the unit attention condition; and

3) if a queue slot is not available, the device server shall either:
   A) replace any unit attention condition in the queue; or
   B) not add the unit attention condition to the queue.

   The device server shall set the OVERFLOW bit to one in the sense-key specific sense data (see SPC-4) for at least one unit attention condition in the queue.

If the device server establishes multiple unit attention conditions because of the same event or because of a series of events, it may add them to the queue in any order (e.g., in direct-access block devices, if a MODE SELECT command changes the initial task priority value, the device server reports both PRIORITY CHANGED and MODE PARAMETERS CHANGED in any order).

When the device server reports and clears a unit attention condition, it:

a) may select any unit attention condition in the queue to report; and
b) shall clear the unit attention condition from the queue after reporting it.

A unit attention condition shall persist ~~on the logical unit for the SCSI initiator port associated with each I_T nexus~~ until the SCSI initiator port associated with the I_T nexus clears the condition, or the device server clears the unit attention condition from the queue due to another unit attention condition. Unit attention conditions are affected by the processing of commands as follows:

a) If an INQUIRY command enters the enabled task state, the device server shall perform the INQUIRY command and shall neither report nor clear any unit attention condition;
b) If a REPORT LUNS command enters the enabled task state, the device server shall perform the REPORT LUNS command and shall not report any unit attention condition.

   If the UA_INTLCK_CTRL field in the Control mode page is set to 00b (see SPC-4), the SCSI target device shall clear any pending unit attention condition with an additional sense code of REPORTED LUNS DATA HAS CHANGED established for the initiator port associated with that I_T nexus in each logical unit accessible by the I_T nexus on which the REPORT LUNS command was received. Other pending unit attention conditions shall not be cleared.

   If the UA_INTLCK_CTRL field in the Control mode page is not set to 00b, the SCSI target device shall not clear any unit attention condition(s);

c) If a REQUEST SENSE command enters the enabled task state while a unit attention condition exists for the SCSI initiator port associated with the I_T nexus on which the REQUEST SENSE command was received, then the device server shall return GOOD status and either:
   A) Report any pending sense data as parameter data and preserve all unit attention conditions on the logical unit; or
   B) Report a unit attention condition as parameter data for the REQUEST SENSE command to the SCSI initiator port associated with the I_T nexus on which the REQUEST SENSE command was received. The logical unit may discard any pending sense data and shall clear the reported unit attention condition for the SCSI initiator port associated with that I_T nexus. If the unit attention condition has an additional sense code of REPORTED LUNS DATA HAS CHANGED, the SCSI target device shall clear any pending unit attention conditions with an additional sense code of

REPORTED LUNS DATA HAS CHANGED established for the I_T nexus on which the command was received in each logical unit accessible by that I_T nexus;

If the device server has already generated the ACA condition (see 5.8.2) for a unit attention condition, the device server shall report the unit attention condition (i.e., option c)B) above);

d) if the device server supports the NOTIFY DATA TRANSFER DEVICE command (see ADC-2) and a NOTIFY DATA TRANSFER DEVICE command enters the enabled task state, then the device server shall perform the NOTIFY DATA TRANSFER DEVICE command and shall neither report nor clear any unit attention condition; and

e) If a command other than INQUIRY, REPORT LUNS, or REQUEST SENSE enters the enabled task state while a unit attention condition exists for the SCSI initiator port associated with the I_T nexus on which the command was received, the device server shall terminate the command with a CHECK CONDITION status. The device server shall provide sense data that reports a unit attention condition for the SCSI initiator port that sent the command on the I_T nexus.

If a device server reports a unit attention condition with a CHECK CONDITION status and the UA_INTLCK_CTRL field in the Control mode page contains 00b (see SPC-4), then the device server shall clear the reported unit attention condition for the SCSI initiator port associated with that I_T nexus on the logical unit. If the unit attention condition has an additional sense code of REPORTED LUNS DATA HAS CHANGED, the SCSI target device shall clear any pending unit attention conditions with an additional sense code of REPORTED LUNS DATA HAS CHANGED established for the I_T nexus on which the command was received in each logical unit accessible by that I_T nexus. If the UA_INTLCK_CTRL field contains 10b or 11b, the device server shall not clear unit attention conditions reported with a CHECK CONDITION status.

6.2 Establishing a unit attention condition subsequent to detection of an event

Table 36 shows the additional sense code that a logical unit shall use when a unit attention condition (see 5.8.7) is established for each of the conditions shown in figure 40 (see 6.1). A SCSI transport protocol may define a more specific additional sense code than SCSI BUS RESET OCCURRED for reset events. The most specific condition in table 36 known to the logical unit should be used to establish the additional sense code for a unit attention.

Table 36 — Unit attention additional sense codes for events detected by SCSI target devices

Condition	Additional Sense Code	Specificity
Logical unit is unable to distinguish between the conditions	POWER ON, RESET, OR BUS DEVICE RESET OCCURRED	Lowest
~~Power loss expected~~	~~COMMANDS CLEARED BY POWER LOSS NOTIFICATION~~	
Power on	POWER ON OCCURRED or DEVICE INTERNAL RESET [a]	
Hard reset	SCSI BUS RESET OCCURRED or MICROCODE HAS BEEN CHANGED [b] or protocol specific [c]	
Logical unit reset	BUS DEVICE RESET FUNCTION OCCURRED	
I_T nexus loss	I_T NEXUS LOSS OCCURRED	Highest
Power loss expected	COMMANDS CLEARED BY POWER LOSS NOTIFICATION	N/A [d]

[a] Used after a vendor-specific power on event has occurred (e.g., a firmware reboot).
[b] Only used if microcode has been changed (see SPC-4).
[c] Only used if a protocol-specific reset event has occurred.
[d] The power loss expected condition shall not be replaced by any of the other less-specific unit attention conditions.

NOTE 12 - The names of the unit attention conditions listed in the subclause (e.g., SCSI BUS RESET OCCURRED) are based on usage in previous versions of this standard. The use of these unit attention condition names is not to be interpreted as a description of how the unit attention conditions are represented by any given SCSI transport protocol.

A logical unit may use the I_T NEXUS LOSS OCCURRED additional sense code when establishing a unit attention condition for an I_T nexus loss if:

a) The SCSI initiator port to which the sense data is being delivered is the SCSI initiator port that was associated with the I_T nexus loss, and the logical unit has maintained all state information specific to that SCSI initiator port since the I_T nexus loss; and
b) The I_T nexus being used to deliver the sense data is the same I_T nexus that was lost, and the logical unit has maintained all state information specific to that I_T nexus since the I_T nexus loss.

Otherwise, the logical unit shall use one of the less specific additional sense codes (e.g., POWER ON OCCURRED) when establishing a unit attention condition for an I_T nexus loss.

NOTE 13 - The unit attention additional sense code specificity order defined in this subclause determines which unit attention condition is allowed to be established when certain conditions occur. The unit attention condition precedence defined in 5.8.7 determines which unit attention conditions are allowed to clear other unit attention conditions if they have not yet been reported.

6.3.1 Power on

Power on is a SCSI device condition resulting from a power on event. When a SCSI device is powered on, it shall cause a hard reset.

The power on condition applies to both SCSI initiator devices and SCSI target devices.

Power on events include:

a) Power being applied to the SCSI device; and
b) Vendor-specific events that cause the SCSI device to behave as if power has been applied (e.g., firmware reboot).

6.3.5 Power loss expected

Power loss expected is a SCSI device condition resulting from a power loss expected event indicated by a Power Loss Expected event notification (see 6.4).

A power loss expected event is an indication from the SCSI transport protocol to the SAL that power loss may occur within a protocol specific period of time. SCSI transport protocols may define power loss expected events.

Each SCSI transport protocol standard that defines power loss expected events should specify when those events result in the delivery of a Power Loss Expected event notification to the SCSI applications layer.

The power loss expected condition applies only to SCSI target devices and is equivalent to a CLEAR TASK SET task management function (see 7.5) applied to all task sets.

When a SCSI target port detects a power loss expected, a Power Loss Expected event notification indication shall be delivered to each logical unit to which the I_T nexus has access. In response to the resulting I_T power loss expected condition a logical unit shall take the following actions:

a) Abort all tasks and establish a unit attention condition as described in 5.6; and
b) Perform any additional functions required by the applicable protocol standards.

7.10 QUERY UNIT ATTENTION

Request:

Service Response = QUERY UNIT ATTENTION (IN (I_T_L Nexus), OUT ([Additional ResponseInformation]))

Description:

A SCSI transport protocol may or may not support QUERY UNIT ATTENTION. A SCSI transport protocol supporting QUERY UNIT ATTENTION may or may not require logical units accessible through SCSI target ports using that transport protocol to support QUERY UNIT ATTENTION.

The task manager in the specified logical unit shall:

a) if there is a unit attention condition (see 5.8.7) or a deferred error (see SPC-4) pending for the specified I_T nexus, then return a service response set to FUNCTION SUCCEEDED; and
b) if there is no unit attention condition or deferred error pending for the specified I_T nexus, then return a service response set to FUNCTION COMPLETE.

If the service response is not FUNCTION SUCCEEDED, then the task manager shall set the Additional Response Information argument to 000000h.

If the service response is FUNCTION SUCCEEDED, then the task manager shall set the Additional Response Information argument as defined in table 38.

The SENSE KEY field indicates the value of the SENSE KEY field that would be returned in the sense data for the ~~highest priority pending~~ next unit attention condition or deferred error that is going to be reported (see SPC-4).

The ADDITIONAL SENSE CODE field indicates the value of the ADDITIONAL SENSE CODE field in the ~~highest priority pending~~ next unit attention condition or deferred error that is going to be reported (see SPC-4).

The ADDITIONAL SENSE CODE QUALIFIER field indicates the value of the ADDITIONAL SENSE CODE QUALIFIER field in the ~~highest priority pending~~ next unit attention condition or deferred error that is going to be reported (see SPC-4).

Suggested changes to SPC-4

3.1.141 unit attention condition: ~~A state that a logical unit maintains while it has~~ asynchronous status information that a logical unit establishes to report to the initiator ports associated with one or more I_T nexuses. See SAM-4.

4.5 Sense data

4.5.1 Sense data introduction

...

The RESPONSE CODE field shall be set to 70h in all unit attention condition sense data in which:

a) The ADDITIONAL SENSE CODE field is set to 29h; or
b) The additional sense code is set to MODE PARAMETERS CHANGED.

...

4.5.2 Descriptor format sense data

The descriptor format sense data for response codes 72h (current errors) and 73h (deferred errors) is defined in table 13.

Table 13 — Descriptor format sense data

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	RESPONSE CODE (72h or 73h)						
1	Reserved				SENSE KEY			
2	ADDITIONAL SENSE CODE							
3	ADDITIONAL SENSE CODE QUALIFIER							
4	Reserved							
6								
7	ADDITIONAL SENSE LENGTH (n - 7)							
	Sense data descriptor(s)							
8	Sense data descriptor x (see table 14)							
	...							
	Sense data descriptor x (see table 14)							
n								

...

Sense data descriptors (see table 14) provide specific sense information. A given type of sense data descriptor shall be included in the sense data only when the information it contains is valid.

Table 14 — Sense data descriptor format

Byte\Bit	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE							
1	ADDITIONAL LENGTH (n - 1)							
2	Sense data descriptor specific							
n								

The DESCRIPTOR TYPE field (see table 15) identifies the type of sense data descriptor. No more than one sense data descriptor of each type shall be included in the descriptor format sense data.

Table 15 — DESCRIPTOR TYPE field

Code	Description	Reference
00h	Information	4.5.2.2
01h	Command specific information	4.5.2.3
02h	Sense key specific	4.5.2.4
03h	Field replaceable unit	4.5.2.5
04h	Stream commands	SSC-3
05h	Block commands	SBC-3
06h	OSD object identification	OSD
07h	OSD response integrity check value	OSD
08h	OSD attribute identification	OSD
09h	ATA Status Return	SAT
0Ah - 7Fh	Reserved	
80h - FFh	Vendor specific	4.5.2.6

The ADDITIONAL LENGTH field indicates the number of sense data descriptor specific bytes that follow in the sense data descriptor.

4.5.2.4 Sense key specific sense data descriptor

4.5.2.4.1 Sense key specific sense data descriptor introduction

The sense key specific sense data descriptor (see table 18) provides additional information about the exception condition. The format and content of the sense-key specific data depends on the value in the SENSE KEY field (see 4.5.2.1).

Table 16 — Sense key specific sense data descriptor format

Byte\Bit	7	6	5	4	3	2	1	0
0	DESCRIPTOR TYPE (02h)							
1	ADDITIONAL LENGTH (06h)							
2	Reserved							
3	Reserved							
4	SKSV (1b)			SENSE KEY SPECIFIC				
6								
7	Reserved							

The DESCRIPTOR TYPE and ADDITIONAL LENGTH fields are described in 4.5.2.1. For the sense-key specific sense data descriptor, the DESCRIPTOR TYPE field shall be set to 01h and the ADDITIONAL LENGTH field shall be set to 06h.

The sense-key specific valid (SKSV) bit shall be set to one.

NOTE 3 - In previous versions of this standard and in the fixed format sense data, the SKSV bit indicates whether the contents of the SENSE KEY SPECIFIC field are valid as defined by a command standard. Since

the contents of the SENSE KEY SPECIFIC field are valid whenever a sense key specific sense data descriptor is included in the sense data, the only legal value for the SKSV bit is set to one.

The definition of the SENSE KEY SPECIFIC field (see table 19) is determined by the value of the SENSE KEY field (see 4.5.2.1).

Table 17 — Sense key specific sense data descriptor definitions

Sense key	SENSE KEY SPECIFIC field definition	Reference
ILLEGAL REQUEST	Field pointer	4.5.2.4.2
HARDWARE ERROR, MEDIUM ERROR, or RECOVERED ERROR	Actual retry count	4.5.2.4.3
NO SENSE or NOT READY	Progress indication	4.5.2.4.4
COPY ABORTED	Segment pointer	4.5.2.4.5
UNIT ATTENTION	Unit attention condition queue overflow	4.5.2.4.6
All other sense keys	The sense key specific sense data descriptor shall not appear in the descriptor format sense data and the SKSV bit (see 4.5.3) shall be set to zero in the fixed format sense data.	

4.5.2.4.2 Field pointer sense key specific data

If the sense key is ILLEGAL REQUEST, then the SENSE KEY SPECIFIC field shall be as shown in table 18.

Table 18 — Field pointer sense key specific data

Byte\Bit	7	6	5	4	3	2	1	0
0	SKSV (1b)	C/D	Reserved		BPV	BIT POINTER		
1	(MSB)	FIELD POINTER						
2								(LSB)

The SKSV bit is described in 4.5.2.4.1 for descriptor format sense data and in 4.5.3 for fixed format sense data.

A command data (C/D) bit set to one indicates that the illegal parameter is in the CDB. A C/D bit set to zero indicates that the illegal parameter is in the data parameters sent by the application client in the Data-Out Buffer.

A bit pointer valid (BPV) bit set to zero indicates that the value in the BIT POINTER field is not valid. A BPV bit set to one indicates that the BIT POINTER field specifies which bit of the byte designated by the FIELD POINTER field is in error. When a multiple-bit field is in error, the BIT POINTER field shall point to the first bit (i.e., the left-most bit) of the field.

The FIELD POINTER field indicates which byte of the CDB or of the parameter data was in error. Bytes are numbered starting from zero, as shown in the tables describing the commands and parameters. When a multiple-byte field is in error, the field pointer shall point to the first byte (i.e., the left-most byte) of the field. If several consecutive bytes are reserved, each shall be treated as a single-byte field.

NOTE 4 - The bytes identified as being in error are not necessarily the bytes that need to be changed to correct the problem.

4.5.2.4.3 Actual retry count sense key specific data

If the sense key is HARDWARE ERROR, MEDIUM ERROR, or RECOVERED ERROR, then the SENSE KEY SPECIFIC field shall be as shown in table 19.

Table 19 — Actual retry count sense key specific data

Byte\Bit	7	6	5	4	3	2	1	0
0	SKSV (1b)	Reserved						
1	(MSB)	ACTUAL RETRY COUNT						
2								(LSB)

The SKSV bit is described in 4.5.2.4.1 for descriptor format sense data and in 4.5.3 for fixed format sense data.

The ACTUAL RETRY COUNT field returns vendor specific information on the number of retries of the recovery algorithm used in attempting to recover an error or exception condition.

NOTE 5 - This field should be computed in the same way as the retry count fields within the Read-Write Error Recovery mode page (see SBC-2, SSC-3, and MMC-4).

4.5.2.4.4 Progress indication sense key specific data

If the sense key is NO SENSE or NOT READY, then the SENSE KEY SPECIFIC field shall be as shown in table 20.

Table 20 — Progress indication sense key specific data

Byte\Bit	7	6	5	4	3	2	1	0
0	SKSV (1b)	Reserved						
1	(MSB)	PROGRESS INDICATION						
2								(LSB)

The SKSV bit is described in 4.5.2.4.1 for descriptor format sense data and in 4.5.3 for fixed format sense data.

The PROGRESS INDICATION field is a percent complete indication in which the returned value is a numerator that has 65 536 (10000h) as its denominator. The progress indication shall be based upon the total operation.

NOTE 6 - The progress indication should be time related, however this is not an absolute requirement. (E.g., since format time varies with the number of defects encountered, etc., it is reasonable for the device server to assign values to various steps within the process. The granularity of these steps should be small enough to provide reasonable assurances to the application client that progress is being made.)

4.5.2.4.5 Unit attention condition queue overflow sense key specific data

If the sense key is UNIT ATTENTION, then the SENSE KEY SPECIFIC field shall be as shown in table 21.

Table 21 — Unit attention condition queue overflow sense key specific data [new]

Byte\Bit	7	6	5	4	3	2	1	0
0	SKSV (1b)	Reserved						OVERFLOW
1		Reserved						
2								

The SKSV bit is described in 4.5.2.4.1 for descriptor format sense data and in 4.5.3 for fixed format sense data.

An OVERFLOW bit set to one indicates that the unit attention condition queue has overflowed. An OVERFLOW bit set to zero indicates that the unit attention condition queue has not overflowed.

[end of all-new section]

4.5.3 Fixed format sense data

The fixed format sense data for response codes 70h (current errors) and 71h (deferred errors) is defined in tatable 22ble 26.

Table 22 — Fixed format sense data

Byte\Bit	7	6	5	4	3	2	1	0
0	VALID	RESPONSE CODE (70h or 71h)						
1	Obsolete							
2	FILEMARK	EOM	ILI	Reserved	SENSE KEY			
3	INFORMATION							
6								
7	ADDITIONAL SENSE LENGTH (n - 7)							
8	COMMAND-SPECIFIC INFORMATION							
11								
12	ADDITIONAL SENSE CODE							
13	ADDITIONAL SENSE CODE QUALIFIER							
14	FIELD REPLACEABLE UNIT CODE							
15	SKSV	SENSE KEY SPECIFIC						
17								
18	Additional sense bytes							
n								

A VALID bit set to zero indicates that the INFORMATION field is not defined in this standard or any other command standard (see 3.1.17). A VALID bit set to one indicates the INFORMATION field contains valid information as defined in this standard or a command standard.

The contents of the RESPONSE CODE field indicate the error type and format of the sense data (see 4.5.1). For fixed format sense data, the RESPONSE CODE field shall be set to 70h or 71h.

See the SSC-3 READ and SPACE commands for examples of FILEMARK bit usage.

See the SSC-3 READ, SPACE, and WRITE commands for examples of end-of-medium (EOM) bit usage.

See the SBC-3 READ LONG, SBC-3 WRITE LONG, and SSC-3 READ commands and for examples of incorrect length indicator (ILI) bit usage.

The SENSE KEY, ADDITIONAL SENSE CODE, and ADDITIONAL SENSE CODE QUALIFIER fields are described in 4.5.2.1.

The contents of the INFORMATION field are device-type or command specific and are defined in a command standard (see 3.1.17).

The ADDITIONAL SENSE LENGTH field indicates the number of additional sense bytes that follow. The additional sense length shall be less than or equal to 244 (i.e., limiting the total length of the sense data to 252 bytes). If the sense data is being returned as parameter data by a REQUEST SENSE command, then the relationship between the ADDITIONAL SENSE LENGTH field and the CDB ALLOCATION LENGTH field is defined in 4.3.4.6.

The COMMAND-SPECIFIC INFORMATION field contains information that depends on the command on which the exception condition occurred.

The FIELD REPLACEABLE UNIT CODE field is described in 4.5.2.5.

A sense-key specific valid (SKSV) bit set to one indicates the SENSE KEY SPECIFIC field contains valid information as defined in this standard. An SKSV bit set to zero indicates that the SENSE KEY SPECIFIC field is not as defined by this standard.

The SENSE KEY SPECIFIC field is described in 4.5.2.4.

The additional sense bytes may contain vendor specific data that further defines the nature of the exception condition.

4.5.6 Sense key and additional sense code definitions

...

6h UNIT ATTENTION: Indicates that a unit attention condition has been established (e.g., the removable medium may have been changed, a logical unit reset occurred). See SAM-4.

...

5.2.6 Using the REQUEST SENSE command

The REQUEST SENSE command (see 6.28) may be used by an application client to poll the status of some background operations and to clear interlocked unit attention conditions (see 7.4.6).

...

5.6.10.2 Releasing

c) If the released persistent reservation is a registrants only type or all registrants type persistent reservation, the device server shall establish a unit attention condition for the initiator port associated with every registered I_T nexus other than I_T nexus on which the PERSISTENT RESERVE OUT command with RELEASE service action was received, with the additional sense code set to RESERVATIONS RELEASED; and

d) If the persistent reservation is of any other type, the device server shall not establish a unit attention condition.

...

5.6.10.3 Unregistering

...

If the I_T nexus is the reservation holder and the persistent reservation is of a type other than all registrants, the device server shall also release the persistent reservation. If the persistent reservation is a registrants only type, the device server shall establish a unit attention condition for the initiator port associated with every registered I_T nexus except for the I_T nexus on which the PERSISTENT RESERVE OUT command was received, with the additional sense code set to RESERVATIONS RELEASED.

5.6.10.4.3 Preempting persistent reservations and registration handling

...

e) Establish a unit attention condition for the initiator port associated with every I_T nexus that lost its persistent reservation and/or registration, with the additional sense code set to REGISTRATIONS PREEMPTED; and

f) If the type or scope has changed, then for every I_T nexus whose reservation key was not removed, except for the I_T nexus on which the PERSISTENT RESERVE OUT command was received, the device server shall establish a unit attention condition for the initiator port associated with that I_T nexus, with the additional sense code set to RESERVATIONS RELEASED. If the type or scope have not changed, then no unit attention condition(s) shall be established for this reason.

5.6.10.4.4 Removing registrations

...

d) Establish a unit attention condition for the initiator port associated with every I_T nexus that lost its registration other than the I_T nexus on which the PERSISTENT RESERVE OUT command was received, with the additional sense code set to REGISTRATIONS PREEMPTED.

If a PERSISTENT RESERVE OUT with a PREEMPT service action or a PREEMPT AND ABORT service action sets the SERVICE ACTION RESERVATION KEY field to a value that does not match any registered reservation key, then the device server shall return a RESERVATION CONFLICT status.

It is not an error for a PERSISTENT RESERVE OUT with a PREEMPT service action or a PREEMPT AND ABORT service action to set the RESERVATION KEY and the SERVICE ACTION RESERVATION KEY to the same value, however, no unit attention condition is established for the I_T nexus on which the PERSISTENT RESERVE OUT command was received. The registration is removed.

5.6.10.6 Clearing

e) Establish a unit attention condition for the initiator port associated with every registered I_T nexus other than the I_T nexus on which the PERSISTENT RESERVE OUT command with CLEAR service action was received, with the additional sense code set to RESERVATIONS PREEMPTED.

5.8.2.5 Transitions between target port asymmetric access states

...

If a target port asymmetric access state change occurred as a result of the failed transition, then the device server shall establish a unit attention condition for the initiator port associated with every I_T nexus other than the I_T nexus on which the SET TARGET PORT GROUPS command was received with the additional sense code set to ASYMMETRIC ACCESS STATE CHANGED.

If the transition was implicit and it failed, then the device server shall establish a unit attention condition for the initiator port associated with every I_T nexus with the additional sense code set to IMPLICIT ASYMMETRIC ACCESS STATE TRANSITION FAILED.

After an explicit target port asymmetric access state change, a device server shall establish a unit attention condition with the additional sense code set to ASYMMETRIC ACCESS STATE CHANGED for the initiator port associated with every I_T nexus other than the I_T nexus on which the SET TARGET GROUPS command was received.

5.12 Device clocks

...

If the timestamp is changed by means other than the SET TIMESTAMP command then the device server shall ~~generate~~establish a unit attention condition for the initiator port associated with every I_T nexus (see SAM-4), with the additional sense code set to TIMESTAMP CHANGED.

5.15 Downloading and activating microcode

SCSI target device implementations may use microcode (e.g., firmware) that is stored in nonvolatile storage. Microcode may be changeable by an application client using the WRITE BUFFER command (see 6.38). The WRITE BUFFER command provides multiple methods for downloading microcode to the SCSI target device and activating the microcode.

Downloading and activating microcode involves the following steps:

1) Download: The application client transfers microcode from the Data-Out buffer to the device server in one or more WRITE BUFFER commands;
2) Save: After receiving the complete microcode, if defined by the download microcode mode, the device server saves the microcode to nonvolatile storage; and
3) Activate: After receiving the complete microcode and after saving it to nonvolatile storage if defined by the download microcode mode, the SCSI target device begins using the new microcode for the first time after an event defined by the download microcode mode.

After power on or hard reset, the SCSI target device shall use the last microcode that was saved to nonvolatile

storage.

Table 53 defines the WRITE BUFFER download microcode modes with respect to the steps described in this subclause.

Table 53 — WRITE BUFFER download microcode modes

Mode	Download	Save	Activate
Download microcode and activate (i.e., 04h)	yes	no	yes
Download microcode, save, and activate (i.e., 05h)	yes	yes	optional
Download microcode with offsets and activate (i.e., 06h)	yes	no	yes
Download microcode with offsets, save, and activate (i.e., 07h)	yes	yes	optional
Download microcode with offsets, save, and defer activate (i.e., 0Eh) [b]	yes	yes	no
Activate deferred microcode (i.e., 0Fh)	no	no	yes
[a] ... [b] Microcode downloaded with this mode is called deferred microcode.			

When microcode is activated due to processing a WRITE BUFFER command with a mode that causes activation after processing (see table 53), the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus except the I_T nexus on which the WRITE BUFFER command was received with the additional sense code set to MICROCODE HAS BEEN CHANGED.

NOTE 7 - The application client should respond to the GOOD status for the WRITE BUFFER command the same way that it responds to a unit attention condition with an additional sense code set to MICROCODE HAS BEEN CHANGED (e.g., assume a hard reset has occurred).

When microcode is activated due to processing a WRITE BUFFER command with a mode that optionally causes activation after processing (see table 53), the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus with the additional sense code set to MICROCODE HAS BEEN CHANGED.

When microcode is activated due to power on or hard reset ~~by a device server that queues unit attention conditions~~, the device server may establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus with the additional sense code set to MICROCODE HAS BEEN CHANGED ~~queued behind~~in addition to the unit attention condition for the power on or hard reset.

Editor's Note 3: Often the POWER ON CHANGED or SCSI BUS RESET OCCURRED will clear any memory that MICROCODE HAS BEEN CHANGED (because the device doesn't maintain state of the firmware before and after the power cycle/hard reset), but if the device server is capable of reporting the microcode change as well, fine.

Editor's Note 4: Microcode is not activated by logical unit reset, I_T nexus loss, or power loss expected, so no paragraphs for those cases.

~~When microcode is activated due to START STOP UNIT command or a FORMAT UNIT command (see command standard) that causes a unit attention condition by a device server that queues unit attention conditions, the device server may establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus with the additional sense code set to MICROCODE HAS BEEN CHANGED queued behind the unit attention condition for the power on or hard reset.~~

When deferred microcode (see table 53) is activated due to a command defined by its command standard as causing deferred microcode to be activated (e.g., the FORMAT UNIT command and the START STOP UNIT command in SBC-3), the device server:

a) shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus with the additional sense code set to MICROCODE HAS BEEN CHANGED; and
b) may establish other unit attention condition(s) as defined for the command (e.g., CAPACITY DATA HAS CHANGED for the FORMAT UNIT command).

Editor's Note 5: That covers all I_T nexuses; no exclusion for the one that sent the WRITE BUFFER command, nor the one that sent START STOP UNIT or FORMAT UNIT.

Editor's Note 6: FORMAT UNIT does not always create a unit attention condition - it only does so if capacity data changes. START STOP UNIT does not create a unit attention condition.

If new microcode is saved before deferred microcode is activated, the deferred microcode is not activated and the new saved microcode is considered deferred.

...

If the device server is unable to process a WRITE BUFFER command with a download microcode mode because of a vendor specific condition, it shall terminate the command with CHECK CONDITION status, with the sense key set to ILLEGAL REQUEST, and the additional sense code set to COMMAND SEQUENCE ERROR.

For all WRITE BUFFER command modes that download microcode (see table 53), the COMMAND SPECIFIC field (see 6.24.4.2) located in the command timeouts descriptor of the parameter data returned by the REPORT SUPPORTED OPERATION CODES command (see 6.24) indicates the maximum time that access to the SCSI device is limited or not possible through any SCSI ports associated with a logical unit that processes a WRITE BUFFER command that activates microcode.

6.3.7.10 Verify device operation

Support for a value of one in the TUR (Test Unit Ready) bit is optional. If setting the TUR bit to one is supported and the TUR bit is set to one, then a TEST UNIT READY command (see 6.36) shall be used to determine the readiness of the device. If setting the TUR to one is not supported and the TUR bit is set to one, then the EXTENDED COPY command shall be terminated with CHECK CONDITION status, with the sense key set to COPY ABORTED, and the additional sense code set to INVALID FIELD IN PARAMETER LIST. The SENSE-KEY SPECIFIC field shall be set as described in 6.3.3. If the TUR bit is set to zero, then the accessibility should be verified without disturbing established unit attention conditions or ACA conditions (e.g., using the INQUIRY command (see 6.4)).

6.4.1 INQUIRY command introduction

...

If an INQUIRY command is received from an initiator port with a pending unit attention condition (i.e., before the device server reports CHECK CONDITION status), the device server shall perform the INQUIRY command and shall not clear the unit attention condition (see SAM-4).

...

If the INQUIRY data changes for any reason, the device server shall establish a unit attention condition for the initiator port associated with every I_T nexus (see SAM-4), with the additional sense code set to INQUIRY DATA HAS CHANGED.

NOTE 20 - The INQUIRY command may be used by an application client after a hard reset or power on condition to determine the device types for system configuration.

6.9 MODE SELECT(6) command

...

If an application client sends a MODE SELECT command that changes any parameters applying to other I_T nexuses, the device server shall establish a unit attention (see SAM-4) condition for the initiator port associated with every I_T nexus except the I_T nexus on which the MODE SELECT command was received, with the additional sense code set to MODE PARAMETERS CHANGED.

6.22 REPORT LUNS command

...

If a REPORT LUNS command is received from an I_T nexus with a pending unit attention condition (i.e., before the device server reports CHECK CONDITION status), the device server shall perform the REPORT LUNS command (see SAM-4).

6.28 REQUEST SENSE command

...

If a REQUEST SENSE command is received on an I_T nexus with a pending unit attention condition (i.e., before the device server reports CHECK CONDITION status) and there is an exception condition specific to the REQUEST SENSE command itself, then the device server shall not clear the pending unit attention condition (see SAM-4).

6.32 SET IDENTIFYING INFORMATION command

On successful completion of a SET IDENTIFYING INFORMATION command that changes identifying information saved by the logical unit, the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus except the I_T nexus on which the SET IDENTIFIER command was received, with the additional sense code set to DEVICE IDENTIFIER CHANGED.

6.33 SET PRIORITY command

...

01b On successful completion of a SET PRIORITY command the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with the I_T nexus specified by the TRANSPORTID field and the RELATIVE TARGET PORT IDENTIFIER field, with the additional sense code set to PRIORITY CHANGED.

10b On successful completion of a SET PRIORITY command the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every other I_T_L nexus, with the additional sense code set to PRIORITY CHANGED.

6.35 SET TIMESTAMP command

...

On successful completion of a SET TIMESTAMP command the device server shall ~~generate~~establish a unit attention condition for the initiator port associated with every I_T nexus except the I_T nexus on which the SET TIMESTAMP command was received (see SAM-4), with the additional sense code set to TIMESTAMP CHANGED.

7.2.1 Log page structure and page codes for all device types

...

If the ETC bit is set to one and the result of the comparison is true, the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus, with the additional sense code set to THRESHOLD CONDITION MET.

...

The SCSI target device may provide independent sets of log parameters for each logical unit or for each combination of logical units and I_T nexuses. If the SCSI target device does not support independent sets of

log parameters and any log parameters are changed that affect other I_T nexuses, then the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus except the I_T nexus on which the LOG SELECT command was received, with the additional sense code set to LOG PARAMETERS CHANGED.

7.4.4.1 General block descriptor format

...

Block descriptors specify some of the medium characteristics for all or part of a logical unit. Support for block descriptors is optional. Each block descriptor contains a DENSITY CODE field, a NUMBER OF BLOCKS field, and a BLOCK LENGTH field. Block descriptor values are always current (i.e., saving is not supported). Whenever any block descriptor values are changed, the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus except the I_T nexus on which the MODE SELECT command (see 6.9) was received, with the additional sense code set to MODE PARAMETERS CHANGED. Command standards (see 3.1.17) may place additional requirements on the general mode parameter block descriptor. Requirements in the command standards that conflict with requirements defined in this subclause shall take precedence over the requirements defined in this subclause.

7.4.6 Control mode page

...

Regardless of the mode page policy (see 6.9) for the Control mode page, the shared mode page policy shall be applied to the TST field. If the most recent MODE SELECT changes the setting of this field, then the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus except the I_T nexus on which the MODE SELECT command was received, with the additional sense code set to MODE PARAMETERS CHANGED.

...

Table 300 — Queue error management (QErr) field

Code	Definition
01b	All the affected tasks in the task set shall be aborted when the CHECK CONDITION status is sent. If the TAS bit is set to zero, the device server shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus that had tasks aborted except for the I_T nexus on which the CHECK CONDITION status was returned, with the additional sense code set to COMMANDS CLEARED BY ANOTHER INITIATOR. If the TAS bit is set to one, all affected tasks in the task set for I_T nexuses other than the I_T nexus for which the CHECK CONDITION status was sent shall be completed with a TASK ABORTED status and no unit attention shall be established. For the I_T nexus to which the CHECK CONDITION status is sent, no status shall be sent for the tasks that are aborted.
...	...

...

The unit attention interlocks control (UA_INTLCK_CTRL) field (see table 300) controls the clearing of unit attention conditions reported in the same I_T_L_Q nexus transaction (see 3.1.46) as a CHECK CONDITION

status and whether returning a status of BUSY, TASK SET FULL or RESERVATION CONFLICT results in the establishment of a unit attention condition (see SAM-4).

Table 300 — Unit attention interlocks control (UA_INTLCK_CTRL) field

Code	Definition
00b	The logical unit shall clear any unit attention condition reported in the same I_T_L_Q nexus transaction as a CHECK CONDITION status and shall not establish a unit attention condition when a task is terminated with BUSY, TASK SET FULL, or RESERVATION CONFLICT status.
01b	Reserved [a]
10b [a]	The logical unit shall not clear any unit attention condition reported in the same I_T_L_Q nexus transaction as a CHECK CONDITION status and shall not establish a unit attention condition when a task is terminated with BUSY, TASK SET FULL, or RESERVATION CONFLICT status.
11b [a]	The logical unit shall not clear any unit attention condition reported in the same I_T_L_Q nexus transaction as a CHECK CONDITION status and shall establish a unit attention condition for the initiator port associated with the I_T nexus on which the BUSY, TASK SET FULL, or RESERVATION CONFLICT status is being returned. Depending on the status, the additional sense code shall be set to PREVIOUS BUSY STATUS, PREVIOUS TASK SET FULL STATUS, or PREVIOUS RESERVATION CONFLICT STATUS. Until it is cleared by a REQUEST SENSE command, a unit attention condition shall be established only once for a BUSY, TASK SET FULL, or RESERVATION CONFLICT status regardless to the number of commands terminated with one of those status values.

[a] A REQUEST SENSE command still clears any unit attention condition that it reports.

...

7.4.7 Control Extension mode page

...

The INITIAL PRIORITY field specifies the priority that may be used as the task priority (see SAM-4) for tasks received by the logical unit on any I_T nexus (i.e., on any I_T_L nexus) where a priority has not been modified by a SET PRIORITY command (see 6.33). If a MODE SELECT command specifies an initial priority value that is different than the current initial priority, then the device server shall set any priorities that have not be set with a SET PRIORITY command to a value different than the new initial priority value to the new priority. The device server shall establish a unit attention condition for the initiator port associated with every I_T_L nexus that receives a new priority, with the additional sense code set to PRIORITY CHANGED.

...

The parameters for a target port affect its behavior regardless of which initiator port is forming an I_T nexus with the target port. The parameters may be accessed by MODE SENSE (see 6.11) and MODE SELECT (see 6.9) commands directed to any logical unit accessible through the target port. If a parameter value is changed, all the device servers for all logical units accessible through the target port shall establish a unit attention condition for the initiator port associated with every I_T nexus that includes the target port except the I_T nexus on which the MODE SELECT command was received, with the additional sense code set to MODE PARAMETERS CHANGED.

7.4.11 Informational Exceptions Control mode page

...

Table 301 — Method of reporting informational exceptions (mrie) field

Code	Description
...	...
2h	~~Generate~~Establish **unit attention** condition: The device server shall report informational exception conditions by establishing a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus, with the additional sense code set to indicate the cause of the informational exception condition.

As defined in SAM-4, the command that has the CHECK CONDITION status with the sense key set to UNIT ATTENTION is not processed before the informational exception condition is reported.

7.4.13 Protocol Specific Logical Unit mode page

...

The parameters for a target port and logical unit affect their behavior regardless of which initiator port is forming an I_T_L nexus with the target port and logical unit. If a parameter value is changed, the device server shall establish a unit attention condition for the initiator port associated with every I_T nexus except the I_T nexus on which the MODE SELECT command was received, with the additional sense code set to MODE PARAMETERS CHANGED.

...

7.4.14 Protocol Specific Port mode page

...

The parameters may be accessed by MODE SENSE (see 6.11) and MODE SELECT (see 6.9) commands directed to any logical unit accessible through the target port. If a parameter value is changed, the device servers for all logical units accessible through the target port shall establish a unit attention condition for the initiator port associated with every I_T nexus except the I_T nexus on which the MODE SELECT command was received, with the additional sense code set to MODE PARAMETERS CHANGED.

...

7.6.4 Extended INQUIRY Data VPD page

...

An LUICLR (logical unit I_T nexus clear) bit set to one indicates the SCSI target device clears any unit attention condition with an additional sense code of REPORTED LUNS DATA HAS CHANGED in each logical unit accessible to an I_T nexus after reporting the unit attention condition for any logical unit over that I_T nexus (see SAM-4). An LUICLR bit set to zero indicates the SCSI target device clears unit attention conditions according to a previous version of this standard. The LUICLR bit shall be set to one.

7.6.7 SCSI Ports VPD page

...

If the device server detects that a SCSI port is added or removed from the SCSI device and the SCSI port designation descriptor list changes, it shall establish a unit attention condition (see SAM-4) for the initiator port associated with every I_T nexus, with the additional sense code set to INQUIRY DATA HAS CHANGED.

7.6.4 Extended INQUIRY Data VPD page

The Extended INQUIRY Data VPD page (see table 370) provides the application client with a means to obtain information about the logical unit.

Table 370 — Extended INQUIRY Data VPD page

Byte\Bit	7	6	5	4	3	2	1	0
0	PERIPHERAL QUALIFIFER			PERIPHERAL DEVICE TYPE				
1	PAGE CODE (86h)							
2	Reserved							
3	PAGE LENGTH (3Ch)							
4	Reserved		SPT			GRD_CHK	APP_CHK	REF_CHK
5	Reserved		~~Reserved~~ UASK_SUP	GROUP_SUP	PRIOR_SUP	HEADSUP	ORDSUP	SIMPSUP
6	Reserved						NV_SUP	V_SUP
7	Reserved							LUICLR
8	Reserved							
63								

...

A unit attention condition sense key specific data supported (UASK_SUP) bit set to one indicates that the device server returns sense-key specific data for the UNIT ATTENTION sense key . A UAQ_SUP bit set to zero indicates that the device server does not return sense-key specific data for the UNIT ATTENTION sense key.

8.3.3.3 DISABLE ACCESS CONTROLS service action

...

j) Establish a unit attention condition for the initiator port associated with every I_T nexus in each logical unit in the SCSI target device, with the additional sense code set to REPORTED LUNS DATA HAS CHANGED.

Suggested changes to SBC-3

4.7 Initialization

...

Any time the parameter data returned by the READ CAPACITY (10) command (see 5.12) or the READ CAPACITY (16) command (see 5.13) changes (e.g., when a FORMAT UNIT command or a MODE SELECT command completes changing the number of logical blocks, logical block length, protection information, or reference tag ownership values, or when a vendor-specific mechanism causes a change), the device server shall establish a unit attention condition for the initiator port associated with each I_T nexus except the I_T nexus on which the command causing the change was received with an additional sense code ~~of~~ set to CAPACITY DATA HAS CHANGED.

NOTE 4 - Logical units compliant with previous versions of this standard were not required to establish a unit attention condition.

4.14.1 Error reporting overview

...

Table 4 — Example error conditions

Condition	Sense key
...	...
Logical unit reset, I_T nexus loss, or medium change since last command from this application client	UNIT ATTENTION

4.xx Deferred microcode activation

The FORMAT UNIT command (see 5.2) and START STOP UNIT command (see 5.12) shall cause deferred microcode that has been downloaded to be activated (see SPC-4).

5.2 FORMAT UNIT command

5.2.1 FORMAT UNIT command overview

...

~~If any deferred downloaded code has been received as a result of a WRITE BUFFER command (see SPC-4), then that deferred downloaded code shall replace the current operational code.~~

This command causes deferred microcode to be activated (see 4.xx).

...

5.12 READ CAPACITY (10) command

5.12.2 READ CAPACITY (10) parameter data

The READ CAPACITY (10) parameter data is defined in table 44. Any time the READ CAPACITY (10) parameter data changes, the device server ~~should~~ establishes a unit attention condition as described in 4.7.

...

5.13 READ CAPACITY (16) command

5.13.2 READ CAPACITY (16) parameter data

The READ CAPACITY (16) parameter data is defined in table 46. Any time the READ CAPACITY (16) parameter data changes, the device server ~~should~~ establishes a unit attention condition as described in 4.7.

...

5.12 START STOP UNIT command

...

~~If any deferred downloaded code has been received as a result of a WRITE BUFFER command (see SPC-4), then that deferred downloaded code shall replace the current operational code.~~

This command causes deferred microcode to be activated (see 4.xx).

...

6.3.2.1 Mode parameter block descriptors overview

...

Support for the mode parameter block descriptors is optional. The device server shall establish a unit attention condition with the additional sense code ~~of~~ set to MODE PARAMETERS CHANGED (see SPC-4 and SAM-4) when the block descriptor values are changed.