Working Draft National Standard

Project INCITS 557

Revision 8
October 31, 2022

Information technology - SCSI / ATA Translation - 5 (SAT-5)

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American National Standard
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SCSI / ATA Translation - 5

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ABSTRACT

This standard specifies a translation layer between SCSI and ATA protocols. This translation layer is used by storage controllers to emulate objects in a SCSI logical unit using an ATA device, providing capabilities defined by SCSI standards (e.g., the SCSI Block Commands (SBC-4), SCSI Primary Commands (SPC-5), and Zoned Block Commands (ZBC) standards). For the purposes of this standard, ATA device capabilities are defined by ATA8-AAM, ACS-5, ATA8-APT, ATA8-AST, ZAC-2, and SATA-3.5a.

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Revision Information

Incorporated T10 Approved Documents (part 1 of 2)

Doc	In Rev	Document title [a] (and notes)
17-066r5	00a	This proposal translates the ATA Storage Element Depopulation feature set.
17-083r4	1a	This proposal translates ATA UNIT ATTENTION to SCSI UNIT ATTENTION
17-102r1	00a	This proposal translates the ATA Zoned Device Statistcs log page to the Zoned Block Device Statistics log page parameters.
17-138r2	1	Corrects translation for WRITE SAME with unmap
17-140r1	1	Translates the READ MEDIA SERIAL NUMBER command
17-161r1	1	Fixes for the change in Logical Block Provisioning in SBC-4
18-009r1	1	Addresses changes made to the LBPRZ bit in SBC-4.
18-019r1	1a	Translates the ZONE COUNT field in zone management commands.
19-020r1	1a	Translates the SEQUENTIALIZE ZONE command
18-021r1	1	Updates FORMAT UNIT translation to account for ZBC extensions
18-040r1	1a	Translates the Pending Defects log
18-043r1	1a	Updates the WRITE LONG command to account for Zoned Block Devices
18-044r1	1a	Updates the WRITE SAME command to account for Zoned Block Devices
18-111r1	1b	SAT-5 Add translation of microcode pending feature
18-077r3	1b	Converts the START STOP unit command from tables to text. Also revises the algorithm for commands issues to the ATA device.
18-096r3	1b	Adds translation for the Start-Stop Cycle Counter Log page
19-013r2	1c	Extends the translation of DOWNLOAD MICROCODE capabilities for the Extended INQUIRY Data VPD page
19-048r2	2	Changes use of the phrase “ATA ... parameter data” to “ATA ... input from device to host data structure”.
19-005r1	2	The subclause for device size calculation is out of date.
19-047r1	2	Clarifies wording in the Sanitize translation.
19-049r0	2	Updates Format Unit and Write Long with features added after SAT-4 to SBC-4.
19-050r1	2	There have been several changes to the Standard INQUIRY requiring SAT updates.
19-052r0	2	Updates several mode pages with newer untranslated fields.
19-053r1	2	Updates VPD pages with updates after SAT-4
19-051r0	2	Fixes some of the field names is rebuild assist
19-115r2	3	Modifies the WRITE SAME command translation to better account for zoned device operation.
20-017r0	3	Normalizes the phrase "…shall terminate the START STOP UNIT command a deferred error…" to “...establish a deferred error condition...”
20-039r0	3	Adds a translation for the wsnz bit.
19-104r2	3	Normalizes the usage of the ATA IDENTIFY DEVICE data and data log.
20-053r1	4	Forces and UNMAP to UNMAP
[a] Document titles shown in blue text define significant new capabilities.		

Incorporated T10 Approved Documents (part 2 of 2)

Doc	In Rev	Document title [a] (and notes)
20-045r1	4	Adds translation for RESTORE ELEMENTS AND REBUILD command.
20-010r2	4	SAT-5: FORMAT WITH PRESET translation
20-063r0	5	Obsoletes the ZONED field.
20-080r1	5	Cleanup work on the Start-Stop Cycle Counter log page.
20-077r1	5	SAT-5: WWN Updates
20-078r3	5	Sets references to SMART commands obsoleted in ACS-5 to reference ACS-4.
20-079r1	5	Clean's up NCQ errors
20-090r2	5	SAT-5 Add Translation for Concurrent Positioning Ranges VPD page.
21-036r0	5	January CAP WG draft review comments.
21-071r2	6	Adds the pwromact bit, hrdrmact bit, ssumact bit, and fmtmact bit to the Control Extension mode page.
20-085r5	6	Adds the translation for the Command Duration Limits T2A mode page and the Command Duration Limits T2B mode page.

[a] Document titles shown in blue text define significant new capabilities.

R.1 Revision 0 (17-Jul-2017)

a) First draft. Taken from the final posted version of SAT-4r06.
b) Updated metadata associated with moving from SAT-4 to SAT-5
c) Updated Chair and Vice-Chair. Need to confirm Vice chair information. Information ported from SSC-5r4
d) Added revision history and bibliography files. Previous versions of SAT did not have bibliographies. That being read, documentation practices have changed and I expect to see some of the normative references become bibliography entries.

R.2 Revision 00a (18-Jul-2017)

a) There are clearly some issues with the master pages. Paragraph style naming conventions are different and there appear to be duplicate styles that need to be cleaned. As a result, a full pass through the document is required. This pass will normalize the usage of paragraph styles and master pages as well as removing duplicate styles. This activity will be done in a future revision of SAT-5.
b) Incorporated 17-066r5. This proposal translates the ATA Storage Element Depopulation feature set.
c) Incorporated 17-102r1. This proposal translates the ATA Zoned Device Statistcs log page to the Zoned Block Device Statistics log page parameters.

R.3 Revision 1 (5-May-2018)

a) Incorporated 17-140r1 - Translates the READ MEDIA SERIAL NUMBER command
b) Incorporated 18-021r1 - Updates FORMAT UNIT translation to account for ZBC extensions
c) Incorporated 17-138r2 - Corrects translation for WRITE SAME with unmap

d) Incorporated 18-009r1 - Addresses changes made to the LBPRZ bit in SBC-4. This proposal lists the READ CAPACITY (16) parameter data with no read or blue text and then indicates there are no further changes in this subclause. Text in 9.36.5 was replaced by 17-138r2. Overlayed changes for the size of the LBPRZ field and changed READ CAPACITY (16) to Logical Block Provisioning VPD page. This area likely needs more work.
e) Incorporated 17-161r1 - More fixes for the change in Logical Block Provisioning

R.4 Revision 1a (2-Aug-2018)

a) Incorporated 17-083r4 - Translates the SCSI Unit Attention to and from SATA
b) Incorporated 18-019r1 - Translates the ZONE COUNT field in zone management commands. This proposal is based on an earlier version of SAT-5 and overlapped changes from other proposals. These changes were mostly fixes not associated with the new functionality.
c) Incorporated 18-020r1 - Translates the SEQUENTIALIZE ZONE command.
d) Incorporated 18-040r1 - Translates the Pending Defects log.
e) Incorporated 18-044r1 - Updates the WRITE LONG command to account for Zoned Block Devices
f) Incorporated 18-043r1 - Updates the WRITE SAME command to account for Zoned Block Devices

R.5 Revision 1b (7-Mar-2019)

a) Incorporated 18-111r1 - Adds translation of the microcode pending feature. This proposal overlays significant changes to 8.13.1 and needs to be checked for accuracy. This insertion may be better as a standalone paragraph. Added an editor's note
b) Incorporated 18-077r3 - Revises the START STOP UNIT translation to better account for an inactive LBA 0. This removes to several page tables in favor of lists. There are many references to step numbers, please pay attention and make sure they all hotlink to the right places. These links are context sensitive.
c) Incorporated 18-096r3 - Adds translation for the Start-Stop Cycle Counter Log page

R.6 Revision 1c (29-Apr-2019)

a) Incorporated 19-013r2 - Adds translation of download microcode modes to Extended INQUIRY Data VPD page fields

R.7 Revision 2 (11-Jul-2019)

a) Incorporated 19-048r2 - Implements issue #3. Changes use of ATA parameter data to input from device to host data structure.
b) Incorporated 19-005r1 - Implements issue #5. The subclause for device size calculation is out of date.
c) Incorporated 19-047r1 - Clarifies wording in the Sanitize translation.
d) Incorporated 19-49r0 - Updates Format Unit and Write Long with features added after SAT-4 to SBC-4.
e) Incorporated 19-050r1 - There have been several changes to the Standard INQUIRY requiring SAT updates.
f) Incorporated 19-052r0 - Updates several mode pages with newer untranslated fields.
g) Incorproated 19-053r1 - Updates VPD pages with updates after SAT-4.
h) Incorporated 19-051r0 - Fixes some of the field names is rebuild assist.

R.8 Revision 3 (30-Apr-2020)

a) Incorporated 19-104r2- Normalizes the usage of the ATA IDENTIFY DEVICE data and data log.
b) Incorporated 19-115r2 - Modifies the WRITE SAME command translation to better account for zoned device operation.
c) Incorporated 20-017r0 - normalizes the phrase "…shall terminate the START STOP UNIT command a deferred error…" to "...establish a deferred error condition..."
d) Incorporate 20-039r0 - adds a translation for the WSNZ bit.

R.9 Revision 4 (9-Jul-2020)

a) Incorporate 20-053r1 - Forces and UNMAP to UNMAP, not write media. This proposal overlaps change from other proposals... All redlines were implemented against changed text.
b) Incorporate 20-045r1 - Adds translation for RESTORE ELEMENTS AND REBUILD command.

c) Incorporate 20-010r2 - Adds translation of FORMAT WITH PRESETS.

R.10 Revision 5 (8-Mar-2021)

a) Incorporated 20-063r0 - Obsoletes the ZONED field.
b) Incorporated 20-081r1 - Cleanup work on the Start-Stop Cycle Counter log page. Addresses an editors note.
c) Incorporated 20-077r1 - Cleans up the usage of the world wide name field as it has been mandatory for several ACS versions
d) Incorporated 20-078r3 - Changes references to SMART to include ACS-4. All other ACS-4's were updated to ACS-5 as a part of this incorporation.
e) Incorporated 20-079r1 - Cleans up NCQ error reporting.
f) Incorporated 20-090r2 - Adds a translation for the Concurrent Positioning Ranges VPD page.
g) Incorporated 21-036r0 - January CAP WG draft review comments. Doc posted as an FDF against SAT-5r4.

R.11 Revision 6 (11-Sep-21)

a) Incorporated 21-071r2 - Adds the PWROMACT bit, HRDRMACT bit, SSUMACT bit, and FMTMACT bit to the Control Extension mode page.
b) Incorporated 20-085r5 - Adds the translation for the Command Duration Limits T2A mode page and the Command Duration Limits T2B mode page.

R.12 Revision 7 (14-Sep-22)

a) Incorporate RFC comment doc 22-025r2
   A) It turns out tht here was a bibliography at the end of clause 12 and another one after the annex. Merged them together and fixed formatting
   B) Added several editors notes for issues with comment conflicts or questions.

R.13 Revision 8 (31-Oct-2022)

a) Corrected the revision and date on the cover page, also corrected the year of the previous revision.
b) Completed incorporation of 22-025r2, published as 22-052r3.
c) Incorporated 22-115r0 - Sep 2022 CAP review of SAT-5r7.
d) Incorporated 22-006r1 - Wording consistency involving the use of SAT vs SATL.
e) Incorporated 22-035r0 - Addresses discrepancies in UNMAP and VPD parameters.
f) Incorporated 22-061r0 - Addresses write pointer issues for the WRITE SAME command.
g) Incorporated 22-085r0 - Corrects reference terminology found in MODE SELECT, MODE SENSE, LOG SELECT, and LOG SENSE.
h) Posted 21-114r1 as the final SAT-5 issues list.

Contents

Tables

Figures

Foreword (this foreword is not part of this standard).

This standard provides a common set of definitions and requirements to establish common behavior among implementations that emulate SCSI device behavior through the combined use of ATA devices and a SCSI / ATA Translation Layer (SATL). The SATL may reside in a host-based software or firmware, or it may reside in a separate component (e.g., a host bus adapter or external controller) with a separate processing unit to perform the translation. A SATL and ATA device combination may provide a functional subset of common SCSI capabilities. There is also a range of optional emulated SCSI capabilities that may be supported, depending on the capabilities of the SATL.

This standard defines SATL capabilities in terms of SCSI capabilities as defined by the applicable SCSI standards and working drafts, and defines the elements and use of ATA protocol to provide those SCSI capabilities and services in a consistent manner among SATL implementations as described by this standard.

Requests for interpretation, suggestions for improvement and addenda, or defect reports are welcome. They should be sent to the INCITS Secretariat, International Committee for Information Technology Standards, Information Technology Industry Council, 700 K Street NW Suite 600, Washington, DC 20001.

This standard was processed and approved for submittal to ANSI by the International Committee for Information Technology Standards (INCITS). Committee approval of the standard does not necessarily imply that all committee members voted for approval. At the time it approved this standard, INCITS had the following members:

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Introduction

The SCSI / ATA Translation - 5 standard is divided into the following clauses and annexes:

Clause 1 defines the scope of this standard.

Clause 2 enumerates the normative references that apply to this standard.

Clause 3 describes the definitions, symbols, and abbreviations used in this standard.

Clause 4 describes the general framework for defining elements of translation between SCSI and ATA protocols.

Clause 5 describes elements of SCSI / ATA Translation that relate to the SCSI architecture model.

Clause 6 describes the mapping of command management functions in the SATL layer.

Clause 7 provides a summary of SCSI commands mapped to ATA in this standard.

Clause 8 describes the mapping between SCSI Primary Commands and ATA protocol.

Clause 9 describes the mapping between SCSI Block Commands, Zoned Block Commands, and ATA protocol.

Clause 10 describes the mapping of diagnostic parameters, mode pages, log pages, and VPD page information to selected ATA protocol elements.

Clause 11 describes error reporting and sense data conventions for SCSI / ATA Translation.

Clause 12 describes additional SCSI commands, mode pages, security protocols, and VPD pages for SCSI / ATA Translation.

Annex A describes sample algorithms for spltting commands.

American National Standard
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SCSI / ATA Translation - 5 (SAT-5)

1 Scope

The set of SCSI standards specifies the interfaces, functions, and operations necessary to ensure interoperability between conforming SCSI implementations. This standard is a functional description. Conforming implementations may employ any design technique that does not violate interoperability.

This standard defines the protocol requirements of the SCSI / ATA Translation Layer (SATL) to allow conforming SCSI / ATA translating components to interoperate with ATA devices, SCSI transports, and SCSI application layers. The SATL covers a range of implementations that use ATA devices to emulate the behavior of SCSI devices as viewed by the SCSI application layer. The primary focus of this standard is to define SCSI / ATA Translation for an ATA device (see 3.1.8).

Where possible, this standard defines SCSI / ATA Translation in a manner that is consistent with the SAM-5, SPC-5, SBC-4, and ZBC standards. In some instances, the defined function of an ATA device is different from corresponding functions defined for SCSI target devices (e.g., many ATA devices provide no means to abort a single ATA queued command). The translation defined in this standard, in such cases, may not be consistent with other SCSI standards. However, in such cases, this standard specifies the expected behavior, and in what manner it is inconsistent with the behavior specified in other SCSI standards.

The objective of this standard is to allow an interoperable set of SCSI functions while minimizing the complexity of the SATL and preserving compatibility with existing SCSI application clients.

The objectives of the SATL are:

a) to provide host computers with device independence with respect to the ATA devices and with respect to various implementations of the translation layer used to emulate the behavior of SCSI target devices;
b) to define common features and functions representing a subset of the capabilities available in SCSI devices that apply to SCSI / ATA Translation implementations;
c) to define common methods to manage aspects of ATA devices that do not map to previously defined features and functions of SCSI, with provision made for the addition of special features and functions; and
d) to provide consistent means for discovery and control of optional SCSI features that may or may not be emulated in SCSI / ATA translator implementations. These means are provided by specifying how transport specific features and functions are represented in a mixed-domain topology in a manner consistent with management of devices in a SCSI domain.

Figure 1 shows the general structure of SCSI standards. Figure 1 is not intended to imply a relationship such as a hierarchy, protocol stack, or system architecture.

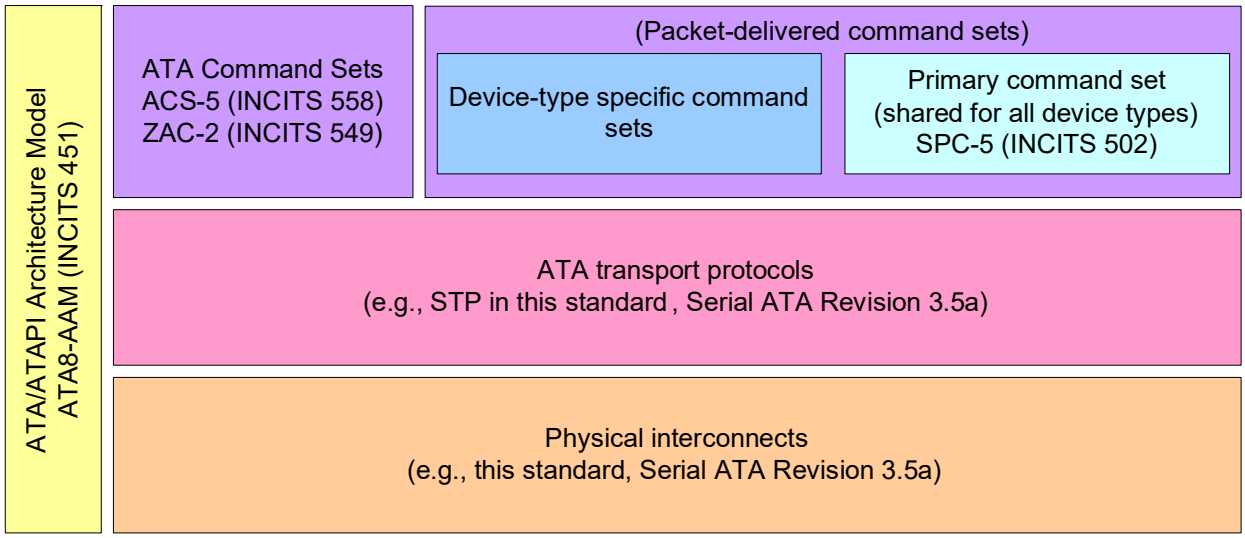


Figure 1 — SCSI document relationships

The term SCSI is used wherever it is not necessary to distinguish between the different SCSI standards.

Figure 2 shows the relationship of the ATA standards and SATA specifications to each other.

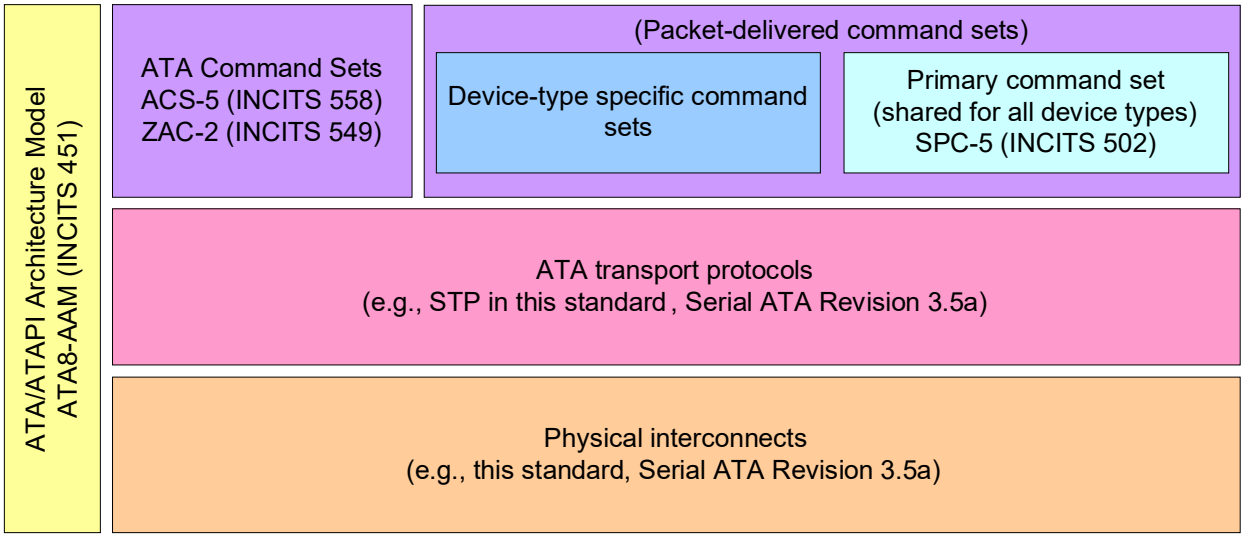


Figure 2 — ATA document structure

This standard defines a translation between the SCSI application layer (see SAM-5) and ATA device protocol.

2 Normative References

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5807:1985 (R2019), *Documentation Symbols and Conventions for Data, Program and System Flowcharts, Program Network Charts and System Resource Charts*

ISO/IEC 14776-412, *SCSI Architecture Model - 2 (SAM-2)*

ISO/IEC 14776-861, *AT Attachment-8 Architecture Model (ATA8-AAM)*

INCITS 491-2017, *SCSI/ATA Translation - 4 (SAT-4)*

INCITS 493-2012 (R2017), *AT Attachment-8 Serial Transport (ATA8-AST)*

T10/BSR INCITS 502-2020, *SCSI Primary Commands - 5 (SPC-5)*

T10/BSR INCITS 566, *SCSI Primary Commands - 6 (SPC-6)*

T10/BSR INCITS 506-2021, *SCSI Block Commands - 4 (SBC-4)*

T10/BSR INCITS 571, *SCSI Block Commands - 5 (SBC-5)*

T10/BSR INCITS 515-2016 (R2-2021), *SCSI Architecture Model - 5 (SAM-5)*

INCITS 524-2016 (R2021), *AT Attachment-8 Parallel Transport (ATA8-APT)*

T13/BSR INCITS 529-2018, *ATA Command Set - 4 (ACS-4)*

T13/BSR INCITS 558, *ATA Command Set - 5 (ACS-5)*

T10/BSR INCITS 534-2019, *Serial Attached SCSI - 4 (SAS-4)*

T10/BSR INCITS 536-2016 (R2021), *Zoned Block Commands (ZBC)*

T10/BSR INCITS 550, *Zoned Block Commands - 2 (ZBC-2)*

T13/BSR INCITS 537-2016 (R2021), *Zoned ATA Command Set (ZAC)*

T13/BSR INCITS 549-2022, *Zoned ATA Command Set - 2 (ZAC-2)*

T10/BSR INCITS 538-2018, *SAS Protocol Layer - 4 (SPL-4)*

Serial ATA Revision 3.5a (SATA-3.5a)

The SATA 3.5a document may be obtained from Serial ATA International Organization (SATA-IO) at https://www.sata-io.org.

3 Definitions, symbols, abbreviations, and conventions

3.1 Definitions

3.1.1 additional sense code

combination of the ADDITIONAL SENSE CODE field and the ADDITIONAL SENSE CODE QUALIFIER field in the sense data.

Note 1 to entry: See SPC-5.

3.1.2 Advanced Power Management (APM)

Advanced Power Management feature set

Note 1 to entry: See ACS-5.

3.1.3 allocation length

value in the ALLOCATION LENGTH field of a CDB that specifies the maximum number of bytes that an application client has allocated in the Data-In Buffer and that is used to limit the maximum amount of variable length data returned to an application client

Note 1 to entry: See SPC-5.

Note 2 to entry: Examples of variable length data include mode data, log data, and diagnostic data.

3.1.4 application client

object that is the source of SCSI commands

Note 1 to entry: See SAM-5.

3.1.5 AT Attachment (ATA)

family of standards and specifications that define the attachment of storage devices to hosts

Note 1 to entry: See ATA8-AAM, ACS-5, ATA8-APT, ATA8-AST, ZAC-2, and SATA-3.5a.

3.1.6 ATA abort retry

policy implemented by a SATL whereby the SATL retries ATA commands if they are aborted by ATA collateral abort (see 3.1.7)

Note 1 to entry: See 6.2.7

3.1.7 ATA collateral abort

ATA command that is aborted as a result of a different ATA command being aborted when an ATA device is processing queued ATA commands (i.e., NCQ.)

3.1.8 ATA device

device that complies with ATA standards and implements the General feature set

Note 1 to entry: See ATA8-AAM and ACS-5.

3.1.9 ATA device capacity

ATA logical sector size (see 3.1.18), multiplied by one more than the ATA maximum LBA (see 3.1.19)

3.1.10 ATA domain

I/O subsystem that is made up of one ATA host, a service delivery subsystem, and one or more ATA devices

Note 1 to entry: See ATA8-AAM.

3.1.11 ATA download microcode command

ATA DOWNLOAD MICROCODE command or ATA DOWNLOAD MICROCODE DMA command

Note 1 to entry: See ACS-5.

3.1.12 ATA flush command

ATA FLUSH CACHE command or ATA FLUSH CACHE EXT command

Note 1 to entry: See ACS-5.

3.1.13 ATA hardware reset

routines performed by the ATA device server and the ATA device port in an ATA device after a hardware reset event occurs

Note 1 to entry: See ATA8-AAM.

3.1.14 ATA host

object that originates requests to be processed by an ATA device

3.1.15 ATA host aware zoned device

ATA device supporting the Host Aware Zones feature set

Note 1 to entry: See ACS-5 and ZAC-2.

Note 2 to entry: Device presents the signature of an ATA device.

3.1.16 ATA host managed zoned device

ATA device supporting the Host Managed Zones feature set

Note 1 to entry: See ACS-5 and ZAC-2.

Note 2 to entry: Device presents the signature of a Host Managed Zoned device.

3.1.17 ATA LBA

LBA (see 3.1.52) used to reference a logical sector in an ATA device

Note 1 to entry: See ACS-5.

3.1.18 ATA logical sector size

size of an ATA logical sector in bytes

Note 1 to entry: See 5.8.

3.1.19 ATA maximum LBA

maximum user LBA for the ATA device

Note 1 to entry: See 5.7.

3.1.20 ATA NCQ command

ATA READ FPDMA QUEUED command, ATA WRITE FPDMA QUEUED command, ATA RECEIVE FPDMA QUEUED command, ATA SEND FPDMA QUEUED command, or ATA FPDMA NON-DATA command

Note 1 to entry: See ACS-5.

3.1.21 ATA nexus loss event

transport specific event where an ATA host port is no longer in communication with an ATA device port

Note 1 to entry: See ATA8-AAM.

Note 2 to entry: See 5.5.

3.1.22 ATA non-NCQ command

ATA command that is not an ATA NCQ command

Note 1 to entry: See 3.1.20.

3.1.23 ATA QWord

sequence of eight contiguous bytes or eight contiguous characters considered as a unit

Note 1 to entry: See ACS-5.

3.1.24 ATA read command

ATA READ DMA command, ATA READ DMA EXT command, ATA READ SECTOR(S) command, ATA READ SECTOR(S) EXT command, or ATA READ FPDMA QUEUED command as selected by table 53

Note 1 to entry: See ACS-5.

3.1.25 ATA read log command

ATA SMART READ LOG command, ATA READ LOG EXT command, or ATA READ LOG DMA EXT command

Note 1 to entry: See ACS-5.

3.1.26 ATA read buffer command

ATA READ BUFFER command or ATA READ BUFFER DMA command

Note 1 to entry: See ACS-5.

3.1.27 ATA Sector Count

count of ATA logical sectors to transfer or process

Note 1 to entry: See ACS-5.

Note 2 to entry: The ATA Sector Count is represented by the COUNT field for non-NCQ commands.

Note 3 to entry: The ATA Sector Count is represented by the FEATURE field for NCQ commands.

3.1.28 ATA software reset

reset that is triggered by an ATA task management function request

Note 1 to entry: See ATA8-AAM.

Note 2 to entry: See 5.6.

3.1.29 ATA trusted receive command

ATA TRUSTED RECEIVE command or ATA TRUSTED RECEIVE DMA command

Note 1 to entry: See ACS-5.

3.1.30 ATA trusted send command

ATA TRUSTED SEND command or ATA TRUSTED SEND DMA command

Note 1 to entry: See ACS-5.

3.1.31 ATA verify command

ATA READ VERIFY SECTOR(S) command or ATA READ VERIFY SECTOR(S) EXT command

Note 1 to entry: See ACS-5.

3.1.32 ATA volatile settings

ATA device settings affecting the way an ATA device responds to ATA commands that are configurable using ATA commands that do not persist across resetting events and that are set by the SATL to correspond to SCSI mode parameters, log parameters, or INQUIRY data

Note 1 to entry: See ACS-5.

Note 2 to entry: Examples of ATA configuration commands include the ATA SET FEATURES and SET SECTOR CONFIGURATION EXT.

3.1.33 ATA write command

ATA WRITE DMA command, ATA WRITE DMA EXT command, ATA WRITE DMA FUA EXT command, ATA WRITE SECTOR(s) command, ATA WRITE SECTOR(s) EXT command, or ATA WRITE FPDMA QUEUED command, as selected by table 53

Note 1 to entry: See ACS-5.

3.1.34 ATA write buffer command

ATA WRITE BUFFER command or ATA WRITE BUFFER DMA command

Note 1 to entry: See ACS-5.

3.1.35 ATA write log command

ATA SMART WRITE LOG command, ATA WRITE LOG EXT command, or ATA WRITE LOG DMA EXT command

See ACS-5.

3.1.36 byte

sequence of eight contiguous bits considered as a unit

3.1.37 command

request describing a unit of work to be performed by a device server

Note 1 to entry: See SAM-5.

3.1.38 command descriptor block (CDB)

structure used to communicate a command from a SCSI application client to a SCSI device server

Note 1 to entry: See SAM-5.

3.1.39 command identifier

numerical identifier of the command

Note 1 to entry: See SAM-5.

3.1.40 device server

object within the logical unit that processes SCSI commands according to the rules for command management

Note 1 to entry: See SAM-5.

3.1.41 direct logical block mapping

SATL implementation that maps logical blocks on a logical unit one to-one with ATA logical sectors on an ATA device, where the LBA of a logical block has the same value as the LBA of the corresponding ATA logical sector and the number of bytes in a logical block equals the number of bytes in an ATA logical sector

Note 1 to entry: See 9.1.2.

3.1.42 domain

I/O system consisting of devices that communicate with one another by means of a service delivery subsystem

Note 1 to entry: Examples of domains include a SCSI domain (see SAM-5) or an ATA domain (see ATA8-AAM).

3.1.43 DRQ data block

unit of logical sectors associated with available status when using either the PIO Data-in command protocol or the PIO Data-out command protocol

Note 1 to entry: See ACS-5.

3.1.44 dword

sequence of four contiguous bytes considered as a unit

3.1.45 field

group of one or more contiguous bits

3.1.46 I_T nexus

nexus between a SCSI initiator port and a SCSI target port

Note 1 to entry: See SAM-5.

3.1.47 I_T_L nexus

nexus between a SCSI initiator port, a SCSI target port, and a logical unit

Note 1 to entry: See SAM-5.

3.1.48 indirect logical block mapping

SATL implementation that does not follow the constraints of direct logical block mapping

Note 1 to entry: See 3.1.41 and 9.1.3.

3.1.49 least significant bit (LSB)

bit or bit position with the smallest numerical weighting in a group of bits that, when taken as a whole, represent a numerical value

Note 1 to entry: For example, in the number 0001b, the LSB is the bit that is set to one.

3.1.50 link reset sequence

phy reset sequence

Note 1 to entry: See SATA-3.5a.

3.1.51 logical block

set of data bytes accessed and referenced as a unit

Note 1 to entry: See SBC-4.

3.1.52 logical block address (LBA)

value used to reference a logical block

3.1.53 logical unit

externally addressable entity within a SCSI target device

Note 1 to entry: See SAM-5.

3.1.54 logical unit capacity

capacity of a logical unit in bytes calculated as length in bytes of each logical block multiplied by one more than the LBA of the last logical block on the logical unit

3.1.55 logical unit number (LUN)

encoded 64-bit identifier for a logical unit

Note 1 to entry: See SAM-5.

3.1.56 logical unit reset

condition resulting from a hard reset condition or a logical unit reset event in which the logical unit performs a logical unit reset operation

Note 1 to entry: See SAM-5, SPC-5, and this standard

3.1.57 logical unit reset event

event that triggers a logical unit reset

Note 1 to entry: See SAM-5.

3.1.58 medium

material on which data is stored (e.g., a magnetic disk)

3.1.59 most significant bit (MSB)

bit or bit position with the largest numerical weighting in a group of bits that, when taken as a whole, represent a numerical value

Note 1 to entry: For example, in the number 1000b, the MSB is the bit that is set to one)

3.1.60 native command queuing (NCQ)

method by which a SATA device may maintain and order the processing of up to 32 outstanding commands

Note 1 to entry: See ACS-5 and SATA 3.5a.

3.1.61 nexus

relationship between a SCSI initiator port and a SCSI target port that may extend to a logical unit and a command

Note 1 to entry: See SAM-5.

3.1.62 object

architectural abstraction or container that encapsulates data types, services, or other objects that are related in some way

3.1.63 Parallel ATA (PATA)

parallel transport protocol

Note 1 to entry: See ATA8-APT.

3.1.64 PATA bus

conductors and connectors required to attain signal line continuity between every driver, receiver, and terminator for each signal between one PATA host and one or two PATA devices

Note 1 to entry: See ATA8-APT.

3.1.65 PATA device

ATA device that uses the PATA transport protocol

Note 1 to entry: See ATA8-APT.

3.1.66 PATA host

ATA host that uses the PATA transport protocol

Note 1 to entry: See ATA8-APT.

3.1.67 power on

power being applied

3.1.68 power on condition

condition resulting from the events defined by SAM-5 in which the SCSI device performs the power on operations described in SAM-5, this standard, and the applicable command standards

3.1.69 queued command

ATA NCQ command (see 3.1.60) or a SCSI command received by the SATL from an application client for an emulated logical unit while the emulated logical unit is processing another SCSI command

Note 1 to entry: See SAM-5.

3.1.70 reset event

transport protocol specific event that results in a hard reset condition (see SAM-5) or a hardware reset

Note 1 to entry: See ATA8-AAM.

3.1.71 SAS address

identifier assigned to a SAS port or expander device

Note 1 to entry: See SPL-4.

3.1.72 SAS initiator device

device containing SSP initiator ports, STP initiator ports, and/or SMP initiator ports in a SAS domain

Note 1 to entry: See SPL-4.

3.1.73 SAS initiator port

SSP initiator port, STP initiator port, and/or SMP initiator port in a SAS domain

Note 1 to entry: See SPL-4.

3.1.74 SATA device

ATA device that uses the Serial ATA transport protocol

Note 1 to entry: See SATA-3.5a.

3.1.75 SATA host

ATA host that implements the Serial ATA transport protocol

Note 1 to entry: See SATA-3.5a.

3.1.76 SCSI / ATA Translation Layer (SATL)

functional layer defined in this standard that uses an ATA device to emulate objects in a SCSI logical unit, including the device server (see SAM-5), task manager (see SAM-5), and task set (see SAM-5)

3.1.77 SCSI device

device that contains one or more SCSI ports that are connected to a service delivery subsystem and supports a SCSI application protocol

3.1.78 SCSI hard reset

condition resulting from a power on condition or a reset event in which the SCSI device performs a hard reset operation

Note 1 to entry: See SAM-5, SPC-5, and the appropriate command and transport standards.

3.1.79 SCSI initiator port

SCSI initiator device object that acts as the connection between application clients and a service delivery subsystem through which requests and responses are routed

Note 1 to entry: See SAM-5.

3.1.80 SCSI read command

READ (10), READ (12), or READ (16) command

Note 1 to entry: See SBC-4.

3.1.81 SCSI synchronize cache command

SYNCHRONIZE CACHE (10) or SYNCHRONIZE CACHE (16) command

Note 1 to entry: See SBC-4.

3.1.82 SCSI target port

SCSI target device object that contains a task router and acts as the connection between device servers, task managers, and a service delivery subsystem through which requests and responses are routed

Note 1 to entry: See SAM-5.

3.1.83 SCSI verify command

VERIFY (10), VERIFY (12), or VERIFY (16) command

Note 1 to entry: See SBC-4.

3.1.84 SCSI write and verify command

WRITE AND VERIFY (10), WRITE AND VERIFY (12), or WRITE AND VERIFY (16) command

Note 1 to entry: See SBC-4.

3.1.85 SCSI write command

WRITE (10), WRITE (12), or WRITE (16) command

Note 1 to entry: See SBC-4.

3.1.86 Serial ATA (SATA)

serial transport protocol that serves as an ATA service delivery subsystem

Note 1 to entry: See SATA-3.5a.

3.1.87 Serial ATA Tunneled Protocol (STP)

protocol used by STP initiator ports to communicate with STP target ports in a SAS domain

Note 1 to entry: See SPL-4.

3.1.88 Serial Attached SCSI (SAS)

set of protocols and the interconnect defined by SAS-4 and SPL-4

3.1.89 service delivery subsystem

that part of a SCSI I/O system that transmits service requests to a logical unit or SCSI target device and returns logical unit or SCSI target device responses to a SCSI initiator device (see SAM-5) or that part of an ATA I/O system that connects an ATA host port and one or more ATA device ports and is a single path for the transfer of requests and responses between a host and one or more devices (see ATA8-AAM)

3.1.90 service response

device service response or SCSI transport protocol specific service response returned to an application client by the SATL on completion of a SCSI transport protocol service request

Note 1 to entry: See SAM-5.

3.1.91 STP initiator port

SAS initiator device object in a SAS domain that interfaces to a service delivery subsystem with STP

Note 1 to entry: See SPL-4.

3.1.92 STP target port

SAS target device object in a SAS domain that interfaces to a service delivery subsystem with STP

Note 1 to entry: See SPL-4.

3.1.93 STP SATA bridge

expander device object containing an STP target port, a SATA host port, and the functions required to forward information between the STP target port and SATA host port to enable STP initiator ports in a SAS domain to communicate with SATA devices in an ATA domain

Note 1 to entry: See SPL-4.

3.1.94 task management function

task manager service capable of being requested by an application client to affect the processing of one or more commands

Note 1 to entry: See SAM-5.

3.1.95 task set

group of commands within a device server whose interaction is dependent on the task management and ACA rules

Note 1 to entry: See SAM-5.

3.1.96 Transport Protocol-Specific Information Unit (TPSIU)

transport specific information unit used to transport information between initiator ports and target ports that may contain additional information needed by a service delivery subsystem to effect the requested information unit transfers

Note 1 to entry: An example of a TPSIU is the Command Block Wrapper as defined in USB-BOT.

3.1.97 word

sequence of two contiguous bytes considered as a unit

3.2 Symbols and abbreviations

3.2.1 Abbreviations

ACS-4	ATA Command Set-4 standard (see clause 2)
ACS-5	ATA Command Set-5 standard (see clause 2)
APM	Advanced Power Management (see 3.1.2)
ATA	AT Attachment (see 3.1.5)
CDB	command descriptor block (see 3.1.38)
FIS	Frame Information Structure (see SATA-3.5a)
HBA	Host Bus Adapter
LBA	logical block address (see 3.1.52)
LSB	least significant bit (see 3.1.49)
LUN	logical unit number (see 3.1.55)
MSB	most significant bit (see 3.1.59)
n/a	not applicable
NCQ	Native Command Queuing (see 3.1.60)
PATA	Parallel ATA (see 3.1.63)
SAM-2	SCSI Architecture Model-2 standard (see clause 2)
SAM-5	SCSI Architecture Model-5 standard (see clause 2)
SAS	Serial Attached SCSI (see 3.1.88)(see also SPL-4)
SATA	Serial ATA (see 3.1.86)
SATA 3.5a	Serial ATA revision 3.5a specification (see clause 2)
SATL	SCSI / ATA Translation Layer (see 3.1.76)
SBC-4	SCSI Block Commands-4 standard (see clause 2)
SCSI	Small Computer System Interface family of standards
SCT	Smart Command Transport (see ACS-5)
SPC-5	SCSI Primary Commands-5 standard (see clause 2)
STP	Serial ATA Tunneled Protocol (see 3.1.87)
TPSIU	Transport Protocol-Specific Information Unit (see 3.1.96)
VPD	vital product data (see SPC-5)
ZAC-2	Zoned Device ATA Command Set - 2 (see clause 2)
ZBC-2	Zoned Block Commands - 2 (see clause 2)

3.2.2 Units

h	Hours
min	Minutes
ms	Milliseconds
s	Seconds
μs	Microseconds

3.2.3 Mathematical Operators

≠ or NE	not equal
≤ or LE	less than or equal to
±	plus or minus
≈	approximately
x	multiply
+	add
-	subtract
< or LT	less than
= or EQ	equal
> or GT	greater than
≥ or GE	greater than or equal to
INT	The integer result of the specified division operation with any decimal remainder discarded

3.3 Keywords

3.3.1 emulated

keyword designating that the SATL is required to implement functions in addition to or in place of functions supported by an ATA device to provide a defined SCSI capability

3.3.2 invalid

keyword used to describe an illegal or unsupported bit, byte, word, field or code value

Note 1 to entry: Receipt of an invalid bit, byte, word, field or code value shall be reported as an error.

3.3.3 mandatory

keyword indicating an item that is required to be implemented as defined in this standard

3.3.4 may

keyword that indicates flexibility of choice with no implied preference

3.3.5 may or may not

keyword that indicates flexibility of choice with no implied preference

Note 1 to entry: Significant uses of "may or may not" occur in descriptions where attention is being drawn to the "may not" case.

3.3.6 obsolete

keyword indicating that an item was defined in a previous version of a standard but has been removed from that standard

3.3.7 option, optional

keyword that describes features that are not required to be implemented by this standard

Note 1 to entry: If any optional feature defined by this standards is implemented, then it shall be implemented as defined in this standard.

3.3.8 reserved

keyword referring to bits, bytes, words, fields, and code values that are set aside for future standardization.

Note 1 to entry: A reserved bit, byte, word, or field shall be set to zero, or in accordance with a future extension to this standard.

Note 2 to entry: Recipients are not required to check reserved bits, bytes, words, or fields for zero values.

Note 3 to entry: Receipt of reserved code values in defined fields shall be reported as error.

3.3.9 shall

keyword indicating a mandatory requirement

Note 1 to entry: Designers are required to implement all such mandatory requirements to ensure interoperability with other products that conform to this standard.

3.3.10 should

keyword indicating flexibility of choice with a strongly preferred alternative

3.3.11 unspecified

keyword designating that this version of this standard does not specify a translation for a SCSI field

Note 1 to entry: A translation for an unspecified field may be specified by future versions of this standard.

Note 2 to entry: Translation of fields marked unspecified shall not conflict with other standards in the SCSI family of standards.

3.3.12 vendor specific

something (e.g., a bit, field, or code value) is not defined by this standard

Note 1 to entry: Specification of the referenced item is determined by the SCSI device vendor and may be used differently in various implementations.

3.4 Editorial Conventions

Certain words and terms used in this standard have a specific meaning beyond the normal English meaning. These words and terms are defined in 3.1 or in the text where they first appear.

Upper case is used when referring to the name of a numeric value defined in this specification or a formal attribute possessed by an entity. When necessary for clarity, names of objects, procedure calls, arguments or discrete states are capitalized or set in bold type. Names of fields are identified using small capital letters (e.g., NACA bit).

Names of procedure calls are identified by a name in bold type (e.g., **Execute Command**). Names of arguments are denoted by capitalizing each word in the name (e.g., Sense Data is the name of an argument in the **Execute Command** procedure call). For more information on procedure calls see SAM-5.

Quantities having a defined numeric value are identified by large capital letters (e.g., CHECK CONDITION). Quantities having a discrete but unspecified value are identified using small capital letters. (e.g., TASK COMPLETE, indicates a quantity returned by the **Execute Command** procedure call). Such quantities are associated with an event or indication whose observable behavior or value is specific to a given implementation standard.

If there is more than one CDB length for a particular command (e.g., MODE SENSE (6) and MODE SENSE (10)) and the name of the command is used in a sentence without any CDB length descriptor (e.g., MODE SENSE), then the condition specified in the sentence applies to all CDB lengths for that command.

Lists sequenced by lowercase or uppercase letters show no ordering relationship between the listed items.

EXAMPLE 1 - The following list shows no relationship between the named items:

a) various forms of red such as:
   A) crimson; or
   B) amber;
b) blue; or
c) green.

Lists sequenced by numbers show an ordering relationship between the listed items.

EXAMPLE 2 -The following list shows an ordered relationship between the named items:

1) top;
2) middle; and
3) bottom.

Lists are associated with an introductory paragraph or phrase and are numbered relative to that paragraph or phrase (i.e., all lists begin with an a) or 1) entry).

If a conflict arises between text, tables, or figures, then the order of precedence to resolve the conflicts is:

1) text;
2) tables; and
3) figures.

Not all tables or figures are fully described in the text.

Notes and examples do not constitute any requirements.

Notes are numbered consecutively throughout this standard.

3.5 Numeric and character conventions

3.5.1 Numeric conventions

A binary number is represented in this standard by any sequence of digits consisting of only the Arabic numerals 0 and 1 immediately followed by a lower-case b (e.g., 0101b). Underscores or spaces may be included in binary number representations to increase readability or delineate field boundaries (e.g., 0 0101 1010b or 0_0101_1010b).

A hexadecimal number is represented in this standard by any sequence of digits consisting of only the Arabic numerals 0 through 9 and/or the upper-case English letters A through F immediately followed by a lower-case h (e.g., FA23h). Underscores or spaces may be included in hexadecimal number representations to increase readability or delineate field boundaries (e.g., B FD8C FA23h or B_FD8C_FA23h).

A decimal number is represented in this standard by any sequence of digits consisting of only the Arabic numerals 0 through 9 not immediately followed by a lower-case b or lower-case h (e.g., 25).

This standard uses the following convention for representing decimal numbers:

a) the decimal separator (i.e., separating the integer and fractional portions of the number) is a period;
b) the thousands separator (i.e., separating groups of three digits in the portion of a number) is a space;
c) the thousands separator is used in both the integer and fractional portion of a number; and
d) the decimal representation of a year is 1999 not 1 999.

Table 1 shows some examples of decimal numbers using various conventions.

Table 1 — Numbering Conventions

French	English	This standard
0,6	0.6	0.6
3,141 592 65	3.14159265	3.141 592 65
1 000	1,000	1 000
1 323 462,95	1,323,462.95	1 323 462.95

A range of numeric values is represented in this standard in the form “a to z”, where a is the first value included in the range, all values between a and z are included in the range, and z is the last value included in the range (e.g., the representation “0h to 3h” includes the values 0h, 1h, 2h, and 3h).

3.5.2 Bit and byte ordering

In this standard, data structures may be defined by a table. A table defines a complete ordering of elements (i.e., bits, bytes, fields, and dwords) within the structure. The ordering of elements within a table does not in itself constrain the order of storage or transmission of the data structure, but in combination with other normative text in this standard, may constrain the order of storage or transmission of the structure.

In a table, any element that is presented in a row above another element in a lower row is more significant than the lower element and any element presented to the left of another element in the same row is more significant than the element to the right.

If a table shows bit numbering (see table 2), then the LSB is numbered 0 and each more significant bit has the next greater number than the immediately less significant bit. If a table shows numbering of bytes or characters (see table 3), then the most significant byte or character is represented at the lowest number and each less significant byte or character has the next greater number than the immediately more significant byte.

In a field in a table consisting of more than one bit that contains a single value (e.g., a number), the LSB is shown on the right and the MSB is shown on the left (e.g., in a byte, bit 7 is the MSB and is shown on the left, bit 0 is the LSB and is shown on the right). The MSB and LSB are not labeled if the field consists of eight or fewer bits. The MSB and LSB are labeled if the field consists of more than eight bits and has no internal structure defined.

In a field in a table consisting of more than one byte that contains multiple fields each with their own values (e.g., a descriptor), there is no MSB and LSB of the field itself and thus there are no MSB and LSB labels. Each individual field has an MSB and LSB, but they are not labeled.

In a field containing a text string (e.g., ASCII or UTF-8), only the MSB of the first character and the LSB of the last character are labeled. See ACS-5 for ATA string conventions.

Multiple byte fields are represented with only two rows, with the non-sequentially increasing byte number denoting the presence of additional bytes.

A dword consists of 32 bits. Table 2 shows a dword containing a single value, where the MSB is on the upper

left in bit 31 and the LSB is on the lower right in bit 0.

Table 2 — Example of ordering of bits and bytes within a multi-byte element

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB) Bit 31	Bit 30	Bit 29	Bit 28	Bit 27	Bit 26	Bit 25	Bit 24
1	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16
2	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
3	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)

Table 3 shows a dword containing four one-byte fields, where byte 0 (the first byte) is on the left and byte 3 (the fourth byte) is on the right. Each byte has an MSB on the left and an LSB on the right.

Table 3 — Example of ordering of bits and bytes within a multiple element

Bit Byte	7	6	5	4	3	2	1	0
0	First byte							
	Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
1	Second byte							
	Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
2	Third byte							
	Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
3	Fourth byte							
	Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)

3.5.3 Byte encoded character strings conventions

When this standard requires one or more bytes to contain specific encoded character, the specific characters are enclosed in single quotation marks. The single quotation marks identify the start and end of the characters that are required to be encoded but are not themselves to be encoded. The characters that are to be encoded are shown in exactly the case that is to be encoded.

An ASCII space character (i.e., 20h) may be represented in a string by the character '¬' (e.g., 'SCSI¬device').

The encoded characters and the single quotation marks that enclose them are preceded by text that specifies the character encoding methodology and the number of characters required to be encoded.

EXAMPLE - Using the notation described in this subclause, stating that eleven ASCII characters 'SCSI¬device' are to be encoded would be the same as writing out the following sequence of byte values: 53h 43h 53h 49h 20h 64h 65h 76h 69h 63h 65h.

3.5.4 Notation for command descriptions

The description of each command begins with a subclause describing the general method applied in translating the SCSI command to the corresponding ATA commands, along with any constraints and special considerations that may apply to the translation applied.

The subclause describing the general translation method for each command contains a table formatted as shown in table 4 with two columns as follows:

a) the first column lists each of the fields in the SCSI CDB (see SPC-5 and SBC-4); and
b) the second column is either a brief description of the corresponding ATA features and functions used to implement the identified SCSI field, or a reference to a subsequent subclause containing a more lengthy description of the method of emulation or implementation.

Table 4 — Format for translated command field descriptions

Field	Description
IMPLEMENTED OR EMULATED	A brief identification of the corresponding ATA features and functions, or a paragraph reference if there are special considerations that need to be applied in the use of the corresponding ATA features and functions that require a separate paragraph of description.
SUMMARY EMULATED	Summary field with more detailed structure.
UNSPECIFIED	Unspecified

Tables listing fields in mode pages have an additional column that defines whether the field is changeable or not.

3.5.5 Use of field names defined in ATA standards and specifications

This standard discusses fields and values defined in other standards and specifications (e.g.,the ATA8-APT standard, the ATA8-AST standard, the ACS-5 standard, and the ATA8-AAM standard) developed by T13 and the SATA-3.5a specification. Such fields and values discussed in this standard are shown using the same notation conventions used in the standards where those fields and values are defined.

When this standard uses terms defined in ATA standards or the SATA-3.5a specification, the following conventions apply:

a) the names of abbreviations, commands, and acronyms used as signal names are in all uppercase (e.g., READ FPDMA QUEUED);
b) names of device registers, fields in data structures, and other defined terms are in small upper-case letters (e.g., FEATURES field);
c) the expression “word n” or “bit n” shall be interpreted as indicating the content of word n or bit n;
d) bit names are shown in small uppercase letters (e.g., REPORT ZONES EXT SUPPORTED bit); and
e) bits n:m denotes a set of bits, for example, bits 7:0.

3.5.6 Flowcharts

This standard uses flowcharts that ISO 5807:1985 (R2019) defines as program flowcharts. Figure 3 shows an example flowchart.

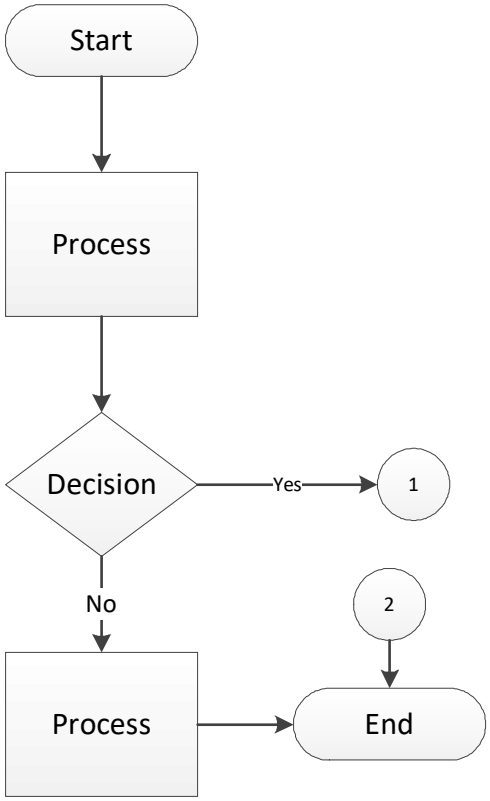


Figure 3 — Example flowchart

The following types of symbols are shown in figure 3:

a) a termination (e.g., start and end) symbol;
b) a process symbol;
c) a decision symbol; and
d) a reference (e.g., 1 and 2) symbol.

A termination symbol shows the starting point for the flowchart or the ending point for the flowchart.

A process symbol shows any kind of processing function that occurs as a result of entering this condition from a previous symbol.

A decision symbol shows a point in the progression of the flowchart from which there is more than one exit possibility of which only one is satisfied by the condition described within the decision symbol.

A reference symbol shows a connection to or from another flowchart that have the same numbers in both the source flowchart and destination flowchart.

4 General

This standard defines a SCSI / ATA Translation Layer (i.e., the SATL) that provides a method for a SCSI application layer (see SAM-5) to access SATA devices or PATA devices by representing ATA devices as SCSI peripheral devices.

Implementations of SCSI / ATA Translation may provide varying levels of SCSI functionality.

EXAMPLE 1 - The SATL may provide a level of SCSI emulation that is indistinguishable from native SCSI devices in terms of reported capabilities. Such SATL implementations need little guidance from this standard to effect interoperability since other SCSI protocol standards define all that is required to establish interoperability.

EXAMPLE 2 - The SATL may implement a subset of SCSI, have limited or no capability to maintain persistent information about the characteristics or state of the emulated SCSI device, have limited capability to manage device state information that carries forward from one command to the next, and maintain little or no capability to coordinate between multiple commands outstanding at a time. The characteristics and behavior of the underlying ATA devices in these minimal implementations of the SATL are expected to be more visible to the SCSI application clients.

This standard provides a set of definitions, conventions, and guidelines for:

a) the consistent reporting by the SATL of capabilities of emulated SCSI devices;
b) the consistent observed behavior for SCSI operations; and
c) the consistent identification of the attached devices by the application clients.

These provisions allow application clients to observe consistent behavior whether or not the application clients recognize the presence of a SATL in a system.

By defining expected behavior in terms of the SCSI commands received, corresponding activity in the ATA domain, and expected SCSI responses based on the results of activity in the ATA domain this standard eliminates:

a) incompatibility between legacy SCSI / ATA Translation implementations; and
b) SCSI application client / ATA device interdependence.

This standard refers to behaviors for SCSI devices defined in SBC-4, ZBC, and SPC-5. Unless otherwise specified, any behaviors that are optional in SBC-4 or SPC-5 are optional for devices implementing SCSI / ATA Translation.

If the SATL receives a SCSI request specifying any value in any field of the CDB that the SATL does not support then, unless otherwise specified in the description of the command, the SATL shall terminate the SCSI command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB (see SPC-5).

If the SATL receives a SCSI request specifying any value in any field of the parameter data that the SATL does not support then, unless otherwise specified in the description of the parameter, the SATL shall terminate the SCSI command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST (see SPC-5).

5 SCSI architecture

5.1 SCSI architcture overview

Clause 5 defines SCSI / ATA translation of features and functions that impact the representation of the domains defined in SAM-5 and ATA8-AAM. Figure 4 shows a SATL providing a communication path between a SCSI application client and an ATA device.

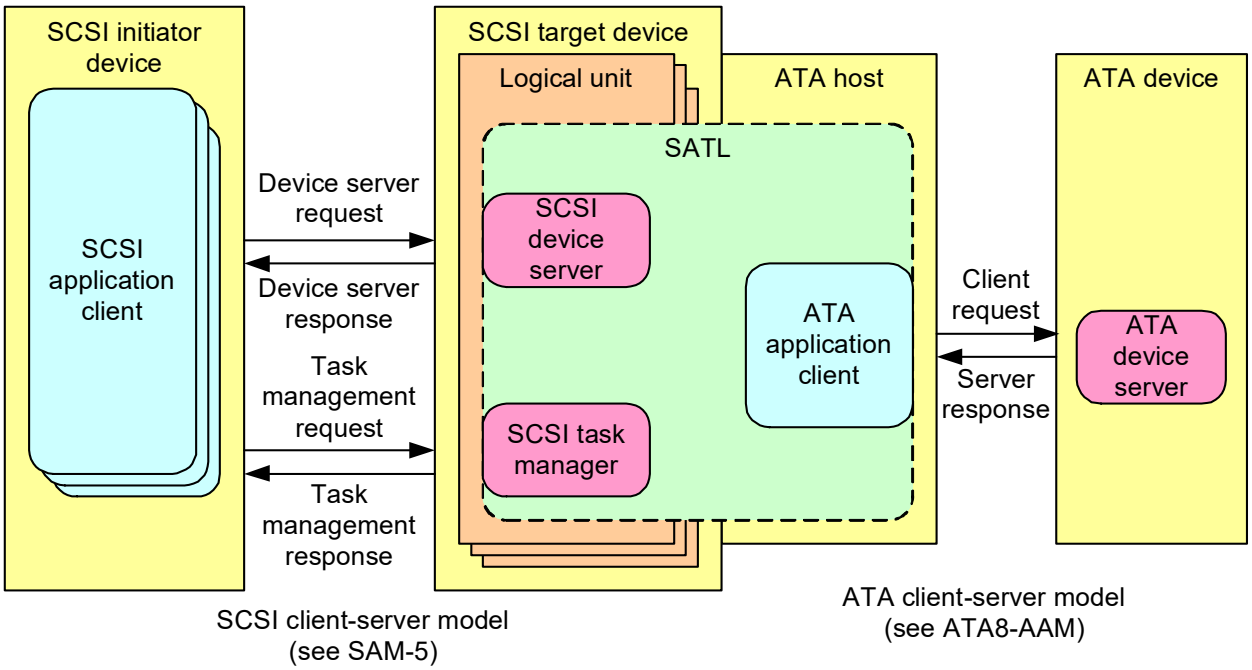


Figure 4 — Example of a SATL between a SCSI application client and an ATA device

The SATL provides the communication path between a SCSI application client and an ATA device by:

a) emulating a SCSI logical unit;
b) integrating an ATA host; and
c) providing the translation that links them together.

This standard defines SCSI / ATA translation using SCSI and ATA command sets. This standard does not define the mapping of transport capabilities as defined at the SCSI transport protocol layer and the ATA protocol interconnect layer.

EXAMPLE 1 - An implementation utilizing a SATL may include a SCSI transport. A SATL may appear in different configurations as shown in figure 5, figure 6, and figure 7. Figure 5 shows a SATL contained within a SCSI to ATA protocol bridge, where the ATA device is being accessed by an ATA host port and the SATL is being accessed with a SCSI target port using a SCSI transport protocol.

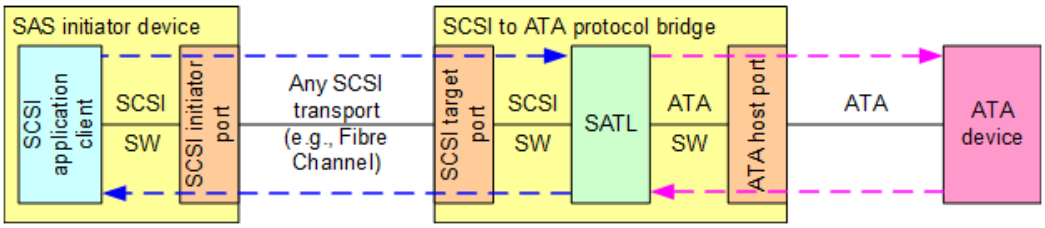


Figure 5 — SATL contained within a SCSI to ATA protocol bridge

EXAMPLE 2 - Figure 6 shows an ATA HBA directly connected to an ATA device. The SATL provides SCSI transport protocol layer services to a SCSI application client in accordance with SAM-5.

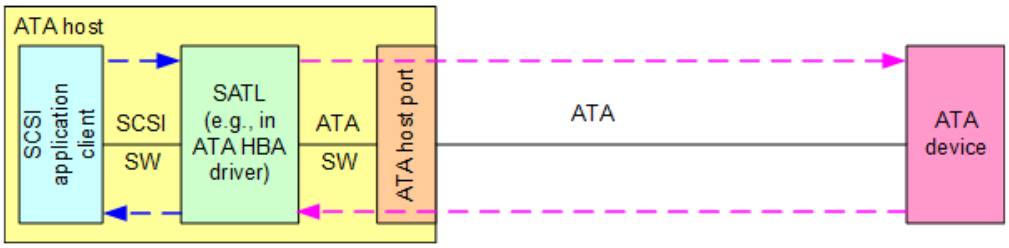


Figure 6 — SATL contained within an ATA host

EXAMPLE 3 - Figure 7 shows an ATA device accessed by a SAS STP initiator port (see SPL-4) through a SAS interconnect. The SAS initiator device includes a SATL to provide the SCSI transport protocol layer services to the application client in accordance with SAM-5.

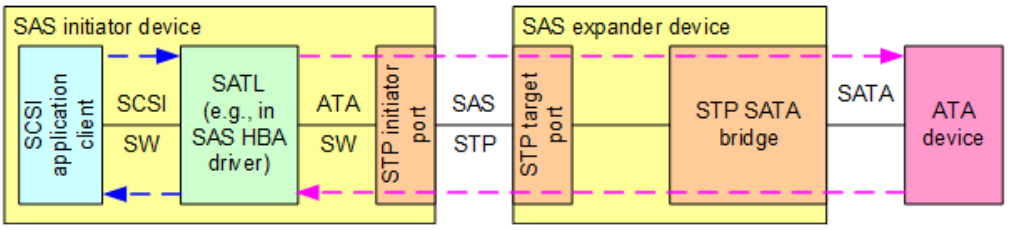


Figure 7 — SATL contained in a SAS initiator device

5.2 Multi-Initiator Configurations

SAM-5 defines configurations that may expose multiple I_T nexuses. Operation of a SATL exposed to multiple I_T nexuses is partially specified in this standard.

5.3 Unit attention condition

The SATL shall report events affecting the state of the emulated SCSI device to the SCSI application clients by emulating unit attention conditions (see SAM-5).

A SATL that detects a link reset sequence for a Serial ATA device or initiates any reset of an ATA device shall establish a unit attention condition on behalf of the emulated logical unit corresponding to the ATA device with the sense key set to UNIT ATTENTION and the additional sense code set to POWER ON, RESET, OR BUS DEVICE RESET OCCURRED for the SCSI initiator port associated with each I_T nexus. The method a SATL uses to detect a link reset sequence on the SATA link is vendor specific.

If the SATL detects that the ATA device has initialized new microcode without error, then the SATL shall establish a unit attention condition for the initiator port associated with all I_T nexuses except the I_T nexus on which the set of WRITE BUFFER commands was received, with the additional sense code set to MICROCODE HAS BEEN CHANGED.

The SATL shall report unit attention conditions, in accordance with SAM-5, regardless of whether the condition results from accessing an ATA device or a condition internal to the SATL.

5.4 Errors in ATA commands

If a SCSI command is translated into one or more ATA commands and one of the ATA commands completes with an error, the SATL shall terminate processing of the SCSI command and report the error as described in clause 11.

If the SCSI transport protocol for the SATL supports returning sense data as defined in SAM-5, then the SATL shall return the sense data associated with a CHECK CONDITION status as defined in SAM-5.

If the SCSI transport protocol for the SATL does not support returning sense data as defined in SAM-5, then the SATL shall establish a contingent allegiance (see SAM-2) condition and return sense data in response to a REQUEST SENSE command (see 8.10) as described in SAM-2.

When interpreting data from an ATA command, the SATL shall only use the data if:

a) no error was reported for the command; and
b) the returned data:
   A) does not contain a checksum; or
   B) contains a checksum and that checksum is valid.

5.5 ATA nexus loss

An ATA nexus loss event occurs if the SATL loses communication with the SATA device. If an ATA nexus loss event occurs, then:

a) the SATL shall terminate all SCSI commands being processed for the corresponding logical unit; and
b) the SATL shall establish a unit attention condition for each I_T nexus with the additional sense code set to:
   A) if the SATL is able to determine that the ATA device is no longer physically present, REPORTED LUNS DATA HAS CHANGED;

B) if the SATL is unable to determine if the ATA device is physically present or not, INQUIRY DATA HAS CHANGED; or
C) if the SATL is able to determine that the ATA device is present, INTERNAL TARGET FAILURE.

The method by which the SATL determines physical presence or absence of the ATA device is outside the scope of this standard (e.g., using cold presence detect (see SATA-3.5a) or a change in the ELEMENT STATUS CODE field in the Device or Array Device element (see SES-3)).

NOTE 1 - SAM-5 and SPC-5 define how the SATL processes subsequent commands if the logical unit is no longer available (i.e., incorrect logical unit selection).

If the ATA nexus is restored or the SATL detects a power on condition for an ATA device, then the SATL shall perform the processing described in 5.6 for those events.

5.6 ATA hardware and software reset processing

The hardware reset routines performed by the ATA device include the actions performed by the ATA device for an ATA software reset (see ATA8-AAM), the actions defined in ACS-5, and the applicable ATA transport standards.

An ATA hardware reset may be caused either by the SATL or by the ATA device. If an ATA hardware reset or an ATA software reset occurs except as part of processing a SCSI task management function (see 6.4), then the SATL shall:

a) terminate processing of all commands for each logical unit affected by the reset;
b) restore the ATA volatile settings of the ATA device (e.g., by sending an ATA SET FEATURES command) to values consistent with:
   A) the saved values of mode pages if savable mode pages are supported and available; or
   B) default values if savable mode pages are not supported or are not available;

   and
c) establish a unit attention condition for each I_T_L nexus with the additional sense code set to POWER ON, RESET, OR BUS DEVICE RESET OCCURRED.

If an ATA hardware reset occurs and the ATA device supports the ATA Sense Data Reporting feature set (i.e., ATA IDENTIFY DEVICE data log SENSE DATA SUPPORTED bit set to one), then the SATL shall enable Sense Data Reporting by sending an ATA SET FEATURES - Enable/Disable the Sense Data Reporting feature set command (i.e., subcommand C3h with bit 0 of the COUNT field set to one) to the ATA device.

If the ATA SET FEATURES command completes:

a) without error, then the SATL shall process the ATA SENSE DATA AVAILABLE bit in the ATA STATUS field as described in clause 11; or
b) with error, then the SATL shall ignore the ATA SENSE DATA AVAILABLE bit in the ATA STATUS field.

5.7 Maximum LBA

The ATA maximum LBA value is one less than the ATA ACCESSIBLE CAPACITY field (see ACS-5).

5.8 Translation of Large Physical Sectors

For SCSI large physical sector operation, see SBC-4 for information on the:

a) Logical Blocks model;
b) Physical Blocks model; and
c) READ CAPACITY (16) command.

For ATA large physical sector operation, see ACS-5 for information on the:

a) Long Logical Sector (LLS) feature set;
b) Long Physical Sector (LPS) feature set;
c) ATA read log command requesting the IDENTIFY DEVICE data log; and
d) Implementation Guidelines for 1 024 and 4 096 Byte Sector Sizes annex.

Table 5 describes parameters used in the translation and operation of large physical sectors and where the values for those parameters are found in both SCSI and ATA environments.

Table 5 — Large physical block geometry parameters

Parameter	SCSI	ATA [a]
Logical Sector Size [b]	READ CAPACITY (16) parameter data LOGICAL BLOCK LENGTH IN BYTES field	ATA IDENTIFY DEVICE data log LOGICAL SECTOR SIZE field
Logical Sectors Per Physical Sector Exponent	READ CAPACITY (16) parameter data LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field	ATA IDENTIFY DEVICE data log LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field
Logical Sectors Per Physical Sector	$2^{(\text{SCSI LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT})}$	$2^{(\text{ATA LOGICAL TO PHYSICAL SECTOR RELATIONSHIP})}$
Logical Sector Alignment [c]	READ CAPACITY (16) parameter data LOWEST ALIGNED LOGICAL BLOCK ADDRESS field	ATA IDENTIFY DEVICE data log LOGICAL SECTOR OFFSET field

[a] The ATA IDENTIFY DEVICE data log provides details on when the LOGICAL SECTOR SIZE field, LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field, and LOGICAL SECTOR OFFSET field are valid.

[b] SCSI Logical Sector Size is measured in bytes, whereas ATA Logical Sector Size is measured in words.

[c] The relationship between the SCSI and ATA logical sector alignment is:

SCSI Logical Sector Alignment = (y - (ATA Logical Sector Alignment) modulus y) modulus y

where

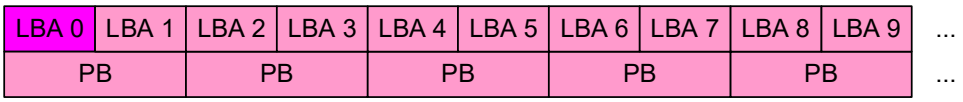
y = ATA Logical Sectors Per Physical Sector

(e.g., If the ATA IDENTIFY DEVICE data log LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field is set to 3h and the ATA IDENTIFY DEVICE data log LOGICAL SECTOR OFFSET field is set to 0001h, then the SCSI READ CAPACITY (16) parameter data LOWEST ALIGNED LOGICAL BLOCK ADDRESS field is set to 0007h)

Figure 8, figure 9, and figure 10 show examples of physical to logical sector mapping.

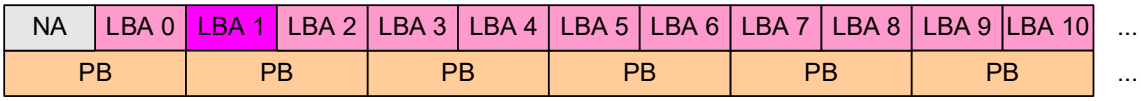
ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 1h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 1h
(indicating 2^1 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 0h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 0h



ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 1h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 1h
(indicating 2^1 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 1h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 1h



Key:
LBA n = logical block with LBA n
PB = physical block
NA = not accessible or addressable

The LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field and LOWEST ALIGNED LOGICAL BLOCK ADDRESS field are in the READ CAPACITY (16) parameter data.

Figure 8 — Logical Sector Alignment Example 1

ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 2h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 2h
(indicating 2^2 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 0h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 0h

LBA 0	LBA 1	LBA 2	LBA 3	LBA 4	LBA 5	LBA 6	LBA 7	...
PB				PB				...

ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 2h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 2h
(indicating 2^2 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 3h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 1h

NA	LBA 0	LBA 1	LBA 2	LBA 3	LBA 4	LBA 5	LBA 6	LBA 7	LBA 8	...
PB			PB			PB				...

ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 2h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 2h
(indicating 2^2 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 2h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 2h

NA	LBA 0	LBA 1	LBA 2	LBA 3	LBA 4	LBA 5	LBA 6	LBA 7	LBA 8	LBA 9	...
PB			PB			PB					...

ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 2h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 2h
(indicating 2^2 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 1h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 3h

NA	LBA 0	LBA 1	LBA 2	LBA 3	LBA 4	LBA 5	LBA 6	LBA 7	LBA 8	LBA 9	LBA 10	...
PB				PB			PB					...

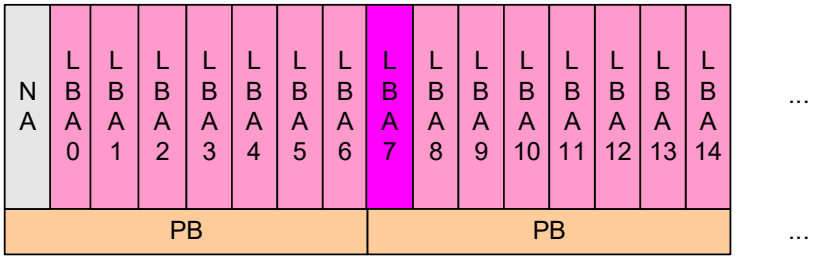
Key:
LBA n = logical block with LBA n
PB = physical block
NA = not accessible and not addressable

The LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field and LOWEST ALIGNED LOGICAL BLOCK ADDRESS field are in the READ CAPACITY (16) parameter data.

Figure 9 — Logical Sector Alignment Example 2

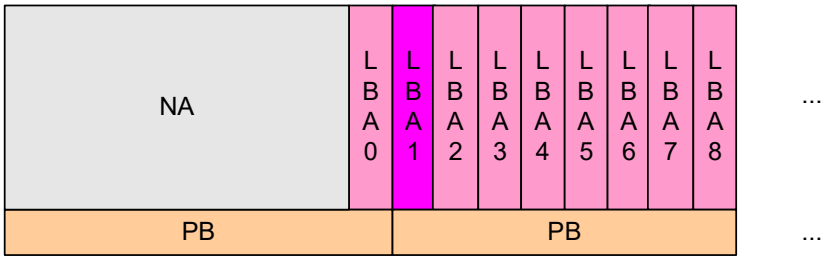
ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 3h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 3h
(indicating 2^3 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 1h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 7h



ATA: LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field set to 3h
SCSI: LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field set to 3h
(indicating 2^3 logical blocks per physical block)

ATA: LOGICAL SECTOR OFFSET field set to 7h
SCSI: LOWEST ALIGNED LOGICAL BLOCK ADDRESS field set to 1h



Key:
LBA n = logical block with LBA n
PB = physical block
NA = not accessible or addressable

The LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT field and LOWEST ALIGNED LOGICAL BLOCK ADDRESS field are in the READ CAPACITY (16) parameter data.

Figure 10 — Logical Sector Alignment Example 3

5.9 Reservations

The translation of reservation operations as defined in SPC-5 is unspecified. Table 6 defines the behavior of commands defined in this standard in the presence of reservations.

Table 6 — Commands defined in this standard allowed in the presence of various reservations

Command	Addressed logical unit has this type of persistent reservation held by another I_T nexus				
	From any I_T nexus		From registered I_T nexus (RR all types)	From I_T nexus not registered	
	Write Exclusive	Exclusive Access		Write Exclusive - RR	Exclusive Access - RR
ATA PASS-THROUGH (12)	Conflict	Conflict	Allowed	Conflict	Conflict
ATA PASS-THROUGH (16)	Conflict	Conflict	Allowed	Conflict	Conflict
ATA PASS-THROUGH (32)	Conflict	Conflict	Allowed	Conflict	Conflict

Key:
RR = Registrants Only or All Registrants
Allowed = Commands received from I_T nexuses not holding the reservation or from I_T nexuses not registered if a registrants only or all registrants type persistent reservation is present should complete normally.
Conflict = Commands received from I_T nexuses not holding the reservation or from I_T nexuses not registered if a registrants only or all registrants type persistent reservation is present shall not be performed and the device server shall complete the command with RESERVATION CONFLICT status.

6 Command management model

6.1 Command management model overview

A SATL may support the full task management model or the basic task management model as well as specific features of the task management model (e.g., SIMPLE and ORDERED task attributes) depending on the task management capabilities of the SATL and whether the SATL supports NCQ.

6.2 Multiple command processing

6.2.1 Comparison of SCSI task set management and ATA queuing

Examples of the differences between SCSI task set management and ATA queuing methods are shown in table 7.

Table 7 — Comparison of SCSI task set management and ATA queuing methods

Feature [a]	SCSI	NCQ
Ordering	Specified by task attributes (e.g., SIMPLE, ORDERED) associated with each command	Always at the discretion of the device
Queue depth	Indeterminate	Fixed at 1 to 32 commands as reported in the QUEUE DEPTH field in the ATA IDENTIFY DEVICE data log
Queue full reporting	TASK SET FULL status	n/a
Queue full management	Target device manages and indicates via TASK SET FULL status	ATA host managed
Queued commands	Task set management is applicable to all commands	Limited to ATA NCQ commands
ATA non-NCQ commands received while one or more ATA NCQ commands are being processed	n/a	Receipt of any non-NCQ command is an error
Error handling	Controlled with mode parameters	Any error aborts all ATA NCQ commands

[a] Queue is a term used to represent a SCSI task set or an ATA queue.

6.2.2 Command translation overview

A SATL that translates SCSI commands to an ATA device using NCQ should implement the SAM-5 task management functions. If the SAM-5 task management functions are not implemented, then the SATL shall implement the basic task management model from SAM-2.

The SATL may implement internal queuing regardless of the version of the SCSI architecture model implemented.

6.2.3 Mapping of SCSI commands to ATA NCQ commands

A SATL that translates SCSI commands to an ATA device using NCQ, whether or not the SATL also queues commands internally, shall either:

a) indicate support for the basic task management model in standard INQUIRY data and follow the rules for the basic task management model (see SAM-2); or
b) indicate support for the full task management model in standard INQUIRY data and set the QERR field of the Control mode page (see 10.4.6) as follows:
   A) a value of 01b if the SATL does not resend an ATA NCQ commands aborted by the ATA device due to an error condition on any one of the ATA NCQ commands; or
   B) a value other than 01b if the SATL resends all other ATA NCQ commands (i.e., except the one in error, or as described in 6.2.7) aborted by the ATA device due to an error condition on any one of the ATA NCQ commands.

For each SCSI command that the SATL translates to ATA NCQ commands , the SATL shall allocate an available tag value (e.g., for NCQ, the value corresponding to the position of a bit set to zero in the SACTIVE field (see SATA-3.5a)). The SATL shall maintain a mapping between allocated ATA queued command tags and the corresponding SCSI command identifier (see SAM-5).

The SATL should use the maximum queue depth supported by the ATA device (i.e., indicated by the QUEUE DEPTH field in the ATA IDENTIFY DEVICE data log) and may either:

a) return a status of TASK SET FULL in response to a SCSI command sent to the corresponding emulated SCSI logical unit if the ATA device represented has the maximum number of ATA NCQ commands outstanding; or
b) queue the SCSI command and return TASK SET FULL status if the SATL exhausts internal queueing resources.

6.2.4 Mechanism for processing some commands as NCQ commands

The ACS-5 standard defines a mechanism for NCQ encapsulation of some commands. Use of this mechanism allows these commands to be processed without quiescing the ATA device.

As defined in ACS-5, the SATL may use an ATA device command (see ACS-5) or an NCQ encapsulation of an ATA device command, if any. If the SATL chooses to use the NCQ encapsulation of an ATA command, then this standard models the translation of a SCSI command to an ATA encapsulated command as:

1) translation of the SCSI command to the equivalent ATA device command as defined in this standard; and
2) ATA NCQ encapsulation of the resulting ATA device command as defined in ACS-5 and SATA 3.5a.

6.2.5 Commands the SATL queues internally

If the translation of a SCSI command requires the SATL to send an ATA non-NCQ command to the ATA device while one or more ATA commands are active, then the SATL shall:

a) suspend processing of that SCSI command, and:
   1) maintain the SCSI command in a task set;
   2) resume processing of that SCSI command when the ATA device returns command complete for all ATA commands the SATL has previously sent to the ATA device; and
   3) after that SCSI command completes, resume processing of other SCSI commands;
b) return TASK SET FULL status for that SCSI command; or
c) return BUSY status for that SCSI command.

6.2.6 Command queuing with multiple I_T nexuses

In some configurations the SATL may receive SCSI requests from multiple I_T nexuses. If the SATL receives SCSI requests from multiple I_T nexuses (e.g., the configuration shown in figure 5), as specified in SAM-5, the command identifiers maintained in the SATL mapping of command identifiers to NCQ tags shall be qualified by the I_T nexus from which the command was received. If translating from an NCQ tag to the corresponding SCSI command identifier, then the SATL shall determine the correct I_T nexus using the qualification information associated with the SCSI command identifier. The SATL may return TASK SET FULL status even if the ATA device has available NCQ tags in order to maintain tags available for other I_T nexuses.

6.2.7 Collateral abort with ATA NCQ commands

6.2.7.1 Introduction

An ATA error while NCQ commands are active causes all active commands to be aborted. The faulted ATA command is identified from the NCQ Command Error log (see ACS-5 and SATA 3.5a).

The SATL shall process aborted ATA commands as shown in table 8, based on the relationship between the errors reported by the ATA device and the SCSI commands associated with the aborted ATA commands.

Table 8 — SATL processing of ATA device aborts of ATA NCQ commands

Association of a SCSI command with the faulted SCSI command [a]	Value of the QERR field set in the Control mode page (see 10.4.6)	Actions taken by the SATL
The SCSI command is the faulted SCSI command [a].	00b	The SATL shall terminate the affected SCSI command with CHECK CONDITION status with the sense key and the additional sense code set based on the reported ATA error as described in clause 11.
	01b	
The SCSI command is a different SCSI command from the same SCSI initiator port (see SAM-5) as the faulted SCSI command [a].	00b	If the ATA device is an ATA host managed zoned device and the SCSI command is a write command, then the SATL may terminate the affected SCSI command as described in 6.2.7.2. If the SATL does not terminate the SCSI command then the SATL shall resend the ATA command and continue processing the corresponding SCSI command.
	01b	The SATL shall: a) terminate the affected SCSI command; b) not return status for the affected SCSI command; and c) not retry the aborted ATA command.
The SCSI command is a different SCSI command from a different SCSI initiator port (see SAM-5) than the faulted SCSI command [a].	00b	If the ATA device is an ATA host managed zoned device and the SCSI command is a write command, then the SATL may terminate the affected SCSI command as described in 6.2.7.2. If the SATL does not terminate the SCSI command then the SATL shall resend the ATA command and continue processing the corresponding SCSI command.
	01b	The SATL shall terminate the affected SCSI command and establish a unit attention condition (see SAM-5) for the affected initiator port [b] with the additional sense code set to COMMANDS CLEARED BY ANOTHER INITIATOR.

[a] The faulted SCSI command is the SCSI command for which an error condition caused the ATA device to abort the related ATA command.

[b] The affected initiator port is the initiator of the SCSI command received from a different SCSI initiator port.

6.2.7.2 Reporting for writes terminated due to ATA collateral abort

If the SATL terminates a SCSI write command as described in 6.2.7.1, then the SATL shall:

a) terminate that SCSI command with CHECK CONDITION status with the sense key set to DATA PROTECT and the additional sense code set to SOME COMMANDS CLEARED BY QUEUING LAYER EVENT; and
b) if the device is a host managed zoned device, then:
   1) use the ATA NCQ Command Error log (see ACS-5) to determine the value of the bit in the WRITE POINTER VALID field, that is associated with the NCQ tag for the aborted ATA command that corresponds to the terminated SCSI write command; and
   2) if that bit is set to one, then set the INFORMATION field to the value reported in the WRITE POINTER [N] field in the NCQ Command Error log.

6.3 Command priority

A SATL that supports NCQ may also support SCSI command priority. SCSI command priority supports 16 priorities (0 to 15), whereas SATA NCQ only supports two priorities via the PRIO field in the ATA READ FPDMA QUEUED command, ATA WRITE FPDMA QUEUED command, RECEIVE FPDMA QUEUED command, and SEND FPDMA QUEUED command. The SATL shall translate SCSI command priorities to SATA NCQ priority as shown in table 9.

Table 9 — SCSI Command priority to NCQ PRIO field mapping

SCSI command priority	SATA NCQ PRIO field
0	00b
1 to 3	10b
4 to 15	00b

6.4 Task management functions

6.4.1 Overview

The translation of SCSI task management functions to ATA equivalents is described in 6.4.

6.4.2 Aborting ATA NCQ commands

Some task management functions processed by the SATL may result in ATA commands aborted by ATA collateral abort (see 6.2.7) affecting SCSI commands other than the SCSI command specified in the task management function request. The translation for each task management function and definition of how the SATL processes the I_T_L nexuses and SCSI commands affected by the task management function (e.g., ABORT TASK (see 6.4.4)) is described in 6.4.

Processing some task management functions requires the SATL to abort one or more ATA commands being processed by an ATA device.

The SATL shall abort an ATA NCQ command being processed by an ATA device by sending an ATA CHECK POWER MODE command or an ATA read log command requesting log page 10h to the ATA device.

NOTE 2 - The ATA CHECK POWER MODE command is used to abort ATA NCQ commands because it is an ATA non-NCQ command that does not transfer data. The ATA CHECK POWER MODE command does not affect ATA volatile settings.

6.4.3 Aborting ATA non-NCQ commands

To abort an ATA non-NCQ command the SATL shall:

a) send an ATA software reset to the ATA device; and
b) restore ATA volatile settings to values consistent with current mode parameter settings.

6.4.4 ABORT TASK

The service request for the ABORT TASK task management function (see SAM-5) is:

Service Response = ABORT TASK (IN (I_T_L nexus, Command Identifier)).

If no ATA commands associated with the I_T_L nexus and command identifier specified in the ABORT TASK task management function are outstanding to the ATA device, then the SATL shall abort the command for the specified I_T_L nexus and command identifier from the SATL internal context and respond to the ABORT TASK task management function with a service response of FUNCTION COMPLETE (see SAM-5).

If the ATA device is processing one or more ATA commands that are related to the specified I_T_L nexus and command identifier, then the SATL shall either:

a) allow the ATA commands to complete as follows:
   1) wait until the ATA device returns command complete for the ATA commands;
   2) if the completed ATA command completes processing of the SCSI command specified by the I_T_L nexus and command identifier, then return completion status for that SCSI command; and
   3) return a service response of FUNCTION COMPLETE for the ABORT TASK task management function regardless of whether or not completion status was returned for the SCSI command specified by the command identifier;

   or
b) abort the ATA commands (see 6.4.2) for the specified I_T_L nexus and respond to the ABORT TASK task management function with a service response of FUNCTION COMPLETE.

If aborting the ATA commands related to the SCSI command specified by the I_T_L nexus and the command identifier results in one or more other ATA commands being aborted by ATA collateral abort, (see clause 6.2.7) then the SATL shall:

a) if the SATL supports ATA abort retry, then the SATL shall retry all ATA commands aborted by ATA collateral abort as described in 6.2.7 and continue processing the affected SCSI commands; or
b) if the SATL does not support ATA abort retry, then for each I_T nexus affected by an ATA command aborted by ATA collateral abort the SATL shall:
   1) terminate all but one of the SCSI commands without returning a function result; and
   2) terminate processing of the remaining SCSI command by returning CHECK CONDITION status with the sense key set to UNIT ATTENTION and the additional sense code set to COMMANDS CLEARED BY DEVICE SERVER.

6.4.5 ABORT TASK SET

The service request for the ABORT TASK SET task management function (see SAM-5) is:

Service Response = ABORT TASK SET (IN (I_T_L nexus)).

If the ATA device is not processing ATA commands for SCSI commands associated with the specified I_T_L nexus, then the SATL shall abort all commands for the specified I_T_L nexus from the SATL internal context and respond to the ABORT TASK SET task management function with a service response of FUNCTION COMPLETE.

If the ATA device is processing any ATA commands related to the specified I_T_L nexus, then the SATL shall either:

a) allow the ATA commands to complete as follows:
   1) wait until the ATA device returns command complete for the ATA commands;
   2) if the completed ATA command does not complete processing a SCSI command in the task set, then remove that SCSI command from the SATL internal task set;
   3) if the completed ATA command completes processing a SCSI command in the task set, then return completion status for that SCSI command; and
   4) after all ATA commands return completion status, return a service response of FUNCTION COMPLETE for the ABORT TASK SET task management function;

   or

b) abort outstanding ATA commands (see 6.4.2) for the specified I_T_L nexus, remove the SATL internal context for the SCSI commands, and respond to the ABORT TASK SET task management function with a service response of FUNCTION COMPLETE.

If aborting ATA commands for the specified I_T_L nexus results in ATA commands aborted by ATA collateral abort (see 6.2.7) that are related to processing SCSI commands for an I_T_L nexus other than the specified I_T_L nexus, then:

a) if the SATL supports ATA abort retry, then the SATL shall resend all ATA commands aborted by ATA collateral abort and continue processing of the affected SCSI commands; or
b) if the SATL does not support ATA abort retry, then for each I_T_L nexus other than the specified I_T_L nexus that had one or more SCSI commands affected due to ATA commands aborted by ATA collateral abort, the SATL shall abort all commands for each affected I_T_L nexus and establish a unit attention condition for each affected I_T_L nexus with the additional sense code set to COMMANDS CLEARED BY ANOTHER INITIATOR.

NOTE 3 - A SATL that does not support ATA abort retry is not able to comply with the SAM-5 requirement that ABORT TASK SET not abort commands other than those in the specified I_T_L nexus.

6.4.6 CLEAR ACA

The service request for the CLEAR ACA task management function (see SAM-5) is:

Service Response = CLEAR ACA (IN (I_T_L nexus)).

The SATL shall respond to a CLEAR ACA task management function with a service response of FUNCTION REJECTED.

6.4.7 CLEAR TASK SET

The service request for the CLEAR TASK SET task management function (see SAM-5) is:

Service Response = CLEAR TASK SET (IN (I_T_L nexus)).

If the SATL indicates support for the full task management model (see 6.2.3), then the SATL shall process the CLEAR TASK SET task management function in accordance with a single task set that includes SCSI commands for all I_T_L nexuses (i.e., the TST field in the Control mode page (see SPC-5) is set to 000b).

If the ATA device is processing any ATA commands, then the SATL shall:

1) abort all outstanding ATA commands;
2) abort all SCSI commands in the task set; and
3) respond to the CLEAR TASK SET task management function with a service response of FUNCTION COMPLETE.

If the SATL aborts commands in the task set for an I_T_L nexus other than the specified I_T_L nexus, then for each other I_T_L nexus, the SATL shall establish a unit attention condition with the additional sense code set to COMMANDS CLEARED BY ANOTHER INITIATOR.

6.4.8 I_T NEXUS RESET

The service request for the I_T NEXUS RESET task management function (see SAM-5) is:

Service Response = I_T NEXUS RESET (IN (I_T nexus)).

If the SATL supports the I_T NEXUS RESET task management function, then the SATL shall process an I_T nexus loss (see 6.6.3) with the additional requirements described in this subclause. If the ATA device is not processing ATA commands for SCSI commands associated with the specified I_T nexus, then the SATL shall abort all commands for the specified I_T nexus, if any, from the SATL internal context and respond to the I_T NEXUS RESET task management function with a service response of FUNCTION COMPLETE.

If the ATA device is processing any ATA commands related to the specified I_T nexus, then the SATL shall either:

a) allow the ATA commands to complete as follows:
   1) wait until the ATA device returns command complete for the ATA commands;
   2) if the completed ATA command does not complete processing a SCSI command in the task set, then remove that SCSI command from the SATL internal context without returning completion status;
   3) if the completed ATA command completes processing a SCSI command in the task set, then return completion status for the SCSI command; and
   4) after all ATA commands return completion status, return a service response of FUNCTION COMPLETE for the I_T NEXUS RESET task management function;

   or

b) abort outstanding ATA commands (see 6.4.2) for the specified I_T nexus and respond to the I_T NEXUS RESET task management function with a service response of FUNCTION COMPLETE.

The SATL shall establish a unit attention condition on behalf of the logical unit corresponding to the ATA device with an additional sense code set to I_T NEXUS LOSS OCCURRED.

If aborting ATA commands for the specified I_T nexus results in ATA commands being aborted by ATA collateral abort (see 6.2.7) that are related to processing SCSI commands in an I_T nexus other than the specified I_T nexus, then:

a) if the SATL supports ATA abort retry, then the SATL shall:
   A) resend all ATA commands aborted by ATA collateral abort;
   B) continue processing of the affected SCSI commands; and
   C) respond to the I_T NEXUS RESET task management function with a service response of FUNCTION COMPLETE;

   or

b) if the SATL does not support ATA abort retry, then for each I_T nexus other than the specified I_T nexus that had one or more SCSI commands affected due to ATA commands aborted by ATA collateral abort, the SATL shall:
   A) terminate all SCSI commands for each affected I_T nexus;
   B) establish a unit attention condition with the additional sense code set to COMMANDS CLEARED BY ANOTHER INITIATOR; and
   C) respond to the I_T NEXUS RESET task management function with a service response of FUNCTION COMPLETE.

NOTE 4 - A SATL that does not support ATA abort retry is not able to comply with the SAM-5 requirement that I_T NEXUS RESET not abort commands other than those in the specified I_T nexus.

If the SATL does not support the I_T NEXUS RESET task management function, then the SATL shall return a service response of FUNCTION REJECTED.

6.4.9 LOGICAL UNIT RESET

The service request for the LOGICAL UNIT RESET task management function (see SAM-5) is:

Service Response = LOGICAL UNIT RESET (IN (I_T_L nexus)).

The SATL shall process a logical unit reset (see 6.6.4), then return a service response of FUNCTION COMPLETE for the LOGICAL UNIT RESET task management function.

6.4.10 QUERY TASK

The service request for the QUERY TASK task management function (see SAM-5) is:

Service Response = QUERY TASK (IN (I_T_L nexus, Command Identifier)).

If the SATL supports the QUERY TASK task management function, then the SATL shall return a service response of:

a) FUNCTION SUCCEEDED if the SCSI command specified by the I_T_L nexus and the command identifier is in the task set; or
b) FUNCTION COMPLETE if the SCSI command specified by the I_T_L nexus and the command identifier is not in the task set.

If the SATL supports the QUERY TASK task management function, then the SATL may return the Additional Response Information as specified in SAM-5.

If the SATL does not support the QUERY TASK task management function, then the SATL shall return a service response of FUNCTION REJECTED.

6.4.11 QUERY TASK SET

The service request for the QUERY TASK SET task management function (see SAM-5) is:

Service Response = QUERY TASK SET (IN (I_T_L nexus)).

If the SATL supports the QUERY TASK SET task management function, then the SATL shall return a service response of:

a) FUNCTION SUCCEEDED if there is any command present in the task set from the specified I_T_L nexus; or
b) FUNCTION COMPLETE if there is no command present in the specified I_T_L nexus.

If the SATL does not support the QUERY TASK SET task management function, then the SATL shall return a service response of FUNCTION REJECTED.

6.4.12 QUERY ASYNCHRONOUS EVENT

The service request for the QUERY ASYNCHRONOUS EVENT task management function (see SAM-5) is:

Service Response = QUERY ASYNCHRONOUS EVENT (IN (I_T_L nexus), OUT ([Additional Response Information])).

If the SATL supports the QUERY ASYNCHRONOUS EVENT task management function, then the SATL shall return a service response of:

a) FUNCTION SUCCEEDED if there is a unit attention condition or deferred error pending for the specified I_T nexus; or
b) FUNCTION COMPLETE if there is no unit attention condition and no deferred error pending for the specified I_T nexus.

If the SATL supports the QUERY ASYNCHRONOUS EVENT task management function, then the SATL shall return the Additional Response Information as specified in SAM-5.

If the SATL does not support the QUERY ASYNCHRONOUS EVENT task management function, then the

SATL shall return a service response of FUNCTION REJECTED.

6.4.13 Reset task management functions

The TARGET RESET task management function (see SAM-2) may be used by a SCSI application client to cause a hard reset (i.e., similar to a power on condition) for each logical unit of a specified target device. The SATL may process the TARGET RESET task management function by issuing an ATA hardware reset to the ATA devices associated with the target device.

6.5 CONTROL byte

Table 10 describes SATL translation of the CDB CONTROL byte. See SAM-5 for CONTROL byte details.

Table 10 — CONTROL BYTE fields

Field	Description
Vendor specific	The SATL may use this field for vendor specific purposes.
NACA	If set to one, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

6.6 Translation of conditions resulting from SCSI events

6.6.1 Overview

Table 11 describes the translations for conditions resulting from SCSI events (see SAM-5).

Table 11 — SAM-5 conditions

Condition	Description
Power on	Unspecified
Hard reset	See 6.6.2.
I_T nexus loss	See 6.6.3.
Logical unit reset	See 6.6.4.
Power loss expected	See 6.6.5.

6.6.2 Hard reset

To process a hard reset (see SAM-5), the SATL shall perform the actions defined in SAM-5.

In addition to the reset events defined in SAM-5 and other standards, the SATL shall include the following as reset events:

a) an ATA device that is a SATA device performing asynchronous signal recovery (see SATA-3.5a); and
b) sending an ATA hardware reset to the ATA device for reasons other than those described in 5.6 (e.g., see 6.4.9, 6.4.13, and 12.2.2.2).

6.6.3 I_T nexus loss

Processing of an I_T nexus loss (see SAM-5) depends on whether the SATL provides multiple I_T nexuses access to the emulated SCSI logical unit.

If the SATL does not provide multiple I_T nexuses access to the emulated SCSI logical unit, then the SATL shall handle the I_T nexus loss by performing the actions defined in SAM-5 with the following additional requirements:

1) abort any outstanding ATA commands (see 6.4.2 and 6.4.3);
2) delete all commands in the task set from the SATL internal context; and
3) establish a unit attention condition for the affected I_T nexus with the additional sense code set to I_T NEXUS LOSS OCCURRED.

If the SATL provides multiple I_T nexuses access to the emulated SCSI logical unit, then the SATL shall handle the I_T nexus loss by performing the actions defined in SAM-5 with the following additional requirements:

1) allow any outstanding ATA commands for each I_T nexus that is not lost to complete;
2) abort any remaining ATA commands (see 6.4.2 and 6.4.3);
3) delete all commands in the task set from the SATL internal context for commands associated with the I_T nexus on which the I_T nexus loss event occurred; and
4) establish a unit attention with the additional sense code set to I_T NEXUS LOSS OCCURRED for the SCSI initiator port associated with the I_T nexus that was lost.

6.6.4 Logical unit reset

To process a logical unit reset, the SATL shall perform the actions defined in SAM-5 with the following additional requirements:

1) reset the ATA device as follows:
    1) optionally send an ATA software reset to the ATA device; and
    2) if the ATA software reset is not successful or not sent, then send an ATA hardware reset to the ATA device;

NOTE 5 - It is vendor specific how the SATL determines if the ATA software reset is successful.

2) abort all commands in the task set from the SATL internal context;
3) restore ATA volatile settings to values consistent with the emulation of saved or default values of mode parameters, log parameters, and INQUIRY data (see SPC-5); and
4) establish a unit attention condition (see SAM-5).

NOTE 6 - If more than one PATA device is present on a PATA bus, then issuing an ATA software reset causes both PATA devices to be reset.

6.6.5 Power loss expected

To process a power loss expected (see SAM-5), the SATL shall:

1) if any queued command has been sent to the ATA device and not completed or if no commands are outstanding at the ATA device, then send an ATA IDLE IMMEDIATE command to the ATA device using the unload feature (see ACS-5);
2) if an ATA non-NCQ command is outstanding at the ATA device, then send an ATA reset followed by an ATA IDLE IMMEDIATE command to the ATA device using the unload feature (see ACS-5); and
3) perform the actions defined in SAM-5.

6.7 Medium access and stopped power condition

If a SATL receives a SCSI medium access command while in the stopped power condition (see SBC-4), then the SATL shall terminate that medium access command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED.

7 Summary of SCSI / ATA command mappings

In the event of a discrepancy between the contents of this clause and the description of individual commands, description of individual commands shall apply.

Clause 7, clause 8, and clause 9 describe the SCSI to ATA command mapping for ATA devices emulating a SCSI logical unit with a peripheral device type of 00h (i.e., direct access block device) or 14h (i.e., host managed zoned device).

The SATL shall queue received SCSI commands as necessary to ensure the SATL does not send more than one ATA command to the ATA device representing the logical unit with the exception of ATA NCQ commands. Table 12 lists the SCSI / ATA command mappings defined in this standard. A SATL may implement commands defined in SPC-5, SBC-4, and ZBC, but not listed in table 12. Translation of commands not listed in table 12 is vendor specific. If a command is not implemented by the SATL, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 12 — Summary of SCSI / ATA command mapping (part 1 of 3)

SCSI command	ATA commands [a]	Reference
ATA PASS-THROUGH (12)	Any	12.2.2.2
ATA PASS-THROUGH (16)		12.2.2.3
ATA PASS-THROUGH (32)		12.2.2.4
CLOSE ZONE	CLOSE ZONE EXT	9.2
FINISH ZONE	FINISH ZONE EXT	9.3
FORMAT UNIT	READ VERIFY SECTORS, READ VERIFY SECTORS EXT, WRITE SECTORS, or WRITE SECTORS EXT, SCT Write Same	9.4
FORMAT WITH PRESET	MUTATE EXT or SET SECTOR CONFIGURATION EXT	9.5
GET PHYSICAL ELEMENT STATUS	GET PHYSICAL ELEMENT STATUS	9.6
INQUIRY	ATA read log command	8.1
LOG SELECT	Log page dependent (see 10.3)	8.2
LOG SENSE	Log page dependent (see 10.3)	8.3
MODE SELECT (6)	Mode page dependent (see 10.4)	8.4
MODE SELECT (10)		8.5
MODE SENSE (6)		8.6
MODE SENSE (10)		8.7
OPEN ZONE	OPEN ZONE EXT	9.7

[a] Translations for SCSI commands may require one or more of the ATA commands listed to be sent to the ATA device.

Table 12 — Summary of SCSI / ATA command mapping (part 2 of 3)

SCSI command	ATA commands [a]	Reference
READ (10)	See 9.1	9.9
READ (12)		9.10
READ (16)		9.11
READ BUFFER (10)	READ BUFFER or ATA read log command	8.8
READ CAPACITY (10)	ATA read log command	9.12
READ CAPACITY (16)		9.13
READ MEDIA SERIAL NUMBER	ATA read log command	8.11
REASSIGN BLOCKS	READ VERIFY SECTOR(S), READ VERIFY SECTOR(S) EXT, WRITE DMA, WRITE DMA EXT, WRITE DMA FUA EXT, WRITE DMA QUEUED, WRITE DMA QUEUED EXT, WRITE DMA QUEUED FUA EXT, or WRITE FPDMA QUEUED	9.14
RECEIVE DIAGNOSTIC RESULTS	ATA read log command	8.10
REMOVE ELEMENT AND TRUNCATE	REMOVE ELEMENT AND TRUNCATE	9.15
REPORT LUNS	n/a	SPC-5
REPORT SUPPORTED OPERATION CODES	n/a	SPC-5 and 8.9
REPORT TIMESTAMP	ATA read log command	8.12
REPORT ZONES	REPORT ZONES EXT	9.16
REQUEST SENSE	SMART RETURN STATUS, CHECK POWER MODE, and SANITIZE STATUS EXT	8.13
RESET WRITE POINTER	RESET WRITE POINTER	9.17
RESTORE ELEMENTS AND REBUILD	RESTORE ELEMENTS AND REBUILD and IDENTIFY DEVICE	9.18
SANITIZE	SANITIZE DEVICE	9.19
SECURITY PROTOCOL IN	TRUSTED RECEIVE, TRUSTED RECEIVE DMA, or TRUSTED NON-DATA	8.14
SECURITY PROTOCOL OUT	TRUSTED SEND, TRUSTED SEND DMA, or TRUSTED NON-DATA	8.15

[a] Translations for SCSI commands may require one or more of the ATA commands listed to be sent to the ATA device.

Table 12 — Summary of SCSI / ATA command mapping (part 3 of 3)

SCSI command	ATA commands [a]	Reference
SEND DIAGNOSTIC	SMART EXECUTE OFF-LINE IMMEDIATE (see ACS-4), ATA verify command, or ATA write log command	8.16
SEQUENTIALIZE ZONE	SEQUENTIALIZE ZONE EXT	9.20
SET TIMESTAMP	SET DATE & TIME EXT	8.17
START STOP UNIT	FLUSH CACHE, FLUSH CACHE EXT, STANDBY, IDLE IMMEDIATE, READ VERIFY SECTOR(S), READ VERIFY SECTOR(S) EXT, or STANDBY IMMEDIATE	9.21
SYNCHRONIZE CACHE (10)	FLUSH CACHE or FLUSH CACHE EXT	9.22
SYNCHRONIZE CACHE (16)		9.23
TEST UNIT READY	CHECK POWER MODE and SANITIZE STATUS EXT	8.18
UNMAP	DATA SET MANAGEMENT or DATA SET MANAGEMENT XL	9.24
VERIFY (10)	See 9.1	9.25
VERIFY (12)		9.26
VERIFY (16)		9.27
WRITE (10)	See 9.1	9.29
WRITE (12)		9.30
WRITE (16)		9.31
WRITE AND VERIFY (10)	See 9.1	9.33
WRITE AND VERIFY (12)		9.34
WRITE AND VERIFY (16)		9.35
WRITE BUFFER	WRITE BUFFER, DOWNLOAD MICROCODE, or DOWNLOAD MICROCODE DMA	8.19
WRITE LONG (10)	WRITE UNCORRECTABLE EXT	9.36
WRITE LONG (16)		9.37
WRITE SAME (10)	See 9.1	9.38
WRITE SAME (16)		9.39

[a] Translations for SCSI commands may require one or more of the ATA commands listed to be sent to the ATA device.

8 SPC-5 command mapping

8.1 INQUIRY command

8.1.1 Overview

The INQUIRY command requests general information about a logical unit and target device. The INQUIRY command and selected VPD pages shall be emulated using information from the ATA IDENTIFY DEVICE data log and other information (see 8.1.2). Table 13 describes the translation of fields in the INQUIRY CDB.

Table 13 — INQUIRY CDB field translations

Field	Description
OPERATION CODE	Set to 12h
EVPD	Unspecified
PAGE CODE [a]	The SATL: a) shall support the Supported VPD Pages VPD page (00h) (see 10.5.2); b) shall support the Device Identification VPD page (83h) (see 10.5.4); c) should support the Mode Page Policy VPD page (87h) (see 10.5.5); d) shall support the ATA Information VPD page (89h) (see 12.4.2); and e) may support other VPD pages as described in 10.5.
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

[a] VPD page translations are defined in 10.5 and 12.4.2.

8.1.2 Standard INQUIRY data

Table 14 describes the standard INQUIRY data fields supported by the SATL.xx

Table 14 — Standard INQUIRY data fields (part 1 of 4)

Field [e]	Description
PERIPHERAL QUALIFIER	Set to 000b [a]
PERIPHERAL DEVICE TYPE	If the device is an ATA host managed zoned device, the SATL shall set this field to 14h (i.e., Host managed zoned block device). Otherwise, the SATL shall set this field to 00h (i.e., Direct access block device).[a]
RMB	Unspecified
LU_CONG	Set to 0b
VERSION	This field indicates the version of SPC to which the SATL complies (see SPC-5) (e.g., 07h for SPC-5).
NORMACA	Set to zero (see 6.5)

Table 14 — Standard INQUIRY data fields (part 2 of 4)

Field [e]	Description
HISUP	Unspecified
RESPONSE DATA FORMAT	Set to 2h
ADDITIONAL LENGTH	Set to the length of the INQUIRY data that follows
SCCS	Unspecified
TPGS	Unspecified
3PC	Unspecified
PROTECT	Unspecified
ENCSERV	Unspecified
MULTIP	Unspecified
CMDQUE	Unspecified
T10 VENDOR IDENTIFICATION	Set to 'ATA¬¬¬¬¬' [b].
PRODUCT IDENTIFICATION [c]	The SATL shall set the PRODUCT IDENTIFICATION field to a representation of the first 16 bytes of the MODEL NUMBER field [c] in the ATA IDENTIFY DEVICE data log, where each pair of bytes are swapped to create a valid ASCII string format: 1) byte 0 contains MODEL NUMBER bits 15:8 (i.e., byte 1); 2) byte 1 contains MODEL NUMBER bits 7:0 (i.e., byte 0); 3) byte 2 contains MODEL NUMBER bits 31:24 (i.e., byte 3); 4) byte 3 contains MODEL NUMBER bits 23:16 (i.e., byte 2); ... 15) byte 14 contains MODEL NUMBER bits 127:120 (i.e., byte 15); and 16) byte 15 contains MODEL NUMBER bits 119:112 (i.e., byte 14).

Table 14 — Standard INQUIRY data fields (part 3 of 4)

Field [e]	Description
PRODUCT REVISION LEVEL [c]	Set to a four byte ASCII character representation of the FIRMWARE REVISION field [c] in the ATA IDENTIFY DEVICE data log. Each pair of bytes are swapped to create a valid ASCII string format. Since the FIRMWARE REVISION field in the ATA IDENTIFY DEVICE data log contains eight ASCII characters and the standard INQUIRY data PRODUCT REVISION LEVEL field is four ASCII characters, the SATL shall select four of the eight ASCII characters from the FIRMWARE REVISION field in the ATA IDENTIFY DEVICE data log to return in the PRODUCT REVISION LEVEL field as follows: a) if bytes 4 to 7 of the ATA FIRMWARE REVISION field in the ATA IDENTIFY DEVICE data log are set to four ASCII spaces (i.e., 2020_2020h), then the four ASCII characters selected shall contain: 1) byte 0 contains FIRMWARE REVISION field bits 15:8 (i.e., byte 1); 2) byte 1 contains FIRMWARE REVISION field bits 7:0 (i.e., byte 0); 3) byte 2 contains FIRMWARE REVISION field bits 31:24 (i.e., byte 3); and 4) byte 3 contains FIRMWARE REVISION field bits 23:16 (i.e., byte 2); or b) if bytes 4 to 7 of the FIRMWARE REVISION field in the ATA IDENTIFY DEVICE data log are not set to four ASCII spaces (i.e., 2020_2020h), then the four ASCII characters selected shall contain: 1) byte 0 contains FIRMWARE REVISION field bits 47:40 (i.e., byte 5); 2) byte 1 contains FIRMWARE REVISION field bits 39:32 (i.e., byte 4); 3) byte 2 contains FIRMWARE REVISION field bits 63:56 (i.e., byte 7); and 4) byte 3 contains FIRMWARE REVISION field bits 55:48 (i.e., byte 6).
VERSION DESCRIPTOR 1 to VERSION DESCRIPTOR 8	The SATL shall include version descriptors (see SPC-5) for: a) the SCSI Architecture Model standard (e.g., SAM-5); b) this standard; c) the SCSI Primary Commands standard (e.g., SPC-5); d) the SCSI Block Commands standard (e.g., SBC-4); e) the SCSI Zoned Block Commands standard (e.g., ZBC), if appropriate; f) if the SATL receives SCSI commands through a SCSI target port (see figure 5 in 5.1), the version of the transport protocol to which the SCSI target port was designed; g) if the SATL sends ATA commands through a SAS STP initiator port (see figure 7 in 5.1), the version of SAS (e.g., SPL-4) to which the SAS STP initiator port was designed; and h) the version(s) of ATA standards (e.g., ACS-5 and ATA8-AAM) to which the ATA device claims compliance in the: A) Major version number field in ATA IDENTIFY DEVICE data; B) Minor version number field in ATA IDENTIFY DEVICE data; C) Transport major version number field in ATA IDENTIFY DEVICE data; and D) Transport minor version number field in ATA IDENTIFY DEVICE data.

Table 14 — Standard INQUIRY data fields (part 4 of 4)

Field [e]	Description
Vendor specific parameters	Unspecified

[a] If the INQUIRY command is sent to an incorrect logical unit then the SATL shall set the PERIPHERAL QUALIFIER field to 011b and shall set the PERIPHERAL DEVICE TYPE field to 1Fh.
[b] See 3.5.3.
[c] The complete contents of the MODEL NUMBER field and the complete contents of the FIRMWARE REVISION field in the ATA IDENTIFY DEVICE data log are returned in the ATA Information VPD page (see 12.4.2).
[d] The encoding used by the SPC-5 standard for INQUIRY version descriptors and the encoding used by the ACS-5 standard for Major version number and the Minor version number in the ATA IDENTIFY DEVICE data log differ. The two standards may not define values for the same revisions.
[e] Standard INQUIRY data contains multiple vendor specific fields (i.e., VS) and their translation is unspecified.

8.2 LOG SELECT command

8.2.1 Overview

The LOG SELECT command provides a means for the application client to manage statistical information maintained by the SCSI target device about the SCSI device target or its logical units. Table 15 shows the translations of the fields specified in the LOG SELECT CDB.

Table 15 — LOG SELECT CDB field translations

Field	Description
OPERATION CODE	Set to 4Ch
PCR	Unspecified
SP	Unspecified
PC	See 8.2.2.
PAGE CODE	See 8.2.3.
SUBPAGE CODE	See 8.2.3.
PARAMETER LIST LENGTH	Unspecified
CONTROL	See 6.5.

8.2.2 PC field

The SATL interpretation and support of the values of the PC field is shown in table 16.

Table 16 — PC field

Code	Translation
00b	Unspecified
01b	Supported as defined in SPC-5
10b	Unspecified
11b	Unspecified

8.2.3 PAGE CODE field and SUBPAGE CODE field translations

The PAGE CODE field and SUBPAGE CODE field specify the log page to be accessed. The values used for specific log pages are described in 10.3.1.

8.3 LOG SENSE command

8.3.1 Overview

The LOG SENSE command provides a means for the application client to retrieve statistical or other operational information maintained by the SCSI target device about the SCSI target device or its logical units.

The SATL shall implement support for this command by returning the log page data for the particular page requested.

Table 17 shows the translation for fields specified in the LOG SENSE CDB.

Table 17 — LOG SENSE CDB field translations

Field	Description
OPERATION CODE	Set to 4Dh
SP	Unspecified
PC	See 8.3.2.
PAGE CODE	See 8.3.3.
SUBPAGE CODE	See 8.3.3.
PARAMETER POINTER	Unspecified
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

8.3.2 PC field

The SATL interpretation and support of the values of the PC field is shown in table 18.

Table 18 — PC field

Code	SATL Translation
00b	Unspecified
01b	Supported as defined in SPC-5
10b	Unspecified
11b	Unspecified

8.3.3 PAGE CODE field and SUBPAGE CODE field

The PAGE CODE field and SUBPAGE CODE field specify the log page to be accessed. The values used for specific log pages are described in table 19 and 10.3.1.

Table 19 — PAGE CODE field and SUBPAGE CODE field

PAGE CODE	SUBPAGE CODE	Description
10h	00h	**Self-Test Results log page:** The SATL shall determine if the ATA SMART self-test is supported from the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit: a) if the ATA SMART self-test is not supported (i.e., SMART SELF-TEST SUPPORTED bit is set to zero), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; or b) if the ATA SMART self-test is supported (i.e., SMART SELF-TEST SUPPORTED bit is set to one), then the SATL shall return the translated Self-Test Results log page to the application client (see 10.3.8).
2Fh	00h	**Informational Exceptions log page:** The SATL shall determine if the ATA SMART feature set is supported from the ATA IDENTIFY DEVICE data log SMART bit: 1) if the ATA SMART feature set is not supported (i.e., the SMART bit is set to zero), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; or 2) if the ATA SMART feature set is supported (i.e., the SMART bit is set to one), then the SATL shall determine if the ATA SMART feature set is enabled or disabled from the ATA IDENTIFY DEVICE data log SMART ENABLED bit: A) if the ATA SMART feature set is disabled (i.e., the SMART ENABLED bit is set to zero), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to ATA DEVICE FEATURE NOT ENABLED; or B) if the ATA SMART feature set is enabled (i.e., the SMART ENABLED bit is set to one), then the SATL shall return the translated Informational Exceptions log page to the application client (see 10.3.5.1).
All others	All	See 10.3.

8.4 MODE SELECT (6) command

8.4.1 Overview

The MODE SELECT (6) command (see SPC-5) provides a means for an application client to specify medium, logical unit, or peripheral device parameters to a device server in the SATL. SATLs that implement the MODE SELECT (6) command shall also implement the MODE SENSE (6) command. Application clients should send a MODE SENSE (6) command prior to each MODE SELECT (6) command to determine supported mode pages, changeable fields, page lengths, and other parameters.

The SATL shall modify logical unit or peripheral device parameters for supported mode pages and parameters as specified in mode pages received from the application client. Some operational parameters in individual pages are provided via ATA commands (see 10.4).

The Mode Page Policy VPD page (see 10.5.6) should be implemented. After a logical unit reset, the SATL shall set all emulated or translated mode page values to saved or default values, as described in SPC-5. See 10.4 for supported mode pages.

8.4.2 MODE SELECT (6) CDB fields

The SATL shall support MODE SELECT (6) CDB fields as shown in table 20.

Table 20 — MODE SELECT (6) CDB field translations

Field	Description
OPERATION CODE	Set to 15h
PF	If this bit is set to zero (i.e., specifies that mode pages are vendor specific), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. The SATL shall support this bit being set to one (i.e., specifies that all mode page formats correspond to SPC-5 and SBC-4 mode page formats).
SP	Unspecified
PARAMETER LIST LENGTH	Unspecified
CONTROL	See 6.5.

The mode parameter header, mode parameter block descriptor, and mode pages are translated as described in 10.4.

8.5 MODE SELECT (10) command

The MODE SELECT (10) command (see SPC-5) provides a means for an application client to set parameters in the device server in a SATL. It is a complementary command to the MODE SENSE (10) command and shall be implemented as described in Table 21.

Table 21 — MODE SELECT (10) CDB field translations

Field	Description
OPERATION CODE	Set to 55h
PF	As specified for MODE SELECT (6), see 8.4.
SP	Unspecified
PARAMETER LIST LENGTH	Unspecified
CONTROL	See 6.5.

SATLs that implement the MODE SELECT (10) command shall also implement the MODE SENSE (10) command.

The mode parameter header, mode parameter block descriptor, and mode pages are translated as described in 10.4.

8.6 MODE SENSE (6) command

8.6.1 Overview

The MODE SENSE (6) command (see SPC-5) provides a means for a device server in a SATL to report parameters to an application client. It is a complementary command to the MODE SELECT (6) command. The SATL shall return the requested mode pages to the application client. Some operational parameters in individual pages are gathered by issuing ATA commands (see 10.4).

SATLs that implement the MODE SENSE (6) command shall also implement the MODE SELECT (6) command. See 10.4 for supported mode pages.

8.6.2 MODE SENSE (6) CDB fields

The SATL shall support MODE SENSE (6) CDB fields as shown in table 22.

Table 22 — MODE SENSE (6) CDB field translations

Field	Description
OPERATION CODE	Set to 1Ah
DBD	A DBD bit set to zero specifies that zero or more block descriptors may be returned in MODE SENSE data. A DBD bit set to one specifies that the SATL shall not return any block descriptors in MODE SENSE data. The SATL shall support only the mode parameter block descriptor format for direct access block devices.
PC	Current values (i.e., the PC field is set to 00b) shall be supported. Reporting changeable, saveable, and default values is unspecified.
PAGE CODE	This field specifies the particular mode page requested (see 10.4). If the SATL does not support the specified mode page, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
SUBPAGE CODE	This field specifies the subpage code within the page code specified by the value in the PAGE CODE field that is requested by the application client (see 10.4).
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

The mode parameter header, mode parameter block descriptor, and mode pages are translated as described in 10.4

8.7 MODE SENSE (10) command

The MODE SENSE (10) command (see SPC-5) provides a means for a device server in a SATL to report parameters to an application client. It is a complementary command to the MODE SELECT (10) command and shall be implemented as shown in table 23.

Table 23 — MODE SENSE (10) CDB field translations

Field	Description
OPERATION CODE	Set to 5Ah
LLBA	Unspecified
DBD	As defined for MODE SELECT (6), see 8.6.
PC	As defined for MODE SELECT (6), see 8.6.
PAGE CODE	As defined for MODE SELECT (6), see 8.6.
SUBPAGE CODE	As defined for MODE SELECT (6), see 8.6.
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

SATLs that implement the MODE SENSE (10) command shall also implement the MODE SELECT (10) command.

The mode parameter header, mode parameter block descriptor, and mode pages are translated as described in 10.4.

8.8 READ BUFFER (10) command

8.8.1 Overview

The READ BUFFER (10) command (see SPC-5) is used in conjunction with the WRITE BUFFER command as a diagnostic function for testing memory in the SCSI device and for testing the integrity of a service delivery subsystem. This command shall not alter the medium.

The SATL shall:

a) send an ATA READ BUFFER command to the ATA device;
b) send an ATA read log command to the ATA device; or
c) emulate the specified function, if supported,

depending on the values for the BUFFER ID field and MODE field (see 8.8.2.1).

Table 24 shows the translation for fields specified in the CDB for the READ BUFFER (10) command.

Table 24 — READ BUFFER (10) CDB field translations

Field	Description
OPERATION CODE	Set to 3Ch
MODE	See 8.8.2.
MODE SPECIFIC	Unspecified
BUFFER ID	See 8.8.2.
BUFFER OFFSET	See 8.8.2.
ALLOCATION LENGTH	See 8.8.2.
CONTROL	See 6.5.

8.8.2 MODE field

8.8.2.1 Overview

Table 25 describes values of the MODE field.

Table 25 — MODE field

Code	Description	Type
02h (i.e., Data)	If the BUFFER ID field is set to 00h, then the translation shall be to the ATA READ BUFFER command (see 8.8.2.2). Otherwise, the translation is unspecified.	M
03h (i.e., Descriptor)	See 8.8.2.3.	M
1Ch (i.e., Error history)	See 8.8.2.4.	O
All others	Unspecified	
Key: M = Mode implementation is Mandatory O = Mode implementation is Optional		

8.8.2.2 Data mode

If the BUFFER ID field is set to 00h, the BUFFER OFFSET field is set to 000000h, and the ALLOCATION LENGTH field is set to 512, then the SATL shall return 512 bytes of data from the buffer in the ATA device, by sending an ATA READ BUFFER command to the ATA device.

If the BUFFER ID field is set to 00h, the BUFFER OFFSET field is set to 000000h, and the ALLOCATION LENGTH field is set to a value other than 512, then the SATL shall either:

a) return the lesser of 512 bytes of data or the number of bytes specified in the ALLOCATION LENGTH field from the buffer in the ATA device by sending an ATA READ BUFFER command to the ATA device; or
b) terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the BUFFER ID field is set to 00h and the BUFFER OFFSET field is set to a value other than 000000h, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

The SATL may support a value other than 00h in the BUFFER ID field. If the SATL supports a value other than 00h in the BUFFER ID field, then the implementation shall be as defined in SPC-5.

8.8.2.3 Descriptor mode

If the ALLOCATION LENGTH field is set to less than four, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the ALLOCATION LENGTH field is set to four or greater, then the SATL shall return four bytes of data describing the requested buffer, including the OFFSET BOUNDARY field and the BUFFER CAPACITY field.

If the BUFFER ID field is set to zero then the SATL shall return:

a) OFFSET BOUNDARY field set to 09h (i.e., 512 bytes); and
b) BUFFER CAPACITY field set to 000200h (i.e., 512 bytes).

If the SATL supports a value other than zero in the BUFFER ID field, then the implementation is unspecified.

8.8.2.4 Error history mode

8.8.2.4.1 Overview

The error history mode is used to manage and retrieve the ATA Current Device Internal Status Data log or the ATA Saved Device Internal Status Data log.

If the ATA device does not support:

a) the General Purpose Logging feature set; or
b) the ATA Current Device Internal Status Data log (log address 24h) and the ATA Saved Device Internal Status Data log (log address 25h),

then the SATL 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.

The translation of the BUFFER ID field is described in table 26.

Table 26 — BUFFER ID field

Code	Translation
00h	The SATL shall return the error history directory as described in 8.8.2.4.2.
01h	The SATL shall: 1) create current device internal status data as described in 8.8.2.4.4; and 2) return the error history directory as described in 8.8.2.4.2.
02h	The SATL shall: 1) establish the error history I_T nexus as described in 8.8.2.4.3; and 2) return the error history directory as described in 8.8.2.4.2.
03h	The SATL shall: 1) establish the error history I_T nexus as described in 8.8.2.4.3; 2) create current device internal status data as described in 8.8.2.4.4; and 3) return the error history directory as described in 8.8.2.4.2.

Table 26 — BUFFER ID field

Code	Translation
10h to EFh	The SATL shall return error history information as described in 8.8.2.4.5 and 8.8.2.4.6.
FEh	The SATL shall clear the error history I_T nexus as described in 8.8.2.4.3.
FFh	The SATL shall: 1) clear the error history I_T nexus as described in 8.8.2.4.3; and 2) release the current device internal status data using an unspecified method.
All others	Unspecified

8.8.2.4.2 Error history directory

To return the error history directory the SATL shall send an ATA read log command to read the ATA General Purpose Log Directory (i.e., ATA GPL Log address 00h) to determine the number of log pages at log address 24h and to determine the number of log pages at log address 25h. If the number of log pages at log address 24h is greater than zero or the number of log pages at log address 25h is greater than zero, then the SATL shall:

1) send an ATA READ LOG EXT or ATA READ LOG DMA EXT command with bit 0 set to zero in the ATA FEATURE field to read the ATA Current Device Internal Status Data Header page (i.e., ATA GPL Log address 24h, log page 00h);
2) 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, if the ATA read log command in step 1) completes with an error; and
3) if the ATA read log command in step 1) completes without error, then return the error history directory with the:
   A) T10 VENDOR IDENTIFICATION field set to:
      a) the eight ASCII characters ‘ATA¬¬¬¬¬’; or
      b) an eight byte string identifying the vendor of the SATL;
   B) VERSION field set to a vendor specific value;
   C) EHS_RETRIEVED field set to 00b;
   D) EHS_SOURCE field set to 11b;
   E) CLR_SUP field set to 0b;
   F) DIRECTORY_LENGTH field set to 0000h (i.e., zero error history directory entries) if:
      a) the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is set to zero in the ATA Current Device Internal Status Data log header (i.e., log page 00h) returned by the ATA read log command in step 1); and
      b) the ATA SAVED DATA field is set to zero in the ATA Current Device Internal Status Data log header returned by the ATA read log command in step 1);
   G) DIRECTORY_LENGTH field set to 0008h (i.e., one error history directory entry) if one of G)a) or G)b) is true:
      a) the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is set to a nonzero value in the ATA Current Device Internal Status Data log header returned by the ATA read log command in step 1); or
      b) the ATA SAVED DATA field is set to one in the ATA Current Device Internal Status Data log header returned by the ATA read log command in step 1);
   H) DIRECTORY_LENGTH field set to 0010h (i.e., two error history directory entries) if:
      a) the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is set to a nonzero value in the ATA Current Device Internal Status Data log header returned by the ATA read log command in step 1); and
      b) the ATA SAVED DATA field is set to one in the ATA Current Device Internal Status Data log header returned by the ATA read log command in step 1);

   and

l) zero (see F)), one (see G)), or two (see H)) error history directory entries with the fields set as described in table 27.

Table 27 — Error history directory entry contents

Field name	Current Device Internal Status	Saved Device Internal Status
SUPPORTED BUFFER ID	A value that the application client sends in the BUFFER ID field to cause the SATL to return the contents of the Current Device Internal Status log data	A value that the application client sends in the BUFFER ID field to cause the SATL to return the contents of the Saved Device Internal Status log data
BUFFER FORMAT	01h	02h
BUFFER SOURCE	3h or 4h [a]	2h
MAXIMUM AVAILABLE LENGTH	512 x ATA GPL Log Address 00h word 24	512 x ATA GPL Log Address 00h word 25

[a] The value 3h shall be returned if the BUFFER ID field that caused the error history directory to be returned was 01h or 03h. The value 4h shall be returned if the BUFFER ID field that caused the error history directory to be returned was not 01h and was not 03h.

8.8.2.4.3 Locking and Unlocking

If the error history I_T nexus is established, the SATL shall process READ BUFFER (10) commands with the MODE field set to 1Ch from only the initiator that established the error history I_T nexus as described in SPC-5.

If the error history I_T nexus is cleared, the SATL shall process READ BUFFER (10) commands with the MODE field set to 1Ch from any initiator as described in SPC-5.

The SATL shall establish error history I_T nexus unit attention conditions as described in SPC-5.

8.8.2.4.4 Create current device internal status log

To create the current device internal status log data the SATL shall send an ATA READ LOG EXT or ATA READ LOG DMA EXT command with the ATA FEATURE field set to 0001h to read the ATA Current Device Internal Status Data pages (i.e., ATA GPL Log address 24h).

8.8.2.4.5 Return current error history buffers

If the BUFFER ID field in the READ BUFFER (10) command (see 8.8) matches the value in the SUPPORTED BUFFER ID field of an error history directory entry (see table 27) with a BUFFER FORMAT field set to 01h, then the SATL shall send an ATA READ LOG EXT or ATA READ LOG DMA EXT command with the ATA FEATURE field set to 0000h to read the ATA Current Device Internal Status Data pages (i.e., ATA GPL Log address 24h).

The SATL shall read no more log pages from ATA GPL Log address 24h than indicated by the ATA NUMBER OF LOG PAGES AT LOG ADDRESS 24h field in the ATA General Purpose Log Directory (i.e., ATA GPL log address 00h).

If the ALLOCATION LENGTH field in the READ BUFFER (10) command is not a multiple of 512 (e.g., 512, 2 048, 2 560, 3 072), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

Table 28 shows the translation of the ATA Current Device Internal Status Data log.

Table 28 — Current Device Internal Status Data Log translation

Current device internal status parameter data field	ATA Current Device Internal Status Data field
AOI	ORGANIZATION IDENTIFIER
CURRENT INTERNAL STATUS DATA SET ONE LENGTH	DEVICE INTERNAL STATUS DATA AREA 1 LAST LOG PAGE
CURRENT INTERNAL STATUS DATA SET TWO LENGTH	DEVICE INTERNAL STATUS DATA AREA 2 LAST LOG PAGE
CURRENT INTERNAL STATUS DATA SET THREE LENGTH	DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE
NEW SAVED DATA AVAILABLE	SAVED DATA AVAILABLE
SAVED DATA GENERATION NUMBER	SAVED DATA GENERATION NUMBER
CURRENT REASON IDENTIFIER	REASON IDENTIFIER
CURRENT INTERNAL STATUS DATA SET A, CURRENT INTERNAL STATUS DATA SET B, and CURRENT INTERNAL STATUS DATA SET C	If the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is not set to zero, then the SATL shall transfer starting from ATA GPL Log address 24h log page 01h ending at the log page indicated in the DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field. If the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is set to zero, then no data shall be transferred to these fields.

8.8.2.4.6 Return saved error history buffers

If the BUFFER ID field in the READ BUFFER (10) command (see 8.8) matches the value in the SUPPORTED BUFFER ID field of an error history directory entry (see table 27) with a BUFFER FORMAT field set to 02h, then the SATL shall send an ATA READ LOG EXT or ATA READ LOG DMA EXT command to read the ATA Saved Device Internal Status Data pages (i.e., ATA GPL Log address 25h).

The SATL shall read no more log pages from ATA GPL Log address 25h than indicated by the ATA NUMBER OF LOG PAGES AT LOG ADDRESS 25h field in the ATA General Purpose Log Directory (i.e., ATA GPL log address 00h).

If the ALLOCATION LENGTH field in the READ BUFFER (10) command is not a multiple of 512 (e.g., 512, 2048, 2560, 3072), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

Table 29 shows the translation of the ATA Saved Device Internal Status Data log.

Table 29 — Saved Device Internal Status Data Log translation

Saved device internal status parameter data field	ATA Saved Device Internal Status Data field
AOI	ORGANIZATION IDENTIFIER
SAVED INTERNAL STATUS DATA SET ONE LENGTH	DEVICE INTERNAL STATUS DATA AREA 1 LAST LOG PAGE
SAVED INTERNAL STATUS DATA SET TWO LENGTH	DEVICE INTERNAL STATUS DATA AREA 2 LAST LOG PAGE
SAVED INTERNAL STATUS DATA SET THREE LENGTH	DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE
SAVED DATA AVAILABLE	SAVED DATA AVAILABLE
SAVED DATA GENERATION NUMBER	SAVED DATA GENERATION NUMBER
SAVED REASON IDENTIFIER	REASON IDENTIFIER
CURRENT INTERNAL STATUS DATA SET A, CURRENT INTERNAL STATUS DATA SET B, and CURRENT INTERNAL STATUS DATA SET C	If the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is not set to zero, then the SATL shall transfer starting from ATA GPL Log address 25h log page 01h ending at the log page indicated in the DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field. If the ATA DEVICE INTERNAL STATUS DATA AREA 3 LAST LOG PAGE field is set to zero, then no data shall be transferred to these fields.

8.9 REPORT SUPPORTED OPERATION CODES command

8.9.1 Overview

The REPORT SUPPORTED OPERATION CODES command is used to request the commands that are supported by the SATL. SPC-5 provides the details for reporting either a list of supported commands or support for a single command, but the information for several commands is modified depending on which mode pages are supported by the SATL. An application client may use the ATA Feature Control mode page (see 12.3.4) to specify which command duration limits mode pages are supported.

Table 30 describes the information in the REPORT SUPPORTED OPERATION CODES parameter data that is changed for certain commands depending on which command duration limits mode pages are supported by the SATL.

Table 30 — REPORT SUPPORTED OPERATION CODES parameter data translation

Command reported	Fields affected	Description
READ (16)	RWCDLP bit and CDLP field	See 8.9.2
WRITE (16)	RWCDLP bit and CDLP field	See 8.9.3

8.9.2 REPORT SUPPORTED OPERATION CODES parameter data for READ (16) command

The REPORT SUPPORTED OPERATION CODES parameter data for the READ (16) command translation is modified as follows:

1) if:
   A) the ATA Command Duration Limits feature set is enabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to one in the ATA Current Settings log page); and
   B) the SATL supports the Command Duration Limit T2A mode page (see 10.4.12),
   then the RWCDLP bit shall be set to one and the CDLP field shall be set to 01b;
2) if:
   A) the ATA Command Duration Limits feature set is disabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to zero in the ATA Current Settings log page); and
   B) the SATL supports the Command Duration Limit A mode page (see 10.4.5),
   then the RWCDLP bit shall be set to zero and the CDLP field shall be set to 01b;

   and
3) otherwise the RWCDLP bit shall be set to zero and the CDLP field shall be set to 00b.

8.9.3 REPORT SUPPORTED OPERATION CODES parameter data for WRITE (16) command

The REPORT SUPPORTED OPERATION CODES parameter data for the WRITE (16) command translation is modified as follows:

1) if:
   A) the ATA Command Duration Limits feature set is enabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to one in the ATA Current Settings log page); and
   B) the SATL supports the Command Duration Limit T2B mode page (see 10.4.13),
   then the RWCDLP bit shall be set to one and the CDLP field shall be set to 10b;
2) if:
   A) the ATA Command Duration Limits feature set is disabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to zero in the ATA Current Settings log page); and
   B) the SATL supports the Command Duration Limit B mode page (see 10.4.5),
   then the RWCDLP bit shall be set to zero and the CDLP field shall be set to 10b;

   and
3) otherwise the RWCDLP bit shall be set to zero and the CDLP field shall be set to 00b.

8.10 RECEIVE DIAGNOSTIC RESULTS command

8.10.1 Overview

The RECEIVE DIAGNOSTIC RESULTS command provides a mechanism for an application client to request diagnostic results from a diagnostic that was previously requested by a SEND DIAGNOSTIC command. Table 31 shows the translation for fields specified in the RECEIVE DIAGNOSTIC RESULTS CDB.

Table 31 — RECEIVE DIAGNOSTIC RESULTS CDB field translations

Field	Description
OPERATION CODE	Set to 1Ch
PCV	If the PCV bit is set to zero, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
PAGE CODE	If the PCV bit is set to one, then this field specifies the diagnostic page requested (see 10.2). If the SATL does not support the requested diagnostic page, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

8.11 READ MEDIA SERIAL NUMBER command

8.11.1 Overview

The READ MEDIA SERIAL NUMBER command (see SPC-5) requests that the SATL return the current media serial number.

The SATL shall send an ATA read log command requesting the ATA IDENTIFY DEVICE data log.

Table 32 shows the translation for fields in the READ MEDIA SERIAL NUMBER CDB.

Table 32 — READ MEDIA SERIAL NUMBER CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to ABh/01h
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

The translation of the READ MEDIA SERIAL NUMBER parameter data is defined in table 33.

Table 33 — READ MEDIA SERIAL NUMBER parameter data translations

READ MEDIA SERIAL NUMBER parameter data	ATA field	Description
MEDIA SERIAL NUMBER LENGTH	n/a	See 8.11.2
MEDIA SERIAL NUMBER	Current Media Serial Number in the ATA IDENTIFY DEVICE data log	The Media Serial Number

8.11.2 Media serial number length

If the MEDIA SERIAL NUMBER IS VALID bit in the ATA IDENTIFY DEVICE data log is set to one (i.e., media serial number is valid), then the MEDIA SERIAL NUMBER LENGTH field shall be set to 60, otherwise this field shall be set to zero.

8.12 REPORT TIMESTAMP command

8.12.1 Overview

The REPORT TIMESTAMP command (see SPC-5) requests that the SATL return the value of the timestamp.

The SATL shall send an ATA read log command for the General Statistics page of the ATA Device Statistics log.

If the DEVICE STATISTIC SUPPORTED bit in the DEVICE STATISTICS FLAGS field in the ATA Date and Time TimeStamp device statistic is set to zero, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

The translation of the REPORT TIMESTAMP parameter data is defined in Table 34.

Table 34 — REPORT TIMESTAMP CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to A3h / 0Fh [a]
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

Table 35 shows the translation for the fields in the REPORT TIMESTAMP parameter data buffer.

Table 35 — REPORT TIMESTAMP parameter data translations

REPORT TIMESTAMP parameter data	ATA field	Description
TIMESTAMP PARAMETER DATA LENGTH	n/a	Unspecified
TIMESTAMP ORIGIN	VALID VALUE bit in the DEVICE STATISTICS FLAGS in the Date and Time TimeStamp device statistic	See 8.12.2.
TIMESTAMP	The Date and Time TimeStamp field in the Date and Time TimeStamp statistic	The timestamp value

8.12.2 Timestamp origin

If the VALID VALUE bit in the DEVICE STATISTICS FLAGS field in the ATA Date and Time TimeStamp statistic is set to one then the TIMESTAMP ORIGIN field shall be set to 010b. If the VALID VALUE bit in the DEVICE STATISTICS FLAGS field in the ATA Date and Time TimeStamp statistic is set to zero, then the TIMESTAMP ORIGIN field shall be set to 000b.

8.13 REQUEST SENSE command

8.13.1 Overview

The REQUEST SENSE command requests any available sense data to be returned to the application client.

The SATL shall determine if there is contingent allegiance (see SAM-2) sense data to return to the application client. To determine if there is power condition sense data to return, the SATL shall send the ATA CHECK POWER MODE command to the ATA device. If the ATA CHECK POWER MODE command completes with an error and the device supports the SANITIZE feature set (see ACS-5), then the SATL shall send an ATA SANITIZE STATUS EXT command to determine status of any sanitize operation. To determine if there is a pending firmware activation condition to return, the SATL shall send an ATA read log command to read the ATA Current Settings log page.

If:

a) the ATA device has the ATA SMART feature set enabled (i.e., SMART ENABLED bit in the ATA IDENTIFY DEVICE data log is set to one); and
b) the MRIE field in the Informational Exceptions Control mode page is set to 6h (see 10.4.10.2),

then the SATL shall send the ATA SMART RETURN STATUS command to the ATA device.

In the event of multiple sense conditions, the SATL shall return sense data in accordance with the precedence specified in SAM-5 and SPC-5.

If the SATL has no sense data to return, then the SATL shall complete the REQUEST SENSE command with GOOD status with the sense key set to NO SENSE and the additional sense code set to NO ADDITIONAL SENSE DATA (see SPC-5). The SATL shall return any available sense data to the application client. Table 36 lists examples of conditions where the SATL has sense data to return.

Table 36 — Special REQUEST SENSE behavior reference

Emulated device state	Reference
Format operation in progress	8.13.2
SMART threshold exceeded condition	8.13.3
Stopped power condition	8.13.4
Unit attention condition established	8.13.5
Idle power condition	8.13.6
Standby power condition	8.13.7
Sanitize operation in progress	8.13.8
Firmware activation is pending	8.13.9

Table 37 shows the fields in the REQUEST SENSE CDB.

Table 37 — REQUEST SENSE CDB field translations

Field	Description
OPERATION CODE	Set to 03h
DESC	Unspecified [a]
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

[a] SATLs compliant with this standard require that descriptor mode sense be supported if the SATL supports the ATA PASS-THROUGH command (see 12.2.2.1).

8.13.2 Format operation in progress

If the SATL is processing a format operation (see SBC-4) and the SATL receives a REQUEST SENSE command, then the SATL shall provide pollable sense data (see SPC-5) with the sense key set to NOT READY with the additional sense code set to LOGICAL UNIT NOT READY, FORMAT IN PROGRESS and the PROGRESS INDICATION field in the sense key specific bytes set to progress indication of the format operation as defined in SBC-4 and SPC-5.

8.13.3 SMART threshold exceeded condition

If:

a) the ATA device has the SMART feature set enabled (i.e., SMART ENABLED bit in the ATA IDENTIFY DEVICE data log is set to one);
b) the MRIE field in the Informational Exceptions Control mode page is set to 6h (see 10.4.10.2);
c) the DEXCPT bit in the Informational Exceptions Control mode page is set to zero; and

d) the most recent ATA SMART RETURN STATUS command sent to the ATA device indicates that the error threshold has been exceeded,

then the SATL shall:

a) return parameter data containing sense data with the sense key set to NO SENSE with the additional sense code set to HARDWARE IMPENDING FAILURE GENERAL HARD DRIVE FAILURE; and
b) complete the REQUEST SENSE command with GOOD status.

8.13.4 Stopped power condition

If the emulated logical unit is in the stopped power condition then the SATL shall provide pollable sense data (see SPC-5) with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED.

8.13.5 Unit attention condition established

If the emulated logical unit has a pending unit attention condition, then the SATL shall:

1) return parameter data containing sense data describing the unit attention condition (see SPC-5);
2) complete the REQUEST SENSE command with GOOD status; and
3) clear the pending unit attention condition.

8.13.6 Idle power condition

If the emulated logical unit is in the idle power condition (e.g., after returning GOOD status to a START STOP UNIT command with the POWER CONDITION field set to IDLE), then the SATL shall provide pollable sense data (see SPC-5) with the sense key set to NO SENSE and the additional sense code set to:

a) POWER CONDITION ACTIVATED BY TIMER if the ATA CHECK POWER MODE command indicates PM1:Idle state; or
b) IDLE CONDITION ACTIVATED BY COMMAND if the logical unit entered the idle power condition as a result of a START STOP UNIT command or receipt of a command requiring the idle power condition.

8.13.7 Standby power condition

If the emulated logical unit is in the standby power condition (e.g., after returning GOOD status to a START STOP UNIT command with the POWER CONDITION field set to STANDBY), then the SATL shall provide pollable sense data (see SPC-5) with the sense key set to NO SENSE and the additional sense code set to:

a) POWER CONDITION ACTIVATED BY TIMER if the ATA CHECK POWER MODE command indicates PM2:Standby state; or
b) STANDBY CONDITION ACTIVATED BY COMMAND if the logical unit entered the standby power condition as a result of a START STOP UNIT command or receipt of a command requiring the standby power condition.

8.13.8 Sanitize operation in progress

If the SATL is processing a sanitize operation (see SBC-4) and the SATL receives a REQUEST SENSE command, then the SATL shall send an ATA SANITIZE STATUS EXT command to the ATA device to determine the status of the sanitize operation. If the ATA SANITIZE STATUS EXT command output indicates that:

a) the sanitize operation is in progress, then the SATL shall provide pollable sense data (see SPC-5) with the sense key set to NOT READY, the additional sense code set to LOGICAL UNIT NOT READY, SANITIZE IN PROGRESS, and the PROGRESS INDICATION field in the sense key specific bytes set to the value of the ATA SANITIZE PROGRESS INDICATION field;

b) the sanitize operation completed with error, then the SATL shall provide pollable sense data with the sense key set to MEDIUM ERROR and the additional sense code set to SANITIZE COMMAND FAILED; or
c) the sanitize operation completed without error, then the SATL shall provide sense data with the sense key set to NO SENSE and the additional sense code set to NO ADDITIONAL SENSE.

8.13.9 Firmware activation is pending

If the FW ACTIVATION PENDING bit is set to one in the ATA Current Settings log page, then the SATL shall:

1) provide pollable sense data (see SPC-5) with the sense key set to NO SENSE and the additional sense code set to DEFERRED MICROCODE IS PENDING; and
2) complete the REQUEST SENSE command with GOOD status.

8.14 SECURITY PROTOCOL IN command

The SECURITY PROTOCOL IN command provides a means for the application client to retrieve security information from a SCSI target device. If the SECURITY PROTOCOL field is set to EFh, then the command shall be processed as described in 12.5.1.

If the SECURITY PROTOCOL field is not set to EFh and the ALLOCATION LENGTH field is set to:

a) a non-zero value, then the SATL shall send the ATA trusted receive command to the ATA device; and
b) zero, then the SATL shall send the ATA TRUSTED NON-DATA command to the ATA device.

The translation for fields specified in the SECURITY PROTOCOL IN CDB is defined in table 38.

Table 38 — SECURITY PROTOCOL IN CDB field translations

Field	Description
OPERATION CODE	Set to A2h
SECURITY PROTOCOL	Copy to the ATA SECURITY PROTOCOL field
SECURITY PROTOCOL SPECIFIC	Copy to the ATA SP SPECIFIC field
INC_512	See 8.14.1.
ALLOCATION LENGTH	See 8.14.1.
CONTROL	See 6.5.

8.14.1 ALLOCATION LENGTH field

If the ALLOCATION LENGTH field is set to zero, then the SATL shall:

a) use the ATA TRUSTED NON-DATA command with bit 24 (i.e., the TRUSTED NON-DATA SEND/RECEIVE bit) of the LBA field set to one; and
b) ignore the INC_512 bit.

If the INC_512 bit is set to one, then:

a) if the ALLOCATION LENGTH field is set to a value greater than 0000_FFFFh, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
b) if the ALLOCATION LENGTH field is set to a value less than or equal to 0000_FFFFh, the ATA TRANSFER LENGTH field shall be set to the contents of bits (15:0) of the ALLOCATION LENGTH field. After completion

of the ATA trusted receive command without error, the data shall be transferred to the SCSI application client.

If the INC_512 bit is set to zero, then:

a) if the ALLOCATION LENGTH field is set to a value greater than 01FF_FE00h, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
b) if the ALLOCATION LENGTH field is set to a value less than or equal to 01FF_FE00h, the ATA TRANSFER LENGTH field shall be translated from a number of bytes to a number of padded 512-byte units from the result of the following calculation:

ATA TRANSFER LENGTH(15:0) = ((allocation length + 511) / 512)

After completion of the ATA trusted receive command without error, the data shall be transferred to the SCSI application client up to the number of bytes specified in the ALLOCATION LENGTH field.

8.15 SECURITY PROTOCOL OUT command

The SECURITY PROTOCOL OUT command provides a means for the application client to send security information to a SCSI target device.

If the SECURITY PROTOCOL field is set to EFh, then the command shall be processed as described in 12.5.3.

If the SECURITY PROTOCOL FIELD is set to a value other than EFh and the TRANSFER LENGTH field is set to:

a) a non-zero value, then the SATL shall send an ATA trusted send command to the ATA device; and
a) zero, then the SATL shall send the ATA TRUSTED NON-DATA command to the ATA device.

The translation for fields specified in the SECURITY PROTOCOL OUT CDB are defined in table 39.

Table 39 — SECURITY PROTOCOL OUT CDB field translations

Field	Description
OPERATION CODE	Set to B5h
SECURITY PROTOCOL	Copy to the ATA SECURITY PROTOCOL field
SECURITY PROTOCOL SPECIFIC	Copy to the ATA SP SPECIFIC field
INC_512	See 8.15.1.
TRANSFER LENGTH	See 8.15.1.
CONTROL	See 6.5.

8.15.1 TRANSFER LENGTH field and INC_512 field

If the TRANSFER LENGTH field is set to zero, then:

a) the SATL shall use the ATA TRUSTED NON-DATA command with bit 24 of the LBA field set to zero; and
b) ignore the INC_512 bit.

If the INC_512 bit is set to one, then:

a) if the TRANSFER LENGTH field is set to a value greater than 0000_FFFFh, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; or

b) if the TRANSFER LENGTH field is set to a value less than or equal to 0000_FFFFh, the ATA TRANSFER LENGTH field shall be set to the contents of bits (15:0) of the ALLOCATION LENGTH field. The ATA trusted send command shall be used to transfer the data.

If the INC_512 bit is set to zero, then:

a) if the TRANSFER LENGTH field is set to a value greater than 01FF_FE00h, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; or
b) if the TRANSFER LENGTH field is set to a value less than or equal to 01FF_FE00h, the ATA TRANSFER LENGTH field shall be translated from a number of bytes to a number of padded 512-byte units from the result of the following calculation:

ATA TRANSFER LENGTH(15:0) = ((transfer length + 511) / 512)

If the length of the final data block is not a multiple of 512 bytes, then the final data block shall be zero-padded (see SPC-5) to a multiple of 512 bytes. The ATA trusted send command shall transfer the padded data for the number of blocks specified by the ATA TRANSFER LENGTH field.

8.16 SEND DIAGNOSTIC command

8.16.1 Overview

The SEND DIAGNOSTIC command provides a mechanism for an application client to request diagnostic operations to be performed on the logical unit. The SATL shall implement the default self-test feature (see SPC-5). Table 40 shows the translation for fields specified in the SEND DIAGNOSTIC CDB.

Table 40 — SEND DIAGNOSTIC CDB field translations

Field	Description
OPERATION CODE	Set to 1Dh
SELF-TEST CODE	See 8.16.2 and 8.16.3.
PF	Unspecified
SELFTEST	See 8.16.3.
DEVOFFL	If the DEVOFFL bit is set to zero, then the SATL shall process the command as specified in SPC-5. If the DEVOFFL bit is set to one, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
UNITOFFL	If the UNITOFFL bit is set to zero, then the SATL shall process the command as specified in SPC-5. If the UNITOFFL bit is set to one, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
PARAMETER LIST LENGTH	Unspecified
CONTROL	See 6.5.

8.16.2 SELF-TEST CODE field

The SATL shall determine if the value in the SELF-TEST CODE field is valid based on the value of the SELFTEST bit and whether the ATA SMART EXECUTE OFF-LINE IMMEDIATE command (see ACS-4) is supported and enabled based on whether the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit and SMART ENABLED bit (see ACS-5) are both set to one (see 8.16.3).

If the value of the SELF-TEST CODE field is valid, then the SATL shall process the command as described in table 41.

Table 41 — SELF-TEST CODE field translation (part 1 of 2)

Code	Name of test	Description of test
000b		Other CDB fields specify the test to be performed (see table 42)
001b	Background short self-test	The SATL shall perform the following: 1) return status for the SEND DIAGNOSTIC command as soon as the CDB has been validated and initialize the Self-Test Results log page (see 10.3.8 and SPC-5); and 2) send an ATA SMART EXECUTE OFF-LINE IMMEDIATE command with bits 7:0 of the ATA LBA field set to one (i.e., Execute SMART Short self-test routine immediately in off-line mode) to the ATA device.
010b	Background extended self-test	The SATL shall perform the following: 1) return status for the SEND DIAGNOSTIC command as soon as the CDB has been validated and initialize the Self-Test Results log page (see 10.3.8 and SPC-5); and 2) send an ATA SMART EXECUTE OFF-LINE IMMEDIATE command with bits 7:0 of the ATA LBA field set to 02h (i.e., Execute SMART Extended self-test routine immediately in off-line mode) to the ATA device.
011b	Reserved	
100b	Abort background self-test	If a previous SEND DIAGNOSTIC command specified a background self-test function and that self-test has not completed (see SPC-5), then the SATL shall send an ATA SMART EXECUTE OFF-LINE IMMEDIATE command with bits 7:0 of the ATA LBA field set to 7Fh (i.e., Abort off-line mode self-test routine) to the ATA device. If the ATA SMART EXECUTE OFF-LINE IMMEDIATE command completes without error, then the SATL shall return GOOD status. If the ATA command completes with an error, then the SATL shall respond as defined in SPC-5.

Table 41 — SELF-TEST CODE field translation (part 2 of 2)

Code	Name of test	Description of test
101b	Foreground short self-test	The SATL shall: 1) send an ATA SMART EXECUTE OFF-LINE IMMEDIATE command with bits 7:0 of the ATA LBA field set to 81h (i.e., Execute SMART Short self-test routine immediately in captive mode) to the ATA device; 2) if the ATA SMART EXECUTE OFF-LINE IMMEDIATE command completes without error, then update the Self-Test Results log page prior to returning GOOD status; and 3) if the ATA command completes with an error, then: 1) update the Self-Test Results log page (i.e., if supported, see SPC-5); and 2) terminate the command with CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to LOGICAL UNIT FAILED SELF-TEST.
110b	Foreground extended self-test	The SATL shall: 1) send an ATA SMART EXECUTE OFF-LINE IMMEDIATE command with bits 7:0 of the ATA LBA field set to 82h (i.e., Execute SMART Extended self-test routine immediately in captive mode) to the ATA device; 2) if the ATA SMART EXECUTE OFF-LINE IMMEDIATE command completes without error, then update the Self-Test Results log page prior to returning GOOD status; and 3) if the ATA command completes with an error, then: 1) update the Self-Test Results log page (i.e., if supported, see SPC-5); and 2) terminate the command with CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to LOGICAL UNIT FAILED SELF-TEST.
111b	Reserved	

8.16.3 SELFTEST bit

The translation of the SELFTEST bit is based on whether or not the ATA device supports and has enabled the ATA SMART EXECUTE OFF-LINE IMMEDIATE command as shown in table 42.

Table 42 — SELFTEST bit (part 1 of 2)

Code	ATA SMART EXECUTE OFF-LINE IMMEDIATE command [a]		SATL translation
	supported	**enabled**	
0	no	n/a	The SATL shall terminate the SEND DIAGNOSTIC command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
	yes	no	The SATL shall terminate the SEND DIAGNOSTIC command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to ATA DEVICE FEATURE NOT ENABLED.
		yes	If the SELF-TEST CODE field is valid, then the SATL shall process the SEND DIAGNOSTIC command based on the value specified in the SELF-TEST CODE field as defined in 8.16.2.

[a] The SATL shall determine if the ATA SMART EXECUTE OFF-LINE IMMEDIATE command is supported and enabled based on the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit and SMART ENABLED bit (see ACS-5).

[b] The SATL may retry any of the three ATA verify commands if an ATA verify command fails on the first attempt and the retried command may specify an alternate LBA. If the retried command completes without error, then the SATL may consider the ATA verify command as having completed without error.

Table 42 — SELFTEST bit (part 2 of 2)

Code	ATA SMART EXECUTE OFF-LINE IMMEDIATE command [a]		SATL translation
	supported	enabled	
1	no	n/a	The SATL shall send three ATA verify commands to the ATA device with the ATA COUNT field set to one and the ATA LBA field set to: a) zero; b) the maximum user-addressable LBA; and c) an arbitrary number between zero and the maximum user-addressable LBA. If any of the three ATA verify commands ends with an error, then the SATL shall terminate the SEND DIAGNOSTIC command with a CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to LOGICAL UNIT FAILED SELF-TEST. If all three ATA verify commands complete without error [b], then the SATL shall return GOOD status.
	yes	no	
	yes		The SATL shall send an ATA SMART EXECUTE OFF-LINE IMMEDIATE command with bits 7:0 of the ATA LBA field set to 81h (i.e., Execute SMART Short self-test routine immediately in captive mode) to the ATA device. If the ATA EXECUTE OFF-LINE IMMEDIATE command completes without error, then the SATL shall return GOOD status. If the ATA EXECUTE OFF-LINE IMMEDIATE command completes with an error, then the SATL shall terminate the SEND DIAGNOSTIC command with CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to LOGICAL UNIT FAILED SELF-TEST.

[a] The SATL shall determine if the ATA SMART EXECUTE OFF-LINE IMMEDIATE command is supported and enabled based on the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit and SMART ENABLED bit (see ACS-5).

[b] The SATL may retry any of the three ATA verify commands if an ATA verify command fails on the first attempt and the retried command may specify an alternate LBA. If the retried command completes without error, then the SATL may consider the ATA verify command as having completed without error.

8.17 SET TIMESTAMP command

8.17.1 Overview

The SET TIMESTAMP command (see SPC-5) requests that the SATL initialize the timestamp.

If the DEVICE STATISTIC SUPPORTED bit in the DEVICE STATISTICS FLAGS field in the ATA Date and Time TimeStamp statistic is set to zero, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

If the DEVICE STATISTIC SUPPORTED bit in the DEVICE STATISTICS FLAGS field in the ATA Date and Time TimeStamp statistic is set to one, then the SATL shall send an ATA SET DATE & TIME EXT command.

The translation for fields in the SET TIMESTAMP CDB is defined in table 43.

Table 43 — SET TIMESTAMP CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to A4h / 0Fh [a]
PARAMETER LIST LENGTH	Unspecified
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

The translation for the fields in the SET TIMESTAMP parameter data buffer are defined in Table 44.

Table 44 — SET TIMESTAMP parameter data translation

Data-out Buffer field	ATA field	Description
TIMESTAMP	ATA LBA field	The timestamp value

8.18 TEST UNIT READY command

8.18.1 Overview

The TEST UNIT READY command is used to determine whether the device is ready (see table 45).

Table 45 — TEST UNIT READY CDB field translations

Field	Description
OPERATION CODE	Set to 00h
CONTROL	See 6.5.

8.18.2 TEST UNIT READY command translation

The SATL processes the TEST UNIT READY command as follows:

1) if any condition exists that prevents the SATL from issuing commands to the ATA device, then the SATL should terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code of LOGICAL UNIT NOT READY, CAUSE NOT REPORTABLE;
2) if the emulated device is in the stopped power condition as the result of processing a START STOP UNIT command (see 9.21), then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code of LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED;
3) if the ATA device is processing a self-test in the foreground mode, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, SELF-TEST IN PROGRESS;

4) if the SATL is processing a FORMAT UNIT command for the emulated device (see 9.4), then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, FORMAT IN PROGRESS;
5) if the SATL is processing a SANITIZE command for the emulated device (see 9.19), then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, SANITIZE IN PROGRESS; and
6) if the ATA device completed the most recent ATA command with the DEVICE FAULT bit set to one in the STATUS field, then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to LOGICAL UNIT FAILURE or INTERNAL TARGET FAILURE.

If none of the conditions defined in items 1) to 6) apply, then the SATL shall send an ATA CHECK POWER MODE command to the ATA device, and:

a) if the ATA CHECK POWER MODE command completes without error, then the SATL shall complete the TEST UNIT READY command with GOOD status;
b) if the ATA CHECK POWER MODE command completes with the DEVICE FAULT bit set to one in the STATUS field, the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to LOGICAL UNIT FAILURE or INTERNAL TARGET FAILURE; or
c) if the ATA CHECK POWER MODE command completes with any other error, then the SATL shall send an ATA SANITIZE STATUS EXT command to the ATA device and:
    A) if the ATA SANITIZE STATUS EXT command completes without error and the output indicates that a sanitize operation is in progress, then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to NOT READY, the additional sense code set to LOGICAL UNIT NOT READY, SANITIZE IN PROGRESS, and the PROGRESS INDICATION field in the sense key specific bytes set to the value of the ATA SANITIZE PROGRESS INDICATION field;
    B) if the ATA SANITIZE STATUS EXT command completes without error and the output indicates that the sanitize operation completed with error, then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to MEDIUM ERROR and the additional sense code set to SANITIZE COMMAND FAILED;
    C) if the ATA SANITIZE STATUS EXT command completes without error and the output indicates that the sanitize operation completed successfully, then the SATL shall complete the TEST UNIT READY command with GOOD status; or
    D) if the ATA SANITIZE STATUS EXT command completes with an error, then the SATL shall terminate the TEST UNIT READY command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT DOES NOT RESPOND TO SELECTION.

8.19 WRITE BUFFER command

8.19.1 Overview

The WRITE BUFFER command (see SPC-5) is used in conjunction with the READ BUFFER (10) command as a diagnostic function for testing logical unit memory in the SCSI target device and for testing the integrity of a service delivery subsystem. Additional modes are provided for downloading, saving, and activating microcode.

Table 46 shows the translation for fields specified in the WRITE BUFFER CDB.

Table 46 — WRITE BUFFER CDB field translations

Field	Description
OPERATION CODE	Set to 3Bh
MODE SPECIFIC	If the MODE field is set to 0Dh, then see 8.19.2.5, otherwise this field is unspecified.
MODE	See 8.19.2.1.
BUFFER ID	If the MODE field is set to 02h, then see 8.19.2.2, otherwise this field is unspecified.
BUFFER OFFSET	If the MODE field is set to 07h, then see 8.19.2.4. If the MODE field is set to 0Dh or 0Eh, then see 8.19.2.5. Otherwise, this field is unspecified.
PARAMETER LIST LENGTH	If the MODE field is set to 02h, then see 8.19.2.2, otherwise this field is unspecified.
CONTROL	See 6.5.

8.19.2 WRITE BUFFER command translation

8.19.2.1 MODE field

The MODE field specifies the function to be performed by the SATL.

Table 47 — MODE field

Code	Description
02h (i.e., Write data)	Send an ATA write buffer command (see 8.19.2.2).
05h (i.e., Download microcode and save)	Send an ATA download microcode command. The ATA FEATURE field shall be set to 07h (i.e., indicating downloaded microcode is saved for immediate and future use) (see 8.19.2.3).
07h (i.e., Download microcode with offsets, save, and activate)	Send an ATA download microcode command. The ATA FEATURE field shall be set to 03h (i.e., download microcode with offsets is saved for immediate and future use) (see 8.19.2.4).
0Dh (i.e., Download microcode with offsets, select activation events, save, and defer activate)	Send an ATA download microcode command. The ATA FEATURE field shall be set to 0Eh (i.e., download microcode with offsets is saved with deferred activation) (see 8.19.2.5).
0Eh (i.e., Download microcode with offsets, save, and defer activate)	Send an ATA download microcode command. The ATA FEATURE field shall be set to 0Eh (i.e., download microcode with offsets is saved with deferred activation) (see 8.19.2.5).
0Fh (i.e., Activate deferred microcode)	Send an ATA download microcode command. The ATA FEATURE field shall be set to 0Fh (i.e., activate deferred microcode) (see 8.19.2.6).
All others	Unspecified

8.19.2.2 Write data mode 02h

In this mode, data transferred to the SATL from the application client is transmitted to the ATA device using the ATA write buffer command.

In this mode, the MODE SPECIFIC field is reserved.

If:

a) the BUFFER ID field is set to 00h;
b) the BUFFER OFFSET field is set to 00h; and
c) the PARAMETER LIST LENGTH field is set to 200h,

then the SATL shall write 200h bytes to the buffer in the ATA device by sending an ATA write buffer command to the ATA device.

If the BUFFER ID FIELD is set to 00h and:

a) the BUFFER OFFSET field is set to a value other than 00h; or
b) the PARAMETER LIST LENGTH field is set to a value other than 200h,

then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

The SATL may support a value other than 00h in the BUFFER ID field. If the SATL supports a value other than 00h in the BUFFER ID field, then the implementation shall be as defined in SPC-5.

8.19.2.3 Download microcode mode 05h

In this mode, data transferred to the SATL from the application client is transmitted to the ATA device using one or more ATA download microcode commands, if supported by the ATA device (i.e., ATA IDENTIFY DEVICE data log DOWNLOAD MICROCODE SUPPORTED bit is set to one or ATA IDENTIFY DEVICE data log DOWNLOAD MICROCODE DMA SUPPORTED bit is set to one).

In this mode, the MODE SPECIFIC field is reserved.

If the ATA device does not support either the ATA DOWNLOAD MICROCODE command or the ATA DOWNLOAD MICROCODE DMA command, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If:

a) the SATL receives a WRITE BUFFER command with the MODE field set to 05h;
b) the contents of the ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field is zero, FFFFh, or not smaller than the contents the PARAMETER LIST LENGTH field bits 23:9; and
c) the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field is zero, FFFFh, or not larger than the contents of the PARAMETER LIST LENGTH field bits 23:9;

then the SATL shall:

1) send one ATA download microcode command with the ATA fields set as specified in table 48 to the ATA device.
2) if the ATA device accepts the ATA download microcode command, then transfer the microcode image or control information from the application client to the ATA device;
3) if the ATA download microcode command completes without error, then:
   A) complete the WRITE BUFFER command with GOOD status;
   B) establish a unit attention condition (see 5.3) for the initiator port associated with all I_T nexuses except the I_T nexus on which the WRITE BUFFER command was received, with the additional sense code set to MICROCODE HAS BEEN CHANGED;

   and
4) if the ATA download microcode command completes with an error, then terminate the WRITE BUFFER command with CHECK CONDITION status with the sense key and the additional sense code set to values as described in clause 11.

Table 48 — Download microcode mode 05h ATA field values

ATA Field		Contents
Field Name	**Bits**	
FEATURE	7:0	07h
LBA	27:7	0b
	6:0	PARAMETER LIST LENGTH field bits 23:17
COUNT	7:0	PARAMETER LIST LENGTH field bits 16:9

If the PARAMETER LIST LENGTH field bits 8:0 is a non-zero value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the PARAMETER LIST LENGTH field bits 23:9 is greater than the contents of ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field and the contents of ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field is a non-zero value, then the SATL shall:

a) translate the transfer into multiple ATA download microcode commands, using ATA download microcode mode 3 if supported (e.g., the DM MODE 3 SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one); or
b) terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the PARAMETER LIST LENGTH field bits 23:9 is less than the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field and the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field is not an FFFFh value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

8.19.2.4 Download microcode mode 07h

In this mode, data transferred to the SATL from the application client is transmitted to the ATA device using one or more ATA download microcode commands if supported by the ATA device (i.e., ATA IDENTIFY DEVICE data log DOWNLOAD MICROCODE SUPPORTED bit is set to one or ATA IDENTIFY DEVICE data log DOWNLOAD MICROCODE DMA SUPPORTED bit is set to one).

In this mode, the MODE SPECIFIC field is reserved.

If the ATA device does not support the ATA download microcode command with the Download with offsets and save microcode for immediate and future use subcommand (i.e., the DM MODE 3 SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN CDB.

If:

a) the SATL receives a WRITE BUFFER command with the MODE field set to 07h;
b) the contents of the ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field is zero, FFFFh, or not smaller than the contents the PARAMETER LIST LENGTH field bits 23:9; and
c) the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field is zero, FFFFh, or not larger than the contents of the PARAMETER LIST LENGTH field bits 23:9;

then the SATL shall:

1) send an ATA download microcode command with the ATA field values specified in table 49;
2) if the ATA download microcode command in step 1) is accepted by the ATA device, transfer the microcode or control information from the application client to the ATA device;
3) if the ATA download microcode command in step 1) completed with an error, terminate the command with CHECK CONDITION status with the sense key and the additional sense code set as described in clause 11;
4) if the ATA download microcode command from step 1) completes without error and the ATA COUNT field returned is value 02h (i.e., indicates that the ATA device has applied the new microcode), then the SATL shall establish a unit attention condition (see SAM-5) for the initiator port associated with all I_T nexuses except the I_T nexus on which the set of WRITE BUFFER commands was received, with the additional sense code set to MICROCODE HAS BEEN CHANGED; and
5) if the ATA download microcode command from step 1) completes without error, then complete the WRITE BUFFER command with GOOD status.

Table 49 — Download microcode mode 07h ATA field values

ATA field		Contents
Field name	**Bits**	
FEATURE	7:0	03h
LBA	27:23	0b
	22:8	BUFFER OFFSET field bits 23:9
	7	0b
	6:0	PARAMETER LIST LENGTH field bits 23:17
COUNT	7:0	PARAMETER LIST LENGTH field bits 16:9

If the PARAMETER LIST LENGTH field bits 8:0 is a non-zero value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the BUFFER OFFSET field bits 8:0 is a non-zero value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the PARAMETER LIST LENGTH field bits 23:9 is greater than the contents of ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field and the contents of ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field is a non-zero value, then the SATL shall either translate the transfer into multiple ATA download microcode commands or terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the PARAMETER LIST LENGTH field bits 23:9 is less than the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field and the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field is not an FFFFh value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

8.19.2.5 Download microcode mode 0Dh and mode 0Eh

In these modes, data transferred to the SATL from the application client is transmitted to the ATA device using one or more ATA download microcode commands if supported by the ATA device (i.e., the ATA IDENTIFY DEVICE data log DOWNLOAD MICROCODE SUPPORTED bit is set to one or the ATA IDENTIFY DEVICE data log DOWNLOAD MICROCODE DMA SUPPORTED bit is set to one).

The MODE SPECIFIC field is reserved for mode 0Eh.

If the ATA device does not support the ATA DOWNLOAD MICROCODE command with offsets and save microcode for future use command (i.e., the DM OFFSETS DEFERRED SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the download microcode mode is set to 0Dh and:

a) the PO_ACT bit is set to zero; or
b) the HR_ACT bit is set to one,

then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If:

a) the SATL receives a WRITE BUFFER command with the MODE field set to 0Dh or 0Eh;
b) the contents of the ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field is zero, FFFFh, or not smaller than the contents the PARAMETER LIST LENGTH field bits 23:9; and
c) the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field is zero, FFFFh, or not larger than the contents of the PARAMETER LIST LENGTH field bits 23:9;

then the SATL shall:

1) send an ATA download microcode command with the ATA field values specified in table 50;
2) if the ATA download microcode command in step 1) is accepted by the ATA device, then transfer the microcode or control information from the application client to the ATA device;
3) if the ATA download microcode command in step 1) completed in error, then terminate the command with CHECK CONDITION status with the sense key and the additional sense code set as described in clause 11;
4) if the ATA download microcode command in step 1) completes without error and the value of the ATA COUNT field returned is 03h (i.e.,all segments of the updated microcode data have been received and saved, and the device is waiting for activation of the updated microcode data), then maintain an indication that there is deferred microcode that has been saved and not activated; and
5) if the ATA download microcode command in step 1) completes without error, then complete the WRITE BUFFER command with GOOD status.

Table 50 — Download microcode mode 0Dh and mode 0Eh ATA field values

ATA field		**Contents**
Field Name	Bits	
FEATURE	7:0	0Eh
LBA	27:23	0b
	22:8	BUFFER OFFSET field bits 23:9
	7	0b
	6:0	PARAMETER LIST LENGTH field bits 23:17
COUNT	7:0	PARAMETER LIST LENGTH field bits 16:9

If the PARAMETER LIST LENGTH field bits 8:0 is a non-zero value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the BUFFER OFFSET field bits 8:0 is a non-zero value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the PARAMETER LIST LENGTH field bits 23:9 is greater than the contents of the ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field and the contents of ATA IDENTIFY DEVICE data log DM MAXIMUM TRANSFER SIZE field is a non-zero value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the PARAMETER LIST LENGTH field bits 23:9 is less than the contents of the ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field and the contents of ATA IDENTIFY DEVICE data log DM MINIMUM TRANSFER SIZE field is not a FFFFh value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

The SATL may translate a single WRITE BUFFER mode 0Dh or mode 0Eh request into multiple ATA download microcode commands.

If any of the ATA download microcode commands completes with an error, the SATL shall terminate processing of the SCSI command and report the error as described in clause 11.

If an ATA download microcode command completes without error and the ATA device returns a COUNT field set to 01h, then the SATL should send additional ATA download microcode commands.

If the ATA command completes without error and the ATA device returns a COUNT field set to 03h, then the SATL shall maintain an indication that there is deferred microcode that has been saved and not activated. The new microcode shall be activated by whichever event in table 51 occurs first.

Table 51 — Activation events for download microcode modes 0Dh and 0Eh

SATL activation events	Microcode to be activated
the next time that the ATA device processes a power on reset	Deferred microcode is activated (see 5.3).
process a WRITE BUFFER command with the MODE field set to 0Fh	Deferred microcode is activated (see 5.3).
START STOP UNIT command	See 9.21.
FORMAT UNIT command	See 9.4.
hard reset	Unspecified
vendor specific event	Unspecified

Since the only activation events in ATA are power on reset and activation by means of an ATA download microcode command with mode 0Fh, the SATL should activate saved microcode pending activation before processing a START STOP UNIT command (see 9.21) or FORMAT UNIT command (see 9.4).

If there is saved microcode pending activation, then the SATL shall terminate a SANITIZE command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, MICROCODE ACTIVATION REQUIRED.

8.19.2.6 Download microcode mode 0Fh

In this mode, no data is transferred to the SATL from the application client and no data is transmitted to the ATA device using the ATA download microcode command.

If any of these fields:

a) MODE SPECIFIC;
b) BUFFER OFFSET;
c) BUFFER ID; and
d) PARAMETER LIST LENGTH,

are not set to zero, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the ATA device does not support the ATA download microcode command with the Activate download microcode subcommand (i.e., the DM OFFSETS DEFERRED SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the SATL receives a WRITE BUFFER command with the MODE field set to 0Fh, then the SATL shall send an ATA download microcode command with the ATA field values specified in table 52. The SATL shall check if the ATA download microcode command completed with an error. If the ATA download microcode command

completed with an error, then the SATL shall terminate the command with CHECK CONDITION status with the sense key and the additional sense code set as described in clause 11.

Table 52 — Download Microcode Mode 0Fh ATA Field Values

ATA field		Contents
Field Name	Bits	
FEATURE	7:0	0Fh
LBA	27:0	000_0000h
COUNT	7:0	00h

If the ATA download microcode command completed without error and the value of the COUNT field in the normal returns is 02h, then the SATL shall establish a unit attention condition (see 5.3) for the initiator port associated with all I_T nexuses except the I_T nexus on which the set of WRITE BUFFER commands was received, with the additional sense code set to MICROCODE HAS BEEN CHANGED.

The SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB if:

a) the ATA LBA field is a non-zero value; or
b) the ATA COUNT field is a non-zero value.

9 SBC-4 and ZBC command mapping

9.1 Translating LBA and transfer length and ATA command use constraints

9.1.1 Overview

A SATL may implement:

1) a direct logical block mapping of ATA logical sectors to SCSI logical blocks (see 9.1.2); or
2) an indirect logical block mapping translation (see 9.1.3).

9.1.2 Direct logical block mapping model

If the SATL implements direct logical block mapping, then the logical block size indicated by the BLOCK LENGTH IN BYTES field in the READ CAPACITY data (see 9.12.2 and 9.13.2) shall equal the ATA logical sector size. The ATA LBA of an ATA logical sector shall equal the LBA of the corresponding SCSI logical block.

9.1.3 Indirect logical block mapping model

If the SATL implements indirect block mapping, then the constraints of the direct logical block mapping model (see 9.1.2) do not apply. The logical block size indicated by the BLOCK LENGTH IN BYTES field in the READ CAPACITY data (see 9.12.2 and 9.13.2) may not equal the ATA logical sector size (e.g., SCSI logical block size of 520 bytes with an ATA Logical Sector Size of 512 bytes). The SATL translates between the SCSI LBA and the ATA LBA in a vendor specific manner. The result of a logical block address translated in one direction and then translated in the reverse direction shall yield the original LBA.

9.1.4 Selection of ATA block commands

The ATA commands the SATL uses to implement the functions specified by SCSI block commands depend upon:

a) the value of the LOGICAL BLOCK ADDRESS field and TRANSFER LENGTH field specified in the SCSI CDB; and
b) the capabilities of the ATA device and the ATA host within the SATL.

Table 53 relates selection conditions to allowable ATA commands used to implement SCSI block storage data transfer commands. ATA commands listed in the Allowed ATA commands column shall not be used in the translation of a SCSI block command if the prerequisite conditions listed in Selection Prerequisites columns are not met.

Table 53 — ATA commands used for SCSI block command translations

Selection Prerequisites				Allowed ATA commands
Requires that the highest ATA logical sector accessed is < 2^{28} [a]	48-bit Address Feature Set [b]	DMA Capability [c]	NCQ Feature Set	
no	no	no	no	WRITE UNCORRECTABLE EXT DATA SET MANAGEMENT DATA SET MANAGEMENT XL
yes [d]	no	no	no	READ SECTOR(S) READ VERIFY SECTOR(S) WRITE SECTOR(S) FLUSH CACHE
yes [d]	no	yes	no	READ DMA WRITE DMA
no	yes	yes	no	READ DMA EXT WRITE DMA EXT WRITE DMA FUA EXT
no	yes	no	no	READ SECTOR(S) EXT READ VERIFY SECTOR(S) EXT WRITE SECTOR(S) EXT FLUSH CACHE EXT
no	no	no	yes	READ FPDMA QUEUED WRITE FPDMA QUEUED

Key:

Yes = The indicated prerequisite shall be met before the SATL uses an ATA command listed in the row.

No = The indicated prerequisite is not required.

[a] If the SATL implements the direct mapping model (see 9.1.2) between ATA logical sectors and SCSI logical blocks, then this represents the last logical block transferred. If the SATL implements the indirect logical block mapping model, then this constraint is vendor specific.

[b] If the ATA device supports neither the 48-bit Address feature set (i.e., ATA IDENTIFY DEVICE data log 48-BIT SUPPORTED bit is set to zero) nor NCQ (i.e., ATA IDENTIFY DEVICE data log NCQ FEATURE SET SUPPORTED bit is set to zero) (see SATA-3.5a) and the LBA of the logical sector is greater than (2^{28}-1), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the sense code set to LOGICAL BLOCK ADDRESS OUT OF RANGE.

[c] The DMA prerequisite requires both the ATA host in the SATL and the ATA device to have the same DMA transfer mode enabled (i.e., the DMA SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one and at least one DMA mode is enabled in the MULTIWORD DMA MODES field in the ATA IDENTIFY DEVICE data log or the ULTRA DMA MODES field in the ATA IDENTIFY DEVICE data log).

[d] The SATL may transfer the number of logical blocks requested in the TRANSFER LENGTH field of the SCSI CDB by sending multiple ATA commands, each time incrementing the ATA LBA field by the number of ATA sectors (i.e., the contents of the previous ATA SECTOR COUNT field) transferred.

The SATL may use the ATA commands listed in table 53 in the translation of SCSI read commands, SCSI write commands, SCSI write and verify commands, SCSI verify commands, and SCSI synchronize cache commands if the prerequisites defined for the command as shown in table 53 are met. The translations for specific SCSI block commands in clause 9 further constrain the use of the available ATA commands in implementing the translation.

9.2 CLOSE ZONE command

9.2.1 Overview

The CLOSE ZONE command requests that the specified zone or zones be closed. This command is applicable to ATA zoned devices. If the ATA CLOSE ZONE EXT command is not supported by the device (i.e., if the NON-DATA CLOSE ZONE EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 54 shows the translation for fields in the CLOSE ZONE CDB.

Table 54 — CLOSE ZONE CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 94h / 01h [a]
ZONE ID	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA ZONE ID field in the ATA CLOSE ZONE EXT command to the value specified in the ZONE ID field. If the SATL does not implement direct logical block mapping, then the usage of this field is unspecified.
ZONE COUNT	The SATL shall set the ATA ZONE COUNT field in the ATA CLOSE ZONE EXT command to the value of the ZONE COUNT field.
ALL	The SATL shall set the ATA ALL bit in the ATA CLOSE ZONE EXT command to the value of the ALL bit.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.2.2 CLOSE ZONE command processing

The SATL shall send an ATA CLOSE ZONE EXT command (see ZAC-2) with the fields set as described in table 54.

9.3 FINISH ZONE command

9.3.1 Overview

The FINISH ZONE command requests that the specified zone or zones be finished. This command is applicable to ATA zoned devices. If the ATA FINISH ZONE EXT command is not supported by the device (i.e., if the NON-DATA FINISH ZONE EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 55 shows the translation for fields in the FINISH ZONE CDB.

Table 55 — FINISH ZONE CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 94h / 02h [a]
ZONE ID	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA ZONE ID field in the ATA FINISH ZONE EXT command to the value specified in this field. If the SATL does not implement direct logical block mapping, then the usage of this field is unspecified.
ZONE COUNT	The SATL shall set the ATA ZONE COUNT field in the ATA FINISH ZONE EXT command to the value of the ZONE COUNT field.
ALL	The SATL shall set the ATA ALL bit in the ATA FINISH ZONE EXT command to the value of the ALL bit.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.3.2 FINISH ZONE command processing

The SATL shall send an ATA FINISH ZONE EXT command (see ZAC-2) with the fields set as described in table 55.

9.4 FORMAT UNIT command

9.4.1 Overview

The FORMAT UNIT command verifies that all LBAs accessible to SCSI application clients are formatted and ready for data transfers. Table 56 shows the translation for fields in the FORMAT UNIT CDB.

Table 56 — FORMAT UNIT CDB field translations

Field	Description
OPERATION CODE	Set to 04h
FMTPINFO	Unspecified
LONGLIST	Unspecified
FMTDATA	If set to zero then no data shall be transferred from the application client and if no other illegal fields in the CDB are detected, then the SATL shall return GOOD status without issuing any commands to the ATA device. If set to one then the FORMAT UNIT parameter list shall be transferred from the application client and the SATL shall process the FORMAT UNIT parameter list as described in 9.4.2.
CMPLIST	If a complete list is specified (i.e., the FMTDATA bit is set to one and the CMPLIST bit is set to one), then the SATL shall terminate the command with a CHECK CONDITION status with sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
DEFECT LIST FORMAT	If: a) the FMTDATA bit is set to one; b) the DEFECT LIST FORMAT field is set to 000b or 110b; and c) the defect list length is non-zero, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST. If: a) the FMTDATA bit is set to one; and b) the DEFECT LIST FORMAT field is set to a value other than 000b or 110b, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.
FFMT	Unspecified
CONTROL	See 6.5.

The SATL shall process commands received during the processing of the FORMAT UNIT command as specified in SBC-4.

If deferred microcode has been saved and not activated (see 8.19.2.5), then the SATL should activate the deferred microcode (see 8.19.2.6) before processing a FORMAT UNIT command.

9.4.2 FORMAT UNIT parameter list

If the FORMAT UNIT command CDB specifies a FMTDATA bit set to one, then the SATL shall accept a FORMAT UNIT parameter list consisting of a short or long defect list header and may accept an initialization pattern descriptor. The SATL shall ignore any defect descriptors provided. Table 57 defines the SATL translation of fields in the FORMAT UNIT defect list header.

Table 57 — FORMAT UNIT parameter list header field translations

Field	Description
PROTECTION FIELD USAGE	Unspecified
FOV	See 9.4.3.
DPRY	The SATL shall ignore this field.
DCRT	See 9.4.3 and 9.4.4.
STPF	Unspecified
IP	See 9.4.3 and 9.4.5.
IMMED	See 9.4.3.
P_I_INFORMATON [a]	Unspecified
PROTECTION INTERVAL EXPONENT [a]	Unspecified
DEFECT LIST LENGTH	Unspecified. The SATL shall ignore any defect descriptors provided.

[a] This field is only present in the long parameter list header.

9.4.3 FORMAT UNIT parameter list header field combinations

Table 58 describes the actions the SATL takes depending on the values set in the IMMED bit, the FOV bit, the DCRT bit, and the IP bit.

Table 58 — FORMAT UNIT parameter list header field combinations (part 1 of 2)

FOV	DCRT	IP	Description of SATL processing
0	0	0	The SATL may complete the command with GOOD status.
0	1	any	The SATL shall complete the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.
0	any	1	The SATL shall complete the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

[a] The FORMAT UNIT command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

[b] The sense key is set to MEDIUM ERROR. If the failure is during the write operation, then the additional sense code is set to PERIPHERAL DEVICE WRITE FAULT. If the failure is during the certify operation (see 9.4.4), then the additional sense code is set to RECORD NOT FOUND.

Table 58 — FORMAT UNIT parameter list header field combinations (part 2 of 2)

FOV	DCRT	IP	Description of SATL processing
1	1	0	The SATL shall complete the command with GOOD status without issuing any commands to the ATA device.
	0	0	If the SATL does not support media certification (see 9.4.4), then the SATL shall terminate the command. [a] If the SATL does support media certification, then the SATL shall: 1) if the IMMED bit is set to one, then return GOOD status; 2) perform the certify operation as described in 9.4.4; 3) if the IMMED bit is set to zero and any unrecoverable errors occur then terminate the FORMAT UNIT command with CHECK CONDITION status [b]; and 4) return GOOD status if the IMMED bit is set to zero and no unrecoverable errors occurred.
	0	1	If the SATL does not support the write operation described by the initialization pattern descriptor (see 9.4.5) or does not support media certification (see 9.4.4), then the SATL shall terminate the command [a]. If the SATL does support the write operation described in 9.4.5: 1) if the IMMED bit is set to one, then the SATL shall return GOOD status; 2) the SATL shall perform the write operation; 3) if the SATL supports media certification, then the SATL shall perform the certify operation as described in 9.4.4; and 4) if the IMMED bit is set to zero: A) if any unrecoverable errors occur, then the SATL shall terminate the FORMAT UNIT command with CHECK CONDITION status [b];and B) if no unrecoverable errors occur, then the SATL shall return GOOD status.
	1	1	If the SATL does not support the write operation described by the initialization pattern descriptor (see 9.4.5), then the SATL shall terminate the command [a]. If the SATL does support the write operation described in 9.4.5: 1) if the IMMED bit is set to one, then the SATL shall return GOOD status; 2) the SATL shall perform the write operation; and 3) if the IMMED bit is set to zero: A) if any unrecoverable errors occur, then the SATL shall terminate the FORMAT UNIT command with CHECK CONDITION status [b]; and B) if no unrecoverable errors occur, then the SATL shall return GOOD status.

[a] The FORMAT UNIT command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

[b] The sense key is set to MEDIUM ERROR. If the failure is during the write operation, then the additional sense code is set to PERIPHERAL DEVICE WRITE FAULT. If the failure is during the certify operation (see 9.4.4), then the additional sense code is set to RECORD NOT FOUND.

9.4.4 DCRT bit

If the FOV bit is set to one, the DCRT bit is set to zero and the SATL supports media certification as described in this clause, then the SATL shall send ATA verify commands to access all the logical sectors on the medium of the ATA device that the SATL uses to emulate logical blocks accessible by the application client. For every unrecoverable read error that is encountered, the SATL shall send an ATA write command to the defective logical sector to attempt to cause logical sector reallocation. The data written shall be:

a) the data pattern specified by the initialization pattern descriptor, if any; or
b) vendor specific if there is no initialization pattern descriptor.

After writing the affected logical sector, the SATL shall again send an ATA verify command to the same logical sector to verify the alternate logical sector is not defective. The process shall repeat until the logical sector is verified successfully or the ATA device returns an error other than an unrecoverable read error (e.g., device fault). See 5.4 for a description of error handling for multiple ATA command sequences.

9.4.5 Initialization pattern descriptor

9.4.5.1 Overview

If the IP bit is set to one, then the initialization pattern descriptor fields are translated as described in table 59.

Table 59 — Initialization pattern descriptor

Field	Description
SI	Unspecified
INITIALIZATION PATTERN TYPE	For 00h or 01h, see 9.4.5.2. Otherwise, the SATL shall terminate the command [a].
INITIALIZATION PATTERN LENGTH	See 9.4.5.2.
INITIALIZATION PATTERN	See 9.4.5.2.

[a] The FORMAT UNIT command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

9.4.5.2 Initialization pattern actions

If the SATL supports an IP bit set to one and the IP bit is set to one, then the SATL shall process the command as follows:

a) if the ATA device supports the SCT Write Same command (see ACS-5) and the value of the INITIALIZATION PATTERN LENGTH field in the initialization pattern descriptor is 0004h, then the SATL should send an ATA SCT Write Same command to the ATA device with:
   A) the ATA FUNCTION CODE field set to 0001b (i.e., Repeat Write Pattern);
   B) the ATA START field and the ATA FILL COUNT field set to initialize the area of the media accessible by the application client;
   C) the ATA PATTERN field set to the value of the INITIALIZATION PATTERN field from the FORMAT command initialization pattern descriptor; and
   D) if the ATA device is an ATA zoned device, then the ATA ZAC OPTIONS field set to 8002h, otherwise the ATA ZAC OPTIONS field set to 0000h;

   or

b) if the ATA SCT Write Same command is not used to write the initialization pattern, then the SATL shall write the specified pattern by issuing ATA write commands (see 9.1) to the ATA device.

9.5 FORMAT WITH PRESET command

9.5.1 Overview

The FORMAT WITH PRESET command requests that the format of the logical unit be changed to one of the formats indicated in the Format Presets VPD page (see 10.5.12).

If:

a) the ATA MUTATE EXT command is supported by the device (i.e., if the MUTATE EXT SUPPORTED bit is set to one in the ATA IDENTIFY DEVICE data log), then the FORMAT WITH PRESET command should be supported as described in 9.5.2;
b) the ATA SET SECTOR CONFIGURATION EXT command is supported by the device (i.e., if the SET SECTOR CONFIGURATION SUPPORTED bit is set to one in the ATA IDENTIFY DEVICE data log), then the FORMAT WITH PRESET command may be supported as described in 9.5.3; and
c) the ATA MUTATE EXT command is not supported by the device and the ATA SET SECTOR CONFIGURATION EXT command is not supported by the device, then the FORMAT WITH PRESET command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

9.5.2 FORMAT WITH PRESET command mutate translation

If a FORMAT WITH PRESET command is translated to an ATA MUTATE EXT command, then table 60 shows the translation for fields in the FORMAT WITH PRESET CDB.

Table 60 — FORMAT WITH PRESET CDB field translations for the mutate translation

Field	Description
OPERATION CODE	Set to 38h
IMMED	Unspecified
FMTMAXLBA	The SATL shall set the ATA REQUEST MAXIMUM ACCESSIBLE CAPACITY bit to the value in the FMTMAXLBA bit.
PRESET IDENTIFIER	The command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB, if the PRESET IDENTIFIER field specifies a value that: a) is not configured for translation to an ATA MUTATE EXT command; or b) does not match the contents of the PRESET IDENTIFIER field in any of the format preset descriptors in the Format Presets VPD page (see 10.5.12). If the command is not terminated with CHECK CONDITION status, then the SATL shall set the ATA REQUESTED CONFIGURATION IDENTIFIER field to the value specified by the PRESET IDENTIFIER field.
CONTROL	See 6.5.

9.5.3 FORMAT WITH PRESET command set sector translation

If a FORMAT WITH PRESET command is translated to an ATA SET SECTOR CONFIGURATION EXT command, then table 61 shows the translation for fields in the FORMAT WITH PRESET CDB.

Table 61 — FORMAT WITH PRESET CDB fields translations for the set sector configuration translation

Field	Description
OPERATION CODE	Set to 38h
IMMED	Unspecified
FMTMAXLBA	Unspecified
PRESET IDENTIFIER	The command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB, if the PRESET IDENTIFIER field specifies a value that: a) is not configured for translation to an ATA SET SECTOR CONFIGURATION EXT command; or b) does not match the contents of the PRESET IDENTIFIER field in any of the format preset descriptors in the Format Presets VPD page (see 10.5.12). If the command is not terminated with CHECK CONDITION status, then the SATL shall use the contents of the PRESET IDENTIFIER field as described in 10.5.12.3 to set: a) the ATA SECTOR CONFIGURATION DESCRIPTOR INDEX field; and b) the ATA COMMAND CHECK field.
CONTROL	See 6.5.

9.6 GET PHYSICAL ELEMENT STATUS command

9.6.1 Overview

The GET PHYSICAL ELEMENT STATUS command requests that the device server return status information for physical elements within the logical unit.

If the ATA GET PHYSICAL ELEMENT STATUS command is not supported by the ATA device (i.e., if the GET PHYSICAL ELEMENT STATUS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 62 shows the translation of the fields in the GET PHYSICAL ELEMENT STATUS CDB.

Table 62 — GET PHYSICAL ELEMENT STATUS field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 9Eh / 17h [a]
STARTING ELEMENT	The SATL shall set the ATA STARTING ELEMENT field in the ATA GET PHYSICAL ELEMENT STATUS command to the value of the STARTING ELEMENT field.
ALLOCATION LENGTH	The SATL shall set the ATA REQUESTED PAGE COUNT field in the ATA GET PHYSICAL ELEMENT STATUS command to INT ((allocation length + 511) / 512).
FILTER	The SATL shall set the ATA FILTER field in the ATA GET PHYSICAL ELEMENT STATUS command to the value of the FILTER field.
REPORT TYPE	The SATL shall set the ATA REPORT TYPE field in the ATA GET PHYSICAL ELEMENT STATUS command to the value of the REPORT TYPE field.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.6.2 GET PHYSICAL ELEMENT STATUS command

The SATL shall send an ATA GET PHYSICAL ELEMENT STATUS command (see ACS-5) with the fields set as described in table 62.

9.6.3 GET PHYSICAL ELEMENT STATUS parameter data

The translation of the GET PHYSICAL ELEMENT STATUS parameter data is defined in table 63.

Table 63 — GET PHYSICAL ELEMENT STATUS parameter data translation

Field	Description
NUMBER OF DESCRIPTORS	This field shall be set to the contents of the ATA NUMBER OF DESCRIPTORS field in the ATA GET PHYSICAL ELEMENT STATUS input from device to host data structure (see ACS-5).
NUMBER OF DESCRIPTORS RETURNED	This field shall be set to the contents of the ATA NUMBER OF DESCRIPTORS RETURNED field in the ATA GET PHYSICAL ELEMENT STATUS input from device to host data structure (see ACS-5).
IDENTIFIER OF ELEMENT BEING DEPOPULATED	This field shall be set to the contents of the ATA IDENTIFIER OF ELEMENT BEING DEPOPULATED field in the ATA GET PHYSICAL ELEMENT STATUS input from device to host data structure (see ACS-5).
ELEMENT IDENTIFIER [a]	This field shall be set to the contents of the ATA ELEMENT IDENTIFIER field in the ATA Physical element status descriptor for the identified element in the ATA GET PHYSICAL ELEMENT STATUS input from device to host data structure (see ACS-5).
PHYSICAL ELEMENT TYPE [a]	This field shall be set to the contents of the ATA PHYSICAL ELEMENT TYPE field in the ATA Physical element status descriptor for the identified element in the ATA GET PHYSICAL ELEMENT STATUS input from device to host data structure (see ACS-5).
PHYSICAL ELEMENT HEALTH [a]	This field shall be set to the contents of the ATA PHYSICAL ELEMENT HEALTH field in the ATA Physical element status descriptor for the identified element in the ATA GET PHYSICAL ELEMENT STATUS input from device to host data structure (see ACS-5).
ASSOCIATED CAPACITY [a]	This field shall be set to the contents of the ATA ASSOCIATED CAPACITY field in the ATA Physical element status descriptor for the identified element in the ATA GET PHYSICAL ELEMENT STATUS parameter data (see ACS-5).
[a] These fields are replicated in each Physical element status descriptor.	

9.7 OPEN ZONE command

9.7.1 Overview

The OPEN ZONE command requests that the specified zone or zones be opened. This command is applicable to ATA zoned devices. If the ATA OPEN ZONE EXT command is not supported by the device (i.e., if the NON-DATA OPEN ZONE EXT SUPPORTED bit is set to zero in the IDENTIFY DEVICE data log), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 64 shows the translation for fields in the OPEN ZONE CDB.

Table 64 — OPEN ZONE CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 94h / 03h [a]
ZONE ID	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA ZONE ID field in the ATA OPEN ZONE EXT command to the value specified in this field. If the SATL does not implement direct logical block mapping, use of this field is unspecified.
ZONE COUNT	The SATL shall set the ATA ZONE COUNT field in the ATA OPEN ZONE EXT command to the value of the ZONE COUNT field.
ALL	The SATL shall set the ATA ALL bit in the ATA OPEN ZONE EXT command to the value of the ALL bit.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.7.2 OPEN ZONE command processing

The SATL shall send an ATA OPEN ZONE EXT command (see ZAC-2) with the fields set as described in table 64.

9.8 READ commands overview

This subclause applies to the translation of SCSI read commands.

The SATL shall process a SCSI read command with the FUA bit set to zero by sending ATA read commands in accordance with the constraints specified in 9.1 to cause the ATA device to transfer the logical blocks specified in the SCSI read command.

If the SATL terminates a SCSI read command with CHECK CONDITION status with the sense key set to a value other than ILLEGAL REQUEST while processing the command, then the SATL may transfer a vendor specific amount of data before terminating the command. If any data is transferred before terminating the command, the sense key shall be set to a value other than ILLEGAL REQUEST.

If the SATL does not support FUA and the FUA bit is set to one, then the SATL shall terminate the SCSI read command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

If the SATL supports FUA, then the SATL shall process a SCSI read command with the FUA bit set to one as follows:

a) if the ATA device supports NCQ (i.e., ATA IDENTIFY DEVICE data log NCQ FEATURE SET SUPPORTED bit is set to one), then the SATL shall send an ATA READ FPDMA QUEUED command (see SATA-3.5a) with the ATA FUA bit in the ATA DEVICE field set to one; or
b) if the ATA device does not support NCQ, then the SATL shall:
   1) if the write cache is enabled on the ATA device (see ACS-5), then send an ATA verify command with an LBA and length matching the ATA LBA and length used for the ATA read command; and
   2) send an ATA read command as specified in accordance with the constraints specified in 9.1 to cause the ATA device to transfer the logical blocks specified in the SCSI read command.

If the REBUILD ASSIST ENABLED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL should translate SCSI read commands using ATA READ FPDMA QUEUED commands.

9.9 READ (10) command

The READ (10) command is used to request the device to transfer logical blocks of user data to the application client (see SBC-4). The read command shall be performed as specified in 9.8.

Table 65 shows the translations for the fields in the READ (10) CDB.

Table 65 — READ (10) CDB field translations

Field	Description
OPERATION CODE	Set to 28h
RDPROTECT	Unspecified
DPO	Unspecified
FUA	See 9.8.
RARC	If the SATL translates (see 9.1.4) a SCSI read command using an ATA READ FPDMA QUEUED command, then the ATA RARC bit in the ATA READ FPDMA QUEUED command shall be set to the value specified by this bit. If the SATL does not translate a SCSI read command using an ATA READ FPDMA QUEUED command, then the processing of the RARC bit is unspecified.
LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA LBA field in the ATA read command equal to the value specified in the LOGICAL BLOCK ADDRESS field. If the SATL does not implement direct logical block mapping, then the processing of this field is unspecified.
GROUP NUMBER	Unspecified
TRANSFER LENGTH [a]	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA Sector Count in the ATA read command equal to the value specified in this field. If the SATL does not implement direct logical block mapping, then the usage of this field is unspecified. The SATL shall send as many ATA read commands as needed to satisfy the transfer length.
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that no data transfer shall take place. In this case, no ATA read command is sent.

9.10 READ (12) command

The READ (12) command is used to request the device to transfer logical blocks of user data to the application client (see SBC-4). The read operation shall be performed as specified in 9.8.

Table 66 shows the translation for fields in the READ (12) CDB.

Table 66 — READ (12) CDB field translations

Field	Description
OPERATION CODE	Set to A8h
RDPROTECT	Unspecified
DPO	Unspecified
FUA	As defined in READ (10) (see 9.9)
RARC	As defined in READ (10) (see 9.9)
LOGICAL BLOCK ADDRESS	As defined in READ (10) (see 9.9)
TRANSFER LENGTH [a]	As defined in READ (10) (see 9.9)
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that no data transfer shall take place. In this case, no ATA read command is sent to the device.

9.11 READ (16) command

9.11.1 Overview

The READ (16) command is used to request the device to transfer logical blocks of user data to the application client (see SBC-4). The read operation shall be performed as specified in 9.8.

Table 67 shows the translation for fields in the READ (16) CDB.

Table 67 — READ (16) CDB field translations

Field	Description
OPERATION CODE	Set to 88h
RDPROTECT	Unspecified
DPO	Unspecified
FUA	As defined in READ (10) (see 9.9)
RARC	As defined in READ (10) (see 9.9)
DLD2	See 9.11.2.
LOGICAL BLOCK ADDRESS	As defined in READ (10) (see 9.9)
TRANSFER LENGTH [a]	As defined in READ (10) (see 9.9)[a]
DLD1	See 9.11.2.
DLD0	See 9.11.2.
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that no data transfer shall take place. In this case, an ATA read command is not sent.

9.11.2 Translation of command duration limit

If the SATL supports the Command Duration Limit A mode page and the ATA Command Duration Limits feature set is disabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to zero in the ATA Current Settings log page), then:

a) if any descriptor in the Command Duration Limit A mode page (see 10.4.5) is not set to zero and a READ (16) command specifying a command duration limit (i.e., at least one of the DLD2 bit, DLD1 bit, and DLD0 bit is set to one) is processed, then in the ATA READ FPDMA QUEUED command sent to the ATA device the SATL shall set:
   A) the ATA ICC field to a value corresponding to the command duration limit specified in the duration limit descriptor as specified in 10.4.5.2; and
   B) the ATA PRIO field as specified in 10.4.5.2;

   and

b) if all descriptors in the Command Duration Limit A mode page are set to zero, then the DLD2 bit, DLD1 bit, and DLD0 bit may be ignored.

If the SATL supports the Command Duration Limit T2A mode page and the ATA Command Duration Limits feature set is enabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to one in the ATA Current Settings log page), then the SATL shall send an ATA READ FPDMA QUEUED command or an ATA READ DMA EXT command with:

a) bit 2 of the ATA COMMAND DURATION LIMITS INDEX field to the value of the DLD2 bit;
b) bit 1 of the ATA COMMAND DURATION LIMITS INDEX field to the value of the DLD1 bit; and
c) bit 0 of the ATA COMMAND DURATION LIMITS INDEX field to the value of the DLD0 bit.

9.12 READ CAPACITY (10) command

9.12.1 Overview

The READ CAPACITY (10) command (see SBC-4) requests that the device server transfer eight bytes of parameter data describing the capacity and medium format of the direct access block device to the application client.

Table 68 shows the translation for fields in the READ CAPACITY (10) CDB.

Table 68 — READ CAPACITY (10) CDB field translations

Field	Description
OPERATION CODE	Set to 25h
CONTROL	See 6.5.

9.12.2 READ CAPACITY (10) parameter data

The SATL shall return READ CAPACITY (10) parameter data as defined by SBC-4. Table 69 describes the translation of fields in the READ CAPACITY (10) parameter data.

Table 69 — READ CAPACITY (10) parameter data

Field	Description
RETURNED LOGICAL BLOCK ADDRESS[a]	If the SATL implements direct logical block mapping (see 9.1.2), then this field shall contain the lower of: a) the ATA maximum LBA; or b) FFFF_FFFFh. If the SATL implements indirect logical block mapping, then this field is unspecified.
LOGICAL BLOCK LENGTH IN BYTES[a]	If the SATL implements direct logical block mapping (see 9.1.2), then this field shall contain the ATA logical sector size. Otherwise this field is unspecified.
[a] The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the LOGICAL BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity is less than or equal to the ATA device capacity.	

9.13 READ CAPACITY (16) command

9.13.1 Overview

The READ CAPACITY (16) command (see SBC-4) requests that the device server transfer parameter data describing the capacity and medium format of the direct access block device to the application client. Table 70 shows the translation for fields in the READ CAPACITY (16) CDB.

Table 70 — READ CAPACITY (16) CDB field translations

Field or bit	Description
OPERATION CODE / SERVICE ACTION	Set to 9Eh/10h [a]
ALLOCATION LENGTH	Unspecified
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.13.2 READ CAPACITY (16) parameter data

The SATL shall return READ CAPACITY (16) parameter data as defined by SBC-4. Table 71 describes the translation of fields in the READ CAPACITY (16) parameter data.

Table 71 — READ CAPACITY (16) parameter data (part 1 of 2)

Field or bit	Description
RETURNED LOGICAL BLOCK ADDRESS[a]	If the SATL implements direct logical block mapping (see 9.1.2), then this field shall contain the ATA maximum LBA. If the SATL implements indirect logical block mapping, then this field is unspecified.
LOGICAL BLOCK LENGTH IN BYTES[a]	As defined in READ CAPACITY (10) (see 9.12)
RC_BASIS [b]	If the device is an ATA host-managed zoned device and the SATL implements direct logical block mapping, then this field shall contain: a) 01b, if the ATA maximum LBA equals the ATA MAXIMUM LBA field returned by an ATA REPORT ZONES EXT command (see ZAC-2); or b) 00b, if the ATA maximum LBA is less than the ATA MAXIMUM LBA field returned by an ATA REPORT ZONES command. If the device is not an ATA host-managed zoned device and the SATL implements direct logical block mapping, then this field shall contain 00b. If the SATL implements indirect logical block mapping, then this field is unspecified.
P_TYPE	Unspecified
PROT_EN	Unspecified
P_I_EXPONENT	Unspecified

[a] The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the LOGICAL BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity is less than or equal to the ATA device capacity.
[b] See ZBC.

Table 71 — READ CAPACITY (16) parameter data (part 2 of 2)

Field or bit	Description
LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT	If the SATL implements direct logical block mapping (see 9.1.2), then this field shall contain the contents of the ATA LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field from the ATA IDENTIFIY DEVICE data log (see 5.8). If the SATL implements indirect logical block mapping, then this field is unspecified.
LBPME	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this bit shall be set to one. Otherwise, this bit shall be set to zero.
LBPRZ	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one, the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, and the ATA IDENTIFY DEVICE data log RZAT SUPPORTED bit is set to one, then this bit shall be set to one. Otherwise, this bit shall be set to zero.
LOWEST ALIGNED LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping and the LOGICAL SECTOR OFFSET field in the ATA IDENTIFY DEVICE data log is set to zero, then this field shall be set to zero. If the SATL implements direct logical block mapping and the LOGICAL SECTOR OFFSET field in the ATA IDENTIFY DEVICE data log is not set to zero, then this field shall contain the value of the LOGICAL SECTOR OFFSET field in the ATA IDENTIFY DEVICE data log subtracted from the value of the LOGICAL SECTORS PER PHYSICAL SECTOR field in the ATA IDENTIFY DEVICE data log (see 5.8). If the SATL implements indirect logical block mapping, then this field is unspecified.

[a] The values reported in the RETURNED LOGICAL BLOCK ADDRESS field and the LOGICAL BLOCK LENGTH IN BYTES field shall be such that the logical unit capacity is less than or equal to the ATA device capacity.
[b] See ZBC.

9.14 REASSIGN BLOCKS command

9.14.1 Overview

The REASSIGN BLOCKS command requests that the SATL reassign logical blocks (see SBC-4). The translation for the REASSIGN BLOCKS command performs actions on the ATA device such that the ATA

device is able to perform any appropriate block reassignment actions. Table 72 shows the translation for fields in the REASSIGN BLOCKS CDB.

Table 72 — REASSIGN BLOCKS CDB field translations

Field	Description
OPERATION CODE	Set to 07h
LONGLBA	See SBC-4.
LONGLIST	See SBC-4.
CONTROL	See 6.5.

The REASSIGN BLOCKS command parameter list transferred from the application client is set to the LBAs of logical blocks on which the SATL shall operate.

The SATL shall support the LONGLBA bit and the LONGLIST bit (see SBC-4).

9.14.2 REASSIGN BLOCKS parameter list

The SATL shall accept a parameter list specifying LBAs of logical blocks on which the SATL shall operate (see SBC-4).

If the SATL implements direct logical block mapping (see 9.1.2), then the values set by the SATL in the ATA LBA field of the ATA verify commands and ATA write commands shall be set to the values of the LBAs in the parameter list. Otherwise, the translation is unspecified.

The SATL shall process each ATA LBA corresponding to LBAs specified in the parameter list as shown in figure 11.

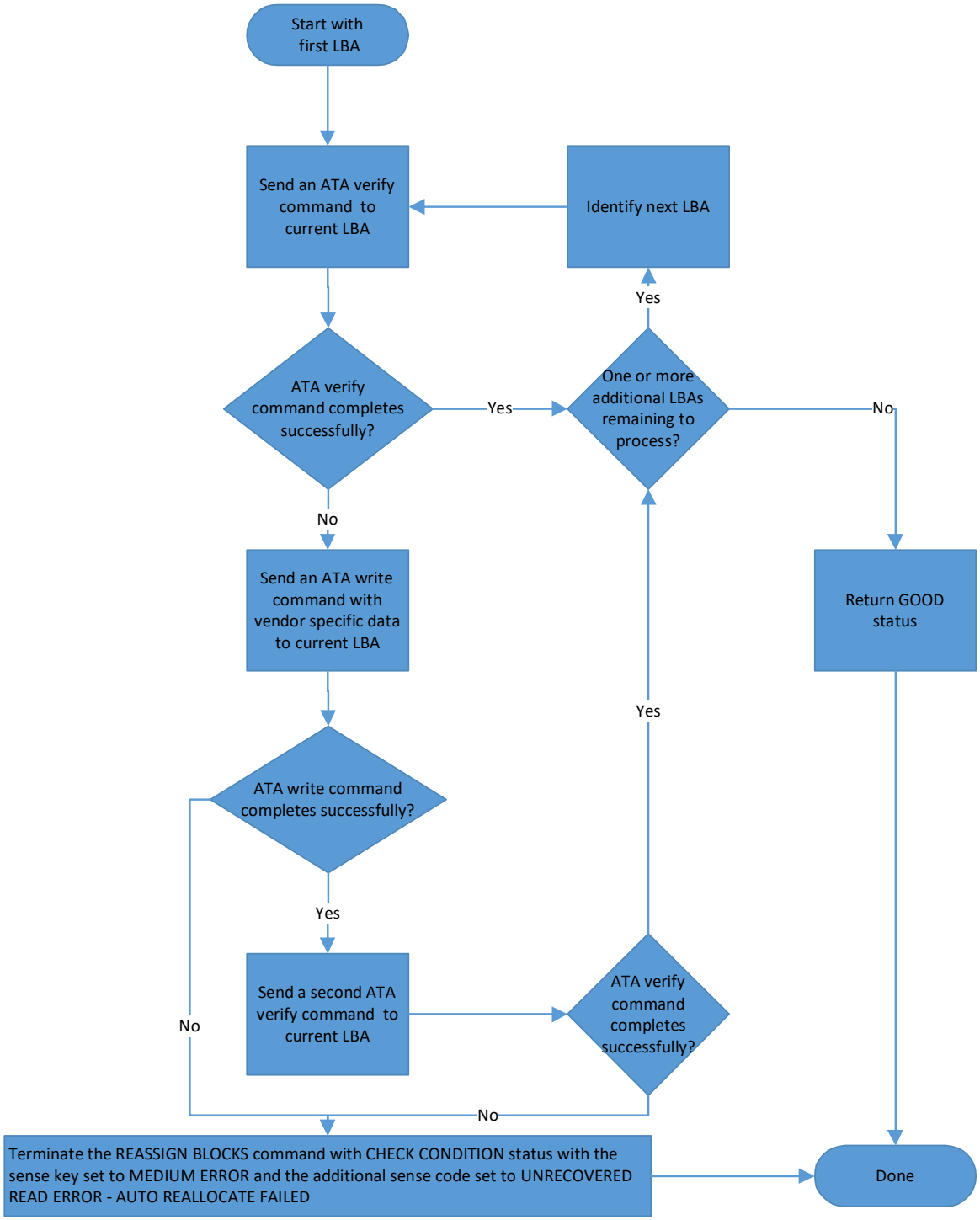


Figure 11 — REASSIGN BLOCKS command translation flowchart

9.15 REMOVE ELEMENT AND TRUNCATE command

9.15.1 Overview

The REMOVE ELEMENT AND TRUNCATE command requests that the device server depopulate a storage element and truncate the reported capacity of the media.

If the ATA REMOVE ELEMENT AND TRUNCATE command is not supported by the ATA device (i.e., if the REMOVE ELEMENT AND TRUNCATE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 73 shows the translation of the fields in the REMOVE ELEMENT AND TRUNCATE CDB.

Table 73 — REMOVE ELEMENT AND TRUNCATE field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 9Eh / 18h [a]
REQUESTED CAPACITY	If the REQUESTED CAPACITY field is set to zero, then the SATL shall set the REQUESTED MAX LBA field in the ATA REMOVE ELEMENT AND TRUNCATE command to zero. If the REQUESTED CAPACITY field is set to one, then the REMOVE ELEMENT AND TRUNCATE command shall be terminated with a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. If the REQUESTED CAPACITY field is greater than one, then the SATL shall set the ATA REQUESTED MAX LBA field in the ATA REMOVE ELEMENT AND TRUNCATE command to the value of the REQUESTED CAPACITY field minus one.
ELEMENT IDENTIFIER	The SATL shall set the ATA ELEMENT IDENTIFIER field in the ATA REMOVE ELEMENT AND TRUNCATE command to the value of the ELEMENT IDENTIFIER field.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.15.2 REMOVE ELEMENT AND TRUNCATE command translation

The SATL shall process the REMOVE ELEMENT AND TRUNCATE command as follows:

1) determine the device capacity from the ACCESSIBLE CAPACITY field in the ATA IDENTIFY DEVICE data log;
2) send an ATA REMOVE ELEMENT AND TRUNCATE command as specified by table 73;
3) determine the device capacity from the ACCESSIBLE CAPACITY field in the ATA IDENTIFY DEVICE data log; and
4) if the device capacity in step 1) is not equal to the device capacity in step 3), then establish a unit attention condition (see 5.3) for each I_T nexus with the additional sense code set to CAPACITY DATA HAS CHANGED.

If an error occurs at step 1) or step 3), then processing of the REMOVE ELEMENT AND TRUNCATE command shall be terminated with a CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to INTERNAL TARGET FAILURE.

9.16 REPORT ZONES command

9.16.1 Overview

The REPORT ZONES command returns parameter data that includes the identifiers and attributes of a selected set of zones (see ZBC) on the device. This command is applicable to ATA zoned devices. If the ATA REPORT ZONES EXT command is not supported by the device (i.e., if the REPORT ZONES EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 74 shows the translation for fields in the REPORT ZONES CDB.

Table 74 — REPORT ZONES field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 95h / 00h [a]
ZONE START LBA	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA ZONE LOCATOR field in the ATA REPORT ZONES EXT command to the value specified in the ZONE START LBA field. If the SATL does not implement direct logical block mapping, then this field is unspecified.
ALLOCATION LENGTH	See 9.16.3.
PARTIAL	The SATL shall set the ATA PARTIAL bit in the ATA REPORT ZONES EXT command to the value specified by the PARTIAL bit.
REPORTING OPTIONS	The SATL shall set the ATA REPORTING OPTIONS field in the ATA REPORT ZONES EXT command to the value specified by the REPORTING OPTIONS field.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.16.2 REPORT ZONES command processing

A REPORT ZONES command is translated to an ATA REPORT ZONES EXT command (see ZAC-2). The fields in the ATA REPORT ZONES EXT command are set as described in table 74 and 9.16.3.

If the ATA REPORT ZONES EXT command completes without error, then:

1) the parameter data is translated as described in 9.16.4;
2) the translated parameter data is transferred to the initiator; and
3) the SCSI REPORT ZONES command is completed with GOOD status.

If the ATA REPORT ZONES EXT command completes with an error, then the SCSI REPORT ZONES command is terminated with CHECK CONDITION status and sense data as described in clause 11.

9.16.3 ALLOCATION LENGTH field

The SATL shall send the ATA REPORT ZONES EXT command with the ATA RETURN PAGE COUNT field set to INT((ALLOCATION LENGTH + 511)/512).

9.16.4 REPORT ZONES parameter data

The translation of the REPORT ZONES parameter data is defined in table 75.

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Table 75 — REPORT ZONES parameter data translation (part 1 of 2)

FIELD OR BIT	Description
ZONE LIST LENGTH	This field shall be set to the contents of the ATA ZONE LIST LENGTH field in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2).
SAME	If the SATL implements direct logical block mapping (see 9.1.2), then this field shall be set to the contents of the ATA SAME field in the ATA REPORT ZONES EXT input from device to host data structure. If the SATL does not implement direct logical block mapping, then this field is unspecified.
MAXIMUM LBA	If the SATL implements direct logical block mapping, then this field shall be set to the contents of the ATA MAXIMUM LBA field in the ATA REPORT ZONES EXT input from device to host data structure. If the SATL implements indirect logical block mapping, then this field is unspecified.
ZONE TYPE [a]	If the SATL implements direct logical block mapping, then this field shall be set to the contents of the ATA ZONE TYPE field in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping, then this field is unspecified.
ZONE CONDITION [a]	If the SATL implements direct logical block mapping, then this field shall be set to the contents of the ATA ZONE CONDITION field in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping, then this field is unspecified.
NON_SEQ [a]	If the SATL implements direct logical block mapping, then this bit shall be set to the contents of the ATA NON_SEQ bit in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping, then this bit is unspecified.

[a] These fields are replicated in each Zone descriptor.

Table 75 — REPORT ZONES parameter data translation (part 2 of 2)

FIELD OR BIT	Description
RESET [a]	If the SATL implements direct logical block mapping, then this bit shall be set to the contents of the ATA RESET bit in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping (see 3.1.46), then this bit is unspecified.
ZONE LENGTH [a]	If the SATL implements direct logical block mapping, then this field shall be set to the contents of the ATA ZONE LENGTH field in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping, then this field is unspecified.
ZONE START LBA [a]	If the SATL implements direct logical block mapping, then this field shall be set to the contents of the ATA ZONE START LBA field in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping, then this field is unspecified.
WRITE POINTER LBA [a]	If the SATL implements direct logical block mapping, then this field shall be set to the contents of the ATA WRITE POINTER LBA field in the ATA Zone descriptor for the identified zone in the ATA REPORT ZONES EXT input from device to host data structure (see ZAC-2). If the SATL implements indirect logical block mapping, then this field is unspecified.

[a] These fields are replicated in each Zone descriptor.

The number of bytes returned shall be the smaller of:

a) 64 plus the contents of the ZONE LIST LENGTH field in the translated parameter data; and
b) the contents of the ALLOCATION LENGTH field in the CDB.

9.17 RESET WRITE POINTER command

9.17.1 Overview

The RESET WRITE POINTER command requests that the specified zone or zones have their write pointer reset (see ZBC-2). This command is applicable to ATA zoned devices. If the ATA RESET WRITE POINTERS EXT command is not supported by the device (i.e., if the NON-DATA RESET WRITE POINTERS EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 76 shows the translation for fields in the RESET WRITE POINTER CDB.

Table 76 — RESET WRITE POINTER field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 94h / 04h [a]
ZONE ID	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA ZONE ID field in the ATA RESET WRITE POINTER EXT command to the value specified in the ZONE ID field. If the SATL does not implement direct logical block mapping, then the usage of this field is unspecified.
ZONE COUNT	The SATL shall set the ATA ZONE COUNT field in the ATA RESET WRITE POINTER EXT command to the value of the ZONE COUNT field.
ALL	The SATL shall set the ATA RESET ALL bit in the ATA RESET WRITE POINTER EXT command to the value of the ALL bit.
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.17.2 RESET WRITE POINTER command processing

The SATL shall send an ATA RESET WRITE POINTER EXT command (see ZAC-2) with the fields set as described in table 76.

9.18 RESTORE ELEMENTS AND REBUILD command

9.18.1 Overview

The RESTORE ELEMENTS AND REBUILD command requests that the device server repopulate storage elements and rebuild the reported capacity of the media. If the ATA RESTORE ELEMENTS AND REBUILD command is not supported by the ATA device (i.e., if the RESTORE ELEMENTS AND REBUILD SUPPORTED bit is set to zero in the ATA IDENTIFY DEVICE data log), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 77 shows the translation of the fields in the RESTORE ELEMENTS AND REBUILD CDB.

Table 77 — RESTORE ELEMENTS AND REBUILD field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 9Eh / 19h [a]
CONTROL	See 6.5.

[a] f a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.18.2 RESTORE ELEMENTS AND REBUILD command

The SATL shall process the RESTORE ELEMENTS AND REBUILD command as follows:

1) determine the device capacity from the ACCESSIBLE CAPACITY field in the ATA IDENTIFY DEVICE data log;
2) send an ATA RESTORE ELEMENTS AND REBUILD command as specified by table 77;
3) determine the device capacity from the ACCESSIBLE CAPACITY field in the ATA IDENTIFY DEVICE data log; and
4) if the device capacity in step 1) is not equal to the device capacity in step 3), then establish a unit attention condition (see 5.3) for each I_T nexus with the additional sense code set to CAPACITY DATA HAS CHANGED.

If an error occurs at step 1) or step 3), then processing of the RESTORE ELEMENTS AND REBUILD command shall be terminated with a CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to INTERNAL TARGET FAILURE.

9.19 SANITIZE command

9.19.1 Overview

The SANITIZE command specifies that one of several sanitize operations be performed.

If deferred microcode has been saved and not activated (see 8.19.2.5), then the SATL shall terminate a SANITIZE command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, MICROCODE ACTIVATION REQUIRED.

Table 78 shows the translation for fields in the SANITIZE CDB.

Table 78 — SANITIZE CDB field translations

Field	Description
OPERATION CODE	Set to 48h
IMMED	If set to one, then the SATL shall validate all CDB and parameter list data fields, if any, and return GOOD status before sending any commands to the device [a]. If set to zero, then the SATL shall wait for completion of all commands sent to the ATA device before returning status.
ZNR	If the SERVICE ACTION field is set to 01h (i.e., OVERWRITE), then see 9.19.2. If the SERVICE ACTION field is set to 02h (i.e., BLOCK ERASE), then see 9.19.3. If the SERVICE ACTION field is set to 03h (i.e., CRYPTOGRAPHIC ERASE), then see 9.19.4. If the SERVICE ACTION field is set to 1Fh (i.e., EXIT FAILURE MODE), then this field is ignored. Otherwise, this field is unspecified.
AUSE	See 9.19.2.2, 9.19.3, and 9.19.4.
SERVICE ACTION	If set to 01h (i.e., OVERWRITE), then see 9.19.2. If set to 02h (i.e., BLOCK ERASE), then see 9.19.3. If set to 03h (i.e., CRYPTOGRAPHIC ERASE), then see 9.19.4. If set to 1Fh (i.e., EXIT FAILURE MODE), then see 9.19.5. If set to any other value, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
PARAMETER LIST LENGTH	If the SERVICE ACTION field is set to: a) 01h and the PARAMETER LIST LENGTH field is not set to 0008h; b) 02h and the PARAMETER LIST LENGTH field is not set to 0000h; c) 03h and the PARAMETER LIST LENGTH field is not set to 0000h; or d) 1Fh and the PARAMETER LIST LENGTH field is not set to 0000h, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
CONTROL	See 6.5.

[a] Additional verification requirements if the IMMED bit is set to one are described in 9.19.2, 9.19.3, and 9.19.4.

9.19.2 Sanitize using overwrite method

9.19.2.1 OVERWRITE service action parameter list translation

For the SANITIZE command with the overwrite method, the parameter list is translated as shown in table 79.

Table 79 — OVERWRITE service action parameter list translation

Field	Description
INVERT	See 9.19.2.2.
TEST	If the TEST field is not set to 00b, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.
OVERWRITE COUNT	If the OVERWRITE COUNT field is set to 00h or set to a value greater than 10h, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST. See 9.19.2.2 for details on processing of this field.
INITIALIZATION PATTERN LENGTH	If the INITIALIZATION PATTERN LENGTH field is not set to 0004h, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST. See 9.19.2.2 for details on processing of this field.
INITIALIZATION PATTERN	These four bytes shall be treated as a dword for translation to an ATA DWord. See 9.19.2.2 for details on processing of this field.

9.19.2.2 Sanitize using overwrite method translation details

If the SATL supports the overwrite method and the ATA IDENTIFY DEVICE data log OVERWRITE SUPPORTED bit is set to one, then the SATA shall:

1) if no CHECK CONDITION status was returned as a result of processing the fields in table 79 and the IMMED bit is set to one, then return GOOD status;
2) if no CHECK CONDITION status was returned as a result of processing the fields in table 79, then send an ATA OVERWRITE EXT command with:
   A) the ATA INVERT PATTERN BETWEEN OVERWRITE PASSES bit in the ATA COUNT field set to the value of the INVERT bit;
   B) the ATA FAILURE MODE bit set to the value of the AUSE bit;
   C) the ATA ZONED NO RESET bit set to the value of the ZNR bit;
   D) the ATA DEFINITIVE ENDING PATTERN bit in the ATA COUNT field set to zero;
   E) the ATA OVERWRITE PASS COUNT field in the ATA COUNT field set to 0h if the OVERWRITE COUNT field is equal to 10h or set to the value of the OVERWRITE COUNT field if the value is from 01h to 0Fh;
   F) the ATA LBA field bits 47:32 set to 4F57h; and
   G) the ATA OVERWRITE PATTERN field set to the value of the INITIALIZATION PATTERN field;
3) if the ATA OVERWRITE EXT command in step 2) completes with an error and the IMMED bit is set to zero, then terminate the SANITIZE command with CHECK CONDITION status with the sense key and the additional sense code set based on the reported ATA error as described in clause 11;
4) If the ATA OVERWRITE EXT command in step 2) did not complete with an error, then periodically issue ATA SANITIZE STATUS EXT commands until the returned status indicates completion of the sanitize operation; and
5) if the ATA OVERWRITE EXT command in step 2) completed without error, the IMMED bit is set to zero (i.e., the SATL has not yet returned status for the SANITIZE command) and:

A) the most recent ATA SANITIZE STATUS EXT command in step 4) indicates completion of the sanitize operation without error, then complete the SANITIZE command with GOOD status; or
B) the most recent ATA SANITIZE STATUS EXT command in step 4) indicates completion of the sanitize operation with error, then terminate the SANITIZE command with CHECK CONDITION status with the sense key set to MEDIUM ERROR and the additional sense code set to SANITIZE COMMAND FAILED.

If the SATL does not support the overwrite method or the ATA IDENTIFY DEVICE data log OVERWRITE SUPPORTED bit is set to zero, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.19.3 Sanitize using block erase method

If the SATL supports the block erase method and the ATA IDENTIFY DEVICE data log BLOCK ERASE SUPPORTED bit is set to one, then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) send an ATA BLOCK ERASE EXT command with:
   A) the ATA FAILURE MODE bit set to the value of the AUSE bit;
   B) the ATA ZONED NO RESET bit set to the value of the ZNR bit;
   C) the ATA LBA bits 47:32 set to zero; and
   D) the ATA LBA bits 31:0 set to 426B_4572h;
3) if the ATA BLOCK ERASE EXT command in step 2) completes with an error and the IMMED bit is set to zero, then terminate the SANITIZE command with CHECK CONDITION status with the sense key and the additional sense code set based on the reported ATA error as described in clause 11;
4) if the ATA BLOCK ERASE EXT command in step 2) completed without error, then periodically send an ATA SANITIZE STATUS EXT commands until the returned status indicates completion of the sanitize operation; and
5) if the IMMED bit is set to zero (i.e., the SATL has not yet returned status for the SANITIZE command), the ATA BLOCK ERASE EXT command in step 2) completed without error and:
   A) the last ATA SANITIZE STATUS EXT command in step 4) indicates completion of the ATA BLOCK ERASE EXT command without error, then complete the SANITIZE command with GOOD status; or
   B) the last ATA SANITIZE STATUS EXT command in step 4) indicates completion of the ATA BLOCK ERASE EXT command with error, then terminate the SANITIZE command with CHECK CONDITION status with the sense key set to MEDIUM ERROR and the additional sense code set to SANITIZE COMMAND FAILED.

If the SATL does not support the block erase method or the ATA IDENTIFY DEVICE data log BLOCK ERASE SUPPORTED bit is set to zero, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.19.4 Sanitize using cryptographic erase method

If the SATL supports the cryptographic erase method and the ATA IDENTIFY DEVICE data log CRYPTO SCRAMBLE SUPPORTED bit is set to one, then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) send an ATA CRYPTO SCRAMBLE EXT command with:
   A) the ATA FAILURE MODE bit set to the value of the AUSE bit;
   B) the ATA ZONED NO RESET bit set to the value of the ZNR bit;
   C) the ATA LBA 47:32 set to zero; and
   D) the ATA LBA 31:0 set to 4372_7970h;
3) if the ATA CRYPTO SCRAMBLE EXT command in step 2) completes with an error and the IMMED bit is set to zero, then terminate the SANITIZE command with CHECK CONDITION status with the sense key and the additional sense code set according to the reported ATA error as described in clause 11;

4) if the ATA CRYPTO SCRAMBLE EXT command in step 2) completes without error, then periodically send ATA SANITIZE STATUS EXT commands until the returned status indicates completion of the sanitize operation; and
5) if the IMMED bit is set to zero (i.e., the SATL has not yet returned status for the SANITIZE command), the ATA CRYPTO SCRAMBLE EXT command in step 2) completed without error and:
   A) the most recent ATA SANITIZE STATUS EXT command in step 4) indicates completion of the sanitize operation without error, then complete the SANITIZE command with GOOD status; or
   B) the most recent ATA SANITIZE STATUS EXT command in step 4) indicates completion of the sanitize operation with error, then terminate the SANITIZE command with CHECK CONDITION status with the sense key set to MEDIUM ERROR and the additional sense code set to SANITIZE COMMAND FAILED.

If the SATL does not support the cryptographic erase method or the ATA IDENTIFY DEVICE data log CRYPTO SCRAMBLE SUPPORTED bit is set to zero, then the SATL shall terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.19.5 Exit the sanitize failure mode

To process the exit failure mode request, then the SATL shall:

1) if the ATA IDENTIFY DEVICE data log SANITIZE SUPPORTED bit is set to zero (i.e., ATA Sanitize feature set is not supported), then terminate the SANITIZE command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
2) if the ATA IDENTIFY DEVICE data log SANITIZE SUPPORTED bit is set to one:
   1) if the IMMED bit is set to one, then return GOOD status;
   2) send an ATA SANITIZE STATUS EXT command with the CLEAR SANITIZE OPERATION FAILED bit set to one;
   3) if the completion of the ATA SANITIZE STATUS EXT command in step 2) 2) indicates that a sanitize operation is active, then periodically send an ATA SANITIZE STATUS EXT commands with the CLEAR SANITIZE OPERATION FAILED bit set to one until the returned status indicates completion of the sanitize operation; and
   4) if the IMMED bit is set to zero (i.e., the SATL has not yet returned status for the SANITIZE command), and:
      a) the most recent ATA SANITIZE STATUS EXT command indicates completion of the sanitize operation without error, then return GOOD status; or
      b) the most recent ATA SANITIZE STATUS EXT command indicates completion of the sanitize operation with error then the SANITIZE command shall be terminated with CHECK CONDITION status with the sense key set to MEDIUM ERROR and the additional sense code set to SANITIZE COMMAND FAILED.

9.20 SEQUENTIALIZE ZONE command

9.20.1 Overview

The SEQUENTIALIZE ZONE command requests that the specified zone or zones be sequentialized. This command is applicable to ATA host aware zoned devices. If the ATA SEQUENTIALIZE ZONE EXT command is not supported by the device (i.e., if the SEQUENTIALIZE ZONE EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID COMMAND OPERATION CODE.

Table 80 shows the translation for fields in the SEQUENTIALIZE ZONE CDB.

Table 80 — SEQUENTIALIZE ZONE CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 94h / 05h [a]
ZONE ID	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA ZONE ID field in the ATA SEQUENTIALIZE ZONE EXT command to the value specified in the ZONE ID field. If the SATL does not implement direct logical block mapping, then the usage of this field is unspecified.
ZONE COUNT	The SATL shall set the ATA ZONE COUNT field in the ATA SEQUENTIALIZE ZONE EXT command to the value of the ZONE COUNT field.
ALL	The SATL shall set the ATA SEQUENTIALIZE ALL bit in the ATA SEQUENTIALIZE ZONE EXT command to the value of the ALL bit.
CONTROL	See 6.5

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.20.2 SEQUENTIALIZE ZONE command processing

The SATL shall send an ATA SEQUENTIALIZE ZONE EXT command (see ZAC-2) with the fields set as described in table 80.

9.21 START STOP UNIT command

9.21.1 Overview

The START STOP UNIT command provides a method for controlling the power condition of a logical unit.

If deferred microcode has been saved and not activated (see 8.19.2.5), then the SATL should activate the deferred microcode (see 8.19.2.6) before processing a START STOP UNIT command.

The POWER CONDITION field is used to specify that the logical unit be placed into a specific power condition or to cause a timer expiration as defined in table 81. If the POWER CONDITION field is set to a value other than 0h, then the SATL shall not consider the ATA device to be in the stopped power condition (see SBC-4).

Table 81 shows the translation for fields in the START STOP UNIT CDB.

Table 81 — START STOP UNIT CDB field translations

Field	Description
OPERATION CODE	Set to 1Bh
IMMED	The SATL shall implement this field as defined in 9.21.2, 9.21.3, 9.21.4, and 9.21.5.
POWER CONDITION MODIFIER	If non-zero values are: a) not supported by the SATL and the field is set to a non-zero value, then the SATL shall terminate the START STOP UNIT command [a]; or b) supported by the SATL and the ATA EPC feature is supported [b], then see 9.21.2, otherwise see 9.21.3.
POWER CONDITION	If non-zero values are: a) not supported by the SATL and the field is set to a non-zero value, then the SATL shall terminate the START STOP UNIT command [a]; or b) supported by the SATL and the ATA EPC feature is supported [b], then see 9.21.2, otherwise see 9.21.3.
NO_FLUSH	See 9.21.6.
LOEJ	The SATL shall implement this field as defined in 9.21.5.
START	The SATL shall implement this field as defined in 9.21.5.
CONTROL	See 6.5.

[a] The command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

[b] The ATA EPC feature set is supported if the ATA IDENTIFY DEVICE data log EPC SUPPORTED bit is set to one.

9.21.2 Power condition translation if ATA EPC is supported

If the POWER CONDITION field is set to START_VALID (i.e., 00h) then the SATL shall process the LOEJ and START fields as defined in 9.21.5.

If the POWER CONDITION field is set to ACTIVE (i.e., 01h) then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) disable all of the supported power condition timers by sending an ATA SET FEATURES - Set Power Condition State command with:
   A) the ATA POWER CONDITION ID field set to FFh;
   B) the ATA ENABLE bit set to zero; and
   C) the ATA SAVE bit set to zero;
3) if the ATA SET FEATURES command in step 2) completes with an error, then process ending status based on the IMMED bit with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
4) if the ATA SET FEATURES command in step 2) completes without error, then:
   1) send an ATA IDLE IMMEDIATE command to the ATA device with:
      a) the ATA FEATURE field set to zero;
      b) the ATA COUNT field set to zero; and
      c) the ATA LBA field set to zero;

2) if the ATA IDLE IMMEDIATE command in step 4) 1) completes with an error, then process ending status based on the IMMED bit with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
3) if the ATA IDLE IMMEDIATE command in step 4) 1) completes without error then:
   a) if the IMMED bit is set to zero, then return GOOD status; and
   b) no longer consider the ATA device to be in the stopped power condition.

If the POWER CONDITION field is set to IDLE (i.e., 02h) then the SATL shall:

1) determine if the idle condition specified in the POWER CONDITION MODIFIER field (i.e., idle_a, idle_b, idle_c) is supported by reading the ATA Power Conditions Log and testing if the POWER CONDITION SUPPORTED bit is set to one in the corresponding power conditions descriptor;
2) if the specified ATA power condition is not supported, then terminate the STOP START UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
3) if the specified ATA power condition is supported then:
   1) if the IMMED bit is set to one, then return GOOD status;
   2) if the NO_FLUSH bit is set to zero, then:
      1) send an ATA flush command to the ATA device; and
      2) if the ATA flush command in step 3) 2) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

      and

   3) if the NO_FLUSH bit is set to one or the ATA flush command in step 3) 2) 1) completes without an error, then:
      1) disable all supported power condition timers by sending an ATA SET FEATURES - Set Power Condition State command with:
         A) the ATA POWER CONDITION ID field set to FFh;
         B) the ATA ENABLE bit set to zero; and
         C) the ATA SAVE bit set to zero;
      2) if the ATA SET FEATURES command in step step 3) 3) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
      3) if the ATA SET FEATURES command in step step 3) 3) 1) completed without error, then:
         1) send an ATA SET FEATURES - Go to Power Condition command with the ATA POWER CONDITION ID field set to the value of the POWER CONDITION MODIFIER field incremented by 81h;
         2) if the ATA SET FEATURES command in step 3) 3) 3) 1) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
         3) if the ATA SET FEATURES command in step 3) 3) 3) 1) completes without an error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to STANDBY (i.e., 03h) then the SATL shall:

1) determine if the standby condition specified in the POWER CONDITION MODIFIER field (i.e., standby_y or standby_z) is supported by reading page 01h of the ATA Power Conditions log (Log Address 08h) and testing if the POWER CONDITION SUPPORTED bit is set to one in the corresponding power conditions descriptor;
2) if the specified ATA power condition is not supported then terminate the START STOP UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
3) if the specified ATA power condition is supported then:
   1) if the IMMED bit is set to one, then return GOOD status;
   2) if the NO_FLUSH bit is set to zero, then:
      1) send an ATA flush command to the ATA device; and

2) if the ATA flush command in step 3) 2) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

and

3) if the NO_FLUSH bit is set to one or the ATA flush command in step 3) 2) 1) completes without error, then:
   1) disable all of the supported power condition timers by sending an ATA SET FEATURES - Set Power Condition State command with:
      A) the ATA POWER CONDITION ID field set to FFh;
      B) the ATA ENABLE bit set to zero; and
      C) the ATA SAVE bit set to zero;
   2) if the ATA SET FEATURES command in step 3) 3) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
   3) if the ATA SET FEATURES command in step 3) 3) 1) completes without an error, then:
      1) send an ATA SET FEATURES - Go to Power Condition command with the ATA POWER CONDITION ID field set to the value of the POWER CONDITION MODIFIER field incremented by one;
      2) if the ATA SET FEATURES command in step 3) 3) 3) 1) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
      3) if the ATA SET FEATURES command in step 3) 3) 3) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to LU_CONTROL (i.e., 07h) then the SATL shall:

1) if the POWER CONDITION MODIFIER field is non-zero, then terminate the START STOP UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
2) if the POWER CONDITION MODIFIER field is set to zero, then:
   1) if the IMMED bit is set to one, then return GOOD status;
   2) enable the power condition timers by sending an ATA SET FEATURES - Set Power Condition State command with:
      a) the ATA POWER CONDITION ID field set to FFh;
      b) the ATA ENABLE bit set to one; and
      c) the ATA SAVE bit set to zero;
3) if the ATA SET FEATURES command in step 2) 2) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
4) if the ATA SET FEATURES command in step 2) 2) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to FORCE_IDLE_0 (i.e., 0Ah) then the SATL shall:

1) determine if the idle condition specified in the POWER CONDITION MODIFIER field (i.e., idle_a, idle_b, or idle_c) is supported by reading page 00h of the ATA Power Conditions log (Log Address 08h) and testing if the POWER CONDITION SUPPORTED bit is set to one in the corresponding power conditions descriptor;
2) if the specified ATA power condition is not supported, then terminate the START STOP UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
3) if the specified ATA power condition is supported then:
   1) if the IMMED bit is set to one, then return GOOD status;
   2) if the NO_FLUSH bit is set to zero, then send an ATA flush command to the ATA device;
   3) if the ATA flush command in step 3) 2) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and

4) if the NO_FLUSH bit is set to one or the ATA flush command in step 3) 2) completes without error, then:
    1) enable all of the supported power condition timers by sending an ATA SET FEATURES – Set Power Condition State command with:
        A) the ATA POWER CONDITION ID set to FFh;
        B) the ATA ENABLE bit set to one; and
        C) the ATA SAVE bit set to zero;
    2) if the ATA SET FEATURES command in step 3) 4) 1) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
    3) if the ATA SET FEATURES command in step step 3) 4) 1) completes without error, then:
        1) send an ATA SET FEATURES – Go to Power Condition command with the ATA POWER CONDITION ID field set to the value of the POWER CONDITION MODIFIER field incremented by 81h;
        2) if the ATA SET FEATURES command in step 3) 4) 3) 1) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
        3) if the ATA SET FEATURES command in step 3) 4) 3) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to FORCE_STANDBY_0 (i.e., 0Bh) then the SATL shall:

1) determine if the standby condition specified in the POWER CONDITION MODIFIER field (i.e., standby_y or standby_z) is supported by reading page 01h of the ATA Power Conditions log (Log Address 08h) and testing if the POWER CONDITION SUPPORTED bit is set to one in the corresponding power conditions descriptor;
2) if the specified ATA power condition is not supported then terminate the START STOP UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB; and
3) if the specified ATA power condition is supported then:
    1) if the IMMED bit is set to one, then return GOOD status;
    2) if the NO_FLUSH bit is set to zero, then:
        1) send an ATA flush command to the ATA device; and
        2) if the ATA flush command in step 3) 2) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

        and

    3) if the NO_FLUSH bit is set to one or the ATA flush command in step 3) 2) 1) completes without error, then:
        1) enable all of the supported power condition timers by sending an ATA SET FEATURES – Set Power Condition State command with:
            A) the ATA POWER CONDITION ID set to FFh;
            B) the ATA ENABLE bit set to one; and
            C) the ATA SAVE bit set to zero;
        2) if the ATA SET FEATURES command in step 3) 3) 1) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
        3) if the ATA SET FEATURES command in step 3) 3) 1) completes without error, then:
            1) send an ATA SET FEATURES – Go to Power Condition command with the ATA POWER CONDITION ID field set to the value of the POWER CONDITION MODIFIER field incremented by 1h;
            2) if the ATA SET FEATURES command in step 3) 3) 3) 1) completes with an error, then process the ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and

3) if the ATA SET FEATURES command in step 3) 3) 3) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to any other value, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.21.3 Power condition translation if ATA EPC is not supported

If the POWER CONDITION field is set to START_VALID (i.e., 00h) then the SATL shall process the LOEJ and START fields as defined in 9.21.5.

If the POWER CONDITION field is set to ACTIVE (i.e., 01h) then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) send an ATA IDLE command to the ATA device with the ATA FEATURE field set to zero, the ATA COUNT field set to zero, and the ATA LBA field set to zero;
3) if the ATA IDLE command in step 2) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;
4) if the ATA IDLE command in step 2) completes without error and the IMMED bit is set to zero, then:
   A) return GOOD status; and
   B) no longer consider the ATA device to be in the stopped power state.

If the POWER CONDITION field is set to IDLE (i.e., 02h) then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) if the NO_FLUSH bit is set to zero, then:
   1) send an ATA flush command to the ATA device; and
   2) if the ATA flush command in step 2) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

   and
3) if the NO_FLUSH bit is set to one or ATA flush command in step 2) 1) completes without error, then:
   A) if the POWER CONDITION MODIFIER field is set to zero, then:
      1) send an ATA IDLE command to the ATA device with the ATA FEATURE field set to zero, the ATA COUNT field set to zero, and the ATA LBA field set to zero;
      2) if the ATA IDLE command in step 3) A) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
      3) if the ATA IDLE command in step 3) A) 1) completes without error and the IMMED bit is set to zero, then return GOOD status;

      and

   B) if the POWER CONDITION MODIFIER field is not set to zero, then:
      1) send an ATA IDLE command to the ATA device with the ATA FEATURE field set to zero, the ATA COUNT field set to zero, and the ATA LBA field set to zero;
      2) if the ATA IDLE command in step 3) B) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;
      3) if the ATA IDLE command in step 3) B) 1) completes without error, the ATA IDENTIFY DEVICE data log UNLOAD SUPPORTED bit is set to zero, and the IMMED bit is set to zero, then return GOOD status (see 9.21.2); and
      4) if the ATA IDLE command in step 3) B) 1) completes without error and the ATA IDENTIFY DEVICE data log UNLOAD SUPPORTED bit is set to one, then:
         1) send an ATA IDLE IMMEDIATE command to the ATA device with:
            a) the ATA FEATURE field set to 44h;
            b) the ATA COUNT field set to zero; and

c) the ATA LBA field set to 55_4E4Ch;

2) if the ATA IDLE IMMEDIATE command in step 3) B) 4) 1) completes with any error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
3) If the ATA IDLE IMMEDIATE command in step 3) B) 4) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to STANDBY (i.e., 03h) then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) if the NO_FLUSH bit is set to zero, then:
   1) send an ATA flush command to the ATA device; and
   2) if the ATA flush command in step 2) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

   and

3) if the NO_FLUSH bit is set to one or ATA flush command in step 2) 1) completes without error, then:
   1) send an ATA STANDBY command to the ATA device with the ATA COUNT field set to zero;
   2) if the ATA STANDBY command in step 3) 1) completes with an error, then process ending status according to the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
   3) if the ATA STANDBY command in step 3) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to LU_CONTROL (i.e., 07h) then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) send an ATA CHECK POWER MODE command to the ATA device;
3) if the ATA COUNT field returned from the ATA CHECK POWER MODE command in step 2) is 00h, then:
   1) send an ATA STANDBY command to the ATA device with the ATA COUNT field set to the previously saved value of the ATA STANDBY_Z CONDITION TIMER field (see table 164);
   2) if the ATA STANDBY command in step 3) 1) completes with any error, then process ending status according to the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
   3) if the ATA STANDBY command in step 3) 1) completes without error and the IMMED bit is set to zero, then return GOOD status;
4) if the ATA COUNT field returned from the ATA CHECK POWER MODE command in step 2) is 80h, then:
   1) send an ATA IDLE command to the ATA device with the ATA COUNT field set to the previously saved value of the ATA STANDBY_Z CONDITION TIMER field (see table 164);
   2) if the ATA IDLE command in step 4) 1) completes with any error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
   3) if the ATA IDLE command in step 4) 1) completes without error and the IMMED bit is set to zero, then return GOOD status;

   and

5) if the ATA COUNT field returned from the ATA CHECK POWER MODE command in step 2) is 40h, 41h, or FFh, then:
   1) send an ATA IDLE command to the ATA device with the ATA COUNT field set to the previously saved value of the ATA STANDBY_Z CONDITION TIMER field (see table 164);
   2) if the ATA IDLE command in step 5) 1) completes with any error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
   3) if the ATA IDLE command in step 5) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to FORCE_STANDBY_0 (i.e., 0Bh) then the SATL shall:

1) if the Standardized Standby Timer Values bit is set to zero in the ATA IDENTIFY DEVICE data log or the standby timer is not enabled, then terminate the START STOP UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB;
2) if the command was not terminated in step 1) and the IMMED bit is set to one, then return GOOD status;
3) if the NO_FLUSH bit is set to zero, then:
   1) send an ATA flush command to the ATA device; and
   2) if the ATA flush command in step 3) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

   and
4) if the NO_FLUSH bit is set to one or the ATA flush command in step 3) 1) completes without error, then:
   1) send an ATA STANDBY IMMEDIATE command to the ATA device;
   2) if the ATA STANDBY IMMEDIATE command in step 4) 1) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and
   3) if the ATA STANDBY IMMEDIATE command in step 4) 1) completes without error and the IMMED bit is set to zero, then return GOOD status.

If the POWER CONDITION field is set to any other value then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.21.4 Processing ending status if an error occurs

If an error occurs during the processing of the START STOP UNIT command and the IMMED bit is set to zero, then the SATL shall terminate the START STOP UNIT command with CHECK CONDITION status with the sense key and the additional sense code set to the value specified for the error being reported (see 9.21.2, 9.21.3, and 9.21.5).

If an error occurs during the processing of the START STOP UNIT command and the IMMED bit is set to one, then the SATL shall establish a deferred error condition (see SPC-5) with the sense key and the additional sense code set to the value specified for the error being reported (see 9.21.2, 9.21.3, and 9.21.5).

9.21.5 START STOP UNIT command START bit and LOEJ bit combinations

The SATL shall perform the actions described in this subclause in response to a START STOP UNIT command with the POWER CONDITION field set to zero.

If the START bit is set to zero and the LOEJ bit is set to zero, then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) if the NO_FLUSH bit is set to zero, then:
   1) send an ATA flush command to the ATA device; and
   2) if the ATA flush command in step 2) completes with an error, then process ending status based on the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR;

   and
3) if the NO_FLUSH bit is set to one or the ATA flush command in step 2) completes without error, then:
   1) send an ATA STANDBY IMMEDIATE command to the ATA device with the ATA COUNT field set to zero;
   2) if the ATA STANDBY IMMEDIATE command in step 3) 1) completes with an error, then process ending status according to the IMMED bit (see 9.21.4) with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR; and

3) if the ATA STANDBY IMMEDIATE command in step 3) 1) completes without error and the IMMED bit is set to zero, then:
   a) return GOOD status; and
   b) consider the ATA device to be in the Stopped power condition (see SBC-4).

If the START bit is set to zero and the LOEJ bit is set to one, then the processing of this bit combination is obsolete.

If the START bit is set to one and the LOEJ bit is set to zero, then the SATL shall:

1) if the IMMED bit is set to one, then return GOOD status;
2) send an ATA IDLE IMMEDIATE command to the ATA device with the ATA FEATURE field set to zero, the ATA COUNT field set to one zero, and the ATA LBA field set to zero;
3) if the IMMED bit is set to zero, then return GOOD status when command completion is received for the ATA IDLE IMMEDIATE command; and
4) the SATL shall consider the ATA device to be in the Active power condition (see SBC-4).

If the START bit is set to one and the LOEJ bit is set to one, then the the SATL shall terminate the START STOP UNIT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.21.6 NO_FLUSH bit translation

The NO_FLUSH bit specifies whether the SATL sends an ATA flush command while processing certain power condition requests (see 9.21.2, 9.21.3, and 9.21.5).

9.22 SYNCHRONIZE CACHE (10) command

The SYNCHRONIZE CACHE (10) command is used to flush the most recent data in the cache of the ATA device to physical medium. The SATL shall send an ATA flush command in accordance with the constraints described in 9.1.

Table 82 shows the translation for fields in the SYNCHRONIZE CACHE (10) CDB.

Table 82 — SYNCHRONIZE CACHE (10) CDB field translations

Field	Description
OPERATION CODE	Set to 35h
IMMED	If the IMMED bit is set to one, then the SATL shall return GOOD status and then send an ATA flush command. If the IMMED bit is set to zero, then the SATL shall send an ATA flush command. If the flush command completes without error, the SATL shall return GOOD status for the operation. If the flush command completes with error, the SATL shall return ending status in accordance with clause 11.
LOGICAL BLOCK ADDRESS	The SATL shall ignore this field and shall process this command as though this field contained zero (see SBC-4).
GROUP NUMBER	Unspecified
NUMBER OF LOGICAL BLOCKS	The SATL shall ignore this field and shall process this command as though this field contained zero (see SBC-4).
CONTROL	See 6.5.

9.23 SYNCHRONIZE CACHE (16) command

The SYNCHRONIZE CACHE (16) command is used to flush the most recent data in the cache of the ATA device to physical medium. The SATL shall send an ATA flush command in accordance with the constraints described in 9.1.

Table 83 shows the translation for fields in the SYNCHRONIZE CACHE (16) CDB.

Table 83 — SYNCHRONIZE CACHE (16) CDB field translations

Field	Description
OPERATION CODE	Set to 91h
IMMED	As defined in SYNCHRONIZE CACHE (10) (see 9.22).
LOGICAL BLOCK ADDRESS	As defined in SYNCHRONIZE CACHE (10) (see 9.22).
NUMBER OF LOGICAL BLOCKS	As defined in SYNCHRONIZE CACHE (10) (see 9.22).
GROUP NUMBER	Unspecified(see 9.22)
CONTROL	See 6.5.

9.24 UNMAP command

9.24.1 Overview

The UNMAP command (see table 84) requests the SATL to transfer parameter data from the application client that is used by the SATL to build a set of LBA range entries that are used in a DATA SET MANAGEMENT command or a DATA SET MANAGEMENT XL command to request the specified LBAs to be trimmed.

If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to zero or the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to zero, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID OPERATION CODE.

Table 84 — UNMAP CDB field translations

Field or Bit	Description
OPERATION CODE	Set to 42h
ANCHOR	Unspecified
GROUP NUMBER	Unspecified
PARAMETER LIST LENGTH	If the PARAMETER LIST LENGTH field is set to zero, then the SATL shall process the command as specified in SBC-4. If the PARAMETER LIST LENGTH field is not set to zero and one or more unmap block descriptors are present, then the SATL shall: 1) create ATA LBA range entries that describe all the logical blocks (see 9.1) represented in all the UNMAP block descriptors (see SBC-4) in the UNMAP parameter list using the procedures described in 9.24.2; and 2) send one or more: A) ATA DATA SET MANAGEMENT XL commands with the TRIM bit set to one, if ATA XL LBA range entries were created as described in 9.19.2; or B) ATA DATA SET MANAGEMENT commands with the TRIM bit set to one, if ATA LBA range entries were created as described in 9.24.2, to transfer the ATA LBA range entries to the ATA device.
CONTROL	See 6.5.

9.24.2 Creating ATA LBA range entries

The WRITE SAME command specifies a starting LBA and number of logical blocks in CDB fields. The UNMAP command passes a parameter list consisting of one or more UNMAP block descriptors each of which is set to a starting LBA and number of logical blocks.

ATA LBA range entries specify a starting LBA and number of ATA logical sectors over which an ATA DATA SET MANAGEMENT command is to be performed.

The SATL shall create one or more ATA LBA range entries from the input starting LBA values and number of blocks values as follows:

a) if the SATL implements indirect logical block mapping (see 9.1.3), then the method of creating ATA LBA range entries is unspecified; or
b) if the SATL implements direct logical block mapping (see 9.1.2), then for each input combination of starting LBA and number of blocks, the SATL shall create one or more ATA LBA range entries as follows:
   A) if the device supports the ATA DATA SET MANAGEMENT XL command (i.e., if the DATA SET MANAGEMENT XL SUPPORTED bit is set to one in the ATA IDENTIFY DEVICE data log), then the SATL may create one ATA XL LBA range entry (see ACS-5) with the LBA VALUE field equal to the starting LBA value and the RANGE LENGTH field equal to the number of blocks; or
   B) if the device does not support the ATA DATA SET MANAGEMENT XL command, then:
      a) if the number of blocks value is less than 1_0000h, then one ATA LBA range entry (see ACS-5) shall be created with the first six bytes equal to the starting LBA value and the remaining two bytes equal to the number of blocks; or
      b) if the number of blocks value is greater than FFFFh, then:

1) one ATA LBA range entry (see ACS-5) shall be created with:
   a) the first six bytes equal to the starting LBA value; and
   b) the remaining two bytes equal to FFFFh;
2) add FFFFh to the starting LBA value;
3) subtract FFFFh from the number of blocks value; and
4) repeat this algorithm starting at step b) a).

9.25 VERIFY (10) command

The VERIFY (10) command is used to verify data on the ATA device's medium. Table 85 shows the translation of fields in the VERIFY (10) CDB.

The SATL shall send an ATA verify command or ATA read command in accordance with the constraints defined in 9.1.

Table 85 — VERIFY (10) CDB field translations

Field	Description
OPERATION CODE	Set to 2Fh
VRPROTECT	Unspecified
DPO	Unspecified
BYTCHK	If the SATL supports: a) a BYTCHK field set to 01b and if the BYTCHK field is set to 01b; or b) a BYTCHK field set to 11b and if the BYTCHK field is set to 11b, then the SATL shall perform a byte-by-byte comparison of the data transferred from the application client to the SATL with data read from the ATA device using an ATA read command and return completion status reflecting the results of that comparison as described in SBC-4. If the BYTCHK field is set to 00b, the SATL shall send an ATA verify command in accordance with the constraints defined in 9.1.
LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA LBA field in the ATA verify command or ATA read command equal to the value specified in the LOGICAL BLOCK ADDRESS field. Otherwise, this field is unspecified.
GROUP NUMBER	Unspecified
VERIFICATION LENGTH [a]	If the SATL implements direct logical block mapping, then the SATL shall set the ATA COUNT in the ATA verify command or ATA read command equal to the value specified in the VERIFICATION LENGTH field. Otherwise, this field is unspecified.
CONTROL	See 6.5.

[a] A VERIFICATION LENGTH field set to zero specifies that no logical blocks shall be read or verified. In this case no ATA command is sent to the device.

9.26 VERIFY (12) command

Table 86 shows the translation of fields in the VERIFY (12) CDB.

The SATL shall send an ATA verify command or ATA read command in accordance with the constraints defined in 9.1.

Table 86 — VERIFY (12) CDB field translations

Field	Description
OPERATION CODE	Set to AFh
VRPROTECT	Unspecified
DPO	Unspecified
BYTCHK	As defined in VERIFY (10) (see 9.25).
LOGICAL BLOCK ADDRESS	As defined in VERIFY (10) (see 9.25).
VERIFICATION LENGTH [a]	As defined in VERIFY (10) (see 9.25).
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

[a] A VERIFICATION LENGTH field set to zero specifies that no logical blocks shall be read or verified. In this case, no ATA command is sent to the device.

9.27 VERIFY (16) command

Table 87 shows the translation of fields in the VERIFY (16) CDB.

The SATL shall send an ATA verify command or ATA read command in accordance with the constraints defined in 9.1.

Table 87 — VERIFY (16) CDB field translations

Field	Description
OPERATION CODE	Set to 8Fh
VRPROTECT	Unspecified
DPO	Unspecified
BYTCHK	As defined in VERIFY (10) (see 9.25).
LOGICAL BLOCK ADDRESS	As defined in VERIFY (10) (see 9.25).
VERIFICATION LENGTH [a]	As defined in VERIFY (10) (see 9.25).
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

[a] A VERIFICATION LENGTH field set to zero specifies that no logical blocks shall be read or verified. In this case, no ATA command is sent to the device.

9.28 WRITE commands overview

This subclause applies to the translation of the WRITE (10) command, the WRITE (12) command, and the WRITE (16) command.

If the FUA bit is set to zero in the SCSI write command CDB, then the SATL shall transfer the logical blocks in the SCSI write command from the SCSI application client to the ATA device. The SATL shall send ATA write commands in accordance with the constraints specified in 9.1.

If the FUA bit is set to one in the SCSI write command CDB, then the SATL shall send, in accordance with the constraints described in 9.1:

a) the following ATA commands:
   1) an ATA write command excluding an ATA WRITE DMA FUA EXT command and an ATA WRITE FPDMA QUEUED command; and
   2) an ATA verify command;
b) an ATA WRITE DMA FUA EXT command; or
c) an ATA WRITE FPDMA QUEUED command (see SATA-3.5a) with the ATA FUA bit in the ATA DEVICE field set to one.

See 5.4 for a description of multiple command sequence error handling.

9.29 WRITE (10) command

The WRITE (10) command is used to request the SATL to transfer user data from the application client to the ATA device. Data may be written to the medium or to the cache of the ATA device. The write operation shall be performed as specified in 9.28.

Table 88 shows the translation of fields in the WRITE (10) CDB.

Table 88 — WRITE (10) CDB field translations

Field	Description
OPERATION CODE	Set to 2Ah
WRPROTECT	Unspecified
DPO	Unspecified
FUA	See 9.28.
LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA LBA field in the ATA write command equal to the value specified in the LOGICAL BLOCK ADDRESS field. Otherwise, this field is unspecified.
GROUP NUMBER	Unspecified
TRANSFER LENGTH [a]	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA COUNT field in the ATA write command (see 3.1.33) equal to the value specified in the TRANSFER LENGTH field. Otherwise, this field is unspecified. The SATL shall send as many ATA write commands as needed to satisfy the transfer length.
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that no data transfer shall take place. In this case, an ATA write command is not sent.

9.30 WRITE (12) command

The WRITE (12) command is used to request the SATL to transfer user data from the application client to the ATA device. Data may be written to the medium or to the cache of the ATA device. The write operation shall be performed as specified in 9.28.

Table 89 shows the translation of fields in the WRITE (12) CDB.

Table 89 — WRITE (12) CDB field translations

Field	Description
OPERATION CODE	Set to AAh
WRPROTECT	Unspecified
DPO	Unspecified
FUA	As defined in WRITE (10) (see 9.29).
LOGICAL BLOCK ADDRESS	As defined in WRITE (10) (see 9.29).
TRANSFER LENGTH [a]	As defined in WRITE (10) (see 9.29).
GROUP NUMBER	As defined in WRITE (10) (see 9.29).
CONTROL	6.5.

[a] A TRANSFER LENGTH field set to zero specifies that no data transfer shall take place. In this case, an ATA write command is not sent.

9.31 WRITE (16) command

9.31.1 Overview

The WRITE (16) command is used to request the SATL to transfer user data from the application client to the ATA device. Data may be written to the medium or to the cache of the ATA device. The write operation shall be performed as specified in 9.28.

Table 90 shows the translation of fields in the WRITE (16) CDB.

Table 90 — WRITE (16) CDB field translations

Field	Description
OPERATION CODE	Set to 8Ah
WRPROTECT	Unspecified
DPO	Unspecified
FUA	As defined in WRITE (10) (see 9.29).
DLD2	See 9.31.2.
LOGICAL BLOCK ADDRESS	As defined in WRITE (10) (see 9.29).
TRANSFER LENGTH [a]	As defined in WRITE (10) (see 9.29).
DLD1	See 9.31.2.
DLD0	See 9.31.2.
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that no data transfer shall take place. In this case, an ATA write command is not sent.

9.31.2 Translation of command duration limit

If the SATL supports the Command Duration Limit B mode page and the ATA Command Duration Limits feature set is disabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to zero in the ATA Current Settings log page), then:

a) if any descriptor in the Command Duration Limit B mode page (see 10.4.5) is not set to zero and a WRITE (16) command specifying a command duration limit (i.e., at least one of the DLD2 bit, DLD1 bit, and DLD0 bit is set to one) is processed, then in the ATA WRITE FPDMA QUEUED command sent to the ATA device the SATL shall set:
   A) the ATA ICC field to a value corresponding to the command duration limit specified in the duration limit descriptor as specified in 10.4.5.2; and
   B) the ATA PRIO field as specified in 10.4.5.2;

   and

b) if all descriptors in the Command Duration Limit B mode page are set to zero, then the DLD2 bit, the DLD1 bit, and the DLD0 bit may be ignored.

If the SATL supports the Command Duration Limit T2B mode page and the ATA Command Duration Limits feature set is enabled (i.e., the COMMAND DURATION LIMITS ENABLED bit is set to one in the ATA Current Settings log page), then the SATL shall send an ATA WRITE FPDMA QUEUED command or an ATA WRITE DMA EXT command with:

a) bit 2 of the ATA COMMAND DURATION LIMITS INDEX field to the value of the DLD2 bit;
b) bit 1 of the ATA COMMAND DURATION LIMITS INDEX field to the value of the DLD1 bit; and
c) bit 0 of the ATA COMMAND DURATION LIMITS INDEX field to the value of the DLD0 bit.

9.32 WRITE AND VERIFY commands overview

This subclause applies to the translation of the WRITE AND VERIFY (10) command, WRITE AND VERIFY (12) command, and WRITE AND VERIFY (16) command.

The SATL shall send:

1) an ATA write command in accordance with the constraints defined in 9.1; and
2) an ATA verify command in accordance with the constraints defined in 9.1.

9.33 WRITE AND VERIFY (10) command

The WRITE AND VERIFY (10) command requests the SATL to transfer the specified logical blocks from the application client to the ATA device and then verify that the data was written correctly to the medium of the ATA device. The write and verify operations shall be performed as specified in 9.32.

Table 91 shows the translation of fields in the WRITE AND VERIFY (10) CDB.

Table 91 — WRITE AND VERIFY (10) CDB field translations

Field	Description
OPERATION CODE	Set to 2Eh
WRPROTECT	Unspecified
DPO	Unspecified
BYTCHK	If the SATL supports: a) a BYTCHK field set to 01b and if the BYTCHK field is set to 01b; or b) a BYTCHK field set to 11b and the BYTCHK field is set to 11b, then after writing the data to the medium, the SATL shall perform a byte-by-byte comparison of the data transferred from the application client to the SATL with data read from the ATA device using an ATA read command and return completion status reflecting the results of the comparison as described in SBC-4. If the BYTCHK field is set to 00b, then after writing the data to the medium, the SATL shall send an ATA verify command in accordance with the constraints defined in 9.1.
LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 9.1.2) and the TRANSFER LENGTH field is within the capabilities of the ATA device (see A.1), then the SATL shall set the ATA LBA field in the ATA write command and the ATA verify command to the value specified in the LOGICAL BLOCK ADDRESS field. If the TRANSFER LENGTH field is not within the capabilities of the device, then the operation is split into as many ATA write commands and ATA verify commands as needed to satisfy the transfer length specified (see A.2 for a way this may be done). If the SATL does not implement direct logical block mapping, this field is unspecified.
GROUP NUMBER	Unspecified
TRANSFER LENGTH[a]	If the SATL implements direct logical block mapping (see 9.1.2) and the TRANSFER LENGTH field is within the capabilities of the ATA device (see A.1), then the SATL shall set the ATA COUNT field in the ATA write command and the ATA verify command equal to the value specified in the TRANSFER LENGTH field. If the SATL implements indirect logical block mapping, then the mapping is unspecified. The SATL shall send as many ATA write commands and ATA verify commands as needed to satisfy the transfer length specified by the WRITE AND VERIFY (10) command (see A.2 for a way this may be done).
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that a data transfer shall not take place. In this case an ATA write command and an ATA verify command are not sent.

9.34 WRITE AND VERIFY (12) command

The WRITE AND VERIFY (12) command requests the SATL to transfer the specified logical blocks from the application client to the ATA device and then verify that the data was written to the medium of the ATA device. The write and verify operations shall be done as specified in 9.32.

Table 92 shows the translation of fields in the WRITE AND VERIFY (12) CDB.

Table 92 — WRITE AND VERIFY (12) CDB field translations

Field	Description
OPERATION CODE	Set to AEh
WRPROTECT	Unspecified
DPO	Unspecified
BYTCHK	As defined in WRITE AND VERIFY (10) (see 9.33).
LOGICAL BLOCK ADDRESS	As defined in WRITE AND VERIFY (10) (see 9.33).
TRANSFER LENGTH[a]	As defined in WRITE AND VERIFY (10) (see 9.33).
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that a data transfer shall not take place. In this case an ATA write command and an ATA verify command are not sent.

9.35 WRITE AND VERIFY (16) command

The WRITE AND VERIFY (16) command requests the SATL to transfer the specified logical blocks from the application client to the ATA device and then verify that the data was written correctly to the medium of the ATA device. The write and verify operations shall be performed as described in 9.32.

Table 93 shows the translation of fields in the WRITE AND VERIFY (16) CDB.

Table 93 — WRITE AND VERIFY (16) CDB field translations

Field	Description
OPERATION CODE	Set to 8Eh
WRPROTECT	Unspecified
DPO	Unspecified
BYTCHK	As defined in WRITE AND VERIFY (10) (see 9.33).
LOGICAL BLOCK ADDRESS	As defined in WRITE AND VERIFY (10) (see 9.33).
GROUP NUMBER	As defined in WRITE AND VERIFY (10) (see 9.33).
TRANSFER LENGTH[a]	Unspecified
CONTROL	See 6.5.

[a] A TRANSFER LENGTH field set to zero specifies that a data transfer shall not take place. In this case an ATA write command and an ATA verify command are not sent.

9.36 WRITE LONG (10) command

9.36.1 Overview

The WRITE LONG (10) command (see SBC-4) requests that the SATL mark a logical block or physical block as containing an error. If the ATA device does not support the ATA WRITE UNCORRECTABLE EXT command (see ACS-5), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID OPERATION CODE.

Table 94 shows the translation of fields in the WRITE LONG (10) CDB.

Table 94 — WRITE LONG (10) CDB field translations

Field	Description
OPERATION CODE	Set to 3Fh
WR_UNCOR	See 9.36.2.
LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the ATA LBA field in the ATA WRITE UNCORRECTABLE EXT command equal to the value specified in this field. If the SATL does not implement direct logical block mapping, then this field is unspecified.
CONTROL	See 6.5.

9.36.2 WR_UNCOR field

If the WR_UNCOR field is set to one, then the SATL shall send an ATA WRITE UNCORRECTABLE EXT command with:

a) the ATA FEATURE field set to AAh (i.e., pseudo-uncorrectable error with logging); and
b) the ATA COUNT field set:
   A) to the value of the number of Logical Sectors Per Physical Sector (see table 5) if the ATA device is an ATA zoned device; and
   B) to 0001h, otherwise.

If the WR_UNCOR field is set to zero, then the SATL shall terminate the WRITE LONG (10) command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

9.37 WRITE LONG (16) command

The WRITE LONG (16) command (see SBC-4) requests that the SATL mark a logical block or physical block as containing an error. If the ATA device does not support the ATA WRITE UNCORRECTABLE EXT command (see ACS-5), then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID OPERATION CODE.

Table 95 shows the translation of fields in the WRITE LONG (16) CDB.

Table 95 — WRITE LONG (16) CDB field translations

Field	Description
OPERATION CODE / SERVICE ACTION	Set to 9Fh / 11h [a]
WR_UNCOR	As defined in WRITE LONG (10) (see 9.36).
LOGICAL BLOCK ADDRESS	As defined in WRITE LONG (10) (see 9.36).
CONTROL	See 6.5.

[a] If a command is defined by a combination of operation code and service action, then the operation code value is shown preceding a slash and the service action value is shown after the slash.

9.38 WRITE SAME (10) command

The WRITE SAME (10) command requests that the SATL transfer a single logical block from the application client and write the contents of that single logical block to the specified range of LBAs on the ATA device. The SATL shall perform the write same operation as described in 9.39.2.

Table 96 shows the translations of the fields in the WRITE SAME (10) CDB.

Table 96 — WRITE SAME (10) CDB field translations

Field	Description
OPERATION CODE	Set to 41h
WRPROTECT	Unspecified
ANCHOR	See 9.39.2.
UNMAP	See 9.39.2.
LOGICAL BLOCK ADDRESS	If the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall set the START field in the ATA SCT Write Same command or the LBA field in the ATA write command equal to the value specified in the LOGICAL BLOCK ADDRESS field. Otherwise, this field is unspecified.
GROUP NUMBER	Unspecified
NUMBER OF LOGICAL BLOCKS	A NUMBER OF LOGICAL BLOCKS field set to zero specifies that the SATL shall repeatedly write the logical block transferred from the application client to the range of ATA logical sectors corresponding to the range of LBAs specified by the LOGICAL BLOCK ADDRESS field through the LBA of the last logical block on the logical unit (i.e., the ATA maximum LBA). If the NUMBER OF LOGICAL BLOCKS field is set to zero and the WSNZ bit (see 10.5.9) is set to one, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. If the NUMBER OF LOGICAL BLOCKS field is set to a value other than zero, then the SATL shall repeatedly write the data block transferred from the application client to the medium of the ATA device for the number of logical blocks specified to the corresponding logical sectors on the ATA device. The SATL shall send as many ATA commands as required to satisfy the number of blocks specified by the WRITE SAME command.
CONTROL	See 6.5.

9.39 WRITE SAME (16) command

9.39.1 Overview

The WRITE SAME (16) command (see table 97) requests that the SATL alter the contents of the specified range of LBAs on the ATA device, based on the contents of a single logical block. The SATL shall, depending on whether the UNMAP bit is set to one or zero, the NDOB is set to one or zero, and whether the LBPME bit is set to one in the READ CAPACITY (16) parameter data (see 9.13.2) either perform:

a) the write operation as described in 9.39.3;
b) write zeros as described in 9.39.4; or
c) write zeros with trim as described in 9.39.5.

Table 97 shows the translations of the fields in the WRITE SAME (16) CDB.

Table 97 — WRITE SAME (16) CDB field translations

Field	Description
OPERATION CODE	Set to 93h
WRPROTECT	Unspecified
ANCHOR	See 9.39.2.
UNMAP	
NDOB	
LOGICAL BLOCK ADDRESS	As defined in WRITE SAME (10) (see 9.38).
NUMBER OF LOGICAL BLOCKS	As defined in WRITE SAME (10) (see 9.38).
GROUP NUMBER	Unspecified
CONTROL	See 6.5.

9.39.2 ANCHOR bit, UNMAP bit, and NDOB bit

Table 98 shows the interactions of the UNMAP bit, the ANCHOR bit, and the NDOB bit.

Table 98 — UNMAP bit, ANCHOR bit, and NDOB bit interactions

UNMAP BIT	ANCHOR bit	NDOB bit [a]	Description
0b	0b	0b	See 9.39.3.
		1b	See 9.39.4.
	1b	0b or 1b	The SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.
1b	0b or 1b	0b	If the LBPRZ bit is set to one in the READ CAPACITY (16) parameter data and the data block transferred from the application client to the SATL for the WRITE SAME command is set to all bits set to zero, then the SATL shall write zeros with trim as described in 9.39.5. Otherwise, the SATL shall write as described in 9.39.3.
1b	0b or 1b	1b	See 9.39.5.

[a] For the WRITE SAME (10) command, there is no NDOB bit and the SATL shall perform the actions described for the NDOB bit set to 0b.

9.39.3 Writing the data block

An entire medium write same command is a WRITE SAME command with:

a) the LOGICAL BLOCK ADDRESS field set to zero; and
b) the NUMBER OF LOGICAL BLOCKS field set to zero.

If the SATL receives an entire medium WRITE SAME command, then the SATL shall send an ATA SCT Write Same command with:

a) the FUNCTION CODE field set to 0102h for writing the data;
b) the FILL COUNT field of the SCT Write Same key page set to zero;
c) the START field of the SCT Write Same key page set to zero; and
d) the ATA ZAC OPTIONS field set to 0000h.

If the SATL receives a WRITE SAME command that is not an entire medium write same command, then the SATL shall write the block of data transferred from the application client to the range of blocks specified in the LOGICAL BLOCK ADDRESS field and the NUMBER OF LOGICAL BLOCKS field to the ATA device as follows:

a) if the ATA device supports the ATA SCT Write Same command, then the SATL should send one or more ATA SCT Write Same commands with:
   A) the FUNCTION CODE field set to 0102h for writing the data;
   B) the FILL COUNT field of the SCT Write Same key page set based on the value of the NUMBER OF LOGICAL BLOCKS field;
   C) the START field of the SCT Write Same key page set based on the value specified in the LOGICAL BLOCK ADDRESS field; and
   D) the ATA ZAC OPTIONS field set to 0000h;

   and

b) if the ATA device does not support the ATA SCT Write Same command, then the SATL shall send ATA write commands as defined in 9.28.

9.39.4 Writing zeros

An entire medium write same command is a WRITE SAME command with:

a) the LOGICAL BLOCK ADDRESS field set to zero; and
b) the NUMBER OF LOGICAL BLOCKS field set to zero.

If the SATL receives an entire medium WRITE SAME command, then the SATL shall send an ATA SCT Write Same command with:

a) the FUNCTION CODE field set to 0101h for writing the data;
b) the PATTERN field in the ATA SCT Write Same command/status page set to 0000_0000h;
c) the FILL COUNT field of the SCT Write Same key page set to zero;
d) the START field of the SCT Write Same key page set to zero; and
e) the ATA ZAC OPTIONS field set to 0000h.

If the SATL receives a WRITE SAME command that is not an entire medium write same command, then the SATL shall write a pattern of zeros to the range of blocks specified in the LOGICAL BLOCK ADDRESS field and the NUMBER OF LOGICAL BLOCKS field to the ATA device as follows:

1) if the device supports the ATA ZERO EXT command (i.e., the ZERO EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data is set to one) and the NUMBER OF LOGICAL BLOCKS field is not set to zero, then the SATL may send one or more ATA ZERO EXT commands with:
   A) the ATA COUNT field based on the value specified in the NUMBER OF LOGICAL BLOCKS field;
   B) the ATA LBA (47:0) field based on the value specified in the LOGICAL BLOCK ADDRESS field; and
   C) the ATA TRIM bit in the FEATURE field set to zero;
2) if the device supports the ATA SCT Write Same command, then the SATL may send one or more ATA SCT Write Same commands, with:
   A) the ATA FILL COUNT field in the ATA SCT Write Same command/status page based on the value specified in the NUMBER OF LOGICAL BLOCKS field;
   B) the ATA LBA(47:0) field of the ATA SCT Write Same command/status page based on the value specified in the LOGICAL BLOCK ADDRESS field;
   C) the ATA FUNCTION CODE field in the ATA SCT Write Same command/status page set to 0001h or 0101h;
   D) the ATA ZAC OPTIONS field set to 0000h; and
   E) the PATTERN field in the ATA SCT Write Same command/status page set to 0000_0000h; and
3) otherwise the SATL shall write zeros to the appropriate LBA range using ATA write commands as described in 9.39.3.

9.39.5 Write zeros with trim

If:

a) the LBPRZ field is set to xx1b in the Logical Block Provisioning VPD page (see 10.5.10);
b) the device supports the ATA ZERO EXT command (i.e., the ZERO EXT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one); and
c) the NUMBER OF LOGICAL BLOCKS field is not set to zero,

then the SATL shall send one or more ATA ZERO EXT commands with:

a) the ATA COUNT field based on the value specified in the NUMBER OF LOGICAL BLOCKS field;
b) the ATA LBA (47:0) field based on the value specified in the LOGICAL BLOCK ADDRESS field; and
c) the ATA TRIM bit in the FEATURE field set to one.

Otherwise the SATL shall write zeros as described in 9.39.4.

10 Parameters for SATL implementations

10.1 Overview

Parameters for all device types are defined in this clause as follows:

a) diagnostic parameters are defined in 10.2;
b) log parameters are defined in 10.3;
c) mode parameters are defined in 10.4; and
d) vital product data parameters are defined in 10.5.

10.2 Diagnostic parameters

10.2.1 Overview

SCSI diagnostic parameters provide a mechanism to initiate diagnostic functions and return results for those diagnostic functions. The SEND DIAGNOSTIC command is used to initiate diagnostic functions and the RECEIVE DIAGNOSTIC RESULTS command is used to obtain results from those functions.

The SATL translations for diagnostic pages are listed in table 99. A SATL that implements the RECEIVE DIAGNOSTIC RESULTS command shall also implement the Supported Diagnostic Pages page (i.e., page 00h) and should implement at least one other diagnostic page.

Table 99 — Summary of SCSI diagnostic page mapping

SCSI diagnostic page	Reference
Rebuild Assist (i.e., 42h)	10.2.2
Supported diagnostic pages (i.e., 00h)	Unspecified
All others	Unspecified

10.2.2 Rebuild Assist diagnostic page

10.2.2.1 Overview

If the SATL supports rebuild assist and the REBUILD ASSIST SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall process:

a) a RECEIVE DIAGNOSTIC RESULTS command addressed to the Rebuild Assist Input diagnostic page by performing an ATA read log command to read from the ATA Rebuild Assist log; and
b) a SEND DIAGNOSTIC command addressed to the Rebuild Assist Output diagnostic page by performing an ATA write log command to write to the ATA Rebuild Assist log.

If the SATL does not support rebuild assist or the REBUILD ASSIST SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall terminate SEND DIAGNOSTIC commands and RECEIVE DIAGNOSTIC RESULTS commands that specify the Rebuild Assist diagnostic page (i.e., 42h) with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

10.2.2.2 Rebuild Assist Input diagnostic page translation

The Rebuild Assist Input diagnostic page data is read from the ATA Rebuild Assist log as described in table 100.

Table 100 — Rebuild Assist Input diagnostic page fields

Field	Description
PAGE CODE	Set to 42h
PAGE LENGTH	Unspecified
ENABLED	The ENABLED bit shall be set to the value of the MANAGE REBUILD ASSIST bit in the ATA Rebuild Assist log.
PHYSICAL ELEMENT LENGTH	The PHYSICAL ELEMENT LENGTH field shall be set to the value of the PHYSICAL ELEMENT LENGTH field in the ATA Rebuild Assist log.
DISABLED PHYSICAL ELEMENT MASK	The DISABLED PHYSICAL ELEMENT MASK field shall be set to the value of the DISABLED PHYSICAL ELEMENT MASK field in the ATA Rebuild Assist log.
DISABLED PHYSICAL ELEMENT	The DISABLED PHYSICAL ELEMENT field shall be set to the value of the DISABLED PHYSICAL ELEMENTS field in the ATA Rebuild Assist log.

10.2.2.3 Rebuild Assist Output diagnostic page translation

The Rebuild Assist Output diagnostic page (see SBC-4) data is written to the ATA Rebuild Assist log as described in table 101.

Table 101 — Rebuild Assist Output diagnostic page fields

Field	Description
PAGE CODE	Set to 42h
PAGE LENGTH	Unspecified
ENABLE	The ATA MANAGE REBUILD ASSIST bit in the ATA Rebuild Assist log shall be set to the value of the ENABLE bit.
PHYSICAL ELEMENT LENGTH	The ATA PHYSICAL ELEMENT LENGTH field in the ATA Rebuild Assist log shall be set to the value specified in the PHYSICAL ELEMENT LENGTH field.
DISABLED PHYSICAL ELEMENT MASK	The ATA DISABLED PHYSICAL ELEMENT MASK field in the ATA Rebuild Assist log shall be set to the value specified in the DISABLED PHYSICAL ELEMENT MASK field.
DISABLE PHYSICAL ELEMENT	The ATA DISABLED PHYSICAL ELEMENTS field in the ATA Rebuild Assist log shall be set to the value specified in the DISABLE PHYSICAL ELEMENT field.

10.3 Log parameters

10.3.1 Overview

The SATL translations for log parameters are listed in table 102.

Table 102 — Summary of SCSI / ATA log page mapping

SCSI log page name	Page code	Subpage code	Reference
Application Client	0Fh	00h	10.3.2
Background Scan	15h	00h	10.3.3
General Statistics and Performance	19h	00h	10.3.4
Informational Exceptions	2Fh	00h	10.3.5
Pending Defects	15h	01h	10.3.6
Read Error Counters	03h	00h	10.3.7
Self-Test Results	10h	00h	10.3.8
Solid State Media	11h	00h	10.3.9
Start-Stop Cycle Counter	0Eh	00h	10.3.10
Supported Log Pages	00h	00h	10.3.11
Supported Log Pages and Subpages	00h	FFh	10.3.12
Temperature	0Dh	00h	10.3.13
Zoned Block Device Statistics	14h	01h	10.3.14
All others			Unspecified

10.3.2 Application Client log page

10.3.2.1 Overview

The Application Client log page provides a location for application clients to store information. A SATL translates a LOG SELECT command or LOG SENSE command to the Application Client log page to accesses to the ATA host vendor specific log pages. Table 103 describes the translation of the general usage application client parameter data for the Application Client log page.

The SATL determines if the ATA device supports host vendor specific log pages by reading ATA log page address 00h using an ATA read log command.

If the ATA device:

a) does not support the General Purpose Logging feature set and the SMART feature set is disabled; or
b) does not support host vendor specific log pages,

then the SATL shall complete the LOG SENSE command or LOG SELECT command for the Application Client log page with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

Table 103 — General usage Application Client log parameter fields

Field	Description
PARAMETER CODE	See 10.3.2.2.
DU	Set to one
TSD	Set to zero
FORMAT AND LINKING	Set to 11b
PARAMETER LENGTH	Set to FCh
GENERAL USAGE PARAMETER BYTES	See 10.3.2.2.

10.3.2.2 LOG SELECT translation

The SATL stores the application client parameter for a LOG SELECT command in the ATA device host vendor specific log page. The SATL stores the application client parameter data at the ATA log address as specified in table 104.

Within an ATA log address, the SATL shall store each parameter code in ascending order within the sixteen 512-byte data blocks for each ATA log address (e.g., parameter code 0000h is stored at offset 0 of the first 512-byte block of data at log address 90h and parameter code 0001h is stored at offset 256 in the first 512-byte block of data at log address 90h). The SATL stores this information by issuing an ATA write log command.

The SATL shall ensure that any previously stored data at the log address is preserved when writing to the log address for the requested parameter data.

Table 104 — Parameter storage location

Parameter code	ATA log address
0000h to 001Fh	90h
0020h to 003Fh	91h
0040h to 005Fh	92h
0060h to 007Fh	93h
0080h to 009Fh	94h
00A0h to 00BFh	95h
00C0h to 00DFh	96h
00E0h to 00FFh	97h
0100h to 011Fh	98h
0120h to 013Fh	99h
0140h to 015Fh	9Ah
0160h to 017Fh	9Bh
0180h to 019Fh	9Ch
01A0h to 01BFh	9Dh
01C0h to 01DFh	9Eh
01E0h to 01FFh	9Fh
All other values	Reserved

10.3.2.3 LOG SENSE translation

The SATL retrieves the requested parameter data by reading the ATA log address (see table 104) that stores the parameter code using an ATA read log command.

10.3.3 Background Scan Results log page

10.3.3.1 Overview

The Background Scan Results log page provides detail about background scan status. Table 105 shows the parameters that may be returned.

Table 105 — Background Scan Status log page parameters

Parameter	Reference
Background Scan Status	10.3.3.2

Table 106 shows the Background Scan Results log page header fields.

Table 106 — Background Scan Results log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 15h
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified

10.3.3.2 Background Scan Status log parameter

The Background Scan Status log parameter is unspecified unless:

a) the ATA Power on Hours statistic is supported (i.e., bit 63 of the ATA QWord located at byte 16 of the General Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Power on Hours statistic is valid (i.e., bit 62 of the ATA QWord located at byte 16 of the General Statistics page of the ATA Device Statistics log is set to one).

If the ATA Power on Hours statistic is supported and valid, then the SATL shall return the Background Scan Status log parameter as shown in table 107.

Table 107 — Background Scan Status log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0000h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 0Ch
ACCUMULATED POWER ON MINUTES	Shall be set to 60 times the value of the ATA Power on Hours statistic.
BACKGROUND SCAN STATUS	Unspecified
NUMBER OF BACKGROUND SCANS PERFORMED	Unspecified
BACKGROUND SCAN PROGRESS	Unspecified
NUMBER OF BACKGROUND MEDIUM SCANS PERFORMED	Unspecified

10.3.4 General Statistics and Performance log page

10.3.4.1 Overview

The General Statistics and Performance log page provides detail about usage and performance. Table 108 shows the parameters that may be returned.

Table 108 — General Statistics and Performance log page parameters

Parameter	Reference
General Statistics and Performance	10.3.4.2

Table 109 shows the General Statistics and Performance log page header fields.

Table 109 — General Statistics and Performance log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 19h
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified

10.3.4.2 General Statistics and Performance log parameters

The SATL shall:

1) send an ATA read log command to read the General Statistics page (i.e., 01h) of the Device Statistics log (i.e., log address 04h); and
2) return the parameter data shown in Table 110.

Table 110 — General Statistics and Performance log parameter fields (part 1 of 2)

Field	Description
PARAMETER CODE	Shall be set to 0001h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 40h

[a] The parameter is supported if bit 63 of the ATA QWord is set to one.
[b] The parameter is valid if bit 62 of the ATA QWord is set to one.

Table 110 — General Statistics and Performance log parameter fields (part 2 of 2)

Field	Description
NUMBER OF READ COMMANDS	If the ATA Number of Read Commands statistic (i.e., the ATA QWord located at byte 48 of the General Statistics page of the ATA Device Statistics log) is supported [a] and valid [b], then the SATL shall set the NUMBER OF READ COMMANDS parameter to the ATA Number of Read Commands statistic.
NUMBER OF WRITE COMMANDS	If the ATA Number of Write Commands statistic (i.e., the ATA QWord located at byte 32 of the General Statistics page of the ATA Device Statistics log) is supported [a] and valid [b], then the SATL shall set the NUMBER OF WRITE COMMANDS parameter to the ATA Number of Write Commands statistic.
NUMBER OF LOGICAL BLOCKS RECEIVED	If the ATA Logical Sectors Written statistic (i.e., the ATA QWord located at byte 24 of the General Statistics page of the ATA Device Statistics log) is supported [a] and valid [b], then the SATL shall set the NUMBER OF LOGICAL BLOCKS RECEIVED parameter to the ATA Logical Sectors Written statistic.
NUMBER OF LOGICAL BLOCKS TRANSMITTED	If the ATA Logical Sectors Read statistic (i.e., the ATA QWord located at byte 40 of the General Statistics page of the ATA Device Statistics log) is supported [a] and valid [b], then the SATL shall set the NUMBER OF LOGICAL BLOCKS TRANSMITTED parameter to the ATA Logical Sectors Read statistic.
READ COMMAND PROCESSING INTERVALS	Unspecified
WRITE COMMAND PROCESSING INTERVALS	Unspecified
WEIGHTED NUMBER OF READ COMMANDS PLUS NUMBER OF WRITE COMMANDS	Unspecified
WEIGHTED READ COMMAND PROCESSING PLUS WRITE COMMAND PROCESSING	Unspecified

[a] The parameter is supported if bit 63 of the ATA QWord is set to one.
[b] The parameter is valid if bit 62 of the ATA QWord is set to one.

10.3.5 Informational Exceptions log page

10.3.5.1 Overview

The Informational Exceptions log page provides detail about informational exceptions. The SATL shall send the ATA SMART RETURN STATUS command to the ATA device. Data returned from the ATA device shall be

translated into the appropriate log sense parameter data (see 10.3.5.2) to be returned to the application client. Table 111 shows the Informational Exceptions log page header fields.

Table 111 — Informational Exceptions log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 2Fh
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified

The first log parameter is the informational exceptions general parameter shown in table 112.

Table 112 — Informational Exceptions General log parameter data

Field	Description
PARAMETER CODE	Shall be set to 0000h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Unspecified
INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE	See 10.3.5.2.
INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE QUALIFIER	See 10.3.5.2.
MOST RECENT TEMPERATURE READING	See 10.3.5.3.
Vendor specific	Unspecified

10.3.5.2 Additional sense code and additional sense code qualifier translations

Data received from an ATA device in response to an ATA SMART RETURN STATUS command shall be translated by the SATL into the informational exceptions general parameter data returned to the application

client. Table 113 provides the parameter data translation for the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE field and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE QUALIFIER field.

Table 113 — ATA SMART RETURN STATUS translations

Data returned to SATL from the ATA device by the ATA SMART RETURN STATUS command	SMART condition	Informational Exceptions General log parameter data fields
LBA Mid = 4Fh LBA High = C2h	threshold not exceeded	If the ATA Device Statistics Notification log is supported, then: 1) the SATL shall read page 00h of the ATA Device Statistics Notification log; 2) if the ATA Device Statistics Notification log indicates that an ATA device statistic threshold has been met and the first ATA device statistic for which the threshold has been met is: A) Physical Element Status Changed (see ACS-5), then the SATL shall set INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE field to 00h and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE field to WARNING - PHYSICAL ELEMENT STATUS CHANGE; and B) any other device statistic (see ACS-5), then the SATL shall set the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE field to 00h and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE field to WARNING - DEVICE STATISTICS NOTIFICATION ACTIVE; and 3) if the ATA Device Statistics Notification log indicates that an ATA device statistic threshold has been met, then the SATL shall set the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE to 00h and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE QUALIFIER to 00h (i.e., NO ADDITIONAL SENSE). If the ATA Device Statistics Notification log is supported, and the ATA Device Statistics Notification log indicates that an ATA device statistic threshold has been met, then the SATL shall set the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE to 00h and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE QUALIFIER to 00h (i.e., NO ADDITIONAL SENSE).
LBA Mid = F4h LBA High = 2Ch	threshold exceeded	The INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE shall be set to 5Dh and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE QUALIFIER shall be set to 10h (i.e., HARDWARE IMPENDING FAILURE GENERAL HARD DRIVE FAILURE).

10.3.5.3 Most recent temperature reading translation

If the ATA device supports the SCT Feature Set (see ACS-5), then to translate the MOST RECENT TEMPERATURE READING field of the Informational Exceptions log page the SATL shall send an ATA SCT Status Request to the ATA device and:

a) if the ATA HDA TEMP field in the SCT Command/Status log (see ACS-5) is less than zero, then the SATL shall set the MOST RECENT TEMPERATURE READING field to zero;
b) if the ATA HDA TEMP field is equal to 80h, then the SATL shall set the MOST RECENT TEMPERATURE READING field to FFh; or
c) if the ATA HDA TEMP field is greater than or equal to zero and not equal to 80h, then the SATL shall set the MOST RECENT TEMPERATURE READING field to the value in the ATA HDA TEMP field.

If the ATA device does not support the SCT feature set, then the SATL shall set the MOST RECENT TEMPERATURE READING field to FFh.

10.3.6 Pending Defects log page

10.3.6.1 Overview

The Pending Defects log page provides information about medium defects that have not been reassigned but should be reassigned. If the ATA Pending Defects log (i.e., log address 0Ch) is not supported then the SATL shall terminate the LOG SENSE command or LOG SELECT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB (see SPC-5).

Table 114 shows the parameters that may be returned.

Table 114 — Pending Defects log page parameters

Parameter	Reference
Pending Defect Count	10.3.6.2
Pending Defect	10.3.6.3

Table 115 shows the Pending Defects log page header fields.

Table 115 — Pending Defects log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to one
PAGE CODE	15h
SUBPAGE CODE	01h
PAGE LENGTH	Shall be set to 8 plus (16 times the value of the ATA NUMBER OF LOG DESCRIPTORS field in the ATA Pending Defects log).

10.3.6.2 Pending Defect Count log parameter

The SATL shall:

1) send an ATA read log command to read the ATA Pending Defects log (i.e., log address 0Ch); and
2) return the parameter data shown in table 116.

Table 116 — Pending Defect Count log parameter

Field	Description
PARAMETER CODE	Shall be set to 0000h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 04h
PENDING DEFECT COUNT	Shall be set to the value of the ATA NUMBER OF LOG DESCRIPTORS field

10.3.6.3 Pending Defect log parameter

The SATL shall:

1) send an ATA read log command to read the ATA Pending Defects log (i.e., log address 0Ch);
2) not return any Pending Defect parameters if the ATA NUMBER OF LOG DESCRIPTORS field is set to zero; and
3) return the number of Pending Defect log parameters indicated by the value of the ATA NUMBER OF LOG DESCRIPTORS field as shown in table 117 if the ATA NUMBER OF LOG DESCRIPTORS field is non-zero.

Table 117 — Pending Defect log parameter

Field	Description
PARAMETER CODE	The SATL shall return Pending Defect log parameters from 0001h to the value of the ATA NUMBER OF LOG DESCRIPTORS field.
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 0Ch
ACCUMULATED POWER ON HOURS	Shall be set to the value of the ATA POWER ON HOURS field associated with this defect entry
PENDING DEFECT COUNT	Shall be set to the value of the ATA LBA field associated with this defect entry

10.3.7 Read Error Counters log page

10.3.7.1 Overview

The Read Error Counters log page provides detail about read errors. Table 118 shows the parameters that may be returned.

Table 118 — Read Error Counters log page parameters

Parameter	Reference
Total Times Correction Algorithm Processed	10.3.7.2
Total Uncorrected Errors	10.3.7.3

Table 119 shows the Read Error Counters log page header fields.

Table 119 — Read Error Counters log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 03h
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified

10.3.7.2 Total Times Correction Algorithm Processed log parameter

The Total Times Correction Algorithm Processed log parameter is unspecified unless:

a) the ATA Read Recovery Attempts statistic is supported (i.e., bit 63 of the ATA QWord located at byte 40 of the Rotating Media Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Read Recovery Attempts statistic is valid (i.e., bit 62 of the ATA QWord located at byte 40 of the Rotating Media Statistics page of the ATA Device Statistics log is set to one).

If the ATA Read Recovery Attempts statistic is supported and valid, then the SATL shall return the Total Times Correction Algorithm Processed log parameter as shown in table 120.

Table 120 — Total Times Correction Algorithm Processed log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0004h
DU	Shall be set to zero

Table 120 — Total Times Correction Algorithm Processed log parameter fields

Field	Description
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 10b
PARAMETER LENGTH	Shall be set to 04h
TOTAL TIMES CORRECTION ALGORITHM PROCESSED	Shall be set to bits 31:0 of the ATA Read Recovery Attempts statistic.

10.3.7.3 Total Uncorrected Errors log parameter

The Total Uncorrected Errors log parameter is unspecified unless:

a) the ATA Number of Reported Uncorrectable Errors statistic is supported (i.e., bit 63 of the ATA QWord located at byte 8 of the General Errors Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Number of Reported Uncorrectable Errors statistic is valid (i.e., bit 62 of the ATA QWord located at byte 8 of the General Errors Statistics page of the ATA Device Statistics log is set to one).

If the ATA Number of Reported Uncorrectable Errors statistic is supported and valid, then the SATL shall return the Total Uncorrected Errors log parameter as shown in table 121.

Table 121 — Total Uncorrected Errors log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0006h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 10b
PARAMETER LENGTH	Shall be set to 04h
TOTAL UNCORRECTED ERRORS	Shall be set to bits 31:0 of the ATA Number of Reported Uncorrectable Errors statistic

10.3.8 Self-Test Results log page

10.3.8.1 Overview

The Self-Test Results log page provides the results from self-test results descriptor entry pointed to by the Self-test descriptor index. Table 122 shows the Self-Test Results log page header fields.

Table 122 — Self-Test Results log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 10h
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Shall be set to 0190h

Translations of the fields for the Self-Test Results log parameters for the Self-Test Results log page are shown in table 123.

Table 123 — Self-Test Results log parameters (part 1 of 4)

Field	Description
PARAMETER CODE	The SATL shall return log parameters with the PARAMETER CODE field set to 0001h to 0014h.
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 10h
SELF-TEST CODE	The SATL shall read the ATA log data as defined in 10.3.8.2. If the SATL reads the ATA log data using the ATA READ LOG EXT command or the ATA READ LOG DMA EXT command specifying the Extended SMART self-test log, then the SATL shall check if the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field in the first log page (i.e., bytes 2 and 3) is set to zero. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to zero, then the SATL shall set the SELF-TEST CODE field to zero for each of the log parameters returned. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to a non-zero value, then the SELF-TEST CODE field is unspecified. If the SATL reads the ATA log data using the ATA SMART READ LOG command specifying the SMART self-test log, then the SELF-TEST CODE field is unspecified.

Table 123 — Self-Test Results log parameters (part 2 of 4)

Field	Description
SELF-TEST RESULTS	The SATL shall read the ATA log data as defined in 10.3.8.2. If the SATL reads the ATA log data using the ATA READ LOG EXT command or the ATA READ LOG DMA EXT command specifying the Extended SMART self-test log, then the SATL shall check if the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field in the first block of data (i.e., bytes 2 and 3) is set to zero. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to zero, then the SATL shall set the SELF-TEST RESULTS field to zero for each log parameter returned. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to a non-zero value, then the SATL shall set the SELF-TEST RESULTS field to: a) the value contained in the Self-test Execution Status bits of the content of the ATA SELF-TEST EXECUTION STATUS BYTE field of the n^{th} descriptor entry, where n is equal to the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one, if the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter returned plus one is greater than zero (e.g., for a log parameter with the PARAMETER CODE field of 0002h and a value contained in the ATA SELF-TEST DESCRIPTOR INDEX field of 6h, then the fifth descriptor entry is used); or b) zero, if the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one is less than or equal to zero. If the SATL reads the ATA log data using the ATA SMART READ LOG command specifying the SMART self-test log, then the SATL shall set the SELF-TEST RESULTS field to the value contained in the Self-test Execution Status bits of the content of the ATA SELF-TEST EXECUTION STATUS BYTE field of the nth descriptor entry, where n is equal to the value contained in the PARAMETER CODE field for the log parameter being returned (e.g., for a log parameter with the PARAMETER CODE field of 0002h, then the second descriptor entry is used).

Table 123 — Self-Test Results log parameters (part 3 of 4)

Field	Description
SELF-TEST NUMBER	Unspecified
ACCUMULATED POWER ON HOURS	The SATL shall read the ATA log data as defined in 10.3.8.2. If the SATL reads the ATA log data using the ATA READ LOG EXT command or the ATA READ LOG DMA EXT command specifying the Extended SMART self-test log, then the SATL shall check if the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field in the first block of data (i.e., bytes 2 and 3) is set to zero. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to zero, then the SATL shall set the ACCUMULATED POWER ON HOURS field to zero for each log parameter returned. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to a non-zero value, then the SATL shall set the ACCUMULATED POWER ON HOURS field to: a) the values contained in the ATA LIFE TIMESTAMP field of the n^{th} descriptor entry, where n is equal to the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one, if the result of value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one is greater than zero (e.g., for a log parameter with the PARAMETER CODE field of 0002h and a value contained in the ATA SELFTEST DESCRIPTOR INDEX field of 6h, then the fourth descriptor entry is used); or b) zero, if the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one is less than or equal to zero. If the SATL reads the ATA log data using the ATA SMART READ LOG command specifying the SMART self-test log, then the SATL shall set the ACCUMULATED POWER ON HOURS field to the values contained in the ATA LIFE TIMESTAMP field of the n^{th} descriptor entry, where n is equal to the value contained in the PARAMETER CODE field for the log parameter being returned (e.g., for a log parameter with the PARAMETER CODE field of 0002h, then the second descriptor entry is used).

Table 123 — Self-Test Results log parameters (part 4 of 4)

Field	Description
ADDRESS OF FIRST FAILURE	The SATL shall read the ATA log data as defined in 10.3.8.2. If the SATL reads the ATA log data using the ATA READ LOG EXT command or the ATA READ LOG DMA EXT command specifying the Extended SMART self-test log, then the SATL shall check if the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field in the first block of data (i.e., bytes 2 and 3) is set to zero. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to zero, then the SATL shall set the ADDRESS OF FIRST FAILURE field to zero for each log parameter returned. If the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field is set to a non-zero value, then the SATL shall set the ADDRESS OF FIRST FAILURE field to: a) the values contained in the ATA FAILING LBA (47:40) field, ATA FAILING LBA (39:32) field, ATA FAILING LBA (31:24) field, ATA FAILING LBA (23:16) field, ATA FAILING LBA (15:8) field, and ATA FAILING LBA (7:0) field of the n^{th} descriptor entry, where n is equal to the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one, if the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one is greater than zero (e.g., for a log parameter with the PARAMETER CODE field of 0002h and a value contained in the ATA SELF-TEST DESCRIPTOR INDEX field of 6h, then the fourth descriptor entry is used); or b) zero, if the result of the value contained in the ATA SELF-TEST DESCRIPTOR INDEX field minus the value contained in the PARAMETER CODE field for the log parameter being returned plus one is less than or equal to zero. If the SATL reads the ATA log data using the ATA SMART READ LOG command specifying the SMART self-test log, then the SATL shall set the ADDRESS OF FIRST FAILURE field to the values contained in the ATA FAILING LBA (27:24) field, ATA FAILING LBA (23:16) field, ATA FAILING LBA (15:8) field, and ATA FAILING LBA (7:0) field of the n^{th} descriptor entry, where n is equal to the value contained in the PARAMETER CODE field for the log parameter being returned (e.g., for a log parameter with the PARAMETER CODE field of 0002h, then the second descriptor entry is used).
SENSE KEY	See 10.3.8.3.
ADDITIONAL SENSE CODE	See 10.3.8.3.
ADDITIONAL SENSE CODE QUALIFIER	See 10.3.8.3.

10.3.8.2 A method of determining ATA command selection for field translations

To translate the SELF-TEST CODE field, the SELF-TEST RESULTS field, the ACCUMULATED POWER ON HOURS field, the ADDRESS OF FIRST FAILURE field, the SENSE KEY field, the ADDITIONAL SENSE CODE field, and the ADDITIONAL SENSE CODE QUALIFIER field of Self-Test Results log parameters, the SATL shall send an ATA read log command requesting the ATA IDENTIFY DEVICE data log and from the returned data the SATL shall determine if the ATA device supports the 48-bit Address feature set. If the 48-bit Address feature set is supported (i.e., the ATA IDENTIFY DEVICE data log 48-BIT SUPPORTED bit is set to one), then the SATL shall

send an ATA READ LOG EXT command or ATA READ LOG DMA EXT command with the ATA LOG ADDRESS field set to 07h (i.e., Extended SMART Self-Test log) to the ATA device. If the 48-bit Address feature set is not supported (i.e., ATA IDENTIFY DEVICE data log 48-BIT SUPPORTED bit is set to zero), then the SATL shall send an ATA SMART READ LOG command with the ATA LOG ADDRESS field set to 06h (i.e., SMART Self-Test log) to the ATA device.

10.3.8.3 Sense key and additional sense code

The SATL shall determine the SENSE KEY field, the ADDITIONAL SENSE CODE field, and the ADDITIONAL SENSE CODE QUALIFIER field returned in each log parameter from the content of the self-test execution status byte returned from an ATA read log command sent to the ATA device (see 10.3.8.2). The values returned in each log parameter shall be translated into sense data for the sense key and additional sense code as shown in table 124.

Table 124 — ATA Self-test execution status values translated to SCSI sense keys and sense codes

ATA	SCSI		
Self-Test execution status value	**Sense key**	**Additional sense code**	**NN [b]**
0	NO SENSE	NO ADDITIONAL SENSE INFORMATION	n/a
1	ABORTED COMMAND	DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	81h
2		DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	82h
3		DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	83h
4	HARDWARE ERROR	DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	84h
5		DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	85h
6		DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	86h
7	MEDIUM ERROR	DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	87h
8	HARDWARE ERROR	DIAGNOSTIC FAILURE ON COMPONENT NN (80h to FFh)	88h
9 to14	Unspecified [a]		
15	NO SENSE	NO ADDITIONAL SENSE INFORMATION	n/a

[a] Self-Test execution status values from 9 to 14 are reserved in ACS-5.
[b] The additional sense code qualifier returned with the additional sense code set to 40h.

10.3.9 Solid State Media log page

10.3.9.1 Overview

The Solid State Media log page provides detail about solid state media. Table 125 shows the parameters that

may be returned.

Table 125 — Solid State Media log page parameters

Parameter	Reference
Percentage Used Endurance Indicator	10.3.9.2

Table 126 shows the Solid State Media log page header fields.

Table 126 — Solid State Media log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 11h
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified

10.3.9.2 Percentage Used Endurance Indicator log parameter

The Percentage Used Endurance Indicator log parameter is unspecified unless:

a) the ATA Percentage Used Endurance Indicator statistic is supported (i.e., bit 63 of the ATA QWord located at byte eight of the Solid State Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Percentage Used Endurance Indicator statistic is valid (i.e., bit 62 of the ATA QWord located at byte eight of the Solid State Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Percentage Used Endurance Indicator statistic is supported and valid, then the SATL shall return the Percentage Used Endurance Indicator log parameter as shown in table 127.

Table 127 — Percentage Used Endurance Indicator log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0001h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 04h
PERCENTAGE USED ENDURANCE INDICATOR	Shall be set to the value of the ATA Percentage Used Endurance Indicator statistic.

10.3.10 Start-Stop Cycle Counter log page

10.3.10.1 Overview

The Start-Stop Cycle Counter log page provides details about start-stop cycles.

Table 128 shows the parameters that may be returned.

Table 128 — Start-Stop Cycle Counter log page parameter codes

Parameter	Reference
Accumulated Start-Stop Cycles	10.3.10.2
Accumulated Load-Unload Cycles	10.3.10.3
All others	Unspecified

Table 129 shows the Start-Stop Cycle Counter log page header fields.

Table 129 — Start-Stop Cycle Counter log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 0Eh
SUBPAGE CODE	Shall be set to 00h
PAGE LENGTH	Shall be set to (8 times the number of parameter codes returned)

10.3.10.2 Accumulated Start-Stop Cycles log parameter

The Accumulated Start-Stop Cycles log parameter is unspecified unless:

a) the ATA Head Load Events statistic is supported (i.e., bit 63 of the ATA QWord located at byte 24 of the Rotating Media Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Head Load Events statistic is valid (i.e., bit 62 of the ATA QWord located at byte 24 of the Rotating Media Statistics page of the ATA Device Statistics log is set to one).

If the ATA Head Load Events statistic is supported and valid then the SATL shall:

1) send an ATA read log command to read the Rotating Media Statistics page (i.e., log page 03h) of the Device Statistics log (i.e., log address 04h); and
2) return the parameter data shown in table 130.

Table 130 — Accumulated Start-Stop Cycles log parameter

Field	Description
PARAMETER CODE	Shall be set to 0004h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 04h
ACCUMULATED START-STOP CYCLES	Shall be set to bits 31:0 of the ATA Head Load Events statistic.

10.3.10.3 Accumulated Load-Unload Cycles log parameter

The Accumulated Load-Unload Cycles log parameter is unspecified unless:

a) the ATA Head Load Events statistic is supported (i.e., bit 63 of the ATA QWord located at byte 24 of the Rotating Media Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Head Load Events statistic is valid (i.e., bit 62 of the ATA QWord located at byte 24 of the Rotating Media Statistics page of the ATA Device Statistics log is set to one).

If the ATA Head Load Events statistic is supported and valid then the SATL shall:

1) send an ATA read log command to read the Rotating Media Statistics page (i.e., log page 03h) of the Device Statistics log (i.e., log address 04h); and
2) return the parameter data shown in table 131.

Table 131 — Accumulated Load-Unload Cycles log parameter

Field	Description
PARAMETER CODE	Shall be set to 0006h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 04h
ACCUMULATED LOAD-UNLOAD CYCLES	Shall be set to bits 31:0 of the ATA Head Load Events statistic.

10.3.11 Supported Log Pages log page

The Supported Log Pages log page (see table 132) returns the list of log pages supported by the SATL (see SPC-5).

Table 132 — Supported Log Pages log page fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to zero
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified
Supported pages	The SATL shall include log pages as follows: a) the Informational Exceptions log page if the ATA device supports the ATA SMART feature set (i.e., the ATA IDENTIFY DEVICE data log SMART bit is set to one); and b) the Self-Test Results log page if the ATA device supports the ATA SMART self-test (i.e., the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit is set to one). The SATL may include other pages.

10.3.12 Supported Log Pages and Subpages log page

The Supported Log Pages and Subpages log page returns the list of log pages and subpages supported by the SATL (see SPC-5).

Table 133 — Supported Log Pages and Subpages log page fields

Field	Description
DS	Unspecified
SPF	Shall be set to one
PAGE CODE	Shall be set to zero
SUBPAGE CODE	Shall be set to FFh
PAGE LENGTH	Unspecified
Supported pages and subpages	As defined for Supported Log Pages log page translation (see 10.3.11)

10.3.13 Temperature log page

10.3.13.1 Overview

The Temperature log page provides detail about the temperature reported by the device server. Table 134 shows the parameters that may be returned.

Table 134 — Temperature Log Page Parameters

Parameter	Reference
Temperature	10.3.13.2
Reference Temperature	10.3.13.3

Table 135 shows the Temperature log page header fields.

Table 135 — Temperature log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to zero
PAGE CODE	Shall be set to 0Dh
SUBPAGE CODE	Shall be set to zero
PAGE LENGTH	Unspecified

10.3.13.2 Current Temperature log parameter

The fields of the Temperature log are set as described in table 136.

Table 136 — Temperature log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0000h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 02h
TEMPERATURE	Shall be set to: a) the value of the ATA HDA TEMP field of the ATA SCT Command/Status log, if: A) a sanitize operation is in progress; B) SCT is supported (i.e., the SCT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one); and C) bit 7 of the value of the ATA HDA TEMP field of the ATA SCT Command/Status log is set to zero; b) the value of the ATA Current Temperature statistic from the Temperature Statistics page of the ATA Device Statistics log, if: A) a sanitize operation is not in progress; B) the ATA Current Temperature statistic is supported (i.e., bit 63 of the ATA QWord located at byte 8 of the Temperature Statistics page of the ATA Device Statistics log is set to one); C) the ATA Current Temperature statistic is valid (i.e., bit 62 of the ATA QWord located at byte 8 of the Temperature Statistics page of the ATA Device Statistics log is set to one); and D) bit 7 of the value of the ATA Current Temperature statistic from the Temperature Statistics page of the ATA device Statistics log is set to zero; or c) otherwise FFh.

10.3.13.3 Reference Temperature log parameter

The Reference Temperature log parameter is unspecified unless:

a) the ATA Specified Maximum Operating Temperature statistic is supported (i.e., bit 63 of the ATA QWord located at byte 88 of the Temperature Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Specified Maximum Operating Temperature statistic is valid (i.e., bit 62 of the ATA QWord located at byte 88 of the Temperature Statistics page of the ATA Device Statistics log is set to one).

If the ATA Specified Maximum Operating Temperature statistic is supported and valid, then the SATL shall return the Reference Temperature log parameter as shown in table 137.

Table 137 — Reference Temperature log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0001h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 02h
REFERENCE TEMPERATURE	If bit 7 of the ATA Specified Maximum Operating Temperature statistic is set to: a) one, then the SATL shall set bits 7:0 of the REFERENCE TEMPERATURE field to 00h; and b) zero, then the SATL shall set bits 7:0 of the REFERENCE TEMPERATURE field to the ATA Specified Maximum Operating Temperature statistic.

10.3.14 Zoned Block Device Statistics log page

10.3.14.1 Overview

The Zoned Block Device Statistics log page provides parameters relevant to the state of a zoned block device. Table 138x shows the parameters that may be returned.

Table 138 — Zoned Block Device Statistics log page parameters

Parameter	Reference
Maximum Open Zones	10.3.14.2
Maximum Explicitly Open Zones	10.3.14.3
Maximum Implicitly Open Zones	10.3.14.4
Minimum Empty Zones	10.3.14.5
Maximum Number of Non-sequential Zones	10.3.14.6
Zones Emptied	10.3.14.7
Suboptimal Write Commands	10.3.14.8
Commands Exceeding Optimal Limit	10.3.14.9

Table 138 — Zoned Block Device Statistics log page parameters

Parameter	Reference
Failed Explicit Opens	10.3.14.10
Read Rule Violations	10.3.14.11
Write Rule Violations	10.3.14.12
All others	Unspecified

Table 139 shows the Zoned Block Device Statistics log page header fields.

Table 139 — Zoned Block Device Statistics log page header fields

Field	Description
DS	Unspecified
SPF	Shall be set to one
PAGE CODE	Shall be set to 14h
SUBPAGE CODE	Shall be set to 01h
PAGE LENGTH	Unspecified

10.3.14.2 Maximum Open Zones log parameter

The Maximum Open Zones log parameter is unspecified unless:

a) the ATA Maximum Open Zones statistic is supported (i.e., bit 63 of the ATA Qword located at byte eight of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Maximum Open Zones statistic is valid (i.e., bit 62 of the ATA QWord located at byte eight of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Maximum Open Zones statistic is supported and valid, then the SATL shall return the Maximum Open Zones log parameter as shown in table 140.

Table 140 — Maximum Open Zones log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0000h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
MAXIMUM OPEN ZONES	Shall be set to the value of the ATA MAX OPEN ZONES field.

10.3.14.3 Maximum Explicitly Open Zones log parameter

The Maximum Explicitly Open Zones log parameter is unspecified unless:

a) the ATA Maximum Explicitly Open Zones statistic is supported (i.e., bit 63 of the ATA Qword located at byte 16 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Maximum Explicitly Open Zones statistic is valid (i.e., bit 62 of the ATA QWord located at byte 16 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Maximum Explicitly Open Zones statistic is supported and valid, then the SATL shall return the Maximum Explicitly Open Zones log parameter as shown in table 141.

Table 141 — Maximum Explicitly Open Zones log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0001h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
MAXIMUM EXPLICITLY OPEN ZONES	Shall be set to the value of the ATA MAX EXPLICITLY OPEN ZONES field.

10.3.14.4 Maximum Implicitly Open Zones log parameter

The Maximum Implicitly Open Zones log parameter is unspecified unless:

a) the ATA Maximum Implicitly Open Zones statistic is supported (i.e., bit 63 of the ATA Qword located at byte 24 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Maximum Implicitly Open Zones statistic is valid (i.e., bit 62 of the ATA QWord located at byte 24 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Maximum Implicitly Open Zones statistic is supported and valid, then the SATL shall return the Maximum Implicitly Open Zones log parameter as shown in table 142.

Table 142 — Maximum Implicitly Open Zones log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0002h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
MAXIMUM EXPLICITLY OPEN ZONES	Shall be set to the value of the ATA MAX IMPLICITLY OPEN ZONES field.

10.3.14.5 Minimum Empty Zones log parameter

The Minimum Empty Zones log parameter is unspecified unless:

a) the ATA Minimum Empty Zones statistic is supported (i.e., bit 63 of the ATA Qword located at byte 32 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Minimum Empty Zones statistic is valid (i.e., bit 62 of the ATA QWord located at byte 32 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Minimum Empty Zones statistic is supported and valid, then the SATL shall return the Minimum Empty Zones log parameter as shown in table 143.

Table 143 — Maximum Implicitly Open Zones log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0003h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
MAXIMUM EXPLICITLY OPEN ZONES	Shall be set to the value of the ATA MIN EMPTY ZONES field.

10.3.14.6 Maximum Number of Non-sequential Zones log parameter

The Maximum Number of Non-sequential Zones log parameter is unspecified unless:

a) the ATA Maximum Number of Non-sequential Zones statistic is supported (i.e., bit 63 of the ATA Qword located at byte 40 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Maximum Number of Non-sequential Zones statistic is valid (i.e., bit 62 of the ATA QWord located at byte 40 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Maximum Number of Non-sequential Zones statistic is supported and valid, then the SATL shall return the Maximum Number of Non-sequential Zones log parameter as shown in table 144.

Table 144 — Maximum Number of Non-sequential Zones log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0004h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
MAXIMUM NONSEQ ZONES	Shall be set to the value of the ATA MAX NONSEQ ZONES field.

10.3.14.7 Zones Emptied log parameter

The Zones Emptied log parameter is unspecified unless:

a) the ATA Zones Emptied statistic is supported (i.e., bit 63 of the ATA Qword located at byte 48 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Zones Emptied statistic is valid (i.e., bit 62 of the ATA QWord located at byte 48 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Zones Emptied statistic is supported and valid, then the SATL shall return the Zones Emptied log parameter as shown in table 145.

Table 145 — Zones Emptied log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0005h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
ZONES EMPTIED	Shall be set to the value of the ATA ZONES EMPTIED field.

10.3.14.8 Suboptimal Write Commands log parameter

The Suboptimal Write Commands log parameter is unspecified unless:

a) the ATA Suboptimal Write Commands statistic is supported (i.e., bit 63 of the ATA Qword located at byte 56 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Suboptimal Write Commands statistic is valid (i.e., bit 62 of the ATA QWord located at byte 56 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Suboptimal Write Commands statistic is supported and valid, then the SATL shall return the Suboptimal Write Commands log parameter as shown in table 146.

Table 146 — Suboptimal Write Commands log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0006h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
SUBOPTIMAL WRITE CMDS	Shall be set to the value of the ATA SUBOPTIMAL WRITE CMDS field.

10.3.14.9 Commands Exceeding Optimal Limit log parameter

The Commands Exceeding Optimal Limit log parameter is unspecified unless:

a) the ATA Commands Exceeding Optimal Limit is supported (i.e., bit 63 of the ATA Qword located at byte 64 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Commands Exceeding Optimal Limit statistic is valid (i.e., bit 62 of the ATA QWord located at byte 64 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Commands Exceeding Optimal Limit statistic is supported and valid, then the SATL shall return the Commands Exceeding Optimal Limit log parameter as shown in table 147.

Table 147 — Suboptimal Write Commands log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0007h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
CMDS EXCEEDING OPTIMAL LIMIT	Shall be set to the value of the ATA CMDS EXCEEDING OPTIMAL LIMIT field.

10.3.14.10 Failed Explicit Opens log parameter

The Failed Explicit Opens log parameter is unspecified unless:

a) the ATA Failed Explicit Opens is supported (i.e., bit 63 of the ATA Qword located at byte 72 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Failed Explicit Opens statistic is valid (i.e., bit 62 of the ATA QWord located at byte 72 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Failed Explicit Opens statistic is supported and valid, then the SATL shall return the Failed Explicit Opens log parameter as shown in table 148.

Table 148 — Failed Explicit Opens log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0008h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
FAILED EXPLICIT OPENS	Shall be set to the value of the ATA FAILED EXPLICIT OPENS field.

10.3.14.11 Read Rule Violations log parameter

The Read Rule Violations log parameter is unspecified unless:

a) the ATA Read Rule Violations is supported (i.e., bit 63 of the ATA Qword located at byte 80 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Read Rule Violations statistic is valid (i.e., bit 62 of the ATA QWord located at byte 80 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Read Rule Violations statistic is supported and valid, then the SATL shall return the Read Rule Violations log parameter as shown in table 149.

Table 149 — Read Rule Violations log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 0009h
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
READ RULE VIOLATIONS	Shall be set to the value of the ATA READ RULE VIOLATIONS field.

10.3.14.12 Write Rule Violations log parameter

The Write Rule Violations log parameter is unspecified unless:

a) the ATA Write Rule Violations is supported (i.e., bit 63 of the ATA Qword located at byte 80 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one); and
b) the ATA Write Rule Violations statistic is valid (i.e., bit 62 of the ATA QWord located at byte 80 of the Zoned Device Statistics page of the ATA Device Statistics log is set to one).

If the ATA Write Rule Violations statistic is supported and valid, then the SATL shall return the Write Rule Violations log parameter as shown in table 150.

Table 150 — Write Rule Violations log parameter fields

Field	Description
PARAMETER CODE	Shall be set to 000Ah
DU	Shall be set to zero
TSD	Shall be set to zero
FORMAT AND LINKING	Shall be set to 11b
PARAMETER LENGTH	Shall be set to 08h
WRITE RULE VIOLATIONS	Shall be set to the value of the ATA WRITE RULE VIOLATIONS field.

10.4 Mode parameters

10.4.1 General information

SCSI mode parameters provide a mechanism to set operating parameters for SCSI devices and logical units. The MODE SENSE command obtains operating parameters and the MODE SELECT command sets operating parameters. This standard does not define the content of most operating parameters defined in mode pages due to lack of equivalent operations or features defined for ATA devices. The SATL emulates a SCSI device server for all MODE SENSE commands and MODE SELECT commands, and shall emulate the mode pages listed in 10.4.2.

The Mode Page Policy VPD page (see 10.5) should be implemented. If implemented, then the MODE PAGE POLICY field in each mode page policy descriptor should be set to 00b (i.e., shared) for each mode page and only one copy of mode page values should be maintained for all logical units within a target device (i.e., the MLUS bit is set to one in each mode page policy descriptor).

If the Mode Page Policy VPD page is not implemented, then the SATL shall maintain shared mode pages for all I_T nexuses and shall share mode pages across all logical units within a target device.

10.4.2 Overview

The SATL translations for mode pages are listed in table 151.

Table 151 — Summary of SCSI / ATA mode page mapping

SCSI mode page	Reference
Command Duration Limit A (i.e., 0Ah/03h)	10.4.5
Command Duration Limit B (i.e., 0Ah/04h)	10.4.5
Control (i.e., 0Ah)	10.4.6
Control Extension (i.e., 0Ah/01h)	10.4.7
Read-Write Error Recovery (i.e., 01h)	10.4.8
Caching (i.e., 08h)	10.4.9
Informational Exceptions Control (i.e., 1Ch)	10.4.10
Power Condition (i.e.,1Ah)	10.4.11
Command Duration Limit T2A (i.e., 0Ah/07h)	10.4.12
Command Duration Limit T2B (i.e., 0Ah/08h)	10.4.13
All others	Unspecified

The format of mode parameter headers used for all pages is as described in 10.4.3.The format of the optional mode parameter block descriptors used for all mode pages is as described in 10.4.4.

The list of mode pages the SATL may support are shown in table 151, table 215, and others that are defined in SPC-6, SBC-5, and ZBC-2 that do not have defined SAT-5 translations.

The Command Duration Limit A mode page, the Command Duration Limit B mode page, the Command Duration Limit T2A mode page, and the Command Duration Limit T2B mode page may or may not be supported depending on the setting of the CDL_CTRL field (see). If the setting specifies that any of these mode pages are not supported, then they shall not be returned in any parameter data that indicates supported mode pages and supported subpages (see SPC-6).

10.4.3 Mode parameter headers

Table 152 shows the fields in the mode parameter header for the MODE SELECT (6) command and the MODE SENSE (6) command.

Table 152 — Mode parameter header (6) fields

Field	Description
MODE DATA LENGTH	Unspecified
MEDIUM TYPE	This field should be set to 00h for MODE SENSE commands. When processing a MODE SELECT command, if the MEDIUM TYPE field is set to a value other than 00h, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.
DEVICE SPECIFIC PARAMETER	Unspecified for the MODE SELECT command. For the MODE SENSE command, the DEVICE SPECIFIC PARAMETER field for direct access block devices is set to the DPOFUA bit and the WP bit (see SBC-4). A DPOFUA bit set to zero indicates that the SATL supports neither the DPO bit nor the FUA bit. A DPOFUA bit set to one indicates that the SATL supports both the DPO bit and the FUA bit. A WP bit set to zero indicates that the medium is not write-protected. A WP bit set to one indicates that the medium is write-protected.
BLOCK DESCRIPTOR LENGTH	This value is obtained by multiplying the number of block descriptors by eight (see SPC-5). The SATL shall support zero or one mode parameter block descriptors.

Table 153 shows the fields in the mode parameter header for the MODE SELECT (10) command and the MODE SENSE (10) command.

Table 153 — Mode parameter header (10) fields

Field	Description
MODE DATA LENGTH	See table 152.
MEDIUM TYPE	See table 152.
DEVICE SPECIFIC PARAMETER	See table 152.
LONGLBA	This field describes the length of the block descriptors as follows: a) if set to zero, then the mode parameter block descriptor is eight bytes long; or b) if set to one, then the mode parameter block descriptor is 16 bytes long.
BLOCK DESCRIPTOR LENGTH	This field specifies (i.e., for a MODE SELECT command) or indicates (i.e., for a MODE SENSE command) the length of the mode parameter block descriptor. It is equal to the number of block descriptors times eight if the LONGLBA bit is set to zero or times sixteen if the LONGLBA bit is set to one. The SATL shall support zero or one mode parameter block descriptors.

10.4.4 Mode parameter block descriptor fields

The SATL may support the direct access short LBA mode parameter block descriptor or the long LBA mode parameter block descriptor. Table 154 describes the translation of fields in the short LBA mode parameter block descriptor and the long LBA mode parameter block descriptor supported by the SATL.

Table 154 — Mode parameter block descriptor fields

Field	Description
NUMBER OF BLOCKS [a]	Unspecified
BLOCK LENGTH [a]	If processing a MODE SELECT command, the SATL implements direct logical block mapping (see 9.1.2) and the value of the BLOCK LENGTH field is not the same as the ATA logical sector size, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST. If the SATL supports indirect logical block mapping, then this field is unspecified. If processing the MODE SENSE command and the SATL implements direct logical block mapping (see 9.1.2), then the SATL shall return the same block length for the entire logical unit and the BLOCK LENGTH field shall contain the ATA logical sector size . Otherwise the BLOCK LENGTH field is unspecified.

[a] The values reported in the NUMBER OF BLOCKS field and the BLOCK LENGTH field shall be such that the logical unit capacity is less than or equal to the ATA device capacity.

10.4.5 Command Duration Limit mode pages

10.4.5.1 Overview

The Command Duration Limit A mode page and the Command Duration Limit B mode page specify command duration limit times that may be used to specify the value of the ICC field in ATA NCQ commands.

If the SATL supports the Command Duration Limit A mode page and the SUPPORTS RDNC bit is set to one in the SATA NCQ Non-Data log reported by the ATA device, then the SATL shall send an ATA DEADLINE HANDLING command with the RDNC bit set to one to the ATA device.

If the SATL supports the Command Duration Limit B mode page and the SUPPORTS WDNC bit is set to one in the SATA NCQ Non-Data log reported by the ATA device, then the SATL shall send an ATA DEADLINE HANDLING command with the WDNC bit set to one to the ATA device.

If the SATL does not support the ATA Feature Control mode page (see 12.3.4), the Command Duration Limit A mode page, or the Command Duration Limit B mode page, then a MODE SELECT command or a MODE SENSE command that includes that mode page shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB (see SPC-5).

Table 155 shows the translation of fields in the Command Duration Limit A mode page and the Command Duration Limit B mode page.

Table 155 — Command Duration Limit A mode page and Command Duration Limit B mode page fields

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to one
PAGE CODE	no	Shall be set to 0Ah
SUBPAGE CODE	no	Shall be set to 03h for Command Duration Limit A mode page. Shall be set to 04h for Command Duration Limit B mode page.
PAGE LENGTH	no	Shall be set to 0020h
Command duration limit descriptors	yes	See 10.4.5.2.

10.4.5.2 Command duration limit descriptor translation

The SATL shall translate the CDLUNIT field and the COMMAND DURATION LIMIT field in the command duration limit descriptor to the ICC field and the PRIO field in the ATA READ FPDMA QUEUED command and the ATA WRITE FPDMA QUEUED command as shown in table 156.

Table 156 — Command duration limit descriptor field translations

Command duration limit descriptor		Time Value	ATA READ FPDMA QUEUED command ATA WRITE FPDMA QUEUED command	
CDLUNIT field	COMMAND DURATION LIMIT field		ICC field	PRIO field
000b	all values	n/a [a]	00h	00b
100b	0000h	n/a [a]	00h	00b
100b	0001h to 270Fh	1 μs to 9 999 μs	00h [c]	01b
100b	2710h	10 000 μs	00h	01b
100b	2711h to FFFFh	10 001 μs to 65 535 μs	INT(z / 10 000) (i.e., 00h to 06h) [b]	01b
101b	0000h	n/a [a]	00h	00b
101b	0001h to 0080h	10 ms to 1 280 ms	z - 1 (i.e., 00h to 7Fh)	01b
101b	0081h to 1900h	1 290 ms to 64 000 ms	INT(z / 500) + 7Fh (i.e., 81h to FFh) [b]	01b
101b	1901h to FFFFh	64 010 ms to 655 350 ms	FFh [c]	01b
110b	0000h	n/a [a]	00h	00b
110b	0001h to 0080h	500 ms to 64 000 ms	z + 7Fh (i.e., 80h to FFh)	01b
110b	all others	≥ 64 500 ms	FFh [c]	01b
all other values	The device server shall terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER DATA.			

Key:
z = Contents of the COMMAND DURATION LIMIT field.

[a] A command duration limit is not specified.
[b] If INT(x) is not equal to x, a parameter rounding error is reported for the MODE SELECT command as specified in SPC-5.
[c] A parameter rounding error is reported for the MODE SELECT command as specified in SPC-5.

10.4.6 Control mode page

10.4.6.1 General translation

The Control mode page provides controls and information about behavior of the emulated SCSI device.

Table 157 describes the translation of the Control mode page for an ATA device.

Table 157 — Control mode page fields (part 1 of 2)

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to zero
PAGE CODE	no	Shall be set to 0Ah
PAGE LENGTH	no	Shall be set to 0Ah
TST	no	Shall be set to 000b to indicate that a SCSI representation of an ATA device has one task set for all initiators.
TMF_ONLY	no	Shall be set to zero [a]
DPICZ	Unspecified	Unspecified
D_SENSE	Unspecified	The SATL shall support this bit as defined in SPC-5 with the following exception: if the D_SENSE bit is set to zero (i.e., fixed format sense data), then the SATL should return fixed format sense data for ATA PASS-THROUGH commands.
GLTSD	Unspecified	Unspecified
RLEC	no	Shall be set to zero
QUEUE ALGORITHM MODIFIER	no	Shall be set to 0001b
NUAR	Unspecified	Unspecified
QERR	no	If the SATL supports the full task management model and ATA abort retry of ATA NCQ commands aborted by ATA collateral abort (see 6.2.7), then the SATL shall set this field to 00b. Otherwise, the SATL shall set this field to 01b and comply with the unit attention condition requirements for a command completed with CHECK CONDITION status (see SPC-5).
VS	Unspecified	Unspecified
RAC	Unspecified	Unspecified
UA_INTLCK_CTRL	no	Shall be set to 00b
SWP	no	Shall be set to zero
ATO	Unspecified	Unspecified
TAS	no	Shall be set to zero
ATMPE	Unspecified	Unspecified

[a] SATL implementations shall not support ACA.

Table 157 — Control mode page fields (part 2 of 2)

Field	Changeable	Description
RWWP	Unspecified	Unspecified
SBLP	no	Shall be set to zero
AUTOLOAD MODE	no	Shall be set to 000b
BUSY TIMEOUT PERIOD	Unspecified	The default value shall be set to FFFFh. A SATL may support variable timeout periods and allow the application client to set a new value through a MODE SELECT operation for this mode page (see SPC-5).
EXTENDED SELF-TEST COMPLETION TIME	no	See 10.4.6.2.
[a] SATL implementations shall not support ACA.		

10.4.6.2 Extended self-test completion time

A SATL implementation shall set the EXTENDED SELF-TEST COMPLETION TIME field to 0000h unless the ATA device supports SMART self-tests and the SATL supports a value other than 000b for the SELF-TEST CODE field for a SEND DIAGNOSTIC command. The SATL determines if the ATA device supports SMART self-test by examining the value of the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit. If the ATA IDENTIFY DEVICE data log SMART SELF-TEST SUPPORTED bit is set to one, then the ATA device supports the SMART self-test and the SATL shall retrieve the ATA device SMART data structure from the ATA device by sending an ATA SMART READ DATA command to the ATA device. The SATL may cache the ATA SMART READ data for future use when a subsequent MODE SENSE command requests the Control mode page. If the SATL caches such data, then the SATL may reference the cached copy instead of sending a new ATA SMART READ DATA command. The SATL shall set the EXTENDED SELF-TEST COMPLETION TIME field as follows:

1) If byte 373 of the returned SMART data structure is not set to FFh, then the SATL shall set the EXTENDED SELF-TEST COMPLETION TIME field to a value that is 60 times the contents of byte 373; or
2) If byte 373 of the returned SMART data structure is set to FFh, then the SATL shall set the EXTENDED SELF-TEST COMPLETION TIME field to a value that is the lesser of FFFFh or the result of the following formula:

EXTENDED SELF-TEST COMPLETION TIME field = ((w x 256) + z) x 60

where:

w is the contents of byte 376; and

z is the contents of byte 375.

10.4.7 Control Extension mode page

The Control Extension mode page provides extended controls and information about behavior of the emulated SCSI device.

Table 158 defines the translation of the fields of the Control Extension mode page.

Table 158 — Control Extension mode page field translations

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to one
PAGE CODE	no	Shall be set to 0Ah
SUBPAGE CODE	no	Shall be set to 01h
PAGE LENGTH	no	Shall be set to 001Ch
DLC	Unspecified	Unspecified
TCMOS	yes	Unspecified
SCSIP	yes	Unspecified
IALUAE	no	Shall be set to zero
INITIAL COMMAND PRIORITY	n/a	Unspecified
MAXIMUM SENSE DATA LENGTH	Unspecified	Unspecified
PWROMACT	no	Shall be set to zero
HRDRMACT	no	Shall be set to one
SSUMACT	Unspecified	Unspecified
FMTMACT	Unspecified	Unspecified

10.4.8 Read-Write Error Recovery mode page

The Read-Write Error Recovery mode page specifies the error recovery parameters the SATL shall use during a command that performs a read or write operation to the medium of the ATA device (see SBC-4). Table 159 defines the translation for the Read-Write Error Recovery mode page.

Table 159 — Read-Write Error Recovery mode page fields

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to zero
PAGE CODE	no	Shall be set to 01h
PAGE LENGTH	no	Shall be set to 0Ah
AWRE	no	Shall be set to one
ARRE	no	Shall be set to zero
TB	n/a	Unspecified
RC	no	Shall be set to zero
PER	no	Shall be set to zero
DTE	no	Shall be set to zero
READ RETRY COUNT	n/a	Unspecified
LBPERE	n/a	Unspecified
WRITE RETRY COUNT	n/a	Unspecified
RECOVERY TIME LIMIT	no	Shall be set to zero

10.4.9 Caching mode page

The Caching mode page defines parameters that affect the behavior of the cache in the ATA device.

Table 160 shows the translation of fields in the Caching mode page.

Table 160 — Caching mode page fields (part 1 of 2)

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to zero
PAGE CODE	no	Shall be set to 08h
PAGE LENGTH	no	Shall be set to 12h
IC	no	Shall be set to zero
ABPF	no	Shall be set to zero
CAP	no	Shall be set to zero
DISC	no	Shall be set to zero
SIZE	no	Shall be set to zero
WCE	yes [a]	If processing a MODE SENSE command, then the SATL shall determine if the write cache of the ATA device is enabled from the ATA IDENTIFY DEVICE data log VOLATILE WRITE CACHE ENABLED bit. If the write cache of the ATA device is enabled, then the SATL shall return a value of one for the WCE bit. If the write cache of the ATA device is disabled, then the SATL shall return a value of zero for the WCE bit. If processing a MODE SELECT command and: a) the WCE bit is set to zero, then the SATL shall disable the write cache of the ATA device by issuing an ATA SET FEATURES – Disable write cache command (i.e., with the FEATURE field set to 82h); or b) the WCE bit is set to one, then the SATL shall enable the write cache of the ATA device by issuing an ATA SET FEATURES – Enable write cache command (i.e., with the FEATURE field set to 02h).
MF	no	Shall be set to zero
RCD	no	Shall be set to zero
DEMAND READ RETENTION PRIORITY	no	Shall be set to zero
WRITE RETENTION PRIORITY	no	Shall be set to zero

[a] If the ATA device does not support a write cache (i.e., ATA IDENTIFY DEVICE data log VOLATILE WRITE CACHE SUPPORTED bit is set to zero), then this field is not changeable.

Table 160 — Caching mode page fields (part 2 of 2)

Field	Changeable	Description
DISABLE PRE-FETCH TRANSFER LENGTH	no	Shall be set to zero
MINIMUM PRE-FETCH	no	Shall be set to zero
MAXIMUM PRE-FETCH	no	Shall be set to zero
MAXIMUM PRE-FETCH CEILING	no	Shall be set to zero
FSW	no	Shall be set to zero
LBCSS	no	Shall be set to zero
DRA	yes	If processing a MODE SENSE command, then the SATL shall determine if the ATA device look-ahead is enabled from the ATA IDENTIFY DEVICE data log READ LOOK-AHEAD ENABLED bit If the look-ahead is enabled, then the SATL shall return a value of zero for the DRA bit. If the look-ahead is disabled, then the SATL shall return a value of one for the DRA bit. If processing a MODE SELECT command and: a) the DRA bit is set to zero, then the SATL shall enable the ATA device read look-ahead feature by issuing an ATA SET FEATURES – Enable read look-ahead feature command (i.e., with the FEATURE field set to AAh); or b) the DRA bit is set to one, then the SATL shall disable the ATA device read look-ahead feature by issuing an ATA SET FEATURES – Disable read look-ahead feature command (i.e., with the FEATURE field set to 55h).
SYNC_PROG	no	Shall be set to 00b
NV_DIS	no	Shall be set to zero
NUMBER OF CACHE SEGMENTS	no	Shall be set to zero
CACHE SEGMENT SIZE	no	Shall be set to zero

[a] If the ATA device does not support a write cache (i.e., ATA IDENTIFY DEVICE data log VOLATILE WRITE CACHE SUPPORTED bit is set to zero), then this field is not changeable.

10.4.10 Informational Exceptions Control mode page

10.4.10.1 Overview

The Informational Exceptions Control mode page defines the methods used by the SATL to control the reporting and the operations of specific informational exception conditions. The Informational Exceptions Control mode page applies to informational exceptions that return an additional sense code of FAILURE PREDICTION THRESHOLD EXCEEDED or WARNING to the application client (see SBC-4).

The SATL shall determine if the ATA SMART feature set is supported from the ATA IDENTIFY DEVICE data log SMART bit. If the ATA SMART feature set is not supported, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB for a MODE SENSE command or INVALID FIELD IN PARAMETER LIST for a MODE SELECT command.

Table 161 shows the translation of fields in the Informational Exceptions Control mode page.

Table 161 — Informational Exceptions Control mode page fields

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to zero
PAGE CODE	no	Shall be set to 1Ch
PAGE LENGTH	no	Shall be set to 0Ah
PERF	no	Shall be set to zero
EBF	n/a	Unspecified
EWASC	n/a	Unspecified
DEXCPT	yes	Unspecified
TEST	no	Shall be set to zero
EBACKERR	no	Unspecified
LOGERR	n/a	Unspecified
MRIE	Unspecified [a]	See 10.4.10.2
INTERVAL TIMER	n/a	Unspecified
REPORT COUNT	n/a	Unspecified

[a] The MRIE field should be set to 6h, however if the SATL supports other settings of the MRIE field, then the SATL should permit the MRIE field to be changeable.

10.4.10.2 Method of reporting informational exceptions (MRIE)

The SATL should support 6h. Support for any other value is unspecified.

10.4.11 Power condition mode pages

10.4.11.1 Overview

The Power condition mode pages allow setting and examining of:

a) the ATA APM mode setting using the ATA specific ATA Power Condition mode page (see 12.3.3);
b) the ATA power management timers (see 10.4.11.2); and
c) the ATA extended power condition settings (see 10.4.11.2).

10.4.11.2 Power condition mode page

10.4.11.2.1 Introduction to Power condition mode page

The Power condition mode page translation allows setting and examining the ATA STANDBY timer value and other ATA idle and ATA standby timers, if they are supported (see ACS-5). If the ATA EPC SUPPORTED bit is:

a) set to one, then the Power condition mode page translation is defined in 10.4.11.2.2; or
b) set to zero, then the Power condition mode page translation is defined in 10.4.11.2.3.

10.4.11.2.2 Power condition mode page processing if ATA EPC is supported

10.4.11.2.2.1 Summary of ATA EPC supported processing

If the ATA device supports EPC (i.e., the ATA EPC SUPPORTED bit is set to one), SATL processing for the Power condition mode page is defined in Table 162.

Table 162 — Power condition mode page fields with ATA EPC supported (part 1 of 6)

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to zero
PAGE CODE	no	Shall be set to 1Ah
PAGE LENGTH	no	Shall be set to 26h
PM_BG_ PRECEDENCE	n/a	Unspecified

Table 162 — Power condition mode page fields with ATA EPC supported (part 2 of 6)

Field	Changeable	Description
IDLE_A bit and IDLE_A CONDITION TIMER field	see 10.4.11.2.2.3	While processing a MODE SENSE command, the SATL shall use the contents of the PC field to set the IDLE_A bit and the IDLE_A CONDITION TIMER field to the values from the ATA fields shown in Table 167 for the Idle_a power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log (see 10.4.11.2.2.2). While processing a MODE SELECT command, the SATL shall: A) if the ATA Power Conditions log indicates that the IDLE_A bit and the IDLE_A CONDITION TIMER field are not changeable (see 10.4.11.2.2.3) and the value of the IDLE_A bit is equal to the value of the ATA CURRENT TIMER ENABLED bit in the Idle_a power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log, then the SATL shall take no further action for the IDLE_A bit and the IDLE_A CONDITION TIMER field; or B) not equal to the value of the ATA CURRENT TIMER ENABLED bit in the Idle_a power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log, then the MODE SELECT command shall be terminated as described in 10.4.11.2.4.2; and 3) if the ATA Power Conditions log indicates that the IDLE_A bit and the IDLE_A CONDITION TIMER field are changeable (see 10.4.11.2.2.3), then the SATL shall use the method described in 10.4.11.2.2.4 to modify the contents of the ATA Power Conditions log based on the contents of the IDLE_A bit and the IDLE_A CONDITION TIMER field.

Table 162 — Power condition mode page fields with ATA EPC supported (part 3 of 6)

Field	Changeable	Description
IDLE_B bit and IDLE_B CONDITION TIMER field	see 10.4.11.2.2.3	While processing a MODE SENSE command, the SATL shall use the contents of the PC field to set the IDLE_B bit and the IDLE_B CONDITION TIMER field to the values from the ATA fields shown in table 163 for the Idle_b power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log (see 10.4.11.2.2.2). While processing a MODE SELECT command, the SATL shall: 1) if the ATA Power Conditions log indicates that the IDLE_B bit and the IDLE_B CONDITION TIMER field are not changeable (see 10.4.11.2.2.3) and the value of the IDLE_B bit is: A) equal to the value of the ATA CURRENT TIMER ENABLED bit in the Idle_b power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log, then the SATL shall take no further action for the IDLE_B bit and the IDLE_B CONDITION TIMER field; or B) not equal to the value of the ATA CURRENT TIMER ENABLED bit in the Idle_b power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log, then the MODE SELECT command shall be terminated as described in 10.4.11.2.4.2; and 2) if the ATA Power Conditions log indicates that the IDLE_B bit and the IDLE_B CONDITION TIMER field are changeable (see 10.4.11.2.2.3), then the SATL shall use the method described in 10.4.11.2.2.4 to modify the contents of the ATA Power Conditions log based on the contents of the IDLE_B bit and the IDLE_B CONDITION TIMER field.

Table 162 — Power condition mode page fields with ATA EPC supported (part 4 of 6)

Field	Changeable	Description
IDLE_C bit and IDLE_C CONDITION TIMER field	see 10.4.11.2.2.3	While processing a MODE SENSE command, the SATL shall use the contents of the PC field to set the IDLE_C bit and the IDLE_C CONDITION TIMER field to the values from the ATA fields shown in table 163 for the Idle_c power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log (see 10.4.11.2.2.2). While processing a MODE SELECT command, the SATL shall: 1) if the ATA Power Conditions log indicates that the IDLE_C bit and the IDLE_C CONDITION TIMER field are not changeable (see 10.4.11.2.2.3) and the value of the IDLE_C bit is: A) equal to the value of the ATA CURRENT TIMER ENABLED bit in the Idle_c power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log, then the SATL shall take no further action for the IDLE_C bit and the IDLE_C CONDITION TIMER field; or B) not equal to the value of the ATA CURRENT TIMER ENABLED bit in the Idle_c power conditions descriptor in the Idle power conditions page of the ATA Power Conditions log, then the MODE SELECT command shall be terminated as described in 10.4.11.2.4.2; and 2) if the ATA Power Conditions log indicates that the IDLE_C bit and the IDLE_C CONDITION TIMER field are changeable (see 10.4.11.2.2.3), then the SATL shall use the method described in 10.4.11.2.2.4 to modify the contents of the ATA Power Conditions log based on the contents of the IDLE_C bit and the IDLE_C CONDITION TIMER field.

Table 162 — Power condition mode page fields with ATA EPC supported (part 5 of 6)

Field	Changeable	Description
STANDBY_Y bit and STANDBY_Y CONDITION TIMER field	see 10.4.11.2.2.3	While processing a MODE SENSE command, the SATL shall use the contents of the PC field to set the STANDBY_Y bit and the STANDBY_Y CONDITION TIMER field to the values from the ATA fields shown in table 163 for the Standby_y power conditions descriptor in the Standby power conditions page of the ATA Power Conditions log (see 10.4.11.2.2.2). While processing a MODE SELECT command, the SATL shall: 1) if the ATA Power Conditions log indicates that the STANDBY_Y bit and the STANDBY_Y CONDITION TIMER field are not changeable (see 10.4.11.2.2.3) and the value of the STANDBY_Y bit is: A) equal to the value of the ATA CURRENT TIMER ENABLED bit in the Standby_y power conditions descriptor in the Standby power conditions page of the ATA Power Conditions log, then the SATL shall take no further action for the STANDBY_Y bit and the STANDBY_Y CONDITION TIMER field; or B) not equal to the value of the ATA CURRENT TIMER ENABLED bit in the Standby_y power conditions descriptor in the Standby power conditions page of the ATA Power Conditions log, then the MODE SELECT command shall be terminated as described in 10.4.11.2.4.2; and 2) if the ATA Power Conditions log indicates that the STANDBY_Y bit and the STANDBY_Y CONDITION TIMER field are changeable (see 10.4.11.2.2.3), then the SATL shall use the method described in 10.4.11.2.2.4 to modify the contents of the ATA Power Conditions log based on the contents of the STANDBY_Y bit and the STANDBY_Y CONDITION TIMER field.

Table 162 — Power condition mode page fields with ATA EPC supported (part 6 of 6)

Field	Changeable	Description
STANDBY_Z bit and STANDBY_Z CONDITION TIMER field	see 10.4.11.2.2.3	While processing a MODE SENSE command, the SATL shall use the contents of the PC field to set the STANDBY_Z bit and the STANDBY_Z CONDITION TIMER field to the values from the ATA fields shown in table 163 for the Standby_z power conditions descriptor in the Standby power conditions page of the ATA Power Conditions log (see 10.4.11.2.2.2). While processing a MODE SELECT command, the SATL shall: A) if the ATA Power Conditions log indicates that the STANDBY_Z bit and the STANDBY_Z CONDITION TIMER field are not changeable (see 10.4.11.2.2.3) and the value of the STANDBY_Z bit is equal to the value of the ATA CURRENT TIMER ENABLED bit in the Standby_z power conditions descriptor in the Standby power conditions page of the ATA Power Conditions log, then the SATL shall take no further action for the STANDBY_Y bit and the STANDBY_Y CONDITION TIMER field; or B) not equal to the value of the ATA CURRENT TIMER ENABLED bit in the Standby_z power conditions descriptor in the Standby power conditions page of the ATA Power Conditions log, then the MODE SELECT command shall be terminated as described in 10.4.11.2.4.2; and 3) if the ATA Power Conditions log indicates that the STANDBY_Z bit and the STANDBY_Z CONDITION TIMER field are changeable (see 10.4.11.2.2.3), then the SATL shall use the method described in 10.4.11.2.2.4 to modify the contents of the ATA Power Conditions log based on the contents of the STANDBY_Z bit and the STANDBY_Z CONDITION TIMER field.
CCF IDLE	n/a	Unspecified
CCF STANDBY	n/a	Unspecified
CCF STOPPED	n/a	Unspecified

10.4.11.2.2.2 Field relationships between the ATA Power Conditions log and SCSI MODE SENSE command Power condition mode page

For the ATA EPC feature set, the ATA Power Conditions log contains separate pages for Idle power conditions and Standby power conditions and each page contains power conditions descriptors. The SCSI Power condition mode page contains fields for each power condition and changeable bits that indicate which fields the application client is allowed to modify.

The relationship between equivalent ATA Power Conditions log fields and SCSI Power Condition mode page fields is shown in table 163.

Table 163 — Power condition page field relationships (part 1 of 2)

ATA Power Conditions log			SCSI Power condition mode page field
Log page	**Power conditions descriptor**	**Field**	
MODE SENSE command PC field set to 00b (i.e., current values)			
Idle	Idle_a	CURRENT TIMER ENABLED bit	IDLE_A bit
		CURRENT TIMER SETTING field	IDLE_A CONDITION TIMER field
	Idle_b	CURRENT TIMER ENABLED bit	IDLE_B bit
		CURRENT TIMER SETTING field	IDLE_B CONDITION TIMER field
	Idle_c	CURRENT TIMER ENABLED bit	IDLE_C bit
		CURRENT TIMER SETTING field	IDLE_C CONDITION TIMER field
Standby	Standby_y	CURRENT TIMER ENABLED bit	STANDBY_Y bit
		CURRENT TIMER SETTING field	STANDBY_Y CONDITION TIMER field
	Standby_z	CURRENT TIMER ENABLED bit	STANDBY_Z bit
		CURRENT TIMER SETTING field	STANDBY_Z CONDITION TIMER field
MODE SENSE command PC field set to 01b (i.e., changeable values)			
Idle	Idle_a	POWER CONDITION CHANGEABLE bit	IDLE_A bit and IDLE_A CONDITION TIMER field [a]
	Idle_b	POWER CONDITION CHANGEABLE bit	IDLE_B bit and IDLE_B CONDITION TIMER field [a]
	Idle_c	POWER CONDITION CHANGEABLE bit	IDLE_C bit and IDLE_C CONDITION TIMER field [a]
Standby	Standby_y	POWER CONDITION CHANGEABLE bit	STANDBY_Y bit and STANDBY_Y CONDITION TIMER field [a]
	Standby_z	POWER CONDITION CHANGEABLE bit	STANDBY_Z bit and STANDBY_Z CONDITION TIMER field [a]

[a] The value of the POWER CONDITION CHANGEABLE bit is replicated in all bits in this field.

Table 163 — Power condition page field relationships (part 2 of 2)

ATA Power Conditions log			SCSI Power condition mode page field
Log page	**Power conditions descriptor**	**Field**	
MODE SENSE command PC field set to 10b (i.e., default values)			
Idle	Idle_a	DEFAULT TIMER ENABLED bit	IDLE_A bit
		DEFAULT TIMER SETTING field	IDLE_A CONDITION TIMER field
	Idle_b	DEFAULT TIMER ENABLED bit	IDLE_B bit
		DEFAULT TIMER SETTING field	IDLE_B CONDITION TIMER field
	Idle_c	DEFAULT TIMER ENABLED bit	IDLE_C bit
		DEFAULT TIMER SETTING field	IDLE_C CONDITION TIMER field
Standby	Standby_y	DEFAULT TIMER ENABLED bit	STANDBY_Y bit
		DEFAULT TIMER SETTING field	STANDBY_Y CONDITION TIMER field
	Standby_z	DEFAULT TIMER ENABLED bit	STANDBY_Z bit
		DEFAULT TIMER SETTING field	STANDBY_Z CONDITION TIMER field
MODE SENSE command PC field set to 11b (i.e., saved values)			
Idle	Idle_a	SAVED TIMER ENABLED bit	IDLE_A bit
		SAVED TIMER SETTING field	IDLE_A CONDITION TIMER field
	Idle_b	SAVED TIMER ENABLED bit	IDLE_B bit
		SAVED TIMER SETTING field	IDLE_B CONDITION TIMER field
	Idle_c	SAVED TIMER ENABLED bit	IDLE_C bit
		SAVED TIMER SETTING field	IDLE_C CONDITION TIMER field
Standby	Standby_y	SAVED TIMER ENABLED bit	STANDBY_Y bit
		SAVED TIMER SETTING field	STANDBY_Y CONDITION TIMER field
	Standby_z	SAVED TIMER ENABLED bit	STANDBY_Z bit
		SAVED TIMER SETTING field	STANDBY_Z CONDITION TIMER field

[a] The value of the POWER CONDITION CHANGEABLE bit is replicated in all bits in this field.

10.4.11.2.2.3 Changeable field processing

If the ATA POWER CONDITION CHANGEABLE bit associated with a Power condition mode page field (see table 164) is:

a) set to zero, then the Power condition mode page fields are not changeable; or

b) set to one, then the Power condition mode page fields are changeable.

The relationships between the ability to change SCSI Power condition mode page fields and the associated ATA POWER CONDITION CHANGEABLE bits is shown in table 164.

Table 164 — Changeable Power condition mode page associations with the ATA POWER CONDITION CHANGEABLE bits

SCSI Power condition mode page fields with which the ATA POWER CONDITION CHANGEABLE bit is associated	Associated ATA power conditions descriptor and log page in the ATA Power Conditions log	
	Power conditions descriptor	Log page
IDLE_A bit and IDLE_A CONDITION TIMER field	Idle_a	Idle
IDLE_B bit and IDLE_B CONDITION TIMER field	Idle_b	
IDLE_C bit and IDLE_C CONDITION TIMER field	Idle_c	
STANDBY_Y bit and STANDBY_Y CONDITION TIMER field	Standby_y	Standby
STANDBY_Z bit and STANDBY_Z CONDITION TIMER field	Standby_z	

10.4.11.2.2.4 MODE SELECT processing to modify the ATA Power Conditions log

To modify the contents of the ATA Power Conditions log for a specific pair of fields from the Power condition mode page, the SATL shall send an ATA SET FEATURES – Set Power Condition Timer EPC subcommand with:

a) the ATA POWER CONDITION ID field set as shown in table 165;
b) the ATA SAVE bit set to the value of the SP bit in MODE SELECT command CDB;
c) the ATA ENABLE bit set based on the value in the field shown in table 165; and
d) the ATA TIMER UNITS bit and ATA TIMER field set to the translated values for the field shown in table 166 as defined in 10.4.11.2.2.5.

If the ATA SET FEATURES command terminates with an error, then the SATL shall terminate the MODE SELECT command as described in 10.4.11.2.4.3.

The SATL translations based on bits in the Power condition mode page are show in table 165.

Table 165 — Power condition mode page bit translations to the ATA SET FEATURES command

SCSI Power condition mode page bits that the SATL may translate for a MODE SELECT command	Values to be set in the ATA SET FEATURES command bits and fields	
	POWER CONDITION ID field	ENABLE bit
IDLE_A bit	81h	contents of the IDLE_A bit
IDLE_B bit	82h	contents of the IDLE_B bit
IDLE_C bit	83h	contents of the IDLE_C bit
STANDBY_Y bit	01h	contents of the STANDBY_Y bit
STANDBY_Z bit	00h	contents of the STANDBY_Z bit

The SATL translations based on fields in the Power condition mode page are shown in table 166.

Table 166 — Power condition mode page field translations to the ATA SET FEATURES command

SCSI Power condition mode page fields that the SATL may translate for a MODE SELECT command	ATA SET FEATURES command bits and fields	
	POWER CONDITION ID field	TIMER UNITS bit and TIMER field [a]
IDLE_A CONDITION TIMER field	81h	IDLE_A CONDITION TIMER field
IDLE_B CONDITION TIMER field	82h	IDLE_B CONDITION TIMER field
IDLE_C CONDITION TIMER field	83h	IDLE_C CONDITION TIMER field
STANDBY_Y CONDITION TIMER field	01h	STANDBY_Y CONDITION TIMER field
STANDBY_Z CONDITION TIMER field	00h	STANDBY_Z CONDITION TIMER field

[a] The SATL shall set TIMER UNIT bit and TIMER field to the translated values described in 10.4.11.2.2.5.

10.4.11.2.2.5 MODE SELECT command condition timer field translations for EPC

The SATL shall translate 32-bit condition timer fields (e.g., the IDLE_A CONDITION TIMER field) to 16-bit TIMER field in an ATA SET FEATURES – Set Power Condition Timer command as shown in table 167.

Table 167 — MODE SELECT condition timer field translations for EPC

Power condition mode page condition timer field	ATA TIMER UNITS field	ATA TIMER field [a]
0	0	1
1 to 65 535 (i.e., 0.1 s to 6 553.5 s)	0	z
65 536 to 39 321 000 (i.e., 109.2 min to 1092 h and 15 min)	1	INT(z/600)
Greater than 39 321 000	1	FFFFh (i.e., 1092 h and 15 min)

Key:
z = Contents of the Power condition mode page condition timer field

[a] The SATL shall read the minimum timer setting and maximum timer setting that are reported for each timer in the ATA Power Conditions log and, if required, round the translated value to a value that is greater than or equal to the minimum timer setting and less than or equal to the maximum timer setting. If any parameter is rounded, a parameter rounding error is reported for the MODE SELECT command as specified in SPC-5.
If the decimal remainder is non-zero (i.e., the parameter is rounded), a parameter rounding error is reported for the MODE SELECT command as specified in SPC-5.

10.4.11.2.3 Power condition mode page processing if ATA EPC is not supported

SATL processing for the Power condition mode page if ATA EPC is not supported (see 10.4.11.2.1) is defined in table 168.

Table 168 — Power condition mode page fields without ATA EPC support (part 1 of 3)

Field	Changeable	Description
PS	n/a	Unspecified
SPF	no	Shall be set to zero
PAGE CODE	no	Shall be set to 1Ah
PAGE LENGTH	no	Shall be set to 26h
PM_BG_ PRECEDENCE	n/a	Unspecified
STANDBY_Y	no	While processing a MODE SENSE command, the STANDBY_Y bit shall be returned as zero. While processing a MODE SELECT command, if the STANDBY_Y bit is set to one, then the SATL shall terminate the command as described in 10.4.11.2.4.2, otherwise the bit is ignored.

Table 168 — Power condition mode page fields without ATA EPC support (part 2 of 3)

Field	Changeable	Description
IDLE_C	no	While processing a MODE SENSE command, the IDLE_C bit shall be returned as zero. While processing a MODE SELECT command, if the IDLE_C bit is set to one, then the SATL shall terminate the command as described in 10.4.11.2.4.2, otherwise the bit is ignored.
IDLE_B	no	While processing a MODE SENSE command, the IDLE_B bit shall be returned as zero. While processing a MODE SELECT command, if the IDLE_B bit is set to one, then the SATL shall terminate the command as described in 10.4.11.2.4.2, otherwise the bit is ignored.
IDLE_A	no	While processing a MODE SENSE command, the IDLE_A bit shall be returned as zero. While processing a MODE SELECT command, if the IDLE_A bit is set to one, then the SATL shall terminate the command as described in 10.4.11.2.4.2, otherwise the bit is ignored.
STANDBY_Z	yes	While processing a MODE SENSE command, the STANDBY_Z bit shall be set to the value in the STANDBY TIMER bit in the ATA IDENTIFY DEVICE data log. While processing a MODE SELECT command, if the STANDBY_Z bit is set to one and the STANDBY TIMER bit in the ATA IDENTIFY DEVICE data log is set to: 1) zero, then the SATL shall terminate the command as described in 10.4.11.2.4.2; and 2) one, then: A) the SATL shall send the ATA STANDBY command to the ATA device; and B) the value in the STANDBY_Z CONDITION TIMER field shall be translated as defined in Table 170 and used to set the Standby timer period value (i.e., the ATA COUNT field) in the command.
IDLE_A CONDITION TIMER	no	While processing a MODE SENSE command, this field shall be returned as zero. While processing a MODE SELECT command, this field shall be ignored.

Table 168 — Power condition mode page fields without ATA EPC support (part 3 of 3)

Field	Changeable	Description
STANDBY_Z CONDITION TIMER	yes	While processing a MODE SENSE command if the the STANDBY TIMER bit in the ATA IDENTIFY DEVICE data log is set to: a) zero, then the STANDBY_Z CONDITION TIMER field shall be set to zero; or b) one, then the ATA standby timer value shall be translated as defined in Table 169 and returned in the STANDBY_Z CONDITION TIMER field. While processing a MODE SELECT command, if the STANDBY_Z bit is set to one, then the value in the STANDBY_Z CONDITION TIMER field shall be translated as defined in Table 170 and used to set the Standby timer period value (i.e., the ATA COUNT field). The SATL may retain this value for return while processing a subsequent MODE SENSE or for translating the POWER CONDITION field during processing of a START STOP UNIT command (see 9.21.3).
IDLE_B CONDITION TIMER	yes	While processing a MODE SENSE command, this field shall be returned as zero. While processing a MODE SELECT command, this field shall be ignored.
IDLE_C CONDITION TIMER	yes	While processing a MODE SENSE command, this field shall be returned as zero. While processing a MODE SELECT command, this field shall be ignored.
STANDBY_Y CONDITION TIMER	yes	While processing a MODE SENSE command, this field shall be returned as zero. While processing a MODE SELECT command, this field shall be ignored.
CCF IDLE	n/a	Unspecified
CCF STANDBY	n/a	Unspecified
CCF STOPPED	n/a	Unspecified

Values in the STANDBY_Z TIMER field for the MODE SENSE command shall be translated as described in table 169.

Table 169 — MODE SENSE STANDBY_Z TIMER field translations

ATA COUNT field [a]	Time	STANDBY_Z CONDITION TIMER field
01h to F0h	5 s to 1 200 s	ATA COUNT field x 50
FCh	21 min	12 600
FFh	21 min, 15 s	12 750
F1h to FBh	30 min to 330 min	(ATA COUNT field - 240) x 18 000
FDh	8 h to 12 h	432 000
Not retained by the SATL	n/a	FFFF_FFFFh
[a] All other values are unspecified.		

Values in the STANDBY_Z TIMER field for the MODE SELECT command shall be translated as defined in table 170.

Table 170 — MODE SELECT STANDBY_Z TIMER field translations

STANDBY_Z CONDITION TIMER field	Time	ATA COUNT field
0	0 s	The SATL shall send an ATA STANDBY IMMEDIATE command to the ATA device
1 to 12 000	0.001 s to 12 s	INT((z - 1) / 50) + 1
12 001 to 12 600	12.001 s to 12.6 s	FCh
12 601 to 12 750	12.601 s to 12.75 s	FFh
12 751 to 17 999	12.751 s to 17.999 s	F1h
18 000 to 198 000	18 s to 55 h	INT(z / 18 000) + 240
All other values		FDh
Key: z = Contents of the Power condition mode page STANDBY CONDITION TIMER field.		

10.4.11.2.4 Command completion for the Power condition mode page

10.4.11.2.4.1 Summary command completion for the Power condition mode page

If the MODE SENSE command for the Power condition mode page has not been terminated during processing as described in 10.4.11.2.2, 10.4.11.2.3, or 10.4.11.2.4.3, then the command shall be completed with GOOD status.

The priority of reporting completion status for MODE SELECT commands for the Power condition mode page shall be:

1) CHECK CONDITION status caused by command translation error (e.g., a parameter value that is not correctable using parameter rounding) (see 10.4.11.2.4.2);
2) CHECK CONDITION status caused by an error returned by the ATA device (see 10.4.11.2.4.3); or
3) GOOD status.

10.4.11.2.4.2 Command translation errors

If the SATL encounters an error during the translation of a MODE SENSE command or a MODE SELECT command for the Power condition mode page, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to:

a) INVALID FIELD IN CDB, if the field that caused the error is in the CDB; or
b) INVALID FIELD IN PARAMETER LIST, if the field that caused the error is in the mode parameter list (see SPC-5).

10.4.11.2.4.3 Errors returned by the ATA device

If the ATA device terminates ATA command with a error during the translation of a MODE SENSE command or a MODE SELECT command for the Power condition mode page, then SATL shall terminate the MODE SENSE command or a MODE SELECT command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to COMMAND SEQUENCE ERROR.

10.4.12 Command Duration Limit T2A mode page

10.4.12.1 Overview

The Command Duration Limit T2A mode page specifies command duration limit values that may be written to or read from the ATA Command Duration Limits log.

If the SATL does not support the ATA Feature Control mode page (see 12.3.4), the Command Duration Limit T2A mode page, or the ATA Command Duration Limits feature set is not supported by the ATA device (i.e., the COMMAND DURATION LIMITS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then a MODE SELECT command or a MODE SENSE command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB (see SPC-5).

Table 171 defines the translation of fields in the Command Duration Limit T2A mode page.

Table 171 — Command Duration Limit T2A mode page fields

Field	Changeable	Description [a] [b]
PS	n/a	Unspecified
SPF	no	Shall be set to one
PAGE CODE	no	Shall be set to 0Ah
SUBPAGE CODE	no	Shall be set to 07h
PAGE LENGTH	no	Shall be set to 00E4h
PERF VERSUS COMMAND DURATION GUIDELINES	yes	ATA PERFORMANCE VERSUS COMMAND DURATION GUIDELINES field
command duration descriptor list		
T2 command duration limit descriptor [first]	See table 172	ATA Command Duration Limits Descriptor r1
T2 command duration limit descriptor [second]	See table 172	ATA Command Duration Limits Descriptor r2
T2 command duration limit descriptor [third]	See table 172	ATA Command Duration Limits Descriptor r3
T2 command duration limit descriptor [fourth]	See table 172	ATA Command Duration Limits Descriptor r4
T2 command duration limit descriptor [fifth]	See table 172	ATA Command Duration Limits Descriptor r5
T2 command duration limit descriptor [sixth]	See table 172	ATA Command Duration Limits Descriptor r6
T2 command duration limit descriptor [seventh]	See table 172	ATA Command Duration Limits Descriptor r7

[a] For the MODE SELECT command (see 10.4.12.2).
[b] For the MODE SENSE command (see 10.4.12.3).

Table 172 — T2 Command Duration Limit descriptor fields

Field	Changeable	Description
T2CDLUNITS	no	Shall be set to Ah (i.e., 10 milliseconds)
MAX INACTIVE TIME	yes	See 10.4.12.2 and 10.4.12.3
MAX ACTIVE TIME	yes	See 10.4.12.2 and 10.4.12.3
MAX INACTIVE TIME POLICY	yes	ATA INACTIVE TIME POLICY field
MAX ACTIVE TIME POLICY	yes	ATA ACTIVE TIME LIMIT POLICY field
COMMAND DURATION GUIDELINE	yes	ATA COMMAND DURATION GUIDELINE field
COMMAND DURATION GUIDELINE POLICY	yes	ATA COMMAND DURATION GUIDELINE POLICY field

10.4.12.2 MODE SELECT command translation

For a MODE SELECT command that includes the Command Duration Limit T2A mode page, the SATL uses a read modify write procedure to update the ATA Command Duration Limits log. The SATL shall:

1) send an ATA read log command to retrieve the ATA Command Duration Limits log;
2) update fields that have yes in the changeable column (see table 171 and table 172) by populating each Command Duration Limit T2A field into the corresponding ATA log field specified in the description column except:
   A) the ATA INACTIVE TIME LIMIT field is set to 10 000 times the value of the MAX INACTIVE TIME field; and
   B) the ATA ACTIVE TIME LIMIT field is set to 10 000 times the value of the MAX ACTIVE TIME field;
3) set the ATA COMMAND DURATION LIMITS STATISTIC A SELECTOR field to 00h and set the ATA COMMAND DURATION LIMITS STATISTIC B SELECTOR field to 00h;
4) not change the values in the ATA Command Duration Limits Descriptor w1 through ATA Command Duration Limits Descriptor w7 parameters; and
5) send an ATA write log command to write the new values to the ATA Command Duration Limits log.

10.4.12.3 MODE SENSE command translation

For a MODE SENSE command, the SATL uses an ATA read log command to read from the ATA Command Duration Limits log. The SATL shall populate the parameters from that log as follows:

a) fields that have yes in the changeable column (see table 171 and table 172) are populated from the corresponding ATA log field indicated in the description column except:
   A) the MAX INACTIVE TIME field is set to the ATA INACTIVE TIME LIMIT field divided by 10 000; and
   B) the MAX ACTIVE TIME field is set to the ATA ACTIVE TIME LIMIT field divided by 10 000;

   and

b) fields that have no in the changeable column are populated as specified in the description column.

10.4.13 Command Duration Limit T2B mode page

10.4.13.1 Overview

The Command Duration Limit T2B mode page specifies command duration limit values that may be written to or read from the ATA Command Duration Limits log.

If the SATL does not support the ATA Feature Control mode page (see 12.3.4), the Command Duration Limit T2B mode page, or the ATA Command Duration Limits feature set is not supported by the ATA device (i.e., the COMMAND DURATION LIMITS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then a MODE SELECT command or a MODE SENSE command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB (see SPC-5).

Table 173 show the translation of fields in the Command Duration Limit T2B mode page.

Table 173 — Command Duration Limit T2B mode page fields

Field	Changeable	Description [a] [b]
PS	n/a	Unspecified
SPF	no	Shall be set to one
PAGE CODE	no	Shall be set to 0Ah
SUBPAGE CODE	no	Shall be set to 08h
PAGE LENGTH	no	Shall be set to 00E4h
command duration descriptor list		
T2 command duration limit descriptor [first]	See table 172	ATA Command Duration Limits Descriptor w1
T2 command duration limit descriptor [second]	See table 172	ATA Command Duration Limits Descriptor w2
T2 command duration limit descriptor [third]	See table 172	ATA Command Duration Limits Descriptor w3
T2 command duration limit descriptor [fourth]	See table 172	ATA Command Duration Limits Descriptor w4
T2 command duration limit descriptor [fifth]	See table 172	ATA Command Duration Limits Descriptor w5
T2 command duration limit descriptor [sixth]	See table 172	ATA Command Duration Limits Descriptor w6
T2 command duration limit descriptor [seventh]	See table 172	ATA Command Duration Limits Descriptor w7

[a] For the MODE SELECT command (see 10.4.13.2).
[b] For the MODE SENSE command (see 10.4.13.3).

10.4.13.2 MODE SELECT command translation

For a MODE SELECT command that includes the Command Duration Limit T2B mode page, the SATL uses a read modify write procedure to update the ATA Command Duration Limits log. The SATL shall:

1) send an ATA read log command to retrieve the ATA Command Duration Limits log;
2) update fields that have yes in the changeable column (see table 171 and table 172) by populating each Command Duration Limit T2B field into the corresponding ATA log field specified in the description column except:

A) the ATA INACTIVE TIME LIMIT field is set to 10 000 times the value of the MAX INACTIVE TIME field; and
B) the ATA ACTIVE TIME LIMIT field is set to 10 000 times the value of the MAX ACTIVE TIME field;

3) set the ATA COMMAND DURATION LIMITS STATISTIC A SELECTOR field to 00h and set the ATA COMMAND DURATION LIMITS STATISTIC B SELECTOR field to 00h;
4) not change the values in the ATA Command Duration Limits Descriptor r1 through ATA Command Duration Limits Descriptor r7 parameters; and
5) send an ATA write log command to write the new values to the ATA Command Duration Limits log.

10.4.13.3 MODE SENSE command translation

For a MODE SENSE command, the SATL uses an ATA read log command to read from the ATA Command Duration Limits log. The SATL shall populate the parameters from that log as follows:

a) fields that have yes in the changeable column (see table 173 and table 172) are populated from the corresponding ATA log field indicated in the description column except:
   A) the MAX INACTIVE TIME field is set to the ATA INACTIVE TIME LIMIT field divided by 10 000; and
   B) the MAX ACTIVE TIME field is set to the ATA ACTIVE TIME LIMIT field divided by 10 000;

   and

b) fields that have no in the changeable column are populated as specified in the description column.

10.5 Vital product data parameters

10.5.1 Overview

The SATL translations for VPD pages are listed in table 174.

Table 174 — Summary of SCSI / ATA VPD page mapping

SCSI VPD page	Reference
Supported VPD Pages VPD page (i.e., 00h)	10.5.2
Unit Serial Number VPD page (i.e., 80h)	10.5.3
Device Identification VPD page (i.e., 83h)	10.5.4
Extended INQUIRY Data VPD page (i.e., 86h)	10.5.5
Mode Page Policy VPD page (i.e., 87h)	10.5.6
ATA Information VPD page (i.e., 89h)	12.4.2
Power Condition VPD page (i.e., 8Ah)	10.5.7
Block Limits VPD page (i.e., B0h)	10.5.9
Block Device Characteristics VPD page (i.e., B1h)	10.5.8
Logical Block Provisioning VPD page (i.e., B2h)	10.5.10
Zoned Block Device Characteristics VPD page (i.e., B6h)	10.5.11
Format Presets VPD page (i.e., B8h)	10.5.12
Concurrent Positioning Ranges VPD page (i.e., B9h)	10.5.13
All others	See SPC-5 and SBC-4 Unspecified

10.5.2 Supported VPD Pages VPD page

Table 175 shows the translation of the fields in the Supported VPD Pages VPD page.

Table 175 — Supported VPD Pages VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to 00h
PAGE LENGTH	Shall be set to indicate the length of the supported VPD page list returned in number of bytes.
Supported VPD page list	Unspecified

10.5.3 Unit Serial Number VPD page

Table 176 shows the the translation of the fields in the Unit Serial Number VPD page.

Table 176 — Unit Serial Number VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to 80h
PAGE LENGTH	Shall be set to 0014h
PRODUCT SERIAL NUMBER	The PRODUCT SERIAL NUMBER field is set to a representation of the SERIAL NUMBER field in the ATA IDENTIFY DEVICE data log. Each pair of bytes in the ATA SERIAL NUMBER field shall be swapped to create a valid ASCII string format in the PRODUCT SERIAL NUMBER field as described in table 177.

Table 177 shows the positional swapping of the SERIAL NUMBER field in the ATA IDENTIFY DEVICE data log to the PRODUCT SERIAL NUMBER field. This swapping is performed in accordance with the ATA string conventions (see ACS-5).

Table 177 — PRODUCT SERIAL NUMBER field

Byte	Contents
0	ATA SERIAL NUMBER field bits 15:8 (i.e., byte 1)
1	ATA SERIAL NUMBER field bits 7:0 (i.e., byte 0)
2	ATA SERIAL NUMBER field bits 31:24 (i.e., byte 3)
3	ATA SERIAL NUMBER field bits 23:16 (i.e., byte 2)
...	...
18	ATA SERIAL NUMBER field bits 159:152 (i.e., byte 19)
19	ATA SERIAL NUMBER field bits 151:144 (i.e., byte 18)

NOTE 7 - Although SPC-5 defines the PRODUCT SERIAL NUMBER field as right-aligned, ACS-5 does not require its SERIAL NUMBER field to be right-aligned. Therefore, right-alignment of the PRODUCT SERIAL NUMBER field for the translation is not assured.

10.5.4 Device Identification VPD page

10.5.4.1 Overview

Table 178 shows the translation of the fields in the Device Identification VPD page..

Table 178 — Device Identification VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to 83h
PAGE LENGTH	Shall be set to the length of the remaining bytes of the VPD page
Designation descriptor	One designation descriptor for a logical unit (i.e., a logical unit name) shall be included (see 10.5.4.2). In some environments, one or more additional designation descriptors may be included (see 10.5.4.3).

10.5.4.2 Logical unit name

Table 179 defines the logical unit name derived from the ATA device world wide name.

Table 179 — Logical unit name derived from the world wide name

Field	Description
PROTOCOL IDENTIFIER	Shall be set to zero
CODE SET	Shall be set to 1h
PIV	Shall be set to zero
ASSOCIATION	Shall be set to zero
DESIGNATOR TYPE	Shall be set to 3h
DESIGNATOR LENGTH	Shall be set to 08h
NAA	NAA field in the ATA IDENTIFY DEVICE data log
AOI	IEEE AOI field in the ATA IDENTIFY DEVICE data log
VENDOR SPECIFIC IDENTIFIER	UNIQUE ID field in the ATA IDENTIFY DEVICE data log

10.5.4.3 Examples of additional designation descriptors

10.5.4.3.1 Designation descriptors included by a SATL in an ATA host

Figure 12 shows the designation descriptor returned by a SATL in an ATA host (i.e., where the ATA device is being accessed with an ATA host port) containing a logical unit name based on ATA IDENTIFY DEVICE data log information (see table 179 in 10.5.4.2).

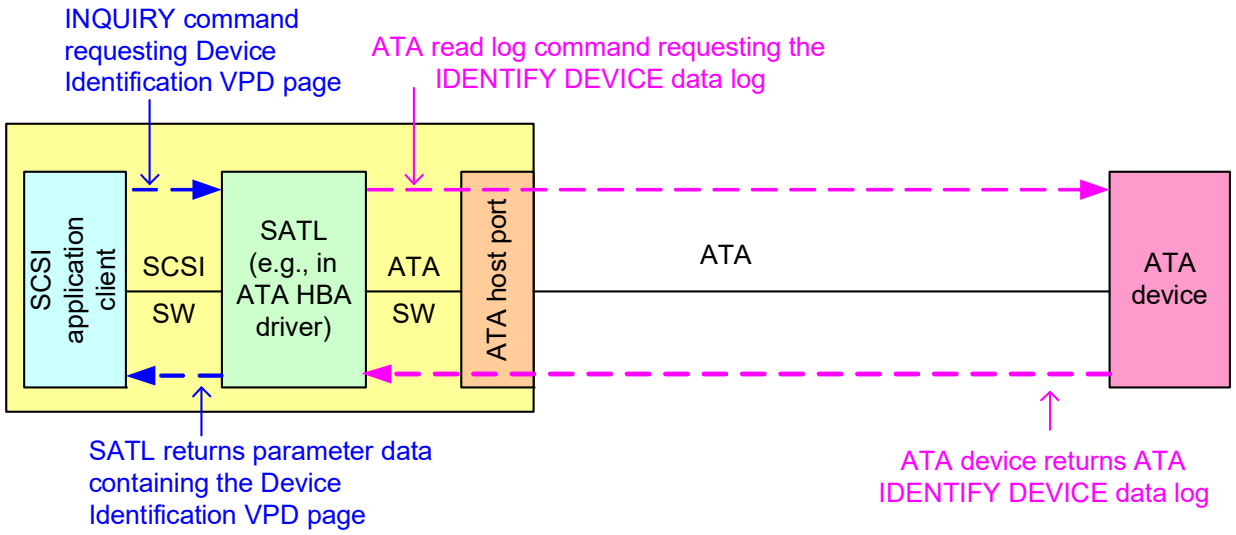

Figure 12 — Designation descriptors included by a SATL in an ATA host

10.5.4.3.2 Designation descriptors included by a SATL in a SAS initiator device

Figure 13 shows the designation descriptors returned by a SATL in a SAS initiator device (i.e., where the ATA device is being accessed by a SAS STP initiator port through an STP SATA bridge) that contain:

a) a logical unit name based on ATA IDENTIFY DEVICE data log information (see table 179 in 10.5.4.2);
b) a target port identifier based on the SAS STP target port SAS address (see table 180); and
c) a relative target port identifier set to 0001h (see SPC-5).

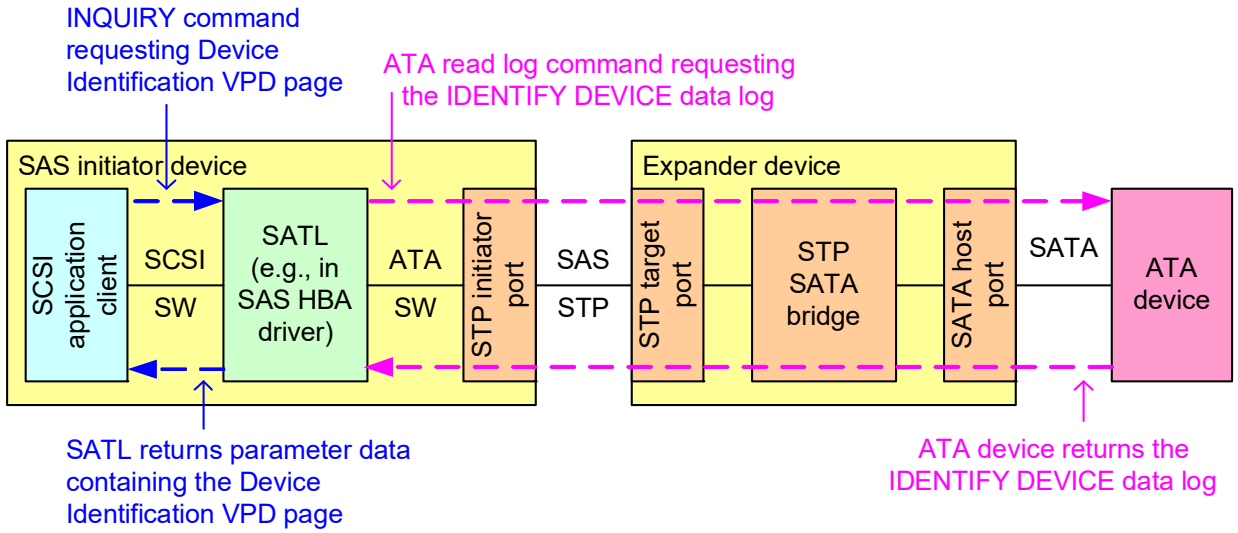

Figure 13 — Designation descriptors included by a SATL in a SAS initiator device

The SATL includes a target port identifier as defined in table 180.

Table 180 — Target port identifier for SAS

Byte\Bit	7	6	5	4	3	2	1	0
0	PROTOCOL IDENTIFIER (6h)				CODE SET (1h)			
1	PIV (1b)	Reserved	ASSOCIATION (01b)		DESIGNATOR TYPE (3h)			
2	Reserved							
3	DESIGNATOR LENGTH (08h)							
4	(MSB)							
...	SAS ADDRESS							
11								(LSB)

The PROTOCOL IDENTIFIER field is set to 6h (i.e., SAS).

The CODE SET field is set to 1h (i.e., binary).

The PIV bit is set to one.

The ASSOCIATION field is set to 01b (i.e., target port).

The DESIGNATOR TYPE field is set to 3h (i.e., NAA).

The DESIGNATOR LENGTH field is set to 08h.

The SAS ADDRESS field is set to the SAS address of the STP target port providing the STP SATA bridge functionality (i.e., the SAS address of the SATA device).

10.5.4.3.3 Designation descriptors included by a SATL in a SCSI to ATA protocol bridge

Figure 14 shows the designation descriptors returned by a SATL in a SCSI to ATA protocol bridge, where the ATA device is being accessed by an ATA host port and the SATL is being accessed with a SCSI target port using a SCSI transport protocol (e.g, FCP-3 or iSCSI) that contains:

a) a logical unit name based on ATA IDENTIFY DEVICE data log information (see table 179 in 10.5.4.2);
b) any target port identifiers specified by the SCSI transport protocol standard; and
c) any other designation descriptors supported by the protocol bridge (e.g., a target device name).

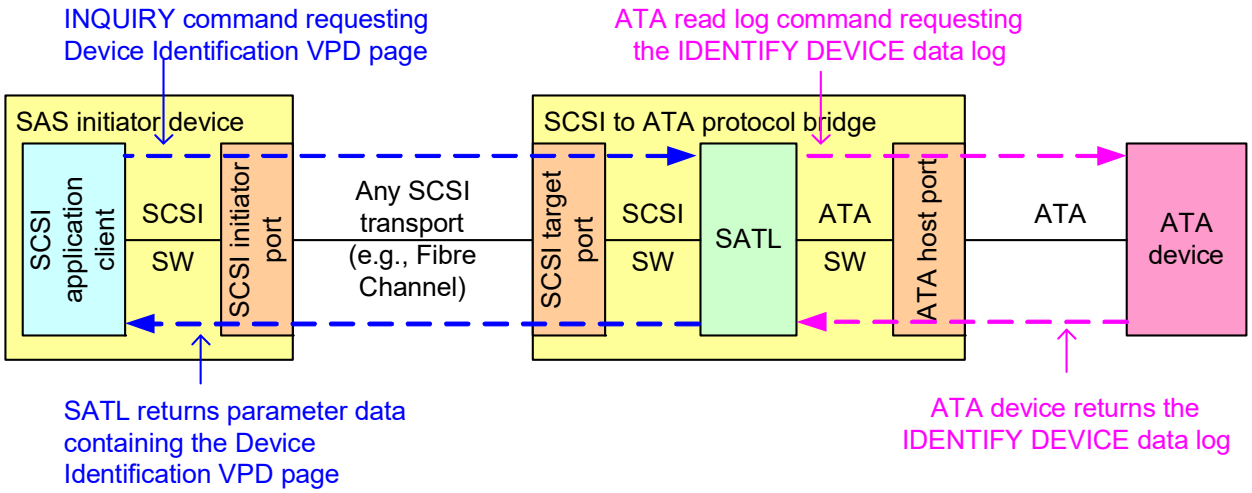

Figure 14 — Designation descriptors included by a SATL in a SCSI to ATA protocol bridge

10.5.5 Extended INQUIRY Data VPD page

Table 181 shows the translation of the fields in the Extended INQUIRY Data VPD page. If the SATL supports the READ BUFFER (10) command (see 8.8) with the MODE field set to 1Ch (i.e., Error history mode), then the SATL shall support the Extended INQUIRY Data VPD page.

Table 181 — Extended INQUIRY Data VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to 86h
PAGE LENGTH	Shall be set to 003Ch
HSSRELEF	Shall be set to one
DMS_VALID	If the SATL supports translation of the download microcode support byte (see SPC-5), then this bit shall be set to one. Otherwise, this bit shall be set to zero.
DM_MD_4	Shall be set to zero
DM_MD_5	Shall be set to the value of the DM_IMMEDIATE_SUPPORTED bit in the ATA IDENTIFY DEVICE data log.
DM_MD_6	Shall be set to zero
DM_MD_7	Shall be set to the value of the DM_OFFSETS_IMMEDIATE_SUPPORTED bit in the ATA IDENTIFY DEVICE data log.

Table 181 — Extended INQUIRY Data VPD page fields

Field	Description
DM_MD_D	Shall be set to the value of the DM_OFFSETS DEFERRED SUPPORTED bit in the ATA IDENTIFY DEVICE data log.
DM_MD_E	Shall be set to the value of the DM_MD_D field
DM_MD_F	Shall be set to the value of the DM_MD_D field
All others	Unspecified

10.5.6 Mode Page Policy VPD page

The SATL should implement the Mode Page Policy VPD page (see SPC-5). Table 182 shows the translation of the fields in the Mode Page Policy VPD page.

Table 182 — Mode Page Policy VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to 87h
PAGE LENGTH	Unspecified
Mode page policy descriptor	If the SATL implements the Mode Page Policy VPD page, then the SATL shall include at least one mode page policy descriptor (see table 183).

Table 183 shows the fields of the mode page policy descriptor. See 10.4.1 for recommendations on implementation of the fields in table 183.

Table 183 — Mode policy descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved		POLICY PAGE CODE					
1	POLICY SUBPAGE CODE							
2	MLUS	Reserved						MODE PAGE POLICY
3	Reserved							

The POLICY PAGE CODE field, the POLICY SUBPAGE CODE field, the multiple logical units share (MLUS) bit, and MODE PAGE POLICY field are unspecified (see SPC-5).

10.5.7 Power Condition VPD page

Table 184 shows the translation of the fields in the Power Condition VPD page. This page shall only be supported by the SATL if the EPC SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one.

Table 184 — Power Condition VPD page field translations (part 1 of 2)

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to 8Ah
PAGE LENGTH	Shall be set to 000Eh
STANDBY_Y	Shall be set to the value of bit 7 of byte 1 in the Standby_y power condition descriptor of the ATA Power Conditions log
STANDBY_Z	Shall be set to the value of bit 7 of byte 1 in the Standby_z power condition descriptor of the ATA Power Conditions log
IDLE_C	Shall be set to the value of bit 7 of byte 1 in the Idle_c power conditions descriptor of the ATA Power Conditions log
IDLE_B	Shall be set to the value of bit 7 of byte 1 in the Idle_b power conditions descriptor of the ATA Power Conditions log
IDLE_A	Shall be set to the value of bit 7 of byte 1 in the Idle_a power conditions descriptor of the ATA Power Conditions log
STOPPED CONDITION RECOVERY TIME	Shall be set to zero

Table 184 — Power Condition VPD page field translations (part 2 of 2)

Field	Description
STANDBY_Z CONDITION RECOVERY TIME	If the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Standby_z power conditions descriptor of the ATA Power Conditions Log is: a) greater than 0000_FFFEh, then the SATL shall set the STANDBY_Z CONDITION RECOVERY TIME field to FFFFh; and b) less than 0000_FFFFh, then the SATL shall set the STANDBY_Z CONDITION RECOVERY TIME field to the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Standby_z power conditions descriptor of the ATA Power Conditions Log.
STANDBY_Y CONDITION RECOVERY TIME	If the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Standby_y power conditions descriptor of the ATA Power Conditions Log is: a) greater than 0000_FFFEh, then the SATL shall set the STANDBY_Y CONDITION RECOVERY TIME field to FFFFh; and b) less than 0000_FFFFh, then the SATL shall set the STANDBY_Y CONDITION RECOVERY TIME field to the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Standby_y power conditions descriptor of the ATA Power Conditions Log.
IDLE_A CONDITION RECOVERY TIME	If the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Idle_a power conditions descriptor of the ATA Power Conditions Log is: a) greater than 0000_FFFEh, then the SATL shall set the IDLE_A CONDITION RECOVERY TIME field to FFFFh; and b) less than 0000_FFFFh, then the SATL shall set the IDLE_A CONDITION RECOVERY TIME field to the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Idle_a power conditions descriptor of the ATA Power Conditions Log.
IDLE_B CONDITION RECOVERY TIME	If the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Idle_b power conditions descriptor of the ATA Power Conditions Log is: a) greater than 0000_FFFEh, then the SATL shall set the IDLE_B CONDITION RECOVERY TIME field to FFFFh; and b) less than 0000_FFFFh, then the SATL shall set the IDLE_B CONDITION RECOVERY TIME field to the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Idle_b power conditions descriptor of the ATA Power Conditions Log.
IDLE_C CONDITION RECOVERY TIME	If the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Idle_c power conditions descriptor of the ATA Power Conditions Log is: a) greater than 0000_FFFEh, then the SATL shall set the IDLE_C CONDITION RECOVERY TIME field to FFFFh; and b) less than 0000_FFFFh, then the SATL shall set the IDLE_C CONDITION RECOVERY TIME field to the value of the NOMINAL RECOVERY TIME TO PM0:ACTIVE field of the Idle_c power conditions descriptor of the ATA Power Conditions Log.

10.5.8 Block Device Characteristics VPD page

Table 185 shows the translation of the fields in the Block Device Characteristics VPD page.

Table 185 — Block Device Characteristics VPD page field translations

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to B1h
PAGE LENGTH	Shall be set to 003Ch
MEDIUM ROTATION RATE	Shall be set to the value contained in the NOMINAL MEDIA ROTATION RATE field in the ATA IDENTIFY DEVICE data log
PRODUCT TYPE	Shall be set to 00h
WABEREQ	Unspecified
WACEREQ	Unspecified
NOMINAL FORM FACTOR	Shall be set to the value contained in the NOMINAL FORM FACTOR field in the ATA IDENTIFY DEVICE data log
RBWZ	Unspecified
BOCS	Unspecified
FUAB	Unspecified
VBULS	Unspecified
DEPOPULATION TIME	Shall be set to the value contained in the DEPOPULATION TIME field in the ATA IDENTIFY DEVICE data log

10.5.9 Block Limits VPD page

Table 186 shows the translation of the fields in the Block Limits VPD page.

Table 186 — Block Limits VPD Page field translations (part 1 of 2)

Field or Bit	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to B0h
PAGE LENGTH	Shall be set to 003Ch
WSNZ	Shall be set to one
MAXIMUM COMPARE AND WRITE LENGTH	Unspecified

Table 186 — Block Limits VPD Page field translations (part 2 of 2)

Field or Bit	Description
OPTIMAL TRANSFER LENGTH GRANULARITY	Unspecified
MAXIMUM TRANSFER LENGTH	Unspecified
OPTIMAL TRANSFER LENGTH	Unspecified
MAXIMUM PREFETCH LENGTH	Unspecified
MAXIMUM UNMAP LBA COUNT	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this field is unspecified, otherwise the value of this field shall be set to zero.
MAXIMUM UNMAP BLOCK DESCRIPTOR COUNT	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this field is unspecified, otherwise the value of this field shall be set to zero.
OPTIMAL UNMAP GRANULARITY	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this field is unspecified, otherwise the value of this field shall be set to zero.
UGAVALID	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this bit is unspecified, otherwise the value of this bit shall be set to zero.
UNMAP GRANULARITY ALIGNMENT	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this field is unspecified, otherwise the value of this field shall be set to zero.
MAXIMUM WRITE SAME LENGTH	Unspecified
MAXIMUM ATOMIC TRANSFER LENGTH	Shall be set to zero
ATOMIC ALIGNMENT	Shall be set to zero
ATOMIC TRANSFER LENGTH GRANULARITY	Shall be set to zero
MAXIMUM ATOMIC TRANSFER LENGTH WITH ATOMIC BOUNDARY	Shall be set to zero
MAXIMUM ATOMIC BOUNDARY SIZE	Shall be set to zero

10.5.10 Logical Block Provisioning VPD page

Table 187 shows the translation of the fields in the Logical Block Provisioning VPD page.

Table 187 — Logical Block Provisioning VPD Page field translations

Field or Bit	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to B2h
PAGE LENGTH	If the SATL implements a resource descriptor, then this field is unspecified, otherwise this field shall be set to 0004h.
THRESHOLD EXPONENT	If the SATL implements thresholds, then this field is unspecified, otherwise this field shall be set to zero.
LBPU	If the TRIM SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one and the DRAT SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one, then this bit shall be set to one, otherwise this bit shall be set to zero.
LBPWS	If the SATL supports translation of a WRITE SAME (16) command with the UNMAP bit set to one as specified in 9.39.5, then this bit shall be set to one, otherwise this bit shall be set to zero.
LBPWS10	If the SATL supports translation of a WRITE SAME (10) command with UNMAP bit set to one as specified in 9.39.5, then this bit shall be set to one, otherwise this bit shall be set to zero.
LBPRZ	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and the ATA IDENTIFY DEVICE data log RZAT SUPPORTED bit is set to one, then this field shall be set to 001b, otherwise this field shall be set to 000b.
ANC_SUP	If ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one and ATA IDENTIFY DEVICE data log DRAT SUPPORTED bit is set to one, then this bit shall be set to one, otherwise this bit is unspecified.
DP	If the SATL implements a resource descriptor, then this bit is unspecified, otherwise this bit shall be set to zero.
MINIMUM PERCENTAGE	Unspecified
PROVISIONING TYPE	If the ATA IDENTIFY DEVICE data log TRIM SUPPORTED bit is set to one, then this field shall be set to 001b. Otherwise, this field shall be set to 000b.
THRESHOLD PERCENTAGE	Unspecified
PROVISIONING GROUP DESCRIPTOR	Unspecified

10.5.11 Zoned Block Device Characteristics VPD page

Table 188 shows the translation of the fields in the Zoned Block Device Characteristics VPD page. This page shall be supported if the device is either an ATA zoned device.

Table 188 — Zoned Block Device Characteristics VPD page field translations

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to B6h
PAGE LENGTH	Shall be set to 003Ch
URSWRZ	Shall be set to the value of the URSWRZ bit (see ZAC-2) in the ATA IDENTIFY DEVICE data log
OPTIMAL NUMBER OF OPEN SEQUENTIAL WRITE PREFERRED ZONES	Shall be set to the value of the OPTIMAL NUMBER OF OPEN SEQUENTIAL WRITE PREFERRED ZONES field (see ZAC-2) in the ATA IDENTIFY DEVICE data log
OPTIMAL NUMBER OF NON-SEQUENTIALLY WRITTEN SEQUENTIAL WRITE PREFERRED ZONES	Shall be set to the value of the OPTIMAL NUMBER OF NON-SEQUENTIALLY WRITTEN SEQUENTIAL WRITE PREFERRED ZONES field (see ZAC-2) in the ATA IDENTIFY DEVICE data log
MAXIMUM NUMBER OF OPEN SEQUENTIAL WRITE REQUIRED ZONES	Shall be set to the value of the MAXIMUM NUMBER OF OPEN SEQUENTIAL WRITE REQUIRED ZONES field (ZAC-2) in the ATA IDENTIFY DEVICE data log

10.5.12 Format Presets VPD page

10.5.12.1 Overview

If the SATL supports the FORMAT WITH PRESET command (see 9.5), then the SATL shall return the Format Presets VPD page (see SBC-4) as defined in table 189.

Table 189 — Format Presets VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to B8h
PAGE LENGTH	Shall be set to the length of the remaining bytes of the VPD page
Format preset descriptors	Each format preset descriptor shall be: a) a mutate translation format preset descriptor (see 10.5.12.2); or b) a set sector translation format preset descriptor (see 10.5.12.3). Some format preset descriptors may be mutate translation format preset descriptors in the a Format Presets VPD page where set sector translation format preset descriptors are also present, if every format preset descriptor contains a unique preset identifier (see 10.5.12.3). Only mutate translation format preset descriptors are able to be translated to an ATA MUTATE EXT command. Only set sector translation format preset descriptors are able to be translated to an ATA SET SECTOR CONFIGURATION EXT command.

10.5.12.2 Format preset descriptors for the mutate translation

If the SATL supports translating the FORMAT WITH PRESET command to an ATA MUTATE EXT command, then the SATL should include mutate translation format preset descriptors in the Format Presets VPD page. The SATL shall translate each included mutate translation format preset descriptor from one ATA Mutate Configuration descriptor in the ATA Mutate Configurations log as defined in table 190.

Table 190 — Format preset descriptor fields for the mutate translation

Field	Description
PRESET IDENTIFIER	Shall be set to the value of the ATA CONFIGURATION IDENTIFIER field in the ATA Mutate Configuration descriptor being translated.
SCHEMA TYPE	Shall be set to the value of the ATA SCHEME TYPE field in the ATA Mutate Configuration descriptor being translated.
LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT	Shall be set to the value of the ATA LOGICAL TO PHYSICAL SECTOR RELATIONSHIP field in the ATA Mutate Configuration descriptor being translated.
LOGICAL BLOCK LENGTH	Shall be set to the value of the ATA LOGICAL SECTOR SIZE field in the ATA Mutate Configuration descriptor being translated.
DESIGNED LAST LOGICAL BLOCK ADDRESS	Shall be set to the value of the ATA DESIGNED ACCESSIBLE CAPACITY field in the ATA Mutate Configuration descriptor being translated.
FMTPINFO	Shall be set to 0h
PROTECTION FIELD USAGE	Shall be set to 0h
PROTECTION INTERVAL EXPONENT	Shall be set to 0h
LOW LBA CONVENTIONAL ZONES PERCENTAGE, if any	Shall be set to the value of the ATA LOW LBA CONVENTIONAL ZONES PERCENTAGE field, if any, in the ATA Mutate Configuration descriptor being translated.
HIGH LBA CONVENTIONAL ZONES PERCENTAGE, if any	Shall be set to the value of the ATA HIGH LBA CONVENTIONAL ZONES PERCENTAGE field, if any, in the ATA Mutate Configuration descriptor being translated.
LOGICAL BLOCKS PER ZONE, if any	Shall be set to the value of the ATA LOGICAL SECTORS PER ZONE field, if any, in the ATA Mutate Configuration descriptor being translated.

10.5.12.3 Format preset descriptors for the set sector translation

If the SATL supports translating the FORMAT WITH PRESET command to an ATA SET SECTOR CONFIGURATION EXT command, then the SATL should include set sector translation format preset descriptors in the Format Presets VPD page. The SATL shall translate each included set sector translation format preset descriptor from one ATA Sector Configuration descriptor in the ATA Sector Configuration log as defined in table 191. Any ATA Sector Configuration descriptor in which the ATA DESCRIPTOR VALID bit is set to zero shall not be translated into a set sector translation format preset descriptor.

Table 191 — Format preset descriptor fields for the set sector translation

Field	Description
PRESET IDENTIFIER	If the Format Presets VPD page contains at least one mutate translation format preset descriptor, then the PRESET IDENTIFIER field shall: a) be greater than 0000_FFFFh; b) not be equal to the value in the PRESET IDENTIFIER field of any other preset format descriptor (see table 189) in the Format Presets VPD page; and c) contain [a]: A) the value in the DESCRIPTOR CHECK field in the ATA Sector Configuration descriptor being translated; and B) index in the ATA Sector Configuration log that is associated with the ATA Sector Configuration descriptor being translated. If this Format Presets VPD page contains zero mutate translation format preset descriptors, then the SATL may use the preset identifies that are greater than 0000_FFFFh described in this table, or: a) the applicable preset identifier values that are less than 0001_0000h defined in SBC-4; and b) an unspecified method for translating those values into descriptor check and index values.
SCHEMA TYPE	01h or Unspecified
LOGICAL BLOCKS PER PHYSICAL BLOCK EXPONENT	Shall be set to the value of the ATA LOGICAL TO PHYSICAL SECTOR RELATIONSHIP SETTING field in the ATA Sector Configuration descriptor being translated.
LOGICAL BLOCK LENGTH	Shall be set to the value of the ATA LOGICAL SECTOR SIZE SETTING field in the ATA Sector Configuration descriptor being translated.
DESIGNED LAST LOGICAL BLOCK ADDRESS	Unspecified

[a] Regardless of where they appear in the PRESET IDENTIFIER field, the descriptor check and index values are used as described in 9.5.3 during the translation of the FORMAT WITH PRESET command.

Table 191 — Format preset descriptor fields for the set sector translation

Field	Description
FMTPINFO	Shall be set to 0h
PROTECTION FIELD USAGE	Shall be set to 0h
PROTECTION INTERVAL EXPONENT	Shall be set to 0h
Schema type specific information	If the SCHEMA TYPE field is set to: a) zero, then all schema type specific information bytes shall be set to zero; and b) a non-zero value, then the contents of the schema type specific information bytes is unspecified.
[a] Regardless of where they appear in the PRESET IDENTIFIER field, the descriptor check and index values are used as described in 9.5.3 during the translation of the FORMAT WITH PRESET command.	

10.5.13 Concurrent Positioning Ranges VPD page

Table 192 shows the translation of the fields in the Concurrent Positioning Ranges VPD page. This page shall be supported by the SATL if the ATA Concurrent Positioning Ranges log is supported by the ATA device.

Table 192 — Concurrent Positioning Ranges VPD page fields

Field	Description
PERIPHERAL QUALIFIER	The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.
PERIPHERAL DEVICE TYPE	
PAGE CODE	Shall be set to B9h
PAGE LENGTH	Shall be set to 32 times the value contained in the ATA NUMBER OF LBA RANGES field in the ATA Concurrent Positioning Ranges log plus 60.
LBA range descriptors	The number of LBA range descriptors (see table 193) is indicated by the value contained in the ATA NUMBER OF LBA RANGES field. The LBA range descriptors shall be translated in the same order as the ATA Concurrent Positioning Ranges log.

Table 193 — LBA range descriptor fields

Field	Description
LBA RANGE NUMBER	Shall be set to the value of the ATA LBA RANGE NUMBER field of the translated ATA LBA range descriptor.
NUMBER OF STORAGE ELEMENTS	Shall be set to the value of the ATA NUMBER OF STORAGE ELEMENTS field of the translated ATA LBA range descriptor.
STARTING LBA	Shall be set to the value of the ATA LOWEST LBA field of the translated ATA LBA range descriptor.
NUMBER OF LBAS	Shall be set to the value of the ATA NUMBER OF LBAS field of the translated ATA LBA range descriptor.

11 Translation of ATA errors to SCSI errors

11.1 Overview

Unless otherwise specified in the subclause describing the translation of a particular SCSI command, log page, mode page, or VPD page, the SATL shall translate ATA commands that complete with an error to SCSI errors as shown in table 194.

Table 194 — ATA to SCSI Error Translation

Command encountering an error	Feature settings	Reference
ATA NCQ Command	ATA NCQ Autosense is supported (i.e., the NCQ AUTOSENSE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one)	11.2
	ATA NCQ Autosense is not supported (i.e., the NCQ AUTOSENSE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero)	11.3
ATA non-NCQ command	ATA Sense Data Reporting feature set enabled (i.e., the SENSE DATA ENABLED bit in the ATA IDENTIFY DEVICE data log is set to one) (see 5.4), the ATA SENSE DATA AVAILABLE bit in the ATA STATUS field is set to one, and the ATA ERROR bit in the ATA STATUS field is set to one)	11.4
	All others	11.6

11.2 Error translation with ATA NCQ Autosense

The SATL shall:

1) set the:
   A) SCSI SENSE KEY field to the value contained in byte 14 of the ATA NCQ Command Error log;
   B) SCSI ADDITIONAL SENSE CODE field to the value contained in byte 15; and
   C) SCSI ADDITIONAL SENSE CODE QUALIFIER field to the value contained in byte 16 for error reporting; and
2) continue processing the error as described in 11.5.

11.3 Error translation without ATA NCQ Autosense

If the ATA device supports the ATA Sense Data Reporting feature set, the ATA Sense Data Reporting feature set is enabled, and the ATA STATUS field had the SENSE DATA AVAILABLE bit set to one, then process the error as described in 11.4.

Otherwise, the SATL shall translate the error to the appropriate SCSI error using the translation described in 11.6.

11.4 ATA sense data available with ATA error translation

To translate an ATA error with sense data available:

1) the SATL shall send an ATA REQUEST SENSE DATA EXT command to the ATA device;
2) if the ATA REQUEST SENSE DATA EXT command:
   A) completes without error, then the SATL shall:
      a) set the SENSE KEY field to the value contained in the ATA SENSE KEY field in the normal outputs for the ATA REQUEST SENSE DATA EXT command (see ACS-5);
      b) set the ADDITIONAL SENSE CODE field to the value contained in the ATA ADDITIONAL SENSE CODE field in the normal outputs for the ATA REQUEST SENSE DATA EXT command; and
      c) set the ADDITIONAL SENSE CODE QUALIFIER field to the value contained in the ATA ADDITIONAL SENSE CODE QUALIFIER field in the normal outputs for the ATA REQUEST SENSE DATA EXT command;

      or

   B) completes with error, then the SATL shall translate the original ATA device error, as described in 11.6;

   and

3) continue processing the error as described in 11.5.

11.5 ATA unit attention translation

If the ATA SENSE KEY field is set to:

a) UNIT ATTENTION with the ATA additional sense code is set to:
   A) WARNING - DEVICE STATISTICS NOTIFICATION ACTIVE, then the SATL shall:
      1) read page 00h of the ATA Device Statistics Notification log;
      2) determine the first device statistic for which the specified threshold condition has been met; and
      3) process the unit attention as specified in table 195;

      or

   B) any value other than WARNING - DEVICE STATISTICS NOTIFICATION ACTIVE, then the SATL shall return the unit attention with the ATA additional sense code;

   or

b) any value other than UNIT ATTENTION, then the SATL shall return sense data with the SENSE KEY field set to the ATA SENSE KEY field and the ADDITIONAL SENSE CODE field set to the ATA ADDITIONAL SENSE CODE field.

Table 195 — ATA Device Statistics Notification Translation

ATA Device statistic threshold condition met for	Description
Physical Element Status Changed	As specified by the MRIE field in the Informational Exceptions Control mode page, the SATL shall report the change in condition with the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE field in the Informational Exceptions log page (see 10.3.5) set to 0Bh and the INFORMATIONAL EXCEPTION ADDITIONAL SENSE CODE QUALIFIER field set to 14h (i.e. WARNING - PHYSICAL ELEMENT STATUS CHANGE).
All others	Return the unit attention with the additional sense code set to WARNING - DEVICE STATISTICS NOTIFICATION ACTIVE.

11.6 ATA Fixed error translation

The ATA STATUS field and ERROR field settings provide the information to be translated into SCSI sense key, additional sense code, and additional sense code qualifier for error reporting as shown in table 196.

Table 196 — Fixed Translation of ATA errors to SCSI sense data

ATA Error Field [e]		SCSI sense data	
STATUS	**ERROR** [a]	**Sense key**	**Additional sense code**
DEVICE FAULT [b]	n/a	HARDWARE ERROR	INTERNAL TARGET FAILURE
ERROR	UNCORRECTABLE ERROR [d]	MEDIUM ERROR	UNRECOVERED READ ERROR
ERROR	ID NOT FOUND	ILLEGAL REQUEST	LOGICAL BLOCK ADDRESS OUT OF RANGE
ERROR	ABORT [c]	ABORTED COMMAND	NO ADDITIONAL SENSE INFORMATION
ERROR	INTERFACE CRC	ABORTED COMMAND	INFORMATION UNIT iuCRC ERROR DETECTED

[a] If the ERROR field has an obsolete bit set to one, then the SATL may return a vendor specific additional sense code (e.g., if the AMNF bit is set to one, return a sense key of MEDIUM ERROR with additional sense code of ADDRESS MARK NOT FOUND FOR DATA FIELD).

[b] After an ATA device returns a DEVICE FAULT bit set to one, the SATL processes any subsequent commands received for the logical unit corresponding to the ATA device by terminating the command with CHECK CONDITION status with the sense key set to HARDWARE ERROR and the additional sense code set to INTERNAL TARGET FAILURE.

[c] The ABORT bit is ignored if any other bit in the ATA ERROR field is set.

[d] If this bit is set on the completion of an ATA write command, then the SATL shall return a sense key of DATA PROTECT with an additional sense code of WRITE PROTECTED.

[e] If the ATA NCQ Command Error log is used, then these values are obtained from the ATA STATUS field and the ATA ERROR field in the ATA NCQ Command Error log. Otherwise, these values are obtained from the ATA STATUS field and the ATA ERROR field in the ATA Error Outputs associated with the command.

11.7 INFORMATION field and COMMAND-SPECIFIC INFORMATION field

Based on the sense key and additional sense code the SATL should set the INFORMATION field (see SPC-5) and COMMAND-SPECIFIC INFORMATION field (see SPC-5) in the sense data as shown in table 197.

Table 197 — Contents of the INFORMATION field and the COMMAND-SPECIFIC INFORMATION field

Sense key	Additional sense code	INFORMATION field	COMMAND-SPECIFIC INFORMATION field
MEDIUM ERROR	UNRECOVERED READ ERROR	ATA LBA field [a]	Unspecified
ABORTED COMMAND	MULTIPLE READ ERRORS	ATA LBA field [a]	ATA FINAL LBA IN ERROR FIELD [b]
ABORTED COMMAND	UNALIGNED WRITE COMMAND	ATA LBA field [a]	Unspecified
ABORTED COMMAND	WRITE BOUNDARY VIOLATION	ATA LBA field [a]	Unspecified
All others		Unspecified	Unspecified

[a] From ATA error outputs (non-NCQ) or ATA NCQ Command Error log
[b] From ATA NCQ Command Error log

12 SATL specific command set extensions

12.1 Overview

This clause defines additional SCSI commands, mode pages, security protocols, and VPD pages that may be supported by a SATL to provide capabilities in addition to the capabilities defined in the other SCSI command sets.

For SCSI commands specific to SATL implementations see 12.2.

For Mode pages specific to SATL implementations see 12.3.

For VPD pages specific to SATL implementations see 12.4.

For Security protocols specific to SATL implementations see 12.5.

For log pages specific to SATL implementations see 12.6.

12.2 SATL specific command extensions

12.2.1 Overview

Commands that the SATL may implement that are unique to this standard are defined in table 198.

Table 198 — SCSI / ATA Translation specific commands

Command name	Operation code	Reference
ATA PASS-THROUGH (12)	A1h	12.2.2.2
ATA PASS-THROUGH (16)	85h	12.2.2.3
ATA PASS-THROUGH (32)	7Fh/1FF0h [a]	12.2.2.4

[a] This command is defined by a combination of operation code and service action. The operation code value is shown preceding the slash and the service action value is shown after the slash.

12.2.2 ATA PASS-THROUGH commands

12.2.2.1 Overview

ATA PASS-THROUGH commands provide a method for:

a) an application client to transmit an ATA command to an ATA device;
b) transferring data between an application client and an ATA device; and
c) an ATA device to transfer completion status through the SATL.

This is accomplished by defining:

a) CDBs containing ATA command information (see 12.2.2.2, 12.2.2.3, and 12.2.2.4); and
b) specific SCSI status and sense data usage for returning the results of an ATA command (see 12.2.2.6, 12.2.2.7, and 12.2.2.8).

If the SATL supports any of the ATA PASS-THROUGH commands, then the SATL shall support the ATA Status Return sense data descriptor (see 12.2.2.7).

The SATL shall process all supported ATA PASS-THROUGH commands regardless of the emulated SCSI power condition (e.g., stopped power condition).

12.2.2.2 ATA PASS-THROUGH (12) command

Table 199 shows the format of the CDB for the ATA PASS-THROUGH (12) command.

Table 199 — ATA PASS-THROUGH (12) command

Byte\Bit	7	6	5	4	3	2	1	0
0	OPERATION CODE (A1h)							
1	Obsolete			PROTOCOL				Reserved
2	OFF_LINE		CK_COND	T_TYPE	T_DIR	BYTE_BLOCK	T_LENGTH	
3	FEATURES (7:0)							
4	COUNT (7:0)							
5	LBA (7:0)							
6	LBA (15:8)							
7	LBA (23:16)							
8	DEVICE							
9	COMMAND							
10	Reserved							
11	CONTROL (see 6.5)							

Table 207 describes the mapping between the fields in the ATA PASS-THROUGH (12) CDB and corresponding ATA command fields (see ACS-5).

The OPERATION CODE field is defined in SPC-5 and shall be set as shown in table 199 for the ATA PASS-THROUGH (12) command.

The PROTOCOL field (see table 200) specifies the action that the SATL is being requested to perform and the protocol associated with that action, if any.

Table 200 — PROTOCOL field

Code	Description
0h	Device Management - ATA hardware reset
1h	Device Management - ATA software reset
2h	Reserved
3h	Non-Data
4h	PIO Data-In
5h	PIO Data-Out
6h	DMA
7h	Reserved
8h	Execute Device Diagnostic
9h	Non-data command - Device Reset
Ah	UDMA Data In
Bh	UDMA Data Out
Ch	NCQ (see SATA 3.5a)
Dh to Eh	Reserved
Fh	Return Response Information

See ATA8-AAM for the definition of protocol values ranging from 0h to Bh.

If the PROTOCOL field is set to 0h (i.e., Device Management - ATA hardware reset) and the device is a PATA device, then the SATL shall assert RST- (see ATA8-APT). If the PROTOCOL field is set to 0h (i.e., Device Management - ATA hardware reset) and the device is a SATA device, then the SATL shall send a COMRESET to the SATA device. If the PROTOCOl field is set to 0h, then only the PROTOCOL field and the OFF_LINE field are valid and the SATL shall ignore all other fields in the CDB.

If the PROTOCOL field is set to 1h (i.e., Device Management - ATA software reset), then the SATL shall send a software reset to the ATA device (see ATA8-AAM). If the PROTOCOL field is set to 1h (i.e., Device Management - ATA software reset), then only the PROTOCOL field and the OFF_LINE field are valid and the SATL shall ignore all other fields in the CDB.

If the PROTOCOL field specified is in the range from 3h to Ch, then the SATL shall send an ATA command specified by the CDB to the ATA device.

If the PROTOCOL field is set to Fh (i.e., Return Response Information), then the SATL shall:

1) ignore all fields in the CDB except for the PROTOCOL field;
2) read the ATA Command Block as follows:
   A) if the transport is SATA, read the current Shadow Command Block registers; or
   B) if the transport is PATA, read the current Command Block registers;

   and

3) return the contents of the ATA Command Block in the ATA Status Return Descriptor as defined in 12.2.2.7.

If the value in the PROTOCOL field is not consistent with the protocol associated with the command specified in the COMMAND field (see ACS-5), then the SATL may lose communication with the ATA device. This standard does not specify the SATL behavior if this occurs.

If the value in the PROTOCOL field requests the SATL to send a command to the ATA device, then the SATL shall set the fields in the ATA command using fields in the ATA PASS-THROUGH CDB as shown in table 207.

The OFF_LINE field specifies the time period during which the ATA STATUS field may be invalid after command acceptance. In a SATL with a PATA device attached, some ATA commands may cause the PATA device to place the ATA bus in an indeterminate state. This may cause the SATL to see ATA command completion before the ATA command is completed. If the application client uses an ATA PASS-THROUGH command to send a command that is capable of placing the bus in an indeterminate state, then the application client should set the OFF_LINE field to a value that specifies the maximum number of seconds from the time that ATA command is sent until the ATA STATUS field is valid. The SATL shall not use the ATA STATUS field to determine ATA command completion status until this time has elapsed. The valid status is available (2^{off_line+1} - 2) seconds (i.e., 0 s, 2 s, 6 s, and 14 s) after the ATA COMMAND field is stored.

If the application client specifies an OFF_LINE field value that is too small, then the results are indeterminate and may compromise the integrity of the data.

If the CK_COND bit is set to:

a) one, then the SATL shall return a status of CHECK CONDITION upon ATA command completion, without interpreting the contents of the STATUS field and returning the ATA fields from the request completion in the sense data as specified in table 201; and
b) zero, then the SATL shall terminate the command with CHECK CONDITION status only if an error occurs in processing the command. See clause 11 for a description of ATA error conditions.

Table 201 — Returned sense data with the CK_COND bit set to one

PROTOCOL [a]	D_SENSE [b]	Returned sense data
PIO Data-in NCQ	1	ATA Return descriptor as described in 12.2.2.7 with byte 3 to byte 13 set to zero
	0	Fixed format sense data as described in 12.2.2.8 with the INFORMATION field set to zero and the COMMAND-SPECIFIC INFORMATION field set to zero
All others	1	ATA Return descriptor as described in 12.2.2.7
	0	Fixed format sense data as described in 12.2.2.8

[a] See table 200 for the description of the PROTOCOL field in the ATA PASS-THROUGH command.
[b] The D_SENSE bit in the Control mode page (see SPC-5)

The SATL determines if a data transfer is necessary and how to perform the data transfer by examining values in the PROTOCOL field, OFF_LINE field, T_DIR bit, T_TYPE bit, BYTE_BLOCK bit, and T_LENGTH field.

The SATL shall ignore the COMMAND field in the CDB except to copy the COMMAND field in the ATA PASS-THROUGH command CDB to the ATA COMMAND field in the Register – Host to Device FIS or to the ATA COMMAND field.

If the ATA command completes with an error, then the SATL shall return the Error Output fields (see ACS-5) in the sense data. See 12.2.2.6, 12.2.2.7, and 12.2.2.8 for descriptions of how the Error Output fields are mapped into fields in the sense data.

The SATL shall configure the ATA host and the ATA device for the PIO, DMA, UDMA, or other transfer mode transfer rates that both the SATL and ATA device support. The SATL should set the transfer rates to the maximum supported by both the SATL and the ATA device.

The ATA PASS-THROUGH command should not be used to send an ATA SET FEATURES command that changes the PIO, DMA, UDMA or other transfer modes of the ATA device. The result of an ATA SET FEATURES command that changes the PIO, DMA, UDMA or other transfer modes of the ATA device is outside the scope of this standard and may cause communication to be lost with the ATA device, preventing the SATL from performing any further actions.

The BYTE_BLOCK bit, T_TYPE bit, and T_LENGTH bit are used as specified in table 204 to determine the amount of data to be transferred by the command.

The DEVICE field specifies a value for the SATL to copy to the ATA DEVICE field. Table 202 shows the bits in the DEVICE field.

Table 202 — ATA PASS-THROUGH command DEVICE field

Bit							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Obsolete	Command Specific	Obsolete	DEV	Command Specific			

The SATL shall ignore the DEV bit in the DEVICE field of the CDB and set the value of the DEV bit in the ATA DEVICE field to:

a) one, if the I_T_L nexus maps to device one on a PATA bus; and
b) zero, otherwise.

If the T_DIR bit is set to zero, then the SATL shall transfer data from the application client to the ATA device. If the T_DIR bit is set to one, then the SATL shall transfer data from the ATA device to the application client. The SATL shall ignore the T_DIR bit if the T_LENGTH field is set to zero.

If the PROTOCOL field specifies a PIO data transfer, then the SATL shall verify consistency of the PROTOCOL and T_DIR fields. If the T_DIR bit and the direction of the data transfer specified in the PROTOCOL field do not match, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

The transfer type (T_TYPE) bit is interpreted as specified in table 204.

The T_LENGTH field specifies which fields of the ATA PASS-THROUGH command CDB contain the transfer length for the command (see table 203) and, together with the BYTE_BLOCK bit and T_TYPE bit, the transfer size for the command (see table 204).

Table 203 — T_LENGTH field

Code	Description
00b	No data is transferred
01b	The transfer length is an unsigned integer specified in the FEATURES (7:0) field and, for the ATA PASS-THROUGH (16) command and the ATA PASS-THROUGH (32) command, the FEATURES (15:8) field.
10b	The transfer length is an unsigned integer specified in the COUNT (7:0) field and, for the ATA PASS-THROUGH(16) command and the ATA PASS-THROUGH (32) command, the COUNT(15:8) field.
11b	The transfer length is an unsigned integer specified in the TPSIU.

Table 204 — Mapping of BYTE_BLOCK bit, T_TYPE bit, and T_LENGTH field

BYTE_BLOCK	T_TYPE	T_LENGTH	Transfer length
1b	0b	non-zero	The number of 512 byte blocks to be transferred
1b	1b	non-zero	The number of ATA logical sector size blocks to be transferred
0b	all	non-zero	The number of bytes to be transferred
all	all	zero	No data to be transferred

NOTE 8 - The ATA IDENTIFY DEVICE command transfers 512 bytes of data, but this information appears in neither the FEATURE field nor the COUNT field.

See 12.2.2.5 for a description of the mapping from the FEATURES (7:0) field, the COUNT (7:0) field, the LBA (7:0) field, the LBA (15:8) field, the LBA (23:16) field, the DEVICE field, and the COMMAND field in the ATA PASS-THROUGH (12) CDB to corresponding ATA command fields (see ACS-5).

12.2.2.3 ATA PASS-THROUGH (16) command

Table 205 shows the format of the ATA PASS-THROUGH (16) command.

Table 205 — ATA PASS-THROUGH (16) command

Byte\Bit	7	6	5	4	3	2	1	0
0	OPERATION CODE (85h)							
1	Obsolete			PROTOCOL				EXTEND
2	OFF_LINE		CK_COND	T_TYPE	T_DIR	BYTE_BLOCK	T_LENGTH	
3	FEATURES (15:8)							
4	FEATURES (7:0)							
5	COUNT (15:8)							
6	COUNT (7:0)							
7	LBA (31:24)							
8	LBA (7:0)							
9	LBA (39:32)							
10	LBA (15:8)							
11	LBA (47:40)							
12	LBA (23:16)							
13	DEVICE							
14	COMMAND							
15	CONTROL (see 6.5)							

If the EXTEND bit is set to zero, then the SATL shall:

a) ignore:
   A) the FEATURES (15:8) field;
   B) the COUNT (15:8) field;
   C) bits 7:4 of the LBA (31:24) field;
   D) the LBA (39:32) field; and
   E) the LBA (47:40) field;

   and

b) process this command as described in 12.2.2.2.

If the EXTEND bit is set to one, then the SATL shall process this command as described in 12.2.2.2 except as described in this subclause.

See 12.2.2.2 for a description of the PROTOCOL field, the OFF_LINE field, the CK_COND bit, the T_DIR bit, the T_TYPE bit, the T_LENGTH field, and the BYTE_BLOCK bit.

See 12.2.2.5 for the mapping of the FEATURES (15:8) field, the FEATURES (7:0) field, the COUNT (15:8) field, the COUNT (7:0) field, the LBA fields, the DEVICE field, and the COMMAND field in the ATA PASS-THROUGH (16) CDB to corresponding ATA command fields (see ACS-5).

12.2.2.4 ATA PASS-THROUGH (32) command

Table 206 shows the format of the ATA PASS-THROUGH (32) command.

Table 206 — ATA PASS-THROUGH (32) command (part 1 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
0	OPERATION CODE (7Fh)							
1	CONTROL (see 6.5)							
2	Reserved							
...								
6								
7	ADDITIONAL CDB LENGTH (18h)							
8	(MSB)							
9	SERVICE ACTION (1FF0h)							(LSB)
10	Reserved			PROTOCOL				EXTEND
11	OFF_LINE		CK_COND	T_TYPE	T_DIR	BYTE_BLOCK	T_LENGTH	
12	Reserved							
13	Reserved							
14	LBA (47:40)							
15	LBA (39:32)							
16	LBA (31:24)							
17	LBA (23:16)							
18	LBA (15:8)							
19	LBA (7:0)							
20	FEATURES (15:8)							
21	FEATURES (7:0)							
22	COUNT (15:8)							
23	COUNT (7:0)							
24	DEVICE							
25	COMMAND							

Table 206 — ATA PASS-THROUGH (32) command (part 2 of 2)

Byte\Bit	7	6	5	4	3	2	1	0
26	Reserved							
27	ICC (7:0)							
28	AUXILIARY (31:24)							
29	AUXILIARY (23:16)							
30	AUXILIARY (15:8)							
31	AUXILIARY (7:0)							

See 12.2.2.3 for a description of the EXTEND bit.

See 12.2.2.2 for a description of the PROTOCOL field, the OFF_LINE field, the CK_COND bit, the T_DIR bit, the T_TYPE bit, the T_LENGTH field, and the BYTE_ BLOCK bit.

See 12.2.2.5 for the mapping of the FEATURES (15:8) field, the FEATURES (7:0) field, the COUNT (15:8) field, the COUNT (7:0) field, the LBA fields, the DEVICE field, the COMMAND field, the AUXILIARY fields, and the ICC field in the ATA PASS-THROUGH (32) CDB to corresponding ATA command fields (see ACS-5).

12.2.2.5 ATA PASS-THROUGH CDB field translations

Table 207 shows the mapping between the fields in an ATA PASS-THROUGH CDB to corresponding ATA command fields (see ACS-5).

Table 207 — Mapping of ATA PASS-THROUGH CDB fields to ATA command fields

CDB field	48-bit ATA command field [a] [b]	28-bit ATA command field [c]
FEATURES (15:8)	FEATURE (15:8)	n/a
FEATURES (7:0)	FEATURE (7:0)	FEATURE (7:0)
COUNT (15:8)	COUNT (15:8)	n/a
COUNT (7:0)	COUNT (7:0)	COUNT (7:0)
LBA (47:40)	LBA (47:40)	n/a
LBA (39:32)	LBA (39:32)	n/a
LBA (31:24)	LBA (31:24)	n/a
LBA (23:16)	LBA (23:16)	LBA (23:16)
LBA (15:8)	LBA (15:8)	LBA (15:8)
LBA (7:0)	LBA (7:0)	LBA (7:0)
DEVICE (7:4)	DEVICE (7:4)	DEVICE (7:4)
DEVICE (3:0)	DEVICE (3:0)	LBA (27:24)
COMMAND	COMMAND	COMMAND
AUXILIARY (31:24) [d]	AUXILIARY (31:24)	n/a
AUXILIARY (23:16) [d]	AUXILIARY (23:16)	n/a
AUXILIARY (15:8) [d]	AUXILIARY (15:8)	n/a
AUXILIARY (7:0) [d]	AUXILIARY (7:0)	n/a
ICC [d]	ICC	n/a

[a] The 48-bit ATA command translation applies only to an ATA PASS-THROUGH (16) command with EXTEND bit set to one or an ATA PASS-THROUGH (32) command with EXTEND bit set to one.
[b] The 48-bit ATA command translation does not apply to the ATA PASS-THROUGH (12) command.
[c] The 28-bit ATA command translation may apply to:
A) the ATA PASS-THROUGH (12) command;
B) the ATA PASS-THROUGH (16) command with the EXTEND bit set to zero; or
C) the ATA PASS-THROUGH (32) command with the EXTEND bit set to zero.
[d] This field is only present in an ATA PASS-THROUGH (32) command. An ATA PASS-THROUGH (16) command sets the corresponding 48-bit ATA command field to zero.

The SATL shall determine the transfer length by the method specified in the T_LENGTH field and EXTEND field

as shown in table 208.

Table 208 — EXTEND bit and T_LENGTH field

EXTEND	T_LENGTH	Description
0	00b	No data is transferred.
	01b	The transfer length is an unsigned integer specified in the FEATURES (7:0) field.
	10b	The transfer length is an unsigned integer specified in the SECTOR_COUNT (7:0) field.
	11b	The transfer length is an unsigned integer specified in the TPSIU.
1	00b	No data is transferred.
	01b	The transfer length is an unsigned integer specified in the FEATURES (7:0) field and the FEATURES (15:8) field.
	10b	The transfer length is an unsigned integer specified in the SECTOR_COUNT (7:0) field and the SECTOR_COUNT (15:8) field.
	11b	The transfer length is an unsigned integer specified in the TPSIU.

12.2.2.6 ATA PASS-THROUGH status return

Table 209 shows the possible results of ATA PASS-THROUGH command processing depending on the value of the CK_COND bit in the CDB, as reflected in the ATA ERROR bit and the ATA DEVICE FAULT bit in the ATA STATUS field.

Table 209 — ATA command results

CK_COND	STATUS field bit		Sense data returned
	ERROR bit	DEVICE FAULT bit	
0	0	0	No error, successful completion or command in progress. The SATL shall return GOOD status.
1			No error, successful completion or command in progress. The SATL shall terminate the command with CHECK CONDITION status with the sense key set to RECOVERED ERROR with the additional sense code set to ATA PASS-THROUGH INFORMATION AVAILABLE (see SPC-5). Descriptor format sense data shall include the ATA Status Return sense data descriptor (see 12.2.2.7).
any	any	1	The ATA command completed with an error. The SATL shall terminate the command with CHECK CONDITION status with the sense key and the additional sense code set as described in clause 11. Descriptor format sense data shall include the ATA Status Return sense data descriptor (see 12.2.2.7).
	1	0	

ATA commands return information in the normal or error output fields (see ACS-5). The current ATA field information may be retrieved by issuing an ATA PASS-THROUGH command with the PROTOCOL field set to 15 (i.e., Return Response Information).

12.2.2.7 ATA Status Return sense data descriptor

Table 210 shows the format of the ATA Status Return sense data descriptor.

Each time the ATA Status Return sense data descriptor is requested, the SATL shall read the ATA fields and return those values in the sense data as shown in table 210.

If the sense data is for:

a) an ATA PASS-THROUGH (12) command;
b) an ATA PASS-THROUGH (16) command with the EXTEND bit set to zero; or
c) an ATA PASS-THROUGH (32) command with the EXTEND bit set to zero,

then the SATL shall return the 28-bit extended status with the EXTEND bit set to zero.

If the sense data is for

a) an ATA PASS-THROUGH (16) command with the EXTEND bit set to one; or
b) an ATA PASS-THROUGH (32) command with the EXTEND bit set to one,

then the SATL shall return the 48-bit extended status with the EXTEND bit set to one.

Table 210 — ATA Status Return sense data descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	DESCRIPTOR CODE (09h)							
1	ADDITIONAL DESCRIPTOR LENGTH (0Ch)							
2	Reserved							EXTEND
3	ERROR							
4	COUNT (15:8)							
5	COUNT (7:0)							
6	LBA (31:24)							
7	LBA (7:0)							
8	LBA (39:32)							
9	LBA (15:8)							
10	LBA (47:40)							
11	LBA (23:16)							
12	DEVICE							
13	STATUS							

If the EXTEND bit is set to one, then the COUNT (7:0) field and the COUNT (15:8) field indicate the ATA Sector Count.

If the EXTEND bit is set to zero, then the COUNT (7:0) field indicates the ATA Sector Count and the COUNT (15:8) field shall be set to zero.

If the EXTEND bit is set to one, then the LBA (7:0) field, the LBA (15:8) field, the LBA (23:16) field, the LBA (31:24) field, the LBA (39:32) field, and the LBA (47:40) field indicate the ATA LBA.

If the EXTEND bit is set to zero, then:

a) the LBA (7:0) field, the LBA (15:8) field, the LBA (23:16), and bits 3:0 of the LBA (31:24) field indicate the ATA LBA; and
b) bits 7:4 of the LBA (31:24) field, the LBA (39:32) field, and the LBA (47:40) field shall be set to zero.

12.2.2.8 Fixed format sense data

Table 211 shows the fields returned in the fixed format sense data (see SPC-5) for ATA PASS-THROUGH commands.

Table 211 — Fixed format sense data fields for ATA PASS-THROUGH commands

Field	Description
VALID	Unspecified
RESPONSE CODE	Unspecified
FILEMARK	Set to zero
EOM	Set to zero
ILI	Set to zero
SENSE KEY	Unspecified
INFORMATION	Table 212
ADDITIONAL SENSE LENGTH	Unspecified
COMMAND-SPECIFIC INFORMATION	Table 213
ADDITIONAL SENSE CODE	Unspecified
ADDITIONAL SENSE CODE QUALIFIER	Unspecified
FIELD REPLACEABLE UNIT CODE	Unspecified
SKSV	Unspecified
SENSE-KEY SPECIFIC	Unspecified
Additional sense bytes	Unspecified

Table 212 defines the INFORMATION field.

Table 212 — Fixed format sense data INFORMATION field for the ATA PASS-THROUGH commands

Byte\Bit	7	6	5	4	3	2	1	0
0	ERROR							
1	STATUS							
2	DEVICE							
3	COUNT (7:0)							

The ERROR field, STATUS field, DEVICE field, and COUNT (7:0) field are copied from the ATA Error outputs (see ACS-5).

Table 213 defines the COMMAND-SPECIFIC INFORMATION field.

Table 213 — Fixed format sense data COMMAND-SPECIFIC INFORMATION field for ATA PASS-THROUGH

Byte\Bit	7	6	5	4	3	2	1	0
0	EXTEND	COUNT UPPER NONZERO	LBA UPPER NONZERO	Reserved	LOG INDEX			
1	LBA (7:0)							
2	LBA (15:8)							
3	LBA (23:16)							

An EXTEND bit set to one indicates that the sense data is for:

a) an ATA PASS-THROUGH (16) command with the EXTEND bit set to one; or
b) an ATA PASS-THROUGH (32) command with the EXTEND bit set to one.

An EXTEND bit set to zero indicates that the sense data is for:

a) an ATA PASS-THROUGH (12) command,
b) an ATA PASS-THROUGH (16) command with the EXTEND bit set to zero; or
c) an ATA PASS-THROUGH (32) command with the EXTEND bit set to zero.

If the EXTEND bit is set to one, then the ATA COUNT (15:8) field, the ATA LBA (31:24) field, the ATA LBA (39:32) field, and the ATA LBA (47:40) field are not able to be returned in fixed format sense data.

If one or more of the ATA LBA (31:24) field, the ATA LBA (39:32) field, and the ATA LBA (47:40) field returned by the ATA device were not set to 00h, then the SATL shall set the LBA UPPER NONZERO bit to one. If the ATA LBA (31:24) field, the ATA LBA (39:32) field, and the ATA LBA (47:40) field returned by the ATA device were each set to 00h, then the SATL shall set the LBA UPPER NONZERO bit to zero.

If the ATA COUNT (15:8) field returned by the ATA device was not set to 00h, then the SATL shall set the COUNT UPPER NONZERO bit to one. If the ATA COUNT (15:8) field returned by the ATA device was set to 00h, then the SATL shall set the COUNT UPPER NONZERO bit to zero.

A LOG INDEX field set to a nonzero value indicates that the SATL has logged the descriptor format sense data for the command for retrieval via the ATA PASS-THROUGH Results log page (see 12.6.2). The SATL shall set the PARAMETER CODE field in the log entry to LOG INDEX minus one (e.g., LOG INDEX 1h corresponds to parameter code 0h and LOG INDEX Fh corresponds to PARAMETER CODE Eh). A LOG INDEX field set to 0h indicates that the SATL has not logged the descriptor format sense data for the command for retrieval via the ATA PASS-THROUGH Results log page.

The SATL:

a) should log the descriptor format sense data if the LBA UPPER NONZERO bit is set to one or the COUNT UPPER NONZERO bit is set to one;
b) shall not log the descriptor format sense data if the LBA UPPER NONZERO bit is set to zero and the COUNT UPPER NONZERO bit is set to zero; and
c) shall select the LOG INDEX as the most recently reported LOG INDEX plus one, wrapping from Fh to 1h.

The LBA (7:0) field, LBA (15:8) field, and LBA (23:16) field are copied from the ATA Error outputs (see ACS-5).

12.3 SATL specific mode page extensions

12.3.1 Overview

Mode pages that the SATL may implement that are unique to the SCSI / ATA Translation standard are shown in table 214.

Table 214 — SATL specific mode page extensions

Page code	Subpage code	Mode page name	Description
0Ah	F1h	PATA Control	See 12.3.2.
1Ah	F1h	ATA Power Condition	See 12.3.3.
0Ah	F2h	ATA Feature Control	See 12.3.4.

12.3.2 PATA Control mode page

The PATA Control mode page provides PATA specific controls for a SATL to configure the underlying PATA host and to understand what parameters are communicated to the PATA device to ensure proper communication for specific transfer rates. This standard specifies the PATA parameters that are to be reported and may be configured by this mode page.

SATL implementations that support the attachment of PATA devices shall support this mode page. The SATL shall allow application clients to configure PATA timings supported by the SATL and ATA device using the MODE SELECT command.

SATL implementations may save the state of the timing parameters defined in this mode page.

Application clients may use the MODE SENSE command for changeable values to determine the underlying ATA host support for a given ATA timing mode. The SATL shall support returning changeable mode parameters for this mode page.

Table 215 shows the PATA Control mode page.

Table 215 — PATA Control mode page

Byte\Bit	7	6	5	4	3	2	1	0
0	PS	SPF (1b)	PAGE CODE (0Ah)					
1	SUBPAGE CODE (F1h)							
2	(MSB)	PAGE LENGTH (0004h)						
3								(LSB)
4	Reserved	MWD2 [a]	MWD1 [a]	MWD0 [a]	Reserved		PIO [b] bits	
							PIO4	PIO3
5	Reserved	UDMA [c] bits						
		UDMA6	UDMA5	UDMA4	UDMA3	UDMA2	UDMA1	UDMA0
6	Reserved							
7								

[a] The MWD2, MWD1, and MWD0 bits specify a number of hardware assisted data transfer modes defined in ATA8-APT.
[b] PIO stands for Programmed Input and Output and the PIOx bits specify transfer modes performed under program control defined in ATA8-APT.
[c] The Ultra Direct Memory Access (UDMA) bits represent a number of hardware assisted data transfer modes defined in ATA8-APT.

The PS bit is described in SPC-5. The SPF bit, PAGE CODE field, SUBPAGE CODE field, and PAGE LENGTH field are described in SPC-5 and shall be set as shown in table 215.

If the SATL is processing a MODE SENSE command, the SATL shall set the PIO3 bit and PIO4 bit as shown in table 216 to identify the configured PIO mode.

Table 216 — PIO modes

PIO4	PIO3	PIO mode
0	0	Reserved
0	1	The ATA host shall use PIO mode 3 transfers.
1	0	The ATA host shall use PIO mode 4 transfers.
1	1	Reserved

If changeable values are requested, the PIO3 bit and the PIO4 bit indicate if the underlying ATA host supports those transfer modes. The PIO3 bit shall be set to one if the ATA host supports PIO mode 3. The PIO3 bit and the PIO4 bit shall be set to one if the ATA host supports PIO mode 4.

If the SATL is processing a MODE SELECT command and the PIO bits specify a change from the current setting, then the SATL shall configure the ATA host to use the new PIO transfer rate, if supported. If the application client requests a PIO setting that the ATA device does not support, then the SATL shall terminate

the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

If the ATA host in the SATL is currently configured to use multiword DMA, then the MWDMA2 bit, MWDMA1 bit, and MWDMA0 bit are used to determine what multiword DMA mode is currently being used, what multiword DMA modes are supported by the ATA host, and control of multiword MWDMA mode.

If the SATL receives a MODE SENSE command requesting the current values of the PATA Control mode page, then:

a) the MWD0 bit shall be set to one by the SATL if the ATA host and ATA device are configured to use multiword DMA mode 0;
b) the MWD1 bit shall be set to one by the SATL if the ATA host and ATA device are configured to use multiword DMA mode 1; and
c) the MWD2 bit shall be set to one by the SATL if the ATA host and ATA device are configured to use multiword DMA mode 2.

If the SATL receives a MODE SENSE command requesting the changeable values of the PATA Control mode page, then:

a) the MWD0 bit shall be set to one if the ATA host supports multiword DMA mode 0;
b) the MWD1 bit and the MWD0 bit shall each be set to one if the ATA host supports multiword DMA mode 1; and
c) the MWD2 bit, the MWD1 bit, and the MWD0 bit shall be each be set to one if the ATA host supports multiword DMA mode 2.

Table 217 specifies values set by the SATL in the MWD0 bit, the MWD1 bit, and the MWD2 bit for current and changeable multiword DMA settings.

Table 217 — Multiword DMA modes reported by MODE SENSE

MWD2	MWD1	MWD0	ATA host and ATA device shared configuration settings returned as current values	ATA host support returned as changeable values
0	0	0	Configured not to use multiword DMA	Illegal combination
1	0	0	Configured to use multiword DMA mode 2	
0	1	0	Configured to use multiword DMA mode 1	
1	1	0	Configured to use multiword DMA modes 1 and 2	
0	0	1	Configured to use multiword DMA mode 0	multiword DMA mode 0 supported
1	0	1	Configured to use multiword DMA modes 0 and 2	Illegal combination
0	1	1	Configured to use multiword DMA modes 0 and 1	multiword DMA mode 1 supported
1	1	1	Configured to use multiword DMA modes 0, 1, and 2	multiword DMA mode 2 supported

If the application client attempts to set a multiword DMA mode that is not supported by the ATA host environment, then the SATL shall terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

If the SATL receives a MODE SELECT command and the MWDMA2 bit,MWDMA1 bit, and MWDMA0 bit specify a change from the current settings, then the SATL shall send an ATA SET FEATURES - Set transfer mode (i.e.,

the ATA FEATURE field set to 03h) command to the ATA device to set the multiword DMA mode on the ATA device to the requested state and then:

a) if the ATA SET FEATURES command completes with an error, then the SATL shall:
   1) not change any host transfer modes; and
   2) terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to ATA DEVICE FAILED SET FEATURES;

   or

b) if the ATA SET FEATURES command completes without error, then the SATL shall:
   1) configure the ATA host to communicate with the device at the requested multiword DMA transfer rate; and
   2) complete the MODE SELECT command with GOOD status.

The MWDMA2 bit, MWDMA1 bit, and MWDMA0 bit values used to configure ATA hosts and ATA devices using the MODE SELECT command have the same meaning as the MWDMA2 bit, MWDMA1 bit, and MWDMA0 bit values returned by the MODE SENSE command if current values are requested as shown in table 217.

If the SATL receives a request to set a multiword DMA mode that is not supported by the ATA host or the attached PATA device, then the SATL shall return CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

The UDMA0 bit, the UDMA1 bit, the UDMA2 bit, the UDMA3 bit, the UDMA4 bit, the UDMA5 bit, and the UDMA6 bit are collectively referred to as the UDMA bits and are used to determine support for, current use of, and control of Ultra DMA transfer rates on the ATA host and ATA device. The SATL shall determine the highest Ultra DMA mode supported as being the lower of the ATA host maximum transfer mode and the device maximum transfer mode.

If the SATL receives a MODE SENSE command requesting the changeable values of the PATA Control mode page, then the Ultra DMA bits shall be set as described in table 218.

Table 218 — UDMA bits requirements for changeable MODE SENSE parameters

UDMA6	UDMA5	UDMA4	UDMA3	UDMA2	UDMA1	UDMA0	Highest Ultra DMA mode supported
0	0	0	0	0	0	0	Ultra DMA Unsupported
0	0	0	0	0	0	1	0
0	0	0	0	0	1	1	1
0	0	0	0	1	1	1	2
0	0	0	1	1	1	1	3
0	0	1	1	1	1	1	4
0	1	1	1	1	1	1	5
1	1	1	1	1	1	1	6

If the SATL receives a MODE SENSE command requesting the current values of the PATA Control mode page, then the SATL shall set the Ultra DMA bits as defined in table 219. Only one of the UDMA bits shall be set to one at any time. If Ultra DMA transfer mode is not the current DMA transfer mode, then all the UDMA

bits shall be set to zero. If an Ultra DMA transfer mode is being used, then the MWDMA2 bit, the MWDMA1bit, and the MWDMA0 bit shall be set to zero.

Table 219 — UDMA for current MODE SENSE settings

UDMA bit	Value	Description
UDMA0	0	ATA host and device are not communicating using UDMA Mode 0
	1	ATA host and device are communicating using UDMA Mode 0
UDMA1	0	ATA host and device are not communicating using UDMA Mode 1
	1	ATA host and device are communicating using UDMA Mode 1
UDMA2	0	ATA host and device are not communicating using UDMA Mode 2
	1	ATA host and device are communicating using UDMA Mode 2
UDMA3	0	ATA host and device are not communicating using UDMA Mode 3
	1	ATA host and device are communicating using UDMA Mode 3
UDMA4	0	ATA host and device are not communicating using UDMA Mode 4
	1	ATA host and device are communicating using UDMA Mode 4
UDMA5	0	ATA host and device are not communicating using UDMA Mode 5
	1	ATA host and device are communicating using UDMA Mode 5
UDMA6	0	ATA host and device are not communicating using UDMA Mode 6
	1	ATA host and device are communicating using UDMA Mode 6

If the SATL receives a MODE SELECT command and the UDMA bits request a change to the Ultra DMA transfer rate, then the SATL shall send an ATA SET FEATURES - Set transfer mode (i.e., the ATA FEATURE field set to 03h) command to the ATA device and then:

1) if the ATA SET FEATURES command completes with an error, then the SATL shall:
   A) not change any host transfer modes; and
   B) terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to ATA DEVICE FAILED SET FEATURES;

   or

2) if the ATA SET FEATURES command completes without error, then the SATL shall:
   A) configure the ATA host to communicate with the device at the requested Ultra DMA transfer rate; and
   B) complete the MODE SELECT command with GOOD status.

If the application client attempts to set an Ultra DMA mode that the ATA host or the ATA device does not support, then the SATL shall terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

12.3.3 ATA Power Condition mode page

The ATA Power Condition mode page provides ATA specific controls to request a SATL to configure ATA specific power management functions.

Table 220 shows the ATA Power Condition mode page.

Table 220 — ATA Power Condition mode page

Byte\Bit	7	6	5	4	3	2	1	0
0	PS	SPF (1b)	PAGE CODE (1Ah)					
1	SUBPAGE CODE (F1h)							
2	(MSB)	PAGE LENGTH (000Ch)						
3								(LSB)
4	Reserved							
5	Reserved							APMP
6	APM VALUE							
7	Reserved							
...								
15								

The PS bit is described in SPC-5.

The SPF bit, PAGE CODE field, SUBPAGE CODE field, and PAGE LENGTH field are described in SPC-5 and shall be set as shown in table 220.

During the processing of a MODE SELECT command, if the APMP bit is set to zero, then the SATL shall ignore the APM VALUE field and not change the power state of the ATA device.

During the processing of a MODE SELECT command, if the APMP bit is set to one, then the SATL shall alter the ATA APM mode by issuing an ATA SET FEATURES command. If the APM VALUE field is set to a non-zero value, then the ATA SET FEATURES – Enable/disable the APM feature set (i.e., subcommand 05h) command shall be sent and the APM VALUE field shall be used to set the power management level (i.e., ATA COUNT field). If the APM VALUE field is set to a zero, then the ATA SET FEATURES – Disable the APM feature set (i.e., subcommand 85h) command shall be sent.

If the ATA SET FEATURES command completes without error, then the SATL shall complete the MODE SELECT command with GOOD status.

If the ATA SET FEATURES command completes with an error, then the SATL shall terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

During the processing of a MODE SENSE command, the SATL shall determine if ATA APM mode is enabled by verifying the APM SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one and the APM ENABLED bit in the ATA IDENTIFY DEVICE data log is set to one. If ATA APM mode is not enabled, then the APMP bit shall be set to zero. If ATA APM mode is enabled, then the APMP bit shall be set to one and the APM VALUE field shall contain the value from APM LEVEL field in the ATA IDENTIFY DEVICE data log.

12.3.4 ATA Feature Control mode page

The ATA Feature Control page provides controls for a SATL to configure itself and the ATA device in accordance with the parameters included in this page.

A SATL that supports the Command Duration Limit A mode page, the Command Duration Limit B mode page, the Command Duration Limit T2A mode page, and the Command Duration Limit T2B mode page (see 10.4.5, 10.4.12, and 10.4.13) shall support this mode page. A SATL that supports only:

a) the Command Duration Limit A mode page and the Command Duration Limit B mode page; or
b) the Command Duration Limit T2A mode page and the Command Duration Limit T2B mode page,

should support this mode page.

Table 221 shows the ATA Feature Control mode page.

Table 221 — ATA Feature Control mode page

Byte \ Bit	7	6	5	4	3	2	1	0
0	PS	SPF (1b)	PAGE CODE (0Ah)					
1	SUBPAGE CODE (F2h)							
2	(MSB)	PAGE LENGTH (000Ch)						
3								(LSB)
4	Reserved						CDL_CTRL	
5								
...	Reserved							
15								

The PS bit is described in SPC-6. The SPF bit, PAGE CODE field, SUBPAGE CODE field, and PAGE LENGTH field are described in SPC-6 and shall be set as shown in table 221.

Table 222 defines the CDL_CTRL field.

Table 222 — CDL_CTRL field

Code	Description
00b	If a MODE SELECT command sets the CDL_CTRL field to 00b, then: a) if the ATA Command Duration Limits feature set is supported by the ATA device (i.e., the COMMAND DURATION LIMITS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one), then the SATL shall send an ATA SET FEATURES – Enable/Disable Command Duration Limits feature set command (i.e., subcommand 0Dh) with the CDL ACTION field set to 00b to the ATA device; and b) the SATL shall not support the Command Duration Limit A mode page, the Command Duration Limit B mode page, the Command Duration Limit T2A mode page, and the Command Duration Limit T2B mode page.
01b	If a MODE SELECT command sets the CDL_CTRL field to 01b, then: a) if the ATA Command Duration Limits feature set is supported by the ATA device (i.e., the COMMAND DURATION LIMITS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one), then the SATL shall send an ATA SET FEATURES – Enable/Disable Command Duration Limits feature set command (i.e., subcommand 0Dh) with the CDL ACTION field set to 00b to the ATA device; b) the SATL shall support the Command Duration Limit A mode page; c) the SATL should support the Command Duration Limit B mode page; and d) the SATL shall not support the Command Duration Limit T2A mode page and the Command Duration Limit T2B mode page.
10b	If a MODE SELECT command sets the CDL_CTRL field to 10b, then: a) if the ATA Command Duration Limits feature set is supported by the ATA device (i.e., the COMMAND DURATION LIMITS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one), then the SATL: A) shall send an ATA SET FEATURES – Enable/Disable Command Duration Limits feature set command (i.e., subcommand 0Dh) with the CDL ACTION field set to 01b to the ATA device; B) shall not support the Command Duration Limit A mode page and the Command Duration Limit B mode page; C) shall support the Command Duration Limit T2A mode page; and D) should support the Command Duration Limit T2B mode page; and b) if the ATA Command Duration Limits feature set is not supported by the ATA device (i.e., the COMMAND DURATION LIMITS SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero), then the MODE SELECT command is terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST (see SPC-6).
11b	Reserved

12.4 SATL specific VPD page extensions

12.4.1 Overview

VPD pages that are unique to the SCSI / ATA Translation standard are described in 12.4. These VPD pages are for use by the SATL and are shown in table 223.

Table 223 — SATL specific VPD pages

Page name	Page code	Type	Reference
ATA Information VPD page	89h	Mandatory	12.4.2

12.4.2 ATA Information VPD page

12.4.2.1 Overview

The ATA Information VPD page contains:

a) information about the SATL;
b) signature of the ATA device; and
c) ATA IDENTIFY DEVICE data from the ATA device.

Some SATLs may modify the ATA IDENTIFY DEVICE data returned in this VPD page. If an application client requires the unmodified ATA IDENTIFY DEVICE data, then the ATA PASS-THROUGH command (see 12.2) should be used to retrieve the unmodified ATA IDENTIFY DEVICE data.

Table 224 defines the ATA Information VPD page.

Table 224 — ATA Information VPD page

Byte\Bit	7	6	5	4	3	2	1	0
0	PERIPHERAL QUALIFIER			PERIPHERAL DEVICE TYPE				
1	PAGE CODE (89h)							
2	(MSB)			PAGE LENGTH (0238h)				
3								(LSB)
4	Reserved							
...								
7								
8	SAT VENDOR IDENTIFICATION							
...								
15								
16	SAT PRODUCT IDENTIFICATION							
...								
31								
32	SAT PRODUCT REVISION LEVEL							
...								
35								
36	ATA DEVICE SIGNATURE (see 12.4.2.2)							
...								
55								
56	COMMAND CODE							
57	Reserved							
...								
59								
60	ATA IDENTIFY DEVICE DATA (see 12.4.2.3)							
...								
571								

The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field are described in SPC-5 and shall be set as described in 8.1.2.

The PAGE CODE field and the PAGE LENGTH field are described in SPC-5 and shall be set as shown in table 224.

The SAT VENDOR IDENTIFICATION field shall contain an 8-byte ASCII string identifying the vendor of the SATL. The data shall be left aligned within the field. The vendor identification string shall be one assigned by INCITS for use in the Standard INQUIRY data VENDOR IDENTIFICATION field. A list of assigned vendor identification strings is in SPC-5 and on the T10 web site (https://www.t10.org).

The SAT PRODUCT IDENTIFICATION field shall contain 16 bytes of ASCII data as defined by the vendor of the SATL. The data shall be left-aligned within the field.

The SAT PRODUCT REVISION LEVEL field shall contain four bytes of ASCII data as defined by the vendor of the SATL. The data shall be left-aligned within the field.

The ATA DEVICE SIGNATURE field is described in 12.4.2.2.

The COMMAND CODE field is set to the contents of the ATA command code used to retrieve the data in the ATA IDENTIFY DEVICE DATA field. The possible command codes are:

a) ECh for an ATA IDENTIFY DEVICE command;
b) 2Fh for an ATA READ LOG EXT command;
c) 47h for an ATA READ LOG DMA EXT command; or
d) 00h for other device types.

The ATA IDENTIFY DEVICE DATA field is described in 12.4.2.3.

12.4.2.2 ATA DEVICE SIGNATURE

The ATA DEVICE SIGNATURE field shall contain the contents of the task file fields after the last power on reset, hardware reset, software reset, or ATA EXECUTE DEVICE DIAGNOSTIC command. The ATA device signature shall have the format of the initial SATA Register Device to Host FIS (see SATA-3.5a). Table 225 shows the ATA device signature.

Table 225 — ATA device signature

Byte\Bit	7	6	5	4	3	2	1	0
0	TRANSPORT IDENTIFIER							
1	Reserved	INTERRUPT/ Reserved [a]	Reserved		PM PORT / Reserved [a]			
2	STATUS [b]							
3	ERROR [b]							
4	LBA (7:0) [b]							
5	LBA (15:8) [b]							
6	LBA (23:16) [b]							
7	DEVICE [b]							
8	LBA (31:24) [b]							
9	LBA (39:32) [b]							
10	LBA (47:40) [b]							
11	Reserved							
12	COUNT (7:0) [b]							
13	COUNT (15:8) [b]							
14	Reserved							
...								
19								

[a] The INTERRUPT bit and the PM PORT field are defined only if the TRANSPORT IDENTIFIER field is set to 34h (see SATA-3.5a). Otherwise, the INTERRUPT field and the PM PORT field are reserved.

[b] These fields are fields with the same names defined in ACS-5.

The TRANSPORT IDENTIFIER field is defined in table 226.

Table 226 — TRANSPORT IDENTIFIER field

Code	Transport
00h	PATA (see ATA8-APT)
34h	SATA (see SATA-3.5a)
All others	Reserved

The INTERRUPT bit corresponds to the “I” bit (i.e., dword 0 bit 14) of the Register Device to Host FIS (see SATA-3.5a).

All the remaining fields within the ATA device signature are defined in ATA8-APT and SATA-3.5a.

12.4.2.3 ATA IDENTIFY DEVICE DATA field

If the command used to obtain the ATA IDENTIFY DEVICE data completes without error, then the ATA IDENTIFY DEVICE DATA field shall contain the ATA IDENTIFY DEVICE data (ACS-5).

Some SATLs may modify the ATA IDENTIFY DEVICE data as noted in 12.4.2.1.

The ATA IDENTIFY DEVICE DATA field shall contain 512 bytes of 00h if:

a) the command used to obtain the ATA IDENTIFY DEVICE data completes with an error; or
b) the command code is 00h (i.e., some other device type).

The data shall be returned with byte preservation (i.e., ATA byte n maps to SCSI byte n), as shown in table 227.

Table 227 — ATA IDENTIFY DEVICE DATA field

Byte	Contents
0	ATA IDENTIFY DEVICE data word 0 bits 7:0 (i.e., byte 0)
1	ATA IDENTIFY DEVICE data word 0 bits 15:8 (i.e., byte 1)
2	ATA IDENTIFY DEVICE data word 1 bits 7:0 (i.e., byte 2)
3	ATA IDENTIFY DEVICE data word 1 bits 15:8 (i.e., byte 3)
...	...
510	ATA IDENTIFY DEVICE data word 255 bits 7:0 (i.e., the signature byte of the Integrity word, see ACS-5)
511	ATA IDENTIFY DEVICE data word 255 bits 15:8 (i.e., the checksum byte of the Integrity word, see ACS-5)

NOTE 9 - Although the ATA SERIAL NUMBER field (i.e., words 10 to 19), ATA FIRMWARE REVISION field (i.e., words 23 to 26), and ATA MODEL NUMBER field (i.e., words 27 to 46) contain ASCII characters, every other byte is swapped within them (see ACS-5) (e.g., the ATA SERIAL NUMBER field is interpreted as: {word 10 bits 15:8, word 10 bits 7:0, word 11 bits 15:8, word 11 bits 7:0,...}, which corresponds to these bytes in the ATA IDENTIFY DEVICE DATA field: {byte 21, byte 20, byte 23, byte 22, etc.}).

Since some of the fields within the ATA IDENTIFY DEVICE data may change depending on the state of the ATA device, the SATL shall resend the command to retrieve updated data each time the ATA Information VPD page is requested.

12.5 SATL specific security protocol extension

12.5.1 SECURITY PROTOCOL IN command

12.5.1.1 Overview

The SECURITY PROTOCOL IN command with the SECURITY PROTOCOL field set to EFh is used by the application client to request the SATL to return ATA Security feature set data extracted from the ATA IDENTIFY DEVICE data log information from the ATA device. See ACS-5 for a description of the ATA Security feature set.

If the SECURITY PROTOCOL field is set to a value other than EFh in a SECURITY PROTOCOL IN command, then the command is processed as described in 8.14.

If the SECURITY PROTOCOL field is set to EFh in a SECURITY PROTOCOL IN command, then the SECURITY PROTOCOL SPECIFIC field shall be ignored.

If a SECURITY PROTOCOL IN command is received with the SECURITY PROTOCOL field set to EFh and the INC_512 bit set to one, then the SECURITY PROTOCOL IN command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

12.5.1.2 SECURITY PROTOCOL IN parameter data

Table 228 defines the parameter data sent in response to a SECURITY PROTOCOL IN command with the SECURITY PROTOCOL field set to EFh. Parameter data in response to a SECURITY PROTOCOL IN command with the SECURITY PROTOCOL field set to other values is set to the data returned by the ATA device for the ATA trusted receive command.

Table 228 — SECURITY PROTOCOL IN parameter data

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	PARAMETER LIST LENGTH (0Eh)							
2	(MSB)	SECURITY ERASE TIME						
3								(LSB)
4	(MSB)	ENHANCED SECURITY ERASE TIME						
5								(LSB)
6	(MSB)	MASTER PASSWORD IDENTIFIER						
7								(LSB)
8	Reserved							MAXSET
9	Reserved		EN_ER_SUP	PWCNTEX	FROZEN	LOCKED	S_ENABLD	S_SUPRT
10	Reserved							
...								
15								

The PARAMETER LIST LENGTH field is described in SPC-5 and shall be set as shown in table 228.

The SECURITY ERASE TIME field indicates the time required by the ATA device to complete its security erase procedure in normal mode. The SATL shall set the field to the ATA Time required for a Normal Erase mode SECURITY ERASE UNIT command in the ATA IDENTIFY DEVICE data log.

The ENHANCED SECURITY ERASE TIME field indicates the time required by the ATA device to complete its security erase procedure in enhanced mode. The SATL shall set the field to the ATA Time required for an Enhanced Erase mode SECURITY ERASE UNIT command in the ATA IDENTIFY DEVICE data log.

The SATL shall set the MASTER PASSWORD IDENTIFIER field to the MASTER PASSWORD IDENTIFIER field in the ATA IDENTIFY DEVICE data log.

The MAXSET bit indicates the ATA device master password capability. If the MASTER PASSWORD CAPABILITY bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the MAXSET bit to zero. If the the MASTER PASSWORD CAPABILITY bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the MAXSET bit to one.

The ER_EN_SUP bit indicates the ATA device SECURITY ERASE UNIT command enhanced erase mode capability. If the ENHANCED SECURITY ERASE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the EN_ER_SUP bit to zero. If the ENHANCED SECURITY ERASE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the EN_ER_SUP bit to one.

The PWCNTEX bit indicates the maximum number of password attempts has been exceeded. If the ENHANCED SECURITY ERASE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the PWCNTEX bit to zero. If the ENHANCED SECURITY ERASE SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the PWCNTEX bit to one.

The FROZEN bit indicates the ATA device is in Security Frozen state. If the SECURITY FROZEN bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the FROZEN bit to zero. If the SECURITY FROZEN bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the FROZEN bit to one.

The LOCKED bit indicates the ATA device is in Security Locked state. If the SECURITY LOCKED bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the LOCKED bit to zero. If the SECURITY LOCKED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the LOCKED bit to one.

The S_ENABLD bit indicates that ATA device security has been enabled by setting a user password. If the SECURITY ENABLED bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the S_ENABLD bit to zero. If the SECURITY ENABLED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the S_ENABLD bit to one. Enabling of this bit is based on setting of the user password via a set password function (see 12.5.3.1).

The S_SUPRT bit indicates the ATA device supports the ATA Security feature set. If the SECURITY SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to zero, then the SATL shall set the S_SUPRT bit to zero. If the SECURITY SUPPORTED bit in the ATA IDENTIFY DEVICE data log is set to one, then the SATL shall set the S_SUPRT bit to one.

12.5.2 ATA Device Server Password security protocol

12.5.2.1 SCSI commands allowed in the presence of various security modes

Certain commands may be allowed or conflict depending on the security mode setting that is in effect for an ATA device.

There are three possible modes:

a) security locked (i.e., the SECURITY LOCKED bit in the ATA IDENTIFY DEVICE data log is set to one);
b) security unlocked or security disabled (i.e., both the SECURITY LOCKED bit and the SECURITY FROZEN bit in the ATA IDENTIFY DEVICE data log are set to zero); and
c) security frozen (i.e., the SECURITY FROZEN bit in ATA IDENTIFY DEVICE data log is set to one).

If a SATL receives a command that is allowed for the current security mode setting of the ATA device, then the SATL translates the command as defined in this standard and sends it to the ATA device. If a SATL receives a command that conflicts with the current security mode setting of the ATA device, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to SECURITY CONFLICT IN TRANSLATED DEVICE.

Table 229 shows the commands defined in SPC-5 and whether each command is allowed or conflicts depending on the security setting that is in effect for an ATA device.

Table 229 — SPC-5 commands allowed in the presence of various ATA security modes (part 1 of 2)

Command	Locked	Unlocked or Disabled	Frozen
CHANGE ALIASES	Allowed	Allowed	Allowed
COPY OPERATION ABORT	Conflict	Allowed	Allowed
EXTENDED COPY	Conflict	Allowed	Allowed
INQUIRY	Allowed	Allowed	Allowed
LOG SELECT	Allowed	Allowed	Allowed
LOG SENSE	Allowed	Allowed	Allowed
MANAGEMENT PROTOCOL IN	Allowed	Allowed	Allowed
MANAGEMENT PROTOCOL OUT	Allowed	Allowed	Allowed
MODE SELECT (6) / MODE SELECT (10) All mode pages	Allowed	Allowed	Allowed
MODE SENSE (6) / MODE SENSE (10) All mode pages	Allowed	Allowed	Allowed
PERSISTENT RESERVE IN	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / REGISTER	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / RESERVE	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / RELEASE	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / CLEAR	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / PREEMPT	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / PREEMPT AND ABORT	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / REGISTER AND IGNORE EXISTING KEY	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / REGISTER AND MOVE	Allowed	Allowed	Allowed
PERSISTENT RESERVE OUT / READ ATTRIBUTE	Allowed	Allowed	Allowed
READ BUFFER (10)	Allowed	Allowed	Allowed
READ MEDIA SERIAL NUMBER	Allowed	Allowed	Allowed
RECEIVE COPY DATA	Allowed	Allowed	Allowed

Table 229 — SPC-5 commands allowed in the presence of various ATA security modes (part 2 of 2)

Command	Locked	Unlocked or Disabled	Frozen
RECEIVE COPY STATUS	Allowed	Allowed	Allowed
RECEIVE ROD TOKEN INFORMATION	Allowed	Allowed	Allowed
RECEIVE CREDENTIALS	Allowed	Allowed	Allowed
RECEIVE DIAGNOSTIC RESULTS	Allowed	Allowed	Allowed
REPORT ALIASES	Allowed	Allowed	Allowed
REPORT ALL ROD TOKENS	Allowed	Allowed	Allowed
REPORT IDENTIFYING INFORMATION	Allowed	Allowed	Allowed
REPORT LUNS	Allowed	Allowed	Allowed
REPORT PRIORITY	Allowed	Allowed	Allowed
REPORT SUPPORTED OPERATION CODES	Allowed	Allowed	Allowed
REPORT SUPPORTED TASK MANAGEMENT FUNCTIONS	Allowed	Allowed	Allowed
REPORT TARGET PORT GROUPS	Allowed	Allowed	Allowed
REPORT TIMESTAMP	Allowed	Allowed	Allowed
REQUEST SENSE	Allowed	Allowed	Allowed
SECURITY PROTOCOL IN	Allowed	Allowed	Allowed
SECURITY PROTOCOL OUT / Tape Data Encryption	Conflict	Conflict	Conflict
SECURITY PROTOCOL OUT / Authentication in Host Attachments of Transient Storage Devices	Conflict	Conflict	Conflict
SECURITY PROTOCOL OUT / Device Server Password Security	Allowed	Allowed	Conflict
SECURITY PROTOCOL OUT / IEEE 1667	Conflict	Conflict	Conflict
SECURITY PROTOCOL OUT / TCG	Conflict	Conflict	Conflict
SEND DIAGNOSTIC	Allowed	Allowed	Allowed
SET IDENTIFYING INFORMATION	Allowed	Allowed	Allowed
SET PRIORITY	Allowed	Allowed	Allowed
SET TARGET PORT GROUPS	Allowed	Allowed	Allowed
SET TIMESTAMP	Allowed	Allowed	Allowed
TEST UNIT READY	Allowed	Allowed	Allowed
WRITE ATTRIBUTE	Allowed	Allowed	Allowed
WRITE BUFFER	Allowed	Allowed	Allowed

Table 230 shows the commands defined in SBC-4 and ZBC and whether each command is allowed or conflicts depending on the security setting that is in effect for an ATA device.

Table 230 — SBC-4 and ZBC commands allowed in the presence of various ATA security modes

Command	Locked	Unlocked or Disabled	Frozen
CLOSE ZONE	Conflict	Allowed	Allowed
COMPARE AND WRITE	Conflict	Allowed	Allowed
FINISH ZONE	Conflict	Allowed	Allowed
FORMAT UNIT	Conflict	Allowed	Allowed
FORMAT WITH PRESET	Conflict	Allowed	Allowed
GET LBA STATUS	Allowed	Allowed	Allowed
GET PHYSICAL ELEMENT STATUS	Allowed	Allowed	Allowed
OPEN ZONE	Conflict	Allowed	Allowed
ORWRITE (16) / (32)	Conflict	Allowed	Allowed
PRE-FETCH (10) / (16)	Conflict	Allowed	Allowed
PREVENT ALLOW MEDIUM REMOVAL (Prevent=0)	Conflict	Allowed	Allowed
PREVENT ALLOW MEDIUM REMOVAL (Prevent<>0)	Conflict	Allowed	Allowed
READ (10) / (12) / (16) / (32)	Conflict	Allowed	Allowed
READ CAPACITY (10) / (16)	Allowed	Allowed	Allowed
READ DEFECT DATA (10) / (12)	Conflict	Allowed	Allowed
REASSIGN BLOCKS	Conflict	Allowed	Allowed
REMOVE ELEMENT AND TRUNCATE	Conflict	Allowed	Allowed
REMOVE ELEMENT AND MODIFY ZONES	Conflict	Allowed	Allowed
REPORT ZONES	Allowed	Allowed	Allowed
RESET WRITE POINTER	Conflict	Allowed	Allowed
RESTORE ELEMENTS AND REBUILD	Conflict	Allowed	Allowed
START STOP UNIT	Allowed	Allowed	Allowed
SYNCHRONIZE CACHE (10) / (16)	Conflict	Allowed	Allowed
UNMAP	Conflict	Allowed	Allowed
VERIFY (10) / (12) / (16) / (32)	Conflict	Allowed	Allowed
WRITE (10) / (12) / (16) / (32)	Conflict	Allowed	Allowed
WRITE AND VERIFY (10) / (12) / (16) / (32)	Conflict	Allowed	Allowed
WRITE LONG (10) / (16)	Conflict	Allowed	Allowed
WRITE SAME (10) / (16) / (32)	Conflict	Allowed	Allowed

Table 231 shows the commands defined in this specification and whether each command is allowed or conflicts depending on the security setting that is in effect for an ATA device.

Table 231 — SATL specific commands allowed in the presence of various ATA security modes

Command	Locked	Unlocked or Disabled	Frozen
ATA PASS-THROUGH (12)	Allowed	Allowed	Allowed
ATA PASS-THROUGH (16)	Allowed	Allowed	Allowed
ATA PASS-THROUGH (32)	Allowed	Allowed	Allowed

12.5.3 SECURITY PROTOCOL OUT command

12.5.3.1 Overview

The SECURITY PROTOCOL OUT command with the SECURITY PROTOCOL field set to EFh is used by an application client to send ATA Security feature set commands and data to the ATA device. See ACS-5 for a description of the ATA Security feature set and 8.15 for the processing of the SECURITY OUT command when the SECURITY PROTOCOL FIELD is set to a value other than EFh.

If the SECURITY PROTOCOL field is set to EFh in a SECURITY PROTOCOL OUT command, then the SECURITY PROTOCOL SPECIFIC field specifies the ATA command that the SATL shall send to the ATA device (see table 232).

Table 232 — SECURITY PROTOCOL SPECIFIC field

SECURITY PROTOCOL SPECIFIC field	Description	ATA command sent by the SATL	Parameter data reference
0000h	Reserved		
0001h	Set password	ATA SECURITY SET PASSWORD	12.5.3.2
0002h	Unlock	ATA SECURITY UNLOCK	12.5.3.3
0003h	Erase prepare	ATA SECURITY ERASE PREPARE	No data is transferred
0004h	Erase unit	ATA SECURITY ERASE UNIT	12.5.3.4
0005h	Freeze lock	ATA SECURITY FREEZE LOCK	No data is transferred
0006h	Disable password	ATA SECURITY DISABLE PASSWORD	12.5.3.5
0007h to FFFFh	Reserved		

If a SECURITY PROTOCOL OUT command is received with the SECURITY PROTOCOL field set to EFh and the INC_512 bit is set to one, then the SECURITY PROTOCOL OUT command shall be terminated with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB.

12.5.3.2 Set password parameter list

If the SECURITY PROTOCOL SPECIFIC field is set to 0001h in the SECURITY PROTOCOL OUT command CDB and the TRANSFER LENGTH field in the CDB is not set to 24h, then the SATL shall terminate the SECURITY PROTOCOL OUT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. Table 233 defines the parameter list for the SECURITY PROTOCOL OUT command if the SECURITY PROTOCOL SPECIFIC field is set to 0001h (i.e., set password).

Table 233 — Set password parameter list

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							MAXLVL
1	Reserved							MSTRPW
2	(MSB)							
...	PASSWORD							
33								(LSB)
34	(MSB)							
35	MASTER PASSWORD IDENTIFIER							(LSB)

The SATL shall:

1) copy the value of the MAXLVL bit to word 0, bit 8 of the ATA SECURITY SET PASSWORD data;
2) copy the value of the MSTRPW bit to word 0, bit 0 of the ATA SECURITY SET PASSWORD data
3) if the MSTRPW field is set to one, then copy the value of the MASTER PASSWORD IDENTIFIER field to ATA SECURITY SET PASSWORD data word 17;
4) copy the PASSWORD field to words 1 to 16 of the ATA SECURITY SET PASSWORD data; and
5) send an ATA SECURITY SET PASSWORD command to the ATA device.

12.5.3.3 Unlock parameter list

If the SECURITY PROTOCOL SPECIFIC field is set to 0002h in the SECURITY PROTOCOL OUT command CDB and the TRANSFER LENGTH field in the CDB is not set to 24h, then the SATL shall terminate the SECURITY PROTOCOL OUT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. Table 234 defines the parameter list for the SECURITY PROTOCOL OUT command if the SECURITY PROTOCOL SPECIFIC field is set to 0002h (i.e., unlock).

Table 234 — Unlock parameter list

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							MSTRPW
2	(MSB)							
...	PASSWORD							
33								(LSB)
34	Reserved							
35								

The SATL shall:

1) copy the MSTRPW bit to ATA SECURITY UNLOCK data word 0 bit 0;
2) copy the PASSWORD field to ATA SECURITY UNLOCK data words 1 to 16; and
3) send an ATA SECURITY UNLOCK command to the ATA device.

12.5.3.4 Erase unit parameter list

If the SECURITY PROTOCOL SPECIFIC field is set to 0004h in the SECURITY PROTOCOL OUT CDB and the TRANSFER LENGTH field in the CDB is not set to 24h, then the SATL shall terminate the SECURITY PROTOCOL OUT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. Table 235 defines the parameter list for the SECURITY PROTOCOL OUT command if the SECURITY PROTOCOL SPECIFIC field is set to 0004h (i.e., erase unit).

Table 235 — Erase unit parameter list

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							EN_ER
1	Reserved							MSTRPW
2	(MSB)							
...	PASSWORD							
33								(LSB)
34	Reserved							
35								

The SATL shall:

1) copy the EN_ER bit to ATA SECURITY ERASE UNIT data word 0, bit 1;
2) copy the MSTRPW bit to ATA SECURITY ERASE UNIT data word 0, bit 0;
3) copy the PASSWORD field to ATA SECURITY ERASE UNIT data words 1 to 16; and
4) send an ATA SECURITY ERASE UNIT COMMAND to the ATA device.

12.5.3.5 Disable password parameter list

If the SECURITY PROTOCOL SPECIFIC field is set to 0006h in the SECURITY PROTOCOL OUT CDB and the TRANSFER LENGTH field in the CDB is not set to 24h, then the SATL shall terminate the SECURITY PROTOCOL OUT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN CDB. Table 236 defines the parameter list for the

SECURITY PROTOCOL OUT command if the SECURITY PROTOCOL SPECIFIC field is set to 0006h (i.e., disable password).

Table 236 — Disable password parameter list

Byte \ Bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							MSTRPW
2	(MSB)							
...	PASSWORD							
33								(LSB)
34	Reserved							
35								

The SATL shall:

1) copy the MSTRPW bit to ATA SECURITY DISABLE PASSWORD data word 0, bit 0;
2) copy the PASSWORD field to the ATA SECURITY DISABLE PASSWORD data words 1 to 16; and
3) send an ATA SECURITY DISABLE PASSWORD command to the ATA device.

12.6 SATL specific log page extensions

12.6.1 Overview

Log pages that the SATL may implement that are unique to the SCSI / ATA Translation standard are described in 12.6. These log pages are for use by the SATL and are shown in table 237.

Table 237 — SATL specific log page extensions

PAGE CODE	SUBPAGE CODE	Log page name	Reference
16h	00h	ATA PASS-THROUGH Results log page	12.6.2

12.6.2 ATA PASS-THROUGH Results log page

The ATA PASS-THROUGH Results log page reports descriptor format sense data for ATA PASS-THROUGH commands that were terminated with CHECK CONDITION status by a SATL that returned fixed format sense data and was not able to return the complete set of information (see 12.2.2.7).

The PAGE CODE field and SUBPAGE CODE field are described in SPC-5 and shall be set to the values shown in table 237.

This log page uses the binary list parameter format defined in SPC-5.

The number of log parameters reported shall be less than or equal to 15.

The PAGE LENGTH field shall be set as described in SPC-5 and is a function of the value of the PARAMETER LENGTH field implemented by the SATL.

The PARAMETER CODE field of each log parameter indicates the value of the LOG INDEX field minus one returned in fixed format sense data (e.g., parameter code 0h corresponds to log index 1h and parameter code Eh corresponds to log index Fh) (see 12.2.2.7). The device server shall support log parameter codes 0h to Eh.

The contents of the DU field and TSD field of each log parameter are unspecified.

The FORMAT AND LINKING field of each log parameter shall be set to 11b, indicating that the parameters are binary format list parameters. The values of the bits and fields in the parameter control byte for binary format list parameters are described in SPC-5.

The PARAMETER LENGTH field of each log parameter is described in SPC-5 and the value is unspecified.

The PARAMETER VALUE field of each log parameter is set to descriptor format sense data for a command that was terminated by the SATL with CHECK CONDITION status and for which the SATL was requested to return fixed format sense data (see 12.2.2.7).

Annex A (Informative) Sample algorithms for splitting commands

A.1 Overview

A.1.1 READ/VERIFY/WRITE/WRITE AND VERIFY

A 28-bit ATA device cannot transfer more than 100h bytes in a single ATA read command, ATA verify command, or ATA write command, and transfers larger than this can be requested by 10-byte or 16-byte SCSI commands.

A 48-bit ATA device cannot transfer more than 10000h bytes in a single ATA read command, ATA verify command or ATA write command, and transfers larger than this can be requested by 16-byte SCSI commands.

In both cases, as an alternative to failing the request, the SATL may split a request exceeding these limits into smaller requests. This can be done in many ways, and the example algorithms that follow are informative.

A.1.2 WRITE BUFFER

An ATA device indicates DM MINIMUM TRANSFER SIZE and DM MAXIMUM TRANSFER SIZE in the ATA IDENTIFY DEVICE data log and indicates support for segmented downloads by setting the DM OFFSETS DEFERRED SUPPORTED bit in the ATA IDENTIFY DEVICE data log to one. A WRITE BUFFER command may request a transfer larger than the ATA device permits.

In this case, rather than rejecting such requests, the SATL may split a request that exceeds the maximum transfer size into multiple requests that comply with the minimum and maximum transfer lengths, provided that the device permits segmented downloads. This can be done in multiple ways, so the example algorithms that follow are informative.

A.2 Splitting READ/VERIFY/WRITE/WRITE AND VERIFY

Set REMAINDER to the value of the TRANSFER LENGTH field in the CDB.

Set CURRENT_LBA to the value of the LOGICAL BLOCK ADDRESS field in the CDB.

Set MAX_SIZE to the maximum transfer size the device can perform (i.e., 100h for a 28-bit device, and 1 0000h for a 48-bit device).

While REMAINDER > 0:

{

1) CURRENT_SIZE = min(REMAINDER, MAX SIZE);
2) if (CURRENT_SIZE == MAX_SIZE) then COUNT = 0 else COUNT = CURRENT_SIZE;
3) set the COUNT field in the ATA command to COUNT;
4) set the LBA field in the ATA command to CURRENT_LBA;
5) perform the ATA command;
6) if ATA command completes with an error, then terminate the SCSI command.
7) REMAINDER = REMAINDER - CURRENT_SIZE;
8) CURRENT_LBA = CURRENT_LBA + CURRENT_SIZE;

}

A.3 Splitting WRITE BUFFER

Set REMAINDER to the TRANSFER LENGTH field in the CDB.

Set OFFSET to the value of the BUFFER OFFSET field in the CDB.

while REMAINDER > 0

{

if (REMAINDER <= DM MAXIMUM TRANSFER SIZE) then CURRENT_SIZE = REMAINDER;

else if (REMAINDER >= DM MINIMUM TRANSFER SIZE + DM MAXIMUM TRANSFER SIZE) then CURRENT_SIZE = DM MAXIMUM TRANSFER SIZE;

else CURRENT_SIZE = REMAINDER - DM MINIMUM TRANSFER SIZE;

send an ATA DOWNLOAD MICROCODE DMA with the BLOCK COUNT field set to CURRENT_SIZE and the BUFFER OFFSET field set to OFFSET.

if the download command completes in error, then terminate the WRITE BUFFER command with CHECK CONDITION status, and sense as described in clause 11.

REMAINDER = REMAINDER - CURRENT_SIZE;

OFFSET = OFFSET + CURRENT_SIZE;

}

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