

SATA-IO Commands for ATA-8

April 26, 2007

Revision 3

e07131r3-SATA-IO_Commands_for_ATA-8.fm

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Abstract: This proposal integrates all the SATA-IO specific commands, logs, and other related information with the exception of NCQ which has already been integrated into ATA8-ACS

Document Status

Revision History		
Rev	Date	Description
0	February 14, 2007	1) Initial Revision
1	April 24, 2007	1) The initial revision had little or no wording changes from the SATA 2.6 document. Changes were made based on the February 2007 plenary.
2	April 25, 2007	1) Implemented changes based on April 2007 plenary review
3	April 26, 2007	1) Implemented changed based on second review during plenary.

1 Introduction

SATA-IO has provided T-13 with a copyright release for incorporating command-set related capability into ATA8-ACS. e06150r5 used this material to document NCQ in ATA8-ACS.

2 Scope

e07131 documents SATA specific commands and related data (log page formats, etc.) using material provided by SATA. This proposal is not intended to introduce new functionality; that is, functionality beyond that documented in Serial ATA Rev 2.6.

3 Overview

None yet.

4 Changes to ACS

4.1 Changes to clause 2

4.1.1 Changes to Approved ANSI References

Replace the references listed with the new references for this proposal.

Name	Reference
Protected Area Run Time Interface Extensions (PARTIES)	ANSI INCITS 346-2001
SCSI Primary Commands - 3 (SPC-3)	ANSI INCITS 408-2005 ISO/IEC 14776-453

4.1.2 Changes to ANSI References Under Development

Replaces the references listed below with the new references for this proposal.

Name	Project Number
AT Attachment-8 - Parallel Transport (ATA8-APT)	INCITS 1698D ISO/IEC 14776-881
AT Attachment-8 – ATA/ATAPI Architecture Model (ATA8-AAM)	INCITS 1700D ISO/IEC 14776-861

4.1.3 Changes to Other References

Replace the references list below with the new references for this proposal.

PC Card Standard, February 1995, PCMCIA (68-pin Connector)

For the PC Card Standard published by the Personal Computer Memory Card International Association, contact PCMCIA at 408-433-2273 or <http://www.pc-card.org> .

CompactFlash™ Association Specification, Revision 4.0

For the CompactFlash™ Association Specification published by the CompactFlash™ Association, contact the CompactFlash™ Association at <http://www.compactflash.org>.

4.2 Changes to clause 3

4.2.1 Changes to Definitions and abbreviations

4.2.2 Your Term: Definition.

4.2.3 Your Term: Definition.

4.3 Changes to clause 4

4.3.1 Overview - Changes to the Feature Set Summary Table

Replace the names of the feature sets in the table below with the new feature set names.

Feature set	General Devices	Packet Devices
Software Settings Preservation (see TBD)	O	P
Your feature set (see TBD)	O	O
Key: M – Mandatory, O – Optional, P – Prohibited, N – Not defined		

4.3.2 Software Settings Preservation (SSP)

When a device is enumerated, software configures the device using SET FEATURES and other commands. These software settings are often preserved across software reset but not necessarily across hardware reset. In Parallel ATA, only commanded hardware resets can occur, thus legacy software only reprograms settings that are cleared for the particular type of reset it has issued. In Serial ATA, COMRESET is equivalent to hard reset and a non-commanded COMRESET may occur if there is an asynchronous loss of signal. Since COMRESET is equivalent to hardware reset, in the case of an asynchronous loss of signal some software settings may be lost without legacy software knowledge. In order to avoid losing important software settings without legacy driver knowledge, the software settings preservation ensures that the value of important software settings is maintained across a COMRESET. Software settings preservation may be enabled or disabled using SET FEATURES with a Count field of 06h. If a device supports software settings preservation, the feature shall be enabled by default. See SATA 2.6 for more information.

The software settings that shall be preserved across COMRESET are listed below. The device is only required to preserve the indicated software setting if it supports the particular feature/command the setting is associated with.

Table 1 — Preserved Feature Sets and Settings

Capability	Preserved Setting
INITIALIZE DEVICE PARAMETERS	- Obsolete Command -
Security Mode	Preserved the Current Security State as defined in the security state transition diagram
Standby Timer	Preserved the setting for the standby timer
Read/Write Stream Error Logs	Preserve the contents of these logs
Security Unlock Counter	Preserve the contents of the failed attempts counter
SET MAX ADDRESS (EXT)	Current maximum address
Write Cache enable/disable	Enabled or Disabled
Transfer Mode	Preserved the PIO, DMA and UDMA transfer mode settings
Advanced Power Mode	Enabled or Disabled
Read Lookahead	Enabled or Disable
Release Interrupt	Enabled or Disabled
Service Interrupt	Enabled or Disabled
Reverting to Power-On Defaults	Enabled or Disabled
Multiple Mode	Preserve the block size from the last set multiple mode

4.4 Changes to clause 7

4.4.1 Changes to DCO Set

If the proposal adds a feature set or command, there may be an addition to the Device Configuration Set data structure and the Device Configuration Identify data structure to allow the capability to be removed from the device. Fill in the description in the table and place a description of each bit or word underneath the table. This one table will indicate the changes for both.

Word	Content
8	SATA Command set/feature sets supported 15:5 Reserved 4 1 = Reporting support for software settings preservation is allowed 3 1 = Reporting support for asynchronous notification is allowed 2 1 = Reporting support for interface power management is allowed 1 1 = Reporting support for non-zero buffer offsets is allowed 0 1 = Reporting support for the NCQ feature set is allowed
9	Reserved for SATA

DCO SET:

WORD 8: Serial ATA command / feature sets supported

This word enables configuration of command sets and feature sets.

Bits 15:5 Reserved for Serial ATA

Bit 4 is cleared to zero to disable support for software settings preservation and has the effect of clearing word 78 bit 6 and word 79 bit 6 of IDENTIFY DEVICE data or IDENTIFY PACKET DEVICE data to zero. When software settings preservation is disabled, the device shall not preserve any software settings that are normally cleared when the device processes a hardware reset.

Bit 3 is cleared to zero to disable support for asynchronous notification and has the effect of clearing word 78 bit 5 and word 79 bit 5 of IDENTIFY PACKET DEVICE to zero. See SATA 2.6 for more information.

Bit 2 is cleared to zero to disable support for interface power management requests and has the effect of clearing word 76 bit 9, word 78 bit 3, and word 79 bit 3 of IDENTIFY DEVICE or IDENTIFY PACKET DEVICE to zero. See SATA 2.6 for more information.

Bit 1 is cleared to zero to disable support for non-zero buffer offsets for commands in the NCQ feature set and has the effect of clearing word 78 bit 1, word 78 bit 4, word 79 bit 1, and word 79 bit 4 of IDENTIFY DEVICE to zero. See SATA 2.6 for more information.

Bit 0 is cleared to zero to disable support for the NCQ feature set and has the effect of clearing word 76 bit 8, word 78 bit 1, word 78 bit 2, word 78 bit 4, word 79 bit 1, word 79 bit 2, and word 79 bit 4 of IDENTIFY DEVICE data to zero.

WORD 9: Reserved for Serial ATA

This word is reserved for Serial ATA and all bits shall be cleared to zero.

DCO IDENTIFY

WORD 8: Serial ATA command / feature sets supported

This word enables configuration of command sets and feature sets.

Bits 15:5 Reserved for Serial ATA

Bit 4 if set to one indicates that the device is allowed to report support for software settings preservation.

Bit 3 if set to one indicates that the ATAPI device is allowed to report support for asynchronous notification. See SATA 2.6 for more information.

Bit 2 if set to one indicates that the device is allowed to report support for interface power management requests. See SATA 2.6 for more information.

Bit 1 if set to one indicates that the device is allowed to report support for non-zero buffer offsets for commands in the NCQ feature set.

Bit 0 if set to one indicates that the device is allowed to report support for the NCQ feature set.

WORD 9: Reserved for Serial ATA

4.4.2 Changes to IDENTIFY DEVICE data

If the proposal adds a feature set or command, there should be an addition to the IDENTIFY DEVICE data to indicate both supported and enabled descriptions. Fill in the description in the table and place a description of each bit or word underneath the table.

Word	O M	S P	F V	Description
76	O	S	F	Serial ATA Capabilities 15:11 Reserved 10 1 = Supports Phy Event Counters 9 1 = Supports receipt of host initiated power management requests 8 1 = Supports native Command Queuing 7:3 Reserved for future SATA signaling speed grades 2 1 = Supports SATA Gen2 Signaling Speed (3.0Gb/s) 1 1 = Supports SATA Gen1 Signaling Speed (1.5Gb/s) 0 Shall be cleared to zero

Word	O	S	F	Description
77	O	S	F	Reserved for SATA
78	O	S	F	SATA Features Supported 15:7 Reserved 6 1 = Device supports Software Settings Preservation 5 Reserved 4 1 = Device supports in-order data delivery 3 1 = Device supports initiating power management 2 1 = Device supports DMA Setup auto-activation 1 1 = Device supports non-zero buffer offsets 0 Shall be cleared to zero
79	O	S	F	SATA Features Enabled 15:7 Reserved 6 1 = Software Settings Preservation enabled 5 Reserved 4 1 = In-order data delivery enabled 3 1 = Device initiated power management enabled 2 1 = DMA Setup auto-activation enabled 1 1 = Non-zero buffer offsets enabled 0 Shall be cleared to zero
Key:				V – The contents of the field is variable and may change depending on the state of the device or the commands executed by the device.
O/M – Mandatory/optional requirement.				X – The content of the field may be fixed or variable
M – Support of the word is mandatory.				S/P – Content applies to Serial or Parallel transport
O – Support of the word is optional.				S – Serial Transport
F/V – Fixed/variable content				P – Parallel Transport
F – The content of the field is fixed and does not change. The DCO command may change the value of a fixed field. For removable media devices, these values may change when media is removed or changed.				B – Both Serial and Parallel Transports
				N – Belongs to a transport other than Serial or Parallel

4.4.2.1 Word 76: Serial ATA capabilities

If not 0000h or FFFFh, the device claims compliance with the Serial ATA specification. If this field is not 0000h or FFFFh, words 77 through 79 shall be valid. If this field is 0000h or FFFFh the device does not claim compliance with the Serial ATA specification and Words 76 through 79 are not valid and shall be ignored.

Bits 15:11 Reserved for Serial ATA

If bit 10 is set to one the device supports Phy event counters. If the device supports Phy event counters, it shall support the Phy event counter READ LOG EXT address 11h. See SATA 2.6 for more information.

If bit 9 is set to one the device supports Partial and Slumber interface power management states when initiated by the host. See SATA 2.6 for more information.

If bit 8 is set to one the device supports the Native Command Queuing feature set.

Bits 7:3 Reserved for Serial ATA.

If bit 2 is set to one the device supports the Gen2 signaling rate of 3.0 Gbps. See SATA 2.6 for more information.

If bit 1 is set to one the device supports the Gen1 signaling rate of 1.5 Gbps. See SATA 2.6 for more information.

Bit 0 shall be cleared to zero.

4.4.2.2 Word 77: Reserved

Word 77 is reserved for future Serial ATA definition and shall be cleared to zero.

4.4.2.3 Word 78: Serial ATA features supported

If Word 76 is not 0000h or FFFFh, Word 78 reports the optional features supported by the device. Support for this word is optional and if not supported the word shall be zero indicating the device has no support for new Serial ATA capabilities.

Bits 15:7 Reserved for Serial ATA

If bit 6 is set to one the device supports software settings preservation across COMRESET. xxxSee SSP feature set for more information.

Editor's Note 1: "When bit 6 is cleared to zero the device clears all software settings when a COMRESET occurs." was in the original. This is a concern because it could be specifying more functionality.

Bit 5 Reserved

If bit 4 is set to one the device supports guaranteed in-order data delivery when non-zero buffer offsets are used for commands in the NCQ feature set. See SATA 2.6 for more information.

If bit 3 is set to one the device supports initiating power management requests to the host. If bit 3 is cleared to zero the device does not support initiating power management requests. A device may support reception of power management requests initiated by the host as described in the definition of bit 9 of Word 76 without supporting initiating such power management requests as indicated by this bit. (bit 3)

If bit 2 is set to one the device supports the use of the DMA Setup FIS Auto-Activate optimization. See SATA 2.6 for more information.

If bit 1 is set to one the device supports the use of non-zero buffer offsets for commands in the NCQ feature set. See SATA 2.6 for more information.

Bit 0 shall be cleared to zero.

4.4.2.4 Word 79: Serial ATA features enabled

If Word 76 is not 0000h or FFFFh, Word 79 reports which optional features supported by the device are enabled. This word shall be supported if optional Word 78 is supported and shall not be supported if optional Word 78 is not supported.

Bits 15:7 Reserved for Serial ATA.

If bit 6 is set to one then software settings preservation is enabled. If the device supports software settings preservation this field shall be one by default. If the device does not support software settings preservation this field shall be zero by default.

Bit 5 Reserved.

If bit 4 is set to one then device support for guaranteed in-order data delivery when non-zero buffer offsets are used for commands in the NCQ feature set is enabled. See SATA 2.6 for more information.

If bit 3 is set to one then device support for initiating power management requests to the host is enabled. When set to one the device may initiate power management transition requests. When cleared to zero the device shall not initiate interface power management requests to the host. This field shall be zero by default.

If bit 2 is set to one then the device support for use of the DMA Setup FIS Auto-Activate optimization is enabled. See SATA 2.6 for more information.

If bit 1 is set to one then device support the use of non-zero buffer offsets for commands in the NCQ feature set is enabled. See SATA 2.6 for more information.

Bit 0 shall be cleared to zero.

4.4.3 Changes to SET FEATURES

Table 2 — SET FEATURES Feature field definitions

Value	Description
10h	Enable use of SATA feature
90h	Disable use of SATA feature

4.4.3.1 Enable/Disable SATA feature

4.4.3.1.1 Overview

The Count field contains the specific Serial ATA feature to enable or disable. The specific Serial ATA features are defined as defined in xxxtable 3.

Table 3: SATA Features

Count	Description
00h	Reserved
01h	Non-zero Buffer Offsets
02h	DMA Setup FIS Auto-Activate optimization
03h	Device-initiated interface power state transitions
04h	Guaranteed In-Order Data Delivery
05h	Asynchronous Notification
06h	Software Settings Preservation
07h-FFh	Reserved

4.4.3.1.2 Enable/Disable Non-Zero Buffer Offsets

A Count field value of 01h is used to enable or disable non-zero buffer offsets for commands in the NCQ feature set. By default, non-zero buffer offsets are disabled. The enable/disable state for non-zero offsets shall be preserved across software reset. The enable/disable state for non-zero offsets shall be reset to its default state upon COMRESET. See SATA 2.6 for more information.

4.4.3.1.3 Enable/Disable DMA Setup FIS Auto-Activate Optimization

A Count field value of 02h is used to enable or disable DMA Setup FIS Auto-Activate optimization. See SATA 2.6 details. The enable/disable state for the autoactivate optimization shall be preserved across software reset. The enable/disable state for the auto-activate optimization shall be reset to its default state upon COMRESET.

4.4.3.1.4 Enable/Disable Device-Initiated Interface Power State Transitions

A Count field value of 03h is used to enable or disable device initiation of interface power state transitions. By default, the device is not permitted to initiate interface power state transitions. See SATA 2.6 for more information. The enable/disable state for device initiated power management shall persist across software reset. The enable/disable state shall be reset to its default disabled state upon COMRESET.

If device initiated interface power management is enabled, the device shall not attempt to initiate an interface power state transition between reset and the delivery of the device reset signature.

4.4.3.1.5 Enable/Disable Guaranteed in-Order Data Delivery

A Count field value of 04h is used to enable or disable guaranteed in-order data delivery for commands in the NCQ feature set. This setting is only valid when non-zero buffer offsets are enabled. By default, guaranteed in-order data delivery is disabled. See SATA 2.6 for more information. The enable/disable state for guaranteed in-order data delivery shall be preserved across software reset. The enable/disable state for guaranteed in-order data delivery shall be reset to its default state upon COMRESET.

4.4.3.1.6 Enable/Disable Asynchronous Notification

For devices implementing the PACKET feature set, a Count field value of 05h is used to enable or disable asynchronous notification. By default, asynchronous notification is disabled. See SATA 2.6 for more information.

The enable/disable state for asynchronous notification shall be preserved across software reset. The enable/disable state for asynchronous notification shall be reset to its default state upon COMRESET.

4.4.3.1.7 Enable/Disable Software Settings Preservation

A Count field value of 06h is used to enable or disable software settings preservation. By default, if the device supports software settings preservation the feature is enabled when it processes a power-on reset. The enable/disable state for software settings preservation shall persist across software reset. The enable/disable state for software settings preservation shall be reset to its default state upon COMRESET. The host may disable software settings preservation in order to not preserve software settings across COMRESET.

[Editor's Note 2: Need to remove the double negative.](#)

4.5 Log Addresses

4.5.1 SATA Phy Event Counters

READ LOG EXT log address 11h is one page (512 bytes) in length. The first Dword of the log page contains information that applies to the rest of the log address. Software should continue to process counters until a counter identifier with value 0h is found or the entire page has been read. A counter identifier with value 0h indicates that the log page contains no more counter values past that point. Log address 11h is defined in xxxtable xxx.

Table 4 — SATA Phy Event Counters Format

Byte	7	6	5	4	3	2	1	0
0-3	Reserved							
4 - 5	Counter 0 Identifier							
6 - (Counter 0 Length+5)	Counter 0 Value							
...							
n - (n+1)	Counter x Identifier							
(n+2) - (Counter x Length+n+1)	Counter x Value							
...	...							
508-510	Reserved							
511	Checksum							

There are two mechanisms by which the host can explicitly cause the Phy counters to be reset. The first mechanism is to issue a BIST Activate FIS to the device. Upon reception of a BIST Activate FIS the device shall reset all Phy event counters to their reset value. The second mechanism uses the READ LOG EXT command.

When the device receives a command to read log address 11h and bit 0 in the Features register is set to one, the device shall return the current counter values for the command and then reset all Phy event counter values.

See ATA 2.6 for more information.

4.5.1.1 Counter x Identifier

Phy event counter identifier that corresponds to Counter n Value. Specifies the particular event counter that is being reported. The Identifier is 16 bits in length. Valid identifiers are listed in SATA 2.6.

4.5.1.2 Counter x Value

Value of the Phy event counter that corresponds to Counter x Identifier. The number of significant bits is determined by Counter n Identifier bits 14:12, see SATA 2.6 for more information. The length of Counter x Value shall always be a multiple of 16-bits. All counters are one-extended. For example, if a counter is only physically implemented as 8-bits when it reaches the maximum value of FFh, it shall be one-extended to FFFFh. The counter shall stop (and not wrap to zero) after reaching its maximum value.

4.5.1.3 Counter x Length

Size of the SATA Phy event counter as defined by bits 14:12 of Counter n Identifier. The size of the Phy event counter shall be a multiple of 16-bits.

4.5.1.4 Checksum

The data structure checksum is the 2's complement of the sum of the first 511 bytes in the data structure. Each byte shall be added with unsigned arithmetic and overflow shall be ignored. The sum of all 512 bytes of the data structure is zero when the checksum is correct.

4.6 Changes to Annex B - Command Set Summary

4.6.1 Changes to the Command Matrix Table

TBD

If the proposal adds commands, this subclause should be included with just the TBD. The reason is that the an actual command code is not assigned until the proposal is accepted.

4.6.2 Changes to the Command Codes Table

Fill in the proper command names and other information replacing the information in the table included below. The command code should remain TBD until a command code assignment is made.

Protocol	Command	General Feature Set	Packet Feature Set	Command Code
ND	YOUR COMMAND NAME	O	M	TBD
PO	YOUR COMMAND NAME	O	O	TBD
VS	YOUR COMMANDNAME			TBD
Key: ND = Non-data command PI = PIO data-in command PO = PIO data-out command DM = DMA command DMQ = DMA QUEUED command DR = DEVICE RESET command DD = EXECUTE DEVICE DIAGNOSTIC command P = PACKET command VS = Vendor specific M = Mandatory O = Optional N = Use prohibited V = Vendor specific implementation E = Retired B = Obsolete R = Reserved F = If the device does not implement the CFA feature set, this command code is Vendor specific.				

4.6.3 Changes to the Historical Command Assignments Table

Fill in the proper command names in the table included below. The ACS editor will fill in the historical information for the command codes that are assigned. The command code should remain TBD until a command code assignment is made.

Opcode	Command Name	ATA1	ATA2	ATA3	ATA4	ATA5	ATA6	ATA7	ATA8
TBD	Your Command Name	C	C	C	C	C	C	C	C
TBD	Your Command Name	R	R	R	R	R	R	R	R
Key: C = a defined command. E = a retired command. O = Obsolete. R = Reserved, undefined in current specifications. V = Vendor specific commands. A = Reserved for assignment by the CompactFlash Association F = If the device does not implement the CFA feature set, this command code is Vendor specific. M = Reserved for the Media Card Pass Through Command feature set. S = Reserved for Serial ATA *Indicates this definition is new to ATA8									

4.6.4 Changes to the Historical Set Feature Code Assignments Table

[Editor's Note 3: Add new SET FEATURES to table.](#)

If the proposal added a SET FEATURES Feature Code, then fill in the proper feature names in the table included below. The ACS editor will fill in the historical information for the command codes that are assigned. The command code should remain TBD until a command code assignment is made

Feature Code	Description	ATA1	ATA2	ATA3	ATA4	ATA5	ATA6	ATA7	ATA8
TBD	Your Feature Name	C	C	O	E	F	F	F	F
TBD	Your Feature Name	V	V	C	C	C	C	C	C
Key:		A = Reserved for assignment by the CompactFlash? Association. F = If the device does not implement the CFA feature set, this command code is Vendor specific. M = Reserved for the Media Card Pass Through Command feature set. S = Reserved for Serial ATA. T = Reserved for Technical Report T13/DT1696 (Time-Limited Commands).							
	C = a defined command.								
	E = a retired command.								
	O = Obsolete.								
	R = Reserved, undefined in current specifications.								
	V = Vendor specific commands.								