To: T10 Technical Committee
From: Bob Sheffield(robert.l.sheffield@intel.com)
Date: 24 June 2006
Subject: 06-291r1: SAT- ATA PASS-THROUGH additional sense code and other clarifications

Revision history

Revision 0 (19 June 2006) First revision
Revision 1 (24 June 2006) Incorporated all resolved LB comments and comments on r0 of this proposal, and incorporated moving SAT-specific VPD pages from clause 10 to this clause.

Related documents

SAT-r08 - SCSI / ATA Translation revision 08
06-121r1 SAT-r08_LB_Comment_Resolution.pdf

Overview

Letter ballot comments received for SAT (see 06-121) regarding the clause on SAT-Specific SCSI Extensions were extensive. This proposal is intended to provide the resolution to all the letter ballot comments in clause 11.

Suggested changes

Add the following to the definitions:

3.1.x SCSI Transport Protocol-Specific Information Unit (STPSIU): A transport-specific information unit used to transport information defined in SCSI command standards between initiator ports and target ports that may contain additional information needed by the service delivery subsystem to effect the requested information unit transfers.

Add the following abbreviation:

STPSIU	SCSI Transport Protocol-Specific Information Unit (see 3.1.x)

12 SAT-~~S~~specific SCSI E~~e~~xtensions

12.1 SAT-~~S~~specific SCSI E~~e~~xtensions overview

This subclause defines additional SCSI commands, mode pages, and ~~log~~ VPD pages that may be supported by a SATL to provide capabilities beyond those defined in the other SCSI command sets.

SCSI commands defined for SATL implementations include:

a) ATA PASS-THROUGH (12) command (see 12.2.2); and
b) ATA PASS-THROUGH (16) command (see 12.2.3).

Mode pages defined for SATL implementations include:

a) PATA Control mode page (see 12.3.2).

Vital Product Data pages defined for SATL implementations include:

a) ATA Information VPD page (see 12.4.2.1).

12.2 ATA PASS-THROUGH commands

12.2.1 ATA PASS-THROUGH commands overview

~~This standard provides for an application client to:~~

~~a) transmit an ATA command to an ATA device;~~
~~b) optionally transfer data between the application client and an ATA device;~~
~~c) transfer completion status from an ATA device through the SATL.~~

ATA PASS-THROUGH commands provide a method for:

a) an application client to transmit an ATA command to an ATA device;
b) optionally, data transfer between an application client and an ATA device; and
c) for 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 and 12.2.3); and
b) specific SCSI status and sense data usage for returning the results of an ATA command (see 12.2.4).

12.2.2 ATA PASS-THROUGH (12) command

Table 92 shows the CDB for the ATA PASS-THROUGH (12) command.

Table 92 — ATA PASS-THROUGH (12) command

Byte\Bit	7	6	5	4	3	2	1	0
0	OPERATION CODE (A1h)							
1	MULTIPLE_COUNT			PROTOCOL				Reserved
2	OFF_LINE		CK_COND	Reserved	T_DIR	BYTE_BLOCK	T_LENGTH	
3	FEATURES (7:0)							
4	SECTOR_COUNT (7:0)							
5	LBA_LOW (7:0)							
6	LBA_MID (7:0)							
7	LBA_HIGH (7:0)							
8	DEVICE							
9	COMMAND							
10	Reserved							
11	CONTROL ~~(see 6.4)~~(see 6.4)							

Table 97 shows the mapping between the fields and the ATA PASS-THROUGH (12) CDB to corresponding ATA command fields (see ATA8-ACS).

If the SATL receives an ATA PASS-THROUGH (12) command, then the SATL ~~it~~ shall check the PROTOCOL field (see table 93) to determine the type of action requested.

Table 93 — PROTOCOL field

Code	Description
0	Hard Reset
1	SRST
2	Reserved
3	Non-data
4	PIO Data-In
5	PIO Data-Out
6	DMA
7	DMA Queued
8	Device Diagnostic
9	DEVICE RESET
10	UDMA Data In
11	UDMA Data Out
12	FPDMA [a]
13, 14	Reserved
15	Return Response Information

[a] See SATA 2.5.

The PROTOCOL field specifies the protocol to use when the ATA device executes the command. ~~ATA/ATAPI~~ATA8-~~7~~ AAMdefines the meaning of protocol values ranging from 0 to 11.

If the ~~A~~ PROTOCOL field specified is ~~value~~ in the range from 3 to 12, ~~requests~~ the SATL ~~to~~ shall send an ATA command to the ATA device.

If the PROTOCOL field contains 15 (i.e., Return Response Information), then the SATL shall:

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;

~~not access the ATA device,~~

~~but shall~~ and return the contents in the ATA Status Return Descriptor as defined in ~~subclause~~ 12.2.5. The SATL shall ignore all other fields in the CDB.

If the value in the PROTOCOL field is inappropriate for the command specified in the COMMAND field (see ~~ATA/ATAPI~~ATA8-~~7 and SATA 2.5~~ACS) the SATL may lose communication with the ATA device., ~~and this~~ This standard does not specify the SATL behavior if this occurs.

If the value in the PROTOCOL field is set to zero (i.e., ~~Hard~~ Hardware Reset) and the ~~attached~~ device is a PATA device, then the SATL shall ~~issue a pin 1 reset to the PATA device~~ assert RST- (see ~~ATA/ATAPI~~ATA8-~~7~~APT). If the value in the PROTOCOL field is set to zero (i.e., ~~Hard~~ Hardware Reset) and the ~~attached~~ device is a SATA device, then the SATL shall issue a COMRESET to the SATA device. When this protocol is selected, only the PROTOCOL field and OFF_LINE field~~s~~ are valid. The SATL shall ignore all other fields in the CDB.

If the PROTOCOL field is set to one, then the SATL shall issue a ~~soft~~ software reset to the ~~attached~~ ATA device (see ~~ATA/ATAPI~~ATA8-~~7~~AAM). When this protocol is selected, only the PROTOCOL field and the OFF_LINE field~~s~~ are valid. The SATL shall ignore all other fields in the CDB.

~~Some PROTOCOL values cause the SATL to reset the ATA device or to return information about the ATA device.~~

If the value in the PROTOCOL field requests the SATL to send a command to the ATA device, then the SATL shall ~~use~~ set the ~~FEATURES (7:0), SECTOR_COUNT (7:0), LBA_LOW (7:0), LBA_MID (7:0), LBA_HIGH (7:0), DEVICE and~~ fields in the ATA command using fields ~~to initiate a command~~ in the ATA PASS-THROUGH CDB as shown in table 97.~~device. These fields correspond to the registers defined in ATA/ATAPI7 volume 2 with the same names, and also to the FIS fields defined in ATA/ATAPI 7 volume 3 with the same names.~~

The SATL shall determine if a data transfer is necessary and how to perform the data transfer by examining values in the MULTIPLE_COUNT field, PROTOCOL field, OFF_LINE field, T_DIR bit, BYTE_BLOCK bit, and T_LENGTH field. The SATL shall ignore the COMMAND field in the CDB except to copy the ~~COMMAND~~ Command field in the Register – Host to Device FIS or to the ATA Command register. If the ATA command completes with an error, then ~~a copy of~~ the ~~PATA registers, or a copy of~~ SATL shall return the ~~SATA Register – Device to Host FIS shall be returned~~ Error Output fields (see ATA8-ACS) in the ATA ~~Status~~ Return ~~Descriptor~~ descriptor (see 12.2.5).

The SATL shall configure the ATA host and the ATA device for the PIO, DMA, and UDMA ~~speeds~~ 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 COMMAND field of the CDB may specify the ATA SET FEATURES command. The ATA PASS-THROUGH (12) command should not be used to issue an ATA SET FEATURES command that changes the PIO/DMA/UDMA or other transfer modes of the ATA device. The result of a 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 action based on the contents of the CDB.

The BYTE_BLOCK (Byte/Block) bit ~~indicates~~ specifies whether the transfer length in the location specified by the T_LENGTH field specifies the number of bytes to transfer or the number of blocks to transfer. If the value in the BYTE_BLOCK bit is set to zero, then the SATL shall transfer the number of bytes specified in the location specified by the T_LENGTH field. If the value in the BYTE_BLOCK bit is set to one the SATL shall transfer the number of blocks specified in the location specified by the T_LENGTH field. The SATL shall ignore the BYTE_BLOCK bit when the T_LENGTH field is set to zero.

The CK_COND (Check Condition) bit may be used to request the SATL to return a copy of ATA register information in the sense data upon command completion. If the CK_COND bit is set to one the SATL shall return

a status of CHECK CONDITION when the ATA command completes, even if the command completes ~~successfully. If the command completes successfully, the SATL shall set the sense key to NO SENSE~~ successfully and ~~shall set the additional sense code to NO ADDITIONAL SENSE INFORMATION. The SATL shall~~ return the ATA registers and related information in the sense data using the ATA ~~Status~~ Return ~~Descriptor (see table 12.2.5)~~descriptor (see 12.2.4). If the CK_COND bit is set to zero, 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.

~~If the CK_COND bit is set to zero, 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. If the CK_COND bit is set to one and the command completes successfully the SATL shall terminate the command with CHECK CONDITION status with a sense key of RECOVERED ERROR and an additional sense code of ATA PASS-THROUGH INFORMATION AVAILABLE (see SPC-4) status.~~

The DEVICE field specifies a value for the SATL to load into the ATA ~~DEVICE~~ Device register or the ~~DEVICE~~ Device field of the Register - Host to Device FIS. Table 94 shows the bits in the DEVICE field.

Table 94 — ATA PASS-THROUGH (12) command and ATA PASS-THROUGH (16) 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. If the ATA host has two devices attached, the SATL may represent them as two distinct logical units or as two distinct SCSI target devices. The SATL shall set the DEV bit in the ATA DEVICE register to the value corresponding to the LUN or SCSI target port for each ATA device.~~

The SATL shall ignore the DEV bit in the DEVICE field of the CDB.

The SATL shall set the value of the DEV bit in the ATA device register based upon the mapping of ATA devices to I_T_L nexuses.

~~The SATL shall set the ATA host registers or construct the Register - Host to Device FIS using the values from the CDB in the FEATURES (7:0) field, the SECTOR_COUNT (7:0) field, the LBA_LOW (7:0) field, the LBA_MID (7:0) field, the LBA_HIGH (7:0) field, the DEVICE field, and the COMMAND field.~~

If the PROTOCOL field specifies a PIO data transfer, the SATL shall perform a PIO type transfer. The MULTIPLE_COUNT field specifies the ~~power~~ logarithm base 2 of ~~two for~~ the number of logical sectors ~~transferred~~ an ATA host shall transfer per DRQ Data Block (e.g, if the field is set to 4, the SATL shall transfer 2^4 (i.e., 16) logical sectors of data in each DRQ Data Block). If the MULTIPLE_COUNT field is nonzero and the COMMAND field is not a READ MULTIPLE command, a READ MULTIPLE EXT command, a WRITE MULTIPLE command, a WRITE MULTIPLE EXT command, or a WRITE MULTIPLE FUA EXT 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.

The OFF_LINE field specifies the time period during which the ATA Status register and the ATA Alternate Status register may be invalid after command acceptance. In a SATL with a PATA device attached, some commands may cause the PATA device to place the ATA bus in an indeterminate state. This may cause the ATA host to see command completion before the command is completed. When the application client issues a command that is capable of placing the bus in an indeterminate state, it shall set the OFF_LINE field to a value that specifies the maximum number of seconds from the time a command is issued until the ATA Status register is valid. The SATL shall not use the ATA Status register or ATA Alternate Status register 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, 2, 6, and 14 seconds) after the command register is stored.

NOTE 1 - If the application client specifies an off_line value that is too small, the results are indeterminate and may compromise the integrity of the data.

If the Transfer Direction (T_DIR) bit and the direction of the data transfer specified in the PROTOCOL field do not match, 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 T_DIR bit is set to zero, then the SATL shall transfer from the application client to the ATA device. If the T_DIR bit is set to one, then the SATL shall transfer 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.

The Transfer Length (T_LENGTH) field specifies where in the CDB the SATL shall locate the transfer length for the command (see table 95). ~~The transfer length is an unsigned integer in the range of 00h to FFh.~~

Table 95 — 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
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 ~~STPSIU field~~ STPSIU (see 3.1.x)

~~The~~ Table 97 shows the mapping from the FEATURES (7:0) field, the SECTOR_COUNT (7:0) field, the LBA_LOW (7:0) field, the LBA_MID (7:0) field, the LBA_HIGH (7:0) field, the DEVICE field, and the COMMAND field ~~shall be copied~~ in the ATA PASS-THROUGH (12) CDB to ~~the~~ corresponding ATA command fields ~~or registers of the same name in the ATA host within the SATL~~ (see ~~ATA/ATAPI~~ATA8-~~7~~ACS).

12.2.3 ATA PASS-THROUGH (16) command

Table 96 shows format of the ATA PASS-THROUGH (16) command.

If the EXTEND bit is set to zero, then the FEATURES (15:8) field, the SECTOR_COUNT (15:8) field, the LBA_LOW (15:8) field, the LBA_MID (15:8) field, and the LBA_HIGH (15:8) field shall be ignored by the SATL, and the SATL shall process this command as specified in 12.2.2.

If the EXTEND bit is set to one, then the FEATURES (15:8) field, the SECTOR_COUNT (15:8) field, the LBA_LOW (15:8) field, the LBA_MID (15:8) field, and the LBA_HIGH (15:8) field are valid, and the SATL shall process this command as specified in 12.2.2 except as described in the remainder of this subclause.

Table 96 — ATA PASS-THROUGH (16) command

Byte\Bit	7	6	5	4	3	2	1	0
0	OPERATION CODE (85h)							
1	MULTIPLE_COUNT			PROTOCOL				EXTEND
2	OFF_LINE		CK_COND	Reserved	T_DIR	BYTE_BLOCK	T_LENGTH	
3	FEATURES (15:8)							
4	FEATURES (7:0)							
5	SECTOR_COUNT (15:8)							
6	SECTOR_COUNT (7:0)							
7	LBA_LOW (15:8)							
8	LBA_LOW (7:0)							
9	LBA_MID (15:8)							
10	LBA_MID (7:0)							
11	LBA_HIGH (15:8)							
12	LBA_HIGH (7:0)							
13	DEVICE							
14	COMMAND							
15	CONTROL (see 6.4)							

If the EXTEND bit is set to one and the value in the PROTOCOL field requests the SATL to send an ATA command to the device, then the SATL shall send a 48 bit ATA command to the ATA device. ~~The SATL shall use the FEATURES (7:0) field, the SECTOR_COUNT (7:0) field, the LBA_LOW (7:0) field, the LBA_MID (7:0) field, the LBA_HIGH (7:0) field, the FEATURES (15:8) field, the SECTOR_COUNT (15:8) field, the LBA_LOW (15:8) field, the LBA_MID (15:8) field, the LBA_HIGH (15:8) field, the DEVICE field and the COMMAND field to initiate a command in the ATA device. These fields correspond to the registers defined in ATA/ATAPI-7 volume 2 with the same names, and also to the FIS fields defined in ATA/ATAPI-7 volume 3 with the same names.~~

Table 97 shows the mapping between the fields and the ATA PASS-THROUGH (16) CDB to corresponding ATA command fields (see ATA8-ACS).

Table 97 — Mapping of ATA PASS-THROUGH (16) CDB fields to ATA command fields

CDB field	48-bit ATA command field	28-bit ATA command field
FEATURES (15:8)	Features (15:8)	n/a
FEATURES (7:0)	Features (7:0)	Features (7:0)
SECTOR_COUNT (15:8)	Count (15:8)	n/a
SECTOR_COUNT (7:0)	Count (7:0)	Count (7:0)
LBA_LOW (15:8)	LBA (31:24)	n/a
LBA_LOW (7:0)	LBA (7:0)	LBA (7:0)
LBA_MID (15:8)	LBA (39:32)	n/a
LBA_MID (7:0)	LBA (15:8)	LBA (15:8)
LBA_HIGH (15:8)	LBA (47:40)	n/a
LBA_HIGH (7:0)	LBA (23:16)	LBA (23:16)
DEVICE (7:4)	Device (7:4)	Device (7:4)
DEVICE (3:0)	Device (3:0)	LBA (27:24)
COMMAND	Command	Command

See 12.2.2 for a description of the MULTIPLE_COUNT field, the PROTOCOL field, the OFF_LINE field, the CK_COND bit, the T_DIR bit, and the BYTE_BLOCK bit.

The SATL shall determine the transfer length by the method specified in the T_LENGTH field (see table 98). ~~If EXTEND bit is set to zero, the transfer length shall be an unsigned integer in the range from 00h to FFh. If EXTEND bit is set to one, the transfer length shall be an unsigned integer in the range from 0000h to FFFFh.~~

Table 98 — EXTEND bit and T_LENGTH field

EXTEND	T_LENGTH	Description
0~~b~~	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 STPSIU (see 3.1.x) ~~STPSIU field~~.
1~~b~~	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 STPSIU (see 3.1.x) ~~STPSIU field~~.

12.2.4 ATA PASS-THROUGH status return

Table 100 shows the possible results of ATA PASS-THROUGH (12) command or ATA PASS-THROUGH (16) command processing depending on the value of the CK_COND bit in the CDB, as reflected in the ~~ATA ERR~~ ERR bit and ~~DF~~ DF bit in the ATA ~~STATUS register or in the STATUS HI~~ Status field ~~and the STATUS LO field of the SATA Set Device Bits – Device to Host FIS.~~

~~**Table 99 — ATA command results**~~

ATA ERR	DF	sense data returned
zero	zero	No error, successful completion or command in progress. If the CK_COND bit is set to zero in the ATA PASS-THROUGH (12) command or the ATA PASS-THROUGH (16) command, then the SATL shall respond to a REQUEST SENSE command and shall return sense data with the sense key set to NO SENSE with the additional sense code set to NO ADDITIONAL SENSE INFORMATION. If the CK_COND bit is set to one in the ATA PASS-THROUGH (12) command or the ATA PASS-THROUGH (16) command, then the SATL shall terminate the command with CHECK CONDITION status with the sense key set to NO SENSE with the additional sense code set to ATA PASS-THROUGH INFORMATION AVAILABLE (see SPC-4). The sense data shall include the ATA Status Return Descriptor.
zero	one	The command was not accepted or otherwise failed to complete successfully. The SATL shall terminate the command with CHECK CONDITION status with the additional sense code set to ATA PASS-THROUGH INFORMATION AVAILABLE. The sense data shall include the ATA Status Return Descriptor.
one	zero	
one	one	Undefined

Table 100 — ATA command results

CK_COND	Status field		Sense data returned
	ERR	DF	
0	0	0	No error, successful completion or command in progress. The SATL shall respond to a REQUEST SENSE command and shall return sense data with the sense key set to NO SENSE with the additional sense code set to NO ADDITIONAL SENSE INFORMATION.
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-4). The sense data shall include the ATA Status Return Descriptor.
n/a	n/a	1	The ATA command was not accepted or completed with an error. The SATL shall terminate the command with CHECK CONDITION status with the sense key and additional sense code set as described in clause 11 and the sense data shall include the ATA Status Return Descriptor (see 12.2.5).
	1	0	

If the sense data is provided in response to an ATA PASS-THROUGH (12) command or ATA PASS-THROUGH (16) command in which the CK_COND bit was set to one, then the SATL shall set the additional sense code to ATA PASS-THROUGH INFORMATION AVAILABLE (see SPC-4), and shall include the ATA Status Return Descriptor (see 12.2.5) in the sense data.

NOTE 2 -This capability allows the host to retrieve the ATA register or field information with successful command completion by returning data in the ATA registers or fields.

Some ATA commands return information in the registers. The current ATA ~~Register~~ register information may be retrieved by requesting the ATA Status Return Descriptor issuing the ATA PASS-THROUGH (12) command

or ATA PASS-THROUGH (16) command with the PROTOCOL field set to 15 (i.e., Return Response Information).

12.2.5 ATA ~~Status~~ Return ~~Descriptor~~descriptor

Table 101 shows the format of the ATA ~~Status~~ Return ~~Descriptor~~ descriptor returned in the sense data (see SPC-3 and SAM-3). The SATL shall return the ATA ~~Status~~ Return ~~Descriptor~~ descriptor if the PROTOCOL field in the ATA PASS-THROUGH (12) command or ATA PASS-THROUGH (16) command is set to 15 (i.e., Return Response Information).

The SATL shall support the ATA ~~Status~~ Return ~~Descriptor~~ descriptor if the SATL supports the ATA PASS-THROUGH (12) command or the ATA PASS-THROUGH (16) command. Each time the ATA ~~Status~~ Return ~~Descriptor~~ descriptor is requested; the SATL shall read the ATA registers and return those values in the sense data as shown in table 101. If the sense data is for an ATA PASS-THROUGH (12) command or for the ATA PASS-THROUGH (16) command with the EXTEND bit set to zero the SATL shall return the 28-bit extended status and shall set the EXTEND bit to zero. If the sense data is for an ATA PASS-THROUGH (16) command with the EXTEND bit set to one the SATL shall return the 48-bit extended status and shall set the EXTEND bit to one.

Table 101 — ~~Extended~~ ATA ~~Status~~ Return ~~Descriptor~~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	SECTOR_COUNT (15:8)							
5	SECTOR_COUNT (7:0)							
6	LBA_LOW (15:8)							
7	LBA_LOW (7:0)							
8	LBA_MID (15:8)							
9	LBA_MID (7:0)							
10	LBA_HIGH (15:8)							
11	LBA_HIGH (7:0)							
12	DEVICE							
13	STATUS							

If the EXTEND bit is set to one, then the SECTOR_COUNT (7:0) field and SECTOR_COUNT (15:8) field specify the ATA Sector Count. If the EXTEND bit is set to zero, then the SECTOR_COUNT (7:0) field specifies the ATA Sector Count and SECTOR_COUNT (15:8) field shall be ignored.

If the EXTEND bit is set to one, then the LBA_LOW (7:0) field, LBA_MID (7:0) field, LBA_HIGH (7:0) field, LBA_LOW (15:8) field, LBA_MID (15:8) field, and LBA_HIGH (15:8) field specify the ATA LBA. If the EXTEND bit is set to zero, then the LBA_LOW (7:0) field, LBA_MID (7:0) field, and LBA_HIGH (7:0) field specify the ATA LBA, and the LBA_LOW (15:8) field, LBA_MID (15:8) field, and LBA_HIGH (15:8) field shall be ignored.

12.3 SAT-specific mode pages

12.3.1 SAT-specific mode pages overview

This subclause describes mode pages that the SATL may implement that are unique to the ~~SCSI – ATA translation environment~~ SCSI / ATA Translation standard. These mode pages are for use by the SATL, ~~and~~ are shown in table 102, and are described in this subclause. Support for these mode pages is optional. A SATL should support the appropriate mode page for the ~~attached~~ ATA environment (e.g., PATA).

Table 102 — ~~SCSI – ATA~~ SCSI / ATA Translation specific mode pages

PAGE CODE	SUB PAGE CODE	~~Page~~ Mode page name
0Ah	F1h	PATA Control Mode Page
0Ah	F2h	Reserved ~~for SAT~~

12.3.2 PATA Control mode page ~~Mode Page (Page 0Ah, Sub Page F1h)~~

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 mode parameters that are provided for this mode page.

SATL implementations that support the attachment of PATA devices ~~shall~~ may support this mode page, ~~when requested through MODE SENSE command.~~ and if this mode page is supported, the SATL ~~implementations~~ should allow application clients to configure alternate PATA timings using the MODE SELECT command.

Table 103 shows the PATA Control mode page.

Table 103 — 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	MWDMA [a] ~~field~~ bits			Reserved		PIO [b] ~~field~~ bits	
		MWD2	MWD1	MWD0			PIO4	PIO3
5	Reserved	UDMA [c] ~~field~~ bits						
		UDMA6	UDMA5	UDMA4	UDMA3	UDMA2	UDMA1	UDMA0
6	Reserved							
7								

[a] ~~MWDMA stands for~~ The Multi-Word Direct Memory Access (MWDMA) ~~and the MWDx~~ bits specify a number of hardware-assisted data transfer modes defined in ~~ATA/ATAPI~~ATA8-~~7~~APT.

[b] PIO stands for Programmed Input and Output and the PIOx bits specify transfer modes performed under program control defined in ~~ATA/ATAPI~~ATA8-~~7~~APT.

[c] ~~UDMA stands for~~ Ultra Direct Memory Access (UDMA) ~~and the UDMAx~~ bits represent a number of hardware-assisted data transfer modes defined in ~~ATA/ATAPI~~ATA8-~~7~~APT.

The parameters saveable (PS) bit is defined in SPC-3.

The SPF bit (see SPC-3) shall be set to one to access this mode page.

The PAGE CODE field shall be set to 0Ah.

The PAGE LENGTH field shall be set to 0004h.

The SUBPAGE CODE field shall be set to F1h.

SATL implementations may save the state of the timing parameters defined in this mode page. However, SATL implementations shall not use any saved parameters to configure the ATA host timing modes to an illegal configuration for the attached PATA device.

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 changeable mode parameters for this mode page.

Editor's Note 1: This mode page shall support changeable parameters, does this imply that returning changeable parameters is required (PC=01b) as seems stated after table 102? If so this contradicts the text in the MODE SENSE command.Perhaps changeable and saving should be unspecified for the other mode pages and shall for this mode page after the may/should/shall supported is determined. (From DELL LB comment.)

When processing a MODE SENSE command, the SATL shall set the PIO3 bit and PIO4 bit as shown table 104 to identify the configured PIO mode.

Table 104 — PIO modes

PIO4	PIO3	PIO mode
0	0	Reserved
1	0	The ATA host shall use PIO mode 3 transfers.
0	1	The ATA host shall use PIO mode 4 transfers.
1	1	Reserved

Editor's Note 2: Swaped pio3 and pio4 columns - be sure to change in draft when this proposal is integrated. Also, is this correct? A "1" in pio4 means use PIO mode 3 transfers?

When 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 receives a MODE SELECT command and the ~~PIO field indicates~~ PIO bits specify a change from the current setting, the SATL shall configure the ATA host to use the new PIO transfer rate, if supported. The application client shall not request a PIO mode setting that the ATA device ~~is unable to~~ does not to support. If the application client requests a PIO setting that the ATA device ~~is unable to~~ does not support, then the SATL shall return a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST and the additional sense code set to INVALID FIELD IN PARAMETER LIST.

The MWD0 bit, the MWD1 bit, and the MWD2 bit are collectively referred to as the ~~MWDMA field~~ MWDMA bits. If the ATA host in the SATL is currently configured to use ~~multi word~~ multiword DMA (MWDMA), then the ~~MWDMA field~~ MWDMA bits ~~is~~ are used to determine what mode is currently being used, what modes are supported by the ATA host, and control of the MWDMA mode.

If the SATL receives a MODE SENSE command requesting the current values of the PATA Control mode page, the MWD0 bit shall be set to one by the SATL when the host and device are configured to use MWDMA mode 0. The MWD1 bit shall be set to one by the SATL when the host and device are configured to use MWDMA mode1. The MWD2 bit shall be set to one by the SATL when the host and device are configured to use MWDMA mode 2.

If the SATL receives a MODE SENSE command requesting the changeable values of the PATA Control mode page, the MWD0 bit shall be set to one if the ATA host supports MWDMA mode 0. The MWD1 bit and MWD0 bit shall each be set to one if the ATA host supports MWDMA mode 1. The MWD2 bit, the MWD1 bit, and the MWD0 bit shall be each be set to one if the ATA host supports MWDMA mode 2.

Table 105 specifies values set by the SATL in the MWD0 bit, the MWD1 bit, and the MWD2 bit for current and changeable MWDMA settings.

Table 105 — MWDMA modes reported by MODE SENSE

~~MWDMA~~ [a] ~~field~~ MWDMA [a] bits			ATA host and device shared configuration settings returned as current values	ATA host support returned as changeable values
MWD2	MWD1	MWD0		
0	0	0	Configured not to use multiword DMA	Illegal combination
1	0	0	Configured to use MWDMA mode 1	
0	1	0	Configured to use MWDMA mode 2	
1	1	0	Configured to use MWDMA modes 1 and 2	
0	0	1	Configured to use MWDMA mode 0	MWDMA mode 0 supported
1	0	1	Configured to use MWDMA modes 0 and 2	Illegal combination
0	1	1	Configured to use MWDMA modes 0 and 1	MWDMA mode 1 supported
1	1	1	Configured to use MWDMA modes 0, 1 and 2	MWDMA mode 2 supported

[a] If the application client attempts to set a MWDMA mode that is not supported by the ATA host environment, the SATL shall return a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN PARAMETER LIST.

Editor's Note 3: Reordered mwdx columns - be sure to integrate swapped columns into draft.

If the SATL receives a MODE SELECT command and the ~~MWDMA field indicates~~ MWDMA bits specify a change from the current settings, then the SATL shall issue an ATA SET FEATURES - Set Transfer Mode (i.e., Features register set to 03h) command to the ATA device to set the MWDMA mode on the device to the requested state, and then:

~~1) issue a SET FEATURES, sub-command 03h (Set Transfer Mode) to the ATA device, to set the MWDMA mode on the device to the requested state;~~

~~2) check the status of the SET FEATURES command once completed, and if the command completes in error, the SATL shall not change any host timing modes and shall complete the MODE SELECT command with a CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to ATA DEVICE FAILED SET FEATURES, and the SATL shall take no further action regarding this MWDMA mode request; or~~

~~1) if the SET FEATURES command completes without error the SATL shall configure the ATA host to communicate with the device at the requested MWDMA mode; and~~

~~2) complete the MODE SELECT command with good status.~~

a) if the ATA SET FEATURES command completes with an error, then the SATL shall:

1) not change any host transfer modes;

2) complete the MODE SELECT command with a CHECK CONDITION status with the sense key set to ABORTED COMMAND with the additional sense code set to ATA DEVICE FAILED SET FEATURES; and

3) take no further action regarding this request to change the MWDMA transfer rate;

or

b) if the SET FEATURES command completes without error, then the SATL shall:
   1) configure the ATA host to communicate with the device at the requested MWDMA transfer rate; and
   2) complete the MODE SELECT command with GOOD status.

The ~~MWDMA field~~ MWDMA bits values used to configure ATA hosts and ATA devices using the MODE SELECT command have the same meaning as the ~~MWDMA field~~ MWDMA bits values returned by the MODE SENSE command when current values are requested as shown in table 105.

If the SATL receives a request to set a MWDMA mode that is not supported by the ATA host or the attached PATA device, the SATL shall return a CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with 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 field~~ UDMA bits, and are used to determine support for, current use of, and control of Ultra DMA (UDMA) ~~timings~~ transfer rates on the ATA host and device. The SATL shall determine the highest UDMA mode supported as being the lower of the ATA host maximum transfer mode and the device maximum transfer mode.

NOTE 3 - The ATA device returns the UDMA transfer mode specified in ATA IDENTIFY DEVICE data, word 88, bits 6:0 (see ~~ATA/ATAPI~~ATA8-~~7~~ACS).

If the SATL receives a MODE SENSE command requesting the changeable values of the PATA Control mode page, the UDMA ~~field~~ bits shall be set according to table 106.

Table 106 — UDMA ~~Field~~ bits ~~R~~requirements for changeable MODE SENSE parameters

UDMA6	UDMA5	UDMA4	UDMA3	UDMA2	UDMA1	UDMA0	Highest UDMA mode supported
0	0	0	0	0	0	0	UDMA 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

Editor's Note 4: Reordered columns - make sure to integrate properly into draft.

If the SATL receives a MODE SENSE command requesting the current values of the PATA Control mode page, the SATL shall set the ~~UDMA field~~ UDMA bits as defined in table 107. Only one ~~UDMA~~ of the UDMA bits shall ~~bet~~ be set to one at any time for such a request. If UDMA is not the current DMA transfer mode, all the ~~bits in the UDMA field~~ UDMA bits shall be set to zero. If a UDMA transfer mode is being used, all the MWDMA bits ~~in the MWDMA field~~ shall be set to zero.

Table 107 — 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

When the SATL receives a MODE SELECT command and the ~~UDMA field indicates~~ UDMA bits request a change in the ~~requested~~ UDMA ~~speed~~ transfer rate ~~in the communications interface~~, then the SATL shall:

~~1) issue a SET FEATURES, sub-command 03h, to set the UDMA timing mode on the device to the requested state;~~

~~2) check the status of the SET FEATURES command once completed, and if the command completes in error, the SATL shall not change any host timing modes and shall complete the MODE SELECT command with a CHECK CONDITION status with the sense key set to ABORTED COMMAND with the additional sense code set to ATA DEVICE FAILED SET FEATURES, and the SATL shall take no further action regarding this timing mode request; or~~

~~1) if the SET FEATURES command completes without error the SATL shall configure the ATA host to communicate with the device at the requested UDMA timing speeds; and~~

~~2) complete the MODE SELECT command with GOOD status.~~

1) if the SET FEATURES command completes with an error, then the SATL shall:
   A) not change any host transfer modes;
   B) complete the MODE SELECT command with a CHECK CONDITION status with the sense key set to ABORTED COMMAND with the additional sense code set to ATA DEVICE FAILED SET FEATURES; and
   C) take no further action regarding this request to change the UDMA transfer rate;

and

2) if the SET FEATURES command completes without error, then the SATL shall:
   A) configure the ATA host to communicate with the device at the requested UDMA transfer rate; and
   B) complete the MODE SELECT command with GOOD status.

If the application client attempts to set a mode that the ~~underlying~~ ATA host or ATA device does not support, then the SATL shall ~~return a~~ terminate the MODE SELECT command with CHECK CONDITION status with the sense key set to ILLEGAL REQUEST with the additional sense code set to INVALID FIELD IN PARAMETER LIST.

12.4 SAT-specific Vital Product Data pages

12.4.1 SAT-specific Vital Product Data overview

This subclause defines VPD pages specific to SAT implementations.

12.4.2 ATA Information VPD page

12.4.2.1 ATA Information VPD page overview

The ATA Information VPD page shall contain:

a) information about the SATL;
b) Signature of the ATA or ATAPI device; and
c) ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data from the ATA or ATAPI device.

Some SATLs may modify ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data. If a SCSI application client requires the unmodified ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data, then the ATA PASS-THROUGH command should be used to retrieve the ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data.

Table 108 defines the ATA Information VPD page.

Table 108 — 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 (238h)				
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 or ATA IDENTIFY PACKET DEVICE data (see 12.4.2.3)							
571								

The PERIPHERAL QUALIFIER field and the PERIPHERAL DEVICE TYPE field shall be set as described in 8.1.2.

The PAGE CODE field shall be set to 89h.

The PAGE LENGTH field shall be set to 238h.

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-3 and on the T10 web site (http://www.t10.org).

The SAT PRODUCT IDENTIFICATION field shall contain sixteen 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 is described in 12.4.2.2.

The COMMAND CODE field contains the of the ATA command used to retrieve the data in the IDENTIFY DEVICE or IDENTIFY PACKET DEVICE DATA field. The possible command codes are:

a) ECh for an IDENTIFY DEVICE command (i.e., for an ATA device);
b) A1h for an IDENTIFY PACKET DEVICE command (i.e., for an ATAPI device); or
c) 00h for other device types.

The ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data is described in 12.4.2.3.

12.4.2.2 ATA device signature

The ATA device signature shall contain the contents of the task file registers after the last power-on reset, hardware reset, software reset, or EXECUTE DEVICE DIAGNOSTIC command. The ATA device signature shall follow the format of the initial SATA Device-to-Host Register FIS (see SATA 2.5). Table 110 shows the ATA device signature.

Table 109 — 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 LOW [b]							
5	LBA MID [b]							
6	LBA HIGH [b]							
7	DEVICE [b]							
8	LBA LOW EXP [b]							
9	LBA MID EXP [b]							
10	LBA HIGH EXP [b]							
11	Reserved							
12	SECTOR COUNT [b]							
13	SECTOR COUNT EXP [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 2.5). Otherwise the INTERRUPT field and the PM PORT field are reserved.
[b] These fields are fields with the same names defined in ATA8-ACS.

The TRANSPORT IDENTIFIER field may contain the values shown in .

Table 110 — TRANSPORT IDENTIFIER field values

Code	Transport
00h	PATA (see ATA8-APT)
34h	SATA (see SATA 2.5)
other	Reserved

The INTERRUPT bit corresponds to the “I” bit (i.e., bit 14 of dword 0) of the Register Device-to-Host FIS (see SATA 2.5).

All the remaining fields within the ATA device signature are defined in ATA8-APT and SATA 2.5.

Table 111 lists common signature values for fields within the ATA device signature.

Table 111 — Common ATA device signature values (informative)

Field	ATA device	ATAPI device
Sector count	01h	01h
LBA Low	01h	01h
LBA Mid/Byte Count Low	00h	14h
LBA High/Byte Count High	00h	EBh
Device	00h	00h

12.4.2.3 ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data

If the command is an ATA IDENTIFY DEVICE command, and the command completes without error, then the IDENTIFY DEVICE OR IDENTIFY PACKET DEVICE DATA field shall contain the ATA IDENTIFY DEVICE data (ATA8-ACS).

If the command is an ATA IDENTIFY PACKET DEVICE command, and the command completes without error, then the IDENTIFY DEVICE OR IDENTIFY PACKET DEVICE DATA field shall contain the IDENTIFY PACKET DEVICE data (see ATA8-ACS).

The IDENTIFY DEVICE OR IDENTIFY PACKET DEVICE DATA field shall contains 512 bytes of 00h if:

a) the command is an IDENTIFY DEVICE command or an IDENTIFY PACKET DEVICE command and the command completes with an error; or
b) the command code is 00h (i.e., some other device type).

The data shall be presented with byte preservation (i.e., ATA byte n maps to SCSI byte n), as shown in table 112.

Table 112 — ATA IDENTIFY DEVICEdata or ATA IDENTIFY PACKET DEVICE data

Byte	Contents
0	ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data word 0 bits 7:0 (i.e., byte 0)
1	ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data word 0 bits 15:8 (i.e., byte 1)
2	ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data word 1 bits 7:0 (i.e., byte 2)
3	ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data word 1 bits 15:8 (i.e., byte 3)
...	...
510	ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data word 255 bits 7:0 (i.e., the signature byte of the Integrity word, see ATA8-ACS)
511	ATA IDENTIFY DEVICE data or ATA IDENTIFY PACKET DEVICE data word 255 bits 15:8 (i.e., the checksum byte of the Integrity word, see ATA8-ACS)

NOTE 4 - Although the Serial number field (i.e., words 19:10), Firmware revision field (i.e., words 26:23), and Model number field (i.e., words 46:27) contain ASCII characters, every other byte is swapped within them (see ATA8-ACS) (e.g., the 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 IDENTIFY DEVICE OR IDENTIFY PACKET DEVICE DATA field: {byte 21, byte 20, byte 23, byte 22,...}).

Since some of the fields within the ATA IDENTIFY DEVICE date or ATA IDENTIFY PACKET DEVICE data may change depending on the state of the ATA device, the SATL shall reissue the ATA IDENTIFY DEVICE command or ATA IDENTIFY PACKET DEVICE command to retrieve updated data whenever the ATA Information VPD page is requested.