

Accredited Standards Committee*
X3, Information Processing Systems

Doc No.:	X3/92-0896-X S
Date:	June 10, 1992
Proj. No.:	791-D
Ref.:	Comment #3
Reply To:	Lynn Barra 202-626-5738
cc:	X3 members, SPARC, SMC, Subgroup Officers

To: X3T9 -- FOR ACTION

Subject: Transmittal of Public Review Comment #3
 BSR X3.221-199x, ATA (At Attachment)

Attached is a comment on BSR X3.221-199x, submitted by Mr. Shishir Shah of Western Digital Corp.

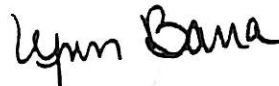
In order to provide administrative control, the Secretariat is maintaining a register of all comments received during the public review and has assigned the comment registry number indicated above.

The X3.221-199x, public review and comment period extends from March 6, 1992 through July 6, 1992. The comment was received on June 10, 1992.

If the Technical Committee action is to accept in whole or in part a proposal contained in the comment, then the changes should be sent to the Coordinator of National Standards Processing together with any TC comments supporting the change. If the TC action is to reject in whole or in part proposals contained in the comment, the response should provide the rationale for the rejection.

The comment should be discussed at the next TC meeting, and if not definitively responded to at once, an interim acknowledgment should be sent along with an estimated date of action. When a final response is issued you must inform the commentors of their need to notify the Secretariat of their satisfaction or dissatisfaction with the committee's response. The commentor is required to send the Secretariat a written statement indicating acceptance or rejection of the TC response within fifteen working days. The commentor must be made aware that failure to respond within fifteen working days indicates to the Secretariat that the comment has been withdrawn.

Sincerely,



Lynn Barra
 Coordinator, Nat'l. Standards Processing, X3

Attachment: Comment #3

cc: D. Shoemaker, X3T9 Chair
 J. Lohmeyer, X3T9.2 Chair



WESTERN DIGITAL CORPORATION 8105 IRVINE CENTER DRIVE
IRVINE CALIFORNIA 92718 TELEPHONE 714 932 5000

April 29 1992

TO:
Lynn Barra,
X3T9.2 Secretariat.
311, 1st street, NW suite 500,
Washington D.C. 20001

Dear Lynn,

Subject: Public Review Comments for ATA standards rev 3.0.

I have enclosed a document as public review comments against ATA attachment draft DSR x3.221, project # 791-D. The current ATA attachment draft revision 3.0 along-with combination of existing INT 13H BIOS interface limits the ATA drive capacity to 528 MB.

This document addresses this issue. It is the opinion of western digital that a LBA mode of operation is essential to the success of the 3.0 ATA specification. Without it the industry will adopt multiple variant proposals until ATA extensions finally address this issue 1 to 2 years from now!

Please forward this document to ATA committee and kindly advise me of any changes to ATA draft attachment that may address this issue.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Shishir Shah', written over a faint, circular stamp or watermark.

Shishir Shah.
Principle Engineer,
Western Digital Corporation.

SUPPORT FOR GREATER THAN 528MB ATA DRIVE

APRIL, 1992

REVISION 1.3

BY

SHISHIR SHAH

WESTERN DIGITAL CORPORATION

PURPOSE:

This document is written as public review comments against ATA Attachment Draft Revision 3.0 (DSR x3.221, project 791-d). The purpose of this document is to break 528MB boundary limitations created by combination of BIOS and ATA interface.

PROBLEM:

Today, INT 13H interface defines 10 bit cylinder number (zero based), 8 bit head number (zero based, maximum 255) and 5 bit sector number (one based). ATA task file interface defines 16 bit cylinder number (zero based), 4 bit head number (zero based) and 8 bit sector number (one based). Minimum of these cylinder, head and sector numbers define the maximum capacity of 528 MB for AT IDE drive using standard BIOS and drivers from different OS vendors. Following table tabulates this information.

	BIOS	IDE	Limitation
Max Sectors/Track	63	255	63
Number of heads	255	16	16
Number of Cylinders	<u>1024</u>	<u>65536</u>	<u>1024</u>
Maximum Capacity	8.4 GB	136.9 GB	528 MB

During boot up sequence, System INT 13H BIOS (AT IDE) reads the drive type from CMOS and gets drive geometry parameters either from BIOS tables or from CMOS (user-defined) or by performing drive Identify command. It resets the drive and sets IDC parameter (sectors/track, Heads and cylinders) equal to that is mentioned in the drive table. Same parameters are presented to DOS via INT 13H interface. Drive uses the same parameters to translate Sectors/track, Head and cylinder number to compute the Logical Block Address (LBA). Based on this LBA drive will compute the true physical drive geometry parameters.

To support higher capacity than 528 MB ATA drive, BIOS must perform translation from ATA interface parameters to INT 13H interface drive geometry parameters. This means BIOS uses different geometry parameters for Set drive parameter command than actually reported at INT 13H interface. This poses the problem for the protected mode device drivers as they do not know what parameters they should use to communicate with the drive.

PROPOSED SOLUTION:

ATA Task file has total of 28 bits available for Sectors, Heads and Cylinder Numbers. If we were to change the definition of these registers as shown below we can access of 137 GB of data at this interface.

	Current								Proposed							
Bits	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sector Number	S	S	S	S	S	S	S	S	LBA Byte 0							
Cylinder Low	C	C	C	C	C	C	C	C	LBA Byte 1							
Cylinder High	C	C	C	C	C	C	C	C	LBA Byte 2							
SDH Port	1	0	1	D	H	H	H	H	1	L	1	D	LBA	27	24	

Where:

C = Cylinder Number
 D = Drive Select
 H = Head Number
 L = 1, Task File in LBA Format
 S = Sector Number

The selection of LBA vs Cylinder, Head and Sector in the task file is made by using a BIT 6 of SDH (port address 1F6H/176H) register. Currently this bit is defined as 0 in ATA specification. This bit should be redefined as Logical Block Address Bit, when set to 1, task file will indicate Logical Block Address.

All op-codes defined in ATA specification Rev 3.0, remain the same. The host will write task file register with LBA, set Logical BIT in SDH port and issue the command. The task file registers Cylinder, Head and sector number, will be valid only when I/O is completed successfully OR error is detected during an I/O operation. When last sector/block is transferred, drive will update the task file with correct value of LBA in Cylinder, Head and Sector Registers.

Drive that supports LBA will maintain its geometry parameters through soft resets. Drive will maintain the last IDC parameters until the next IDC (Set parameter) command is issued.

CHANGE TO IDENTIFY COMMAND:

Since new capability is added to this interface, BIT 9 of word 49 (Drive capabilities) of IDENTIFY Command data is defined as Logical Block support available. This bit is currently defined as 0 by ATA specifications.

Word 49 Drive Capabilities:

Bit 15-10 = 0, Reserved
 09 = 1, LBA Mode Supported
 08 = 1, DMA Supported
 07-00 = Vendor Unique

Word 60 = Maximum user addressable LBA, BITS 15_0

Word 61 = Maximum user addressable LBA, BITS 31_16

It is very important to note that when drive is accessed in LBA mode it will always access the LBA in linear mode irrespective of IDC geometry data.

RECOMMENDED DRIVE TYPE:

It would be nice to have a new drive type that indicates the drive has LBA support. BIOS can use this drive type and issue IDENTIFY command to the drive and auto configure the geometry parameters.

Since there will be a standard drive type defined, Device Drivers that communicate directly to AT IDE interface (Windows 3.1, OS/2, UNIX, Netware, etc) will determine Sectors/Track and Heads from BIOS INT 13H, Read Drive parameter (function =8) command. This geometry is required today to support FDISK partition table (LBA 0) and partitions on the drive.

COMPUTE LBA FROM SECTOR, HEAD, AND CYLINDER NUMBER AT INT 13H INTERFACE:

$LBA = [\{ Cylinder * (\#of\ Heads) \} + Head] * Sectors/Track + Sector - 1$

Initial definition CHS (0, 0, 1) = LBA 0.

CHANGES REQUIRED AS FOLLOWS:

1. Drive F/W:

When command is issued, Drive F/W will read SDH register and check if bit 6 is set. If bit 6 is set, host has programmed task file register with zero based LBA. Upon command completion, update ATA task file with last LBA processed.

Identify command data has to be modified to indicate that LBA support is present. i.e. BIT 9 of word 49 = 1, for LBA support & Word 60 and Word 61 is defined as Maximum user addressable LBA. Drive when accessed in LBA mode, will always access Linear LBAs irrespective of IDC data.

2. INT 13H BIOS:

Changes to BIOS are as follows:

DURING POST:

- Send IDENTIFY Command and check if LBA capability present.
- IF (LBA supported)
 - LBA_Support = TRUE
- ELSE
 - LBA_Support = FALSE
- Get Drive capacity from word 60 - word 61 of IDENTIFY data and if drive type is "Auto Configure" word 1 through 6 indicates the Cylinder, head and sector number.

AT RUN TIME:

- IF (LBA_Support)
 - {
 - Convert INT 13 parameter to LBA.
 - Program ATA Task file with LBA.
 - Set the BIT 6 of head/drive register to 1.
 - Send Normal Op-code.
 - Upon command completion, Read LBA from task file and convert it to INT 13H cylinder, head , sector number.
 - }

3. OS Drivers (Windows 3.1, OS/2, UNIX, Novell):

To support LBA drives, OS drivers must be modified as follows:

Initialization time:

- Send Drive IDENTIFY COMMAND.
- IF (LBA supported)
 - LBA_Support = TRUE
 - Get Drive SPT and Heads from fn 8 / INT 13H.
 - Get total drive capacity from word 60 and word 61 of Identify data.
 - Compute Number of cylinders.
- ELSE
 - LBA_Support = FALSE

RUN TIME:

- IF (LBA_Support)
 - {
 - Program ATA task file with LBA.
 - Set BIT 6 of Drive/Head Register
 - Write Normal Command Code in Command Register (1F7).
 - Upon I/O completion, Read LBA from Task file to get last LBA transferred.
 - }