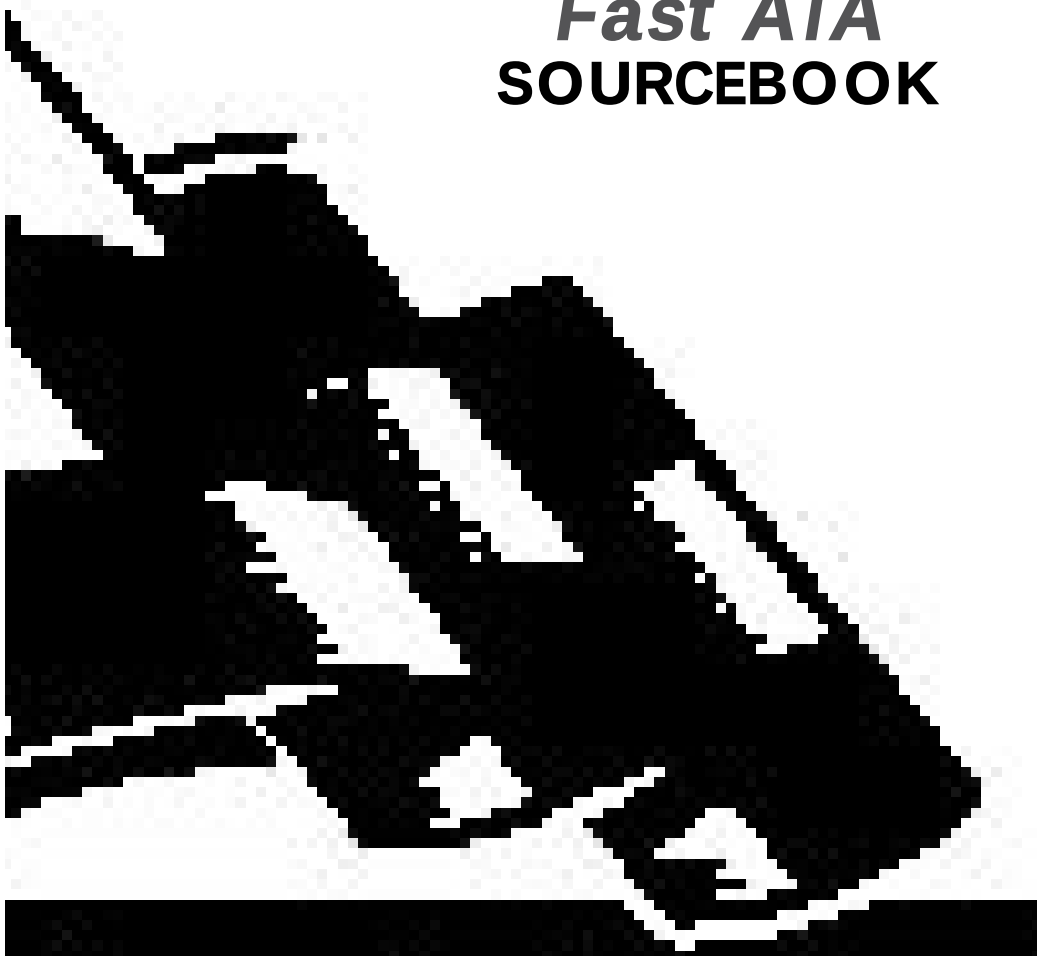
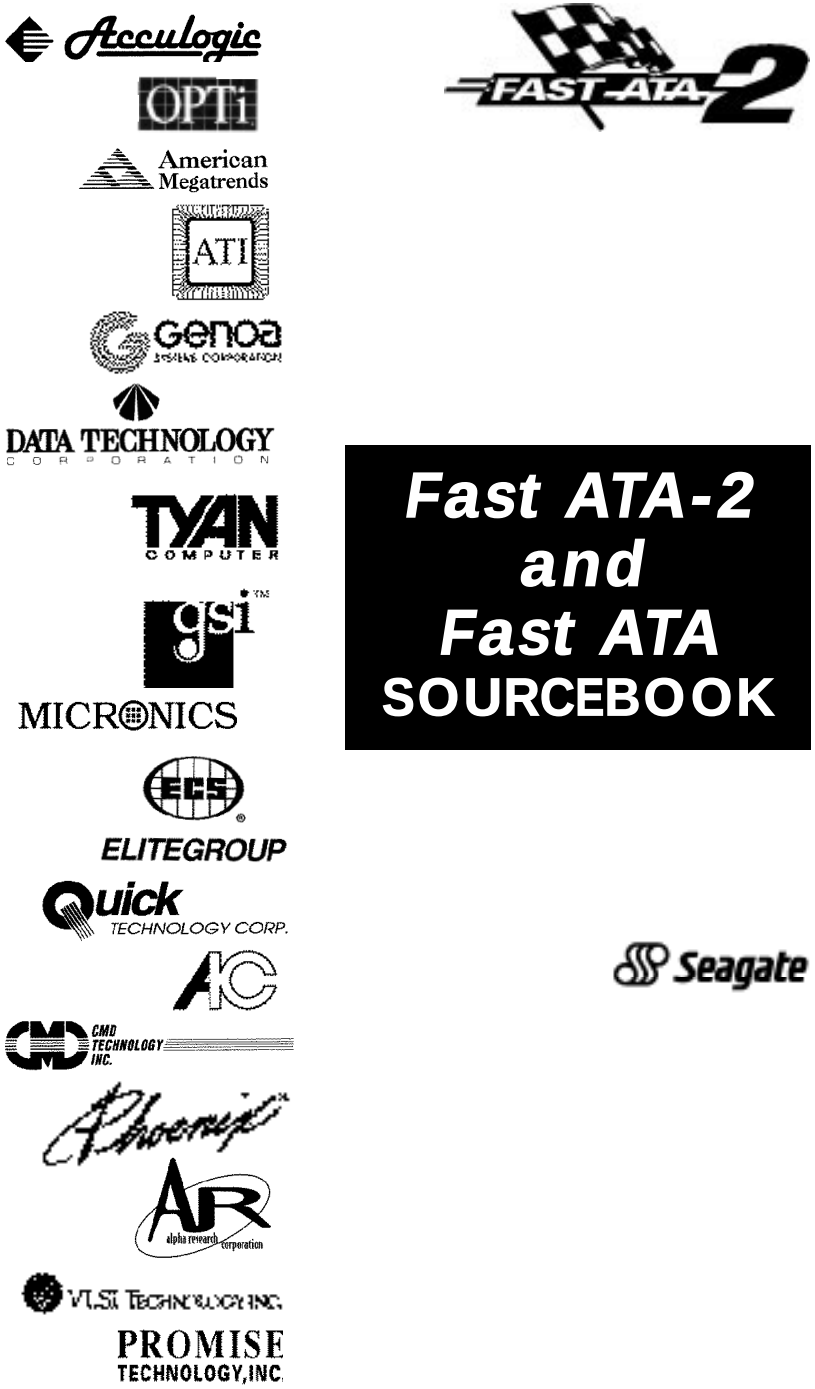


Fast ATA-2 and Fast ATA
SOURCEBOOK



Fast ATA-2 and Fast ATA SOURCEBOOK

Publication Number: 1121-001

Contents

Executive Summary

Fast ATA disc drives can transfer data up to 13.3 Mbytes per second compared with standard ATA transfer rates of 4.1 or 8.3 Mbytes per second. Fast ATA-2 disc drives can transfer data up to 16.6 Mbytes per second.

Fast ATA and Fast ATA-2 are important technologies that can better take advantage of the latest high-speed processors and bus architectures. ATA (IDE) drives cost less to integrate than SCSI drives and have data transfer rates up to 16.6 Mbytes per second. Fast SCSI-2 transfers data up to 10 Mbytes per second. Fast ATA and Fast ATA-2 drives are based on industry-standard specifications and are backward compatible with older ATA (IDE) systems. Fast ATA drives are not, however, expected to displace SCSI in higher-end applications such as file servers, mini computers, mainframes and technical workstations because of SCSI's superior capabilities in these I/O intensive multiuser, multitasking environments.

Seagate Technology and Quantum Corp., who together supply approximately 45% of the world's disc drives, are the leading endorsers of Fast ATA and Fast ATA-2. Any drive, host adapter, BIOS or system supporting the SFF Committee PIO Mode 3 or 4 or DMA Mode 1 or 2 is Fast ATA-compliant. Seagate Fast ATA and Fast ATA-2 drives are available in capacities from 210 Mbytes to 1.08 Gbytes. Form-factors include 2.5-inch slim line, 2.5-inch 19 mm, 3.5-inch low profile and 3.5-inch mini designs.

What are Fast ATA and Fast ATA-2?

Fast ATA is the market identity given to disc drives that support the high-speed data transfers resulting from implementing the industry standard protocols:

- Programmed input/output (PIO) mode 3
- Multiword memory direct access
- Read/write multiple

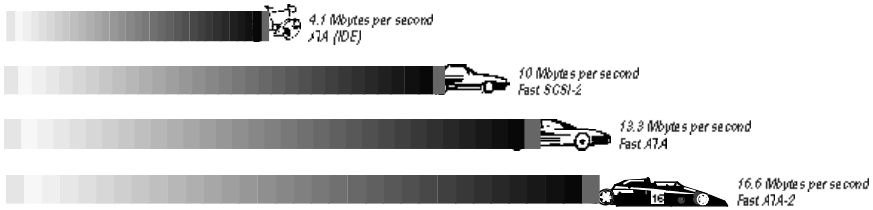
System and disc drive manufacturers who implement the PIO Mode 3 and multiword DMA Mode 1 can transfer data up to a maximum of 11.1 or 13.3 Mbytes per second respectively.

Fast ATA-2 is the market identity given to PIO Mode 4 and Multiword DMA Mode 2 protocols. System and disc drive manufacturers who implement the PIO Mode 4 or multiword DMA Mode 2 can transfer data up to a maximum 16.6 Mbytes per second.

Fast ATA is a simple, easy-to-understand term that means faster data transfer rates. As with SCSI, there are different implementations of the ATA (AT Attachment also referred to as IDE) interface. The market identities given to

the various SCSI protocols include Fast SCSI-2, Wide SCSI-2, SCSI-3, and so forth. ATA protocols are differentiated with the Fast ATA and Fast ATA-2 market identities. End-users and system designers can easily identify with the principal benefit of each implementation—faster data transfer rates. Put simply, Fast ATA drives are faster than standard ATA or IDE drives and Fast ATA-2 drives are even faster

Why are Fast ATA and Fast ATA-2 important?



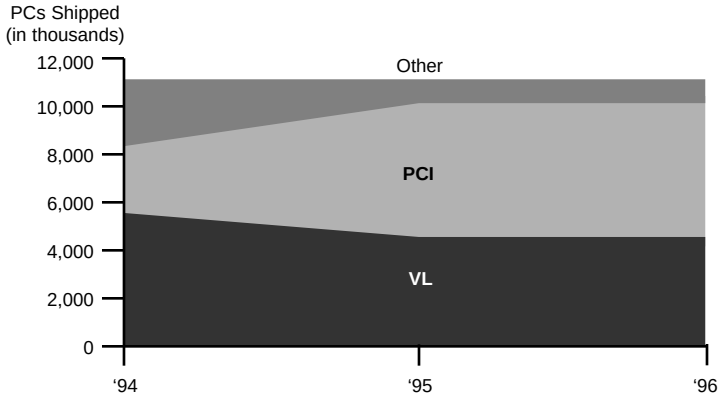
Interface	Burst Transfer Rate
Fast ATA-2	16.6 Mbytes per second
Fast ATA	13.3 Mbytes per second
Fast SCSI-2	10 Mbytes per second
Standard ATA IDE	4.1 Mbytes per second

Computers are faster

A computer is only as fast as its slowest component. Today's 486-, Pentium- and PowerPC-based computers offer processor speeds many times faster than only two years ago. Bus speed have also increased with the inclusion of VL and PCI. Faster processors means that data can be manipulated at ever-increasing speeds. The adoption of 32-bit VL bus or PCI architectures provides extremely high data bandwidth of up to 132 Mbytes per second. Older 16-bit ISA connections had a limit of 8.3 Mbytes per second. Faster buses means the data can be transferred from the storage device to the host at greater speeds. Fast ATA and Fast ATA-2 means that the disc drive can store and access this data faster, enhancing the other high-speed components in the system and removing the bottleneck associated with older IDE drives.

It is estimated that the number of high-speed VL or PCI bus computers will grow from 77% of the market to 96% in 1995.

US Intel and Compatible-Based Desktop/Tower PC Unit Shipments By Local Bus Architecture. Source: IDC 8/94



Low Cost of Integration

Compared to SCSI, Fast ATA is the least expensive way to achieve faster disc drive data transfer rates. The implementation of Fast ATA through system BIOS provides performance without incremental hardware costs. Older systems can support Fast ATA using an inexpensive host adapter. A typical VL-bus to Fast SCSI implementation can cost up to $200 more then a VL bus to Fast ATA implementation, considering not only the cost of the Fast SCSI host adapter but also the higher cost of SCSI hard drives. Read/Write multiple commands can be implimented without any hardware changes by installing an inexpensive software driver.

Ease of Implementation

Fast ATA and Fast ATA-2 are easy to implement in either VL bus or PCI systems. The hardware connection can be made using a standard 40-pin ATA ribbon cable from the drive to the host adapter. Direct connection to the motherboard further eases integration when provided by the motherboard supplier. Once connected, the high data-transfer capabilities of Fast ATA can be enabled through the data-transfer options found in most CMOS BIOS setup tables. Newer versions of BIOS provide automatic configuration for Fast ATA drives. Turn to page 35 for a directory of Fast ATA-capable products.

Interface Performance and Integration Comparison

Interface	Burst Transfer Rate (Mbytes/sec)	Typical Connection[1]	Typical PC Implementation[2]
Standard IDE	4.0 to 8.3	ISA, MB[3]	BIOS
Fast ATA	11.1 or 13.3	PCI, VL, MB	BIOS, Host Adapter
Fast ATA-2	16.6	PCI, VL, MB	BIOS, Host Adapter
SCSI	5.0	ISA	Host Adapter
Fast SCSI	10.0	VL, PCI, EISA	Host Adapter
Fast Wide SCSI	20.0	VL, PCI, EISA	Host Adapter

Systems with motherboards that do not already support the full transfer capabilities of Fast ATA (PIO Mode 2 or lower) or Fast ATA-2 drives (PIO Mode 3 or lower) can be upgraded through flash BIOS, if equipped, or by using Fast ATA or Fast ATA-2 host adapters. Seagate Fast ATA and Fast ATA-2 drives are fully backward compatible with older ATA (IDE) systems. If a Fast ATA or Fast ATA-2 drive is attached to a motherboard that does not support PIO Mode 3 or 4 or DMA Mode 1 or 2, the data transfer rate is limited to the capabilities of the motherboard.

Established Industry Standards

Fast ATA describes products that take advantage of PIO Mode 3 or DMA Mode 1 protocols, allowing data to transfer up to 11.1 or 13.3 Mbytes per second. Fast ATA-2 describes products that take advantage of PIO Mode 4 or DMA Mode 2 protocols allowing data to transfer up to 16.6 Mbytes per second. These data transfer protocols are based on the Small Form Factor (SFF) Committee's official ATA-2 document (Ref: 9048D), which has been submitted to ANSI for approval. The Small Form Factor Committee represents disc drive manufacturers and makes proposals on behalf of the industry to ANSI. The SFF Committee includes manufacturers such as Conner, Quantum, Seagate and Western Digital.

Both Seagate Technology and Quantum Corp. have taken the lead and endorsed the Fast ATA and Fast ATA-2 standards along with most BIOS and host-adapter manufacturers. Seagate and Quantum are the two largest disc drive manufacturers and IDC has estimated that their combined worldwide market share will reach 45% for 1994.

1 The physical bus connection between the disc drive and the host
2 The method by which the transfer rate performance is invoked on a typical IBM or compatible personal computer
3 Direct motherboard connections

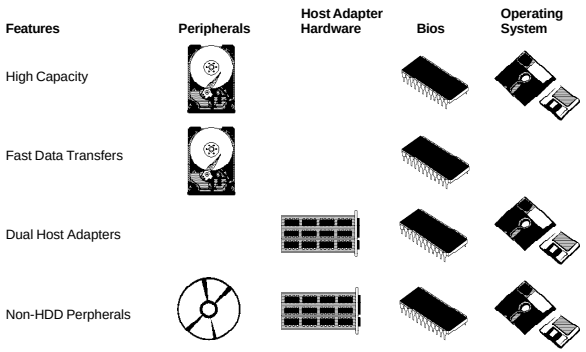
What is the difference between Fast ATA and Enhanced IDE?

Enhanced IDE is the market identity given to a collection of four features that are designed to help meet the future needs of the market. Enhanced IDE features include:

- High-capacity addressing of ATA hard drives over 528 Mbytes
- Fast data transfer rates for ATA hard drives (support for PIO Mode 3 up to 13.3 Mbytes/sec)
- Dual ATA host adapters supporting up to 4 hard disc drives per computer system
- Nonhard disc ATA peripherals (such as CD-ROMs)

Each of these features supports improved functionality at a system level, and accordingly, these features are considered positive for the industry and for end-users. As a package, however, Enhanced IDE is causing increased confusion in the industry while raising the risks of incompatibility and mismatched system integration because these features require an extremely high degree of integration. To have a fully functional Enhanced IDE system, specific support is required not only for the storage peripherals but also for host adapters, core logic, system bus, BIOS and operating systems—virtually every major block of PC architecture. Adding to this complexity is the fact that there is no central industry-supported standard that controls these features.

Required Support for Enhanced IDE Features



Note. Some host adapters provide on-board BIOS support.

Fast ATA and Fast AT-2 represent only the fast data transfer rates for ATA hard drives (support for PIO Mode 3 or 4 and DMA Mode 1 or 2). Fast ATA and Fast ATA-2 data transfer rates can easily be achieved when the system BIOS and hard drive support the PIO and DMA protocols. Fast ATA BIOS have been included in popular computer systems since 1993.

BIOSs that support Fast ATA do not necessarily support high-capacity addressing, dual host adapters or nonhard disc peripherals. Unfortunately for Enhanced IDE, the features are being introduced independently as each manufacturer sees fit for their competitive positioning. Because there is no central industry-supported standard that controls these features, manufacturers may promote their products as Enhanced but only provide some of the features of true Enhanced IDE. The result of this independent introduction is that buyers of newer systems receive only the benefits of an individual feature. For example, fast data transfer rate support is becoming standard on midrange and high-end Local Bus systems. This single feature may satisfy the users immediate requirements without the need for other Enhanced IDE features. In the future, if the same system is upgraded to add the remaining features of Enhanced IDE, the user may be forced to purchase an Enhanced IDE package that contains a feature that is already installed. This represents not only wasted features and unnecessary costs but also may result in integration conflicts and incompatibility with original factory implementation.

"In our experiments with some of the first available Enhanced IDE products, we encountered a variety of problems that prevented us from tapping their full potential."—PC Magazine, July 1994, The Perfect Hard Disk, page 194.

All of Seagate's Medalist, Decathlon and Marathon drives now support Fast ATA or Fast ATA-2 and all are fully backward compatible with older ATA (IDE) (non-Fast ATA) BIOSs.

Will Seagate drives work with nonhard disc ATA peripherals?

Yes. Support for nonhard disc ATA peripherals is primarily targeted at a new generation of CD-ROM and tape drives that provide a low-cost connection alternative to SCSI. Support for these nondisc drive ATA peripherals is included in a draft proposal to the ANSI ATA Committee. This ATA Packet Interface (ATAPI) specification is independent of the existing hard disc specifications. If the other components of the computer system support ATAPI, there will be no incompatibilities with Seagate hard disc drives.

Is high-capacity addressing over 528 Mbytes supported by Seagate drives?

Yes. All Seagate Medalist disc drives over 500 Mbytes support the AT Attachment industry-standard specifications and allow high-capacity addressing. The 528-Mbyte restriction is a limitation of Microsoft DOS

drivers, not the disc drives. The Medalist 1080 (1.08 Gbytes) and Medalist 720 (722 Mbytes) disc drives are available with a software driver that allows the DOS (and Windows) operating system to address the full capacity. Windows 95 (Chicago) is expected to automatically support drive capacities up to 8.4 Gbytes. Third-party host adapters and software drivers also remove the 528-Mbyte limitation.

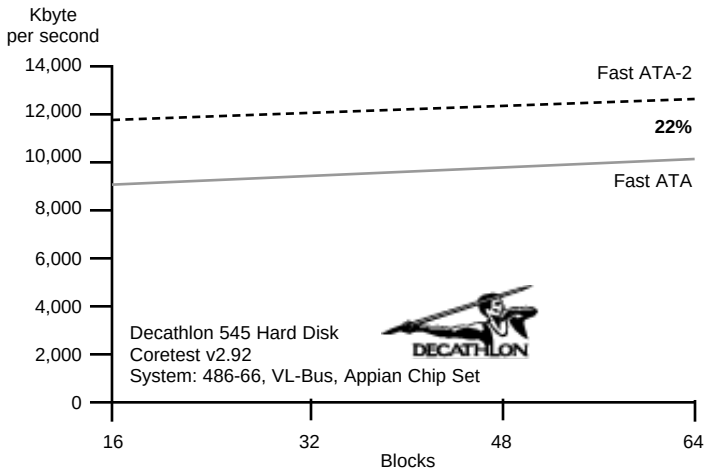
Can Seagate drives be used with dual host adapters?

Yes. Support by the disc drive is not required for this feature so Seagate drives will work with appropriately configured host-adapter systems. Note that a dual host-adapter system requires support from the BIOS and operating system, and the host adapter must provide a secondary address jumper.

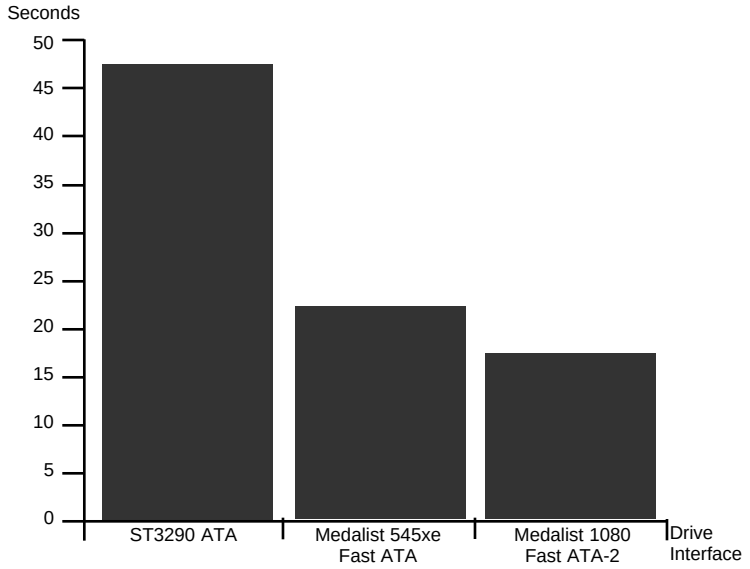
How will a Fast ATA or Fast ATA-2 disc drive affect my work?

Fast ATA can improve efficiency by allowing more work to be completed in less time because the computer moves data faster. Graphic users will benefit most because the speed of those applications are transfer-rate-dependent.

Fast ATA offers data transfer rates up to three times that of standard IDE. Fast ATA-2 is 20% faster than Fast ATA. This increase in performance can best be seen using Seagate's Decathlon 545 disc drive. The Decathlon was originally shipped with Fast ATA support and later Fast ATA-2 support was added. The Coretest benchmark shows the measured difference in performance using the same computer.



A Fast ATA system allows you to run applications previously associated with high-end RISC workstations. Digital video, audio, CAD and 3D rendering applications are all made more accessible to the average PC user.



Do all Fast ATA, Fast ATA-2 or Enhanced IDE drives provide similar performance?

No. There are differences in performance between various Fast ATA (and Enhanced IDE) drives. Disc drive performance is a combination of many factors such as seek time, data transfer rate, cache and rotational speeds. Fast ATA refers to only the data transfer rate. The data transfer rate is the most critical feature when working with large blocks of data. Users working with graphics, multimedia, and so forth, can benefit from faster data transfer rates. Small blocks of data are associated with word processing and spreadsheet applications. These types of applications mainly benefit from faster seek times.

"Although Western Digital, champion of the Enhanced IDE movement, has endowed its Caviar IDE drives with all the right high-speed protocol support—Mode 3 PIO and Mode 1 DMA—its efforts do not seem to have brought superior performance. The drives are fast, but not as fast as the others I tested."—BYTE Magazine, September 1994, page 156.

Are Fast ATA and Fast ATA-2 exclusive to Seagate?

No. Fast ATA is not Seagate-exclusive. Any drive, host adapter, BIOS or system supporting the Small Form Factor Committee PIO Mode 3 or 4 or DMA Mode 1 or 2 is Fast ATA-compliant. Among the corporate endorsers are:

Acculogic	Adaptec	Alpha Research
Appian Technology	Arco Electronics	ATronics
Award Software	Boca Research	Buslogic
Cirrus Logic	CMD Technology	Data Technology Corporation
GSI	Intel Corporation	Microid Research
Micronics	OPTi	Phoenix Technology
Promise Technology	Quantum Corp.	Quick Technology
VLSI		

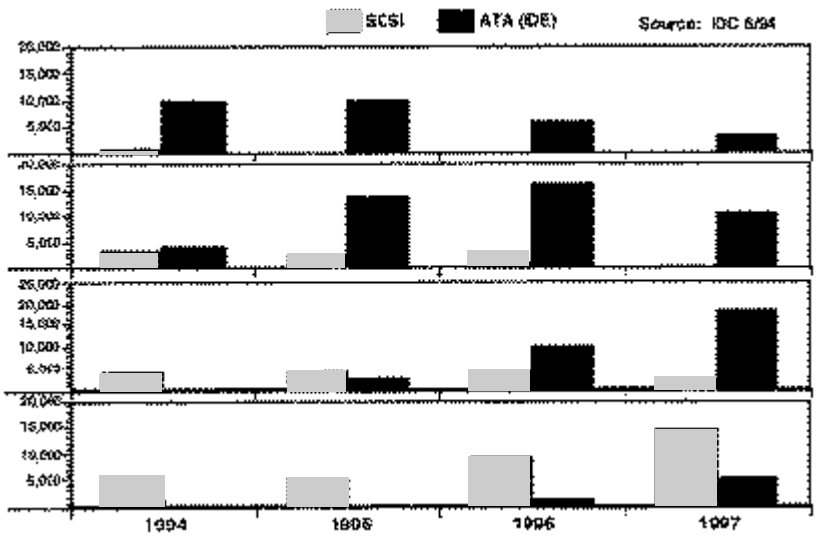
Under the Fast ATA industry standard, products feature the most advanced high-speed data-transfer capabilities, while conforming to the AT Attachment (ATA) standard to ensure capatibility with new and existing system hardware and software. Among the supporting companies are: Compaq Computer, Dell Computer, Olivetti and Zeos International.

The Fast ATA checkered-flag logo is not copyrighted. Any product that supports the higher PIO and DMA data transfer rates can use them.

Will Fast ATA-2 replace Fast SCSI-2?

Although Fast ATA provides burst data transfer rates that surpass that of Fast SCSI devices, Fast ATA is not expected to displace Fast SCSI in higher-end applications such as file servers, mini computers, mainframes and technical workstations. The I/O intensive environments of these platforms require not only high data transfer capabilities but typically are called to handle large numbers of simultaneous I/O events from their multiple users' multitasking environment. SCSI implementations also allow larger number of devices to be attached (including scanners and plotters), allowing the cost of the SCSI host adapter to be amortized over several devices.

The higher-end uses for SCSI are also reflected in the market-demand figures that show the growth of SCSI in capacities over 2 Gbytes and the decline of SCSI in drive capacities under 2 Gbytes. It is also worth noting that Apple recently shipped its first desktop computer incorporating a 500-Mbyte ATA drive, and MacUser Magazine (September 4) reports, *"Preliminary MacUser Labs tests showed that if an IDE drive with a good caching scheme is installed in a [Quadra] 630-series Mac, performance can be impressive."*



Where can I get more information?

The following publications are available from Seagate:

Fast ATA Sourcebook

Enhanced IDE Faces Many Challenges.
Technology Paper SV-19 June 1994.

PC Magazine, The Perfect Hard Disc: Fast ATA Reprint. Seagate part number 6411-001.

ATA Timing Extensions for Local Bus Attachments are available from the Small Form Factor Committee. Telephone 408-867-6630.

You can purchase copies of ANSI standards or proposed ANSI standards from Global Engineering. Telephone 800-854-7179 or 303-792-2181, FAX 303-792-2192.

Copies of SFF Specifications are available by Faxback or by joining the SFF Committee as an observer or member. Telephone 408-867-6630, FAX 408-867-2115, Faxback 408-741-1600.

Small Form Factor Committee

Specification for ATA Timing Extensions for Local Bus Attachment

The following section provides excerpts from the industry supported SFF specification which defines the PIO and DMA modes of Fast ATA. For complete specifications or further information on the ATA specification contact:

I. Dal Allan, Chairman SFF Committee
14426 Black Walnut Ct, Saratoga, CA 95070
408-867-6630 FAX 408-867-2115 250-1752@mcimail.com

ATA Timing Extensions for Local Bus Attachment

Abstract: This document defines the timing changes needed increase the transfer rates of the AT Attachment interface for magnetic disk drives which are utilized in local bus applications.

This document provides a common specification for systems manufacturers,system integrators, and suppliers of magnetic disk drives.

Rev 1.2 dated December 1993 of this specification was forwarded to X3T10 for inclusion in ATA-2. This revision is an information copy of an internal working document of the ATA Working Group, an X3T10 subcommittee. To avoid the possibility of using down-level information, you are encouraged to contact the ATA Editor.

This document is made available for public information, and written comments should be directed to the editor.

1. Scope

This SFF specification defines extensions to the AT Attachment interface needed to allow PC and peripheral designers to provide products with improved data transfer rates of over 10 megabytes per second.

The purpose of this SFF Specification is to define the pinouts so that products from different vendors may be used in the same configurations.

In an effort to broaden the applications for small form factor disk drives, an ad hoc industry group of companies representing system integrators, peripheral suppliers, and component suppliers decided to address the issues involved.

The Small Form Factor Committee was formed in August, 1990 and the first working document was introduced in January, 1991.

1.1 Description of Clauses

Clause 1 contains the Scope and Purpose.

Clause 2 contains Referenced and Related Standards and SFF Specifications.

Clause 3 contains the General Description.

Clause 4 contains the Glossary.

Clause 5 contains information on ATA compatibility.

Clause 6 contains the New Timing Modes and associated parameters.

Clause 7 contains the Command and Parameter Changes.

2. References

The Small Form Factor Committee activities support the requirement of the disk drive industry, and it is involved with several standards.

2.1 Industry Documents

The following interface standards are relevant to disk drives.

- X3.131R-199x SCSI-2 Small Computer System Interface
- X3.221-199x ATA (AT Attachment) Interface
- X3T9.2/0855D SPI (SCSI-3 Parallel Interface)
- PCMCIA 2.01 Personal Computer Card Physical Specification
- PCMCIA PC Card-ATA Specification

2.2 SFF Specifications

...See Complete Specification...

2.3 Sources

Copies of ANSI standards or proposed ANSI standards may be purchased from Global Engineering.

15 Inverness Way East 800-854-7179 or 303-792-2181
Englewood 303-792-2192 Fax
CO 80112-5704

Copies of PCMCIA specifications may be purchased from PCMCIA.

1030G E Duane Ave 408-720-0107
Sunnyvale 408-720-9416Fax
CA 94086

Copies of SFF Specifications are available by Faxback or by joining the SFF Committee as an Observer or Member.

14426 Black Walnut Ct 408-867-6630x303
Saratoga 408-867-2115Fax
CA 95070 Faxback :408-741-1600

3. General Description

High performance local bus PCs (Personal Computer) and AT Attachment disk drives are capable of transfer rates greater than those specified within X3.221. The desire to improve performance prompted development of this Specification, which provides a way to achieve higher transfer rates of up to 13 megabytes per second.

The purpose of an SFF Specification is to provide information that will assist vendors to design products that can interoperate at the higher speeds, and permit products from different vendors to be used in the same configuration.

The environment for this SFF specification is any computer or peripheral which implements an ATA compatible peripheral interface.

X3.221 defines three modes of data transfer:

- PIO
- Single Word DMA
- Multiword DMA

DMA is optional. This specification provides a method to increase transfer rates in PIO and Multiword DMA. No changes are defined for Single Word DMA.

The timing extensions define the addition of:

- New PIO (Programmed Input Output) and Multiword DMA (Direct Memory Access) transfer modes.
- Methods of selecting the new modes.
- Methods for controlling the use of IORDY for flow control.

IORDY may be used as a means of flow control during PIO transfers. Since the implementation of IORDY is an option in both the host and the drive, IORDY can only be successfully utilized if both implement IORDY. There is no method in X3.221 to determine whether IORDY can be successfully used, so compliant drives typically report a maximum PIO transfer rate which assumes that IORDY is not being used. This means that a host which uses the drive's information to adjust its transfer timing to be compatible with the the drive, may end up transmitting at a transfer rate which is significantly less than optimal.

This SFF Specification provides both advanced PIO transfer timings, and a method to determine and control the use of IORDY for flow control.

Devices implementing these advanced features shall maintain compatibility with the ATA standard by powering up in a mode compatible with X3.221 so that drives implemented to this Specification can be installed in existing systems.This Specification provides a host with the information and tools necessary to reconfigure a drive to maximize the transfer rate.

Only one PIO mode and one DMA mode may be active at any one point in time. DMA transfers occur only when a Read DMA or a Write DMA command is issued, and only in the currently selected DMA mode. All other transfers utilize PIO data transfers and operate in the currently selected PIO Mode.

4. Definitions and Conventions

4.1 Definitions

For the purpose of SFF Specifications, the following definitions apply:

4.1.1 ATA (AT Attachment)

This term defines the signal and logical protocol described in X3.221 for IDE (Integrated Drive Electronics) peripherals.

4.1.2 DMA (Direct Memory Access)

A means of data transfer between peripheral and host memory without processor intervention.

4.1.3 IDE (Integrated Drive Electronics)

IDE describes a device with built in ATA protocol electronics.

4.1.4 Optional

This term describes features which are not required by the SFF Specification. However, if any feature defined by the SFF Specification is implemented, it shall be done in the same way as defined by the Specification. Describing a feature as optional in the text is done to assist the reader. If there is a conflict between text and tables on a feature described as optional, the table shall be accepted as being correct.

4.1.5 PCMCIA

This is the acronym for the Personal Computer Memory Card International Association Person, a trade association responsible for the promotion of removable device interfaces for a variety of products including memory, modems, disks, etc.

4.1.6 PCMCIA 2.01

This is the Specification published for removable devices based upon a 68-pin connector and associated form factors.

4.1.7 PC Card-ATA

This term describes an application specification for the implementation of ATA-like devices compatible with host systems implementing PCMCIA Type III slots.

4.1.8 Reserved

Where this term is used for bits, bytes, fields and code values; the bits, bytes, fields and code values are set aside for future standardization. The default value shall be zero. The originator is required to define a Reserved field or bit as zero, but the receiver should not check Reserved fields or bits for zero.

4.1.9 VU (Vendor Unique)

This term is used to describe bits, bytes, fields, pins, signals, code values and features which are not described in this SFF Specification, and may be used in a way that varies between vendors.

4.1.10 VU Mode

A mode of execution by the drive in which its use is not defined by this SFF Specification. The means by which a vendor invokes vendor unique operations within a drive is defined by this SFF Specification.

4.2 Conventions

Certain terms used herein are the proper names of signals. These are printed in uppercase to avoid possible confusion with other uses of the same words;

e.g., ATTENTION. Any lower-case uses of these words have the normal American-English meaning.

A number of conditions, commands, sequence parameters, events, English text, states or similar terms are printed with the first letter of each word in uppercase and the rest lower-case; e.g., In, Out, Request Status. Any lower-case uses of these words have the normal American-English meaning.

The American convention of numbering is used i.e., the thousands and higher multiples are separated by a comma and a period is used as the decimal point. This is equivalent to the ISO convention of a space and comma.

American:	0.6	ISO:	0,6
	1,000		1 000
	1,323,462.9		1 323 462,9

5. ATA Compatibility

5.1 New Signals

No new signals are defined by this Specification.

5.2 Signal Timing Changes

Signal timing changes are restricted to PIO and Multiword DMA timing.

These timing changes are only implemented if the host places the device in one of the advanced transfer timing modes specified by this specification.

- If the host does not select an advanced timing mode, a device remains compatible with ATA.
- Drives compatible with this specification can maintain compatibility with the existing ATA.
- No changes have been made to the signals, signal names, registers, register names or existing commands. The usage of these names is compatible with ATA, and have the same meaning.

The four new timing parameters which are additions to or clarifications of those in ATA, do not conflict with ATA.

- tZ in Multiword DMA
- t2i, t6Z, and tR in PIO

5.3 Command and Parameter Changes

Command changes are restricted to the setting of Transfer Mode with the Set Features command.

- The usage of existing commands and parameter names is compatible with ATA.
- Additional parameters defined to existing commands do not obsolete any existing parameters.
- With the exception of Set Features, no parameter names or parameter meanings have been changed.

The functionality of Set Features is the same, but the capability of this command has been expanded and the definition in ATA has been clarified.

6. New Timing Modes

Two new timing modes, one for Multiword DMA and one for PIO data transfers have been defined.

6.1 Cycle Time For New Timing Modes

For PIO Modes 0, 1, 2, and Multiword DMA Mode 0, the timing parameters defined the operating characteristics the device was required to provide if it supported the associated mode e.g. if the device supported PIO Mode 2, it was required to support a minimum cycle time of 240 nanosecond (t0 for PIO Mode 2).

The use of IORDY is optional in ATA. Some ATA devices reported support of various PIO modes only if they could support a mode without the use of IORDY. This was necessary to prevent problems between a device that could support a timing mode only if IORDY is used and a host which supported the same timing mode without IORDY. This meant that those ATA devices reported lower transfer rates than they could support if IORDY was used.

A new word has been added to the Identify Drive command to indicate the minimum cycle time the devices supports without the use of IORDY i.e. the minimum cycle time supported by the device in PIO Mode 3 when IORDY is not being used. The value contained in this word shall always be greater than or equal to the minimum cycle time defined by the highest PIO Mode supported e.g. a drive supporting PIO Mode 3 timing could not report a value less than 180 nanosecond, the minimum cycle time defined for Mode 3 PIO Timings.

The investigation of methods to increase the ATA transfer rate learned that a number of new rates were desirable. PIO Mode 2 had a transfer rate of 8.33 megabytes per second and host systems indicated a desire for several granular increments. There was an even larger set of transfer rates desired for DMA. Since each transfer rate represented a new mode, this would have caused a significant increase in the number of modes defined.

The alternative adopted by this Specification is to change the usage of the cycle time parameter t0, and include additional information in the Identify Drive parameters. This makes it possible to support a wide range of speed increments, identify them to the host, and reflect the maximum transfer capabilities of a particular implementation.

In the new PIO Mode 3 and Multiword DMA Mode 1, Cycle Time t0 has been changed to the minimum cycle supported by the mode. The definition of other timing parameters associated with the new modes are not changed. If a device supports one of the new modes it is required to meet the timing requirements for all timing specifications associated with that mode, other than the possible exception of Cycle Time. NOTE: PIO Modes 0, 1, 2, and Multiword DMA Mode 0 remain compatible with ATA.

Two new words added to the Identify Drive parameter list indicate the minimum cycle time supported by the device in PIO Mode 3 and Multiword DMA Mode 1 respectively. The value contained in each of these two words shall always be greater than or equal to the minimum cycle time defined by the associated Mode e.g. a drive supporting PIO Mode 3 timing shall not report a value less than 180 nanoseconds, the minimum cycle time defined for Mode 3 PIO Timings.

Another word was added for Multiword DMA Mode 1 to specify the manufacturer's recommended Multiword DMA cycle time and assist the host system in attaining the maximum transfer rate provided by an implementation.

Note: A hardware implementation may be able to burst at a very high transfer rate, but be unable to sustain this transfer rate over an entire transfer. If the maximum burst rate is utilized, the result might be a lower sustained transfer rate than can be achieved at a lower transfor rate. Adjustment of the transfer rate to that recommended by the manufacturer maximizes performance under nominal conditions.

Note: If more PIO or Multiword DMA Modes are added in the future, it is anticipated that they will follow these new definitions.

6.2 New Multiword DMA Transfer Mode

The new Multiword DMA Transfer Mode is Mode 1.

6.2.1 Timing Parameters

The timing parameters associated with Multiword DMA Transfer Mode 1 are defined in Table 6-1. Peripherals reporting support for Multiword DMA Transfer Mode 1 shall also support Multiword DMA Transfer Mode 0.

Table 6-1 Multiword DMA Timing Parameters

	Multiword DMA Timing Parameters		Mode 1 nsec Min	Max
t0	Cycle time	*3	**	
tC	DMACK to DMREQ delay			—-
tD	DIOR-/DIOW- 16-bit	*3	80	
tE	DIOR- data access			60
tF	DIOR- data hold		5	
tF	DIOR- data hold	*1		n/a
tGr	DIOW- data setup		30	
tGw	DIOW- data setup		30	
tH	DIOW- data hold		15	
tI	DMACK to DIOR-/DIOW- setup		0	
tJ	DIOR-/DIOW- to DMACK hold		5	
tKr	DIOR- negated pulse width	*3	50	
tKw	DIOW- negated pulse width	*3	50	
tLr	DIOR- to DMREQ delay			40
tLw	DIOW- to DMREQ delay			40
tZ	DMACK- to tristate	*2		25

*1 The meaning of this parameter in ATA was not clear. The parameter is not applicable to this Specification.

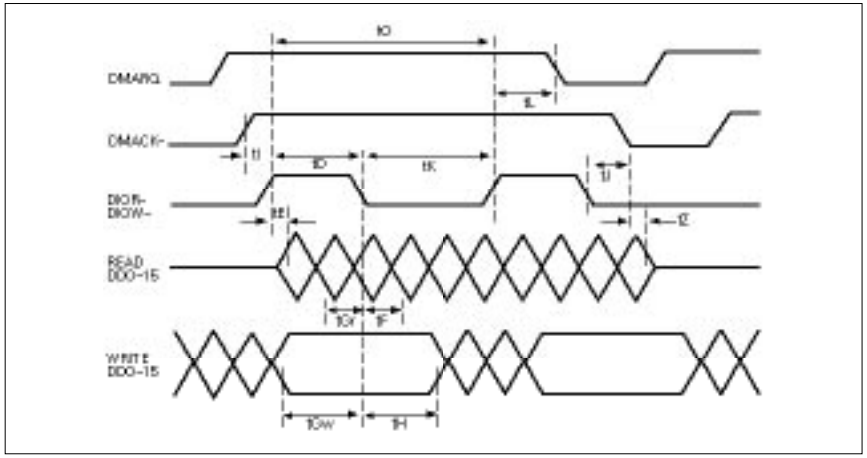
*2 This parameter specifies the time from the negation edge of DMACK- to the time the data bus is no longer driven by the device (tristate). The tZ parameter applies only at the end of a Multiword DMA cycle, i.e. when DMACK is negated. The device may actively drive the data bus or m aytristate the data bus while DMACK- is active from the first time that DIOR- is asserted until DMACK- is deasserted as long as tE and tF requirements are met.

*3 t0 is the minimum total cycle time, tD is the minimum command active time, and tK is the minimum command recovery time or command inactive time. The actual cycle time equals the sum of the actual command active time and the actual command inactive time. The three remaining requirements of t0, tD, tK shall be met. The minimum total cycle time requirement, t0, is greater than the sum of tD and tK. This means that a host implementation can lengthen either or both tD or tK to unsure that t0 is met. A device implementation shall support any legal host implementation.

6.2.2 Timings

The timings associated with Multiword DMA Transfers are defined in Figure 6-1, and include the new timing parameter tZ. The minimum value of t0 is specified by word 65 in the Identify Drive parameter list (see 7.1.6).

Figure 6-1 Multiword DMA Timing Diagram

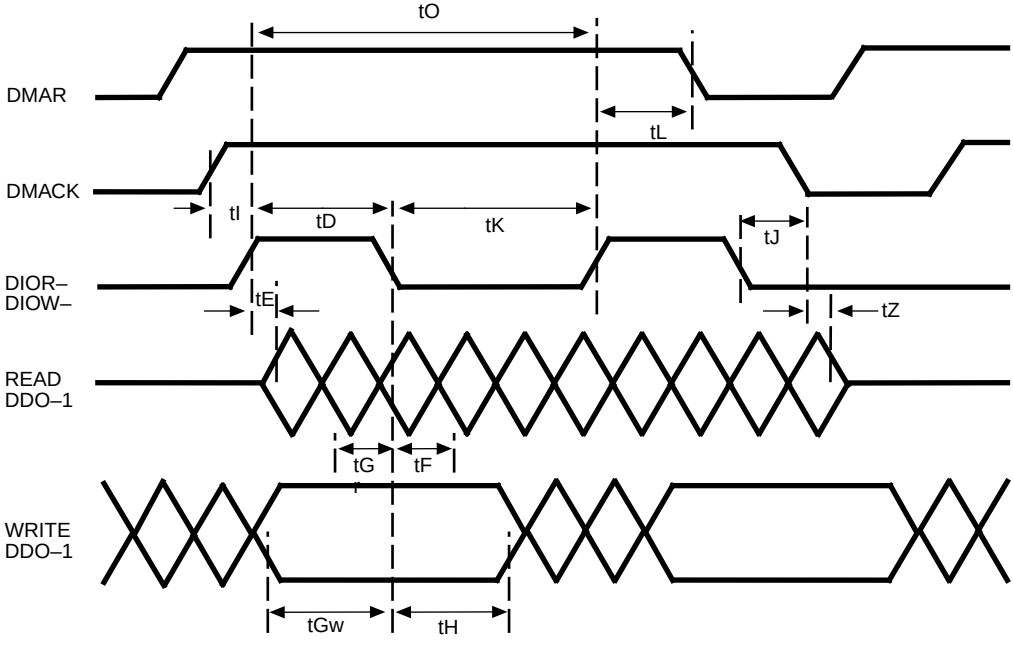


6.3 New PIO Transfer Mode

The new PIO Transfer Mode is Mode 3.

6.3.1 Timing Parameters

The timing parameters associated with PIO Transfer Mode 3 are defined in Table 6-2. Peripherals reporting support for PIO Transfer Mode 3 shall power up in a PIO Transfer Mode compatible with ATA.



Detailed view of Multiword DMA timing diagram

Table 6-2 PIO Timing Parameters

	PIO Timing Parameters nsec		Mode 3 nsec Min	Max
t0	Cycle time	*4	**	
t1	Address valid to DIOR-/DIOW- setup		30	
t2	DIOR-/DIOW- 16-bit Pulse width 8-bit	*4 *4	80 80	
t2i	DIOR-/DIOW- recovery time	*4	70	
t3	DIOW- data setup		30	
t4	DIOW- data hold		10	
t5	DIOR- data setup		20	
t6	DIOR- data hold		5	
t6	DIOR- data hold	*1		n/a
t6Z	DIOR- data tristate	*2		30
t7	Addr valid to IOCS16- assertion	*5		—
t8	Addr invalid to IOCS16- negation	*5		—
t9	DIOR-/DIOW- to address valid hold		10	
tA	IORDY Setup time	*3	35	
tB	IORDY Pulse Width			1,250
tRD	Read Data Valid to IORDY active (if IORDY initially low after tA)	0		

*1 The meaning of this parameter in ATA was not clear. The parameter is not applicable to this Specification.

*2 This parameter specifies the time from the negation edge of DIOR- to the time that the data bus is no longer driven by the device (tristate).

*3 The delay from DIOR- or DIOW- until the state of IORDY is first sampled. If IORDY is inactive then the host shall wait until IORDY is active before the PIO cycle can be completed. If the device is not driving IORDY negated at the time tA after the activation of DIOR- or DIOW-, then t5 shall be met and tRD is not applicable. If the device is driving IORDY negated at the time tA after the activation of DIOR- or DIOW-, then tRD shall be met and t5 is not applicable.

*4 t0 is the minimum total cycle time, t2 is the minimum command active time, and t2i is the minimum command recovery time or command inactive time. The actual cycle time equals the sum of the actual command active time and the actual command inactive time. The three timing requirements of t0, t2, t2i shall be met. The minimum total cycle time requirement, t0, is greater than the sum of t2 and t2i. This means a host implementation can lengthen either or both t2 or t2i to ensure that t0 is met. A device implementation shall support any legal host implementation.

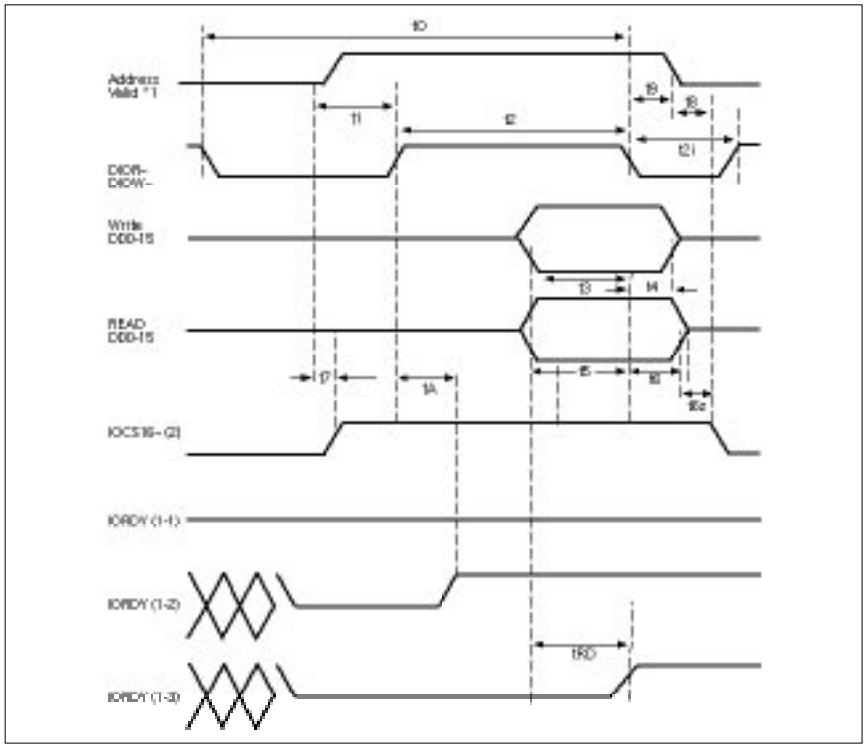
*5 IOCS16- shown for PIO Mode 0,1,2 only. For other modes, this signal is not valid.

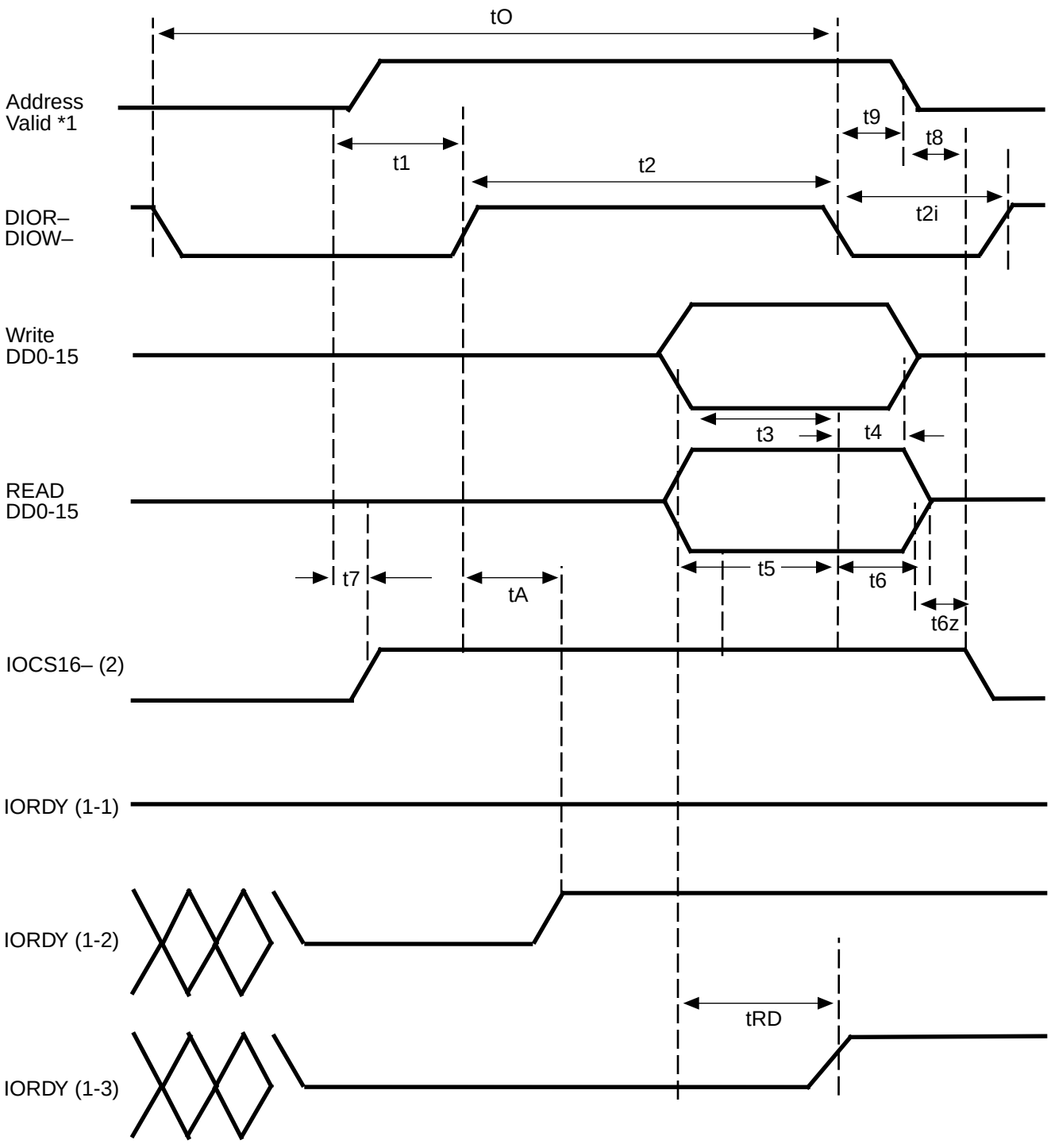
6.3.2 Timings

The timings associated with PIO Mode 3 transfers are defined in Figure 6-2, and include the new timing parameters t2i, t6Z and tR. The minimum value of t0 is specified by word 68 in the Identify Drive parameter list (see 7.1.8).

It is mandatory that IORDY be supported when PIO Mode 3 is the current mode of operation.

Figure 6-2 PIO Timing Diagram





Detailed view of PIO Timing Diagram

(1)The deassertion of IORDY by the device is used to extend the PIO cycle. The Determination of whether the cycle is to be extended is made by the host after tA from the assertion of DIOR- or DIOW-. The assertion and deassertion of IORDY are described in the following three cases:
(1-1) Device never deasserts IORDY: no wait is generated.
(1-2) Device starts to drive IORDY low before tA, but causes IORDY to be deasserted before tA: no wait generated.
(1-3) Device drives IORDY low before tA: wait generated. The cycle completes after IORDY is reasserted. For cycles where a wait is generated and DIOR- is asserted, device must place read data on DD0-15 for tRD before causing IORDY to be asserted.

(2)IOCS16- shown for Mode 0,1,2. For other modes this signal is not valid.

7. Command and Parameter Changes

Changes have been made to the Identify Drive and Set Feature commands.

7.1 Identify Drive Parameters

Table 7-1 includes the Identify Drive parameters that have been re-defined and the parameter words that have been added.

Note: See X3.221 for full definition of all bits not listed in this table.

Table 7-1 Identify Drive Parameters

Word	Description
49	Capabilities
	12=0 Reserved for Enhanced Data Transfer definition
	11=1 IORDY Supported
	11=0 IORDY may be Supported
	10=1 IORDY can be disabled
53	15-2 reserved
	1 1=the fields reported in words 64-70 are valid
	0=the fields reported in words 64-70 are not valid
	0 (as defined in X3.221
63	9=1 Multiword DMA Transfer Mode 1 active
	1=1 Multiword DMA Transfer Mode 1 supported
64	15-8 reserved
	7-0 Advanced PIO Transfer Modes Supported
65	Minimum Multiword DMA Transfer Cycle Time Per Word
	15-0 Cycle time in nanoseconds
66	Manufacturer's Recommended Multiword DMA Transfer Cycle Time
	15-0 Cycle time in nanoseconds
67	Minimum PIO Transfer Cycle Time Without Flow Control
	15-0 Cycle Time in nanoseconds
68	Minimum PIO Transfer Cycle Time With IORDY Flow Control
	15-0 Cycle Time in nanoseconds
69	reserved
70	reserved

7.1.1 Word 49: IORDY Support

Word 49 Bit 11 (Capabilities) is used to help determine whether a device supports IORDY.

- If Bit 11=1, the device supports IORDY operation.
- If Bit 11=0, the device may support IORDY (this is to ensure backward compatibility).

If a device supports PIO Mode 3, Bit 11=1 shall be set.

7.1.2 Word 49: IORDY Can Be Disabled

Word 49 Bit 10 (Capabilities) is used to indicate the device's ability to enable or disable the use of IORDY. If Bit 10=1, the device supports the disabling of IORDY.

8.10.14 Word 51: PIO data transfer cycle timing mode

The PIO transfer timing for each ATA device falls into categories which have unique parametric timing specifications. To determine the proper device, timing category, compare the Cycle Time specified in figure 5 with the contents of this field. The value returned in Bits 15-8 should fall into one of the mode 0 through mode 2 categories specified in figure 5, and if it does not, then Mode 0 shall be used to serve as the default timing.

Note: For backwards compatibility with BIOSs written before Word 64 was defined for advanced modes, a device reports in Word 51 the highest original PIO mode (i.e. PIO mode 0, 1, or 2) it can support.

8.10.15 Word 52: Single Word DMA data transfer cycle timing mode

The DMA transfer timing for each ATA device falls into categories which have unique parametric timing specifications. To determine the proper device timing category, compare the Cycle Time specified in figure 6 with the contents of this field. The value returned in Bits 15-8 should fall into one of the categories specified in figure 6 (i.e. 0,1, or 2), and if it does not, then Mode 0 shall be used to serve as the default timing.

The contents of this word shall be ignored if Words 62 or 63 are supported.

7.1.3 Word 53 Bit 1: Field Validity

Word 53 Bit 0 defines whether the fields contained in words 54-58 are guaranteed to be valid. To identify the additional words returned by Identify Drive command, bit 1 has been defined.

- If Bit 1=1, the fields reported in words 64-70 shall be valid.
- If Bit 1=0, the fields reported in words 64-70 are not valid.

Any device which supports PIO Mode 3 or above, or supports Multiword DMA Mode1 or above, shall set this bit to 1.

7.1.4 Word 64: Flow Control PIO Transfer Modes Supported

Word 64 Bits 7-0 is a bit significant field. Any number of bits may be set in this field by the device to indicate which Advanced PIO Modes it is capable of supporting. Bits 7-1 are reserved for future use.

- If Bit 0=1, the device supports PIO Mode 3.

Note: For backwards compatibility with BIOSs written before Word 64 was defined for advanced modes, a device reports in Word 51 the highest original PIO mode (i.e. PIO mode 0, 1, or 2) it can support.

7.1.5 Word 65: Minimum Multiword DMA Transfer Cycle Time Per Word

Word 65 defines the minimum Multiword DMA cycle time that the device can support when performing Multiword DMA transfers on a per word basis.

If this field is supported, Word 53 Bit 1=1 shall be set.

Any device which supports Multiword DMA Mode 1 or above shall support this field, and the value in word 65 shall not be less than 150.

If Word 53 Bit 1=1 because a drive supports a field in Words 64-70 other than this field, the device shall return a value of zero in this field.

7.1.6 Word 66: Manufacturer's Recommended Multiword DMA Transfer Cycle Time

Word 66 defines the minimum cycle time per word during a single sector host transfer while performing a multiple sector Read DMA or Write DMA command over all locations on the media under nominal conditions.

If a host runs at a faster cycle rate by operating at a cycle time of less than this value, the device may negate DMARQ for flow control. The rate at which DMARQ is negated could result in reduced throughput despite the faster cycle rate. Transfer at this rate does not ensure that flow control will not be used, but implies that higher performance MAY result.

If this field is supported, Word 53 Bit 1=1 shall be set.

Any device which supports Multiword DMA Mode 1 or above shall support this field, and the value in word 66 shall not be less than the value in Word 65.

If Word 53 Bit 1=1 because a drive supports a field in Words 64-70 other than this field, the device shall return a value of zero in this field.

7.1.7 Word 67: Minimum PIO Transfer Cycle Time Without Flow Control

Word 67 of the parameter information of the IDENTIFY DEVUCE command is defined as the Minimum PIO Transfer without Flow Control Cycle Time. This field defines, in nanoseconds, the minimum cycle time that, if used by the host, the device guarantees data integrity during the transfer with our utilization of flow control.

Any device may support this field, and if this field is supported, bit 1 of word 53 shall be set.

Any device which supports PIO Mode 3 or above shall support this field, and the value in Word 67 shall not be less than 180.

If Word 53 Bit 1=1 because a drive supports a field in Words 64-70 other than this field, the device shall return a value of zero in this field.

7.1.8 Word 68: Minimum PIO Transfer Cycle Time With IORDY Flow Control

Word 68 defines the minimum cycle time that the device can support when performing data transfers while utilizing IORDY flow control.

Any device may support this field, and if this field is supported, bit 1 of word 53 shall be set.

Any device which supports PIO Mode 3 or above shall support this field, and the value in word 68 shall not be less than 180.

If Word 53 Bit 1=1 because a drive supports a field in Words 64-70 other than this field, the device shall return a value of zero in this field.

7.1.9 Words 69 and 70

Words 69 and 70 are reserved for future definition.

Note: These fields are intended for use in a future specification of an alternative flow control mechanism.

7.2. Set Features

In ATA, the Set Features command with the Set Transfer Mode parameter utilizes the Sector Count Register to specify which transfer parameter to change and the value to be implemented.

The use of the term ‘Block Transfer’ has been changed to PIO Default Transfer Mode and re-defined. The Sector Count Register values are changed to:

PIO Default Transfer Mode	00000 00n
PIO Flow Control Transfer Mode x	00001 nnn
Single Word DMA Mode x	00010 nnn
Multiword DMA Mode x	00100 nnn
Reserved	01000 nnn

where “n” or “nnn” is a valid mode number for the associated transfer type.

Note: The reserved values are intended for use in a future specification of an alternative flow control mechanism.

If a device does not support the mode specified, the device posts an Aborted Command error.

If a device which supports this specification receives a Set Feature command with a Set Transfer Mode parameter and a Sector Count Register value of 00000 000, it shall set its default PIO transfer mode.

If a device which supports this specification receives a Set Feature command with a Set Transfer Mode parameter and a Sector Count Register value 00000 001 and the device supports disabling of IORDY, then the device shall set its default PIO transfer mode and disable IORDY.

Devices reporting support for Multiword DMA Transfer Mode 1 must also support Multiword DMA Transfer Mode 0.

Support of IORDY is mandatory when PIO mode 3 is the current mode of operation.

Implementation Notes for Fast ATA-2 and Fast ATA

Fast ATA and Fast ATA-2 Advantage

Fast ATA and Fast ATA-2 achieve their higher data rate throughput by use of advanced data transfer protocols. The high performance, industry standard methods supported are Programmed Input Output (PIO) mode 3 and multiword Direct Memory Access (DMA) mode 1 for Fast ATA. In addition to the features of Fast ATA, PIO mode 4 and multiword DMA mode 2 are supported by Fast ATA-2.

Both PIO and multiword DMA are arbitrated signal processes between the BIOS (contained in either the motherboard or a host adapter) and hard disc drive. PIO modes of 3 or higher use the I/O channel ready (IORDY) line of the ATA interface to regulate the flow of data, while multiword DMA utilizes the DMA request (DMREQ) and DMA acknowledge (DMACK) lines. Multiword DMA also differentiates itself from PIO by freeing the host processor during data transfers allowing data transfer to or from the host system's memory, hence its name.

The support of these advanced features in motherboards and host adapters has been steadily increasing. However, without the support of a Fast ATA or Fast ATA-2 disc drive, the system performance capabilities rest untapped. Fast ATA and Fast ATA-2 disc drives unlock the hidden performance of motherboards and host adapter BIOS to accelerate the performance of virtually any application. Verification of system BIOS capability should done by consulting the system motherboard or host adapter supplier.

Host adapter support

Systems with VESA or PCI motherboards that do not already support the full transfer rate capability of Fast ATA drives can be upgraded through flash BIOS, if equipped, to support PIO or by using a Fast ATA host adapter to support both PIO and multiword DMA. Fast ATA and Fast ATA-2 host adapters and their suppliers are listed in the directory and should be consulted directly to verify system and compatibility requirements.

Hard disc support

In addition to the PIO mode 3 and multiword DMA mode 1 protocols supported by Fast ATA and PIO mode 4 and multiword DMA mode 2 supported by Fast ATA-2, these drives also support the industry standard multiple block read/write feature that is commonly supported in system BIOS. Multiple block read/write can accelerate disc drive performance by up to 30% in older systems without the requirement for local bus connections or PIO and DMA mode support.

Seagate drives supporting Fast ATA and Fast ATA-2 are listed in the disc drive directory, located at the back of the Sourcebook. Detailed disc drive specifications are available by calling (408)438-8111, or faxing (408)438-7852.

Transfer mode selection

For ease of set-up, most system and host adapter BIOS revisions currently support the automatic configuration of Fast ATA and Fast ATA-2 disc drives. Through automatic configuration, the motherboard or host adapter BIOS interrogates the drive, automatically, through the identify drive command and properly configures itself to match the transfer mode and performance capabilities of the system hardware. Specifically, words 62, 63 and 64 of the identify drive parameters describe the data transfer modes that a particular drive will support, while words 65-68 define the minimum cycle times that can be used for data transfers in the various modes (See the ATA industry standard specification section of this book for more details).

Directory of Fast ATA Products

Company Name	Product Name/ Model Number	System Bus	PIO Mode Supported	DMA Mode Supported	Manual Configure	Auto Configure	Contact Information Phone
HOST ADAPTERS							
Acculogic	sIDE-2PCI	PCI	3	n/a	yes	yes	714-454-2441
Acculogic	sIDE-4VL	VL	3	n/a	yes	yes	714-454-2441
Alpha Research	DC 280S	VL	3	n/a	yes	yes	512-418-0220
Alpha Research	DC 280W	VL	3	n/a	yes	yes	512-418-0220
Alpha Research	DC690B	PCI	3	n/a	yes	yes	512-418-0220
Alpha Research	DC680C	VL	3	n/a	yes	yes	512-418-0220
Arco Electronics	AC-32VL+ IDE	VL	3	n/a	yes	yes	305-925-2688
Arco Electronics	AC-32VL	VL	3	n/a	yes	yes	305-925-2688
Arco Electronics	AC-32PCI	VL	3, 4	n/a	yes	yes	305-925-2688
ATronics International	VL/IDE IO Card	PCI	3, 4	n/a	yes	yes	510-656-8400
ATronics International	IDEal PCI	PCI	3, 4	n/a	yes	yes	510-656-8400
CMD	CSA6400/EB0	PCI	3, 4	n/a	yes	yes	714-454-0800
CMD	CSA6210/K	VL	3, 4	n/a	yes	yes	714-454-0800
Data Tech. Corp.	DTC2130 (dual port)	PCI	3	n/a	yes	yes	408-942-4081
Data Tech. Corp.	DTC2130 (single port)	PCI	3	n/a	yes	yes	408-942-4081
Data Tech. Corp.	DTC2278S	VL	3	n/a	yes	yes	408-942-4081
Elitegroup Computer Systems	DI 60 Z	VL	3	n/a	yes	yes	510-226-7333
Genoa Systems Corporation	M5 Veloce 8600VLIO	VL	3	n/a	yes	yes	408-432-9123
Genoa Systems Corporation	2015 PCI	PCI	3	n/a	yes	yes	408-432-9123
GSI	Model 18 (1533-18)	VL	req extender	n/a	yes	yes	714-757-1778
GSI	Model 21 (1533-21)	VL	req extender	n/a	yes	yes	714-757-1778
GSI	Model 32 (1533-32)	VL	req extender	n/a	yes	yes	714-757-1778
GSI	Model 4C (1533-4C)	VL	req extender	n/a	yes	yes	714-757-1778
GSI	VESA extender (1645-VE)	VL	3, 4	n/a	yes	yes	714-757-1778
Promise	DC2300 +	VL	3, 4	1	yes	yes	408-452-1180
Promise	DC4030	PCI	3, 4	n/a	yes	yes	408-452-1180
Promise	DC5030	PCI	3, 4	n/a	yes	yes	408-452-1180
Promise	DC500	PCI	3, 4	n/a	no	yes	408-452-1180
Quick Tech. Corporation	SIDEjr.	VL	3	n/a	yes	yes	714-660-4948
Quick Tech. Corporation	SIDEjr. Plus	VL	3	n/a	yes	yes	714-660-4948
Quick Tech. Corporation	SIDE VL-bus SCSI/IDE/IO	VL	3	n/a	yes	yes	714-660-4948
TEKRAM Technology	VL IDE Cache/DC-680C	VL	3	n/a	yes	yes	886-2-783-6867 (fax)
TEKRAM Technology	PCI IDE Cache/DC-690C	PCI	3	n/a	yes	yes	886-2-783-6867 (fax)
TEKRAM Technology	PCI IDE/DC-290N	PCI	3	n/a	yes	yes	886-2-783-6867 (fax)
TEKRAM Technology	Master 290	PCI	3, 4	1, 2	no	yes	886-2-783-6867 (fax)
Tyan Computer Corporation	S1342-001 VLB IDE	VL	3	n/a	yes	yes	408-956-8044
Tyan Computer Corporation	S1342-002 VLB IDE	VL	3	n/a	yes	yes	408-956-8044
Tyan Computer Corporation	S1342-003 VLB IDE	VL	3	n/a	yes	yes	408-956-8044
Tyan Computer Corporation	S1362-001 VLB IDE	PCI	3, 4	n/a	yes	yes	408-956-8044
Tyan Computer Corporation	S1363-004 VLB IDE	PCI	3, 4	n/a	yes	yes	408-956-8044
Tyan Computer Corporation	S1363-034 VLB IDE	PCI	3, 4	n/a	yes	yes	408-956-8044
Tyan Computer Corporation	S1363-014 VLB IDE	PCI	3, 4	n/a	yes	yes	408-956-8044

Directory of Fast ATA Products *Continued*

Company Name	Product Name/ Model Number	System Bus	PIO Mode Supported	DMA Mode Supported	Manual Configure	Auto Configure	Contact Information Phone
HA CHIPSETS							
Cirrus Logic	PD7230 (previously ADI/3)	PCI	3, 4	1, 2	yes	yes	510-623-8300
Cirrus Logic	PD7220 (previously ADI/2)		VL	3, 4	n/a	yes	yes 510-623-8300
ATronics International	2015PL	PCI	3, 4	n/a	yes	yes	510-656-8400
ATronics International	2015PL	VL	3, 4	n/a	yes	yes	510-656-8400
CMD	PCIO640B	PCI	3,4	n/a	yes	yes	714-454-0800
CMD	PCIO640B	VL	3,4	n/a	yes	yes	714-454-0800
Data Technology Corporation	DTC 801	PCI	3	n/a	yes	yes	408-942-4081
Promise Technology Inc.	PDC20240	VL	3, 4	1	yes	yes	408-452-1180
Promise Technology Inc.	PDC20630	PCI	3, 4	1	yes	yes	408-452-1180
TEKRAM Technology	IDE Master/TRM	PCI	3, 4	1, 2	no	yes	886-2-783-6867 (fax)
MOTHERBOARDS							
AMI	Super Voyager VLB III	VL	3	n/a	yes	yes	404-263-8181
AMI	Atlas VIP	VL	3	n/a	yes	yes	404-263-8181
AMI	Atlas PCI	PCI	3	n/a	yes	yes	404-263-8181
AMI	Excalibur PCI	PCI	3	n/a	yes	yes	404-263-8181
AMI	Excalibur PCI II	PCI	3	n/a	yes	yes	404-263-8181
AMI	Excalibur PCI EISA	PCI	3	n/a	yes	yes	404-263-8181
Elitegroup Computer Systems	AL486 VIO	VL	3	n/a	yes	yes	510-226-7333
Elitegroup Computer Systems	UM4981-AIO	VL	3	1	yes	yes	510-226-7333
Elitegroup Computer Systems	UM8810VP	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	UM8810-AIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	UM8810-VIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	S1L5PI-AIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	AL5PI-VIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	SI5PI-VIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	S154P-AIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	UM8910-AIO	PCI	3, 4	1	yes	yes	510-226-7333
Elitegroup Computer Systems	UM8911-VIO	PCI	3, 4	1	yes	yes	510-226-7333
Genoa Systems Corporation	Turbo Express 486 VLG	VL/PCI	3	1	yes	yes	408-432-9123
Micronics	JX30Gc	VL	3	n/a	yes	yes	510-651-2300
Micronics	Mpower 4 plus	VL	3	n/a	yes	yes	510-651-2300
Micronics	M4Pi	PCI	3	n/a	yes	yes	510-651-2300
Micronics	M4Pe	PCI/EISA	3	n/a	yes	yes	510-651-2300
Micronics	M5Pi	PCI	3	n/a	yes	yes	510-651-2300
Micronics	M54Pi	PCI	3	n/a	yes	yes	510-651-2300
Micronics	M54Pe	PCI/EISA	3	n/a	yes	yes	510-651-2300

Directory of Fast ATA Products *Continued*

Company Name	Product Name/ Model Number	System Bus	PIO Mode Supported	DMA Mode Supported	Manual Configure	Auto Configure	Contact Information Phone	
CORE LOGIC CHIPSETS								
OPTi Inc.	82C621	PCI	3	n/a	yes	yes	408-980-8178	
OPTi Inc.	82C611	VL	3	n/a	yes	yes	408-980-8178	
BIOS								
AMI	AMI BIOS	PCI	3	OEM	yes	yes	404-263-8181	
AMI	AMI BIOS	VL	3	OEM	yes	yes	404-263-8182	
Award Software Inc.	POWERbios	PCI	3	n/a	yes	yes	415-968-4433	
Award Software Inc.	POWERbios	VL	3	n/a	yes	yes	415-968-4434	
Phoenix Tech. Inc.	PhoenixBIOS 4.04		PCI	3	1	yes	yes	408-452-1985
Phoenix Tech. Inc.	PhoenixBIOS 4.04		VL	3	1	yes	yes	408-452-1985
Microid Research Inc.	MRBIOS	VL	3,4	n/a	yes	yes	408-727-6991	
Microid Research Inc.	MRBIOS	PCI	3,4	n/a	yes	yes	408-727-6992	

Specifications are subject to change without notice.
All questions about the listed products should be referred to the respective manu facturers and not to Seagate.

Directory of Seagate Fast ATA Disc Drives

MOBILE STORAGE PRODUCTS

Name	Model Number	Capacity	Average Seek	Interface Type	PIO Mode Supported	DMA Model Supported	Manual Configure	Auto Configure	Form Factor	Height
Marathon 130sl	ST9150AG	131 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	12.5 mm
Marathon 170sl	ST9190AG	171 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	12.5 mm
Marathon 210sl	ST9240AG	210 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	12.5 mm
Marathon 260sl	ST9300AG	262 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	12.5 mm
Marathon 340	ST9385AG	341 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	19 mm
Marathon 420sl	ST9420AG	420 MB	16 ms	FastATA-2	3, 4	1, 2	yes	yes	2.5-inch	12.5 mm
Marathon 455	ST9550AG	455 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	19 mm
Marathon 520	ST9655AG	524 MB	16 ms	Fast ATA	3	1	yes	yes	2.5-inch	19 mm

DESKTOP STORAGE PRODUCTS

Name	Model Number	Capacity	Average Seek	Interface Type	PIO Mode Supported	DMA Model Supported	Manual Configure	Auto Configure	Form Factor	Height
Medalist 210xe	ST3250A	214 MB	14 ms	Fast ATA	3	1	yes	yes	3.5-inch	1-inch
Medalist 275xe	ST3295A	272 MB	14 ms	Fast ATA	3	1	yes	yes	3.5-inch	1-inch
Medalist 340xe	ST3391A	341 MB	13 ms	Fast ATA	3	1	yes	yes	3.5-inch	1-inch
Medalist 425xe	ST3491A	428 MB	14 ms	Fast ATA	3	1	yes	yes	3.5-inch	1-inch
Medalist 545xe	ST3660A	545 MB	14 ms	Fast ATA	3	1	yes	yes	3.5-inch	1-inch
Decathlon 545	ST5660A	545 MB	12 ms	Fast ATA-2	3, 4	1, 2	yes	yes	3.5-inch	.75-inch
Medalist 720	ST3780A	720 MB	12 ms	Fast ATA-2	3, 4	1, 2	yes	yes	3.5-inch	1-inch
Decathlon 850	ST5850A	850 MB	12 ms	Fast ATA-2	3, 4	1, 2	yes	yes	3.5-inch	.75-inch
Medalist 1080	ST31220A	1,080 MB	12 ms	Fast ATA-2	3, 4	1, 2	yes	yes	3.5-inch	1-inch

Do you have a product that is Fast ATA-2 or Fast ATA capable?
Please write to:

Fast ATA Product Manager
Seagate Technology, Inc.
920 Disc Drive, B-1, Scotts Valley, CA 95067-0360 Fax: 408-438-4120

For pre-sales support and information about Seagate products, please call
408-438-8111 Monday through Friday 7:00 am to 5:00 pm (Pacific time).

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