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## Ultra ATA/100

A Quantum White Paper

June 5, 2000



Ultra ATA/100 :  
Laying the Foundation for Tomorrow's Performance

### Introduction

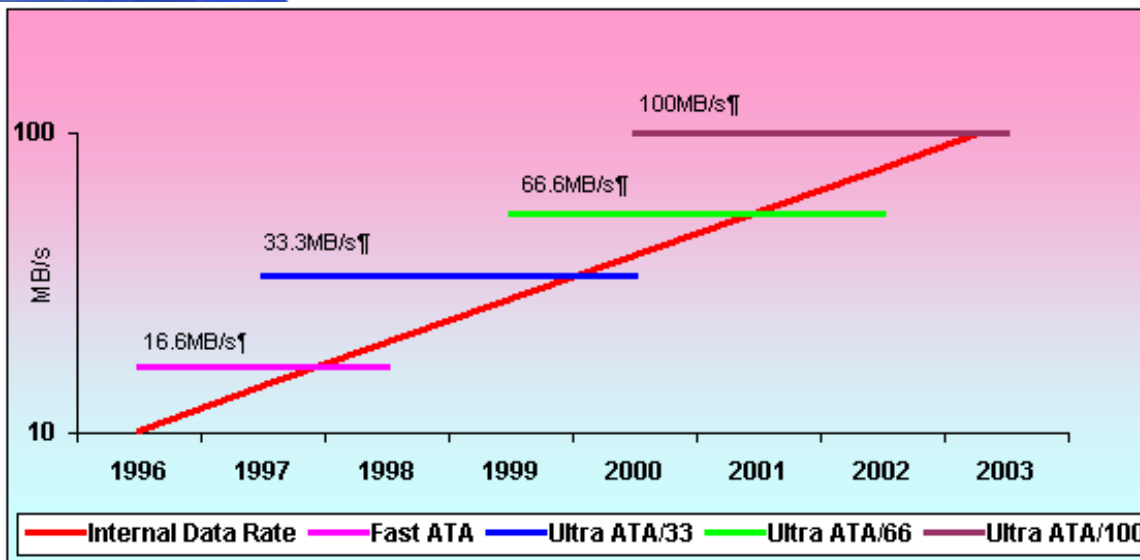
New desktop computers are pushing the limits of system performance. Faster microprocessors, multimedia applications, ballooning file sizes, and higher performance hard drives all mean that we will eventually reach the limits of current data transport pipelines, resulting in reduced system performance and slower host-to-storage access. This will cause a growing need for higher speed I/O "connections" in order to fully utilize the potential of soon to be released next-generation devices.

## Why is pipeline speed so important?

As component performance improves and audio/video files become more predominant, the connection between host and storage device must also improve in order to keep up. Within a year the new hard disk drives' internal data rates will be so fast that the host-to-drive interface (bus) will become the system's roadblock. If the drives' internal data rates surpass the interface's burst transfer rate, data throughput will be stymied, requiring larger buffer memories in the drive to hold data before transferring it to the host CPU. This reduces overall system performance while adding cost. But these conditions can be prevented!

## Internal and Interface Data Rates

This chart shows internal media data rate increasing at the current 40% per year (log scale). Ultra ATA/100 is an atypical half-step to prevent the industry from being transfer rate limited by 2001.



By increasing the interface's burst transfer rate, throughput is enhanced, eliminating potential delays between the host's memory and the disk drive. Faster data transfers over the I/O bus can prevent audio/video data stream interruption from degrading the user's experience. The increase in speed also minimizes the risk of other data processing throughput losses due to a buffer empty condition when the operating system fills an I/O (for example, disk read) request. These bus improvements enhance overall system performance. Increased data transfer speed also means that smaller buffer sizes can be used, reducing cost.

Today, the popular ATA/66 Interface is able to handle the fastest PC hard drives (which have a top internal data transfer rate of around 56MB/s). But newer drives, expected to arrive in 2001, will exceed today's interface capabilities, causing host-to-disk data transfers to hinder overall system performance.

To protect against this eventual reality, Quantum developed the new Ultra ATA/100 interface with additional speed. Ultra ATA/100 leverages off the solid protocol foundation Quantum laid with the invention of the original Ultra ATA/33 interface. It also incorporates the improvements in cables and connectors that were introduced with Ultra ATA/66.

Ultra ATA/100 provides the lowest risk and fastest time to market solution to this performance problem. It is also backward compatible with over 15 years of previous ATA interface products, including hard disk drives, removable media disk drives (e.g. ZIP, JAZ), CD-ROM drives, CD-R/RW drives, ATA tape drives, and the newest product to use ATA, DVD-ROM drives.

## Building the Infrastructure for the Future

The ATA/100 implementation is the latest advancement for the robust, Quantum-developed Ultra ATA interface series, positioning it as the continuing standard host-to-drive interface for the PC industry.

To use an analogy, it's like building a new freeway exit for a soon to be developed major entertainment complex (for example, a ball park and convention center). That sparsely traveled new three-lane exit ramp might seem like overkill when it first replaces the old one-lane off-ramp. The few cars using it easily fit into one lane, without delay, when exiting so no performance benefit is immediately noticed. However, when the product arrives (i.e., the complex is built), the expanded capacity of the three-lane exit prevents congestion from the increased traffic flow into the new arenas.

The key to improved and smooth operation is having the infrastructure in place BEFORE the developers deliver the new product. This is exactly what Quantum and its industry partners are doing with the ATA/100 product -- getting the infrastructure in place BEFORE it must handle future "traffic".

## About the Ultra ATA/100 Interface

Ultra ATA/100 is an updated version of the current Ultra ATA/66 data bus, originally introduced by Quantum in 1998. Quantum has worked closely with leading PC, system, drive, and chip vendors to establish the ATA/100 specification and to drive standardization. The ATA/100 is now positioned as the future parallel host-to-drive industry standard and will be supported by most leading manufacturers in their next generation products.

As defined in the ATA/100 specification, the interface quickly and reliably transfers large amounts of data between computers and hard drives. Quantum has addressed compatibility issues associated with the previous ATA/66 product by tightening slew rates, trace lengths, hysteresis, and other timing parameters. As a result, the Quantum implementation of ATA/100 is well aligned with the latest chipset releases from Intel and others and features improved compatibility, simplifying the chip and component designer's task. The ATA/100 improves upon existing ATA interface specifications; in theory, the new bus provides higher speed, at the same cost, and is more designer "friendly" than previous versions.

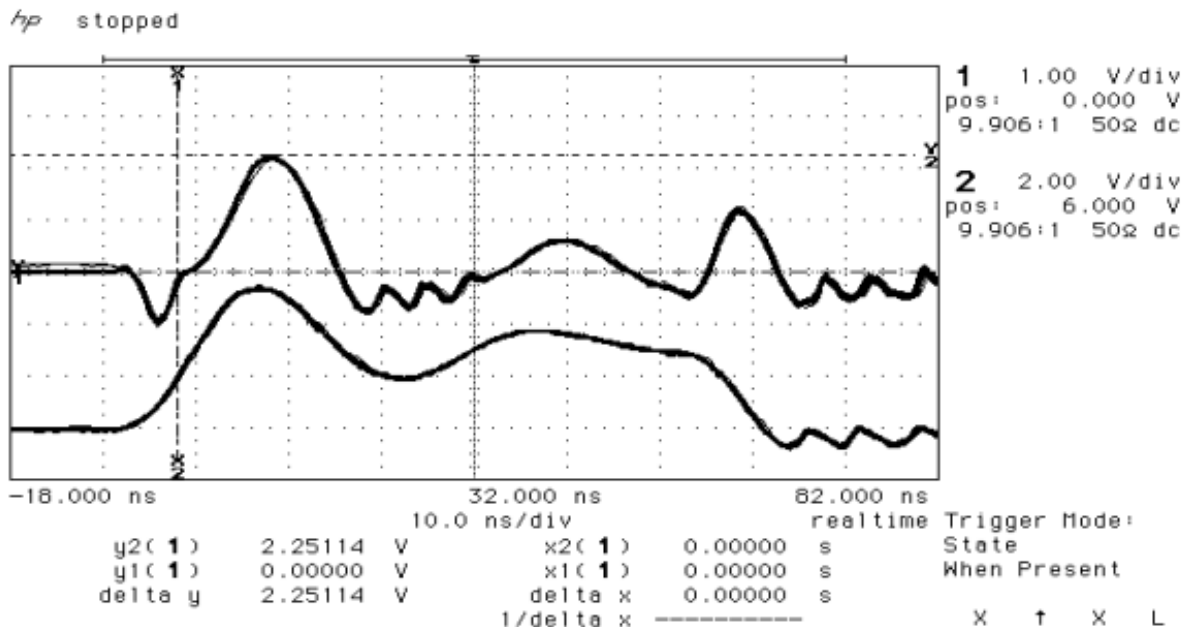
The ATA/100's functionality, speed, and reliability make it ideal for host-to-drive interface use in applications such as multimedia, video streaming, and large file access/storage. The ATA/100 specification defines a physical layer operating at 100 megabytes per second and is backward compatible with ATA/33 and ATA/66 enabled devices.

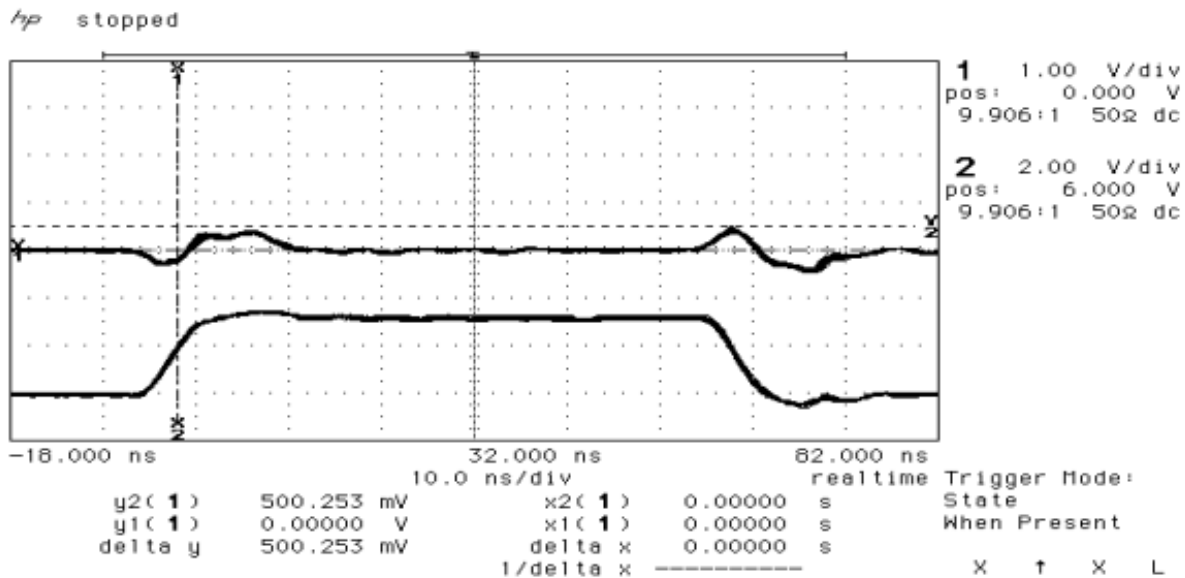
The interface's compatibility with earlier Ultra ATA protocol motherboards and controllers means the Ultra ATA/100 is simple and cost effective for PC manufacturers, distributors, and their customers alike to implement. This plug compatibility allows PC vendors and distributors to streamline their inventory management and prevents IT organizations from incurring the substantial costs of switching to an alternative, expensive high-speed interface technology and replacing their entire PC storage infrastructures. That all adds up to considerable cost savings for everyone!

Older Ultra ATA/33 or ATA/66 drives can be easily connected to the ATA/100 interface without modifying existing software or components. The interface will automatically step down to their operating level when transferring data between the host and these older drives. New ATA/100 drives can be purchased and used both in newer ATA/100 systems (that will take advantage of the next generation devices via the higher-speed interface) and in older ATA systems. In these cases, the new Ultra ATA/100 drives will transfer data to and from the host at the host's slower speed. An Ultra ATA/100 adapter card solution can be installed in PCs with older ATA chip sets to step up to ATA/100 with newer, Ultra ATA/100 drives.

The 80-conductor, 40-pin cable standard in ATA/66 has enhanced reliability and been carried forward to ATA/100. The cable's 40 ground lines virtually eliminate cross talk and protect against electromagnetic noise interference while maintaining the standard 40-pin connector. Inside each connector, the 40 additional ground lines are tied together and are connected to the existing ground pins from the 40-pin connector. This ensures complete plug compatibility with existing drives and systems.

**Figure 1: DD12 Crosstalk with 40 Conductor Cable**



**Figure 2: DD12 Crosstalk with 80 Conductor Cable**

Quantum originally developed and, working in conjunction with Intel, introduced the Ultra ATA interface with DMA/33 and DMA/66 protocols. This latest version of the bus provides a high burst transfer rate of 100 megabytes per second, effectively providing enough data pipeline capacity to handle the next generation drives due out in the near future. With the new Ultra ATA/100 interface, PC users will need less time to boot their systems and open their applications, when the higher performance systems and drives become available. The new interface also includes a Cyclical Redundancy Check (CRC) feature to ensure the integrity of transferred data.

CRC is a proven, powerful data protection verification method for hard drives, previously employed in earlier ATA technology. With CRC, a verification code is produced for each burst data transfer by both the host and the drive, and is stored in their respective CRC registers. At the end of each burst, the host and drive CRC register contents are compared to ensure that the data burst sent matches the data burst received.

Although this ATA technology is patented by Quantum, the interface is freely licensed to chip set vendors, system designers and major desktop computer and drive manufacturers.

## Why ATA/100 Now?

With this specification in place, ATA/100 is set to become the non-proprietary, flexible, low-cost host-to-drive parallel interface of the future for the PC world. Supporters promise that ATA/100 will provide simplified compatibility, and throughput speeds of up to 100 megabytes per second, capable of handling the next generation of hard drives due out 2001.

ATA/100 has the bandwidth capacity to ensure that the hard disk to host data transfer pipeline does not become the albatross limiting next generation system performance. Features of the new bus include:

- Backward compatibility with ATA/33 and ATA/66 devices.
- Data integrity and reliable transfer over an 80-conductor, 40-pin cable
- Complete plug-and-play operation with next generation chip sets and drives from major manufacturers and vendors.
- Data transfer rates of up to 100MB/second
- Built-in design compatibility simplification with tightly controlled trace lengths, slew rates, hysteresis, and other timing parameters.

The Ultra ATA/100 interface is ready for the new generation of advanced operating systems, multimedia, streaming video, and Internet-based applications which are on the near horizon. Although not yet an official standard, this interface does have industry-wide endorsement with major vendors on-board. The Ultra ATA/100 specification will be announced and released to the public in June of 2000.

## When Will ATA/100 Features Be Utilized?

A lot sooner than you may expect! Most of the industry's key players have followed Quantum's lead and are "on-board" for the ATA/100 protocol. Products and components using the ATA/100 specification are expected to ship in volume during the third quarter of calendar year 2000. Intel, in February 1999, announced support for the ATA/100 protocol in its upcoming 820E (ICH-2) chip set.



The ATA/100 implementation of the Ultra ATA parallel interface line is expected to be the dominant interface for connections to PC hard disk drives. Designers who begin ATA/100 specification compatibility development now will have a head start on their peers. Users operating higher performance PCs and drives will demand interfaces capable of handling their system needs. Quickly moving multimedia data and large files between their personal computers and hard drives is a key requirement of demanding publishing and media authoring customers. They will be one of the first user groups to benefit from ATA/100 performance once enhanced products are released.

The ATA/100 will improve the transport of digital data between computers and new generation hard drives. Since it can be added into existing systems without the need for termination devices, new cabling, or other hardware changes, industry implementation of ATA/100 will provide an inexpensive, simple, non-proprietary, high-speed method of host to storage access. Its performance, reliability, support for legacy machines in PIO and DMA modes, and compatibility with the existing large ATA technology user-base will make it the standard data storage interface.

Ultra ATA/100 protocol is here and ready to meet the performance challenges of next generation PCs and hard drives. It will be the preferred parallel methodology for connecting a host platform to a storage device; it will do the job!

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