

# **Maxtor<sup>®</sup>**

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## ***DiamondMax Plus8 20/30/40GB AT Product Manual***

*May 13, 2005*

*Revision 1*

*Part Number: 000001876*

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## **UL/CSA/VDE/TUV/RoHS**

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UL standard 1954 recognition granted under File No. E78016

CSA standard C22.2-950 certification granted under File No. LR49896

TUV Rheinland EN 60 950

Tested to FCC Rules for Radiated and Conducted Emissions, Part 15, Sub Part J, for Class-B Equipment.

DiamondMax Plus 8 model number 6K040L0 meets the EU directive for the Restriction and Use of Hazardous Substances (RoHS), 2002/95/EC of the European Parliament and the council of 27 January, 2003.

DiamondMax Plus 8 model numbers 6EXXXL0 do not meet these initiatives.

## **PATENTS**

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Part Number: 000001876

Before You Begin: Thank you for your interest in Maxtor hard disk drives. This manual provides technical information for OEM engineers and systems integrators regarding the installation and use of Maxtor hard drives. Drive repair should be performed only at an authorized repair center. For repair information, contact the Maxtor Product Support Center at 1-800-2MAXTOR.

**CAUTION:** Maxtor hard drives are precision products. Failure to follow these precautions and guidelines outlined here may lead to product failure, damage and invalidation of all warranties.

- 1 **BEFORE** unpacking or handling a drive, take all proper electrostatic discharge (ESD) precautions, including personnel and equipment grounding. Stand-alone drives are sensitive to
- 1 electrostatic discharge (ESD) damage.
- 2 **BEFORE** removing drives from their packing material, allow them to reach room temperature.
- 3 During handling, **NEVER** drop, jar, or bump a drive.
- 4 Once a drive is removed from the Maxtor shipping container, **IMMEDIATELY** secure the drive through its mounting holes within a chassis. Otherwise, store the drive on a padded, grounded, antistatic surface.
- 5 **NEVER** switch DC power onto the drive by plugging an electrically live DC source cable into the drive's connector. **NEVER** connect a live bus to the drive's interface connector.
- 6 **ELECTRICAL GROUNDING** - For proper operation, the drive must be securely fastened to a device bay that provides a suitable electrical ground to the drive baseplate.

Please do not remove or cover up Maxtor factory-installed drive labels. They contain information required should the drive ever need repair. Thank you for your interest in Maxtor hard disk drives. This manual provides technical information for OEM engineers and systems integrators regarding the installation and use of Maxtor hard drives. Drive repair should be performed only at an authorized repair center. For repair information, contact the Maxtor Customer Service Center at 800-2MAXTOR or 1-303-678-2015.

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# **Chapter 1**

## **Introduction**

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### **1.1 Maxtor Corporation**

Maxtor corporation is one of the world's largest suppliers of hard disk drive products-products that help store the digital world for millions of users. Maxtor products serve a range of markets, including personal and entertainment, small office/home office, mid-sized business and enterprise

#### **Products**

Maxtor storage products include drives and accessories for PC's, workstations, RAID products, enterprise applications, enterprise servers, high-end systems, consumer electronics and personal storage.

#### **Support**

Maxtor provides a variety of consumer support options, all designed to make sure the user gets fast, helpful, accurate information to help resolve any difficulties. These options include a broad, searchable knowledge base of FAQ's, product manuals, installation guides, information on previously resolved problems, software downloads, and contact by phone or E-mail with a support person. For more information, visit

[www.maxtor.com/en/support](http://www.maxtor.com/en/support).

### **1.2 Audience**

The DiamondMax Plus 8 20/30/40GB AT product manual is intended for several audiences. These audiences include: the end user, installer, developer, consumer electronics and personal computer original equipment manufacturer (CE/PC,OEM), and distributor. The manual provides information about installation, principles of operation, interface command implementation, and maintenance.

### **1.3      *MANUAL ORGANIZATION***

This manual is organized into the following chapters:

- Chapter 1 – *Introduction*
- Chapter 2 – *Product Description*
- Chapter 3 – *Product Specifications*
- Chapter 4 – *Installation*
- Chapter 5 – *ATA Bus Interface and ATA Commands*
- Chapter 6 – *Service and Support*
- Glossary

### **1.4      *TERMINOLOGY AND CONVENTIONS***

In the Glossary at the back of this manual, you can find definitions for many of the terms used in this manual. In addition, the following abbreviations are used in this manual:

- ASIC    application-specific integrated circuit
- ATA    advanced technology attachment
- bpi    bits per inch
- DA    Double Amplitude (represents ph-pk shaker displacement)
- dB    decibels
- dBA    decibels, A weighted
- DPS    Data Protection System
- SPS    Shock Protection System
- ECC    error correcting code
- Kfci    thousands of flux changes per inch
- Hz    hertz
- KB    kilobytes
- LSB    least significant bit
- mA    milliamperes
- MB    megabytes (1 MB = 1,000,000 bytes when referring to disk transfer rates or storage capacities and 1,048,576 bytes in all other cases)
- Mb/s    megabits per second

- MB/s megabytes per second
- MHz megahertz
- ms milliseconds
- MSB most significant bit
- mV millivolts
- ns nanoseconds
- tpi tracks per inch
- $\mu$ s microseconds
- V volts

The typographical and naming conventions used in this manual are listed below. Conventions that are unique to a specific table appear in the notes that follow that table.

#### Typographical Conventions:

- **Names of Bits:** Bit names are presented in initial capitals. An example is the Host Software Reset bit.
- **Commands:** Interface commands are listed in all capitals. An example is WRITE LONG.
- **Register Names:** Registers are given in this manual with initial capitals. An example is the Alternate Status Register.
- **Parameters:** Parameters are given as initial capitals when spelled out, and are given as all capitals when abbreviated. Examples are Prefetch Enable (PE), and Cache Enable (CE).
- **Hexadecimal Notation:** The hexadecimal notation is given in 9-point subscript form. An example is 30<sub>H</sub>.
- **Signal Negation:** A signal name that is defined as active low is listed with a minus sign following the signal. An example is RD<sub>-</sub>.
- **Messages:** A message that is sent from the drive to the host is listed in all capitals. An example is ILLEGAL COMMAND.

#### Naming Conventions:

- **Host:** In general, the system in which the drive resides is referred to as the host.
- **Computer Voice:** This refers to items you type at the computer keyboard. These items are listed in 10-point, all capitals, Courier font. An example is `FORMAT C:/S`.

## **1.5 REFERENCE**

For additional information about the ATA interface, refer to the latest revision of the draft standard on the internet at <http://www.t13/> using the link under “1410DAT Attachment - 6 with Packet Interface (ATA/ATAPI - 6).”

## **Chapter 2**

# **PRODUCT DESCRIPTION**

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### **2.1 PRODUCT DESCRIPTION**

Maxtor drive leadership continues with the DiamondMax Plus 8 drive - the first single-head, single platter, 7200RPM product. DiamondMax Plus 8 drives combine performance and value making a perfect choice for mainstream consumer or commercial/business desktop users.

DiamondMax Plus 8 drives use the Ultra ATA/133 interface, the fastest desktop interface with maximum data transfer rates of 133MB/second.

Fluid dynamic bearing (FDB) motors minimize drive acoustics, allowing the drive to operate with low sound output. DiamondMax Plus 8 is designed for higher reliability. The drive's inner diameter load/unload ramp locks the recording head into a protective carrier to cradle the head during shipment and any other time the drive is not in operation.

DiamondMax Plus 8 drives deliver high reliability and data integrity using Maxtor developed Shock Protection System (SPS) and Data Protection System (DPS). SPS and DPS give the user enhanced protection against both operating and non-operating shock and verify essential functions in seconds to minimize costly drive returns.

- Supports today's favorite capacity - 40GB
- Leading mainstream performance from 7200RPM rotation speed
- ATA/133 the fastest and latest IDE interface
- FDB (Fluid Dynamic Bearing) motor for quiet operation
- Low height to improve airflow and cooling
- Low weight to reduce shipping costs
- Improved reliability with:
  - ~ Shock Protection System
  - ~ Data Protection System

## 2.2 KEY FEATURES

The DiamondMax Plus 8 20/30/40GB AT hard disk drives include the following key features:

### General

- Formatted storage capacity of 20.0, 30.0 and 40.0 GB
- Low profile, 17 mm high
- 7200 RPM spin speed
- Industry standard 3 1/2-inch form factor
- Emulation of IBM® PC AT® task file register, and all AT fixed disk commands
- Windows NT and 9X Certification

### Performance

- 10.0 ms seek time
- Average rotational latency of 4.17ms
- New Ultra ATA interface with Maxtor-patented Ultra ATA/133 protocol supporting burst data transfer rates of 133MB/s.
- 2 MB buffer with 1.9MB (approximate) Advance Cache Management (ACM).
- Advanced Multi-burst ECC on-the-fly
- Support of all standard ATA data transfer modes with PIO mode 4 and multiword DMA mode 2, and Ultra DMA modes 0, 1, 2, 3, 4, 5 and 6

### Reliability

- 57 Byte Reed-Soloman ECC with up to 54 Byte correction capability.
- S.M.A.R.T. 4 (Self-Monitoring, Analysis and Reporting Technology)
- Auto Park and Lock actuator mechanism
- Transparent media defect mapping
- High durability with 100,000 cycles for reliable load/unload function
- High performance, in-line defective sector skipping
- Reassignment of defective sectors discovered in the field, without reformatting
- Shock Protection System to reduce handling induced failures
- Data Protection System to verify drive integrity
- Quiet Drive Technology (QDT)

### Versatility

- Power saving modes
- Downloadable firmware
- Cable select feature
- Ability to daisy-chain two drives on the interface

## **2.3 REGULATORY COMPLIANCE STANDARDS**

Maxtor Corporation's disk drive products meet all domestic and international product safety regulatory compliance requirements. Maxtor's disk drive products conform to the following specifically marked Product Safety Standards:

- Underwriters Laboratories (UL) Standard 1950. This certificate is a category certification pertaining to all 3.5-inch series drives models.
- Canadian Standards Association (CSA) Standard C.22.2 No. 1950. This certificate is a category certification pertaining to all 3.5-inch series drives models.
- TUV Rheinland Standard EN60 950. This certificate is a category certification pertaining to all 3.5-inch series drives models.

### ***Product EMI/EMS Qualifications:***

- CE Mark authorization is granted by TUV Rheinland in compliance with our qualifying under EN 55022:1994 and EN 50082-1:1997.
- C-Tick Mark is an Australian authorization marked noted on Maxtor's disk drive products. The mark proves conformity to the regulatory compliance document AS/NZS 3548: 1995 and BS EN 55022: 1995.
- Maxtor's disk drives are designed as a separate subassembly that conforms to the FCC Rules for Radiated and Conducted emissions, Part 15 Subpart J; Class B when installed in a given computer system.
- Approval from Taiwan BSMI. Number: 3892A638

## **2.4 HARDWARE REQUIREMENTS**

The Maxtor DiamondMax Plus 8 hard disk drives are compatible with the IBM PC AT, and other computers that are compatible with the IBM PC AT. It connects to the PC either by means of a third-party IDE-compatible adapter board, or by plugging a cable from the drive directly into a PC motherboard that supplies an ATA interface.



# **Chapter 3**

## **PRODUCT SPECIFICATIONS**

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### **3.1 Models and Capacities**

<b>MODELS NUMBERS</b>			
Non-RoHS Compliant RoHS Compliant*	6E020LO -	6E030LO -	6E040LO 6K040LO*
Formatted Capacity (GB LBA Mode)	20GB	30GB	40GB
GB means 1 billion bytes. Total accessible capacity varies depending on operating environment.			
* Complies with European Union Directive on Restriction of Hazardous Substances (Section 3.13)			

### **3.2 Drive Configuration**

<b>MODELS</b>	<b>20GB</b>	<b>30GB</b>	<b>40GB</b>
Data Surfaces/Number of Heads	1	1	1
Number of Disks	1	1	1
Sectors per Drive (max LBA)	40,718,160	60,058,656	80,293,248
Integrated Interface	Maxtor Ultra ATA/133 (ATA-5/ATA-6)		
Recording Method	PRML		
Servo Type	Embedded		
Number of Servo Sectors	180		
Data Zones per Surface	16		
Data Sectors per Track (ID/OD)	450/720, 612/990, 720/1140		
Areal Density (Gbits/in <sup>2</sup> max, ID/OD)	33.9/25.6, 46.6/36.1, 63.2/49.7		

<b>MODELS</b>	<b>20GB</b>	<b>30GB</b>	<b>40GB</b>
Flux Density (kfc, ID/OD)	OD = 352/496/583 ID = 465/639/743		
Recording Density (kbp, ID/OD)	ID = 446/613/713 OD = 338/476/560		
Track Density (ktp)	75.9/75.9/88.7		

### 3.3 Performance Specifications

<b>MODELS</b>	<b>20GB</b>	<b>30GB</b>	<b>40GB</b>
Seek Times (typical read, ms)			
Track-to-Track		0.8	
Average (normal seek)		≤10.0	
Full Stroke (normal seek)		≤18.0	
Average Latency (ms)		4.17	
Controller Overhead (ms)		<0.3	
Rotation Speed (RPM ±0.1%)		7200	
Data Transfer Speed (MByte/sec max)			
To/From Interface (Maxtor Ultra ATA/133, up to)		133	
To/From Media (ID/OD up to nn.n, where nn.n is the maximum transfer rate possible)		ID = 290/399/463 OD = 454/636/738	
Sustained (ID/OD up to nn.n, where nn.n is the maximum transfer rate possible)		ID = 23.9/32.5/38.2 OD = 38.2/52.6/60.5	
Data Buffer Size (MB)/Type		2/SDRAM	
Drive Ready Time (typical sec)		<5.0	

### 3.4 Physical Dimensions

<b>PARAMETER</b>	<b>VALUE</b>
Height (maximum in mm)	17.5
Width (typical mm)	101.6
Length (maximum in mm)	146.1
Weight (maximum in grams)	≤510

### 3.5 Power Requirements

<b>MODE</b>	<b>12V (MA)</b>	<b>5V (MA)</b>	<b>POWER (W)</b>
Spin-up (peak)	1554.20	756.04	22.43
Seek	440.42	562.13	8.10
Read/Write	489.99	442.42	8.09
Idle	380.57	396.41	7.27
Standby	34.35	65.83	0.75
Sleep	34.25	65.77	0.75

### 3.6 Power Mode Definitions

#### **Spin-up**

The drive is spinning up following initial application of power and has not yet reached full speed.

#### **Seek**

A random access operation by the drive.

#### **Read/Write**

Data is being read from or written to the drive.

#### **Idle**

The drive is spinning, the actuator is parked and powered off and all other circuitry is powered on.

The drive is capable of responding to read commands within 40 ms.

#### **Standby**

The motor is not spinning. The drive will leave this mode upon receipt of a command that requires disk access. The time-out value for this mode is programmable. The buffer is active to accept write data.

#### **Sleep**

This is the lowest power state – with the interface set to inactive. A software or hardware reset is required to return the drive to the Standby state.

### 3.7 EPA Energy Star Compliance

Maxtor Corporation supports the goals of the U.S. Environmental Protection Agency’s Energy Star program to reduce the electrical power consumption of computer equipment.

### 3.8 Environmental Limits

<b>PARAMETER</b>	<b>OPERATING</b>	<b>NON-OPERATING/ STORAGE</b>
Temperature	5° C to 55° C (with no ARR impact) 0° C to 60° C (margin demonstrated <sup>1</sup> )	low temperature (-40° C)  high temperature (71° C) per MIL-STD-810E, method 501.3, climatic category; hot-induced conditions.
Thermal Gradient	30° C per hour (maximum)	
Relative Humidity	5% to 95% (non-condensing)	
Wet Bulb	30° C (maximum)	
Altitude (relative to sea level)	-650 to 10,000 feet	-650 to 40,000 feet
Acoustic Noise <sup>2</sup>	<b>IDLE MODE (Track Following at Speed)</b>	<b>NORMAL SEEK MODE</b>
Fluid Bearing	2.9 bel average 3.3 bel maximum	3.0 bel average 3.3 bel maximum

Notes:

1. Margin Demonstrated implies the product will operate at the stated conditions with an acceptable impact to the ARR specification for any OEM requiring those values in their purchase specification.
2. The testing performed by Maxtor is consistent with ISO 7779. Variation in acoustic levels from the idle specification may occur due to offline activity according to the SMART specification and/or atmospheric conditions.

### 3.9 Shock and Vibration

<b>PARAMETER</b>	<b>OPERATING</b>	<b>NON-OPERATING</b>
Mechanical Shock	R = 0.988/shock at 60 Gs; R = 0.999/shock at 30 Gs	1 msec, 1/2 sine R = 0.90@ > = 300G 1 disk R = 0.95@ > = 250G, 1 disk R = 0.99@ > = 200G, 1 disk
Rotational Shock	R = 0.988 @ 2000 rad/sec <sup>2</sup>	R = 0.95 @ 20K rad/sec <sup>2</sup> , 0.5ms to 1ms input R = 0.99 @ 15K rad/sec <sup>2</sup> , 1.5ms to 2ms input
Rotational Random Vibration	5 - 2000 Hz 4.50 rad/sec <sup>2</sup> RMS Overall	2 - 300 Hz 96.5 rad/sec <sup>2</sup> RMS
Random Vibration	5 - 2000 Hz 1.15 GRMS Overall	PSD: 7 - 800 Hz at 3.08 GRMS No Damage
Swept Sine Vibration (1 octave/minute, peak amplitude) 10 to 300 Hz  301 to 400 Hz  401 to 500 Hz	1.0 G (0 to peak) amplitude, 1 octave per minute 0.25 G (0 to peak) amplitude, 1 octave per minute 0.0625 G (0 to peak) amplitude, 1 octave per minute	
Operating Sine Vibration, 0.25 octave/min.	5-1500 Hz Frequency (Hz)/Acceleration (Gpk)  5/ 0.40" DA 8.6/ 0.40" DA 9/ 1.500 300/ 1.500 600/ 0.250 650/ 0.070 1500/ 0.070	

### **3.10 Reliability Specifications**

#### **Annualized Return Rate**

*< 1.0%* Annualized Return Rate (ARR) indicates the average against products shipped. ARR includes all reasons for returns (failures, handling, damage, NDF) but does not include inventory credit returns.

#### **Load/Unload Cycles**

*100,000* This indicates the average minimum cycles for reliable load/unload function.

#### **Data Reliability**

*< 1 per 10e15 bits read*

Data errors (non-recoverable). Average data error rate allowed with all errorrecovery features activated.

#### **Component Design Life**

*5 years (minimum)*

Component design life is defined as a.) the time period before identified wear-out mechanisms impact the failure rate, or b.) the time period up to the wear-out point when useful component life expires.

### **3.11 EMC/EMI**

#### **3.11.1 Radiated Electromagnetic Field Emissions - EMC Compliance**

The hard disk drive mechanism is designed as a subassembly for installation into a suitable enclosure and is therefore not subject to Subpart J of Part 15 of FCC Rules (47CFR15) or the Canadian Department of Communications Radio Interference Regulations. Although not required, the disk mechanism has been tested within a suitable end-use product and found to comply with Class B limits of the FCC Rules and Regulations of the Canadian Department of Communications.

The CE Marking indicates conformity with the European Union Low Voltage Directive (73/23/EEC) when the disk mechanism is installed in a typical personal computer. Maxtor recommends that testing and analysis for EMC compliance be performed with the disk mechanism installed within the user's end-use application.

#### **3.11.2 Canadian Emissions Statement**

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian department of communications.

Le present appareil numerique n'emet pas de bruit radioelectriques depassant les limites applicables aux appareils numeriques de Class B prescrites dans le reglement sur le brouillage radioelectrique edicte pa le ministere des communications du Canada.

### **3.12 Safety Regulatory Compliance**

All Maxtor hard drives comply with relevant product safety standards such as CE, CUL, TUV and UL rules and regulations. As delivered, Maxtor hard drives are designed for system integration before they are used.

### **3.13 RoHS Compliance**

Versions of DiamondMax Plus 8 drives will become available during 2005 that will meet the Restriction of Hazardous Substances (RoHS) compliance directive of the European Union as applicable. The full description of this legislation, commonly called RoHS, is “Directive 2002/95/EC of the European Parliament and the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment”.





# Chapter 4 INSTALLATION

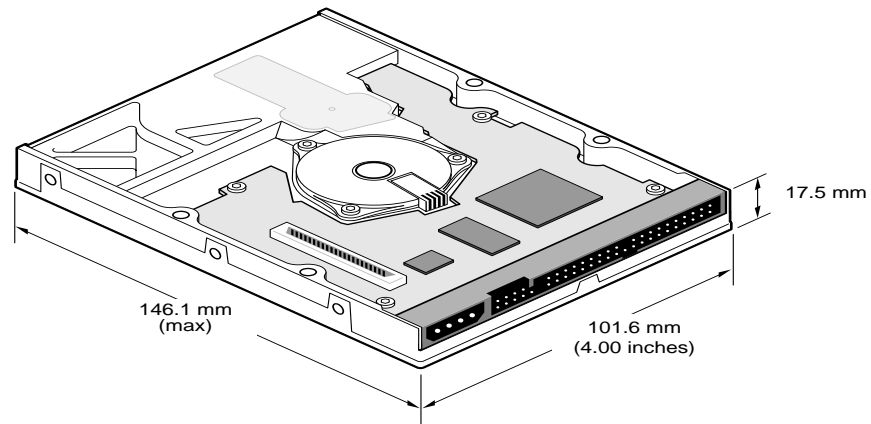
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This chapter explains how to unpack, configure, mount, and connect the Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drive prior to operation. It also explains how to start up and operate the drive.

## 4.1 SPACE REQUIREMENTS

The Maxtor DiamondMax Plus8 hard disk drives are shipped without a faceplate. Figure 4-1 shows the external dimensions of the Maxtor DiamondMax Plus8 20/30/40GB AT drives.



**Figure 4-1** Mechanical Dimensions of Maxtor DiamondMax Plus8 Hard Disk Drive

## 4.2 UNPACKING INSTRUCTIONS

**CAUTION:** The maximum limits for physical shock can be exceeded if the drive is not handled properly. Special care should be taken not to bump or drop the drive. It is highly recommended that Maxtor DiamondMax Plus8 drives are not stacked or placed on any hard surface after they are unpacked. Such handling could cause media damage.

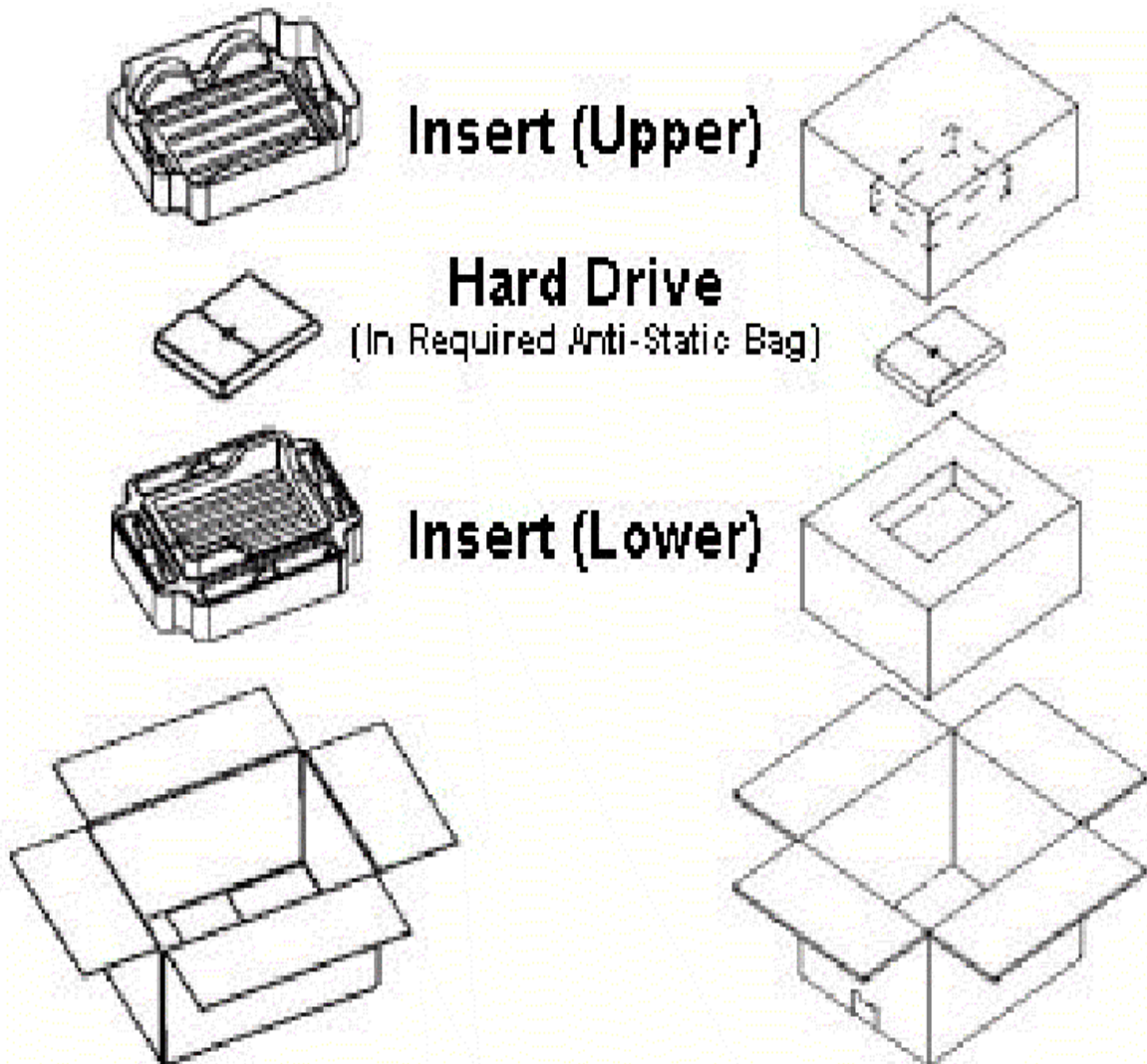
1. Open the shipping container and remove the packing assembly that contains the drive.
2. Remove the drive from the packing assembly.

**CAUTION:** During shipment and handling, the antistatic electrostatic discharge (ESD) bag prevents electronic component damage due to electrostatic discharge. To avoid accidental damage to the drive, do not use a sharp instrument to open the ESD bag and do not touch PCB components. Save the packing materials for possible future use.

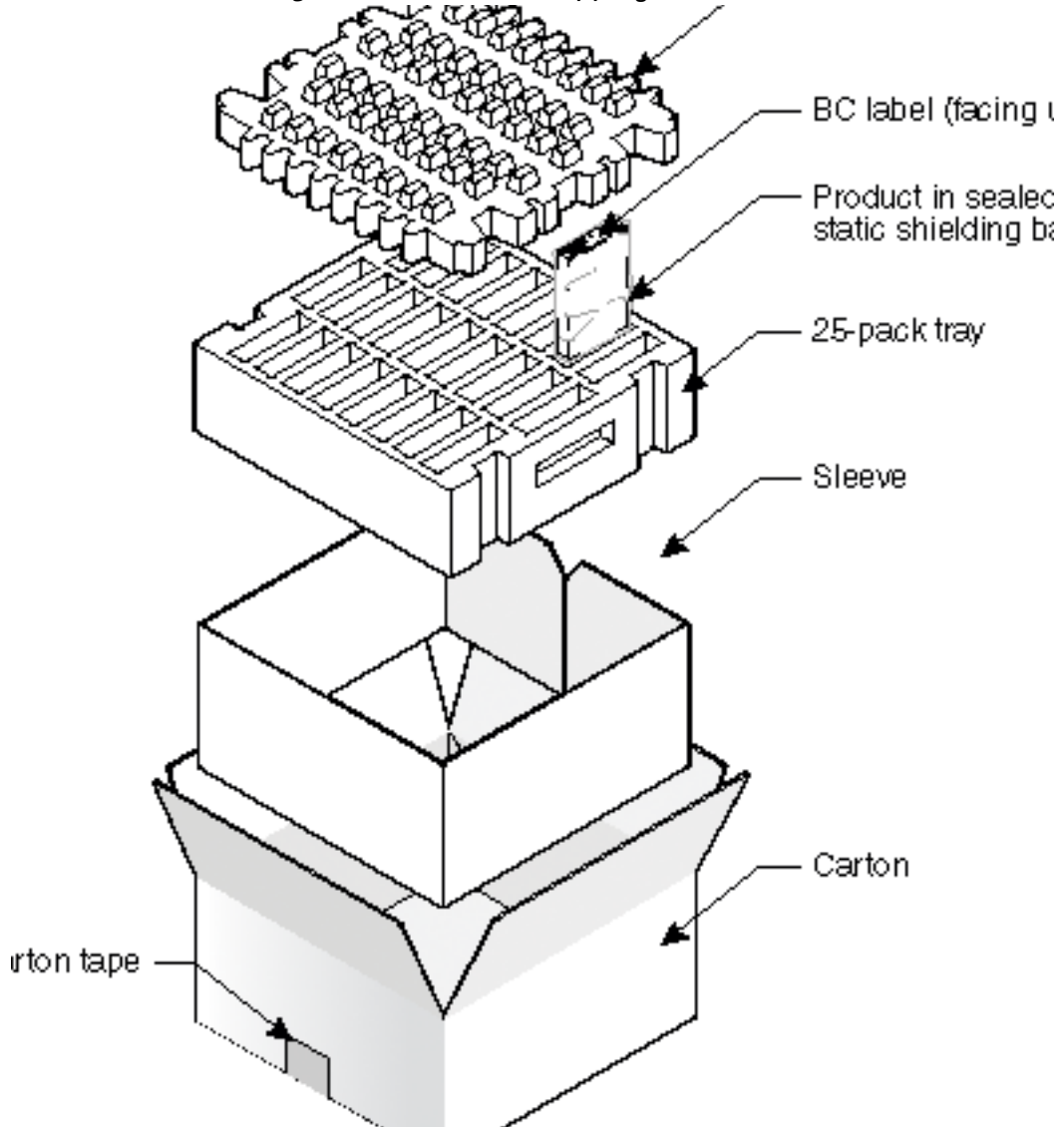
3. When you are ready to install the drive, remove it from the ESD bag.

**Figure 4-2** shows the packing assembly for a single Maxtor DiamondMax Plus8 hard disk drive. A 20 and 25-pack shipping container is available for multiple drive shipments.

**Figure 4-2** Single-Pack Shipping Container

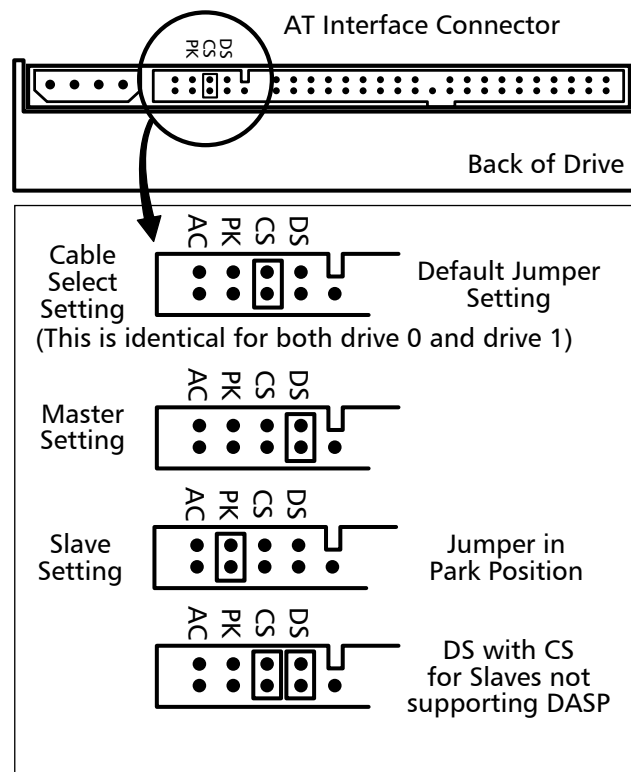


**Figure 4-3 25-Pack Shipping Container**



### **4.3 HARDWARE OPTIONS**

The configuration of a Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drive depends on the host system in which it is to be installed. This section describes the hardware options that you must take into account prior to installation.



**Figure 4-4** Jumper Locations on the Interface Connector

The configuration of the following Three jumpers controls the drive's five modes of operation:

- CS – Cable Select
- DS – Drive Select
- PK– Jumper Parking Position (Slave mode)
- AC– Alternate Capacity

The AT PCB has two jumper locations provided to configure the drive in a system. The default configuration for the drive as shipped from the factory is with a jumper across the DS location, and open positions in the CS, PK and AC positions.

Table 4-1 defines the operation of the master/slave jumpers and their function relative to pin 28 on the interface. *1* indicates that the specified jumper is installed; *0* indicates that the jumper is not installed.

**Table 4-1 AT Jumper Options**

<b>CS</b>	<b>DS</b>	<b>PK</b>	<b>PIN 28</b>	<b>DESCRIPTION</b>
0	0	X	X	Drive is configured as a slave
1	0	X	Gnd	Drive is configured as Master (Device 0) when attached to the end of a 80 conductor Ultra ATA cable
0	1	X	X	Drive is configured as a Master
1	0	X	Open	Drive is configured as a Slave (Device 1) when attached to the middle of a 80 conductor Ultra ATA cable
1	1	X	X	Drive is configured as a Master with an attached slave that does not support DASP

Note: In Table 4-1, a *0* indicates that the jumper is removed, a *1* indicates that the jumper is installed, and an *X* indicates that the jumper setting does not matter.

#### **4.3.1 Cable Select (CS) Jumper**

When a Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drive and another ATA hard disk drive are daisy-chained together, they can be configured as Master or Slave either by the CS or DS jumpers. To configure the drive as a Master or Slave with the CS feature, the CS jumper is installed (1). The drive's position on the 80 conductor Ultra ATA data cable then determines whether the drive is a Master (Device 0) or a Slave (Device 1). If the drive is connected to the end of the Ultra (cable Select) data cable the drive is a Master. If the drive is connected to the middle connection it is set as a Slave.

Once you install the CS jumper, the drive is configured as a Master or Slave by the state of the Cable Select signal: pin 28 of the ATA bus connector. Please note that pin 28 is a vendor-specific pin that Maxtor is using for a specific purpose. More than one function is allocated to CS, according to the ATA CAM specification (see reference to this specification in Chapter 1). If pin 28 is a *0* (grounded), the drive is configured as a Master. If it is a *1* (high), the drive is configured as a Slave. In order to configure two drives in a Master/Slave relationship using the CS jumper, you need to use a cable that provides the proper signal level at pin 28 of the ATA bus connector. This allows two drives to operate in a Master/Slave relationship according to the drive cable placement.

The Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drives are shipped from the factory as a Master (Device 0 - CS jumper installed). To configure a drive as a Slave (Device 1- DS scheme), the CS jumper must be removed. In this configuration, the spare jumper removed from

the CS position may be stored on the PK jumper pins.

#### **4.3.2 Drive Select (DS) Jumper**

You can also daisy-chain two drives on the ATA bus interface by using their Drive Select (DS) jumpers. To use the DS feature, the CS jumper must not be installed.

To configure a drive as the Master (Device 0), a jumper must be installed on the DS pins.

Note: The order in which drives are connected in a daisy chain has no significance.

#### **4.3.3 Master Jumper configuration**

In combination with the current DS or CS jumper settings, the Slave Present (SP) jumper can be implemented if necessary as follows:

Note: The CS position doubles as the Slave present on this drive.

- When the drive is configured as a Master (DS jumper installed **or** CS jumper installed, and the Cable Select signal is set to (0), adding an additional jumper (both jumpers DS and CS now installed) will indicate to the drive that a Slave drive is present. This Master with Slave Present jumper configuration should be installed on the Master drive only if the Slave drive does *not* use the Drive Active/Slave Present (DASP-) signal to indicate its presence.

#### **4.3.4 Jumper Parking (PK) Position**

The PK position is used as a holding place for the jumper for a slave drive in systems that do not support Cable Select. The pins used for the parking position are vendor unique.

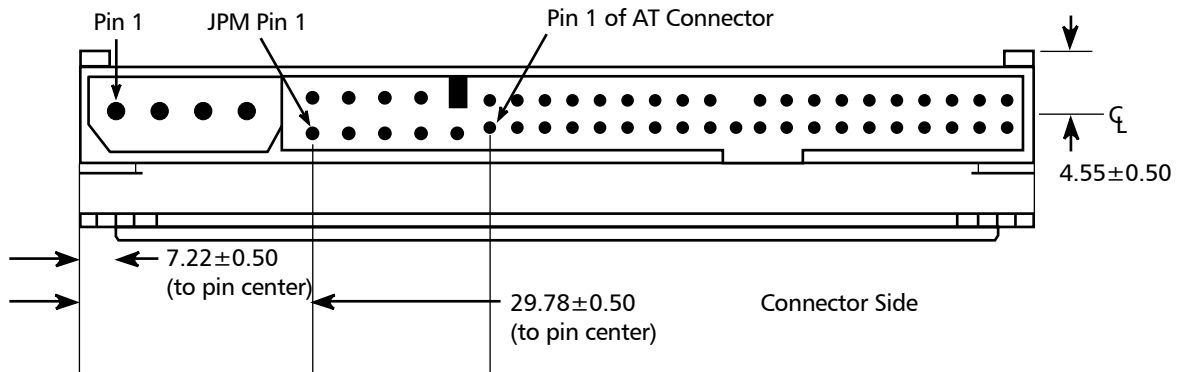


### 4.3.5 Alternate Capacity (AC)

For user capacities below 66,055,248 sectors (32GB), inserting the AC jumper limits the Number of Cylinders field 1 to a value of 16,383, as reported in IDENTIFY DEVICE data word. This allows software drivers to determine that the actual capacity is larger than indicated by the maximum CHS, requiring LBA addressing to use the full capacity.

A summary of these effects for the Maxtor DiamondMax Plus8 drives is shown in the following table:

	<i>AC JUMPER OUT</i>	<i>AC JUMPER IN</i>
<b>20GB</b>	C = 16,383 H = 16 S = 63 LBA = 40,718,160	C = 4,092 H = 16 S = 63 LBA = 39,876,479
<b>30GB</b>	C = 16,383 H = 16 S = 63 LBA = 60,058,656	C = 16,383 H = 16 S = 63 LBA = 66,055,247
<b>40GB</b>	C = 16,383 H = 16 S = 63 LBA = 80,293,248	C = 16,383 H = 16 S = 63 LBA = 66,055,247

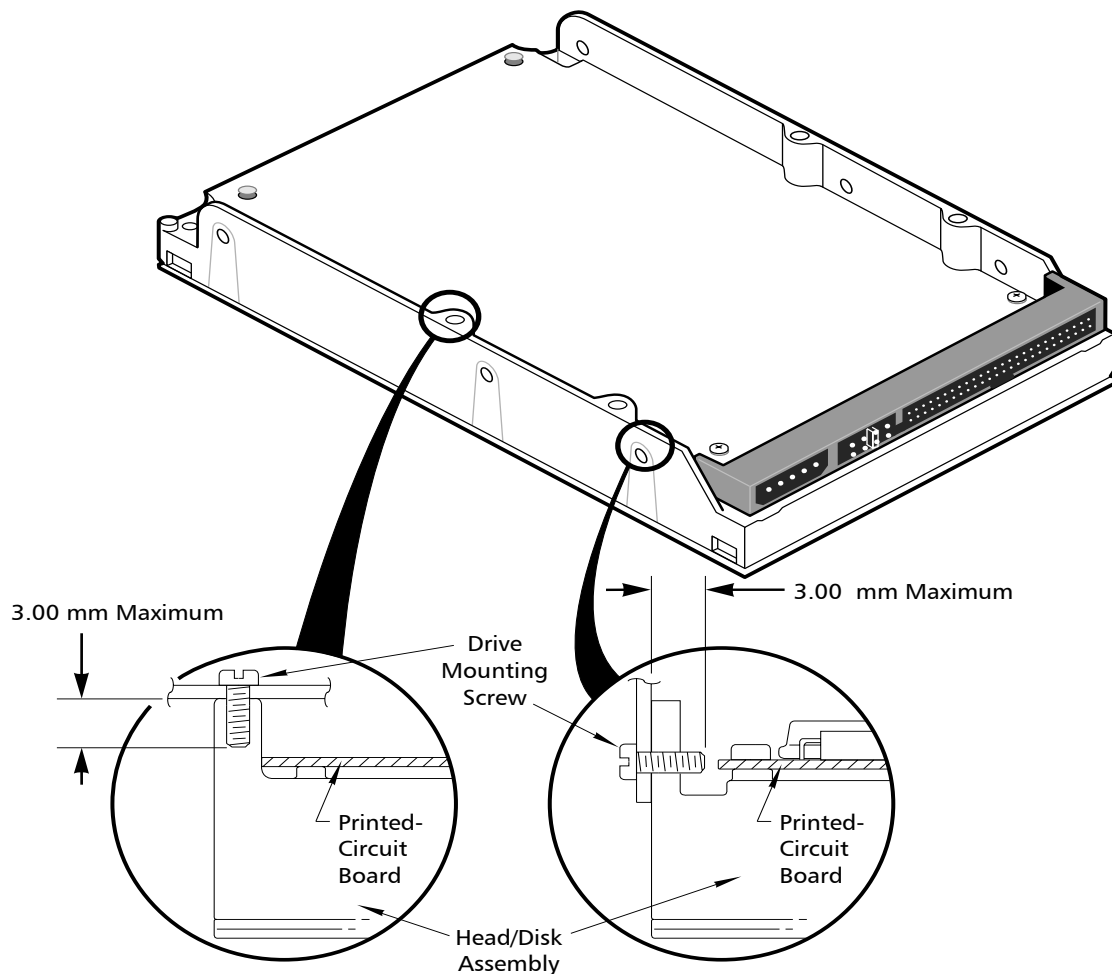


**Figure 4-5** AT Connector and Jumper Location

**CAUTION:** The PCB is very close to the mounting holes. Do not exceed the specified penetration for the mounting screws. The specified screw penetration allows full use of the mounting hole threads, while avoiding damaging or placing unwanted stress on the PCB. Figure 4-7 specifies the minimum clearance between the PCB and the screws in the mounting holes.

The Maxtor hard drive design allows greater shock tolerance than that afforded by larger, heavier drives. The drive may be mounted in any attitude using four size 6-32 screws with 3 mm maximum penetration and a maximum torque of 5-inch pounds. Allow adequate ventilation to the drive to ensure reliable operation.

**Figure 4-6** Mounting Screw Clearance



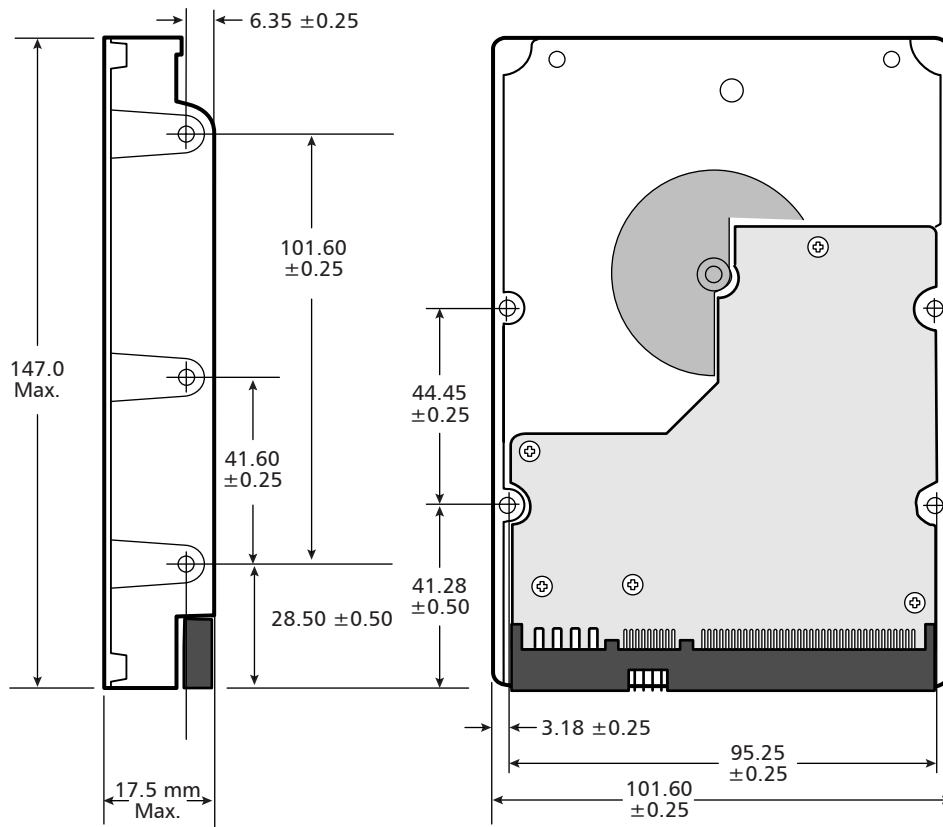
#### 4.4 MOUNTING

Drive mounting orientation, clearance, and ventilation requirements are described in the following subsections.

### 4.4.1 Orientation

The mounting holes on the Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drives allow the drive to be mounted in any orientation. Figure 4-6 show the location of the three mounting holes on each side of the drive. The drive can also be mounted using the four mounting hole locations on the PCB side of the drive.

**Note:** It is highly recommended that the drive is hard mounted on to the chassis of the system being used for general operation, as well as for test purposes. Failure to hard mount the drive can result in erroneous errors during testing. Drives can be mounted in any orientation. Normal position is with the PCB facing down. All dimensions are in millimeters. For mounting, #6-32 UNC screws are recommended.



**Figure 4-7** *Mounting Dimensions Clearance*

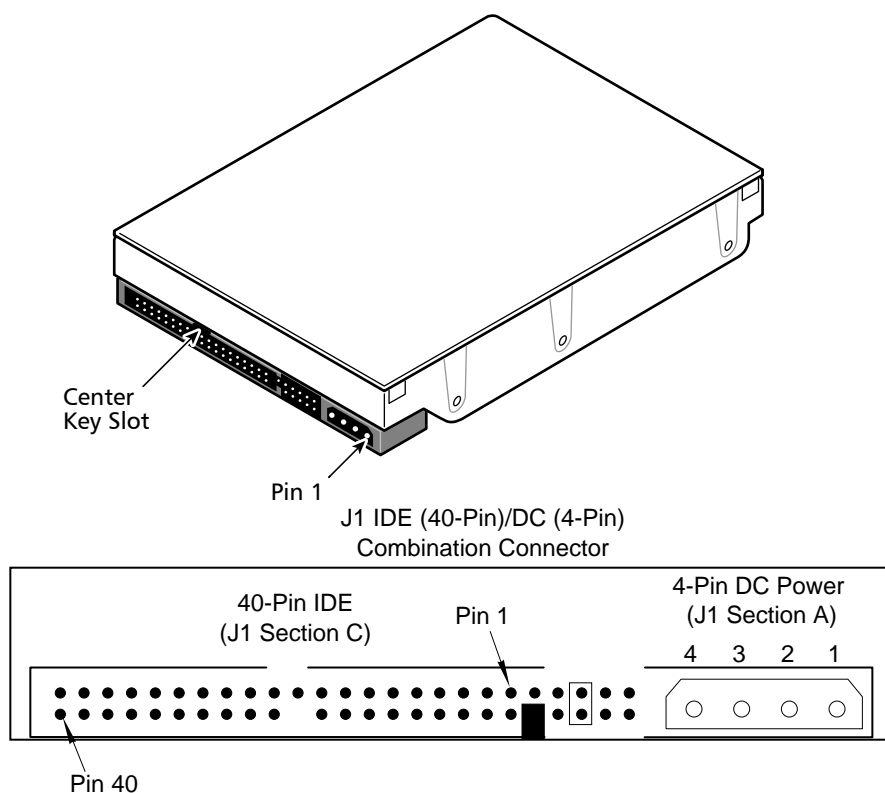
Clearance from the drive to any other surface (except mounting surfaces) must be a minimum of 1.25 mm (0.05 inches).

#### 4.4.2 Ventilation

The Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drives operate without a cooling fan, provided the ambient air temperature does not exceed 131 × F (55 × C) at any point along the drive form factor envelope.

#### 4.5 COMBINATION CONNECTOR (J1)

J1 is a three-in-one combination connector. The drive's DC power can be applied to section A. The ATA bus interface (40-pin) uses section C. The connector is mounted on the back edge of the printed-circuit board (PCB), as shown in Figure 4-7.



**Figure 4-8** J1 DC Power and ATA Bus Combination Connector

### 4.5.1 DC Power (J1, Section A)

The recommended mating connectors for the +5 VDC and +12 VDC input power are listed in Table 4-2.

*Table 4-2 J1 Power Connector, Section A*

<b>PIN NUMBER</b>	<b>VOLTAGE LEVEL</b>	<b>MATING CONNECTOR TYPE AND PART NUMBER (OR EQUIVALENT)</b>
J1 Section A (4-Pin):		
1	+12 VDC	4-Pin Connector: AMP P/N 1-480424-0 Loose piece contacts: AMP P/N VS 60619-4 Strip contacts: AMP P/N VS 61117-4
2	Ground Return for +12 VDC	
3	Ground Return for +5 VDC	
4	+5 VDC	

Note: Labels indicate the pin numbers on the connector. Pins 2 and 3 of section A are the +5 and +12 volt returns and are connected together on the drive.

### 4.5.2 External Drive Activity LED

An external drive activity LED may be connected to the DASP-I/O pin 39 on J1. For more details, see the pin description in Table 6-1.

### 4.5.3 ATA Bus Interface Connector (J1, Section C)

On the Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drives, the ATA bus interface cable connector (J1, section C) is a 40-pin Universal Header, as shown in Figure 4-7.

To prevent the possibility of incorrect installation, the connector has been keyed by removing Pin 20. This ensures that a connector cannot be installed upside down.

See Chapter 5, "ATA Bus Interface and ATA Commands," for more detailed information about the required signals. Refer to Table 5-1 for the pin assignments of the ATA bus connector (J1, section C).

## 4.6 FOR SYSTEMS WITH A MOTHERBOARD ATA ADAPTER

You can install the Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drives in an AT-compatible system that contains a 40-pin ATA bus

connector on the motherboard.

To connect the drive to the motherboard, use a 40 conductor ribbon cable (80 conductor ribbon cable if using Ultra ATA/66/100 or /133 drive) 18 inches in length or shorter. Ensure that pin 1 of the drive is connected to pin 1 of the motherboard connector.

#### **4.7 FOR SYSTEMS WITH AN ATA ADAPTER BOARD**

To install the Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drive in an AT-compatible system without a 40-pin ATA bus connector on its motherboard, you need a third-party IDE-compatible adapter board.

##### **4.7.1 Adapter Board Installation**

Carefully read the manual that accompanies your adapter board before installing it. Make sure that all the jumpers are set properly and that there are no address or signal conflicts. You must also investigate to see if your AT-compatible system contains a combination floppy and hard disk controller board. If it does, you must disable the hard disk drive controller functions on that controller board before proceeding.

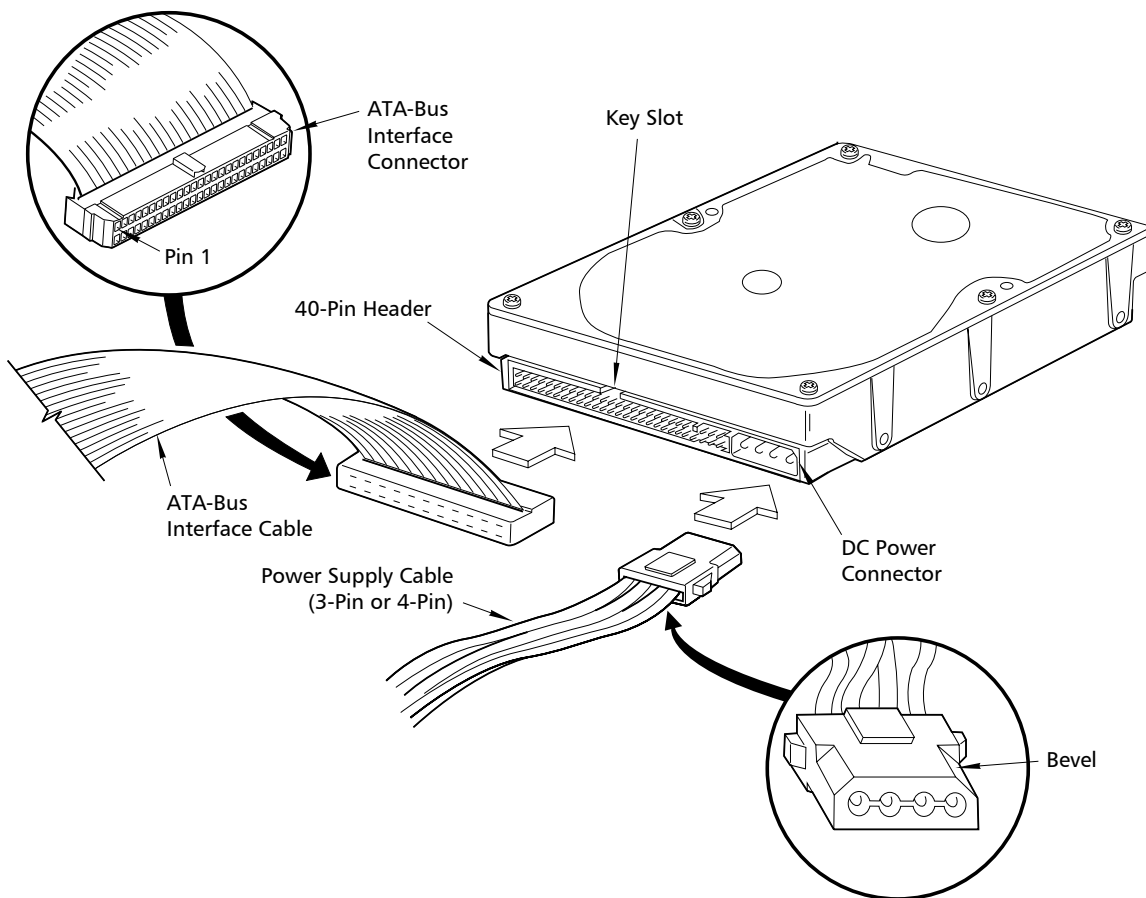
Once you have disabled the hard disk drive controller functions on the floppy/hard drive controller, install the adapter board. Again, make sure that you have set all jumper straps on the adapter board to avoid addressing and signal conflicts.

Note: For Sections 4.7 and 4.8, power should be turned off on the computer before installing the drive.

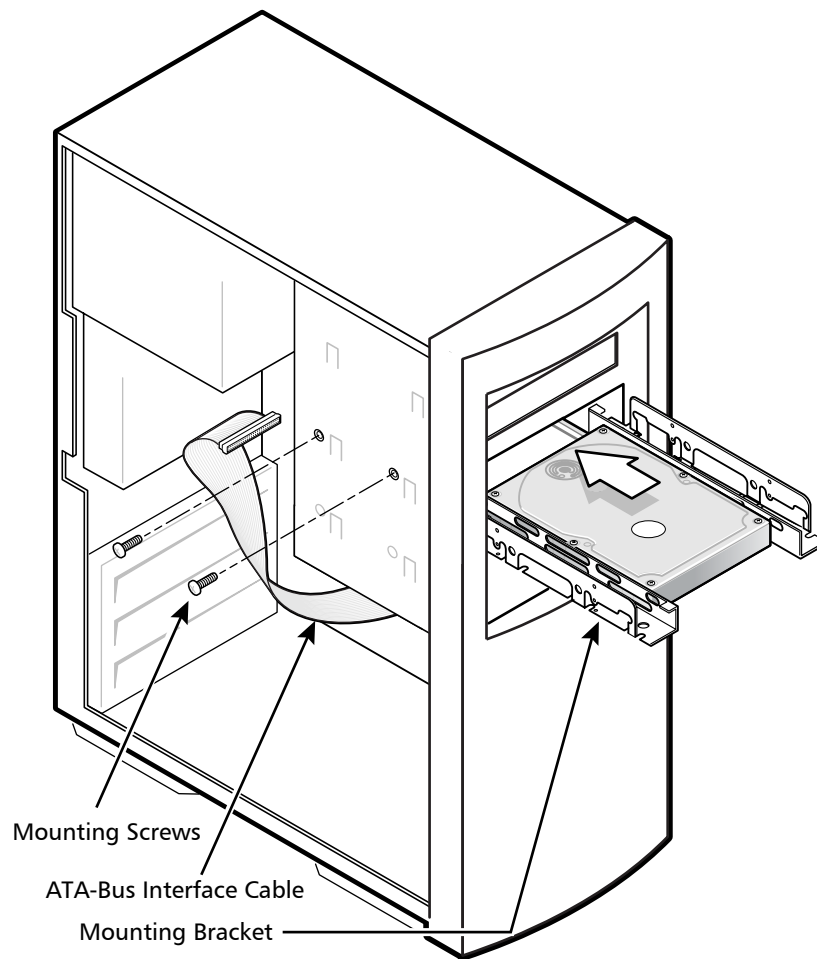
#### 4.7.1.1 Connecting the Adapter Board and the Drive

Use a 40-pin ribbon cable to connect the drive to the board. See Figure 4-8. To connect the drive to the board:

1. Insert the 40-pin cable connector into the mating connector of the adapter board. Make sure that pin 1 of the connector matches with pin 1 on the cable.
2. Insert the other end of the cable into the header on the drive. When inserting this end of the cable, make sure that pin 1 of the cable connects to pin 1 of the drive connector.
3. Secure the drive to the system chassis by using the mounting screws, as shown in Figure 4-9.



**Figure 4-9** Drive Power Supply and ATA Bus Interface Cables



*Figure 4-10* Completing the Drive Installation

## **4.8**     **TECHNIQUES IN DRIVE CONFIGURATION**

### **4.8.1**    **The 528-Megabyte Barrier**

Older BIOS that only support Int 13 commands for accessing ATA drives through DOS based operating systems will be limited to use only 1024 cylinders. This will reduce the effective capacity of the drive to 528Mbytes.

Whenever possible the Maxtor DiamondMax Plus8 20/30/40GB AT drive should be used on systems that support LBA translation to ensure the use of the entire capacity of the disk drive. If that is not possible the following are some techniques that can be used to overcome this barrier.



- Use a third party software program that translates the hard drive parameters to an acceptable configuration for MS-DOS.
- Use a hard disk controller that translates the hard drive parameters to an appropriate setup for both MS-DOS and the computer system's ROM-BIOS.
- Insert the Alternate Capacity (AC) jumper on the drive (see Section 4.3.5).

#### **4.8.2    *The 8.4-Gigabyte Barrier***

Newer BIOS's allow users to configure disk drives to go beyond the 528MB barrier by using several BIOS translation schemes. However, while using these translations the BIOS using Int 13 functions are limited to 24 bits of addressing which results in another barrier at the 8.4GB capacity.

To overcome this barrier a new set of Int 13 extensions are being implemented by most BIOS manufacturers. The new Int 13 extension allows for four words of addressing space (64 bits) resulting in 9.4 Terrabytes of accessible space.

Whenever possible the Maxtor DiamondMax Plus8 20/30/40GB AT drive should be used on systems with BIOS that support Int 13 extensions. If that is not possible the following are some techniques that can be used to overcome this barrier: Use a third party software that supplements the BIOS and adds Int 13 extension support.

- Obtain a BIOS upgrade from the system board manufacturer. Many system board manufacturers allow their BIOS to be upgraded in the field using special download utilities. Information on BIOS upgrades can be obtained on the System Board Customer Service respective web sites on the Internet.
- Insert the Alternate Capacity (AC) jumper on the drive (see Section 4.3.5).

#### **4.8.3    *Operating system limitations***

Most popular operating systems available today have additional limitations which affect the use of large capacity drives. However, these limitations can not be corrected on the BIOS and it is up to the operating system manufacturers to release improved versions to address these problems.

The most popular operating systems available today, DOS and Win 95, use a File Allocation Table (FAT) size of 16 bits which will only support partitions up to 2.1GB. A newer release of Win 95 called OSR2 with a 32 bit FAT has been released to system manufacturers only. This new FAT size table will support partitions of up to 2.2 Terrabytes.

## 4.9 SYSTEM STARTUP AND OPERATION

Once you have installed the Maxtor DiamondMax Plus8 20/30/40GB AT hard disk drive, and adapter board (if required) in the host system, you are ready to partition and format the drive for operation. To set up the drive correctly, follow these steps:

1. Power on the system.
2. Run the SETUP program. This is generally on a Diagnostics or Utilities disk, or within the system's BIOS. Some system BIOS have an auto-detecting feature making SETUP unnecessary.
3. Enter the appropriate parameters.

The SETUP program allows you to enter the types of optional hardware installed—such as the hard disk drive type, the floppy disk drive capacity, and the display adapter type. The system's BIOS uses this information to initialize the system when the power is switched on. For instructions on how to use the SETUP program, refer to the system manual for your PC.

During the AT system CMOS setup, you must enter the drive type for the Maxtor DiamondMax Plus8 hard disk drives. The drive supports the translation of its physical drive geometry parameters such as cylinders, heads, and sectors per track to a logical addressing mode. The drive can work with different BIOS drive-type tables of the various host systems.

You can choose any drive type that does not exceed the capacity of the drive. Table 4-3 gives the logical parameters that provide the maximum capacity on the Maxtor DiamondMax Plus8 family of hard disk drives.

*Table 4-3 Logical Addressing Format*

<b>MODELS</b>	<b>CYL</b>	<b>HD</b>	<b>SPT</b>	<b>MAX LBA</b>	<b>CAPACITY</b>
6E020LO	40,395	16	63	40,718,160	20GB
6E030LO	59,582	16	63	60,058,656	30GB
6E040LO	79,656	16	63	80,293,248	40GB

Note: \*Capacity may be restricted to 8.4GB (or less) due to system BIOS limitations. Check with your system manufacturer to determine if your BIOS supports LBA Mode for hard drives greater than 8.4GB. Default logical cylinders is limited to 16,383 as per the ATA-4 specifications.

To match the logical specifications of the drive to the drive type of a particular BIOS, consult the system's drive-type table. This table

specifies the number of cylinders, heads, and sectors for a particular drive type.

You must choose a drive type that meets the following requirements:

For the 20, 30 and 40 GB:

Logical Cylinders x Logical Heads x Logical Sectors/Track x 512 =  
8,455,200,768

4. Boot the system using the operating system installation disk— for example, MS-DOS—then follow the installation instructions in the operating system manual.

# **Chapter 5**

## **ATA BUS INTERFACE AND ATA COMMANDS**

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This chapter describes the interface between DiamondMax Plus8 hard disk drives and the ATA bus. The commands that are issued from the host to control the drive are listed, as well as the electrical and mechanical characteristics of the interface.

### **5.1 INTRODUCTION**

Maxtor DiamondMax Plus8 hard disk drives use the standard ATA/ATAPI interface. Support of various options in the standard are explained in the following sections.

### **5.2 MECHANICAL INTERFACE**

#### **5.2.1 Signal Cable and Connector**

The Maxtor DiamondMax Plus8 hard disk drive contains a 40-pin unitized connector for both signal and power connections as well as configuration jumpers. The dimensions and specifications of the unitized connector comply with Annex. A in the ATA/ATAPI standard.

The Maxtor DiamondMax Plus8 drives require the use of an 80 conductor cable (ATA/ATAPI-6, Annex. A, Figure A.4 and description) to support the drive's Ultra DMA capability.

### **5.3 ELECTRICAL INTERFACE**

#### **5.3.1 ATA Bus Interface**

##### **5.3.1.1 Electrical Characteristics**

Signals on the ATA interface are assigned to connector pins according to Annex. A in the ATA/ATAPI-6 standard for the 80 conductor cable assembly. The signaling protocol complies with clause 9 and signal timing complies with clause 10 of the standard.

The Maxtor DiamondMax Plus8 hard disk drives support all Ultra DMA Data Transfer modes (0 - 5) defined in the ATA/ATAPI-6 standard. In addition, these drives support Mode 6, and can send and receive data at the full 133MB/s transfer rate.

Hosts may assert the RESET- signal for longer than the minimum. When power is applied with RESET- asserted, the Maxtor DiamondMax Plus8 disk media will not begin to spin up until RESET- is negated. This may reduce maximum current

consumption for the overall system.

## 5.4 REGISTER ADDRESS DECODING

The Maxtor DiamondMax Plus8 hard disk drives allow their host systems to address the full set of command and control registers as specified in clause 7 of the ATA/ATAPI-6 standard.

## 5.5 COMMAND INTERFACE

### 5.5.1 General Feature Set

The  $\mu$ Processor, Disk Controller, and ATA Interface electronics are contained in a proprietary ASIC developed by Maxtor.

### 5.5.2 Supported Commands

The Maxtor DiamondMax Plus8 hard disk drives support all the mandatory commands from the general feature set for devices not supporting the Packet command feature set. Refer to the ATA/ATAPI-6 standard for a detailed description of these commands. The IDENTIFY DRIVE command, however, is elaborated in the section "Identify Drive Command" on page 5-5.

Table 5-1 lists the supported commands.

**Table 5-1** Supported Commands

<b>Command</b>	<b>Command Code</b>	<b>Feature Register Value(s)</b>
CHECK POWER MODE	98h, E5h	
DEVICE CONFIGURATION FREEZE LOCK	B1h	C1h
DEVICE CONFIGURATION IDENTIFY	B1h	C2h
DEVICE CONFIGURATION RESTORE	B1h	C0h
DEVICE CONFIGURATION SET	B1h	C3h
DOWNLOAD MICROCODE	92h	07h, 01h
EXECUTE DRIVE DIAGNOSTIC	90h	
FLUSH CACHE	E7h	
IDENTIFY DRIVE	ECh	
IDLE	97h, E3h	
IDLE IMMEDIATE	95h, E1h	

**Table 5-1** Supported Commands

<b>Command</b>	<b>Command Code</b>	<b>Feature Register Value(s)</b>
NOP	00h	
READ BUFFER	E4h	
READ DMA	C8h, C9h	
READ LONG	22h, 23h	
READ MULTIPLE	C4h	
READ NATIVE MAX ADDRESS	F8h	
READ SECTOR(S)	20h, 21h	
READ VERIFY SECTOR(S)	40h, 41h	
SECURITY DISABLE PASSWORD	F6h	
SECURITY ERASE PREPARE	F3h	
SECURITY ERASE UNIT	F4h	
SECURITY FREEZE LOCK	F5H	
SECURITY SET PASSWORD	F1h	
SECURITY UNLOCK	F2h	
SEEK	70h	
SET FEATURES	EFh	Note 1
SET MAX ADDRESS	F9h	00h
SET MAX SET PASSWORD	F9h	01h
SET MAX LOCK	F9h	02h
SET MAX UNLOCK	F9h	03h
SET MAX FREEZE LOCK	F9h	04h
SET MULTIPLE MODE	C6h	
SLEEP	99h, E6h	
SMART DISABLE OPERATIONS	B0h	D9h
SMART ENABLE OPERATIONS	B0h	D8h

**Table 5-1** Supported Commands

<b>Command</b>	<b>Command Code</b>	<b>Feature Register Value(s)</b>
SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	B0h	D2h
SMART EXECUTE OFF-LINE IMMEDIATE	B0h	D4h
SMART READ DATA	B0h	D0h
SMART READ LOG	B0h	D5h
SMART RETURN STATUS	B0h	DAh
SMART SAVE ATTRIBUTE VALUES	B0h	D3h
SMART WRITE LOG	B0h	D6h
STANDBY	96h, E2h	
STANDBY IMMEDIATE	94h, E0h	
WRITE BUFFER	E8h	
WRITE DMA	CAh, CBh	
WRITE MULTIPLE	C5h	
WRITE PIO OVERLAP	34h	
WRITE SECTOR(S)	30h, 31h	

**Note:** 1. As defined in the ATA/ATAPI-6 standard.

**Identify Drive Command**

This command allows the host to receive parameter information from the drive.

When the command is received, the drive:

1. Sets BSY
2. Stores the required parameter information in the sector buffer
3. Sets the DRQ bit
4. Generates an interrupt

The host may then read the information out of the sector buffer. Parameter words in the buffer are shown in Table 5-2.

**Note:** All reserved bits or words should be zeroes.

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
0	General configuration bit-significant information:
	15: 0 = ATA device
	14-8: Retired
	7: 1 = removable media device
	6: Obsolete
	5-3: Retired
	2: Response incomplete
	1: Retired
	0: Reserved
1	Obsolete
2	Specific configuration
3	Obsolete
4-5	Retired
6	Obsolete
7-8	Reserved for assignment by the CompactFlash Association
9	Retired
10-19	Serial number (20 ASCII characters)



**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
20-21	Retired
22	Obsolete
23-26	Firmware revision (8 ASCII characters)
27-46	Model number (40 ASCII characters)
47	15-8: 80h
	7-0: 00h = Reserved
	01h-FFh: = Maximum number of sectors that shall be transferred per interrupt on READ/WRITE MULTIPLE commands
48	Reserved
49	Capabilities
	15-14: Reserved for the IDENTIFY PACKET DEVICE command.
	13: 1 = Standby timer values as specified in this standard are supported. 0 = Standby timer values shall be managed by the device
	12: Reserved for the IDENTIFY PACKET DEVICE command.
	11: 1 = IORDY supported. 0 = IORDY may be supported
	10: 1 = IORDY may be disabled
	9: 1 = LBA supported
	8: 1 = DMA supported.
	7-0: Retired
50	Capabilities
	15: Shall be cleared to zero.
	14: Shall be set to one.
	13-2: Reserved.
	1: Obsolete
	0: Shall be set to one to indicate a device specific Standby timer value minimum.
51-52	Obsolete

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
53	15-3: Reserved
	2: 1 = the fields reported in word 88 are valid. 0 = the fields reported in word 88 are not valid
	1: 1 = the fields reported in words (70:64) are valid. 0 = the fields reported in words (70:64) are not valid
	0: Obsolete
54-58	Obsolete
59	15-9: Reserved
	8: 1 = Multiple sector setting is valid
	7-0: xxh = Current setting for number of sectors that shall be transferred per interrupt on R/W Multiple command
60-61	Total number of user addressable sectors
62	Obsolete
63	15-11: Reserved
	10: 1 = Multiword DMA mode 2 is selected. 0 = Multiword DMA mode 2 is not selected
	9: 1 = Multiword DMA mode 1 is selected. 0 = Multiword DMA mode 1 is not selected
	8: 1 = Multiword DMA mode 0 is selected. 0 = Multiword DMA mode 0 is not selected
	7-3: Reserved
	2: 1 = Multiword DMA mode 2 and below are supported
	1: 1 = Multiword DMA mode 1 and below are supported
	0: 1 = Multiword DMA mode 0 is supported
	64
7-0: PIO 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

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
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
69-70	Reserved (for future command overlap and queuing)
71-74	Reserved for IDENTIFY PACKET DEVICE command.
75	Queue depth
	15-5: Reserved
	4-0: Maximum queue depth – 1
76-79	Reserved for Serial ATA
80	Major version number
	0000h or FFFFh = device does not report version
	15: Reserved
	14: Reserved for ATA/ATAPI-14
	13: Reserved for ATA/ATAPI-13
	12: Reserved for ATA/ATAPI-12
	11: Reserved for ATA/ATAPI-11
	10: Reserved for ATA/ATAPI-10
	9: Reserved for ATA/ATAPI-9
	8: Reserved for ATA/ATAPI-8
	7: Reserved for ATA/ATAPI-7
	6: 1 = supports ATA/ATAPI-6
	5: 1 = supports ATA/ATAPI-5
	4: 1 = supports ATA/ATAPI-4
	3: 1 = supports ATA-3
	2: Obsolete
	1: Obsolete
0: Reserved	

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
81	Minor version number
	0000h or FFFFh = device does not report version. 0001h-FFFEh = see 6.16.41 of ATA/ATAPI-7 specification
82	Command set supported.
	15: Obsolete
	14: 1 = NOP command supported
	13: 1 = READ BUFFER command supported
	12: 1 = WRITE BUFFER command supported
	11: Obsolete
	10: 1 = Host Protected Area feature set supported
	9: 1 = DEVICE RESET command supported
	8: 1 = SERVICE interrupt supported
	7: 1 = release interrupt supported
	6: 1 = look-ahead supported
	5: 1 = write cache supported
	4: Shall be cleared to zero to indicate that the PACKET Command feature set is not supported
	3: 1 = mandatory Power Management feature set supported
	2: 1 = Removable Media feature set supported
	1: 1 = Security Mode feature set supported
0: 1 = SMART feature set supported	
83	Command sets supported.
	15: Shall be cleared to zero
	14: Shall be set to on
	13: 1 = FLUSH CACHE EXT command supported
	12: 1 = mandatory FLUSH CACHE command supported
	11: 1 = Device Configuration Overlay feature set supported
	10: 1 = 48-bit Address feature set supported
	9: 1 = Automatic Acoustic Management feature set supported
	8: 1 = SET MAX security extension supported

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
83	7: See Address Offset Reserved Area Boot, INCITS TR27:2001
	6: 1 = SET FEATURES subcommand required to spinup after power-up
	5: 1 = Power-Up In Standby feature set supported
	4: 1 = Removable Media Status Notification feature set supported
	3: 1 = Advanced Power Management feature set supported
	2: 1 = CFA feature set supported
	1: 1 = READ/WRITE DMA QUEUED supported
	0: 1 = DOWNLOAD MICROCODE command supported
84	Command set/feature supported extension.
	15: Shall be cleared to zero
	14: Shall be set to one
	13-8: Reserved
	7: 1 = WRITE DMA QUEUED FUA EXT command supported
	6: 1 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands supported
	5: 1 = General Purpose Logging feature set supported
	4: 1 = Streaming feature set supported
	3: 1 = Media Card Pass Through Command feature set supported
	2: 1 = Media serial number supported
	1: 1 = SMART self-test supported
	0: 1 = SMART error logging supported
85	Command set/feature enabled.
	15: Obsolete
	14: 1 = NOP command enabled
	13: 1 = READ BUFFER command enabled
	12: 1 = WRITE BUFFER command enabled
	11: Obsolete
	10: 1 = Host Protected Area feature set enabled
	9: 1 = DEVICE RESET command enabled
	8: 1 = SERVICE interrupt enabled

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
85	7: 1 = release interrupt enabled
	6: 1 = look-ahead enabled
	5: 1 = write cache enabled
	4: Shall be cleared to zero to indicate that the PACKET Command feature set is not supported.
	3: 1 = Power Management feature set enabled
	2: 1 = Removable Media feature set enabled
	1: 1 = Security Mode feature set enabled
	0: 1 = SMART feature set enabled
86	Command set/feature enabled.
	15-14: Reserved
	13: 1 = FLUSH CACHE EXT command supported
	12: 1 = FLUSH CACHE command supported
	11: 1 = Device Configuration Overlay supported
	10: 1 = 48-bit Address features set supported
	9: 1 = Automatic Acoustic Management feature set enabled
	8: 1 = SET MAX security extension enabled by SET MAX SET PASSWORD
	7: See Address Offset Reserved Area Boot, INCITS TR27:2001
	6: 1 = SET FEATURES subcommand required to spin-up after power-up
	5: 1 = Power-Up In Standby feature set enabled
	4: 1 = Removable Media Status Notification feature set enabled
	3: 1 = Advanced Power Management feature set enabled
	2: 1 = CFA feature set enabled
	1: 1 = READ/WRITE DMA QUEUED command supported
0: 1 = DOWNLOAD MICROCODE command supported	
87	Command set/feature default.
	15: Shall be cleared to zero
	14: Shall be set to one
	13-8: Reserved
	7: 1 = WRITE DMA QUEUED FUA EXT command supported

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
87	6: 1 = WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands supported
	5: General Purpose Logging feature set supported
	4: 1 = Valid CONFIGURE STREAM command has been executed
	3: 1 = Media Card Pass Through Command feature set enabled
	2: 1 = Media serial number is valid
	1: 1 = SMART self-test supported
	0: 1 = SMART error logging supported
88	15: Reserved
	14: 1 = Ultra DMA mode 6 is selected. 0 = Ultra DMA mode 6 is not selected
	13: 1 = Ultra DMA mode 5 is selected. 0 = Ultra DMA mode 5 is not selected
	12: 1 = Ultra DMA mode 4 is selected. 0 = Ultra DMA mode 4 is not selected
	11: 1 = Ultra DMA mode 3 is selected. 0 = Ultra DMA mode 3 is not selected
	10: 1 = Ultra DMA mode 2 is selected. 0 = Ultra DMA mode 2 is not selected
	9: 1 = Ultra DMA mode 1 is selected. 0 = Ultra DMA mode 1 is not selected
	8: 1 = Ultra DMA mode 0 is selected. 0 = Ultra DMA mode 0 is not selected
	7: Reserved
	6: 1 = Ultra DMA mode 6 and below are supported
	5: 1 = Ultra DMA mode 5 and below are supported
	4: 1 = Ultra DMA mode 4 and below are supported
	3: 1 = Ultra DMA mode 3 and below are supported
	2: 1 = Ultra DMA mode 2 and below are supported
	1: 1 = Ultra DMA mode 1 and below are supported
0: 1 = Ultra DMA mode 0 is supported	
89	Time required for security erase unit completion
90	Time required for Enhanced security erase completion
91	Current advanced power management value
92	Master Password Revision Code

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
93	Hardware reset result. The contents of bits (12:0) of this word shall change only during the execution of a hardware reset
15:	Shall be cleared to zero.
14:	Shall be set to one.
13:	1 = device detected CBLID- above ViH. 0 = device detected CBLID- below ViL
12-8:	Device 1 hardware reset result. Device 0 shall clear these bits to zero. Device shall set these bits as follows:
12:	Reserved.
11:	0 = Device 1 did not assert PDIAG-. 1 = Device 1 asserted PDIAG-.
10-9:	These bits indicate how Device 1 determined the device number:
	00 = Reserved.
	01 = a jumper was used.
	10 = the CSEL signal was used.
	11 = some other method was used or the method is unknown.
8:	Shall be set to one.
7-0:	Device 0 hardware reset result. Device 1 shall clear these bits to zero. Device shall set these bits as follows:
7:	Reserved.
6:	0 = Device 0 does not respond when Device 1 is selected. 1 = Device 0 responds when Device 1 is selected.
5:	0 = Device 0 did not detect the assertion of DASP-. 1 = Device 0 detected the assertion of DASP-
4:	0 = Device 0 did not detect the assertion of PDIAG-. 1 = Device 0 detected the assertion of PDIAG-.
3:	0 = Device 0 failed diagnostics. 1 = Device 0 passed diagnostics.
2-1:	These bits indicate how Device 0 determined the device number:
	00 = Reserved.
	01 = a jumper was used.
	10 = the CSEL signal was used.
	11 = some other method was used or the method is unknown.
0:	Shall be set to one.



**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
94	15-8: Vendor's recommended acoustic management value.
	7-0: Current automatic acoustic management value
95	Stream Minimum Request Size
96	Stream Transfer Time - DMA
97	Stream Access Latency - DMA
98-99	Streaming Performance Granularity
100-103	Maximum user LBA for 48-bit Address feature set.
104	Stream Transfer Time - PIO
105	Stream Access Latency - PIO
106	Physical sector size
	15: Shall be cleared to zero
	14: Shall be set to one
	13: 1 = Device has multiple logical sectors per physical sector.
	12-4: Reserved
	3-0: 2 <sup>X</sup> logical sectors per physical sector
107	Inter-seek delay for ISO-7779 acoustic testing in microseconds
108-126	Reserved
127	Removable Media Status Notification feature set support
	15-2: Reserved
	1-0:
	00 = Removable Media Status Notification feature set not supported
	01 = Removable Media Status Notification feature supported
	10 = Reserved
	11 = Reserved

**Table 5-2** Identify Drive Command Parameters

<b>Word</b>	<b>CONTENT DESCRIPTION</b>
128	Security status
	15-9: Reserved
	8: Security level 0 = High, 1 = Maximum
	7-6: Reserved
	5: 1 = Enhanced security erase supported
	4: 1 = Security count expired
	3: 1 = Security frozen
	2: 1 = Security locked
	1: 1 = Security enabled
	0: 1 = Security supported
129-159	Vendor specific
160	CFA power mode 1
	15: Word 160 supported
	14: Reserved
	13: CFA power mode 1 is required for one or more commands implemented by the device
	12: CFA power mode 1 disabled
	11-0: Maximum current in ma
161-175	Reserved for assignment by the CompactFlash Association
176-205	Current media serial number
206-254	Reserved
255	Integrity word
	15-8: Checksum
	7-0: Signature

# **Chapter 6**

## **SERVICE AND SUPPORT**

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### **6.1 Product Support/Technical Assistance/Customer Service**

For Product Service and Support Information please visit our site at:

[www.maxtor.com](http://www.maxtor.com) for warranty service or [www.maxtorkb.com](http://www.maxtorkb.com) for technical support.

# GLOSSARY

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## A

**ACCESS** – (v) Read, write, or update information on some storage medium, such as a disk. (n) One of these operations.

**ACCESS TIME** – The interval between the time a request for data is made by the system and the time the data is available from the drive. Access time includes the actual seek time, rotational latency, and command processing overhead time. See also seek, rotational latency, and overhead.

**ACTUATOR** – Also known as the *positioner*. The internal mechanism that moves the read/write head to the proper track. The Maxtor actuator consists of a rotary voice coil and the head mounting arms. One end of each head mounting arm attaches to the rotor with the read/write heads attached at the opposite end of each arm. As current is applied to the rotor, it rotates, positioning the heads over the desired cylinder on the media.

**AIRLOCK** – A patented Maxtor feature that ensures durable and reliable data storage. Upon removal of power from the drive for any reason, the read/write heads automatically park and lock in a non data area called the landing zone. AIRLOCK allows the drive to withstand high levels of non-operating shock. When power is applied to the drive, airflow created from the spinning disks causes the AIRLOCK arm to swing back and unlock the actuator, allowing the heads to move from the landing zone. Upon power down, the AIRLOCK swings back to the locked position, locking the heads in the landing zone. A park utility is not required to park the heads on drives equipped with

AIRLOCK (all Maxtor drives).

**ALLOCATION** – The process of assigning particular areas of the disk to particular files. See also allocation unit.

**ALLOCATION UNIT** – An allocation unit, also known as a *cluster*, is a group of sectors on the disk that can be reserved for the use of a particular file.

**AVERAGE SEEK TIME** – The average time it takes for the read/write head to move to a specific location. To compute the average seek time, you divide the time it takes to complete a large number of random seeks all over the disk by the number of seeks performed.

## B

**BACKUP** – A copy of a file, directory, or volume on a separate storage device from the original, for the purpose of retrieval in case the original is accidentally erased, damaged, or destroyed.

**BAD BLOCK** – A block (usually the size of a sector) that cannot reliably hold data because of a media flaw or damaged format markings.

**BAD TRACK TABLE** – A label affixed to the casing of a hard disk drive that tells which tracks are flawed and cannot hold data. The listing is typed into the low-level formatting program when the drive is being installed. Because Maxtor disk drive's defect-management scheme handles all such flaws automatically, there is no need to concern yourself with bad track tables.

**BIT** – Abbreviation for binary digit. A binary digit may have one of two values—1 or 0. This contrasts with a

decimal digit, which may have a value from 0 to 9. A bit is one of the logic 1 or logic 0 binary settings that make up a byte of data. See also byte.

**BLOCK** – A sector or group of sectors. By default, a block of data consists of 512 bytes.

**BPI** – Abbreviation for *bits per inch*. A measure of how densely information is packed on a storage medium. Flux changes per inch is also a term commonly used in describing storage density on a magnetic surface.

**BUFFER** – An area of RAM reserved for temporary storage of data that is waiting to be sent to a device that is not yet ready to receive it. The data is usually on its way to or from the disk drive or some other peripheral device.

**BUS** – The part of a chip, circuit board, or interface designed to send and receive data.

**BYTE** – The basic unit of computer memory, large enough to hold one character of alphanumeric data. Comprised of eight bits. See also bit.

## C

**CACHE** – Random-access memory used as a buffer between the CPU and a hard disk. Information more likely to be read or changed is placed in the cache, where it can be accessed more quickly to speed up general data flow.

**CAPACITY** – The amount of information that can be stored on a disk drive. The data is stored in bytes, and capacity is usually expressed in megabytes.

**CDB** – Command Descriptor Block. The SCSI structure used to communicate requests from an initiator (system) to a target (drive).

**CLEAN ROOM** – An environmentally

controlled dust-free assembly or repair facility in which hard disk drives are assembled or can be opened for internal servicing.

**CLUSTER** – A group of sectors on a disk drive that is addressed as one logical unit by the operating system.

**CONTROLLER** – Short form of *disk controller*. The chip or complete circuit that translates computer data and commands into a form suitable for use by the disk drive.

**CONTROLLER CARD** – An adapter holding the control electronics for one or more hard disks, usually installed in a slot in the computer.

**CPU** – Acronym for *Central Processing Unit*. The microprocessor chip that performs the bulk of data processing in a computer.

**CRC** – Acronym for *Cyclic Redundancy Check*. An error detection code that is recorded within each sector and is used to see whether parts of a string of data are missing or erroneous.

**CYLINDER** – On a disk drive that has more than one recording surface and heads that move to various tracks, the group of all tracks located at a given head position. The number of cylinders times the number of heads equals the number of tracks per drive.

## D

**DATA SEPARATOR** – On a disk drive that stores data and timing information in an encoded form, the circuit that extracts the data from the combined data and clock signal.

**DEDICATED SERVO** – A surface separate from the surface used for data that contains only disk timing and positioning information and contains no data.

**DEFECT MANAGEMENT** – A method that is implemented to ensure long

term data integrity. Defect management eliminates the need for user defect maps. This is accomplished by scanning the disk drives at the factory for defective sectors. Defective sectors are deallocated prior to shipment. In addition, during regular use, the drive continues to scan and compensate for any new defective sectors on the disk.

**DISK** – In general, any circular-shaped data-storage medium that stores data on the flat surface of the platter. The most common type of disk is the magnetic disk, which stores data as magnetic patterns in a metal or metal-oxide coating. Magnetic disks come in two forms: floppy and hard. Optical recording is a newer disk technology that gives higher capacity storage but at slower access times.

**DISK CONTROLLER** – A plug-in board, or embedded circuitry on the drive, that passes information to and from the disk. The Maxtor disk drives all have controllers embedded on the drive printed-circuit board.

**DISKWARE** – The program instructions and data stored on the disk for use by a processor.

**DMA** – Acronym for *direct memory access*. A process by which data moves directly between a disk drive (or other device) and system memory without passing through the CPU, thus allowing the system to continue processing other tasks while the new data is being retrieved.

**DRIVE** – Short form of *disk drive*.

**DRIVE GEOMETRY** – The functional dimensions of a drive in terms of the number of heads, cylinders, and sectors per track. See also logical format.

## E

**ECC** – Acronym for *error correction code*. The recording of extra verifying

information encoded along with the disk data. The controller uses the extra information to check for data errors, and corrects the errors when possible.

**EMBEDDED SERVO** – A timing or location signal placed on the disk's surface on the tracks that also store data. These signals allow the actuator to fine-tune the position of the read/write heads.

**ENCODING** – The protocol by which particular data patterns are changed prior to being written on the disk surface as a pattern of On and Off or 1 and 0 signals.

**EXTERNAL DRIVE** – A drive mounted in an enclosure separate from the PC or computer system enclosure, with its own power supply and fan, and connected to the system by a cable.

## F

**FAT** – Acronym for *file allocation table*. A data table stored on the outer edge of a disk that tells the operating system which sectors are allocated to each file and in what order.

**FCI** – Acronym for *flux changes per inch*. See also BPI.

**FILE SERVER** – A computer that provides network stations with controlled access to shareable resources. The network operating system is loaded on the file server, and most shareable devices (disk subsystems, printers) are attached to it. The file server controls system security and monitors station-to-station communications. A dedicated file server can be used only as a file server while it is on the network. A non dedicated file server can be used simultaneously as a file server and a workstation.

**FLUX DENSITY** – The number of magnetic field patterns that can be stored in a given length of disk surface. The number is usually stated as flux

changes per inch (FCI), with typical values in the thousands.

**FLYING HEIGHT** – The distance between the read/write head and the disk surface caused by a cushion of air that keeps the head from contacting the media. Smaller flying heights permit more dense storage of data, but require more precise mechanical designs.

**FORMAT** – To write onto the disk surface a magnetic track pattern that specifies the locations of the tracks and sectors. This information must exist on a disk before it can store any user data. Formatting erases any previously stored data.

**FORMATTED CAPACITY** – The amount of room left to store data on the disk after the required space has been used to write sector headers, boundary definitions, and timing information generated by a format operation. All Maxtor drive capacities are expressed in formatted capacity.

**FORM FACTOR** – The physical outer dimensions of a device as defined by industry standard. For example, most Maxtor disk drives use a 3 1/2-inch form factor.

## G

**GIGABYTE (GB)** – One billion bytes (one thousand megabytes).

**GUIDE RAILS** – Plastic strips attached to the sides of a disk drive mounted in an IBM AT and compatible computers so that the drive easily slides into place.

## H

**HALF HEIGHT** – Term used to describe a drive that occupies half the vertical space of the original full size 5 1/4-inch drive. 1.625 inches high.

**HARD DISK** – A type of storage medium that retains data as magnetic patterns on a rigid disk, usually made of an iron oxide or alloy over a magnesium or aluminum platter. Because hard disks spin more rapidly than floppy disks, and the head flies closer to the disk, hard disks can transfer data faster and store more in the same volume.

**HARD ERROR** – A repeatable error in disk data that persists when the disk is reread, usually caused by defects in the media surface.

**HEAD** – The tiny electromagnetic coil and metal pole piece used to create and read back the magnetic patterns (write and read information) on the media.

**HIGH-CAPACITY DRIVE** – By industry conventions typically a drive of 1 gigabytes or more.

**HIGH-LEVEL FORMATTING** – Formatting performed by the operating system's format program. Among other things, the formatting program creates the root directory and file allocation tables. See also low-level formatting.

**HOME** – Reference position track for re-calibration of the actuator, usually the outer track (track 0).

**HOST ADAPTER** – A plug-in board that forms the interface between a particular type of computer system bus and the disk drive.

## I

**INITIALIZE** – See low level formatting.

**INITIATOR** – A SCSI device that requests another SCSI device to perform an operation. A common example of this is a system requesting data from a drive. The system is the initiator and the drive is the target.

**INTERFACE** – A hardware or software protocol, contained in the electronics

of the disk controller and disk drive, that manages the exchange of data between the drive and computer.

**INTERLEAVE** – The arrangement of sectors on a track. A 1:1 interleave arranges the sectors so that the next sector arrives at the read/write heads just as the computer is ready to access it. See also interleave factor.

**INTERLEAVE FACTOR** – The number of sectors that pass beneath the read/write heads before the next numbered sector arrives. When the interleave factor is 3:1, a sector is read, two pass by, and then the next is read. It would take three revolutions of the disk to access a full track of data. Maxtor drives have an interleave of 1:1, so a full track of data can be accessed within one revolution of the disk, thus offering the highest data throughput possible.

**INTERNAL DRIVE** – A drive mounted inside one of a computer's drive bays (or a hard disk on a card, which is installed in one of the computer's slots).

## J

**JUMPER** – A tiny box that slips over two pins that protrude from a circuit board. When in place, the jumper connects the pins electrically. Some board manufacturers use Dual In-Line Package (DIP) switches instead of jumpers.

## K

**KILOBYTE (Kb)** – A unit of measure consisting of 1,024 ( $2^{10}$ ) bytes.

## L

**LANDING ZONE** – A position inside the disk's inner cylinder in a non data area reserved as a place to rest the heads during the time that power is off. Using this area prevents the heads from

touching the surface in data areas upon power down, adding to the data integrity and reliability of the disk drive.

**LATENCY** – The period of time during which the read/write heads are waiting for the data to rotate into position so that it can be accessed. Based on a disk rotation speed of 3,662 rpm, the maximum latency time is 16.4 milliseconds, and the average latency time is 8.2 milliseconds.

**LOGICAL FORMAT** – The logical drive geometry that appears to an AT system BIOS as defined by the drive tables and stored in CMOS. With an installation program like Disk Manager, the drive can be redefined to any logical parameters necessary to adapt to the system drive tables.

**LOOK AHEAD** – The technique of buffering data into cache RAM by reading subsequent blocks in advance to anticipate the next request for data. The look ahead technique speeds up disk access of sequential blocks of data.

**LOW-LEVEL FORMATTING** – Formatting that creates the sectors on the platter surfaces so the operating system can access the required areas for generating the file structure. Maxtor drives are shipped with the low-level formatting already done.

**LOW PROFILE** – Describes drives built to the 3 1/2-inch form factor, which are only 1 inch high.



## **M**

**MB** – See megabyte.

**MEDIA** – The magnetic film that is deposited or coated on an aluminum substrate which is very flat and in the shape of a disk. The media is overcoated with a lubricant to prevent damage to the heads or media during head take off and landing. The media is where the data is stored inside the disk in the form of magnetic flux or polarity changes.

**MEGABYTE (MB)** – A unit of measurement equal to 1,024 kilobytes, or 1,048,576 bytes except when referring to disk storage capacity.

1 MB = 1,000,000 bytes when referring to disk storage capacity.

See also kilobyte.

**MEGAHERTZ** – A measurement of frequency in millions of cycles per second.

**MHz** – See megahertz.

**MICROPROCESSOR** – The integrated circuit chip that performs the bulk of data processing and controls the operation of all of the parts of the system. A disk drive also contains a microprocessor to handle all of the internal functions of the drive and to support the embedded controller.

**MICROSECOND ( $\mu$ s)** – One millionth of a second (.000001 sec.).

**MILLISECOND (ms)** – One thousandth of a second (.001 sec.).

**MTTF** – MTTF is a basic measure of reliability for non-repairable systems. It is the mean time expected until the first failure of a piece of equipment. MTTF is a statistical value and is meant to be the mean over a long period of time and large number of units. For constant failure rate systems, MTTF is the inverse of the failure rate. If failure rate

is in failures/million hours,  $MTTF = 1,000,000 / \text{Failure Rate}$  for components with exponential distributions.

**MTTR** – Mean Time To Repair. The average time it takes to repair a drive that has failed for some reason. This only takes into consideration the changing of the major sub-assemblies such as circuit board or sealed housing. Component level repair is not included in this number as this type of repair is not performed in the field.

## **O**

**OVERHEAD** – The processing time of a command by the controller, host adapter or drive prior to any actual disk accesses taking place.

**OVERWRITE** – To write data on top of existing data, erasing it.

**OXIDE** – A metal-oxygen compound. Most magnetic coatings are combinations of iron or other metal oxides, and the term has become a general one for the magnetic coating on tape or disk.

## **P**

**PARTITION** – A portion of a hard disk devoted to a particular operating system and accessed as one logical volume by the system.

**PERFORMANCE** – A measure of the speed of the drive during normal operation. Factors affecting performance are seek times, transfer rate and command overhead.

**PERIPHERAL** – A device added to a system as an enhancement to the basic CPU, such as a disk drive, tape drive or printer.

**PHYSICAL FORMAT** – The actual physical layout of cylinders, tracks, and sectors on a disk drive.

**PLATED MEDIA** – Disks that are

covered with a hard metal alloy instead of an iron-oxide compound. Plated disks can store greater amounts of data in the same area as a coated disk.

**PLATTER** – An disk made of metal (or other rigid material) that is mounted inside a fixed disk drive. Most drives use more than one platter mounted on a single spindle (shaft) to provide more data storage surfaces in a small package. The platter is coated with a magnetic material that is used to store data as transitions of magnetic polarity.

**POH** – Acronym for *power on hours*. The unit of measurement for Mean Time Between Failure as expressed in the number of hours that power is applied to the device regardless of the amount of actual data transfer usage. See MTBF.

**POSITIONER** – See actuator.

## R

**RAM** – Acronym for *random access memory*. An integrated circuit memory chip which allows information to be stored and retrieved by a microprocessor or controller. The information may be stored and retrieved in any order desired, and the address of one storage location is as readily accessible as any other.

**RAM DISK** – A “phantom disk drive” for which a section of system memory (RAM) is set aside to hold data, just as if it were a number of disk sectors. The access to this data is extremely fast but is lost when the system is reset or turned off.

**READ AFTER WRITE** – A mode of operation that has the computer read back each sector on the disk, checking that the data read back is the same as recorded. This slows disk operations, but raises reliability.

**READ VERIFY** – A disk mode where the disk reads in data to the controller, but the controller only checks for errors and does not pass the data on to the system.

**READ/WRITE HEAD** – The tiny electromagnetic coil and metal pole piece used to create and read back the magnetic patterns (write or read information) on the disk. Each side of each platter has its own read/write head.

**REMOVABLE DISK** – Generally said of disk drives where the disk itself is meant to be removed, and in particular of hard disks using disks mounted in cartridges. Their advantage is that multiple disks can be used to increase the amount of stored material, and that once removed, the disk can be stored away to prevent unauthorized use.

**RLL** – Run Length Limited. A method used on some hard disks to encode data into magnetic pulses. RLL requires more processing, but stores almost 50% more data per disk than the MFM method.

**ROM** – Acronym for *read only memory*. Usually in the form of an ROM in the controller that contains programs that can be accessed and read but not modified by the system.

**ROTARY ACTUATOR** – The rotary actuator replaces the stepper motor used in the past by many hard disk manufacturers. The rotary actuator is perfectly balanced and rotates around a single pivot point. It allows closed-loop feedback positioning of the heads, which is more accurate than stepper motors.

**ROTATIONAL LATENCY** – The delay between when the controller starts looking for a specific block of data on a track and when that block rotates around to where it can be read by the read/write head. On the average, it is half of the time needed for a full rotation (about 8 ms.).

## S

**SCSI** – Acronym for *Small Computer System Interface*, an American National Standards Institute (ANSI) version of Shugart Associates' SASI interface between the computer and controller. SCSI has grown in popularity and is one of the most flexible and intelligent interfaces available.

**SECTOR** – A section of space along a track on the disk, or the data that is stored in that section. Hard disks most often have sectors that are 512 data bytes long plus several bytes overhead for error correcting codes. Each sector is preceded by ID data known as a header, which cannot be overwritten.

**SEEK** – A movement of the disk read/write head in or out to a specific track.

**SERVO DATA** – Magnetic markings written on the media that guide the read/write heads to the proper position.

**SERVO SURFACE** – A separate surface containing only positioning and disk timing information but no data.

**SETTLE TIME** – The interval between when a track to track movement of the head stops, and when the residual vibration and movement dies down to a level sufficient for reliable reading or writing.

**SHOCK RATING** – A rating (expressed in Gs) of how much shock a disk drive can sustain without damage.

**SOFT ERROR** – An error in reading data from the disk that does not recur if the same data is reread. Often caused by power fluctuations or noise spikes.

**SOFT SECTORED** – Disks that mark the beginning of each sector of data within a track by a magnetic pattern.

**SPINDLE** – The center shaft of the disk upon which the drive's platters are mounted.

**SPUTTER** – A type of coating process used to apply the magnetic coating to some high-performance disks. In sputtering, the disks are placed in a vacuum chamber and the coating is vaporized and deposited on the disks. The resulting surface is hard, smooth, and capable of storing data at high density. Maxtor disk drives use sputtered thin film disks.

**STEPPER** – A type of motor that moves in discrete amounts for each input electrical pulse. Stepper motors used to be widely used for read/write head positioner, since they can be geared to move the head one track per step. Stepper motors are not as fast or reliable as the rotary voice coil actuators which Maxtor disk drives use.

**SUBSTRATE** – The material the disk platter is made of beneath the magnetic coating. Hard disks are generally made of aluminum or magnesium alloy (or glass, for optical disks) while the substrate of floppies is usually mylar.

**SURFACE** – The top or bottom side of the platter which is coated with the magnetic material for recording data. On some drives one surface may be reserved for positioning information.

## T

**THIN FILM** – A type of coating, used for disk surfaces. Thin film surfaces allow more bits to be stored per disk.

**TPI** – Acronym for *tracks per inch*. The number of tracks or cylinders that are written in each inch of travel across the surface of a disk.

**TRACK** – One of the many concentric magnetic circle patterns written on a disk surface as a guide to where to store and read the data.

**TRACK DENSITY** – How closely the tracks are packed on a disk surface. The number is specified as tracks per inch (TPI).

**TRACK TO TRACK SEEK TIME** – The time required for the read/write heads to move to an adjacent track.

**TRANSFER RATE** – The rate at which the disk sends and receives data from the controller. Drive specifications usually reference a high number that is the burst mode rate for transferring data across the interface from the disk buffer to system RAM. Sustained data transfer is at a much lower rate because of system processing overhead, head switches, and seeks.

## U

**UNFORMATTED CAPACITY** – The total number of bytes of data that could be fit onto a disk. Formatting the disk requires some of this space to record location, boundary definitions, and timing information. After formatting, user data can be stored on the remaining disk space, known as formatted capacity. The size of a Maxtor drive is expressed in formatted capacity.

## V

**VOICE COIL** – A type of motor used to move the disk read/write head in and out to the right track. Voice-coil actuators work like loudspeakers with the force of a magnetic coil causing a proportionate movement of the head. Maxtor's actuator uses voice-coil technology, and thereby eliminates the high stress wearing parts found on stepper motor type actuators.

## W

**WEDGE SERVO** – The position on every track that contains data used by the closed loop positioning control. This information is used to fine tune the position of the read/write heads exactly over the track center.

**WINCHESTER DISKS** – Hard disks that use a technology similar to an IBM model using Winchester as the code name. These disks use read/write heads that ride just above the magnetic surface, held up by the air flow created by the turning disk. When the disk stops turning, the heads land on the surface, which has a specially lubricated coating. Winchester disks must be sealed and have a filtration system since ordinary dust particles are large enough to catch between the head and the disk.

**WRITE ONCE** – In the context of optical disks, technologies that allow the drive to store data on a disk and read it back, but not to erase it.

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