

TEXT,C,55  
INTRODUCTION

Maxtor 7000 Series AT disk drives are 1" high and 3.5" random access storage devices which incorporate an on-board AT controller. Maxtor engineers have applied recent advances in hard drive technology to the design and manufacture of these drives. High data transfer rates and fast access times make the 7131A especially well-suited to high-end desktop and entry level workstation applications. Product features include:

- 15 millisecond access
- 131 MByte formatted capacity\*
- Low power requirements
- MTBF: >300,000 POH at 35oC
- High shock resistance (70 Gs)
- 64K cache and concurrent transferring
- Automatic error detection and correction
- Autopark/lock
- 1:1 interleave
- On-board AT controller
- Zone density data throughput performance
- Quiet operation

\*One megabyte (as defined by Maxtor) equals 10<sup>6</sup>, or one million bytes.

This 7000 series product manual is intended for use by engineers and other industry professionals who need detailed about the drives.

#### Functional Description

Maxtor 7000 Series drives contain all necessary mechanical and electronic parts to interpret control signal and commands from an AT-compatible host computer.

#### Microprocessor

The microprocessor controls these function:

- Host interface
- Command execution
- Cache Management
- Data correction and error recovery
- Diagnostic execution
- Data sequencing
- Head positioning (including error recovery)
- Index detection
- Spin speed control
- Seeks and Servo

Interface component (interfaces between: the microprocessor, servo electronics, host and I/O ports, data encoder/decoder)

#### 64K Look-ahead Cache

Caching with look

-ahead read decreases access time to sequential data in the drive by temporarily placing small amounts of data in high speed memory. Cache may contain from 0 to 128 sectors.

#### How Look-ahead Cache Functions

In the absence of an error, corrected data, or an interrupt command, the device caches not only requested sectors, but "looks ahead" and caches all remaining physical sectors until the cache is full. The "look ahead" feature prepares the drive to transfer cached data when the host requests it (preventing access time delays). Commands are interrupt driven, so if the drive is performing a look-ahead cache when a command is received, it will stop caching and process the command.

Resets and Write Long commands to any of the cached sectors invalidate the whole cache. Sectors on a track are cached until an error occurs, corrupted data is read, or a host command interrupts the drive. Zone Density Recording

The disk capacity is increased with bit density management - common with Zone Density Recording. Each disk surface is divided into 5 circumferential zones. All tracks within a given zone contain a constant number of data sectors. The number of data sectors per track varies in different zones; the outermost zone contains the largest number of data sectors, and the innermost contains the fewest.

#### Sector Address Translation

All 7000 Series drives feature a universal Translate Mode. In an AT-class system, the drive may be configured to any specified combination of cylinders, heads, and sectors (within the range of the drive's formatted capacity)

The 7131A powers-up in the Translate Mode:

Cylinders	Heads	Sectors
1002	8	32

For more information refer to Initialise Drive Parameter Command.

#### 1:1 Interleave Operation

Since all 7000 Series drives operate with a 1:1 interleave "optimising" interleave for a host system is unnecessary. Regardless of the host system's speed, the drive's 64K buffer allows all disk transfers to occur at a one-to-one rate. Since these drives always format with interleave 1, they override any interleave specifies in the FORMAT command.

#### Defect Management

The 7131A has three(3) spare sectors per cylinder, located at the end of each cylinder. Upon detection of a bad sector that has been reassigned, the next sequential sector is used. For example, if sector 3 is flagged, data that would have been stored there is "pushed down" and recorded in sector 4. Sector 4 then effectively becomes sector 3, as sequential sectors are "pushed down"

The first spare sector makes up for the loss of sector 3, and so maintains the sequential order of data, with 2 spare sectors still allocated for that cylinder. This push down method assures maximum performance.

In the rare occurrence that the number of reassigned bad sectors exceeds the number of spare sectors allocated for that cylinder, an alternate track at the inner diameter of the disk is used. The 7131A has four(4) alternate tracks.

#### Error Correction Code

The 7131A used a Reed-Solomon code for error detection and correction. The error correction polynomial can correct one error burst with a maximum of 11 bits. Individual bursts (11 bits) are corrected without any resulting performance degradation.

#### Automatic Headpark and Lock Operation

Immediately following power down, dynamic braking of the spinning disks delays momentarily allowing the heads to move to an inner ,mechanical stop. A small fixed magnet holds the heads in place as the disk spins down. The heads are released only when power is again applied.

#### Subsystem Configuration

Dual Drive Support

Two drives may be accessed via a common interface cable, using the same range of I/O addresses. The drives are jumpered as drive 0 or 1 (Master/Slave), and are selected by the drive select bit in the Drive/Head register of the task file.

All Task File registers are written in parallel to both drives. The interface processor on each drive decides whether a command wrote to it should be executed; this depends on the type of command and which drive is selected. Only the drive selected executes the command and activates the data bus in response to host I/O reads; the drive not selected remains inactive.

A master/slave relationship exists between the two drives 0 is the master, and drive 1, the slave. When J20 is closed (factory default), the drive assumes the role of master; when open, the drive acts as a slave. In single drive configurations, J20 must be closed.

7131A Jumper Designation

J23 J22 J20 J16

SYNC Spindle Control

Sync Spindle Disabled*	O
Sync Spindle Enabled	J
Sync Slave	O
Sync Master	J

Master/Slave

Only drive in single drive system*	J
Master in dual drive system	J
Slave in dual drive system	O

I/O Channel Ready

Option Disabled*	O
Option Enabled	J

\*-Default J=Jumpered O=Open

Note: Jumpers J17 J18 J24 and J25 factory reserved. Jumper 19 may be used to store shunt if used in slave mode.

Abnormal operation may occur if reserved jumpers are altered.

Product Specifications

Interleave	1:1
Buffer size	64K
Interface	AT

Encoding method	RLL 1,7
Number of data zones per surface	5
Physical Configuration	
Formatted Capacity (bytes)	131,115,008
(Formatted capacity varies with drive type and DOS setup)	
Actuator type	Rotary voice coil
Servo system	Embedded
Number of disks	1
Data surfaces	2
Data heads	2
Number of Cylinders	
User available	2,084
Total	2,096
Sectors per drive(user)	256,528
Sectors per drive (total)	261,568
Bytes per sector	512
Sectors per track	
Zone 1	72
Zone 2	64
Zone 3	60
Zone 4	54
Zone 5	48
Track density (tpi)	2,500 avg
Flux density (kfc) i	31.9 max
Recording density (kbp) i	42.6 max

Performance

Seek performance (including settling time and servo overhead)\*

	Average	
Track to track	3 ms	
Average (of 10,000 random seeks)	15 ms	
Full Stroke	27 ms	
Rotation speed (0.1%)	3,551 rpm	
Controller overhead	1 ms	
Average latency	8.45 ms	
Data transfer rate (MBytes per second)		
To/from media		
Zone 1	2.83	
Zone 2	2.58	
Zone 3	2.40	
Zone 4	2.20	
Zone 5	1.81	
To/from buffer	9.0	
To/from interface	8.0	

\*Average - Measured on standard personal computers.

Performance

Start time (0-Drive Ready)

Average	6 sec
Maximum	10 sec
Stop Time	
Average	3 sec
Maximum	5 sec

Power Requirements (Average)

Mode	+12 V DC 8%	+5 V DC 5%	Power/Duration
Spin-up	850 mA peak	320 mA peak	<10 ms
Read/Write (total rms)	130 mA	330 mA	3.20 W
Active (total rms)	120 mA	308 mA	3.00 W

Power Supply Ripple

Maximum allowed: 100 mV peak to peak, 0-20 MHz  
 Spin-up: The drive is spinning up following initial application of power and has not yet reached full speed. Maximum current draw lasts 3 seconds.

Read/Write: Data is being read from or written to the drive.

Active: The drive is spinning and all circuitry is powered on. The drive is capable of responding to commands in the shortest possible time.

Physical Dimensions

Height 1.00" (2.54 cm) Width 4.00" (10.16 cm)  
 Length 5.75" (14.61 cm) Weight 1.2lbs (0.5kg)

Environmental

Temperature

Operating 5oC to 55oC, thermal gradient  
 20oC max

Non-operating/Storage Low temperature (-40oC) per MIL-STD-810E, Method 502.3.  
 High temperature per MIL-STD-810E, Method 501.3, Climatic Category; Hot-induced Conditions.

Humidity

Operating Per MIL-STD-810E, Method 507.3, Test Procedure 1, Natural Cycle 3.

Non-operating/Storage Per MIL-STD-810E, Method 507.3, test Procedure 1lb, Induced

Cycle 5.

Thermal Shock

Low Temperature            Per MIL-STD-810E, Method 503.3  
(-20oC to +25oC)        Storage: Test Procedure 1, 10.  
   minutes to specified operating  
   performance.

High temperature and    Per MIL-STD-810E, Method 503.3  
high humidity            Storage; Test Procedure 1. 1.0  
(+35oC,80% RH to       minute to specified operating  
+25oC, 50% RH)        performance.

Altitude (relative to sea level)

Operating                -200 to 10,000 feet (with  
   naturally occurring temperature  
   and humidity within this  
   altitude range)

Non-operating/Storage    Per MIL-STD-810E, Method 500.3,  
   Low pressure (altitude) Test  
   Procedure 1, Storage; Test  
   Condition 2, Transport aircraft  
   cargo compartment pressure.

Reliability and Maintenance

MTBF                      >300,000 power-on hours (POH)  
Calculation of MTBF includes one or more of these  
factors:

1 As measured by Maxtor's reliability demonstration  
test method, the characteristic Life for all failure  
modes has a >60% confidence level.

2 With a .90% confidence level, an assumed POH (power-  
on hours)divided by an AFR (annualised failure rate)  
yields the MTBF.

3 For product used in desktop, notebook or sub-notebook  
computer applications the assumed POH per year is <  
2,500 hours.

Start/stop cycles            >40,000

As measured by Maxtor's reliability test method, this  
specification indicated (with 99% reliability) the  
minimum cycles for start/stop failure modes at a .60%  
confidence level.

AFR                        <1.0%

The annualised average failure rate applies to the





errors).

Operating Shock            10 Gs, 11 ms (no errors)

Non-operating, random    Per MIL-STD-810E, Method  
Vibration                    514.4, Basic  
                                  transportation, Vertical  
                                  axis PSD profile, 10-500  
                                  Hz, 60 minutes/axis.

Operating, random        Per MIL-STD-810E, Method  
Vibration                    514.4, Basic  
                                  transportation, Vertical  
                                  axis PSD profile, 10  
                                  minutes/axis.

10 Hz at 0.004 G /Hz  
40 Hz at 0.004 G /Hz  
500 Hz at 0.00004 G /HZ

Operating, swept sine  
vibration (1 octave/  
minute)

5 - 20 Hz                    0.049 (double amplitude)  
20-300 HZ                   1.5 Gs Peak amplitude

Acoustic Noise

Averages are recorded during Active (track follow)  
mode.

Sound power (per ISO 7779) 3.9 belA  
Sound pressure            32.2dBA  
(1 meter perpendicular to  
top cover)

AT Interface Description

Interface Connector

All 7000 Series AT drives have a 40-pin interface  
connector mounted on the PCBA. The drive may connect  
directly to the host; or it can also accommodate a  
cable connection (maximum cable length: 18 inches).