



Product Manual

# Momentum® 5400.3

**ST9160821A**

**ST9120822A**

**ST9100828A**

**ST980815A**

**ST960815A**

**ST940815A**

100398876

Rev. C

August 2007

©2004-2007, Seagate Technology LLC All rights reserved.  
Publication number: 100398876, Rev. C  
August 2007

Seagate, Seagate Technology and the Wave logo are registered trademarks of Seagate Technology LLC in the United States and/or other countries. Momentus, Seagate-SeaBOARD, SeaFONE, SeaTDD, and SeaTools are either trademarks or registered trademarks of Seagate Technology LLC or one of its affiliated companies in the United States and/or other countries. All other trademarks or registered trademarks are the property of their respective owners.

One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. Quantitative usage examples for various applications are for illustrative purposes. Actual quantities will vary based on various factors, including file size, file format, features and application software. Seagate reserves the right to change, without notice, product offerings or specifications.

# Contents

<b>1.0</b>	<b>Introduction</b>	<b>1</b>
<b>2.0</b>	<b>Drive specifications</b>	<b>3</b>
2.1	Specification summary	3
2.2	Formatted capacity	9
2.3	Default logical geometry	9
2.4	Physical organization	9
2.5	Recording and interface technology	10
2.6	Physical characteristics	10
2.7	Seek time	11
2.8	Time to ready	11
2.9	Power specifications	12
2.9.1	Power consumption	12
2.9.2	Conducted noise	13
2.9.3	Voltage tolerance	13
2.9.4	Power-management modes	14
2.10	Environmental specifications	15
2.10.1	Ambient temperature	15
2.10.2	Temperature gradient	15
2.10.3	Humidity	15
2.10.4	Altitude	15
2.10.5	Shock	16
2.10.6	Vibration	16
2.11	Acoustics	17
2.12	Electromagnetic immunity	17
2.13	Reliability	18
2.14	Agency certification	18
2.14.1	Safety certification	18
2.14.2	Electromagnetic compatibility	18
2.14.3	FCC verification	19
2.15	Environmental protection	20
2.15.1	European Union Restriction of Hazardous Substances (RoHS)	20
2.16	Corrosive environment	20
<b>3.0</b>	<b>Configuring and mounting the drive</b>	<b>21</b>
3.1	Handling and static discharge precautions	21
3.2	Jumper settings	22
3.2.1	Master/slave configuration	22
3.2.2	Cable-select option	22
3.3	Drive mounting	23
<b>4.0</b>	<b>ATA interface</b>	<b>25</b>
4.1	ATA interface signals and connector pins	25
4.1.1	Supported ATA commands	26
4.1.2	Identify Device command	29
4.1.3	Set Features command	32
<b>5.0</b>	<b>Compatibility summary</b>	<b>33</b>
5.1	Installation considerations	33
5.2	BIOS versions tested	35
5.3	Operating system versions tested	36
5.4	Compatibility test configurations	36
5.5	Software utilities	36
5.6	Other certification	36
<b>6.0</b>	<b>Seagate Technology support services</b>	<b>37</b>



## List of Figures

Figure 1.	Typical 5V startup and operation current profile . . . . .	13
Figure 2.	Jumper settings . . . . .	22
Figure 3.	Mounting dimensions—top, side and end view . . . . .	23



## 1.0 Introduction

---

This manual describes the functional, mechanical and interface specifications for the following Seagate® Momentus®5400.3 drives:

- ST9160821A
- ST9120822A
- ST9100828A
- ST980815A
- ST960815A
- ST940815A

These drives provide the following key features:

- 5,400-RPM spindle speed.
- 8-Mbyte buffer.
- Quiet operation. Fluid Dynamic Bearing (FDB) motor.
- High instantaneous (burst) data transfer rates (up to 100 Mbytes per second) using Ultra DMA mode 5.
- Tunneling Magnetoresistive (TMR) recording heads. .
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Full-track multiple-sector transfer capability without local processor intervention.
- 900 Gs nonoperating shock and 350 Gs operating shock.
- SeaTools™ diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- The 3D Defense System™, which includes Drive Defense, Data Defense, and Diagnostic Defense, offers the industry's most comprehensive protection for disc drives.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Support for Read Multiple and Write Multiple commands.
- Support for autodetection of master/slave drives using cable select (CSEL).





## 2.0 Drive specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate ST9160821A, ST9120822A, ST9100828A, ST980815A, ST960815A, and ST940815A model drives.

### 2.1 Specification summary

The specifications listed in this table are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual.

**Table 1: Specifications for 160 and 120 Gbyte models**

Drive specification	ST9160821A	ST9120822A
Formatted Gbytes (512 bytes/sector)*	160	120
Guaranteed sectors	312,581,808	234,441,648
Bytes per sector	512	
Physical read/write heads	4	3
Discs	2	
Cache (Mbytes)	8	
Recording density, BPI (bits/inch typical)	835k	
Track density, TPI (tracks/inch typical)	150k	
Areal density (Gbits/inch <sup>2</sup> max)	132	
Spindle speed (RPM)	5,400	
Internal data transfer rate (Mbits/sec max)	352	
I/O data-transfer rate (Mbytes/sec max)	100	
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–5	
Height	9.5 +/-0.2 mm (0.374 +/-0.008 inches)	
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)	
Length	100.50 +/-0.25 mm (3.957 +/-0.010 inches)	
Weight (typical)	102 grams (0.22 lb)	
Average latency (msec)	5.6	
Power-on to ready (sec typical)	3.0	
Standby to ready (sec typical)	3.0	
Track-to-track seek time (msec typical)	1.0 (read), 1.5 (write)	
Average random seek, write (msec typical)	13.0	
Average random seek, read (msec typical)	11.0	
Average random seek, (msec typical)	12.5	
Full-stroke seek (msec)	22 (typical); 24 (max)	
Startup current 5V (typical)	1.0 amps	

**Table 1: Specifications for 160 and 120 Gbyte models**

Drive specification	ST9160821A	ST9120822A
Seek power (typical)	2.0 watts	
Read/write power (typical)	Read: 2.0 watts; Write: 1.8 watts	
Idle mode (typical, low power)	0.8 watts	
Standby mode	0.2 watts (typical)***	
Sleep mode	0.2 watts (typical)***	
Voltage tolerance (including noise)	5V ± 5%	
Ambient temperature	0° to 60°C (operating), -40° to 70°C (nonoperating)	
Temperature gradient (°C per hour max, noncondensing)	20°C (operating) 30°C (nonoperating)	
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient	30% per hour max	
Wet bulb temperature (°C max)	30°C (operating) 38°C (nonoperating)	
Altitude, operating	-304.8 m to 3,048 m (-1000 ft to 10,000 ft)	
Altitude, nonoperating (below mean sea level)	-304.8 m to 12,192 m (-1,000 ft to 40,000 ft) max	
Shock, operating (Gs max at 2 msec)	350	
Shock, nonoperating (Gs max at 2 msec)	800	
Shock, nonoperating (Gs max at 1 msec)	900	
Shock, nonoperating (Gs max at 0.5 msec)	400	
Vibration, operating (max displacement may apply below 10 Hz)	1.0 Gs (0 to peak, 5–500 Hz)	
Vibration, nonoperating (max displacement may apply below 22 Hz)	5.0 Gs (0 to peak, 5–500 Hz)	
Drive acoustics, sound power (bels), 2 disc		
Idle**	2.4 (typical) 2.6 (max)	
Performance seek	3.0 (typical) 3.2 (max)	
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)	<0.60%	
Load/Unload (U/UL) cycles		
25°C, 50% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles	
32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 20% relative humidity 60°C, 20% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles	
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur, according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

\*\*\*Typical notebooks will pull power to the drive when entering S3 and S4; while in the S3 and S4 states, drive sleep and drive standby modes will not contribute to battery power consumption.

**Table 1: Specifications for 100 and 80 Gbyte models**

<b>Drive specification</b>	<b>ST9100828A</b>	<b>ST980815A</b>
Formatted Gbytes (512 bytes/sector)*	100	80
Guaranteed sectors	195,371,568	156,301,488
Bytes per sector	512	
Physical read/write heads	3	2
Discs	2	1
Cache (Mbytes)	8	
Recording density, BPI (bits/inch typical)	835k	
Track density, TPI (tracks/inch typical)	150k	
Areal density (Gbits/inch <sup>2</sup> max)	132	
Spindle speed (RPM)	5,400	
Internal data transfer rate (Mbits/sec max)	352	
I/O data-transfer rate (Mbytes/sec max)	100	
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–5	
Height	9.5 +/-0.2 mm (0.374 +/-0.008 inches)	
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)	
Length	100.50 +/-0.25 mm (3.957 +/-0.010 inches)	
Weight (typical)	102 grams (0.22 lb)	98 grams (0.216 lb)
Average latency (msec)	5.6	
Power-on to ready (sec typical)	3.0	
Standby to ready (sec typical)	3.0	
Track-to-track seek time (msec typical)	1.0 (read), 1.5 (write)	
Average random seek, write (msec typical)	13.0	
Average random seek, read (msec typical)	11.0	
Average random seek, (msec typical)	12.5	
Full-stroke seek (msec)	22 (typical); 24 (max)	
Startup current 5V (typical)	1.0 amps	
Seek power (typical)	2.0 watts	
Read/write power (typical)	Read: 2.0 watts; Write: 1.8 watts	
Idle mode (typical, low power)	0.8 watts	
Standby mode	0.2 watts (typical)***	
Sleep mode	0.2 watts (typical)***	
Voltage tolerance (including noise)	5V ± 5%	
Ambient temperature	0° to 60°C (operating), -40° to 70°C (nonoperating)	
Temperature gradient (°C per hour max, noncondensing)	20°C (operating) 30°C (nonoperating)	
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient	30% per hour max	
Wet bulb temperature (°C max)	30°C (operating) 38°C (nonoperating)	
Altitude, operating	-304.8 m to 3,048 m (-1000 ft to 10,000 ft)	
Altitude, nonoperating (below mean sea level)	-304.8 m to 12,192 m (-1,000 ft to 40,000 ft) max	
Shock, operating (Gs max at 2 msec)	350	
Shock, nonoperating (Gs max at 2 msec)	800	

**Table 1: Specifications for 100 and 80 Gbyte models**

Drive specification	ST9100828A	ST980815A
Shock, nonoperating (Gs max at 1 msec)	900	
Shock, nonoperating (Gs max at 0.5 msec)	400	
Vibration, operating (max displacement may apply below 10 Hz)	1.0 Gs (0 to peak, 5–500 Hz)	
Vibration, nonoperating (max displacement may apply below 22 Hz)	5.0 Gs (0 to peak, 5–500 Hz)	
Drive acoustics, sound power (bels), 2 disc		
Idle**	2.4 (typical) 2.6 (max)	
Performance seek	2.9 (typical) 3.1 (max)	
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)	0.60%	
Load/Unload (U/UL) cycles		
25°C, 50% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles	
32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 20% relative humidity 60°C, 20% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles	
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur, according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

\*\*\*Typical notebooks will pull power to the drive when entering S3 and S4; while in the S3 and S4 states, drive sleep and drive standby modes will not contribute to battery power consumption.

**Table 1: Specifications for 60 and 40 Gbyte models**

<b>Drive specification</b>	<b>ST960815A</b>	<b>ST940815A</b>
Formatted Gbytes (512 bytes/sector)*	60	40
Guaranteed sectors	117,410,240	78,140,160
Bytes per sector	512	
Physical read/write heads	2	1
Discs	1	
Cache (Mbytes)	8	
Recording density, BPI (bits/inch typical)	835k	
Track density, TPI (tracks/inch typical)	150k	
Areal density (Gbits/inch <sup>2</sup> max)	132	
Spindle speed (RPM)	5,400	
Internal data transfer rate (Mbits/sec max)	352	
I/O data-transfer rate (Mbytes/sec max)	100	
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–5	
Height	9.5 +/-0.2 mm (0.374 +/- .008 inches)	
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)	
Length	100.50 +/-0.25 mm (3.957 +/-0.010 inches)	
Weight (typical)	98 grams (0.216 lb)	
Average latency (msec)	5.6	
Power-on to ready (sec typical)	3.0	
Standby to ready (sec typical)	3.0	
Track-to-track seek time (msec typical)	1.0 (read), 1.5 (write)	
Average random seek, write (msec typical)	13.0	
Average random seek, read (msec typical)	11.0	
Average random seek, (msec typical)	12.5	
Full-stroke seek (msec)	22 (typical); 24 (max)	
Startup current 5V (typical)	1.0 amps	
Seek power (typical)	2.0 watts	
Read/write power (typical)	Read: 2.0 watts; Write: 1.8 watts	
Idle mode (typical, low power)	0.8 watts	
Standby mode	0.2 watts (typical)***	
Sleep mode	0.2 watts (typical)***	
Voltage tolerance (including noise)	5V ± 5%	
Ambient temperature	0° to 60°C (operating), –32° to 70°C (nonoperating)	
Temperature gradient (°C per hour max, noncondensing)	20°C (operating) 30°C (nonoperating)	
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient	30% per hour max	
Wet bulb temperature (°C max)	30°C (operating) 38°C (nonoperating)	
Altitude, operating	–304.8 m to 3,048 m (–1000 ft to 10,000 ft)	
Altitude, nonoperating (below mean sea level)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft) max	
Shock, operating (Gs max at 2 msec)	350	
Shock, nonoperating (Gs max at 2 msec)	800	

**Table 1: Specifications for 60 and 40 Gbyte models**

Drive specification	ST960815A	ST940815A
Shock, nonoperating (Gs max at 1 msec)	900	
Shock, nonoperating (Gs max at 0.5 msec)	400	
Vibration, operating (max displacement may apply below 10 Hz)	1.0 Gs (0 to peak, 5–500 Hz)	
Vibration, nonoperating (max displacement may apply below 22 Hz)	5.0 Gs (0 to peak, 5–500 Hz)	
Drive acoustics, sound power (bels), 2 disc		
Idle**	2.4 (typical) 2.6 (max)	
Performance seek	2.9 (typical) 3.1 (max)	
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Annualized Failure Rate (AFR)	<0.60%	
Load/Unload (U/UL) cycles		
25°C, 50% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles	
32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 20% relative humidity 60°C, 20% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles	
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the “Verify Your Warranty” link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.	

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

\*\*During periods of drive idle, some offline activity may occur, according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

\*\*\*Typical notebooks will pull power to the drive when entering S3 and S4; while in the S3 and S4 states, drive sleep and drive standby modes will not contribute to battery power consumption.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST9160821A	160 Gbytes	312,581,808	512
ST9120822A	120 Gbytes	234,441,648	512
ST9100828A	100 Gbytes	195,371,568	512
ST980815A	80 Gbytes	156,301,488	512
ST960815A	60 Gbytes	117,410,240	512
ST940815A	40 Gbytes	78,140,160	512

\*One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

## 2.3 Default logical geometry

Cylinders	Read/write heads	Sectors per track
16,383	16	63

### LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Physical organization

Model	Read/write heads	Number of discs
ST9160821A	4	2
ST9120822A	3	2
ST9100828A	3	2
ST980815A	2	1
ST960815A	2	1
ST940815A	1	1

## 2.5 Recording and interface technology

Technology	Specification
Interface	Parallel ATA
Recording method	Perpendicular
Recording density BPI (bits/inch typical)	835k
Track density TPI (tracks/inch typical)	150k
Areal density (Gbits/inch <sup>2</sup> max)	132
Spindle speed (RPM) ( $\pm 0.2\%$ )	5,400
Internal data-transfer rate OD (Mbits/sec max)	352
I/O data-transfer rate (Mbytes/sec max)	100 (Ultra DMA mode 5)
Interleave	1:1
Cache buffer	8 Mbytes (8,192 kbytes)

## 2.6 Physical characteristics

Height	(mm) (inches)	9.5 $\pm 0.2$ 0.374 $\pm 0.008$
Width	(mm) (inches)	69.85 $\pm 0.25$ 2.750 $\pm 0.010$
Length	(mm) (inches)	100.50 $\pm 0.25$ 3.957 $\pm 0.010$
Typical weight		
	ST9160821A ST9120822A ST9100828A	102 grams 0.22 pounds
	ST980815A ST960815A ST940815A	98 grams 0.216 pounds



## 2.7 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead.

Typical seek times (msec)*	Read	Write
Track-to-track	1.0	1.5
Average	11.0	13.0
Full-stroke	22.0	24.0
Average latency	5.56	5.56

\*Measured in performance mode

**Note.** These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet or exceed the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 2.8 Time to ready

Time to ready	Typical	Max @ 25°C
Power-on to Ready (sec)	3.0	8.0
Standby to Ready (sec)	3.0	8.0

## 2.9 Power specifications

The drive receives DC power (+5V) through the interface connector.

### 2.9.1 Power consumption

Power requirements for the drives are listed in the table on page 12. Typical power measurements are based on an average of drives tested, under nominal conditions, at 25°C ambient temperature.

- **Spinup power**

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

- **Seek mode**

During seek mode, the read/write actuator arm moves toward a specific position on the disc surface and does not execute a read or write operation. Servo electronics are active. Seek mode power is measured based on three random seek operations every 100 msec. This mode is not typical.

- **Read/write power and current**

Read/write power is measured with the heads on track, based on three 63 sector read or write operations every 100 msec.

- **Idle mode power\***

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

- **Standby mode**

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down model

**Table 2: DC power for 2 disk models**

Power dissipation	+5V average (25° C)
Spinup (typical)	1.0 amps
Seek	2.0 watts
Read	2.0 watts
Write	1.8 watts
Idle, performance	1.7 watts
Idle, active*	0.99 watts
Idle, low power mode*	0.8 watts
Standby	0.2 watts
Sleep	0.2 watts

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

### 2.9.1.1 Typical current profile

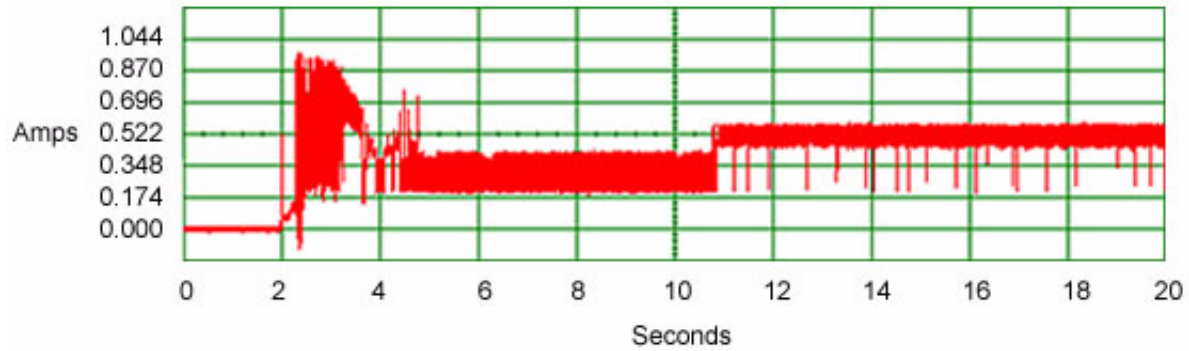


Figure 4. Typical 5V startup and operation current profile

### 2.9.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 15-ohm resistive load on the +5 volt line.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10 MHz.

**Note.** Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 2.9.3 Voltage tolerance

Voltage tolerance (including noise):

5V  $\pm$  5%

## 2.9.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

**Table 3: Power management modes**

Power modes	Heads	Spindle	Buffer
Active (operating)	Tracking	Rotating	Full power
Idle, performance	Tracking	Rotating	Self refresh—low power
Idle, active	Floating	Rotating	Self refresh—low power
Idle, low power	Parked	Rotating	Self refresh—low power
Standby	Parked	Stopped	Self refresh—low power
Sleep	Parked	Stopped	Self refresh—low power

- **Active mode**

The drive is in Active mode during the read/write and seek operations.

- **Idle mode**

The buffer remains enabled in performance mode, and the drive accepts all commands and returns to Active mode any time disc access is necessary.

- **Standby mode**

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is in Self Refresh Low Power mode, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disc access is necessary.

- **Sleep mode**

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is in Self Refresh Low Power mode, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

- **Idle and Standby timers**

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disc access is necessary.

## 2.10 Environmental specifications

### 2.10.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 65°C (149°F) within the operating ambient conditions.

Above 1,000 feet (305 meters), the maximum temperature is derated linearly by 1°C every 1000 feet.

Operating	0° to 60°C (32° to 140°F)
Nonoperating	-40° to 70°C (-40° to 158°F)

### 2.10.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Nonoperating	30°C per hour (86°F per hour max), without condensation

### 2.10.3 Humidity

#### 2.10.3.1 Relative humidity

Operating	5% to 90% noncondensing (30% per hour max)
Nonoperating	5% to 95% noncondensing (30% per hour max)

#### 2.10.3.2 Wet bulb temperature

Operating	30°C (86°F max)
Nonoperating	38°C (100.4°F max)

### 2.10.4 Altitude

Operating	-304.8 m to 3,048 m (-1,000 ft to 10,000 ft)
Nonoperating	-304.8 m to 12,192 m (-1,000 ft to 40,000 ft)

## 2.10.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

### 2.10.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 350 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second.

### 2.10.5.2 Nonoperating shock

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 800 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 900 Gs based on a nonrepetitive half-sine shock pulse of 1 msec duration.

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 400 Gs based on a nonrepetitive half-sine shock pulse of 0.5 msec duration.

## 2.10.6 Vibration

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis.

### 2.10.6.1 Operating vibration

The following table lists the maximum vibration levels that the drive may experience while meeting the performance standards specified in this document.

5–500 Hz	1.0 Gs (0 to peak). Max displacement may apply below 10 Hz.
----------	---

### 2.10.6.2 Nonoperating vibration

The following table lists the maximum nonoperating vibration that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation.

5–500 Hz	5.0 Gs (0 to peak). Max displacement may apply below 22 Hz.
----------	---

## 2.11 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

**Note.** For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

**Table 4: Drive level acoustics**

Models		Idle*	Normal Seek	Performance Seek
2 Discs	ST9160821A ST9120822A ST9100828A	2.4 bels (typ) 2.6 bels (max)	2.6 2.8	3.0 bels (typ) 3.2 bels (max)
1 Disc	ST980815A ST960815A ST940815A	2.2 bels (typ) 2.4 bels (max)	2.5 2.7	2.9 bels (typ) 3.1 bels (max)

\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.12 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in the following table:

**Table 5: Electromagnetic immunity**

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN 61000-4-2: 95
Radiated RF immunity	80 to 2,000 MHz, 10 V/m, 80% AM with 1 kHz sine 900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz	A	EN 61000-4-3: 96 ENV 50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN 61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN 61000-4-5: 95
Conducted RF immunity	150 kHz to 80 MHz, 3 Vrms, 80% AM with 1 kHz sine	A	EN 61000-4-6: 97
Power Frequency H-field immunity	1 A/m, 50Hz/60Hz, 3 axes	A	EN 61000-4-8: 97
Voltage dips, interrupts	30% Reduction for 25 cycles >95% Reduction for 250 cycles >95%, 0.5 cycles	C C B	EN 61000-4-11: 94

A - 1) No upset or degradation in performance beyond manufacturer's specified limits.

2) No data loss.

B - 1) Unit self recovers without user intervention.

2) No data loss.

C - 1) Upset OK provided that unit will function after user intervention.

## 2.13 Reliability

Measurement type	Specification
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read, max.
Annualized Failure Rate (AFR)	<0.60%
Load/Unload (U/UL)  25°C, 50% relative humidity  32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 10% relative humidity 55°C, 16% relative humidity	  600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles  600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles
Warranty	5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a> From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

## 2.14 Agency certification

### 2.14.1 Safety certification

The drives are recognized in accordance with UL 1950 and CSA C22.2 (950) and meet all applicable sections of IEC950 and EN 60950 as tested by TUV North America.

### 2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (89/336/EEC). Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Seagate uses an independent laboratory to confirm compliance with the EC directives specified in the previous paragraph. Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.



## Korean RRL

If these drives have the Korea Ministry of Information and Communication (MIC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Ministry of Information and Communication Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

EUT name (model numbers): ST9120822A, ST980815A, ST960815A, ST980815A, ST960815A, and ST940815A.

- Certificate numbers:

ST9160821A	STX-L253 (B)
ST9120822A	STX-L253 (B)
ST9100828A	STX-L253 (B)
ST980815A	STX-L253 (B)
ST960815A	STX-L253 (B)
ST940815A	STX-L253 (B)
- Trade name or applicant: Seagate Technology International
- Manufacturing date: January 2006
- Manufacturer/nationality: Seagate Technology International

## Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZS3548 1995 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

### 2.14.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate Technology LLC has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disc drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference to radio and television reception.

**Radio and television interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

## **2.15 Environmental protection**

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### **2.15.1 European Union Restriction of Hazardous Substances (RoHS)**

The European Union Restriction of Hazardous Substances (RoHS) Directive restricts the presence of chemical substances, including Lead (Pb), in electronic products effective July 2006.

A number of parts and materials in Seagate products are procured from external suppliers. We rely on the representations of our suppliers regarding the presence of RoHS substances in these parts and materials. Our supplier contracts require compliance with our chemical substance restrictions, and our suppliers document their compliance with our requirements by providing material content declarations for all parts and materials for the disc drives documented in this publication. Current supplier declarations include disclosure of the inclusion of any RoHS-regulated substance in such parts or materials.

Seagate also has internal systems in place to ensure ongoing compliance with the RoHS Directive and all laws and regulations which restrict chemical content in electronic products. These systems include standard operating procedures that ensure that restricted substances are not utilized in our manufacturing operations, laboratory analytical validation testing, and an internal auditing process to ensure that all standard operating procedures are complied with.

## **2.16 Corrosive environment**

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

## 3.0 Configuring and mounting the drive

---

This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

**Caution:**

- Keep the drive in the electrostatic discharge (ESD) bag until you are ready for installation to limit the drive's exposure to ESD.
- Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive only by its edges or frame.
- The drive is fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until you mount it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

## 3.2 Jumper settings

### 3.2.1 Master/slave configuration

Use the options jumper block shown in Figure 5 to configure the drive for operation. This jumper block is the 4-pin header adjacent to pins 1 and 2 of the I/O signal pins. For additional information about using the Cable select option, see Section 3.2.2.

The “Master or single drive” option is the factory default setting.

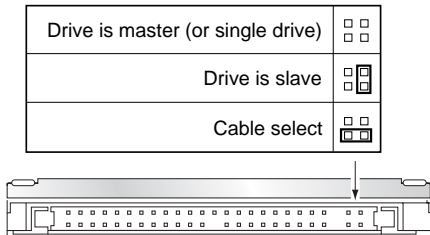


Figure 5. Jumper settings

### 3.2.2 Cable-select option

Computers that use cable select determine the master and slave drives by selecting or deselecting pin 28, CSEL, on the interface bus. Master and slave drives are determined by their physical position on the cable. To enable cable select, set a jumper as shown in Figure 5. Refer to your computer manual to determine whether your computer supports this option.

### 3.3 Drive mounting

You can mount the drive using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 6 for drive mounting dimensions (dimensions in inches with mm in parentheses). Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only M3 x 0.5 mounting screws.
- Do not overtighten the mounting screws (maximum torque: 4.0 inch-lb).
- Four (4) threads (0.080 inches) minimum screw engagement recommended.

Measurements shown in Figure 6 are in inches.

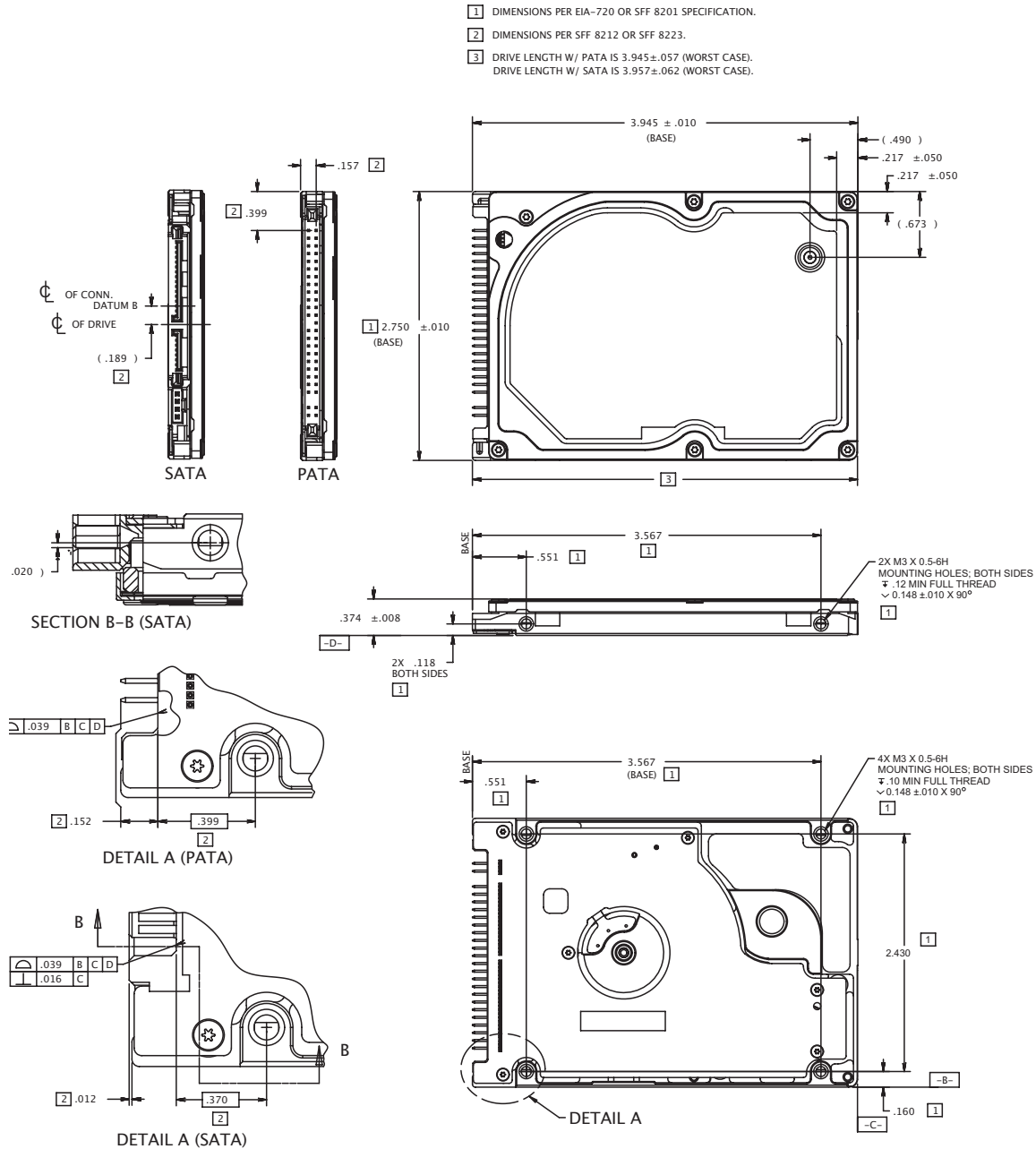


Figure 6. Mounting dimensions—top, side and end view



## 4.0 ATA interface

These drives use the industry-standard ATA task file interface that supports 16-bit data transfers. It supports ATA programmed input/output (PIO) modes 0–4; multiword DMA modes 0–2, and Ultra DMA modes 0–5. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

For detailed information about the ATA interface, refer to the draft of *AT Attachment with Packet Interface Extension (ATA/ATAPI-6)*, *NCITS T13 1410D*, subsequently referred to as the *Draft ATA-6 Standard*.

### 4.1 ATA interface signals and connector pins

The following table summarizes the signals on the 44-pin ATA interface connector. For a detailed description of these signals, refer to the *Draft ATA-6 Standard*.

**Table 6: Connector signals**

Signal Name	Connector Contact	Cable Conductor
RESET-	1	1
DD7	3	3
DD6	5	5
DD5	7	7
DD4	9	9
DD3	11	11
DD2	13	13
DD1	15	15
DD0	17	17
Ground	19	19
DMARQ	21	21
DIOW-	23	23
DIOR-	25	25
IORDY	27	27
DMACK-	29	29
INTRQ	31	31
DA1	33	33
DA0	35	35
CS1FX-	37	37
DASP-	39	39
+5 V (Logic)	41	41
Ground (Return)	43	43

Cable Conductor	Connector Contact	Signal Name
2	2	Ground
4	4	DD8
6	6	DD9
8	8	DD10
10	10	DD11
12	12	DD12
14	14	DD13
16	16	DD14
18	18	DD15
20	20	(keypin)
22	22	Ground
24	24	Ground
26	26	Ground
28	28	PSYNC:CSEL
30	30	Ground
32	32	IOCS16-
34	34	PDIAG-
36	36	DA2
38	38	CS3FX-
40	40	Ground
42	42	+5V (Motor)
44	44	No connection

#### 4.1.1 Supported ATA commands

The following table lists ATA-standard commands that the drive supports. For a detailed description of the ATA commands, refer to the *Draft ATA-6 Standard...*

**Table 7: Supported commands**

Command name	Command code (in hex)
<b>ATA-standard commands</b>	
ATA Device Configuration Overlay	B1 <sub>H</sub>
ATA Service	A2 <sub>H</sub>
Check Power Mode	98 <sub>H</sub> , E5 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track (Legacy)	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	97 <sub>H</sub> , E3 <sub>H</sub>
Idle Immediate	95 <sub>H</sub> , E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub> , C9 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read Log Extended	22 <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub> , 21 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub> , 41 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze Lock	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>



**Table 7: Supported commands**

Command name	Command code (in hex)
Seek	70 <sub>H</sub>
Set Drive Parameters	91 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>
Note: Individual Set Max commands are identified by the value placed in the Set Max Features register as defined to the right.	Address 00 <sub>H</sub> Password 01 <sub>H</sub> Lock 02 <sub>H</sub> Unlock 03 <sub>H</sub> Freeze Lock 04 <sub>H</sub>
Set Multiple Mode	C6 <sub>H</sub>
Sleep	99 <sub>H</sub> , E6 <sub>H</sub>
S.M.A.R.T.	B0 <sub>H</sub>
Standby	96 <sub>H</sub> , E2 <sub>H</sub>
Standby Immediate	94 <sub>H</sub> , E0 <sub>H</sub>
Vendor Unique	9A <sub>H</sub> , FA <sub>H</sub> , FB <sub>H</sub>
Write Buffer	E8 <sub>H</sub>
Write DMA	CA <sub>H</sub> , CB <sub>H</sub>
Write DMA Extended	35 <sub>H</sub>
Write Log Extended	32 <sub>H</sub>
Write Multiple	C5 <sub>H</sub>
Write Multiple Extended	39 <sub>H</sub>
Write Sectors	30 <sub>H</sub> , 31 <sub>H</sub>
Write Sectors Extended	34 <sub>H</sub>
<b>ATA-standard power-management commands</b>	
Check Power Mode	98 <sub>H</sub> or E5 <sub>H</sub>
Idle	97 <sub>H</sub> or E3 <sub>H</sub>
Idle Immediate	95 <sub>H</sub> or E1 <sub>H</sub>
Sleep	99 <sub>H</sub> or E6 <sub>H</sub>
Standby	96 <sub>H</sub> or E2 <sub>H</sub>
Standby Immediate	94 <sub>H</sub> or E0 <sub>H</sub>
<b>ATA-standard security commands</b>	
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze Lock	F5 <sub>H</sub>

**Table 7: Supported commands**

Command name	Command code (in hex)
Security Disable Password	F6 <sub>H</sub>

#### 4.1.2 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in Table 7 on page 26. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive. See Section 2.0 on page 3 for default parameter settings.

The following commands contain drive-specific features that may not be included in the *Draft ATA-6 Standard*.

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number (40 ASCII characters, padded with blanks to end of string)	ST9160821A ST9120822A ST9100828A ST980815A ST960815A ST940815A
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>

Word	Description	Value
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information)	ST9160821A = 312,581,808 ST9120822A = 234,441,648 ST9100828A = 195,371,568 ST980815A = 156,301,488 ST960815A = 117,410,240 ST940815A = 78,140,160
62	Retired	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	00F0 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	0000 <sub>H</sub>
76–79	ATA-reserved	0000 <sub>H</sub>
80	Major version number	007E <sub>H</sub>
81	Minor version number	0000 <sub>H</sub>
82	Command sets supported	346B <sub>H</sub>
83	Command sets supported	7D01 <sub>H</sub>
84	Command sets support extension	4003 <sub>H</sub>
85	Command sets enabled	34xx <sub>H</sub>
86	Command sets enabled	3xxx <sub>H</sub>
87	Command sets enable extension	4003 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx3F <sub>H</sub>
89	Security erase time	0000 <sub>H</sub>
90	Enhanced security erase time	0000 <sub>H</sub>
91	Advanced power management value	0040 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value (see description following this table)	xxxx <sub>H</sub>
94	Auto acoustic management setting	xxxx <sub>H</sub>
95–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>

Word	Description	Value
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**Note.** See the bit descriptions below for words 63, 88, 93 and 94 of the Identify Drive data.

**Description (if bit is set to 1)**

Bit	Word 63
0	Multiword DMA mode 0 is supported.
1	Multiword DMA mode 1 is supported.
2	Multiword DMA mode 2 is supported.
8	Multiword DMA mode 0 is currently active.
9	Multiword DMA mode 1 is currently active.
10	Multiword DMA mode 2 is currently active.
Bit	Word 88
0	Ultra DMA mode 0 is supported.
1	Ultra DMA mode 1 is supported.
2	Ultra DMA mode 2 is supported.
3	Ultra DMA mode 3 is supported.
4	Ultra DMA mode 4 is supported.
8	Ultra DMA mode 0 is currently active.
9	Ultra DMA mode 1 is currently active.
10	Ultra DMA mode 2 is currently active.
11	Ultra DMA mode 3 is currently active.
12	Ultra DMA mode 4 is currently active.
13	Ultra DMA mode 5 is currently active.
Bit	Word 93
13	1 = 80-conductor cable detected, CBLID above V <sub>IH</sub> 0 = 40-conductor cable detected, CBLID below V <sub>IL</sub>

### 4.1.3 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

**Table 8: Features register values**

02 <sub>H</sub>	Enable write cache ( <i>default</i> ).
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2).
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2).
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
05 <sub>H</sub>	Enable advanced power management
55 <sub>H</sub>	Disable read look-ahead (read cache) feature.
82 <sub>H</sub>	Disable write cache.
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> ).
F1 <sub>H</sub>	Report full capacity available

**Note.** At power-on or after a hardware or software reset the default values of the features are as indicated above.

## **5.0 Compatibility summary**

---

### **5.1 Installation considerations**

Many of today's mobile computers have been designed to make it possible for the end user to replace the hard drive. Refer to your system's user manual for the location of the hard drive compartment and the specific instructions regarding replacement. Refer to your system manufacturer's support website for the most up-to-date information. Read and follow all instructions regarding the proper steps to be taken when replacing the system hard drive. Some mobile systems are sealed and require specialized tools to gain access to the hard drive. Special training or tools may be needed to service some mobile computers. In some cases, opening the case may void your warranty. Consult your system documentation. Seagate recommends taking your system to an authorized service technician to replace your hard drive.

## System Compatibility

Seagate Product Assurance has tested Momentus drives in the systems listed in Table 9. Testing included multiple BIOS versions and operating systems. This testing was done to demonstrate compatibility with various hardware and software configurations. Hardware and software combinations, other than those tested, may also be compatible with this drive.

**Table 9: Tested systems**

Gateway 300SE	EVO D300	Lavie LJ700/7E	Micron T2000
Gateway 450RGH	EVO D300V	Lavie LL750/8	Micron T2100
Gateway 500XL	EVO D310	Lavie LL970/9D	Micron T2200
Gateway 700S	EVO D310M	Lavie LR700/9E	Thinkpad
Gateway 700X	EVO D310V	Lavie LS830/9D	Thinkpad A22E
ABIT BL7	EVO D500	Microstar MSI-6561	ThinkpadG40
Acer Aspire 2000	EVO D500M	Microstar MSI-6566E	Thinkpad T30
Amilio	EVO D500S	Millennia 920I PRO	Thinkpad T40
ASUS P4SGL-VM	EVO D510	MIM 2020	Tian YI S180
AZZA P4X2-AV	EVO D510 SFF	MIT-RHE-BT	Transport GX3
Bonatti	EVO D510C	Netvista	Transport T1000
Brasilia	EVO E-6000	Optiplex GX150	Transport V1000
Client Pro 345	EVO N620C	Optiplex GX260	Travel Mate 660
Client Pro 345E	EVO W-4000	Optiplex GX400	Travel Mate 800LCI
Compaq NX9500	FID 2040	Pavillion 774Y	Travel Mate 800LCI
Compaq D315	FID 2100	Pavillion ZD7000	Travel Mate 2500
HP D330	FMV 16C/V	Pavillion ZT3000	Travel Mate 290VCI
HP D330 MT	FMV Biblo MG 75HT/ST	Pavillion ZV5000	Travel Mate 650
HP D330 UT	FMV Biblo NB75H/T	Pavillion ZX5000	Travel Mate 660
HP D530	FMV Biblo NH90H/T	Sony PCV-RZ60	Travel Mate 800
HP D530 CMT	FMV CE50G7 (IVY6)	Performance	Travel Mate 8000
HP D530 SFF	FMV NB18C	Performance 1400	Trigem S7 7570
HP D530 USDT	Gigabyte GA-7DXR+	Performance 1500	Trigem V7 7600
Dimensio GX400	Gigabyte GA-8IDX	Powerbook 5	NECUNI-TRI-NT
Dimension 4100	Gigabyte GA-8SIML	Powerbook 5,2	Micron V2000
Dimension 4100 XPSZ	Gigabyte GA-8SR533	Powerbook 5,2	Vaio PCG-V505/B
Dimension 4400	HP/Compaq NX7000	Powerbook G4	Vaio PCG-ZIR/P
Dimension 4500S	IBM XNote	Precision 330	Vaio PCV RX770
Dimension 4600	Imedia 7150(Discovery)	Precision 340	Vaio PCV7753
Dimension 8100	Inspirion 8100	Precision 350	Vaio PCV-7753
Dimension 8200	Inspirion 1150	Precision 360	Valuestar VC300/4D
Dimension 8250	Inspirion 2650	Precision 530	Valuestar VF500/8D
Dimension 8300	Inspirion 300M	Precision M60	Valuestar VF500/D
Dimension XPS	Inspirion 5100	Presario 2100	Valuestar VG17H/8
Dynabook TX/2513CMCW	Inspirion 5150	Presario 2500	Valuestar VG17H2Z38
Compaq E -6000	Inspirion 600M	Presario 6000	Valuestar VT500/4D
Gateway E Series	Inspirion 8600	Presario 8000	Veriton 7200D
Gateway E-2000	Inspirion 9100	Presario 8000Z	Veriton 7500
Gateway E-4000	Inspirion XPS	Presario R3000	VGN-A70P
Gateway E-4100	Intel 845GBV	Presario X1000	W 6000
Gateway E4600	Intel SPRINGDALE-G	Pro S P4-1300SE	Workstation XW5000
Gateway E6000	Intellistation EPVO	Pro S P4-1400	Workstation XW8000
Gateway E-6100	Intellistation M PRO	Qosmio E10/1JCDT	Presario X1000
Elite ECS-K7S6A	JIA HE H150	IBM R50	MPC X3000
Elite ECS-L4S5MG	Latitude 100L	IBM R50P	Yi He A760D
Elite K7S5A	Latitude 8600	SB-4100A	Zhao Yang E260
Equium 3140CS	Latitude D400	SB-4100-C	Zhao Yang E600A
Equium 3150	Latitude D505	SB-4100-E	Zhao Yang S620
Equium 5070CS	Latitude D600	SB-4100-B	
ES2 300X	Latitude D800	Shuttle AV40	
ES2 500S	Latitude X300	Slotek SL-85SD	
ESX- SB-400 E PC		Scnic	
ESX500S			



## 5.2 BIOS versions tested

The following list indicates the types of BIOS Seagate tested during the compatibility testing process. The list highlights the major BIOS manufacturers. Individual systems contain variations of these BIOS versions and were tested with regard to their implementation in the individual systems.

**Table 10: Tested BIOS versions**

Vendor	Release	Revision
ACER		1.01
ACPI		Ver. 1.20
AMI	Various	Various
Apple	4.71F1	
Apple	4.8.4F1	
Award	Various	Various
Compal	38118	v2.00
Compaq	68xxx	Various
Compaq	78xxx	Various
Compaq	8602	v1.08
Compaq	F.07	
Dell	Various	A03
Gateway	Various	
HP	Various	Various
IBM	Various	Various
Insyde SCU		1.1
Insyde	Various	Various
Insyde	Mobilepro	Various
Intel	786B2	v1.11
M1300	A02	37763
Medion	1.0D-1373-0812	
Micron	Various	
Mobile Pro	4.00.01	V1.04 EC1.01M
NEC	Various	Various
Phoenix	Various	Various
Toshiba	Various	Various

### 5.3 Operating system versions tested

This list indicates the types of Operating Systems Seagate tested during the compatibility testing process and highlights the major OS manufacturers. Several variations of the major operating systems have been tested.

**Table 11: Operating systems tested**

Manufacturer	Version/Release
Apple	MacOS 9.22
Apple	MacOS X 10.2.3
Microsoft	MSDOS 6.22
Microsoft	Windows 98, 98SE, ME (multiple languages)
Microsoft	Windows 2000, 2000-Pro (+SP 1 thru 4) (multiple languages)
Microsoft	Windows NT 4.0 (+SP 6 and 6a) (+Japanese)
Microsoft	Windows XP, XP Pro, XP Home (+SP1) (multiple languages)

### 5.4 Compatibility test configurations

The Momentus drives have been tested to demonstrate compliance with ATA/ATAPI-6 in both the master drive and slave drive positions. These tests were performed to ensure the functionality to ATA/ATAPI-6 specifications and the compatibility of Seagate Momentus drives with other ATA/ATAPI-6 compliant peripherals.

### 5.5 Software utilities

The following is a brief overview of a some of the Seagate utilities used during the Seagate competitive analysis process.

The Seagate SeaTools application is an exclusive disc drive diagnostic software designed to troubleshoot most hard drive issues. Desktop edition works with most ATA, SATA, or SCSI drives in desktop systems and has a 98 percent accuracy rate.

The Seagate DiscWizard™ application simplifies the installation of disc drives. This software also overcomes many system BIOS and operating system limitations that can complicate the installation of higher-capacity ATA (IDE) interface drives.

This is a list of some of the third party utilities used in the testing process.

Vendor	Application
AMI	Diagnostic
Apple	Macbench
Intel	PCI-EXE
Microsoft	Winbench99
Symantec	Norton Utilities

### 5.6 Other certification

Microsoft software compatibility.

## 6.0 Seagate Technology support services

---

### Internet

For information regarding Seagate products and services, visit [www.seagate.com](http://www.seagate.com). Worldwide support is available 24 hours daily by email for your questions.

### Presales Support:

Presales@Seagate.com

### Technical Support:

DiscSupport@Seagate.com

### Warranty Support:

<http://www.seagate.com/support/service/index.html>

### mySeagate

my.seagate.com is the industry's first Web portal designed specifically for OEMs and distributors. It provides self-service access to critical applications, personalized content and the tools that allow our partners to manage their Seagate account functions. Submit pricing requests, orders and returns through a single, password-protected Web interface-anytime, anywhere in the world.

### spp.seagate.com

spp.seagate.com supports Seagate resellers with product information, program benefits and sales tools. You may register for customized communications that are not available on the web. These communications contain product launch, EOL, pricing, promotions and other channel-related information. To learn more about the benefits or to register, go to spp.seagate.com, any time, from anywhere in the world.

## Seagate Service Centers

### Presales Support

Our Presales Support staff can help you determine which Seagate products are best suited for your specific application or computer system, as well as product availability and compatibility.

### Technical Support

Seagate technical support is available to assist you online at [support.seagate.com](http://support.seagate.com) or through one of our call centers. Have your system configuration information and your "ST" model number available.

**SeaTDD™ (+1-405-324-3655)** is a telecommunications device for the deaf (TDD). You can send questions or comments 24 hours daily and exchange messages with a technical support specialist during normal business hours for the call center in your region.

## Customer Service Operations

### Warranty Service

Seagate offers worldwide customer support for Seagate products. Seagate distributors, OEMs and other direct customers should contact their Seagate Customer Service Operations (CSO) representative for warranty-related issues. Resellers or end users of drive products should contact their place of purchase or Seagate warranty service for assistance. Have your serial number and model or part number available.

### Data Recovery Services

Seagate offers data recovery services for all formats and all brands of storage media. Our data recovery services labs are currently located throughout the world. . Additional information, including an online request form and data loss prevention resources, is available at <http://services.seagate.com/index.aspx>

### Authorized Service Centers

Seagate Service Centers are available on a global basis for the return of defective products. Contact your customer support representative for the location nearest you.

### USA/Canada/Latin America support services

For an extensive list of telephone numbers to technical support, presales and warranty service in USA/Canada/Latin America, including business hours, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

## Global Customer Support

### Presales, Technical, and Warranty Support

Call Center	Toll-free	Direct dial
USA, Canada, and Mexico	1-800-SEAGATE	+1-405-324-4700

### Data Recovery Services

Call Center	Toll-free	Direct dial	FAX
USA, Canada, and Mexico	1-800-475-01435	+1-905-474-2162	1-800-475-0158 +1-905-474-2459

## Europe, the Middle East and Africa Support Services

For an extensive list of telephone numbers to technical support, presales and warranty service in Europe, the Middle East and Africa, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

## Asia/Pacific Support Services

For an extensive list of telephone numbers to technical support, presales and warranty service in Asia/Pacific, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

# Index

## Numerics

3D Defense System 1

## A

acoustics 17  
Active mode 14  
AFR 18  
agency certification (regulatory) 18  
altitude 15  
ambient conditions 3  
ambient temperature 11, 15  
Annualized Failure Rate 18  
areal density 10  
ATA interface 25  
ATA-standard commands 26  
Australian C-Tick 19  
autodetection 1  
average seek time 11

## B

BIOS manufacturers 35  
BPI 10  
buffer 1, 10  
burst 1

## C

cable select 1  
cable-select option 22  
cache 1, 10  
case temperature 15  
CE mark 18  
certification 18  
Check Power Mode 27  
chemical substances 20  
commands 26  
compatibility 34  
compatibility summary 33  
compatibility test configurations 36  
compliance 18  
conducted noise 13  
conducted RF immunity 17  
configuring the drive 21  
connector pins 25  
Corrosive environment 20  
CSA C22.2 (950) 18  
CSEL 22  
C-Tick 19  
current profile 13  
cycles 18

## D

Data Defense 1  
data-transfer rates 1  
DC power 12  
demonstrate compliance 36  
density 10  
Diagnostic Defense 1  
diagnostic software 1  
discs 9  
dissipation 12  
Download Microcode 26  
Drive Defense 1  
drive diagnostics 11  
drive monitoring 1  
drive self-test 1

## E

electrical fast transient 17  
electromagnetic compatibility 18  
Electromagnetic Compatibility Directive 18  
electromagnetic immunity 17  
electrostatic discharge 17  
EMC compliance 18  
EN 60950 18  
enclosures 19  
Environmental protection 20  
environmental specifications 15  
error-correction algorithms 1  
errors 18  
European Union 18  
Execute Device Diagnostics 26

## F

FCC verification 19  
Features register 32  
Flush Cache 26  
Flush Cache Extended 26  
formatted capacity 9  
frequency 17

## G

guaranteed sectors 9

## H

handling 21  
heads 1, 9  
height 10  
humidity 15

## I

I/O data-transfer rate 10  
Identify Device 26

Identify Device command 29  
Idle 27  
Idle and Standby timers 14  
Idle Immediate 27  
Idle mode 14  
Idle mode power 12  
IEC950 18  
Information Technology Equipment 18  
Initialize Device Parameters 26  
interface 10, 25  
interface signals 25  
interference 19  
interleave 10  
internal data-transfer rate OD 10  
ISO document 7779 17

## J

jumper settings 22

## K

Korean RRL 19

## L

LBA mode 9  
length 10  
Load/Unload 18  
logical geometry 9

## M

master/slave 1  
Master/slave configuration 22  
maximum temperature 15  
modes 25  
monitoring 1  
mounting the drive 21, 23

## N

noise 13  
nominal power 3  
nonoperating shock 16  
nonoperating vibration 16  
nonrecoverable read errors 18

## O

operating shock 16  
operating system 34  
operating vibration 16  
OS manufacturers 36  
other certification 36

## P

physical characteristics 10

physical organization 9  
pins 25  
PIO 25  
power consumption 12  
power dissipation 12  
power frequency h-field immunity 17  
power management 14  
power on/off cycles 18  
power specifications 12  
power-management commands 27  
power-management modes 14  
Power-on to Ready 11  
precautions 23  
programmable power management 14

## R

radiated RF immunity 17  
radio and television interference 19  
radio frequency (RF) 17  
random track location 12  
Read Buffer 26  
Read DMA 26  
Read DMA Extended 26  
read errors 18  
Read Multiple 1, 26  
Read Multiple Extended 26  
Read Native Max Address 26  
Read Native Max Address Extended 26  
Read Sectors 26  
Read Sectors Extended 26  
Read Verify Sectors 26  
Read Verify Sectors Extended 26  
read/write heads 9  
read/write power and current 12  
recording and interface technology 10  
recording density 10  
recording heads 1  
recording method 10  
register 32  
relative humidity 15  
reliability 18  
resistance 13  
RF 17  
RoHS 20

## S

S.M.A.R.T. 27  
S.M.A.R.T. drive monitoring 1  
safety certification 18  
screws 23  
SeaTools 1  
sectors 9  
security commands 27  
Security Disable Password 28

- Security Erase Prepare 27
- Security Erase Unit 27
- Security Freeze Lock 27
- Security Set Password 27
- Security Unlock 27
- Seek 27
  - seek mode 12
  - seek time 11
- Seeking 12
- Self refresh, low power 14
- servo electronics 12
- Set Features 27
- Set Features command 32
- Set Max 27
- Set Multiple Mode 27
- shock 16
- signals 25
- single-track seeks 11
- Sleep 12, 27
- Sleep mode 14
- software utilities 36
- sound 17
- specifications 3
- spindle speed 10
- Spinup 12
  - spinup power 12
- Standby 12, 27
  - Standby Immediate 27
  - Standby mode 12, 14
  - Standby to Ready 11
- static-discharge precautions 21
- subassembly 19
- support services 37
- surge immunity 17

## T

- technical support services 37
- temperature 15
- temperature gradient 15
- third party utilities 36
- time to ready 11
- timers 14
- TMR 1
- track density 10
- track-to-track seek time 11
- Tunneling Magnetoresistive heads 1
- TUV North America 18

## U

- UL 1950 18

## V

- vibration 16
- voltage 13

- voltage dips, interrupts 17
- voltage tolerance 13

## W

- Warranty 18
- weight 10
- wet bulb temperature 15
- width 10
- Write Buffer 27
- Write DMA 27
- Write DMA Extended 27
- Write Multiple 1, 27
- Write Multiple Extended 27
- Write Sectors 27
- Write Sectors Extended 27









**Seagate Technology LLC**  
**920 Disc Drive, Scotts Valley, California 95066-4544, USA**  
*Publication Number: 100398876, Rev. C, Printed in U.S.A.*

## Free Manuals Download Website

<http://myh66.com>

<http://usermanuals.us>

<http://www.somanuals.com>

<http://www.4manuals.cc>

<http://www.manual-lib.com>

<http://www.404manual.com>

<http://www.luxmanual.com>

<http://aubethermostatmanual.com>

Golf course search by state

<http://golfingnear.com>

Email search by domain

<http://emailbydomain.com>

Auto manuals search

<http://auto.somanuals.com>

TV manuals search

<http://tv.somanuals.com>