Product Manual

Barracuda 7200.7 Serial ATA

ST3200822AS

ST3160827AS

ST3160023AS

ST3160021AS

ST3120827AS

ST3120026AS

ST3120022AS

ST380817AS

ST380013AS

ST380011AS

ST340111AS

ST340014AS

Seagate

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Seagate

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Barracuda 7200.7 Serial ATA Product Manual, Rev. N

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1.0　　Introduction

This manual describes the functional, mechanical and interface specifications for the following Seagate Barracuda® 7200.7 Serial ATA model drives:

Table 1:　　Barracuda 7200.7 Serial ATA models

OEM models		Distribution models not supporting NCQ	Distribution models supporting NCQ
ST3200822AS	ST380013AS [1]	ST3200822AS	ST3160827AS
ST3160023AS [1]	ST380011AS [1]	ST3160023AS	ST3120827AS
ST3160021AS [1]	ST340111AS [1]	ST3120026AS	ST380817AS
ST3120026AS [1]	ST340014AS [1]	ST380013AS	
ST3120022AS [1]			

[1]　OEM model that may support NCQ

These drives provide the following key features:

- 7,200 RPM spindle speed
- 8 Mbyte buffer (ST3200822AS, ST3160827AS, ST3160023AS, ST3120827AS, ST3120026AS, ST380817AS, ST380013AS and ST340111AS models)
- 2 Mbyte buffer (ST3160021AS, ST3120022AS, ST380011AS, and ST340014AS models)
- High instantaneous (burst) data-transfer rates (up to 150 Mbytes per second).
- Giant magnetoresistive (GMR) recording heads and EPRML technology, provide the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Full-track multiple-sector transfer capability without local processor intervention.
- Quiet operation.
- 350 Gs nonoperating 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.
- Native Command Queing enabled on some models.

1.1 About the Serial ATA interface

The Serial ATA interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, Serial ATA makes the transition from parallel ATA easy by providing legacy software support. Serial ATA was designed to allow you to install a Serial ATA host adapter and Serial ATA disc drive in your current system and expect all of your existing applications to work as normal.

The Serial ATA interface connects each disc drive in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship with Serial ATA devices like there is with parallel ATA. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both "masters" on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

Note. The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate Serial ATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical Serial ATA environment.

The Serial ATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The Serial ATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All Serial ATA devices behave like Device 0 devices. For additional information about how Serial ATA emulates parallel ATA, refer to the "Serial ATA: High Speed Serialized AT Attachment" specification. The specification can be downloaded from http://www.serialata.com.

1.2 Native Command Queuing

Native Command Queuing (NCQ) is among the advanced features introduced in the Serial ATA II: Extensions to Serial ATA 1.0 Specification. NCQ is a powerful technology designed to increase performance and endurance by allowing the drive to internally optimize the execution order of workloads. Intelligent reordering of commands within the drive's internal command queue helps improve performance of queued workloads by minimizing mechanical positioning latencies on the drive.

Operating systems such as Microsoft Windows and Linux are increasingly taking advantage of multi-threaded software or processor-based Hyper-Threading Technology. These features have a high potential to create workloads where multiple commands are outstanding to the drive at the same time. By utilizing NCQ, the potential disc performance is increased significantly for these workloads.

Native Command Queuing achieves high performance and efficiency through efficient command reordering. In addition, there are three new capabilities that are built into the Serial ATA protocol to enhance NCQ performance: racefree status return, interrupt aggregation, and First-Party DMA.

To learn more about NCQ, go to the Seagate Serial ATA resource site at:
www.seagate.com/products/interface/sata/.

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 the ST3200822AS, ST3160827AS, ST3160023AS, ST3160021AS, ST3120827AS, ST3120026AS, ST3120022AS, ST380817AS, ST380013AS, ST380011AS, ST340111AS and ST340014AS models.

2.1   Specification summary table

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 2:   Drive specifications

Drive specification	ST3200822AS	ST3160827AS ST3160023AS ST3160021AS	ST3120827AS ST3120026AS ST3120022AS	ST380817AS ST380013AS ST380011AS	ST340111AS ST340014AS
Formatted Gbytes (512 bytes/sector)*	200	160	120	80	40
Guaranteed sectors	390,721,968	312,581,808	234,441,648	156,301,488	78,165,360
Bytes per sector	512				
Default sectors per track	63				
Default read/write heads	16				
Default cylinders	16,383				
Physical read/write heads	4	4	3	2	1
Discs	2	2	2	1	1
Recording density in BPI (bits/inch max)	671,500	595,000			
Track density TPI (tracks/inch max)	98,000	94,600			
Areal density (Gbits/inch^2 max)	68.5	56.3			
Spindle speed (RPM)	7,200				
Internal transfer rate (Mbytes/sec max)	85.4				
Sustained transfer rate OD (Mbytes/sec)	58				
I/O data transfer rate (Mbytes/sec max)	150				
ATA data-transfer modes supported	SATA 1.0, SATA II PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–6				
Cache buffer	8 Mbytes: ST3200822AS, ST3160827AS, ST3160023AS, ST3120827AS, ST3120026AS, ST380817AS, ST380013AS and ST340111AS 2 Mbytes: ST3160021AS, ST3120022AS, ST380011AS, and ST340014AS				
Height (max)	26.035 mm (1.028 inches)				
Width (max)	101.6 mm (4.000 inches)				
Length (max)	146.99 mm (5.787 inches)				
Weight (typical)	635 grams (1.4 lb)				

Table 2: Drive specifications

Drive specification	ST3200822AS	ST3160827AS ST3160023AS ST3160021AS	ST3120827AS ST3120026AS ST3120022AS	ST380817AS ST380013AS ST380011AS	ST340111AS ST340014AS
Average latency (msec)	4.16				
Power-on to ready (typical)	10 sec				
Standby to ready (typical)	10 sec				
Startup current (typical) 12V (peak)	2.8 amps				
Track-to-track seek time (msec typical)	<1.0 (read), <1.2 (write)				
Average seek, read (msec typical)	8.5				
Average seek, write (msec typical)	9.5				
Seek power (typical)	See Table 4 and Table 5 on page 8.				
Operating power (typical)					
Idle mode (typical)					
Standby mode (typical)					
Sleep mode					
Voltage tolerance (including noise)	5V ± 5% 12V ± 10%				
Ambient temperature	5° to 55°C (op.) −40° to 70°C (nonop.)	0° to 60°C (op.) −40° to 70°C (nonop.)			
Temperature gradient (°C per hour max)	20°C (operating) 30°C (nonoperating)				
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)				
Relative humidity gradient	30% per hour max				
Wet bulb temperature (°C max)	33 (operating) 40 (nonoperating)				
Altitude, operating	−60.96 m to 3,048 m (−200 ft to 10,000+ ft)				
Altitude, nonoperating (meters below mean sea level, max)	−60.96 m to 12,192 m (−200 ft to 40,000+ ft)				
Shock, operating (Gs max at 2 msec)	63				
Shock, nonoperating (Gs max at 2 msec)	350 Gs				
Vibration, operating	5–22 Hz: Limited displacement 23–350 Hz: 0.5 G acceleration				
Vibration, nonoperating	5–22 Hz: Limited displacement 23–350 Hz: 5.0 Gs				
Drive acoustics, sound power (bels) Idle*	<2.5 (typical) 2.7 (max)				<2.2 (typ) 2.4 (max)
Performance seek	3.4 (typical) 3.7 (max)				3.1 (typical) 3.5 (max)
Nonrecoverable read errors	1 per 10^{14} bits read				
Mean time between failures (power-on hours)	600,000				
Service life	5 years				
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: www.seagate.com/support/service/ 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 countyr of purchase. The system will display the warranty information for your drive.				

Table 2:   Drive specifications

Drive specification	ST3200822AS	ST3160827AS ST3160023AS ST3160021AS	ST3120827AS ST3120026AS ST3120022AS	ST380817AS ST380013AS ST380011AS	ST340111AS ST340014AS
Contact start-stop cycles (25°C, 40% relative humidity)	50,000				
Supports Hotplug operation per SATA II specification	Yes				

*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.

2.2   Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3200822AS	200 Gbytes	390,721,968	512
ST3160827AS ST3160023AS ST3160021AS	160 Gbytes	312,581,808	512
ST3120827AS ST3120026AS ST3120022AS	120 Gbytes	234,441,648	512
ST380817AS ST380013AS ST380011AS	80 Gbytes	156,301,488	512
ST340111AS ST340014AS	40 Gbytes	78,165,360	512

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

2.2.1   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.

See Section 4.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137 Gbytes.

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

Drive model	Read/write heads	Number of discs
ST3200822AS, ST3160827AS, ST3160023AS and ST3160021AS	4	2
ST3120827AS, ST3120026AS and ST3120022AS	3	2
ST380817AS, ST380013AS and ST380011AS	2	1
ST340111AS and ST340014AS	1	1

2.5 Recording and interface technology

Interface	Serial ATA (SATA)
Recording method	16/17 EPRML
Recording density BPI (bits/inch max)	595,000 (671,500 on ST3200822AS model)
Track density TPI (tracks/inch max)	94,600 (98,000 on ST3200822AS model)
Areal density (Gbits/inch^2 max)	56.3 (68.5 on ST3200822AS model)
Spindle speed (RPM) (± 0.2%)	7,200
Maximum Internal transfer rate (Mbytes/sec)	85.4
Sustained transfer rate OD (Mbytes/sec max)	58
I/O data-transfer rate (Mbytes/sec max)	150 (SATA 1.0)
Interleave	1:1
Cache buffer ST3200822AS, ST3160827AS, ST3160023AS, ST3120827AS, ST3120026AS, ST380817AS, ST380013AS and ST340111AS ST3160021AS, ST3120022AS, ST380011AS, and ST340014AS	 8 Mbytes 2 Mbytes

2.5.1 Physical characteristics

Drive specification	
Maximum height (mm) (inches)	 26.035 1.028
Maximum width (mm) (inches)	 101.6 4.00
Maximum length (mm) (inches)	 146.99 5.787
Typical weight (grams) (pounds)	 635 1.4

2.6   Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table 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.

Table 3:   Typical seek times

*Typical seek times (msec)	Read	Write
Track-to-track	<1.0	<1.2
Average	8.5	9.5
Average latency	4.16	4.16

*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 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.

2.7   Start/stop times

Power-on to Ready (sec)	10 (max)
Standby to Ready (sec)	10 (max)
Ready to spindle stop (sec)	10 (max)

2.8   Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. See Figure 4 on page 20.

2.8.1   Power consumption

Power requirements for the drives are listed in the table on page 9. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage 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 represents the worst-case power consumption, using only random seeks with read or write latency time. This mode is not typical and is provided for worst-case information.

• **Read/write power and current**

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-msec delay, then a 16-sector read followed by a 32-msec delay.

- **Operating power and current**

  Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

- **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 mode.

Table 4:   DC power requirements (example of 160GB models supporting NCQ[1])

Power dissipation (watts)	Average (watts, 25° C)	5V typ amps	12V typ amps
Spinup	—	—	2.8 (peak)
Idle	7.5	0.487	0.422
Idle (with offline activity) [2]	9.3	0.875	0.41
Operating (40% r/w, 40% seek, 20% inop.)	12.0	0.631	0.737
Seeking	12.5	0.405	0.873
Standby/Sleep	1.0	0.185	0.006

Table 5:   DC power requirements (example of 160GB and 200GB models not supporting NCQ)

Power dissipation (watts)	Average (watts, 25° C)	5V typ amps	12V typ amps
Spinup	—	—	2.8 (peak)
Idle	7.5	0.482	0.424
Idle (with offline activity) [2]	9.3	0.587	0.53
Operating (40% r/w, 40% seek, 20% inop.)	12.1	0.638	0.739
Seeking	12.5	0.412	0.87
Standby/Sleep	2.0	0.367	0.014

[1]   NCQ may not be enabled during power measurements.
[2]   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.
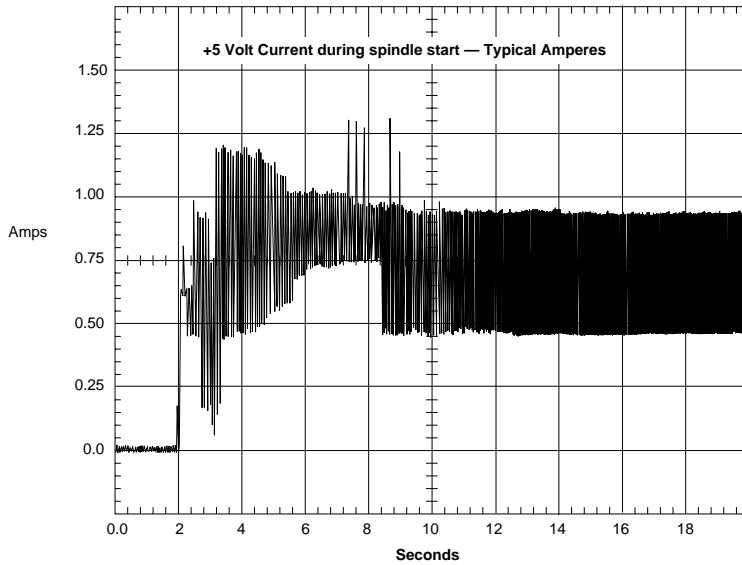
2.8.1.1   Typical current profiles

Figure 1. Typical 5V startup and operation current profile
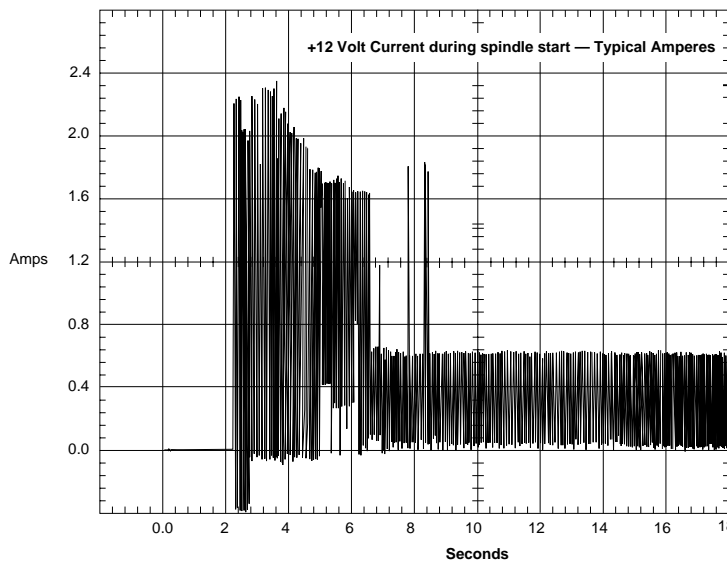

Figure 2. Typical 12V startup and operation current profile

2.8.2   Deferred spinup

Barracuda 7200.7 Serial ATA drives provide a deferred spinup feature which storage subsystem controllers can use to sequence disc drive initialization. This is beneficial to systems which include multiple Serial ATA hard disc drives because it allows subsystem controllers to stagger the spinup of each drive to accommodate available power supply current. This feature does not impact time-to-ready in typical desktop systems.

To accommodate the deferred spinup of multiple disc drives in an enclosure, Barracuda 7200.7 Serial ATA disc drives will spin up only after power is applied to the drive and after successful PHY (Physical layer) initialization. PHY initialization occurs after the PHY enters the DP7:DR_Ready state. This state is reached after a suc-

cessful exchange of Out-Of-Band (OOB) signals with a functional host-side Serial ATA port. In desktop systems, SATA transceivers should initialize OOB as soon as power comes ready to guarantee the drive spins up quickly. Seagate disc drives will not spin up without an operational host-side Serial ATA transceiver.

Additional details

Upon system power up, PHY communication is initiated with a COMRESET signal, which is generated by the host-side transceiver. COMRESET is followed by a COMINIT signal generated by the disc drive transceiver. COMRESET and COMINIT are followed by an exchange of COMWAKE signals and Align primitives. The disc drive will spin up after the successful exchange of Align primitives cause the PHY to come ready.

For more details, refer to:

- Section 6.8 of the Serial ATA 1.0 High-Speed Serialized AT Attachment specification
- Section 6.2 of the Serial ATA II: Extensions to Serial ATA 1.0 specification
- SATA 1.0 design guides

Note. These specifications and guides are available on the Serial ATA web site (www.serialata.org).

2.8.3 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10 MHz.
- 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.

2.8.4 Voltage tolerance

Voltage tolerance (including noise):

5V ± 5%
12V ± 10%

2.8.5 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:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**

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

- **Idle mode**

  The buffer remains enabled, 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 enabled, 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 disabled, 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.

2.9 Environmental specifications

2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions for standard models, or 64°C (147°F) within the operating ambient conditions for ST3200822AS model. Recommended measurement locations are shown in See Figure 5 on page 22 .

Above 1,000 feet (305 meters), the maximum temperature is derated linearly to 112°F (44°C) at 10,000 feet (3,048 meters).

Operating   0° to 60°C (32° to 140°F) for standard models
                                 5° to 55°C (41° to 131°F) for ST3200822AS model

Nonoperating   –40° to 70°C (–40° to 158°F)

2.9.2   Temperature gradient

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

2.9.3   Humidity

2.9.3.1   Relative humidity

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

2.9.3.2   Wet bulb temperature

Operating	33°C (91.4°F max)
Nonoperating	40.0°C (104°F max)

2.9.4   Altitude

Operating	–60.96 m to 3,048 m (–200 ft to 10,000+ ft)
Nonoperating	–60.96 m to 12,192 m (–200 ft to 40,000+ ft)

2.9.5   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.

2.9.5.1   Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 63 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second.

2.9.5.2   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 350 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

2.9.6 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.

2.9.6.1 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

5–22 Hz	Limited displacement
23–350 Hz	0.5 G acceleration

2.9.6.2 Nonoperating vibration

The maximum nonoperating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5–22 Hz	Limited displacement
23–350 Hz	5.0 Gs

2.10 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:

(Number of seeks per second = 0.4 / (average latency + average access time)

Table 6: Fluid Dynamic Bearing (FDB) motor acoustics

Models	Idle*	Performance seek
ST3200822AS ST3160827AS ST3160023AS ST3160021AS ST3120827AS ST3120026AS ST3120022AS ST380817AS ST380013AS ST380011AS	<2.5 bels (typ) 2.7 bels (max)	3.4 bels (typ) 3.7 bels (max)
ST340111AS ST340014AS	<2.2 bels (typ) 2.4 bels (max)	3.1 bels (typ) 3.5 bels (max)

Note. 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.

2.11 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 7: Radio frequency environments

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV	B	EN 61000-4-2: 95
Radiated RF immunity	80 to 1,000 MHz, 3 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	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN 61000-4-4: 95
Surge immunity	± 1 kV differential, ± 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
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN 61000-4-11: 94

2.12 Reliability

Nonrecoverable read errors	1 per 10^{14} bits read, max
Mean time between failures (MTBF)	600,000 power-on hours (nominal power, 25°C ambient temperature)
Contact start-stop cycles	50,000 cycles (at nominal voltage and temperature, with 60 cycles per hour and a 50% duty cycle)
Service Life	5 years.
Warranty	To determine the warranty for a specific drive, use a web browser to access the follwoing web page: www.seagate.com/support/service/ 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 diplay the warranty information for your drive.
Preventive maintenance	None required.

2.13   Agency certification

2.13.1   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.

2.13.2   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):ST3200822AS, ST3160827AS, ST3160023AS, ST3160021AS, ST3120827AS, ST3120026AS, ST3120022AS, ST380817AS, ST380013AS, ST380011AS, ST340111AS and ST340014AS

- Certificate numbers

ST3200822AS	E-H011-04-0508 (B)
ST3160827AS	E-H011-04-2274 (B)
ST3160023AS	E-H011-03-0784 (B)
ST3160021AS	E-H011-03-0783 (B)
ST3120827AS	E-H011-04-2276 (B)
ST3120026AS	E-H011-03-0788 (B)
ST3120022AS	E-H011-03-0785 (B)
ST380817AS	E-H011-04-2275 (B)
ST380013AS	E-H011-03-0787 (B)
ST380011AS	E-H011-03-0781 (B)
ST340111AS	E-H011-03-0782 (B)
ST340014AS	E-H011-03-0782 (B)

- Trade name or applicant: Seagate Technology International

- Manufacturing date: February 2003 for ST3160023AS, ST3160021AS, ST3120026AS, ST3120022AS, ST380013AS, ST380011AS, and ST340014AS models.

- Manufacturing date: February 2004 for ST3200822AS models.

- Manufacturing date: February 2004 for ST3160827AS, ST3120827AS and ST380817AS models.

- Manufacturing date: February 2004 for ST340111AS models.

- Manufacturer/nationality: Singapore and China

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).

2.13.3   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.

2.14   Environmental protection

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

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. Although amendments to the Euro-pean Union's Restriction of Hazardous Substances (RoHS) Directive have not been finalized, to the best of our knowledge the disc drives documented in this publication will comply with the final RoHS Directive require-ments.

A number of parts and materials in Seagate products are procured from external suppliers. We rely on the rep-resentations 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 operat-ing procedures that ensure that restricted substances are not utilized in our manufacturing operations, labora-tory analytical validation testing, and an internal auditing process to ensure that all standard operating procedures are complied with.

2.15   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.

Barracuda 7200.7 Serial ATA Product Manual, Rev. N

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:

- The SeaShell™ replaces electrostatic discharge (ESD) bags. The SeaShell package is a shock-ribbed, transparent clamshell enclosure that limits a drive's exposure to ESD and also protects against external shocks and stresses. The design permits attaching cables, software loading and label/barcode scanning without removing the drive from the SeaShell. This minimizes handling damage. Keep the drive in the SeaShell package until you are ready for installation.
- 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 by its edges or frame *only*.
- The drive is extremely 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   Configuring the drive

Each drive on the Serial ATA interface connects in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationships. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both "masters" on two separate ports. This means both drives behave as if they are Device 0 (master) devices.

Serial ATA drives are designed for easy installation with no jumpers, terminators, or other settings. It is not necessary to set any jumpers on this drive for proper operation. The jumper block adjacent to the signal connector is for factory use only.
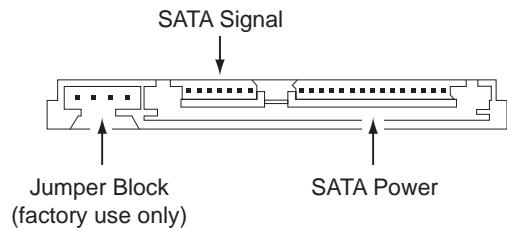
SATA Signal

Jumper Block
(factory use only)

SATA Power

Figure 3. Serial ATA connectors

3.3   Serial ATA cables and connectors

The Serial ATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See Table 8 for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

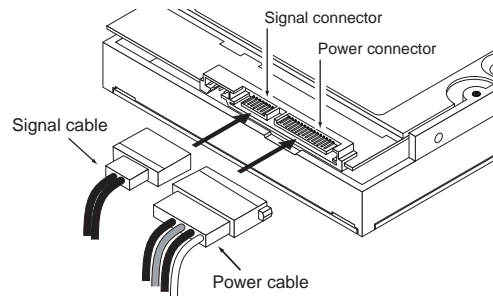For installations which require cables, you can connect the drive as illustrated in Figure 4.

Signal connector

Power connector

Signal cable

Power cable

Figure 4. Attaching SATA cabling

Each cable is keyed to ensure correct orientation.

3.4   Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 5 on page 22 for drive mounting dimensions. 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 6-32 UNC mounting screws.
- The screws should be inserted no more than 0.150 inch (3.81 mm) into the bottom or side mounting holes.
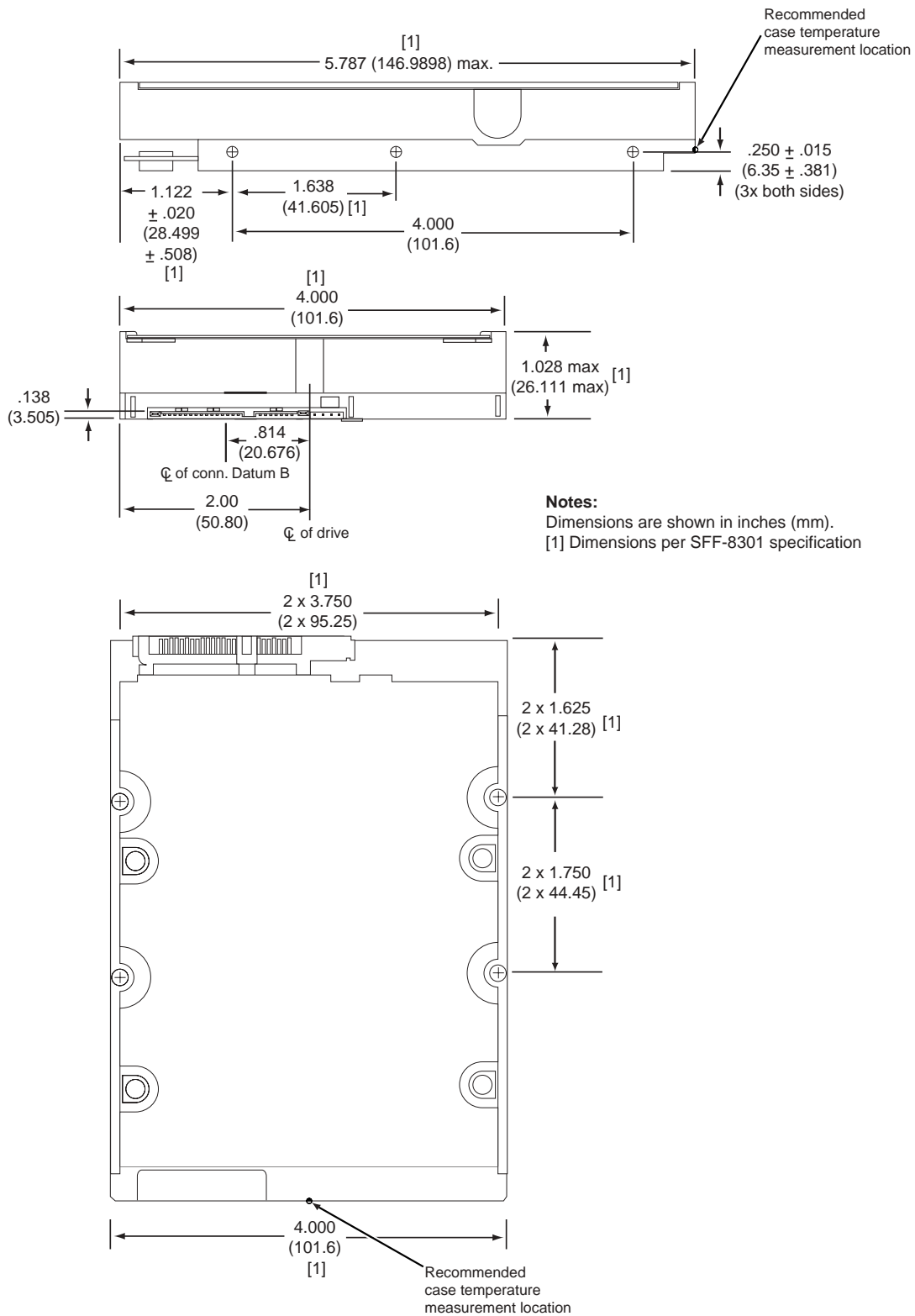- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

Recommended case temperature measurement location

[1]
5.787 (146.9898) max.

.250 ± .015
(6.35 ± .381)
(3x both sides)

1.122
± .020
(28.499
± .508)
[1]

1.638
(41.605) [1]

4.000
(101.6)

[1]
4.000
(101.6)

1.028 max
(26.111 max) [1]

.138
(3.505)

.814
(20.676)
C̶L̶ of conn. Datum B

2.00
(50.80)

C̶L̶ of drive

Notes:
Dimensions are shown in inches (mm).
[1] Dimensions per SFF-8301 specification

[1]
2 x 3.750
(2 x 95.25)

2 x 1.625
(2 x 41.28) [1]

2 x 1.750
(2 x 44.45) [1]

4.000
(101.6)
[1]

Recommended
case temperature
measurement location

Figure 5. Mounting dimensions—top, side and end view

4.0   Serial ATA (SATA) interface

These drives use the industry-standard Serial ATA interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0–4; multiword DMA modes 0–2, and Ultra DMA modes 0–6. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

For detailed information about the Serial ATA interface, refer to the "Serial ATA: High Speed Serialized AT Attachment" specification.

4.1   Hot-Plug compatibility

Barracuda 7200.7 Serial ATA drives incorporate connectors which enable you to hot plug these drives in accordance with the Serial ATA: High Speed Serialized AT Attachment specification revision 2.0. This specification can be downloaded from http://www.serialata.com.

4.2 Serial ATA device plug connector pin definitions

Table 8 summarizes the signals on the Serial ATA interface and power connectors.

Table 8:   Serial ATA connector pin definitions

Segment	Pin	Function	Definition
	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
Signal	S7	Ground	2nd mate

Key and spacing separate signal and power segments

Segment	Pin	Function	Definition
	P1	V_{33}	3.3V power
	P2	V_{33}	3.3V power
	P3	V_{33}	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V_5	5V power, pre-charge, 2nd mate
	P8	V_5	5V power
	P9	V_5	5V power
Power	P10	Ground	2nd mate
	P11	Reserved	The pin corresponding to P11 in the backplane receptacle connector is also reserved
			The corresponding pin to be mated with P11 in the power cable receptacle connector shall always be grounded
	P12	Ground	1st mate.
	P13	V_{12}	12V power, pre-charge, 2nd mate
	P14	V_{12}	12V power
	P15	V_{12}	12V power

Notes:

1. All pins are in a single row, with a 1.27 mm (0.050") pitch.

2. The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
   - the ground pins P4 and P12.
   - the pre-charge power pints and the other ground pins.
   - the signal pins and the rest of the power pins.

3. There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.

4. All used voltage pins (V_x) must be terminated.

4.3   Supported ATA commands

The following table lists Serial ATA standard commands that the drive supports. For a detailed description of the ATA commands, refer to the Serial ATA: High Speed Serialized AT Attachment specification. See "S.M.A.R.T. commands" on page 33.for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code (in hex)	
ATA-standard commands		
Download Microcode	92h	
Execute Device Diagnostics	90h	
Flush Cache	E7h	
Flush Cache Extended	EAh	
Identify Device	ECh	
Initialize Device Parameters	91h	
Read Buffer	E4h	
Read DMA	C8h	
Read DMA Extended	25h	
Read DMA without Retries	C9h	
Read Multiple	C4h	
Read Multiple Extended	29h	
Read Native Max Address	F8h	
Read Native Max Address Extended	27h	
Read Sectors	20h	
Read Sectors Extended	24h	
Read Sectors without Retries	21h	
Read Verify Sectors	40h	
Read Verify Sectors Extended	42h	
Read Verify Sectors without Retries	41h	
Seek	70h	
Set Features	EFh	
Set Max Address	F9h	
Note: Individual Set Max commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00_H 01_H 02_H 03_H 04_H
Set Multiple Mode	C6h	
S.M.A.R.T.	B0h	
Write Buffer	E8h	
Write DMA	CAh	
Write DMA Extended	35h	

Command name	Command code (in hex)
Write DMA without Retries	CBh
Write Multiple	C5h
Write Multiple Extended	39h
Write Sectors	30h, 31h
Write Sectors Extended	34h
ATA-standard power-management commands	
Check Power Mode	98h or E5h
Idle	97h or E3h
Idle Immediate	95h or E1h
Sleep	99h or E6h
Standby	96h or E2h
Standby Immediate	94h or E0h
ATA-standard security commands	
Security Set Password	F1h
Security Unlock	F2h
Security Erase Prepare	F3h
Security Erase Unit	F4h
Security Freeze Lock	F5h
Security Disable Password	F6h

4.3.1 Identify Device command

The Identify Device command (command code EC$_H$) 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 the table on page 27. 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 Serial ATA specification.

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	0C5A$_H$
1	Number of logical cylinders	16,383
2	ATA-reserved	0000$_H$
3	Number of logical heads	16
4	Retired	0000$_H$
5	Retired	0000$_H$
6	Number of logical sectors per logical track: 63	003F$_H$
7–9	Retired	0000$_H$
10–19	Serial number: (20 ASCII characters, 0000$_H$ = none)	ASCII
20	Retired	0000$_H$
21	Retired	0400$_H$
22	Obsolete	0000$_H$
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)	ST3200822AS ST3160827AS ST3160023AS ST3160021AS ST3120827AS ST3120026AS ST3120022AS ST380817AS ST380013AS ST380011AS ST340111AS ST340014AS
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010$_H$
48	Reserved	0000$_H$
49	Standard Standby timer, IORDY supported and may be disabled	2F00$_H$
50	ATA-reserved	0000$_H$
51	PIO data-transfer cycle timing mode	0200$_H$
52	Retired	0200$_H$

Word	Description	Value
53	Words 54–58, 64–70 and 88 are valid	0007$_H$
54	Number of current logical cylinders	xxxx$_H$
55	Number of current logical heads	xxxx$_H$
56	Number of current logical sectors per logical track	xxxx$_H$
57–58	Current capacity in sectors	xxxx$_H$
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx$_H$
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137 Gbytes). Drives with capacities over 137 Gbytes will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	ST3200822AS = 0FFFFFFFh* ST3160827AS = 0FFFFFFFh* ST3160023AS = 0FFFFFFFh* ST3160021AS = 0FFFFFFFh* ST3120827AS = 234,441,648 ST3120026AS = 234,441,648 ST3120022AS = 234,441,648 ST380817AS = 156,301,488 ST380013AS = 156,301,488 ST380011AS = 156,301,488 ST340111AS = 78,165,360 ST340014AS = 78,165,360
62	Retired	0000$_H$
63	Multiword DMA active and modes supported (see note following this table)	xx07$_H$
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003$_H$
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078$_H$
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078$_H$
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	00F0$_H$
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078$_H$
69–74	ATA-reserved	0000$_H$
75	Queue depth	0000$_H$
76–79	ATA-reserved	0000$_H$
80	Major version number	003E$_H$
81	Minor version number	0000$_H$
82	Command sets supported	306B$_H$
83	Command sets supported	4001$_H$
84	Command sets support extension	4000$_H$
85	Command sets enabled	30xx$_H$
86	Command sets enabled	0001$_H$
87	Command sets enable extension	4000$_H$
88	Ultra DMA support and current mode (see note following this table)	xx3F$_H$
89	Security erase time	0000$_H$

Word	Description	Value
90	Enhanced security erase time	0000$_H$
92	Master password revision code	FFFE$_H$
93	Hardware reset value (see description following this table)	xxxx$_H$
94	Auto acoustic management setting	xxxx$_H$
95–99	ATA-reserved	0000$_H$
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFFFFh.	ST3200822AS = 390,721,968 ST3160827AS = 312,581,808 ST3160023AS = 312,581,808 ST3160021AS = 312,581,808 ST3120827AS = 234,441,648 ST3120026AS = 234,441,648 ST3120022AS = 234,441,648 ST380817AS = 156,301,488 ST380013AS = 156,301,488 ST380011AS = 156,301,488 ST340111AS = 78,165,360 ST340014AS = 78,165,360
104–127	ATA-reserved	0000$_H$
128	Security status	0001$_H$
129–159	Seagate-reserved	xxxx$_H$
160–254	ATA-reserved	0000$_H$
255	Integrity word	xxA5$_H$

Note. Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported

Note. See the bit descriptions below for words 63, 88, and 93 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_{IH} 0 = 40-conductor cable detected, CBLID below V_{IL}

4.3.2 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 9: Set Features command values

02_H Enable write cache *(default).*

03_H Set transfer mode (based on value in Sector Count register).
             Sector Count register values:

           00_H Set PIO mode to default (PIO mode 2).

           01_H Set PIO mode to default and disable IORDY (PIO mode 2).

           08_H PIO mode 0

           09_H PIO mode 1

           $0A_H$ PIO mode 2

           $0B_H$ PIO mode 3

           $0C_H$ PIO mode 4 *(default)*

           20_H Multiword DMA mode 0

           21_H Multiword DMA mode 1

           22_H Multiword DMA mode 2

           40_H Ultra DMA mode 0

           41_H Ultra DMA mode 1

           42_H Ultra DMA mode 2

           43_H Ultra DMA mode 3

           44_H Ultra DMA mode 4

           45_H Ultra DMA mode 5

55_H Disable read look-ahead (read cache) feature.

82_H Disable write cache

AA_H Enable read look-ahead (read cache) feature *(default).*

$F1_H$ 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.

4.3.3   S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disc drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard.*

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for $D4_H$) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: http://seatools.seagate.com.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Table 10:   S.M.A.R.T. commands

Code in features register	S.M.A.R.T. command
$D0_H$	S.M.A.R.T. Read Data
$D1_H$	Vendor-specific
$D2_H$	S.M.A.R.T. Enable/Disable Attribute Autosave
$D3_H$	S.M.A.R.T. Save Attribute Values
$D4_H$	S.M.A.R.T. Execute Off-line Immediate (runs DST)
$D5_H$	S.M.A.R.T. Read Log Sector
$D6_H$	S.M.A.R.T. Write Log Sector
$D7_H$	Vendor-specific
$D8_H$	S.M.A.R.T. Enable Operations
$D9_H$	S.M.A.R.T. Disable Operations
DA_H	S.M.A.R.T. Return Status

Note.   If an appropriate code is not written to the Features Register, the command is aborted and $0x04$ (abort) is written to the Error register.

5.0   Seagate Technology support services

Online services

Internet
www.seagate.com for information about Seagate products and services. Worldwide support is available 24 hours daily by e-mail for your questions.

Presales Support: www.seagate.com/support/email/email_presales.html *or* Presales@Seagate.com
Technical Support: www.seagate.com/support/email/email_disc_support.html *or* DiscSupport@Seagate.com

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.

reseller.seagate.com
reseller.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 reseller.seagate.com, any time, from anywhere in the world.

Automated phone services

SeaFONE® (1-800-SEAGATE) is the Seagate toll-free number (1-800-732-4283) to access our automated directory assistance for Seagate Service Center support options. International callers can reach this service by dialing +1-405-324-4770.

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 drive availability and compatibility.

Technical Support
If you need help installing your drive, consult your system's documentation or contact the dealer's support services department for assistance specific to your system. Seagate technical support is also available to assist you online at support.seagate.com or through one of our call centers. Have your system configuration information and your drive's "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 drives. 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 one of the Seagate CSO warranty centers for assistance. Have your drive's "ST" model number and serial 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 in North America. To get a free quick quote or speak with a case management representative, call 1-800-475-0143. Additional information, including an online request form and data loss prevention resources, is available at www.datarecovery.seagate.com.

Authorized Service Centers
In some locations outside the US, you can contact an Authorized Service Center for service.

USA/Canada/Latin America support services

Seagate Service Centers

Presales Support

Call center	Toll-free	Direct dial	FAX
Americas	1-877-271-3285[1]	+1-405-324-4730[1]	+1-405-324-4704

Technical Support

Call center	Toll-free	Direct dial	FAX
Americas	1-800-SEAGATE[2]	+1-405-324-4700[2]	+1-405-324-3339

Customer Service Operations

Warranty Service

Call center	Toll-free	Direct dial	FAX / E-mail
USA, Canada, Mexico and Latin America	1-800-468-3472[3]	—	+1-956-664-4725
Brazil			
Jabil Industrial Do Brasil LTDA[4]	—	+55-11-4191-4761	+55-11-4191-5084 SeagateRMA.br@jabil.com

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

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[1]Hours of operation are 8:00 A.M. to 11:45 A.M. and 1:00 P.M. to 6:00 P.M., Monday through Friday (Central time).
[2]Hours of operation are 8:00 A.M. to 8:00 P.M., Monday through Friday (Central time).
[3]Hours of operation are 8:00 A.M. to 5:00 P.M., Monday through Friday (Central time).
[4]Authorized Service Center
[5]Hours of operation are 8:00 A.M. to 8:00 P.M., Monday through Friday, and 9:00 A.M. to 5:00 P.M., Saturday (Eastern time).

European support services

For presales and technical support in Europe, dial the Seagate Service Center toll-free number for your specific location. If your location is not listed here, dial our presales and technical support call center at +1-405-324-4714 from 8:00 A.M. to 11:45 A.M. and 1:00 P.M. to 5:00 P.M. (Central Europe time) Monday through Friday. The presales and technical support call center is located in Oklahoma City, USA.

For European warranty service, dial the toll-free number for your specific location. If your location is not listed here, dial our European CSO warranty center at +31-20-316-7222 from 8:30 A.M. to 5:00 P.M. (Central Europe time) Monday through Friday. The CSO warranty center is located in Amsterdam, The Netherlands.

Seagate Service Centers

Toll-free support numbers

Call center	Presales and Technical Support	Warranty Service
Austria	—	00 800-47324289
Belgium	00 800-47324283 (00 800-4SEAGATE)	00 800-47324289
Denmark	00 800-47324283	00 800-47324289
France	00 800-47324283	00 800-47324289
Germany	00 800-47324283	00 800-47324289
Ireland	00 800-47324283	00 800-47324289
Italy	00 800-47324283	00 800-47324289
Netherlands	00 800-47324283	00 800-47324289
Norway	00 800-47324283	00 800-47324289
Poland	00 800-311 12 38	00 800-311 12 38
Spain	00 800-47324283	00 800-47324289
Sweden	00 800-47324283	00 800-47324289
Switzerland	00 800-47324283	00 800-47324289
Turkey	00 800-31 92 91 40	00 800-31 92 91 40
United Kingdom	00 800-47324283	00 800-47324289

FAX services—All Europe (toll call)

Technical Support	+1-405-324-3339
Warranty Service	+31-20-653-3513

Africa/Middle East support services

For presales and technical support in Africa and the Middle East, dial our presales and technical support call center at +1-405-324-4714 from 8:00 A.M. to 11:45 A.M. and 1:00 P.M. to 5:00 P.M. (Central Europe time) Monday through Friday. The presales and technical support call center is located in Oklahoma City, USA.

For warranty service in Africa and the Middle East, dial our European CSO warranty center at +31-20-316-7222 from 8:30 A.M. to 5:00 P.M. (Central Europe time) Monday through Friday, or send a FAX to +31-20-653-3513. The CSO warranty center is located in Amsterdam, The Netherlands.

Asia/Pacific support services

For Asia/Pacific presales and technical support, dial the toll-free number for your specific location. The Asia/Pacific toll-free numbers are available from 6:00 A.M. to 10:45 A.M. and 12:00 P.M. to 6:00 P.M. (Australian Eastern time) Monday through Friday, except as noted. If your location is not listed here, direct dial one of our technical support locations.

Warranty service is available from 9:00 A.M. to 6:00 P.M. April through October, and 10:00 A.M. to 7:00 P.M. November through March (Australian Eastern time) Monday through Friday.

Seagate Service Centers

Call center	Toll-free	Direct dial	FAX
Australia	1800-14-7201	—	—
China (Mandarin)[1, 4]	800-810-9668	+86-10-6225-5336	—
Hong Kong	800-90-0474	—	—
Hong Kong (Cantonese)[1, 4]	001-800-0830-1730	—	—
India[2, 4]	1-600-180-1104	—	—
Indonesia	001-803-1-003-2165	—	—
Japan[3, 4]	0034 800 400 554	—	—
Korea[3, 4]	007 98 8521 7635	—	—
Malaysia	1-800-80-2335	—	—
New Zealand	0800-443988	—	—
Singapore	800-1101-150	—	+65-6488-7525
Taiwan (Mandarin)[1, 4]	00-800-0830-1730	—	—
Thailand	001-800-11-0032165	—	—

Customer Service Operations

Warranty Service

Call center	Toll-free	Direct dial	FAX
Asia/Pacific	—	+65-6485-3595	+65-6485-4860
Australia	1800-12-9277	—	—
India[4]	—	+91-44-821-6164	+91-44-827-2461

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[1]Hours of operation are 8:30 A.M. to 5:30 P.M., Monday through Friday (Australian Western time).
[2]Hours of operation are 9:00 A.M. to 6:00 P.M., Monday through Saturday.
[3]Hours of operation are 9:30 A.M. to 6:30 P.M., Monday through Friday.
[4]Authorized Service Center

Publication feedback survey

We are interested in your comments and suggestions regarding this publication. Please take a few minutes to participate in our survey at the following URL:

http://survey.seagate.com/survey/techpubs.nsf

Thank you for your time and comments.

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