



Product Manual

Barracuda 7200.7 Serial ATA

ST3200822AS

ST3160827AS

ST3160023AS

ST3160021AS

ST3120827AS

ST3120026AS

ST3120022AS

ST380817AS

ST380013AS

ST380011AS

ST340111AS

ST340014AS





Product Manual

Barracuda 7200.7 Serial ATA

ST3200822AS

ST3160827AS

ST3160023AS

ST3160021AS

ST3120827AS

ST3120026AS

ST3120022AS

ST380817AS

ST380013AS

ST380011AS

ST340111AS

ST340014AS

Rev. L



©2003–2004 Seagate Technology LLC All rights reserved

Publication number: 100270024, Rev. L

July 2004

Seagate and Seagate Technology are registered trademarks of Seagate Technology LLC. SeaTools, SeaFONE, SeaBOARD, SeaTDD, and the Wave logo are either registered trademarks or trademarks of Seagate Technology LLC. Other product names are registered trademarks or trademarks of their owners.

Seagate reserves the right to change, without notice, product offerings or specifications. No part of this publication may be reproduced in any form without written permission of Seagate Technology LLC.

Revision status summary sheet

Revision	Date	Sheets Affected
Rev. A	02/27/03	All.
Rev. B	04/10/03	Pages 5, 7, 10, 13, and 14.
Rev. C	05/09/03	Pages 1, 5, 10, 25, 37-39, 41, and 43-47.
Rev. D	06/26/03	Pages 6, 7, 19, and 36. Added ST3200822AS model. Also updated to new format and page size.
Rev. E	09/02/03	Page 21.
Rev. F	02/18/04	Add ST3200822AS model. Pages 1, 3-6, 13, 16, 19, 23 and 31-33.
Rev. G	03/01/04	Page 3.
Rev. H	04/02/04	Page 4.
Rev. J	04/19/04	Pages 26 and 27. Corrections to the Supported ATA Commands table.
Rev. K	05/25/04	Pages cover, 1, 3-5, 14, 16 and 28-30.
Rev. L	07/28/04	Pages cover, i, 1, 3-6, 8, 14, 16, and 28-30. Corrected power numbers for Non-NCQ models and added new power numbers for NCQ models and 200GB model.

Contents

1.0	Introduction	1
1.1	About the Serial ATA interface	2
1.2	Native Command Queuing	2
2.0	Drive specifications	3
2.1	Specification summary table	3
2.2	Formatted capacity	5
2.2.1	LBA mode	5
2.3	Default logical geometry	5
2.4	Physical organization	5
2.5	Recording and interface technology	6
2.5.1	Physical characteristics	6
2.6	Seek time	7
2.7	Start/stop times	7
2.8	Power specifications	7
2.8.1	Power consumption	7
2.8.2	Deferred spinup	9
2.8.3	Conducted noise	10
2.8.4	Voltage tolerance	10
2.8.5	Power-management modes	10
2.9	Environmental specifications	11
2.9.1	Ambient temperature	11
2.9.2	Temperature gradient	12
2.9.3	Humidity	12
2.9.4	Altitude	12
2.9.5	Shock	12
2.9.6	Vibration	13
2.10	Acoustics	14
2.11	Electromagnetic immunity	15
2.12	Reliability	15
2.13	Agency certification	16
2.13.1	Safety certification	16
2.13.2	Electromagnetic compatibility	16
2.13.3	FCC verification	17
3.0	Configuring and mounting the drive	19
3.1	Handling and static-discharge precautions	19
3.2	Configuring the drive	20
3.3	Serial ATA cables and connectors	20
3.4	Drive mounting	21
4.0	Serial ATA (SATA) interface	23
4.1	Hot-Plug compatibility	23
4.2	Serial ATA device plug connector pin definitions	24
4.3	Supported ATA commands	26
4.3.1	Identify Device command	28
4.3.2	Set Features command	31
4.3.3	S.M.A.R.T. commands	33
5.0	Seagate Technology support services	35

List of Figures

Figure 1.	Typical 5V startup and operation current profile	9
Figure 2.	Typical 12V startup and operation current profile	9
Figure 3.	Serial ATA connectors	20
Figure 4.	Attaching SATA cabling	20
Figure 5.	Mounting dimensions—top, side and end view	22

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 Queuing 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 ST3160827AS ST3160023AS	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 (Mbits/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	ST3120827AS	ST380817AS	ST340111AS ST340014AS
		ST3160827AS ST3160023AS	ST3120026AS ST3120022AS	ST380013AS ST380011AS	
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	1.0 G (0 to peak, 5–350 Hz)				
Vibration, nonoperating	5 Gs (0 to peak, 22–350 Hz)				
Drive acoustics, sound power (bels)					
Idle*	<2.5 (typical) 2.7 (max)			<2.2 (typ) 2.4 (max)	
Quiet seek	2.8 (typical) 3.0 (max)			2.5 (typ) 2.7 (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				
Contact start-stop cycles (25°C, 40% relative humidity)	50,000				
Supports Hotplug operation per SATA II specification	Yes				

*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

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 (Mbits/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	8 Mbytes
ST3160021AS, ST3120022AS, ST380011AS, and ST340014AS	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

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)	20 (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

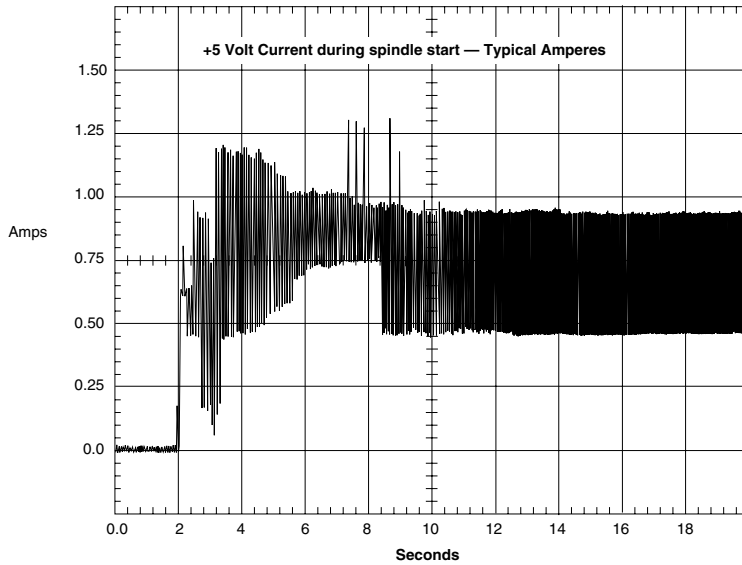


Figure 1. Typical 5V startup and operation current profile

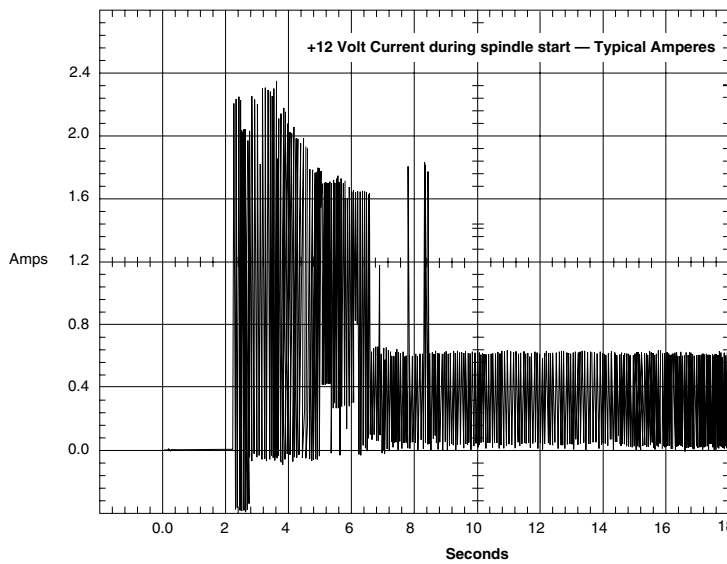


Figure 2. Typical 12V startup and operation current profile

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-

successful 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 \pm 5%

12V \pm 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.

5–350 Hz	1.0 G acceleration (zero to peak)
----------	-----------------------------------

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	1.0-inch displacement (zero to peak)
22–350 Hz	5.0 Gs acceleration (zero to peak)

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.

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 6: Fluid Dynamic Bearing (FDB) motor acoustics

Models	Acoustic mode		
	Idle*	Quiet seek	Performance seek
ST3200822AS ST3160827AS ST3160023AS ST3160021AS ST3120827AS ST3120026AS ST3120022AS ST380817AS ST380013AS ST380011AS	<2.5 bels (typ) 2.7 bels (max)	2.8 bels (typ) 3.0 bels (max)	3.4 bels (typ) 3.7 bels (max)
ST340111AS ST340014AS	<2.2 bels (typ) 2.4 bels (max)	2.5 bels (typ) 2.7 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
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-H011-04-0 TBD (B)
ST3160023AS	E-H011-03-0784 (B)
ST3160021AS	E-H011-03-0783 (B)
ST3120827AS	E-H011-04-0 TBD (B)
ST3120026AS	E-H011-03-0788 (B)
ST3120022AS	E-H011-03-0785 (B)
ST380817AS	E-H011-04-0 TBD (B)
ST380013AS	E-H011-03-0787 (B)
ST380011AS	E-H011-03-0781 (B)
ST340111AS	E-H011-03-0782 (B)
ST340014AS	E-H011-03-0 TBD (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: **TBD** 2004 for ST3160827AS, ST3120827AS and ST380817AS models.
- Manufacturing date: **TBD** 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.

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.

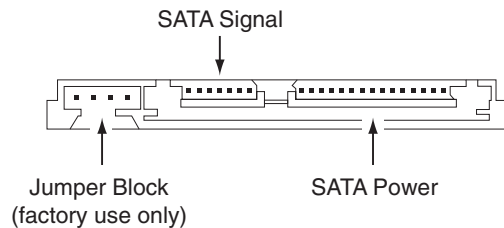


Figure 3. Serial ATA connectors

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.

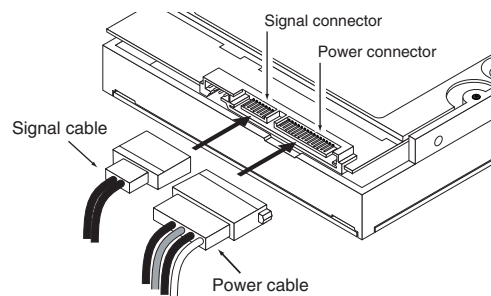


Figure 4. Attaching SATA cabling

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).

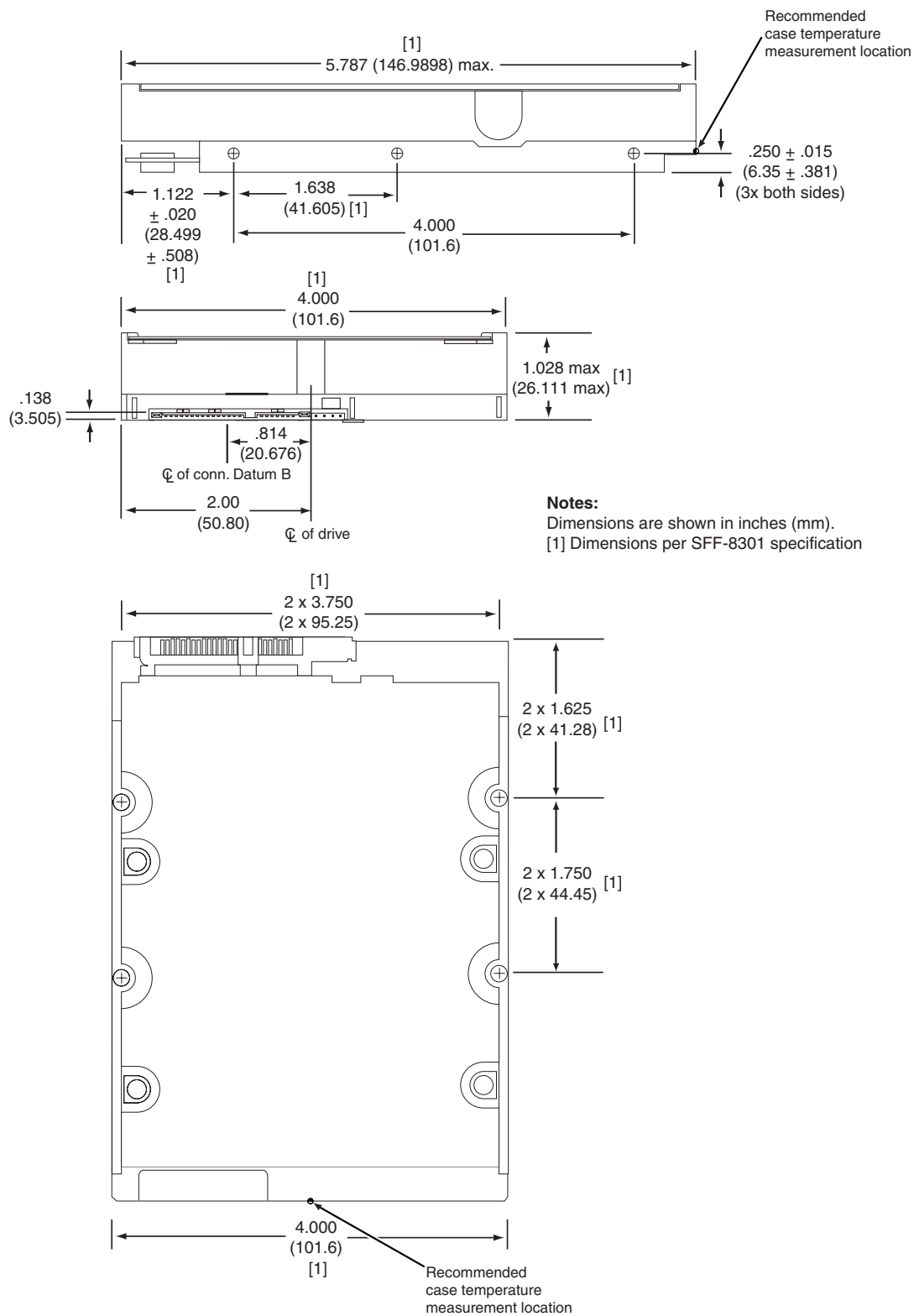


Figure 5. Mounting dimensions—top, side and end view

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
Signal	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+	
	S7	Ground	2nd mate

Key and spacing separate signal and power segments

Power	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
	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:

- All pins are in a single row, with a 1.27 mm (0.050") pitch.
- 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:	00 _H
	Password:	01 _H
	Lock:	02 _H
	Unlock:	03 _H
	Freeze Lock:	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: 0000FFFFFFFFFh.	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 (<i>default</i>).
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 (<i>default</i>)
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 (<i>default</i>).

Table 9: Set Features command values

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 DiscPresales@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 self-help and directory assistance for Seagate support services. Using a touch-tone phone, you can find service and support phone numbers for disc drives 24 hours daily. International callers can reach this service by dialing +1-405-324-4770.

Presales, Technical Support and Warranty Service

Presales Support

Our Presales Support staff can help you determine which Seagate products are best suited for your specific application or computer system.

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.

Warranty Service

Seagate offers worldwide customer support for Seagate drives. Seagate distributors, OEMs and other direct customers should contact their Seagate service center representative for warranty-related issues. Resellers or end users of drive products should contact their place of purchase or one of the Seagate warranty service centers for assistance. Have your drive's "ST" model number and serial number available.

Authorized Service Centers

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

USA/Canada/Latin America Support Services

Presales Support

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

Technical Support

Call Center Americas	Toll-free 1-800-SEAGATE ²	Direct dial +1-405-324-4700 ³	FAX +1-405-324-4702
--------------------------------	--	--	-------------------------------

Warranty Service

Call Center USA, Mexico and Latin America	Toll-free 1-800-468-3472 ⁴	Direct dial +1-405-324-4720 ⁴	FAX / Internet +1-405-324-4722
Canada <i>Memofix</i> ⁵	1-800-636-6349	+1-905-660-4936	+1-905-660-4951 www.memofix.com
Brazil <i>MA Centro de Serviços</i> ⁵	—	+55-21-2509-7267 www.mainformatica.com.br/produtos.htm	+55-21-2507-6672

¹Hours 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)

²For product-specific phone number

³Hours of operation are 8:00 A.M. to 8:00 P.M., Monday through Friday (Central time)

⁴Hours of operation are 8:30 A.M. to 12:15 P.M. and 1:30 P.M. to 5:30 P.M., Monday through Friday (Central time)

⁵Authorized Service Center

European Support Services

For presales and technical support in Europe, dial the 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 warranty service center at +31-20-316-7222 from 8:30 A.M. to 5:00 P.M. (Central Europe time) Monday through Friday. The warranty service center is located in Amsterdam, The Netherlands.

Toll-Free Support Numbers

Call Center	Presales and Technical Support	Warranty Service
Austria	0 800-20 12 90	0 800-20 12 90
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	+1-405-324-4702
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 warranty service 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 warranty service 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 P.M. to 7:00 P.M. November through March (Australian Eastern time) Monday through Friday.

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}	1-600-33-1104	—	—
Indonesia	001-803-1-003-2165	—	—
Japan ^{3, 4}	0034 800 400 554	—	—
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	—	—

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

¹Hours of operation are 8:30 A.M. to 5:30 P.M., Monday through Friday (Australian Western time).

²Hours of operation are 9:00 A.M. to 6:00 P.M., Monday through Saturday.

³Hours of operation are 9:30 A.M. to 6:30 P.M., Monday through Friday (Japan time).

⁴Authorized Service Center

Index

A

- ACA 17
- acceleration 13
- acoustics 4, 14
- Active 10
- Active mode 10
- actuator arm 7
- Address 26
- Agency certification 16
- Altitude 12
- Altitude, nonoperating 4
- Altitude, operating 4
- Ambient temperature 4, 11
- ambient temperature 7
- Areal density 3, 6
- areal density 1
- ATA commands 26
- ATA data-transfer modes supported 3
- Australia/New Zealand Standard AS/NZS3548 1995 17
- Australian Communication Authority (ACA) 17
- Australian C-Tick 16
- Average latency 7
- Average seek time 7
- Average seek, read 4
- Average seek, write 4

B

- bels 4
- BPI 3
- buffer 3, 6
- Bytes per sector 3, 5

C

- cables and connectors 20
- Cache 3, 6
- capacity 5
- case temperature 11
- CE mark 16
- certification 16
- Check Power Mode 27
- Class B computing device 17
- compatibility 16
- Conducted noise 10
- Conducted RF immunity 15
- Configuring the drive 19
- connectors 20
- CSA C22.2 (950) 16
- current 4
- cycles 15
- Cylinders 5

- cylinders 3

D

- data-transfer rates 1
- DC power 7
- Default logical geometry 5
- Default sectors per track 3
- density 3
- Diagnostics 26
- dimensions 22
- disc surface 7
- Discs 3
- displacement 13
- Download Microcode 26

E

- Electrical fast transient 15
- Electromagnetic compatibility 16
- Electromagnetic Compatibility (EMC) 16
- Electromagnetic Compatibility control Regulation 16
- Electromagnetic Compatibility Directive (89/336/EEC) 16
- Electromagnetic immunity 15
- Electrostatic discharge 15
- electrostatic discharge (ESD) 19
- EN 55022, Class B 16
- EN 55024 16
- EN 60950 16
- Environmental specifications 11
- EPRML 1, 6
- error-correction algorithms 1
- errors 4, 15
- ESD 19
- EU 16
- European Union (EU) requirements 16
- Execute Device Diagnostics 26

F

- FCC verification 17
- features 1
- Federal Communications Commission 17
- Flush Cache 26
- Flush Cache Extended 26
- Formatted capacity 5
- Formatted Gbytes 3

G

- Gbytes 5
- geometry 5
- gradient 4
- Gs 13
- Guaranteed sectors 3, 5
- guaranteed sectors 5

H

Handling precautions 19
heads 3, 5
Height 3
Humidity 12
humidity 4

I

I/O data-transfer rate 3, 6
Identify Device 26
Identify Device command 28
Idle 8, 10, 27
Idle Immediate 27
Idle mode 4, 8, 11
IEC950 16
Information Technology Equipment (ITE) 16
Initialize Device Parameters 26
Input noise ripple 10
input voltage 7
Interface 6
interface 23
Interleave 6
Internal data transfer rate 3
Internal data-transfer rate 6
ISO document 7779 14
ITE 16

K

Korea Ministry of Information and Communication
(MIC) 16
Korean RRL 16

L

latency 4, 7
latency time 7
LBA mode 5
Length 3
logical geometry 5

M

magnetoresistive (GMR) recording heads 1
maintenance 15
master/slave 2
Max Address 26
maximum temperature 11
Mean time between failures 4
Mean time between failures (MTBF) 15
measurement locations 11
MIC 16
Microcode 26
mounting 21
mounting screws 12
mounting the drive 19

MTBF 15

N

native command queuing 2
NCQ 2
noise 10
nominal power 7
Nonoperating shock 12
Nonoperating vibration 13
Nonrecoverable read errors 4, 15

O

Operating 8
Operating power 4, 8
Operating shock 12
Operating vibration 13

P

Physical characteristics 6
Physical organization 5
Physical read/write heads 3
point-to-point 2, 20
Power consumption 7
power consumption 7
Power dissipation 8
Power modes 10
Power specifications 7
Power-management modes 10
Power-on to Ready 7
Power-on to ready 4
precautions 19
printed circuit board 19
programmable power management 10

Q

quick reference 3

R

Radiated RF immunity 15
Radio and television interference 17
radio frequency (RF) 15
random seeks 7, 8
Read Buffer 26
Read DMA 26
Read DMA Extended 26
Read DMA without Retries 26
read errors 4, 15
Read Multiple 26
Read Multiple Extended 26
Read Native Max Address 26
Read Native Max Address Extended 26
Read Sectors 26
Read Sectors Extended 26

- Read Sectors without Retries 26
- Read Verify Sectors 26
- Read Verify Sectors Extended 26
- Read Verify Sectors without Retries 26
- read/write actuator arm 7
- Read/write heads 5
- read/write heads 3
- Read/write power 7
- Ready to spindle stop 7
- Recording density 3, 6
- Recording method 6
- Recording technology 6
- Relative humidity 4, 12
- Reliability 15
- Retries 26
- RF 15
- RMS read/write current 10
- RPM 3
- RRL 16

S

- S.M.A.R.T. 26
- S.M.A.R.T. implementation 26
- Safety certification 16
- SATA 6, 23
- screws 12
- SeaShell™ 19
- sector 5
- sectors 5
- Sectors per track 5
- sectors per track 3
- Security Disable Password 27
- Security Erase Prepare 27
- Security Erase Unit 27
- Security Freeze Lock 27
- Security Set Password 27
- Security Unlock 27
- Seek 26
- seek mode 7
- Seek mode power 7
- Seek power 4
- Seek time 7
- seek time 4
- Seeking 8
- Serial ATA 6
- Serial ATA (SATA) interface 23
- serial ATA ports 2
- Servo electronics 7
- servo electronics 8
- Set Features 26
- Set Max Address 26
- Set Multiple Mode 26
- Shock 12
- Shock, nonoperating 4
- Shock, operating 4

- single-track seeks 7
- Sleep 8, 10, 27
- Sleep mode 4, 11
- sound power 4
- Specification summary table 3
- Spindle speed 3, 6
- spindle stop 7
- Spinup 8
- Spinup power 7
- Standby 8, 10, 27
- Standby Immediate 27
- Standby mode 4, 8, 11
- standby timer 11
- Standby to Ready 7
- Standby to ready 4
- Start/stop times 7
- start-stop cycles 4, 15
- Startup current 4
- static-discharge 19
- support services 35
- Surge immunity 15

T

- technical support services 35
- temperature 4, 7, 11
- Temperature gradient 4, 12
- timer 11
- timers 11
- TPI 3
- Track density 3, 6
- Track-to-track 7
- Track-to-track seek time 4, 7
- TUV North America 16

U

- UL 1950 16

V

- Vibration 13
- Vibration, nonoperating 4
- Vibration, operating 4
- voltage 7
- Voltage dips, interrupts 15
- Voltage tolerance 4, 10

W

- Weight 3
- Wet bulb temperature 4, 12
- Width 3
- Write Buffer 26
- Write DMA 26
- Write DMA Extended 26, 27
- Write Multiple 27

Write Multiple Extended 27
Write Sectors 27



Seagate Technology LLC
920 Disc Drive, Scotts Valley, California 95066-4544, USA
Publication Number: 100270024, Rev. L, Printed in USA