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Product Manual

EE25.2 Series

SATA	PATA
ST980817SM	ST980817AM
ST980818SM	ST980818AM
ST960817SM	ST960817AM
ST960818SM	ST960818AM
ST940817SM	ST940817AM
ST940818SM	ST940818AM
ST930817SM	ST930817AM
ST930818SM	ST930818AM

100448541
Rev. E
December 2008

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Publication number: 100448541, Rev. E, December 2008

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When referring to hard drive capacity, one gigabyte, or GB, equals one billion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Quantitative usage examples for various applications are for illustrative purposes. Actual quantities will vary based on various factors, including file size, file format, features and application software. Seagate reserves the right to change, without notice, product offerings or specifications.

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following Seagate® EE25.2 Series drives:

Market	Capacity	Interface	Model
Extreme	80 GBytes	PATA	ST980817AM
Extreme	80 Gbytes	SATA	ST980817SM
Extreme	60 Gbytes	PATA	ST960817AM
Extreme	60 Gbytes	SATA	ST960817SM
Extreme	40 Gbytes	PATA	ST940817AM
Extreme	40 Gbytes	SATA	ST940817SM
Extreme	30 Gbytes	PATA	ST930817AM
Extreme	30 Gbytes	SATA	ST930817SM
Rugged	80 GBytes	PATA	ST980818AM
Rugged	80 Gbytes	SATA	ST980818SM
Rugged	60 Gbytes	PATA	ST960818AM
Rugged	60 Gbytes	SATA	ST960818SM
Rugged	40 Gbytes	PATA	ST940818AM
Rugged	40 Gbytes	SATA	ST940818SM
Rugged	30 Gbytes	PATA	ST930818AM
Rugged	30 Gbytes	SATA	ST930818SM

These drives provide the following key features:

- Extreme operating environment capabilities:
  Extreme temperature range: -30°C to 85°C
  Rugged temperature range: -20°C to 75°C
- 5,400-RPM spindle speed and 8-Mbyte buffer combine for superior performance.
- Quiet operation. Fluid Dynamic Bearing (FDB) motor.
- High instantaneous (burst) data transfer rates (up to 3 Gbytes per second) using SATA interface.
- Giant magnetoresistive (GMR) recording heads and EPRML technology, which 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.

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- 900 Gs nonoperating shock and 300 Gs operating shock.
- SeaTools™ diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- The 3D Defense System™, which includes Drive Defense, Data Defense, and Diagnostic Defense, offers the industry's most comprehensive protection for disc drives.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Support for Read Multiple and Write Multiple commands.
- PATA models support for autodetection of master/slave drives that use cable select (CSEL).

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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 to indicate the models documented in this manual.

2.1 Specification summary

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

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Table 1: Specifications for 80 Gbyte models

Drive specification	ST980817AM (Extreme)	ST980818AM (Rugged)	ST980817SM (Extreme)	ST980818SM (Rugged)
Formatted (512 bytes/sector)*	80 Gbytes			
Guaranteed sectors	156,301,488			
Interface	PATA		SATA	
Bytes per sector	512			
Physical read/write heads	2			
Discs	1			
Cache	8 Mbytes			
Recording density, BPI	840k bits/inch (typical)			
Track density. TPI	150k tracks/inch (typical)			
Areal density	126 Gbits/inch^2 (typical)			
Spindle speed	5,400 RPM			
Internal data transfer rate	450 Mbits/sec max			
I/O data transfer rate	100 Mbytes/sec		Up to 3 Gbits/sec	
Sustained throughput, typical (nominal operating conditions)	45 Mbytes/sec maximum			
ATA data-transfer modes supported	PIO modes 0–4; Multiword DMA modes 0–2; Ultra DMA modes 0–5			
Height	9.5 +/-0.2 mm (0.374 +/-.008 inches)			
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)			
Length	100.2 +/-0.25 mm (3.945 +/-0.010 inches)		100.5 +/- 1.58 mm (3.957 +/- 0.062 inches)	
Weight	102 grams (0.22 lb) (maximum)			
Average latency	5.6 msec			
Power-on to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Standby to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Track-to-track seek time	1.0 msec (read, typical), 1.5 msec (write, typical)			
Average seek time (random)	12.5 msec (typical), 14 msec (max)			
Average seek, read (random)	13 msec (typical), 14 msec (max)			
Average seek, write (random)	14 msec (typical), 15 msec (max)			
Full-stroke seek	23 msec (typical); 24 msec (max)			
Startup current 5V	1.30 amps (typical) 1.55 amps (max)		1.30 amps (typical) 1.55 amps (max)	
Seek power at 25°C	1.65 watts / 0.33 amps (typical)		2.45 watts / 0.49 amps	
Read power at 25°C	1.40 watts / 0.28 amps (typical)		3.00 watts / 0.60 amps (typical)	
Write power at 25°C	1.50 watts / 0.30 amps (typical)		2.30 watts / 0.46 amps (typical)	
Idle mode (active idle at 25°C)	1.65 watts / 0.33 amps (typical)		2.35 watts / 0.47 amps (typical)	
Standby mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Sleep mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Voltage tolerance (including noise)	5V ± 5%			
Ambient temperature Operating Nonoperating	-30° to 85°C (Extreme); -20° to 75°C (Rugged); –40° to 95°C (Extreme and Rugged)			

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Drive specification	ST980817AM (Extreme)	ST980818AM (Rugged)	ST980817SM (Extreme)	ST980818SM (Rugged)
Temperature gradient (noncondensing)	20°C/hour (operating) 30°C/hour (nonoperating)			
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)			
Relative humidity gradient (noncondensing)	30% per hour max			
Wet bulb temperature	30°C (operating, max) 40°C (nonoperating, max)			
Altitude, operating (Extreme models: -30°C to 85°C) Altitude, operating (Rugged models: -20°C to 75°C)	–304.8 m to 5,500 m (–1000 ft to 18,100 ft)			
Altitude, nonoperating (below mean sea level, max)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft)			
Shock, operating at 2 msec at 11 msec	 300 Gs max 150 Gs max			
Shock, nonoperating at 2 msec at 1 msec at 0.5 msec	 800 Gs max 900 Gs max 400 Gs max			
Vibration, operating (linear swept sine) (max displacement may apply below 10 hz)	2.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear swept sine) (max displacement may apply below 22 hz)	5.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, operating (linear random)	.003 G^2/hz (5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear random)	.025 G^2/Hz, 3.5 Grms (5–500 Hz); (X, Y, Z axis, 45° angles)			
Drive acoustics, sound power Idle** Seek	 1.7 Bels (typical) 1.9 Bels (max) 1.9 Bels (typical) 2.1 Bels (max)			
Nonrecoverable read errors	1 per 10^{14} bits read			
Mean Time Before Failure (MTBF)	1,000,000 power-on hours At 8,760 POH (Power On Hours) per year Max ambient air temperature: 25°C.			
Load/Unload (U/UL) cycles 25°C, 50% relative humidity -30°C, 0% relative humidity (extreme models) 85°C, 20% relative humidity (extreme models) -20°C, 0% relative humidity (rugged models) 75°C, 20% relative humidity (rugged models)	 1,200,000 software-controlled power on/off cycles 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles			
Service life	10 years (form, fit, and function replacement)			
Warranty	To determine the warranty for a specific drive, use a web browser to access the follow-ing web page: support.seagate.com/customer/warranty_validation.jsp You will be asked to provide the drive serial number, model number (or part number) and country of purchase. After submitting this information, the system will display the warranty information for your drive.			

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

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

*** Typical host and S4; while in the S3 and S4 states, drive sleep and drive standby modes will not contribute to battery power consumption.

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Table 2: Specifications for 60 Gbyte models

Drive specification	ST960817AM (Extreme)	ST960818AM (Rugged)	ST960817SM (Extreme)	ST960818SM (Rugged)
Formatted (512 bytes/sector)*	60 Gbytes			
Guaranteed sectors	117,210,240			
Interface	PATA		SATA	
Bytes per sector	512			
Physical read/write heads	2			
Discs	1			
Cache	8 Mbytes			
Recording density, BPI	840k bits/inch (typical)			
Track density. TPI	150k tracks/inch (typical)			
Areal density	126 Gbits/inch^2 (typical)			
Spindle speed	5,400 RPM			
Internal data transfer rate	450 Mbits/sec max			
I/O data transfer rate	100 Mbytes/sec		Up to 3 Gbits/sec	
Sustained throughput, typical (nominal operating conditions)	45 Mbytes/sec maximum			
ATA data-transfer modes supported	PIO modes 0–4; Multiword DMA modes 0–2; Ultra DMA modes 0–5			
Height	9.5 +/-0.2 mm (0.374 +/-.008 inches)			
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)			
Length	100.2 +/-0.25 mm (3.945 +/-0.010 inches)		100.5 +/- 1.58 mm (3.957 +/- 0.062 inches)	
Weight	102 grams (0.22 lb) (maximum)			
Average latency	5.6 msec			
Power-on to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Standby to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Track-to-track seek time	1.0 msec (read, typical), 1.5 msec (write, typical)			
Average seek time (random)	12.5 msec (typical), 14 msec (max)			
Average seek, read (random)	13 msec (typical), 14 msec (max)			
Average seek, write (random)	14 msec (typical), 15 msec (max)			
Full-stroke seek	23 msec (typical); 24 msec (max)			
Startup current 5V	1.30 amps (typical) 1.55 amps (max)		1.30 amps (typical) 1.55 amps (max)	
Seek power at 25°C	1.65 watts / 0.33 amps (typical)		2.45 watts / 0.49 amps	
Read power at 25°C	1.40 watts / 0.28 amps (typical)		3.00 watts / 0.60 amps (typical)	
Write power at 25°C	1.50 watts / 0.30 amps (typical)		2.30 watts / 0.46 amps (typical)	
Idle mode (active idle at 25°C)	1.65 watts / 0.33 amps (typical)		2.35 watts / 0.47 amps (typical)	
Standby mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Sleep mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Voltage tolerance (including noise)	5V ± 5%			
Ambient temperature Operating Nonoperating	-30° to 85°C (Extreme); -20° to 75°C (Rugged); –40° to 95°C (Extreme and Rugged)			

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Drive specification	ST960817AM (Extreme)	ST960818AM (Rugged)	ST960817SM (Extreme)	ST960818SM (Rugged)
Temperature gradient (noncondensing)	20°C/hour (operating) 30°C/hour (nonoperating)			
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)			
Relative humidity gradient (noncondensing)	30% per hour max			
Wet bulb temperature	30°C (operating, max) 40°C (nonoperating, max)			
Altitude, operating (Extreme models: -30°C to 85°C) Altitude, operating (Rugged models: -20°C to 75°C)	–304.8 m to 5,500 m (–1000 ft to 18,100 ft)			
Altitude, nonoperating (below mean sea level, max)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft)			
Shock, operating at 2 msec at 11 msec	 300 Gs max 150 Gs max			
Shock, nonoperating at 2 msec at 1 msec at 0.5 msec	 800 Gs max 900 Gs max 400 Gs max			
Vibration, operating (linear swept sine) (max displacement may apply below 10 hz)	2.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear swept sine) (max displacement may apply below 22 hz)	5.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, operating (linear random)	.003 G^2/hz (5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear random)	.025 G^2/Hz, 3.5 Grms (5–500 Hz); (X, Y, Z axis, 45° angles)			
Drive acoustics, sound power Idle** Seek Nonrecoverable read errors	 1.7 Bels (typical) 1.9 Bels (max) 1.9 Bels (typical) 2.1 Bels (max) 1 per 10^{14} bits read			
Mean Time Before Failure (MTBF)	1,000,000 power-on hours At 8,760 POH (Power On Hours) per year Max ambient air temperature: 25°C.			
Load/Unload (U/UL) cycles 25°C, 50% relative humidity -30°C, 0% relative humidity (extreme models) 85°C, 20% relative humidity (extreme models) -20°C, 0% relative humidity (rugged models) 75°C, 20% relative humidity (rugged models)	 1,200,000 software-controlled power on/off cycles 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles			
Service life	10 years (form, fit, and function replacement)			
Warranty	To determine the warranty for a specific drive, use a web browser to access the follow-ing web page: support.seagate.com/customer/warranty_validation.jsp You will be asked to provide the drive serial number, model number (or part number) and country of purchase. After submitting this information, the system will display the warranty information for your drive.			

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

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

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

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Table 3: Specifications for 40 Gbyte models

Drive specification	ST940817AM (Extreme)	ST940818AM (Rugged)	ST940817SM (Extreme)	ST940818SM (Rugged)
Formatted (512 bytes/sector)*	40 Gbytes			
Guaranteed sectors	78,140,160			
Interface	PATA		SATA	
Bytes per sector	512			
Physical read/write heads	1			
Discs	1			
Cache	8 Mbytes			
Recording density, BPI	840k bits/inch (typical)			
Track density. TPI	150k tracks/inch (typical)			
Areal density	126 Gbits/inch^2 (typical)			
Spindle speed	5,400 RPM			
Internal data transfer rate	450 Mbits/sec max			
I/O data transfer rate	100 Mbytes/sec		Up to 3 Gbits/sec	
Sustained throughput, typical (nominal operating conditions)	45 Mbytes/sec maximum			
ATA data-transfer modes supported	PIO modes 0–4; Multiword DMA modes 0–2; Ultra DMA modes 0–5			
Height	9.5 +/-0.2 mm (0.374 +/-.008 inches)			
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)			
Length	100.2 +/-0.25 mm (3.945 +/-0.010 inches)		100.5 +/- 1.58 mm (3.957 +/- 0.062 inches)	
Weight	102 grams (0.22 lb) (maximum)			
Average latency	5.6 msec			
Power-on to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Standby to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Track-to-track seek time	1.0 msec (read, typical), 1.5 msec (write, typical)			
Average seek time (random)	12.5 msec (typical), 14 msec (max)			
Average seek, read (random)	13 msec (typical), 14 msec (max)			
Average seek, write (random)	14 msec (typical), 15 msec (max)			
Full-stroke seek	23 msec (typical); 24 msec (max)			
Startup current 5V	1.30 amps (typical) 1.55 amps (max)		1.30 amps (typical) 1.55 amps (max)	
Seek power at 25°C	1.65 watts / 0.33 amps (typical)		2.45 watts / 0.49 amps	
Read power at 25°C	1.40 watts / 0.28 amps (typical)		3.00 watts / 0.60 amps (typical)	
Write power at 25°C	1.50 watts / 0.30 amps (typical)		2.30 watts / 0.46 amps (typical)	
Idle mode (active idle at 25°C)	1.65 watts / 0.33 amps (typical)		2.35 watts / 0.47 amps (typical)	
Standby mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Sleep mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Voltage tolerance (including noise)	5V ± 5%			
Ambient temperature Operating Nonoperating	-30° to 85°C (Extreme); -20° to 75°C (Rugged); –40° to 95°C (Extreme and Rugged)			

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Drive specification	ST940817AM (Extreme)	ST940818AM (Rugged)	ST940817SM (Extreme)	ST940818SM (Rugged)
Temperature gradient (noncondensing)	20°C/hour (operating) 30°C/hour (nonoperating)			
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)			
Relative humidity gradient (noncondensing)	30% per hour max			
Wet bulb temperature	30°C (operating, max) 40°C (nonoperating, max)			
Altitude, operating (Extreme models: -30°C to 85°C) Altitude, operating (Rugged models: -20°C to 75°C)	–304.8 m to 5,500 m (–1000 ft to 18,100 ft)			
Altitude, nonoperating (below mean sea level, max)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft)			
Shock, operating at 2 msec at 11 msec	 300 Gs max 150 Gs max			
Shock, nonoperating at 2 msec at 1 msec at 0.5 msec	 800 Gs max 900 Gs max 400 Gs max			
Vibration, operating (linear swept sine) (max displacement may apply below 10 hz)	2.0 G (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear swept sine) (max displacement may apply below 22 hz)	5.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, operating (linear random)	.003 G^2/hz (5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear random)	.025 G^2/Hz, 3.5 Grms (5–500 Hz); (X, Y, Z axis, 45° angles)			
Drive acoustics, sound power Idle** Seek Nonrecoverable read errors	 1.7 Bels (typical) 1.9 Bels (max) 1.9 Bels (typical) 2.1 Bels (max) 1 per 10^{14} bits read			
Mean Time Before Failure (MTBF)	1,000,000 power-on hours At 8,760 POH (Power On Hours) per year Max ambient air temperature: 25°C.			
Load/Unload (U/UL) cycles 25°C, 50% relative humidity -30°C, 0% relative humidity (extreme models) 85°C, 20% relative humidity (extreme models) -20°C, 0% relative humidity (rugged models) 75°C, 20% relative humidity (rugged models)	 1,200,000 software-controlled power on/off cycles 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles			
Service life	10 years (form, fit, and function replacement)			
Warranty	To determine the warranty for a specific drive, use a web browser to access the follow-ing web page: support.seagate.com/customer/warranty_validation.jsp You will be asked to provide the drive serial number, model number (or part number) and country of purchase. After submitting this information, the system will display the warranty information for your drive.			

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

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

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

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Table 4: Specifications for 30 Gbyte models

Drive specification	ST930817AM (Extreme)	ST930818AM (Rugged)	ST930817SM (Extreme)	ST930818SM (Rugged)
Formatted (512 bytes/sector)*	30 Gbytes			
Guaranteed sectors	58,605,120			
Interface	PATA		SATA	
Bytes per sector	512			
Physical read/write heads	1			
Discs	1			
Cache	8 Mbytes			
Recording density, BPI	840k bits/inch (typical)			
Track density. TPI	150k tracks/inch (typical)			
Areal density	126 Gbits/inch^2 (typical)			
Spindle speed	5,400 RPM			
Internal data transfer rate	450 Mbits/sec max			
I/O data transfer rate	100 Mbytes/sec		Up to 3 Gbits/sec	
Sustained throughput, typical (nominal operating conditions)	45 Mbytes/sec maximum			
ATA data-transfer modes supported	PIO modes 0–4; Multiword DMA modes 0–2; Ultra DMA modes 0–5			
Height	9.5 +/-0.2 mm (0.374 +/-.008 inches)			
Width	69.85 +/-0.25 mm (2.750 +/-0.010 inches)			
Length	100.2 +/-0.25 mm (3.945 +/-0.010 inches)		100.5 +/- 1.58 mm (3.957 +/- 0.062 inches)	
Weight	102 grams (0.22 lb) (maximum)			
Average latency	5.6 msec			
Power-on to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Standby to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	3.0 seconds (typical), 5 seconds (max) 12 seconds (typical) <30 seconds			
Track-to-track seek time	1.0 msec (read, typical), 1.5 msec (write, typical)			
Average seek time (random)	12.5 msec (typical), 14 msec (max)			
Average seek, read (random)	13 msec (typical), 14 msec (max)			
Average seek, write (random)	14 msec (typical), 15 msec (max)			
Full-stroke seek	23 msec (typical); 24 msec (max)			
Startup current 5V	1.30 amps (typical) 1.55 amps (max)		1.30 amps (typical) 1.55 amps (max)	
Seek power at 25°C	1.65 watts / 0.33 amps (typical)		2.45 watts / 0.49 amps	
Read power at 25°C	1.40 watts / 0.28 amps (typical)		3.00 watts / 0.60 amps (typical)	
Write power at 25°C	1.50 watts / 0.30 amps (typical)		2.30 watts / 0.46 amps (typical)	
Idle mode (active idle at 25°C)	1.65 watts / 0.33 amps (typical)		2.35 watts / 0.47 amps (typical)	
Standby mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Sleep mode at 25°C	0.26 watts / 0.05 amps (typical)***		1.10 watts / 0.22 amps (typical)***	
Voltage tolerance (including noise)	5V ± 5%			
Ambient temperature Operating Nonoperating	-30° to 85°C (Extreme); -20° to 75°C (Rugged); –40° to 95°C (Extreme and Rugged)			

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Drive specification	ST930817AM (Extreme)	ST930818AM (Rugged)	ST930817SM (Extreme)	ST930818SM (Rugged)
Temperature gradient (noncondensing)	20°C/hour (operating) 30°C/hour (nonoperating)			
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)			
Relative humidity gradient (noncondensing)	30% per hour max			
Wet bulb temperature	30°C (operating, max) 40°C (nonoperating, max)			
Altitude, operating (Extreme models: -30°C to 85°C) Altitude, operating (Rugged models: -20°C to 75°C)	–304.8 m to 5,500 m (–1000 ft to 18,100 ft)			
Altitude, nonoperating (below mean sea level, max)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft)			
Shock, operating at 2 msec at 11 msec	 300 Gs max 150 Gs max			
Shock, nonoperating at 2 msec at 1 msec at 0.5 msec	 800 Gs max 900 Gs max 400 Gs max			
Vibration, operating (linear swept sine) (max displacement may apply below 10 hz)	2.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear swept sine) (max displacement may apply below 22 hz)	5.0 Gs (0 to peak, 5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, operating (linear random)	.003 G^2/hz (5–500 Hz); (X, Y, Z axis, 45° angles)			
Vibration, nonoperating (linear random)	.025 G^2/Hz, 3.5 Grms (5–500 Hz); (X, Y, Z axis, 45° angles)			
Drive acoustics, sound power Idle** Seek Nonrecoverable read errors	 1.7 Bels (typical) 1.9 Bels (max) 1.9 Bels (typical) 2.1 Bels (max) 1 per 10^{14} bits read			
Mean Time Before Failure (MTBF)	1,000,000 power-on hours At 8,760 POH (Power On Hours) per year Max ambient air temperature: 25°C.			
Load/Unload (U/UL) cycles 25°C, 50% relative humidity -30°C, 0% relative humidity (extreme models) 85°C, 20% relative humidity (extreme models) -20°C, 0% relative humidity (rugged models) 75°C, 20% relative humidity (rugged models)	 1,200,000 software-controlled power on/off cycles 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles 300,000 software-controlled 100,000 hard power on/off cycles			
Service life	10 years (form, fit, and function replacement)			
Warranty	To determine the warranty for a specific drive, use a web browser to access the follow-ing web page: support.seagate.com/customer/warranty_validation.jsp You will be asked to provide the drive serial number, model number (or part number) and country of purchase. After submitting this information, the system will display the warranty information for your drive.			

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

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

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

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2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST980817AM	80 Gbytes	156,301,488	512
ST980818AM	80 Gbytes	156,301,488	512
ST980817SM	80 Gbytes	156,301,488	512
ST980818SM	80 Gbytes	156,301,488	512
ST960817AM	60 Gbytes	117,210,240	512
ST960818AM	60 Gbytes	117,210,240	512
ST960817SM	60 Gbytes	117,210,240	512
ST960818SM	60 Gbytes	117,210,240	512
ST940817AM	40 Gbytes	78,140,160	512
ST940818AM	40 Gbytes	78,140,160	512
ST940817SM	40 Gbytes	78,140,160	512
ST940818SM	40 Gbytes	78,140,160	512
ST930817AM	30 Gbytes	58,605,120	512
ST930818AM	30 Gbytes	58,605,120	512
ST930817SM	30 Gbytes	58,605,120	512
ST930818SM	30 Gbytes	58,605,120	512

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

2.3 Default logical geometry

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

LBA mode

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

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2.4 Physical organization

Model	Read/write heads	Number of disks
ST980817AM	2	1
ST980818AM	2	1
ST980817SM	2	1
ST980818SM	2	1
ST960817AM	2	1
ST960818AM	2	1
ST960817SM	2	1
ST960818SM	2	1
ST940817AM	1	1
ST940818AM	1	1
ST940817SM	1	1
ST940818SM	1	1
ST930817AM	1	1
ST930818AM	1	1
ST930817SM	1	1
ST930818SM	1	1

2.5 Recording technology

Technology	Specification
Recording density BPI	840k bits/inch typical
Track density TPI	150k tracks/inch typical
Areal density	126 Gbits/inch^2 typical
Spindle speed	5,400 RPM (± 0.2%)
Internal data-transfer rate	450 Mbits/sec max
I/O data transfer rate	PATA: 100 Mbytes/sec max SATA: Up to 3 Gbits/sec max
Sustained throughput, typical (nominal operating conditions)	45 Mbytes/sec maximum
Interleave	1:1
Cache buffer	8 Mbytes (8,192 kbytes)

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2.6 Physical characteristics

		PATA	SATA
Height	(mm) (inches)	9.5 +/–0.2 0.374 +/–0.008	9.5 +/–0.2 0.374 +/–0.008
Width	(mm) (inches)	69.85 +/–0.25 2.750 +/–0.010	69.85 +/–0.25 2.750 +/–0.010
Length	(mm) (inches)	100.2 +/–0.25 3.945 +/–0.010	100.5 +/- 1.58 3.957 +/- 0.062
Maximum weight	(grams) (pounds)	102 0.22	102 0.22

2.7 Seek time

Seek measurements are taken with nominal power. All times are measured using drive diagnostics. The specifications below are defined as follows:

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

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

	Read (all temperatures)		Write (all temperatures)	
	msec		msec	
	Typical	Max	Typical	Max
Track-to-track	0.7	1	1	2
Average	13	14	14	15
Full-stroke	23	24	25	27
Average latency	5.6		5.6	

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2.8 Start/stop times

	Typical	Max
Power-on to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	 3.0 seconds 12 seconds -	 5.0 seconds - <30 seconds
Standby to ready -20 to 85°C for extreme models (75°C for rugged models) -30 to -20°C (extreme models only) 3 sigma maximum at extreme cold temperature	 3.0 seconds 12 seconds -	 5.0 seconds - <30 seconds
Spin down (secs typical at 1 to 85°C)	5.0	8.0
Spin down (secs typical at -30 to 0°C)	15	20

2.9 Power specifications

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

2.9.1 Power consumption

Power requirements for the drives are listed in the table below. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V 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 is measured based on three random seek operations every 100 msecs. This mode is not typical.

- **Read/write power and current**

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

- **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.

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Power dissipation	+5V Average 25C	
SATA	**Watts**	**Amps**
Spinup, typical	5.0	1.0
Spinup, maximum	6.70	1.34
Idle, active*	2.35	0.47
Seeking	2.45	0.49
Read	3.00	0.60
Write	2.30	0.46
Standby	1.10	0.22
Sleep	1.10	0.22
PATA		
Spinup, typical	5.0	1.0
Spinup, maximum	6.70	1.34
Idle, active*	1.65	0.33
Seeking	1.65	0.33
Read	1.40	0.28
Write	1.50	0.30
Standby	0.26	0.05
Sleep	0.26	0.05

* 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.

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2.9.1.1 Typical current profile

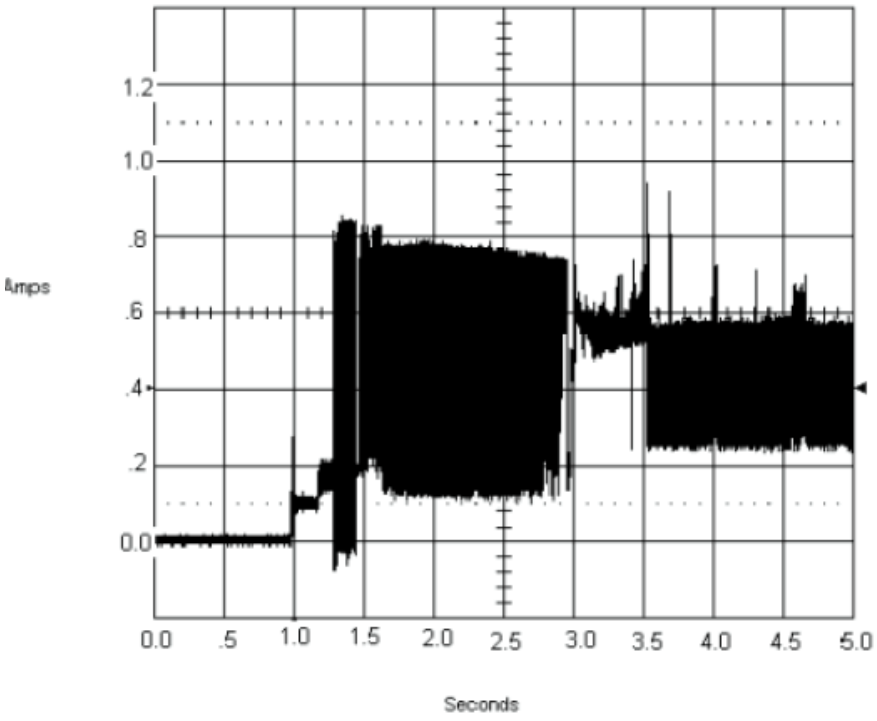


Figure 1. Typical 5V startup and operation current profile

2.9.2 Conducted noise

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

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

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

2.9.3 Voltage tolerance

Voltage tolerance (including noise):

5V ± 5%

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2.9.4 Power-management modes

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

Power modes	Heads	Spindle	Buffer	Std timing
Active (operating)	Tracking	Rotating	Enabled	
Idle, performance	Tracking	Rotating	Enabled	
Idle, active	Floating	Rotating	Disabled	100ms
Idle, low power	Parked	Rotating	Disabled	5.00 secs
Standby	Parked	Stopped	Disabled	Set by host
Sleep	Parked	Stopped	Disabled	Set by host

- **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.

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2.10 Environmental specifications

2.10.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature, measured on baseplate, should not exceed 90°C (194°F) within the operating ambient conditions.

Operating	Extreme: -30° to 85°C (-86° to 185°F) Rugged: -20° to 75°C (-68° to 167°F)
Nonoperating	–40° to 95°C (–140° to 203°F)

2.10.2 Temperature gradient

Operating	20°C/hour without condensation
Nonoperating	30°C/hour

2.10.3 Humidity

2.10.3.1 Relative humidity

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

2.10.3.2 Wet bulb temperature

Operating	30°C (86°F max)
Nonoperating	40°C (104°F max)

2.11 Altitude

Operating (Extreme models: -30°C to 85°C) Operating (Rugged models: -20°C to 75°C)	–304.8 m to 5,500 m (–1000 ft to 18,100 ft)
Nonoperating (below mean sea level, max)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft)

2.11.1 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.

2.11.1.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 300 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second. For 11 msec shock duration, these drives will withstand operating shock up to 150 Gs.

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2.11.1.2 Nonoperating shock

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

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

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

2.11.2 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.

2.11.2.1 Operating vibration

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

5–500 Hz	2.0 G (0 to peak) Linear swept sine Max displacement may apply below 10 Hz X, Y, Z axis, 45° angles
5–500 Hz	.003 G^2/Hz (5–500 Hz) X, Y, Z axis, 45° angles

2.11.2.2 Nonoperating vibration

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

5–500 Hz	5.0 Gs (0 to peak) Linear swept sine Max displacement may apply below 22 Hz X, Y, Z axis, 45° angles
5–500 Hz	.025 G^2/Hz, 3.5 Grms (5–500 Hz) X, Y, Z axis, 45° angles

2.12 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:

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

Acoustic mode	
Idle*	**Seeks**
1.7 bels (typ) 1.9 bels (max)	1.9 bels (typ) 2.1 bels (max)

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

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2.13 Electromagnetic immunity

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

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 2,000 MHz, 10 V/m, 80% AM with 1 kHz sine 900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz	A	EN 61000-4-3: 96 ENV 50204: 95
Electrical fast transient	± 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
Power Frequency H-field immunity	1 A/m, 50Hz/60Hz, 3 axes	A	EN 61000-4-8: 97
Voltage dips, interrupts	30% Reduction for 25 cycles >95% Reduction for 250 cycles >95%, 0.5 cycles	C C B	EN 61000-4-11: 94

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

B - 1) Unit self recovers without user intervention.
2) No data loss.

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

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2.14 Reliability

Measurement type	Specification
Nonrecoverable read errors	1 per 10^{14} bits read, max.
Mean time between failures (MTBF)	1,000,000 power-on hours At 8,760 POH (Power On Hours) per year Max ambient air temperature: 25°C.
Load/Unload (U/UL) cycles	
25°C, 50% relative humidity	1,200,000 software-controlled power on/off cycles 100,000 hard power on/off cycles
-30°C, 0% relative humidity (extreme models) 85°C, 20% relative humidity (extreme models)	300,000 software-controlled 100,000 hard power on/off cycles
-20°C, 0% relative humidity (rugged models) 75°C, 20% relative humidity (rugged models)	300,000 software-controlled 100,000 hard power on/off cycles
Service Life	10 years, form, fit, and function replacement.
Warranty	To determine the warranty for a specific drive, use a web browser to access the follow-ing web page: support.seagate.com/customer/warranty_validation.jsp You will be asked to provide the drive serial number, model number (or part number) and country of purchase. After submitting this information, the system will display the warranty information for your drive.

2.15 Agency certification

2.15.1 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.

2.15.2 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.

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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: EE25 Series
- Certificate numbers:STX-EE251 (B)
- Trade name or applicant: Seagate Technology International
- Manufacturing date: March 2006
- Manufacturer/nationality: Seagate Technology International

Australian C-Tick (N176)

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

2.15.3 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.

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2.16 Environmental protection

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

2.16.1 European Union Restriction of Hazardous Substances (RoHS)

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

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

Seagate also has internal systems in place to ensure ongoing compliance with the RoHS Directive and all laws and regulations which restrict chemical content in electronic products. These systems include standard 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.

2.17 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.

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3.0 Mounting and configuring the drive

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

3.1 Handling and static discharge precautions

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

Caution:

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

3.2 Drive mounting

You can mount the drive using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 2 for drive mounting dimensions (dimensions in inches with mm in parentheses). Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only M3 x 0.5 mounting screws.
- Do not overtighten the mounting screws (maximum torque: 4.0 inch-lb).
- Four (4) threads (0.080 inches) minimum screw engagement recommended.
- If mounting drive using the bottom holes, ensure the coplanarity of the mating surface is 0.010 inches or less.

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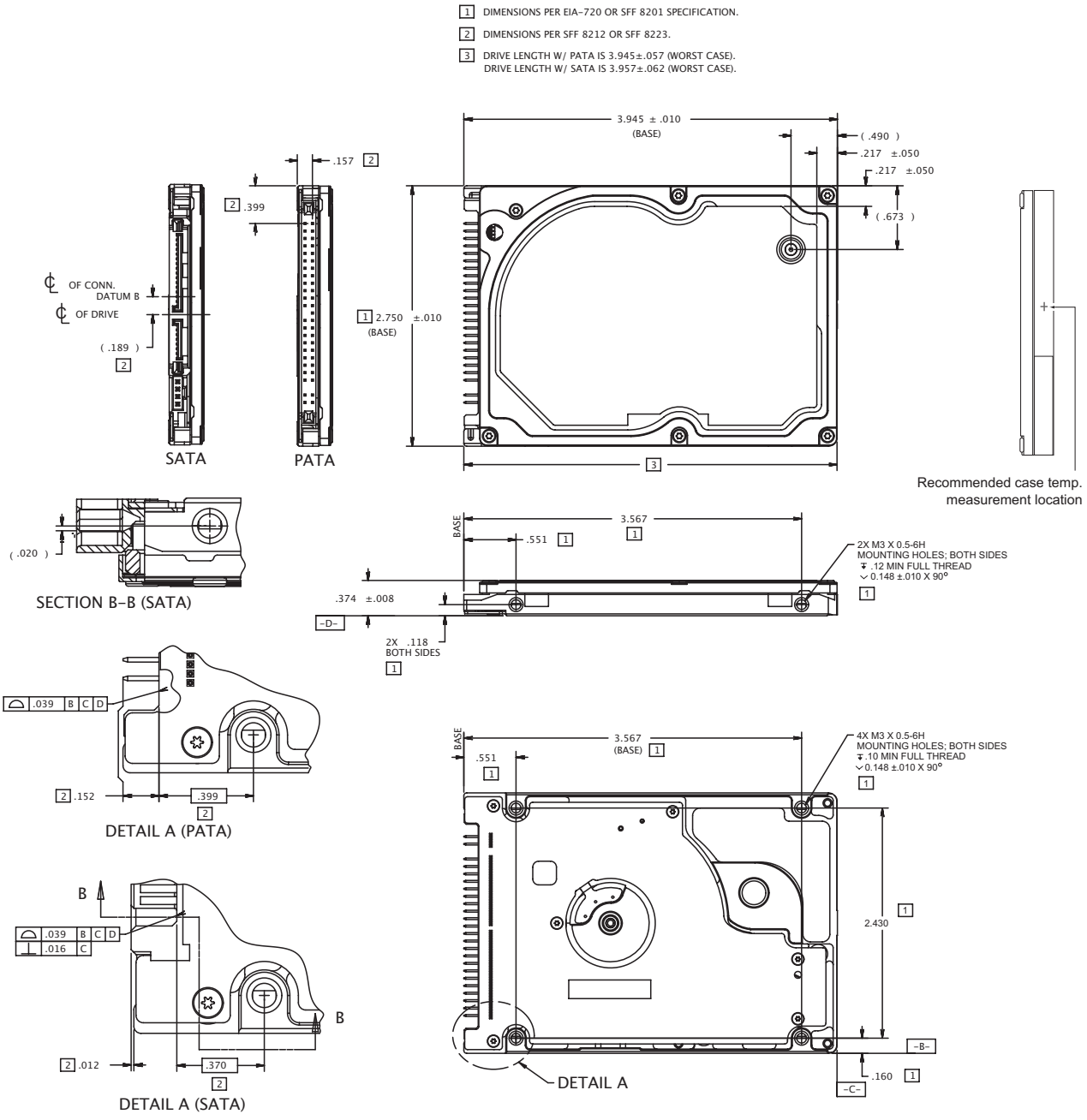


Figure 2. Mounting dimensions—top, side and end view

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3.3 Breather filter hole precautions

Observe the following breather filter hole precautions to ensure full functionality and prevent possible damage to the drive.

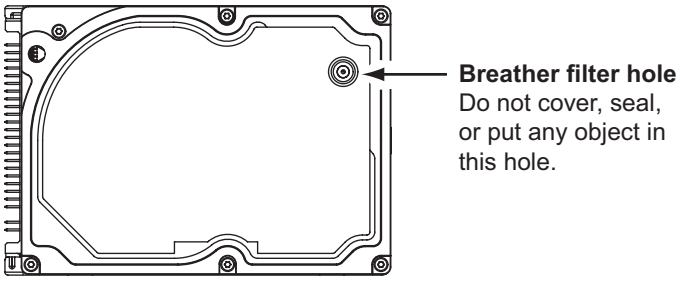


Figure 3 Breather filter hole location

Caution: Do not cover, seal, or insert any object into this hole.

This hole has two purposes:

- To allow condensation inside the hard disc to escape
- To allow air pressure inside the hard disc to equalize with ambient pressure

Note. If this hole is covered, sealed, or penetrated by any object, drive reliability may be compromised and could lead to permanent damage. Covering or sealing this hole voids the warranty.

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3.4 How to configure the drive

See Section 3.4.1 beginning on page 30 for SATA drives.

See Section 3.4.2 beginning on page 31 for PATA drives.

3.4.1 How to configure and connect Serial ATA (SATA) drives

3.4.1.1 How to configure the drive

Each drive on the SATA interface connects in a point-to-point configuration with the SATA 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 SATA 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.

SATA 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.

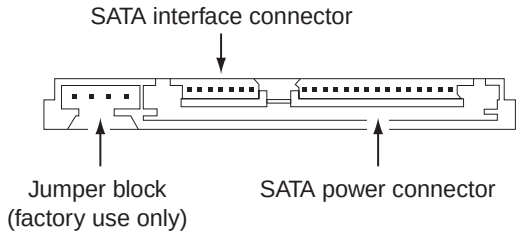


Figure 4. SATA connectors

3.4.1.2 How to connect SATA cables

The SATA 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 5 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 5.

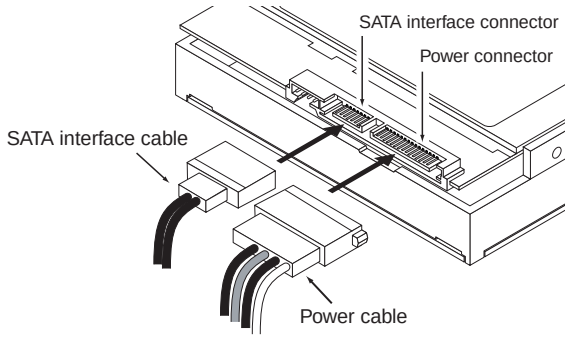


Figure 5. Attaching SATA cabling

Each cable is keyed to ensure correct orientation.

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3.4.2 How to configure Parallel ATA (PATA) drives

Use the options jumper block shown in Figure 6 to configure the drive for operation. This jumper block is the 4-pin header adjacent to pins 1 and 2 of the I/O signal pins. For additional information about using the Cable select option, see Section 3.4.2.1.

Note. Limit the number of PATA interface connector connects and disconnects to a maximum of 50 cycles.

3.4.2.1 How to configure the drive as a master or slave

The “Drive is master (or single drive)” option is the default setting.

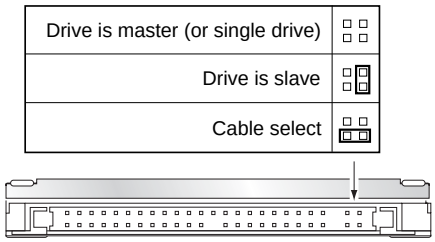


Figure 6. Jumper settings

3.4.2.2 How to use the cable-select option

Computers that use cable select determine the master and slave drives by selecting or deselecting pin 28, CSEL, on the interface bus. Master and slave drives are determined by their physical position on the cable. To enable cable select, set a jumper as shown in Figure 6. Refer to your computer manual to determine whether your computer supports this option.

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4.0 Interface

Interface	Refererence
SATA	See Section 4.1 beginning on page 34
PATA	See Section 4.2 beginning on page 36

The following sections apply to both SATA and PATA drives:

- Supported commands (See Section 4.3 beginning on page 37)
- Identify Device command (See Section 4.4 beginning on page 39)
- Set Features command (See Section 4.5 beginning on page 42)
- S.M.A.R.T. commands (See Section 4.6 beginning on page 43)

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4.1 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.

4.1.1 Hot-Plug compatibility

EE25.2 Series SATA 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.

4.1.2 Serial ATA device plug connector pin definitions

Table 5 summarizes the signals on the Serial ATA interface and power connectors..

Table 5: 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			

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Table 5: Serial ATA connector pin definitions

Segment	Pin	Function	Definition
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:

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.

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4.2 Parallel ATA (ATA) interface

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

For detailed information about the ATA interface, refer to the *AT Attachment - 6 with Packet Interface (ATA/ATAPI-6), ANSI NCITS 361-200,* subsequently referred to as the *ATA-6 Standard*.

4.2.1 PATA interface signals and connector pins

The following table summarizes the signals on the 44-pin ATA interface connector. For a detailed description of these signals, refer to the draft *ATA-6 Standard.* Limit the number of PATA interface connector connects and disconnects to a maximum of 50 cycles.

Table 6: Connector signals

Signal Name	Connector Contact	Cable Conductor	Cable Conductor	Connector Contact	Signal Name
RESET-	1	1	2	2	Ground
DD7	3	3	4	4	DD8
DD6	5	5	6	6	DD9
DD5	7	7	8	8	DD10
DD4	9	9	10	10	DD11
DD3	11	11	12	12	DD12
DD2	13	13	14	14	DD13
DD1	15	15	16	16	DD14
DD0	17	17	18	18	DD15
Ground	19	19	20	20	(keypin)
DMARQ	21	21	22	22	Ground
DIOW-	23	23	24	24	Ground
DIOR-	25	25	26	26	Ground
IORDY	27	27	28	28	PSYNC:CSEL
DMACK-	29	29	30	30	Ground
INTRQ	31	31	32	32	IOCS16-
DA1	33	33	34	34	PDIAG-
DA0	35	35	36	36	DA2
CS1FX-	37	37	38	38	CS3FX-
DASP-	39	39	40	40	Ground
+5 V (Logic)	41	41	42	42	+5V (Motor)
Ground (Return)	43	43	44	44	No connection

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4.3 Supported ATA commands

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

EE25.2 Series drives support all standard 48-bit extended commands.

Command name	Command code (in hex)
ATA-standard commands	
ATA Device Configuration Overlay	$B1_H$
ATA Service	$A2_H$
Check Power Mode	98_H, $E5_H$
Download Microcode	92_H
Execute Device Diagnostics	90_H
Flush Cache	$E7_H$
Format Track (Legacy)	50_H
Identify Device	EC_H
Idle	97_H, $E3_H$
Idle Immediate	95_H, $E1_H$
Initialize (Set) Device Parameters	91_H
Read Buffer	$E4_H$
Read DMA	$C8_H$, $C9_H$
Read Log Extended	$2F_H$
Read Multiple	$C4_H$
Read Native Max Address	$F8_H$
Read Sectors	20_H, 21_H
Read Verify Sectors	40_H, 41_H
Recalibrate	10_H
Security Disable Password	$F6_H$
Security Erase Prepare	$F3_H$
Security Erase Unit	$F4_H$
Security Freeze Lock	$F5_H$
Security Set Password	$F1_H$
Security Unlock	$F2_H$
Seek	70_H
Set Drive Parameters	91_H
Set Features	EF_H
Set Max Address	$F9_H$
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

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Command name	Command code (in hex)
Set Multiple Mode	$C6_H$
Sleep	99_H, $E6_H$
S.M.A.R.T.	$B0_H$
Standby	96_H, $E2_H$
Standby Immediate	94_H, $E0_H$
Vendor Unique	$9A_H$, FA_H, FB_H
Write Buffer	$E8_H$
Write DMA	CA_H, CB_H
Write Log Extended	$3F_H$
Write Multiple	$C5_H$
Write Sectors	30_H, 31_H
ATA-standard power-management commands	
Check Power Mode	98_H or $E5_H$
Idle	97_H or $E3_H$
Idle Immediate	95_H or $E1_H$
Sleep	99_H or $E6_H$
Standby	96_H or $E2_H$
Standby Immediate	94_H or $E0_H$
ATA-standard security commands	
Security Set Password	$F1_H$
Security Unlock	$F2_H$
Security Erase Prepare	$F3_H$
Security Erase Unit	$F4_H$
Security Freeze Lock	$F5_H$
Security Disable Password	$F6_H$

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4.4 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data, shown below, is organized as a single 512-byte block of data. 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 *ATA-6 Standard.*

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	$0C5A_H$
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)	ST980817AM ST980818AM ST980817SM ST980818SM ST960817AM ST960818AM ST960817SM ST960818SM ST940817AM ST940818AM ST940817SM ST940818SM ST930817AM ST930818AM ST930817SM ST930818SM
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

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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)	ST980817AM = 156,301,488 ST980818AM = 156,301,488 ST980817SM = 156,301,488 ST980818SM = 156,301,488 ST960817AM = 117,210,240 ST960818AM = 117,210,240 ST960817SM = 117,210,240 ST960818SM = 117,210,240 ST940817AM = 78,140,160 ST940818AM = 78,140,160 ST940817SM = 78,140,160 ST940818SM = 78,140,160 ST930817AM = 58,605,120 ST930818AM = 58,605,120 ST930817SM = 58,605,120 ST930818SM = 58,605,120
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	$007E_H$
81	Minor version number	0000_H
82	Command sets supported	$346B_H$
83	Command sets supported	$7D01_H$
84	Command sets support extension	4003_H
85	Command sets enabled	$34xx_H$
86	Command sets enabled	$3xxx_H$
87	Command sets enable extension	4003_H
88	Ultra DMA support and current mode (see note following this table)	$xx3F_H$

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Word	Description	Value
89	Security erase time	0000_H
90	Enhanced security erase time	0000_H
91	Advanced power management value	0040_H
92	Master password revision code	$FFFE_H$
93	Hardware reset value (see description following this table)	$xxxx_H$
94	Auto acoustic management setting	$xxxx_H$
95–127	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. See the bit descriptions below for words 63, 88, 93 and 94 of the Identify Drive data.

Description (if bit is set to 1)

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

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4.5 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:

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
05_H	Enable advanced power management	
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.

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4.6 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 7: 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

If an appropriate code is not written to the Features Register, the command is aborted and 0*x*04 (abort) is written to the Error register.

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Seagate Technology LLC
920 Disc Drive, Scotts Valley, California 95066-4544, USA
Publication Number: 100448541, Rev. E, Printed in U.S.A.

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