Product Manual

Momentus® 4200.2

ST9100822A

ST9808210A

ST960821A

ST950212A

ST9402113A

ST930219A

100342049
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One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. Quantitative usage examples for various applications are for illustrative purposes. Actual quantities will vary based on various factors, including file size, file format, features and application software. Seagate reserves the right to change, without notice, product offerings or specifications.

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following Seagate® Momentus 4200.2 drives:

- ST9100822A
- ST9808210A
- ST960821A
- ST950212A
- ST9402113A
- ST930219A

These drives provide the following key features:

- 4,200-RPM-Class Performance spindle speed. Actual spindle speed is 5,400 RPM.
- 8-Mbyte buffer on models ST9100822A, ST9808210A and ST960821A.
- 2-Mbyte buffer on models ST950212A, ST9402113A and ST930219A.
- Quiet operation. Fluid Dynamic Bearing (FDB) motor.
- High instantaneous (burst) data transfer rates (up to 100 Mbytes per second) using Ultra DMA mode 5.
- Tunneling Magnetoresistive (TMR) recording heads.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Full-track multiple-sector transfer capability without local processor intervention.
- 800 Gs nonoperating shock, and 250 Gs operating shock.
- SeaTools™ diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Support for Read Multiple and Write Multiple commands.
- Support for autodetection of master/slave drives that use cable select (CSEL).



Figure 1. Momentus 4200.2 PATA disc drive

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 ST9100822A, ST9808210A, ST960821A, ST950212A, ST9402113A, and ST930219A model drives.

2.1 Specification summary

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

Table 1: Specifications

Drive specification	ST9100822A	ST9808210A	ST960821A	ST950212A	ST9402113A	ST930219A
Formatted Gbytes (512 bytes/sector)	100	80	60	50	40	30
Guaranteed sectors	195,371,568	156,301,488	117,210,240	97,696,368	78,140,160	58,605,120
Bytes per sector	512					
Physical read/write heads	4	3	3	2	2	2
Discs	2	2	2	1	1	1
Cache (Mbytes)	8			2		
Recording density, BPI (bits/inch typical)	703,000					
Track density. TPI (tracks/inch typical	115,000					
Areal density (Gbits/inch^2 max)	86					
Spindle speed (RPM)	4,200 RPM-Class Performance (Actual spin speed 5,400 RPM)					
Internal data transfer rate OD (Mbytes/sec max)	48.25					
I/O data-transfer rate (Mbytes/sec max)	100					
ATA data-transfer modes supported	PIO modes 0–4; Multiword DMA modes 0–2; Ultra DMA modes 0–5					
Height	9.5+/–0.2 mm (0.374 +/–.008 inches)					
Width	69.85 +/–0.25 mm (2.750 +/–0.010 inches)					
Length	100.2 +/–0.25 mm (3.945 +/–0.010 inches)					
Weight (typical)	100 grams (0.22 lb)					
Average latency (msec)	5.6					
Power-on to ready (sec typical)	3.5					
Standby to ready (sec typical)	3.0					
Startup current 5V (typical)	1.0 amps					
Track-to-track seek time (msec typical)	1.0 (read), 1.5 (write)					

Table 1: Specifications

Drive specification	ST9100822A	ST9808210A	ST960821A	ST950212A	ST9402113A	ST930219A
Average seek time (msec typical)	12.5					
Average seek, read (msec typical)	12.5					
Average seek, write (msec typical)	14.5					
Full-stroke seek (msec)	22 (typical); 24 (max)					
Seek power (typical)	2.3 watts					
Read/write power (typical)	2.05/2.1 watts					
Idle mode (typical)	0.99 watts					
Standby mode	0.2 watts (typical)**					
Sleep mode	0.2 watts (typical)**					
Voltage tolerance (including noise)	5V ± 5%					
Ambient temperature	5° to 55°C (operating) –40° to 70°C (nonoperating)					
Temperature gradient (°C per hour max, noncondensing)	20°C (operating) 30°C (nonoperating)					
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)					
Relative humidity gradient	30% per hour max					
Wet bulb temperature (°C max)	30°C (operating) 40°C (nonoperating)					
Altitude, operating	–304.8 m to 3,048 m (–1000 ft to 10,000 ft)					
Altitude, nonoperating (below mean sea level, max)	–304.8 m to 12,192 m (–1,000 ft to 40,000 ft)					
Shock, operating (Gs max at 2 msec)	250					
Shock, nonoperating (Gs max at 2 msec)	800					
Shock, nonoperating (Gs max at 1 msec)	900					
Shock, nonoperating (Gs max at 0.5 msec)	400					
Vibration, operating (max displacement may apply below 10 hz)	1.0 Gs (0 to peak, 5–500 Hz)					
Vibration, nonoperating (max displacement may apply below 22 hz)	5.0 Gs (0 to peak, 10–500 Hz)					
Drive acoustics, sound power (bels)						
Idle*	2.4 (typical) 2.6 (max)					
Quiet seek	2.6 (typical) 2.8 (max)					
Performance seek	2.9 (typical) 3.1 (max)					
Nonrecoverable read errors	1 per 10^{14} bits read					
Mean time between failures (MTBF)	330,000 Power-on hours At nominal power, 25°C ambient temperature. Max case temperature: 65°C at the case measurement location shown in Figure 4					

Table 1: Specifications

Drive specification	ST9100822A	ST9808210A	ST960821A	ST950212A	ST9402113A	ST930219A
Load/Unload (U/UL) cycles						
25°C, 50% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles					
32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 10% relative humidity 55°C, 16% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles					
Service life	5 Years					
Warranty	5 Year					

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

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

2.2 Formatted capacity

Model	Formatted capacity	Guaranteed sectors	Bytes per sector
ST9100822A	100 Gbytes	195,371,568	512
ST9808210A	80 Gbytes	156,301,488	512
ST960821A	60 Gbytes	117,210,240	512
ST950212A	50 Gbytes	97,696,368	512
ST9402113A	40 Gbytes	78,140,160	512
ST930219A	30 Gbytes	58,605,120	512

2.3 Default logical geometry

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

LBA mode

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

2.4 Physical organization

Model	Read/write heads	Number of discs
ST9100822A	4	2
ST9808210A	3	2
ST960821A	3	2
ST950212A	2	1
ST9402113A	2	1
ST930219A	2	1

2.5 Recording and interface technology

Technology	Specification
Interface	Parallel ATA
Recording method	RLL 0,11
Recording density BPI (bits/inch typical)	703,000
Track density TPI (tracks/inch typical)	115,000
Areal density (Mbits/inch^2 max)	86
Spindle speed (RPM) (± 0.2%)	4,200 RPM-Class Performance (Actual spin speed 5,400 RPM)
Internal data-transfer rate OD (Mbytes/sec max)	48.25
I/O data-transfer rate (Mbytes/sec max)	100 (Ultra DMA mode 5)
Interleave	1:1
Cache buffer	8 Mbytes (8,184 kbytes) on ST9100822A, ST9808210A and ST960821A 2 Mbytes (2,048 kbytes) on ST950212A, ST9402113A, and ST930219A

2.6 Physical characteristics

Height	(mm) (inches)	9.5 +/-0.2 0.374 +/-0.008
Width	(mm) (inches)	69.85 +/-0.25 2.750 +/-0.010
Length	(mm) (inches)	100.2 +/-0.25 3.945 +/-0.010
Typical weight	(grams) (pounds)	100 0.22

2.7 Seek time

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

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

Typical seek times (msec)*	Read	Write
Track-to-track	1.0	1.5
Average	12.5	14.5
Full-stroke	22.0	24.0
Average latency	5.56	5.56

*Measured in performance mode

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

2.8 Time to ready

Time to ready	Typical	Max
Power-on to Ready (sec)	3.5	8.0
Standby to Ready (sec)	3.0	8.0

2.9 Power specifications

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

2.9.1 Power consumption

Power requirements for the drives are listed in the table on page 8. 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.

Table 2: DC power

Power dissipation	+5V Average (watts, 25° C)
Spinup (typical)	1.00 amps
Idle, performance mode*	1.85
Idle, active*	0.99
Idle, low power mode*	0.85
Seeking	2.3
Read	2.05
Write	2.1
Standby	0.20
Sleep	0.20

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

2.9.1.1 Typical current profile

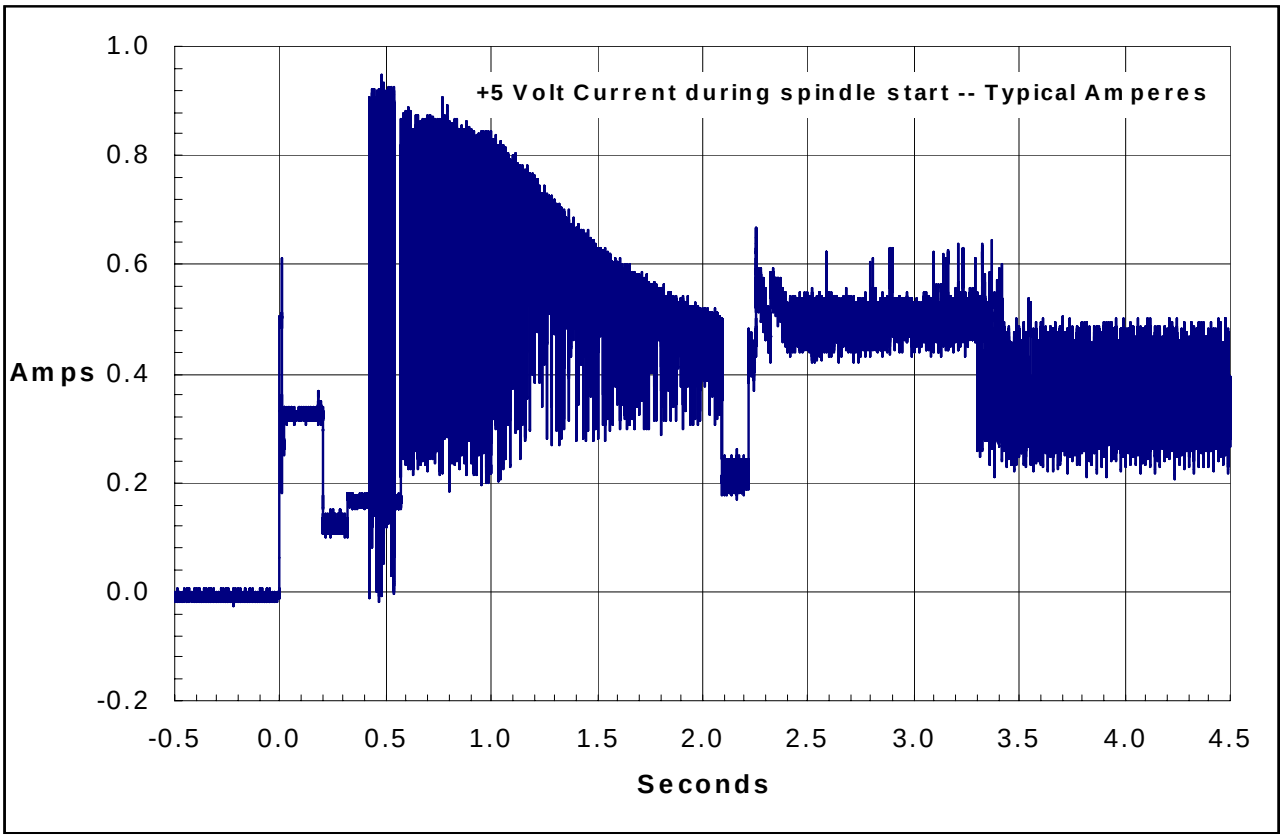


Figure 2. Typical 5V startup and operation current profile

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%

2.9.4 Power-management modes

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

Table 3: Power management modes

Power modes	Heads	Spindle	Buffer
Active (operating)	Tracking	Rotating	Enabled
Idle, performance	Tracking	Rotating	Enabled
Idle, active	Floating	Rotating	Disabled
Idle, low power	Parked	Rotating	Disabled
Standby	Parked	Stopped	Disabled
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.

2.10 Environmental specifications

2.10.1 Ambient temperature

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

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

Operating	5° to 55°C (41° to 131°F)
Nonoperating	–40° to 70°C (–40° to 158°F)

2.10.2 Temperature gradient

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

2.10.3 Humidity

2.10.3.1 Relative humidity

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

2.10.3.2 Wet bulb temperature

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

2.10.4 Altitude

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

2.10.5 Shock

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

2.10.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 250 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second.

2.10.5.2 Nonoperating shock

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

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

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

2.10.6 Vibration

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

2.10.6.1 Operating vibration

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

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

2.10.6.2 Nonoperating vibration

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

10–500 Hz	5.0 Gs (0 to peak). Max displacement may apply below 22 Hz.

2.11 Acoustics

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

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

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

Table 4: Drive level acoustics

Acoustic mode		
Idle*	**Quiet Seek**	**Performance Seek**
2.4 bels (typ) 2.6 bels (max)	2.6 bels (typ) 2.8 bels (max)	2.9 bels (typ) 3.1 bels (max)

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

2.12 Electromagnetic immunity

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

Table 5: Electromagnetic immunity

Test	**Description**	**Performance level**	**Reference standard**
Electrostatic discharge	Contact, HCP, VCP: ± 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.

2.13 Reliability

Measurement type	Specification
Nonrecoverable read errors	1 per 10^{14} bits read, max.
Mean time between failures (MTBF)	330,000 Power-on hours At nominal power, 25°C ambient temperature. Max case temperature: 65°C at the case measurement location shown in Figure 4
Load/Unload (U/UL)	
25°C, 50% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles
32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 10% relative humidity 55°C, 16% relative humidity	600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles
Service Life	5 Years
Warranty	5 Years

2.14 Agency certification

2.14.1 Safety certification

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

2.14.2 Electromagnetic compatibility

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

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

Korean RRL

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

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

- EUT name (model numbers): ST9100822A. ST9808210A, ST960821A, ST950212A, ST9402113A and ST930219A.
- Certificate numbers: Pending
- Trade name or applicant: Seagate Technology
- Manufacturing date: August 2004
- Manufacturer/nationality: USA, 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).

2.14.3 FCC verification

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

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

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

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

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

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

2.15 Environmental protection

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

European Union Restriction of Hazardous Substances (RoHS)

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

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

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

3.0 Configuring and mounting the drive

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

3.1 Handling and static discharge precautions

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

Caution:

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

3.2 Jumper settings

3.2.1 Master/slave configuration

Use the options jumper block shown in Figure 3 to configure the drive for operation. This jumper block is the 4-pin header adjacent to pins 1 and 2 of the I/O signal pins. For additional information about using the Cable select option, see Section 3.2.2.

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

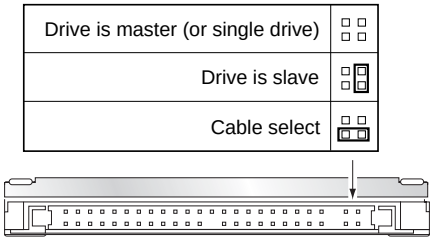


Figure 3. Jumper settings

3.2.2 Cable-select option

Computers that use cable select determine the master and slave drives by selecting or deselecting pin 28, CSEL, on the interface bus. Master and slave drives are determined by their physical position on the cable. To enable cable select, set a jumper as shown in Figure 3. Refer to your computer manual to determine whether your computer supports this option.

3.3 Drive mounting

You can mount the drive using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 4 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.

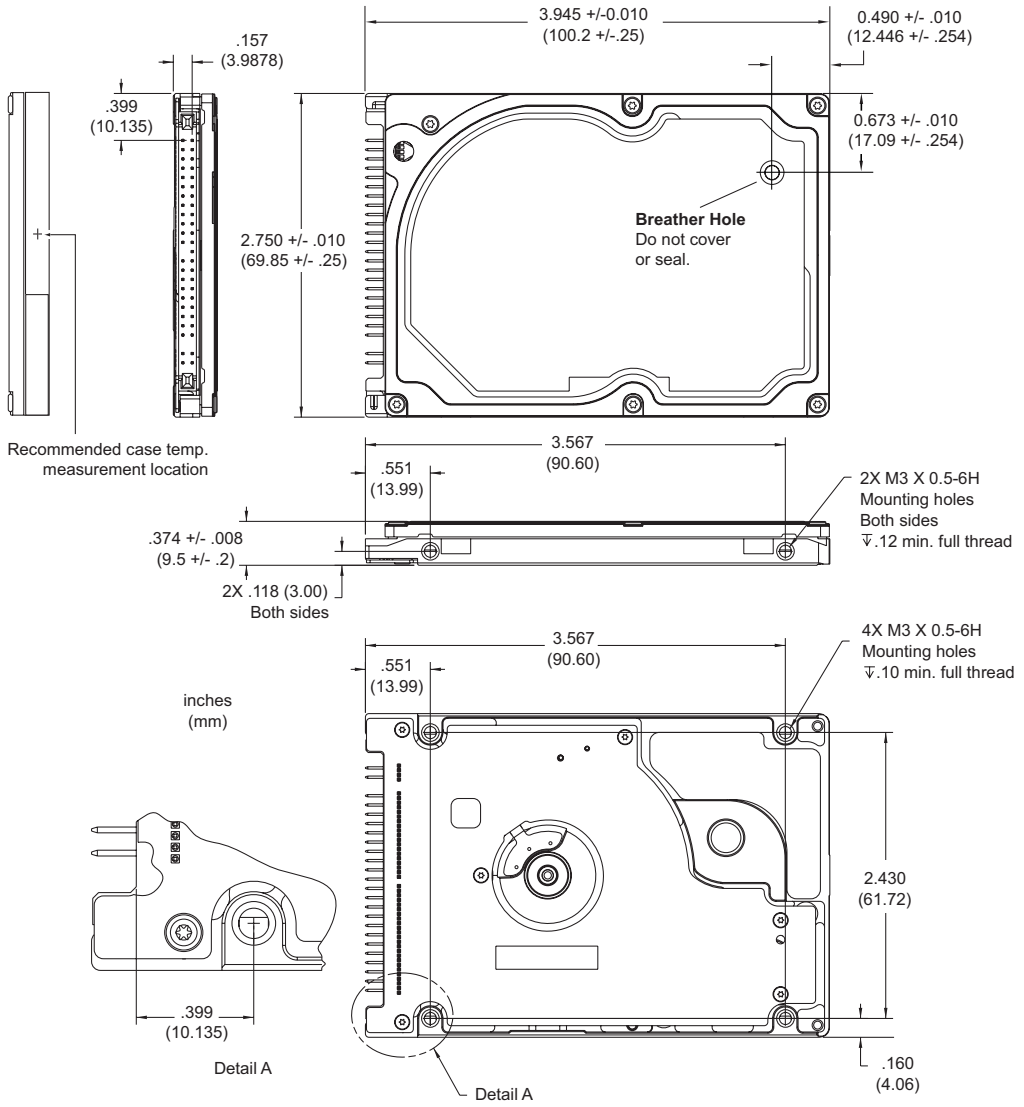


Figure 4. Mounting dimensions—top, side and end view

4.0 ATA interface

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

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

4.1 ATA interface signals and connector pins

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

Table 6: Connector signals

Signal Name	Connector Contact	Cable Conductor	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

4.1.1 Supported ATA commands

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

Table 7: Supported commands

Command name	Command code (in hex)
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	$E7_H$
Flush Cache Extended	EA_H
Format Track (Legacy)	50_H
Identify Device	EC_H
Idle	$97_{H,}$ $E3_H$
Idle Immediate	$95_{H,}$ $E1_H$
Initialize Device Parameters	91_H
Read Buffer	$E4_H$
Read DMA	$C8_{H,}$ $C9_H$
Read DMA Extended	25_H
Read Log Extended	22_H
Read Multiple	$C4_H$
Read Multiple Extended	29_H
Read Native Max Address	$F8_H$
Read Native Max Address Extended	27_H
Read Sectors	$20_{H,}$ 21_H
Read Sectors Extended	24_H
Read Verify Sectors	$40_{H,}$ 41_H
Read Verify Sectors Extended	42_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	$F1_H$

Table 7: Supported commands

Command name	Command code (in hex)
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
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 DMA Extended	35_H
Write Log Extended	32_H
Write Multiple	$C5_H$
Write Multiple Extended	39_H
Write Sectors	30_H, 31_H
Write Sectors Extended	34_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	$F4_H$

Table 7: Supported commands

Command name	Command code (in hex)
Security Freeze Lock	$F5_H$
Security Disable Password	$F6_H$

4.1.2 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 Table 7 on page 20. All reserved bits or words should be set to zero. Parameters listed with an "x" are drive-specific or vary with the state of the drive. See Section 2.0 on page 3 for default parameter settings.

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

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	$0C5A_H$
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)	ST9100822A ST9808210A ST960821A ST950212A ST9402113A ST930219A
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
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	$xxxx_H$

Word	Description	Value
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)	ST9100822A = 195,371,568 ST9808210A = 156,301,488 ST960821A = 117,210,240 ST950212A = 97,696,368 ST9402113A = 78,140,160 ST930219A = 58,605,120
62	Retired	0000$_H$
63	Multiword DMA active and modes supported (see note following this table)	*xx*07$_H$
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	34*xx*$_H$
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)	*xx*3F$_H$
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$_H$

Word	Description	Value
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}

4.1.3 Set Features command

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

Table 8: Features register values

02_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.

5.0 Compatibility summary

5.1 Installation considerations

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

5.2 System Compatibility

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

Table 9: Tested systems

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

5.3 BIOS versions tested

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

Table 10: Tested BIOS versions

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

5.4 Operating system versions tested

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

Table 11: Operating systems tested

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

5.5 Compatibility test configurations

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

5.6 Software utilities

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

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

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

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

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

5.7 Other certification

Microsoft software compatibility.

6.0 Seagate Technology support services

Internet
For information regarding Seagate products and services, visit www.seagate.com. Worldwide support is available 24 hours daily by email for your questions.

Presales Support:
Presales@Seagate.com

Technical Support:
DiscSupport@Seagate.com

Warranty Support:
http://www.seagate.com/support/service/index.html

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

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

Seagate Service Centers

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

Technical Support
Seagate technical support is available to assist you online at support.seagate.com or through one of our call centers. Have your system configuration information and your “ST” model number available.

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

Customer Service Operations

Warranty Service

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

Data Recovery Services

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

Authorized Service Centers

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

USA/Canada/Latin America support services

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

Global Customer Support

Presales, Technical, and Warranty Support

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

Data Recovery Services

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

Europe, the Middle East and Africa Support Services

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

Asia/Pacific Support Services

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

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