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User manual MAXTOR MOMENTUS 5400 FDE.3 SATA
User guide MAXTOR MOMENTUS 5400 FDE.3 SATA
Operating instructions MAXTOR MOMENTUS 5400 FDE.3 SATA
Instructions for use MAXTOR MOMENTUS 5400 FDE.3 SATA
Instruction manual MAXTOR MOMENTUS 5400 FDE.3 SATA

Seagate

Product Manual

Momentus® 5400 FDE.3 SATA

ST9320322AS
ST9160312AS
ST9120312AS

100513273
Rev. A
June 2008

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Manual abstract:

@@@@All other trademarks or registered trademarks are the property of their respective owners. One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. Quantitative usage examples for various applications are for illustrative purposes. Actual quantities will vary based on various factors, including file size, file format, features and application software. Seagate reserves the right to change, without notice, product offerings or specifications. Contents 1.0 Introduction. . .

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. . . . 11 20 20 21 22 Momentus 5400 FDE.
3 SATA Product Manual, Rev. A iii 1.0 Introduction This manual describes the functional, mechanical and interface specifications for the following Seagate Momentus® 5400 FDE.3 SATA model drives: ST9320322AS ST9160312AS ST9120312AS These drives provide the following key features: · DriveTrust technology including: · Hardware-based Full Disc Encryption (FDE) · DriveTrust security interface and ATA security interface · Integrates with standard security software packages to provide features such as: Pre-boot authentication and initialization using the drive's secure partition and DriveTrust API · 5,400-RPM spindle speed · 8-Mbyte buffer · Quiet operation.

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Fluid Dynamic Bearing (FDB) motor. · High instantaneous (burst) data transfer rates (up to 100 Mbytes per second) using Ultra DMA mode 6. · State-of-the-art cache and on-the-fly error-correction algorithms. · Full-track multiple-sector transfer capability without local processor intervention. · 1,000 Gs nonoperating shock and 350 Gs operating shock. · SeaToolsTM 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. 1.1 System requirements The following hardware and software is required to use these drives. Host system requirements: · Windows XP with Service Pack 2 (or later) when utilizing the Windows DriveTrust API.

· System/BIOS that supports ATA Security commands. Momentus 5400 FDE.3 SATA Product Manual, Rev. A 1 1.2 About Momentus 5400 FDE.

3 SATA disc drives The Momentus® 5400 FDE.3 SATA drives contain DriveTrust technology providing Full Disc Encryption (FDE) using proven Advanced Encryption Standard (AES) data encryption and decryption. You can elect to use Momentus 5400 FDE.3 SATA drives in one of two different security modes: 1. The ATA Security mode To operate in ATA Security mode, you only need a host system and operating system that supports the existing ATA Security Command Set.

The drive is shipped to operating in this mode, ready to use. 2. The DriveTrust Security mode To enable a robust enterprise-level security and management policy, you may elect to operate in DriveTrust Security mode. To do so, you will need to use a third-party security application to manage the DriveTrust features. Please on 2.6 PIO modes 04 Multiword DMA modes 02 Ultra DMA modes 06 9.5 +/- 0.2 mm (0.374 +/- .0078 inches) 69.

85 +/- 0.249 mm (2.75 +/- 0.0098 inches) 100.33 +/- 0.25 mm (3.95 +/- 0.010 inches) 98 grams (0.212 lb) 5.6 3.

4 3.2 1.5 11.0 24 (typical) 1.0 amps 2.

0 watts Read: 1.6 watts; Write: 1.9 watts 93 grams (0.205 lb) 2 1 2 1 ST9160312AS 160 312,581,808 ST9120312AS 120 234,441,648 Drive specification Formatted Gbytes (512 bytes/sector) Guaranteed sectors Bytes per sector Physical read/write heads Discs Cache (Mbytes) Recording density in BPI (bits/inch max) Track density TPI (tracks/inch max) Areal density (Gbits/inch2 max) Spindle speed (RPM) Internal transfer rate (Mbits/sec max) I/O data transfer rate (Gbits/sec max) ATA data-transfer modes supported Height (max) Width (max) Length (max) Weight (typical) Average latency (msec) Power-on to ready (sec typical) Standby to ready (sec typical) Track-to-track seek time, read (msec typical) Average seek, read (msec typical) Full-stroke seek, read (msec) Startup current, +5V (max) Seek power (typical) Read/write power (typical) Momentus 5400 FDE.3 SATA Product Manual, Rev.*

*A 5 Table 2: Drive specifications ST9320322AS 0.7 watts 0.24 watts (typical)*** 0.24 watts (typical)*** +5V ± 5% 0° to 60°C (operating), 40° to 70°C (nonoperating) 20°C (operating) 35°C (nonoperating) 5% to 95% (operating) 5% to 95% (nonoperating) 30% per hour max 37.7°C (operating) 40°C (nonoperating) 60.96 m to 3,048 m (200 ft to 10,000+ ft) 304.8 m to 12,192 m (1000 ft to 40,000+ ft) 350 800 1,000 600 1.0 G (0 to peak, 5500 Hz) 5 Gs (0 to peak, 5500 Hz) ST9160312AS ST9120312AS Drive specification Idle mode, low power (typical) Standby mode Sleep mode Voltage tolerance (including noise) Ambient temperature Temperature gradient (°C per hour max) Relative humidity Relative humidity gradient Wet bulb temperature (max) Altitude, operating Altitude, nonoperating (meters below mean sea level, max) Shock, operating (Gs max at 2 msec) Shock, nonoperating (Gs max at 2 msec) Shock, nonoperating (Gs max at 1 msec) Shock, nonoperating (Gs max at 0.5 msec) Vibration, operating Vibration, nonoperating Drive acoustics, sound power (bels) Idle** Performance seek Nonrecoverable read errors Annualized Failure Rate (AFR) Load/Unload (U/UL) cycles 25°C, 50% relative humidity 32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 10% relative humidity 55°C, 16% relative humidity Warranty 2.3 (typical) 2.*

5 (max) 2.6 (typical) 2.7 (max) 1 per 1014 bits read <0.48% 600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles 600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles 5 years on distribution units. To determine the warranty for a specific drive, use a web browser to access the following web page: www.seagate.com/support/service/ From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive. Yes (requires COMPRESET from host after a hotplug event) Supports Hotplug operation per Serial ATA Revision 2.

*5 specification *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 6 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 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 Model Formatted capacity Formatted capacity* 320 Gbytes 160 Gbytes 120 Gbytes Guaranteed sectors 625,142,448 312,581,808 234,441,648 Bytes per sector 512 512 512 ST9320322AS ST9160312AS ST9120312AS *One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. 2.2.1 LBA mode When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to n1, where n is the number of guaranteed sectors as defined above. See Section 4.2.5, "Identify Device command" (words 60-61 and 100-103) for additional information about 48bit addressing support of drives with capacities over 137 Gbytes.*

2.3 Cylinders 16,383 Default logical geometry Read/write heads 16 Sectors per track 63 LBA mode When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to n1, where n is the number of guaranteed sectors as defined above. Momentus 5400 FDE.3 SATA Product Manual, Rev. A 7 2.4 Physical organization Read/write heads 4 2 2 Number of discs 2 1 1 Drive model ST9320322AS ST9160312AS ST9120312AS 2.5 Interface Recording and interface technology Serial ATA (SATA) Perpendicular 1,337k 191.5k 253 5,400 830 3.0 1:1 8 Mbytes (8,192 kbytes) Recording method Recording density BPI (bits/inch max) Track density TPI (tracks/inch max) Areal density (Gbits/inch2 max) Spindle speed (RPM) (± 0.

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2%) Maximum Internal transfer rate (Mbits/sec) I/O data-transfer rate (Gbits/sec max) Interleave Cache buffer 2.
6 Physical characteristics Drive specification Height Width Length Typical weight ST9320322AS 98 grams 0.212 pounds 93 grams 0.205 pounds (mm) (inches) (mm) (inches) (mm) (inches) 9.5 +/-0.2 0.
374 +/-0.0078 69.85 +/-0.249 2.75 +/-0.
0098 100.33 +/-0.25 3.95 +/-0.010 ST9160312AS ST9120312AS 8 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 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 in the table below are defined as follows: · Track-to-track seek time is an average of all possible single-track seeks in both directions.

· Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead. Typical seek times (msec) Track-to-track Average Full-stroke Average latency Read 1.5 11.0 24.0 5.56 Note. These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications. 2.
8 Start/stop times Typical 3.4 3.2 Max @ 25°C 8.0 8.0 Time to ready Power-on to Ready (sec) Standby to Ready (sec) Momentus 5400 FDE.
3 SATA Product Manual, Rev. A 9 2.9 Power specifications The drive receives DC power (+5V) through a native SATA power connector. 2.9.
1 Power consumption Power requirements for the drives are listed in table 3. Typical power measurements are based on an average of drives tested, under nominal conditions, at 25°C ambient temperature. · Spinup power Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed. · Seek mode During seek mode, the read/write actuator arm moves toward a specific position on the disc surface and does not execute a read or write operation. Servo electronics are active. Seek mode power is measured based on three random seek operations every 100 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 model Table 3: DC power +5V input average (25° C) 1.

0 amps 2.0 watts 1.6 watts 1.9 watts 1.6 watts 0.8 watts 0.7 watts 0.24 watts 0.24 watts Power dissipation Spinup (max) Seek Read Write Idle, performance Idle, active* Idle, low power mode* Standby Sleep *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. 10 Momentus 5400 FDE.
3 SATA Product Manual, Rev. A 2.9.1.1 Typical current profile Figure 1.
Typical +5V only startup and operation current profile 2.9.2 Deferred spinup Momentus 5400 FDE.3 SATA drives do not support the deferred spinup option. If you require this option, refer to the Momentus 5400.3 SATA Blade Server family of drives. 2.9.3 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. Voltage tolerance 2.9.4 Voltage tolerance (including noise): 5V ± 5% Momentus 5400 FDE.3 SATA Product Manual, Rev. A 11 2.9.5 Power-management modes The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program.
The drive features the following power-management modes: Table 4: Power management modes Heads Tracking Tracking Floating Parked Parked Parked Spindle Rotating Rotating Rotating Rotating Stopped Stopped Buffer Full power Self refresh--low power Self refresh--low power Self refresh--low power Self refresh--low power Self refresh--low power Power modes Active (operating) Idle, performance Idle, active Idle, low power Standby Sleep · 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 in Self Refresh Low Power mode, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disc access is necessary. · Sleep mode The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is in Self Refresh Low Power mode, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host.
After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact. · Idle and Standby timers Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disc access is necessary. 12 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 2.10 2.10.1 Environmental specifications 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 Nonoperating 0° to 60°C (32° to 140°F) 40° to 70°C (40° to 158°F) 2.10.2 Operating Temperature gradient 20°C per hour (68°F per hour max), without condensation 35°C per hour (95°F per hour max), without condensation Nonoperating 2.

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10.3 2.10.3.1 Operating Humidity Relative humidity 5% to 95% noncondensing (30% per hour max) 5% to 95% noncondensing (30% per hour max) Nonoperating 2.

10.3.2 Operating Wet bulb temperature 37.7°C (99.86°F max) 40°C (104°F max) Nonoperating 2.

10.4 Operating Altitude 60.96 m to 3,048 m (200 ft to 10,000+ ft) 304.8 m to 12,192 m (1,000 ft to 40,000+ ft) Nonoperating Momentus 5400 FDE.3 SATA Product Manual, Rev.

A 13 2.10.5 Shock All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis. 2.10.5.1 Operating shock These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 350 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second. 2.

10.5.2 Nonoperating shock The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 800 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration. The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 1,000 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 600 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 maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below. 5500 Hz 1.

0 Gs (0 to peak). Max displacement may apply below 10 Hz. 2.10.6.

2 Nonoperating vibration The maximum nonoperating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below. 5500 Hz 5.0 Gs (0 to peak). Max displacement may apply below 22 Hz. 14 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 2.11 Acoustics Drive emission of sound is measured consistent with the ECMA-74 and its' referenced standards. Testing is conducted at room temperature (approximately 25°C). Emission levels are reported as the total A-weighted sound power levels for steady state, idle, and active seek modes of operation.

Idle 2.3 bels (typ) 2.5 bels (max) Performance seek 2.6 bels (typ) 2.7 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.*

Test for Prominent Discrete Tones (PDTs) Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses the lower limit for the threshold curve to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards. *Defined as the median curve given by ISO 389-7 (Tf curve) minus 10dB at all frequencies. 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: Performance level B A Reference standard EN 61000-4-2: 95 EN 61000-4-3: 96 ENV 50204: 95 EN 61000-4-4: 95 EN 61000-4-5: 95 EN 61000-4-6: 97 EN 61000-4-8: 97 EN 61000-4-11: 94 Test Electrostatic discharge Radiated RF immunity Description Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV 80 to 2,000 MHz, 10 V/m, 80% AM with 1 kHz sine 900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz ± 1 kV on AC mains, ± 0.5 kV on external I/O ± 1 kV differential, ± 2 kV common, AC mains 150 kHz to 80 MHz, 3 Vrms, 80% AM with 1 kHz sine 1 A/m, 50Hz/60Hz, 3 axes 30% Reduction for 25 cycles >95% Reduction for 250 cycles >95%, 0.5 cycles Electrical fast transient Surge immunity Conducted RF immunity Power Frequency H-field immunity Voltage dips, interrupts B B A A C C B Momentus 5400 FDE.3 SATA Product Manual, Rev. A 15 2.

13 Reliability Specification 1 per 1014 bits read, max. <0.48% Measurement type Nonrecoverable read errors Annualized Failure Rate (AFR) Load/Unload (U/UL) 25°C, 50% relative humidity 600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles 600,000 software-controlled power on/off cycles 20,000 hard power on/off cycles 32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 10% relative humidity 55°C, 16% relative humidity Warranty 5 years on distribution units. Important: When returning a drive for warranty support, if possible, you should provide the valid ATA Master password, or return the drive in the Security Erased state with the User Data Area accessible. If these recommendations are not followed, Seagate cannot access the drive to perform failure analysis to verify your warranty claim. To determine the warranty for a specific drive, use a web browser to access the following web page: www.seagate.com/support/service/ From this page, click on the "Verify Your Warranty" link. You will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for your drive.

2.14 2.14.1 Agency certification 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.

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16 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 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.

· Certificate number: STX-54005 (B) · Trade name or applicant: Seagate TEchnology LLC · Manufacturing date: March 18, 2008 (Date of Certification) · 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. Momentus 5400 FDE.3 SATA Product Manual, Rev. A 17 2.15 Environmental protection Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances. 2.15.1 European Union Restriction of Hazardous Substances (RoHS) Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

A new law, the European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive. 2.15.2 China Restriction of Hazardous Substances (RoHS) Directive This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard. "O" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is lower than the threshold defined by the China RoHS MCV Standard. "O"RoHS MCV "X" indicates the hazardous and toxic substance content of the part (at the homogenous material level) is over the threshold defined by the China RoHS MCV Standard. "X"RoHS MCV 2.16 Corrosive environment Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845.

However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives. 18 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 3.

0 Configuring and mounting the drive This section contains the specifications and instructions for configuring and mounting the drive. Momentus® 5400 FDE.3 SATA drives may be connected to any computer system that supports a standard SATA interface. You can elect to use Momentus 5400 FDE.3 SATA drives in one of two different security modes: 1.

The ATA Security mode To operate in ATA Security mode, you only need a host system and operating system that supports the existing ATA Security Command Set. The drive is shipped to operating in this mode, ready to use. 2. The DriveTrust Security mode To enable a robust enterprise-level security and management policy, you may elect to operate in DriveTrust Security mode. To do so, you will need to use a third-party security application to manage the DriveTrust features.

Please contact your system or software provider for more details. Refer to Table 1 on page 2 to determine which mode is best for your particular solution.

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Note. As with any disc drive, Seagate highly encourages consumers to consistently back up their data as well as the security pre-boot password, user name, and domain name on another storage device. Seagate is not responsible for lost or stolen authentication data such as passwords, user names, domain names, or any authentication data perceived to be inoperative, and as a consequence of lost or stolen passwords, user names, or domain names, Seagate cannot be held liable for data that cannot be retrieved from the drive due to inability to authenticate the user to the drive as required by the security pre-boot software. 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. @@@@· 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. @@@@@@Removal voids the warranty. @@@@@@@@@@@@@@@@@@@@@@@@@See Table 5 for connector pin definitions. @@@@@@@@@@A 3.4 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. 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 UNC mounting screws.
· Do not overtighten the mounting screws. Maximum torque: 4.0 inch-lb (0.4519 N-m). · Four (4) threads (0.
080 inches, 2.032 mm) minimum screw engagement recommended. · Avoid excessive drive distortion when mounting. Measurements shown in Figure 4 are in inches. 3.
95 +/- .010 Breather Hole Do not cover or seal. + Recommended case temperature measurement location Figure 4. Mounting dimensions Momentus 5400 FDE.3 SATA Product Manual, Rev. A 21 3.5 Drive integration Momentus 5400 FDE.3 SATA drives may be installed in the target computer system in exactly the same way as a non-FDE Momentus drive. . Figure 5.

Momentus 5400 FDE.3 SATA drive label example To install the drive in the system: 1. Remove the drive from the packaging material. 2. Install the drive in the computer system. 3. Load any desired images and operating system to the drive. 4. Install other components and options. 5.
Set the original Master Password to a new value (see Section 1.2.1 for information about setting the SID) utilizing System/BIOS or third party software (optional). No password is required to change the Master password when the drive is in the unlocked state. The drive remains in the unlocked state until a User password is set.
After the installation procedure is complete, the computer is ready to be shipped to the customer. Note. The manufacturer of the computer system (system integrator) does not have to enter any password. The installation procedure for the Momentus 5400 FDE.3 SATA is exactly the same as the Momentus 5400. 5 SATA. 22 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 3.5.1 Drive installation Upon receipt by the consumer, the drive's user interface is identical to a Momentus 5400.5 drive. The normal ATA security commands are functioning and available for initialization of the password as follows: Per normal ATA Security Commands specifications, the drive is unlocked and all ATA security commands and all normal ATA commands may be issued. 1. Consumer accesses the computer manufacturer's BIOS set-up screen.

2. Consumer selects option to set User Password. After setting the User password, the drive is now under access control (locked) and will require a password for future accesses. 3. Optional: Consumer selects the option to set the Master password from the BIOS choices. 4. Consumer exits the BIOS settings menu and continues with the boot process. 5. The BIOS enters the Security Freeze Command (F5) prior to exiting the boot sequence. 3.
5.2 Consumer usage After initialization, the consumer will just need to enter their User password each time the computer is booted according to the following description: 1. The computer system is turned on or the hardware is reset. 2. The drive reports to the BIOS that it is in the locked state per standard ATA Security Command reporting.
3. The BIOS queries the user for the password. 4. The BIOS supplies the password to the drive using the Security Unlock Command (F2). 5.
The drive is unlocked and the BIOS may continue the booting process. 6. The BIOS enters the Security Freeze Lock Command (F5) prior to exiting the boot sequence. Note. To ensure that the system reauthenticates the user, turn the laptop power off (shut down) rather than putting it in sleep mode. The system will authenticate the user at powerup. 3.6 Security Erase--ATA security commands The Momentus 5400 FDE.3 SATA provides powerful features for cryptographically erasing the drive for disposal or repurposing. The drive uses the ATA Security Erase Prepare (F3) and ATA Security Erase (F4) commands to perform the cryptographic erase.

3.6.1 Secure Erase procedure Using the Security Erase commands, the drive's cryptographic key can be replaced according to the following procedure: 1. Consumer boots up the computer normally according to the Consumer Usage section above. 2. Consumer invokes software or BIOS option for Erase. 3. The software or BIOS queries the user for either the User or Master password. 4. The software or BIOS issues the Security Erase Prepare (F3) command.
5. The software or BIOS issues the Security Erase Unit (F4) command. Select the Enhanced erase for cryptographic key erasure that completes in less than one second. Momentus 5400 FDE.3 SATA Product Manual, Rev.
A 23 3.6.2 Drive State after Secure Erase Upon completion of the erase sequence, the existing cryptographic key is erased, rendering all existing data unintelligible, and the drive has been returned to the manufactured state as follows: · The existing encryption key is deleted. · A new random encryption key has been created on the drive. · Encryption function is active and functioning.
The new key is used to encrypt all user data on write and decrypt on read. · The user interface to the drive is active and all read and write commands are allowed. · The ATA User password is reset to null (no value). · The ATA Master password is not modified The ATA Master password is the same value as it was before the erase. · The ATA Security is set to the Unlocked state. No password is required to access the drive. The drive may now be disposed of safely, or the drive may be returned to service for another consumer following the initialization procedure defined above. Drives returned to Seagate for warranty purposes have special requirements.

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See the warranty information in Section 2.13 for additional details.

24 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 4.0 Serial ATA interface These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 04; multiword DMA modes 02, and Ultra DMA modes 06. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers. For detailed information about the Serial ATA interface, refer to the "Serial ATA: High Speed Serialized AT Attachment" specification. 4.1 Hot-Plug compatibility Momentus 5400 FDE.3 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.org. This device requires a COMRESET from the host after a hotplug event.
4.2 Serial ATA device plug connector pin definitions Table 5 summarizes the signals on the Serial ATA interface and power connectors.. Table 5: Segment Serial ATA connector pin definitions Pin S1 S2 S3 S4 S5 S6 Function Ground A+ AGround BB+ Ground 2nd mate Key and spacing separate signal and power segments 2nd mate Differential signal pair B from Phy Definition 2nd mate Differential signal pair A from Phy Signal S7 Momentus 5400 FDE.3 SATA Product Manual, Rev.
A 25 Table 5: Segment Serial ATA connector pin definitions Pin P1 P2 P3 P4 P5 P6 P7 P8 Function V33 V33 V33 Ground Ground Ground V5 V5 V5 Ground Reserved Definition 3.3V power 3.3V power 3.3V power, pre-charge, 2nd mate 1st mate 2nd mate 2nd mate 5V power, pre-charge, 2nd mate 5V power 5V power 2nd mate 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 1st mate. 12V power, pre-charge, 2nd mate 12V power 12V power Power P9 P10 P11 P12 P13 P14 P15 Ground V12 V12 V12 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 pins 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 (Vx) must be terminated. 4.2.
1 ATA Security policy exceptions In the ATA Security Interface mode, the drive conforms to the ATA Security Policy, except the following desirable exceptions to implement the desired Momentus 5400 FDE.3 SATA behavior: Upon execution of the secure erase sequence, the drive will have the following behavior: · All secure erase modes will instantaneously delete the encryption key rendering all user data unintelligible. · A new encryption key will be generated inside the drive replacing the previous encryption key. · The new encryption/decryption key will be applied to the data for all subsequent writes/reads prior to the next secure erase sequence. · The user password will be cleared to a null value.
· The master password will retain the current value per the ATA specification. Note. On completion of this sequence, the user is assured that all sectors on the drive are unintelligible and 26 Momentus 5400 FDE.3 SATA Product Manual, Rev. A the drive is returned to the default factory state.
It is then immediately ready for disposal or repurposing. The ATA Security Erase Unit Command provides for normal and enhanced erase modes as follows: Table 6: Word ATA Security Erase Unit bits Content 0 Control word Bit 0 Identifier 0 = Compare User password 1 = Compare Master password Bit 1 Erase mode 0 = Normal Erase 1 = Enhanced Erase Bit (15:2) Reserved 1 - 16 17 - 255 Password (32 bytes) Reserved Choosing enhanced erase mode will simply perform the cryptographic erase described above, and return status almost immediately. This is the recommended option. To maintain consistency with the ATA Security specification, Momentus 5400 FDE.3 SATA drives provide an option to perform the Normal Erase mode. Choosing normal erase will result in the drive performing the cryptographic erase which is the same as choosing enhanced erase. Momentus 5400 FDE.3 SATA Product Manual, Rev. A 27 4.2.

2 DriveTrust Mode support Identify Page - Word 150 decimal (0x96h)- Bit 12 Identifies DriveTrust Support. Value = 1 = DriveTrust is supported Table 7: DriveTrust Identify Page BIT set Bit Description Ident Value 0 1 5 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Vendor specific Vendor specific Vendor specific DriveTrust Enabled Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific DriveTrust Supported Vendor specific Vendor specific Vendor specific Vendor specific 0 1 0 0 0 0 0 1 0 9 0 1 1 0 8 0 0 28 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 4.2.3 Full Disc Encryption support Identify Page--Word 243 decimal (0xF3h)--bit 14 indicates Full Disc Encryption capability. 1 = Full Disc Encryption supported. Table 8: Full Disc Encryption Identify Page BIT set Bit Description Ident Value 0 1 4 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Vendor specific Full Disc Encryption Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific Vendor specific 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 29 4.
2.4 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 Serial ATA: High Speed Serialized AT Attachment specification. See "S.M.
A.R.T. commands" on page 38 for details and subcommands used in the S.M.
A.R.T. implementation. Table 9: Supported commands ATA Security API Op Code DriveTrust Security API Secure State Authenticated State Command Locked Unlocked Frozen Special Commands 5C 5D 5E 5F TRUSTED RECEIVE (PIO) TRUSTED RECEIVE DMA TRUSTED SEND (PIO) TRUSTED SEND DMA Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Normal Commands E5 98 51 B1 08 92 90 E7 EA EC A1 E3 97 E1 95 00 E4 C8 C9 25 CHECK POWER MODE CHECK POWER MODE CONFIGURE STREAM DEVICE CONFIGURATION DEVICE RESET DOWNLOAD MICROCODE EXECUTE DEVICE DIAGNOSTIC FLUSH CACHE FLUSH CACHE EXT IDENTIFY DEVICE IDENTIFY PACKET DEVICE IDLE IDLE IDLE IMMEDIATE IDLE IMMEDIATE NOP READ BUFFER READ DMA READ DMA READ DMA EXT Executable Executable Aborted Aborted Executable Aborted Executable Aborted Aborted Executable Executable Executable Executable Executable Executable Aborted Aborted Aborted Aborted Executable Executable Executable Executable Executable Aborted Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Aborted Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Aborted Aborted Executable Aborted Executable Aborted Aborted Executable Executable Executable Executable Executable Executable Executable Aborted Aborted Aborted Aborted Executable Executable Executable Executable Aborted Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable 30 Momentus 5400 FDE.

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3 SATA Product Manual, Rev. A Table 9: Supported commands ATA Security API DriveTrust Security API Secure State Executable Aborted Aborted Executable Executable Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Executable Aborted Aborted Aborted Aborted Aborted Executable Executable Executable Executable Aborted Aborted Aborted Aborted Authenticated State Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Aborted Aborted Aborted Executable Aborted Executable Executable Executable Executable Executable Executable Executable Op Code 2F C4 29 F8 27 20 21 24 2A 2B 40 41 42 10 F6 F3 F4 F5 F1 F2 70 91 EF F9H F9H / 00H F9H / 01H F9H / 02H Command READ LOG EXT READ MULTIPLE READ MULTIPLE EXT READ NATIVE MAX ADDRESS READ NATIVE MAX ADDRESS EXT READ SECTOR(S) READ SECTOR(S) READ SECTOR(S) EXT READ STREAM DMA EXT READ STREAM EXT READ VERIFY SECTOR(S) READ VERIFY SECTOR(S) READ VERIFY SECTOR(S) EXT RECALIBRATE SECURITY DISABLE PASSWORD SECURITY ERASE PREPARE SECURITY ERASE UNIT SECURITY FREEZE LOCK SECURITY SET PASSWORD SECURITY UNLOCK SEEK SET DRIVE PARAMETERS SET FEATURES SET MAX ADDRESS SET MAX ADDRESS EXT SET MAX SET PASSWORD SET MAX LOCK Locked Executable Aborted Aborted Executable Executable Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Executable Aborted Executable Executable Aborted Aborted Executable Executable Executable Executable Aborted Aborted Aborted Aborted Unlocked Executable Frozen Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Executable Aborted Aborted Aborted Executable Aborted Aborted Executable Executable Executable Executable Executable Executable Momentus 5400 FDE.3 SATA Product Manual, Rev. A 31 Table 9: Supported commands ATA Security API DriveTrust Security API Secure State Aborted Aborted Executable Executable Executable Executable Executable Executable Executable Authenticated State Executable Executable Executable Executable Executable Executable Executable Executable Op Code F9H / 04H F9H / 03H C6 E6 99 B0H / D9H B0H / D2H B0H / D8H B0H / D4H Command SET MAX FREEZE LOCK SET MAX UNLOCK SET MULTIPLE MODE SLEEP SLEEP SMART DISABLE OPERATIONS SMART ENABLE/DISABLE AUTOSAVE SMART ENABLE OPERATIONS SMART EXECUTE OFF-LINE IMMEDIATE SMART READ DATA SMART READ LOG SMART RETURN STATUS SMART WRITE LOG STANDBY STANDBY STANDBY IMMEDIATE STANDBY IMMEDIATE WRITE BUFFER WRITE DMA WRITE DMA WRITE DMA EXT WRITE DMA FUA EXT WRITE LOG EXT WRITE MULTIPLE WRITE MULTIPLE EXT WRITE SECTOR(S) WRITE SECTOR(S) WRITE SECTOR(S) EXT Locked Aborted Aborted Executable Executable Executable Executable Executable Executable Executable Unlocked Executable Executable Executable Executable Executable Executable Executable Executable Executable Frozen Executable Executable Executable Executable Executable Executable Executable Executable B0H / 08H B0H / D5H B0H / DAH B0H / D6H E2 96 E0 94 E8 CA CB 35 3D 3F C5 39 30 31 34 Executable Executable Executable Executable Executable Executable Executable Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Executable Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Aborted Executable 32 Momentus 5400 FDE.3 SATA Product Manual, Rev.

A Table 9: Supported commands ATA Security API DriveTrust Security API Secure State Aborted Aborted Authenticated State Executable Executable Op Code 3A 3B Command WRITE STREAM DMA EXT WRITE STREAM EXT Locked Aborted Aborted Unlocked Executable Executable Frozen Executable Executable Momentus 5400 FDE.3 SATA Product Manual, Rev. A 33 4.2.5 Identify Device command The Identify Device command (command code ECH) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in the table below. 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. The following commands contain drive-specific features that may not be included in the Serial ATA specification. Word Description Configuration information: · Bit 15: 0 = ATA; 1 = ATAPI · Bit 7: removable media · Bit 6: removable controller · Bit 0: reserved Number of logical cylinders ATA-reserved Number of logical heads Retired Retired Number of logical sectors per logical track: 63 Retired Serial number: (20 ASCII characters, 0000H = none) Retired Retired Obsolete Firmware revision (8 ASCII character string, padded with blanks to end of string) Drive model number: (40 ASCII characters, padded with blanks to end of string) (Bits 70) Maximum sectors per interrupt on Read multiple and Write multiple (16) Reserved Standard Standby timer, IORDY supported and may be disabled ATA-reserved PIO data-transfer cycle timing mode Retired Words 5458, 6470 and 88 are valid Number of current logical cylinders Number of current logical heads Number of current logical sectors per logical track Value 0C5AH 0 1 2 3 4 5 6 79 1019 20 21 22 2326 2746 16,383 0000H 16 0000H 0000H 003FH 0000H ASCII 0000H 0400H 0000H x.
xx ST9320322AS ST9160312AS ST9120312AS 8001H 0000H 2F00H 0000H 0200H 0200H 0007H xxxxH xxxxH xxxxH 47 48 49 50 51 52 53 54 55 56 34 Momentus 5400 FDE.3 SATA Product Manual, Rev. A Word 5758 59 6061 Description Current capacity in sectors Number of sectors transferred during a Read Multiple or Write Multiple command Total number of user-addressable LBA sectors. This field contains a value that is one greater than the total number of user-addressable sectors. The maximum value that shall be placed in this field is 0FFFFFFFh.

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The 0FFFFFFFh value applies to all capacities over 137 Gbytes (see Section 2.2 and 2.3 for related information). Retired Multiword DMA active and modes supported (see note following this table) Advanced PIO modes supported (modes 3 and 4 supported) Minimum multiword DMA transfer cycle time per word (120 nsec) Recommended multiword DMA transfer cycle time per word (120 nsec) Minimum PIO cycle time without IORDY flow control (240 nsec) Minimum PIO cycle time with IORDY flow control (120 nsec) ATA-reserved Queue depth Serial ATA capabilities ATA-reserved Serial ATA features supported Serial ATA features enabled Major version number Minor version number Command sets supported Command sets supported Command sets support extension Command sets enabled Command sets enabled Command sets enable extension Ultra DMA support and current mode (see note following this table) Security erase time Enhanced security erase time Master password revision code Value xxxxH xxxxH ST9320322AS = 0FFFFFFFh ST9160312AS = 0FFFFFFFh ST9120312AS = 234,441,648 62 63 64 65 66 67 68 6974 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 92 0000H xx07H 0003H 0078H 0078H 00F0H 0078H 0000H 0000H 0508H 0000H 0048H 0040H 003EH 0000H 346BH 7D09H 61E3H 34xxH BC09H 61E3H xx7FH 0001H 0001H FFFEH Momentus 5400 FDE.3 SATA Product Manual, Rev.
A 35 Word 93 94 9599 100 103 Description Hardware reset value (see description following this table) Auto acoustic management setting ATA-reserved Total number of user-addressable LBA sectors available (see Section 2.2 for related information) These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFFFFh. ATA-reserved Security status Seagate-reserved ATA-reserved Integrity word Value xxxxH xxxxH 0000H ST9320322AS = 625,142,448 ST9160312AS = 312,581,808 ST9120312AS = 234,441,648 104 127 128 129 159 160 254 255 0000H 0021H xxxxH 0000H xxA5H 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 0 1 2 8 9 10 Word 63 Multiword DMA mode 0 is supported. Multiword DMA mode 1 is supported. Multiword DMA mode 2 is supported. Multiword DMA mode 0 is currently active. Multiword DMA mode 1 is currently active. Multiword DMA mode 2 is currently active.

Bit 0 1 2 3 4 8 9 10 11 12 13 Word 88 Ultra DMA mode 0 is supported. Ultra DMA mode 1 is supported. Ultra DMA mode 2 is supported. Ultra DMA mode 3 is supported. Ultra DMA mode 4 is supported. Ultra DMA mode 0 is currently active. Ultra DMA mode 1 is currently active. Ultra DMA mode 2 is currently active. Ultra DMA mode 3 is currently active. Ultra DMA mode 4 is currently active.
Ultra DMA mode 5 is currently active. Bit 13 Word 93 1 = 80-conductor cable detected, CBLID above VIH 0 = 40-conductor cable detected, CBLID below VIL 36 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 4.2.
6 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 10: 02H 03H Set Features command values Enable write cache (default).
Set transfer mode (based on value in Sector Count register). Sector Count register values: 00H Set PIO mode to default (PIO mode 2). 01H Set PIO mode to default and disable IORDY (PIO mode 2). 08H PIO mode 0 09H PIO mode 1 0AH PIO mode 2 0BH PIO mode 3 0CH PIO mode 4 (default) 20H Multiword DMA mode 0 21H Multiword DMA mode 1 22H Multiword DMA mode 2 40H Ultra DMA mode 0 41H Ultra DMA mode 1 42H Ultra DMA mode 2 43H Ultra DMA mode 3 44H Ultra DMA mode 4 45H Ultra DMA mode 5 46H Ultra DMA mode 6 55H 82H AAH F1H Disable read look-ahead (read cache) feature. Disable write cache Enable read look-ahead (read cache) feature (default). 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. Momentus 5400 FDE.3 SATA Product Manual, Rev. A 37 4.

2.7 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 D4H) 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 11: S.M.A.R.T. commands S.
M.A.R.T. command S.
M.A.R.T. Read Data Vendor-specific S.
M.A.R.T. Enable/Disable Attribute Autosave S.M.A.R.T. Save Attribute Values S.

M.A.R.T. Execute Off-line Immediate (runs DST) Vendor-specific S.M.A.R.T. Enable Operations S.
M.A.R.T. Disable Operations S.
M.A.R.T. Return Status Code in features register D0H D1H D2H D3H D4H D7H D8H D9H DAH Note.
If an appropriate code is not written to the Features Register, the command is aborted and 0x 04 (abort) is written to the Error register. 38 Momentus 5400 FDE.3 SATA Product Manual, Rev. A 5.0 5.1 Compatibility summary 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-todate 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 using WIndows XP SP2 Seagate Product Assurance has tested Momentus drives in systems using ATA Security mode. Testing included multiple BIOS versions and the Windows XP SP2 Pro operating system. This testing was done to demonstrate compatibility with various hardware and software configurations.

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