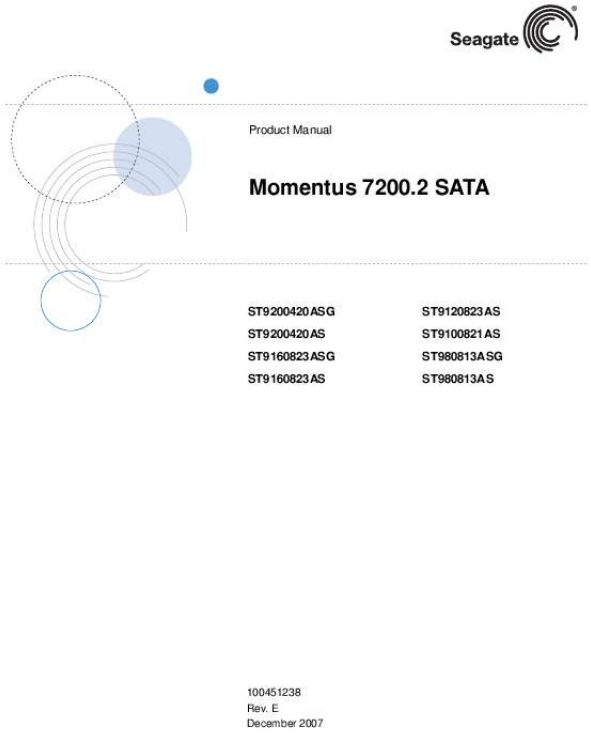

Seagate

Product Manual

Momentus 7200.2 SATA

ST9200420ASG	ST9120823AS
ST9200420AS	ST9100821AS
ST9160823ASG	ST980813ASG
ST9160823AS	ST980813AS

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Rev. E
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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 2.0 Introduction. .

In addition, Serial ATA makes the transition from parallel ATA easy by providing legacy software support. Serial ATA was designed to allow you to install a Serial ATA host adapter and Serial ATA disc drive in your current system and expect all of your existing applications to work as normal. The Serial ATA interface connects each disc drive in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship with Serial ATA devices like there is with parallel ATA. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both "masters" on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices. Note.

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate Serial ATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical Serial ATA environment. The Serial ATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

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

com. 2 Momentus 7200.2 SATA Product Manual, Rev. E 2.0 Drive specifications Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases the drive and this drive are used throughout this manual to indicate the ST9200420ASG, ST9200420AS, ST9160823AS, ST9160823ASG, ST9120823AS, ST9100821AS, ST980813AS and ST980813ASG models. 2.1 Specification summary table The specifications listed in this table are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual. Table 1: Drive specifications ST9200420ASG ST9200420AS 200 390,721,968 512 63 16 16,383 4 2 1,014,000 162,600 169.

*4 7,200 850 69.5 711 59 853,000 155,000 131 3 2 3 2 2 1 ST9160823ASds 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 Model Formatted capacity Formatted capacity* 200 Gbytes 160 Gbytes 120 Gbytes 100 Gbytes 80 Gbytes Guaranteed sectors 390,721,968 312,581,808 234,441,648 195,371,568 156,301,488 Bytes per sector 512 512 512 512 512 ST9200420AS and ST9200420ASG ST9160823AS and ST9160823ASG ST9120823AS ST9100821AS ST980813AS and ST980813ASG *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.

3.1, "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 7200.

2 SATA Product Manual, Rev. E 5 2.4 Physical organization Read/write heads 4 Number of discs Drive model ST9200420AS and ST9200420ASG ST9160823AS and ST9160823ASG 2 ST9120823AS 3 ST9100821AS ST980813AS and ST980813ASG 2 1 2.5 Recording and interface technology 200 GB models 160 - 80 GB models Interface Recording density BPI (bits/inch max) Track density TPI (tracks/inch max) Areal density (Gbits/inch2 max) Serial ATA (SATA) 1,014,000 162,600 169.4 7,200 850 69.5 711 59 853,000 155,000 131 Spindle speed (RPM) (± 0.2%) Maximum Internal transfer rate (Mbits/sec) Sustained transfer rate OD (Mbytes/sec max) I/O data-transfer rate (Mbytes/sec max) Interleave Cache buffer 300 (can also be configured for 150MB/s operation) 1:1 16 Mbytes (16,384 kbytes) 8 Mbytes (8,192 kbytes) 2.6 Physical characteristics Drive specification Height Width Length Maximum weight (mm) (inches) (mm) (inches) (mm) (inches) (grams) (pounds) 9.5 +/-0.2 0.

374 +/-0.0078 69.85 +/-0.25 2.75 +/-0.00984 100.5+/- 0.25 3.957 +/- 0.00984 115 grams (0.

254 lb) 6 Momentus 7200.2 SATA Product Manual, Rev. E 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. Table 2: Typical seek times Read 1.0 11.0 22.

*0 4.17 Write 1.5 13.0 24.0 *Typical seek times (msec) Track-to-track Average Full-stroke Average latency *Measured in performance mode Note. These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications. 2.8 Start/stop times Typical 4 4 5 Max 8 8 8 Time to ready Power-on to Ready (sec) Standby to Ready (sec) Spin down Momentus 7200.*

2 SATA Product Manual, Rev. E 7 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, on page 8. 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 requirements +5V input average (watts, 25° C) -- 2.
3 2.1 2.1 1.9 1.1 0.
8 0.25 0.2 +5V typ amps 1.1 Power dissipation (watts) Example: ST9160823AS Spinup Seek Read Write Idle, performance mode 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. 8 Momentus 7200.*

2 SATA Product Manual, Rev. E 2.9.1.1 Typical current profile Figure 1. Typical 5V startup and operating 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. Voltage tolerance 2.9.3 Voltage tolerance (including noise): 5V ± 5% Momentus 7200.2 SATA Product Manual, Rev.
E 9 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 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. 10 Momentus 7200.2 SATA Product Manual, Rev. E 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 30°C per hour (86°F per hour max) Nonoperating 2.10.
3 2.10.3.1 Operating Humidity Relative humidity 5% to 90% noncondensing (30% per hour max) 5% to 95% noncondensing (30% per hour max) Nonoperating 2.10.
3.2 Operating Wet bulb temperature 30°C (86°F max) 40°C (104°F max) Nonoperating 2.10.4 Operating Altitude 304.8 m to 3,048 m (1,000 ft to 10,000+ ft) - 304.8 m to 12,192 m (1,000 ft to 40,000+ ft) Nonoperating Momentus 7200.2 SATA Product Manual, Rev. E 11 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. Note. Additional shock protection is provided by the Free Fall Protection feature on ST9200420ASG, ST9160823ASG and ST980813ASG models. See Section 2.13.1 for additional information about this feature. Operating shock 2.10.5.1 These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 300 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second. 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 maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below. 5500 Hz 1.0 G (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 G (0 to peak). Max displacement may apply below 22 Hz. 12 Momentus 7200.2 SATA Product Manual, Rev. E 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. 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 5: Drive level acoustics Acoustic mode Idle 2.5 bels (typ) 2.8 bels (max) Seek 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 6: Test Electrostatic discharge Radiated RF immunity Radio frequency environments Description Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV 80 to 1,000 MHz, 3 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 0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds Performance level B A Reference standard EN 61000-4-2: 95 EN 61000-4-3: 96 ENV 50204: 95 Electrical fast transient Surge immunity Conducted RF immunity Voltage dips, interrupts B B A C C C B EN 61000-4-4: 95 EN 61000-4-5: 95 EN 61000-4-6: 97 EN 61000-4-11: 94 Momentus 7200.

2 SATA Product Manual, Rev. E 13 2.13 Reliability Specification 1 per 1014 bits read, max. 0.68% Measurement type Nonrecoverable read errors Annualized Failure Rate (AFR) Load/Unload (U/UL) 25°C, 50% relative humidity 32°C, 80% relative humidity 5°C, 80% relative humidity 5°C, 20% relative humidity 60°C, 20% relative humidity Warranty 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: http://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.

2.13.1 Free Fall Protection feature The Free Fall Protection feature provides enhanced data protection against shock events that may occur while the drive is operating. This feature is designed to decrease the likelihood of data loss by detecting a free fall event and unloading the actuator before a shock takes place in falls of >8 inches (nominal). The drive uses a 0 G sensor mounted on the printed circuit board assembly (PCBA) to sense this event.

To enable the Free Fall Protection feature on ST9200420ASG, ST9160823ASG and ST980813ASG models, use Set Features command 41h. To disable this feature, use Set Features command C1h. Information about Free Fall Events that have occurred are available through SMART Attribute FEh. Note. The Free Fall Protection Feature is provided only on ST9200420ASG, ST9160823ASG and ST980813ASG models.

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). @@@@Drives are tested in representative end-user systems.

@@@@@@@@@@@@@@@@@@@@@@@@@@@@Radio and television interference. @@@@@@@@· Move the device to one side or the other of the radio or TV. · Move the device farther away from the radio or TV. @@@@@@This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. @@E 15 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) Directive 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 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 16 Momentus 7200.2 SATA Product Manual, Rev. E 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. Momentus 7200.2 SATA Product Manual, Rev. E 17 18 Momentus 7200.2 SATA Product Manual, Rev. E 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. Momentus 7200.2 SATA Product Manual, Rev. E 19 3.2 Configuring the drive Each drive on the Serial ATA interface connects in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationships. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both "masters" on two separate ports. This means both drives behave as if they are Device 0 (master) devices. Serial ATA drives are designed for easy installation.

It is normally not necessary to set any jumpers on this drive for proper operation. If the host system does not support SATA 3Gb/s operation, place a jumper on pins 1 and 2 to limit the drive to 1.5Gb/s. 3.0 Gbits per second operation Limit data transfer rate to 1.5 Gbits per second Jumper block SATA power connector SATA interface connector Figure 2. Serial ATA connectors and jumper options 3.3 Serial ATA cables and connectors The Serial ATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches).

See Table 7 for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host. For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable. For installations which require cables, you can connect the drive as illustrated in Figure 3.

Signal connector Power connector Signal cable Power cable Figure 3. Attaching SATA cabling Each cable is keyed to ensure correct orientation. 20 Momentus 7200.2 SATA Product Manual, Rev. E 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). · Four (4) threads (0.080 inches) minimum screw engagement recommended.

3.957 +/- .010 (100.5 +/- .254) .138 +/- .015 (3.505 +/- .381) .528 +/- .
015 (13.411 +/- .381) 0.490 +/- .010 (12.
446 +/- .254) 0.680 +/- .010 (17.27 +/- .
254) Breather Hole Do not cover or seal. 2.750 +/- .010 (69.85 +/- .254) inches (mm) Recommended case temp. measurement location 3.567 (90.602) .551 (13.

99) 2X M3 X 0.5-6H Mounting holes Both sides .12 min. full thread .374 +/- .0078 (9.5 +/- .2) 2X .118 Both sides 3.567 (90.
60) .551 (13.99) 4X M3 X 0.5-6H Mounting holes .10 min.
full thread 2.430 (61.722) .160 (4.06) Figure 4.

Drive dimensions Momentus 7200.2 SATA Product Manual, Rev. E 21 22 Momentus 7200.2 SATA Product Manual, Rev. E 4.0 Serial ATA (SATA) interface These drives use the industry-standard Serial ATA interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 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 7200.2 SATA drives incorporate connectors which enable you to hot plug these drives in accordance with the Serial ATA: High Speed Serialized AT Attachment specification revision 2.0. This specification can be downloaded from http://www.serialata.com. 4.2 Serial ATA device plug connector pin definitions Table 7 summarizes the signals on the Serial ATA interface and power connectors.. Table 7: 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 7200.
2 SATA Product Manual, Rev. E 23 Table 7: 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 pints and the other ground pins. · the signal pins and the rest of the power pins. 3. There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration. 4.

All used voltage pins (Vx) must be terminated. 24 Momentus 7200.2 SATA Product Manual, Rev. E 4.3 Supported ATA commands The following table lists Serial ATA standard commands that the drive supports. For a detailed description of the ATA commands, refer to the Serial ATA: High Speed Serialized AT Attachment specification. See "S.M.A.R.
T. commands" on page 31.for details and subcommands used in the S.M.A.
R.T. implementation. Command name ATA-standard commands Device Configuration Restore Device Configuration Freeze Lock Device Configuration Identify Device Configuration Set Download Microcode Execute Device Diagnostics Flush Cache Flush Cache Extended Identify Device Initialize Device Parameters Read Buffer Read DMA Read DMA Extended Read DMA without Retries Read Long with Retries Read Long without Retries Read Multiple Read Multiple Extended Read Native Max Address Read Native Max Address Extended Read Sectors Read Sectors Extended Read Sectors without Retries Read Verify Sectors Read Verify Sectors Extended Read Verify Sectors without Retries Seek Set Features Set Max Address Note: Individual Set Max commands are identified by the value placed in the Set Max Features register as defined to the right. B1h/C0h B1h/C1h B1h/C2h B1h/C3h 92h 90h E7h EAh ECh 91h E4h C8h 25h C9h 22h 23h C4h 29h F8h 27h 20h 24h 21h 40h 42h 41h 70h EFh F9h Address: Password: Lock: Unlock: Freeze Lock: 00H 01H 02H 03H 04H Command code (in hex) Momentus 7200.
2 SATA Product Manual, Rev. E 25 Command name Set Multiple Mode S.M.A.R.T. Disable Operations S.M.A.R.

T. Enable/Disable Autosave S.M.A.R.T. Enable Operations S.M.A.R.
T. Enable/Disable Auto Offline S.M.A.R.
T. Enable One Attribute Modification S.M.A.R.
T. Execute Offline S.M.A.R.T. Free Fall Protection Host Interface S.M.A.R.

T. Read Attribute Thresholds S.M.A.R.T. Read Data S.M.A.R.
T. Read Log Sector S.M.A.R.
T. Return Status S.M.A.R.
T. Save Attribute Values S.M.A.R.T. Write Attribute Thresholds S.M.A.R.

T. Write Attribute Values S.M.A.R.T. Write Log Sector Write Buffer Write DMA Write DMA Extended Write DMA without Retries Write Long with Retries Write Long without Retries Write Multiple Write Sectors Write Sectors Extended ATA-standard power-management commands Check Power Mode Idle Idle Immediate Sleep Standby Standby Immediate Command code (in hex) C6h B0h/D9h B0h/D2h B0h/D8h B0h/DBh B0h/E0h B0h/D4h FEh B0h/D1h B0h/D0h B0h/D5h B0h/DAh B0h/D3h B0h/D7h B0h/E1h B0h/D6h E8h CAh 35h CBh 32h 33h C5h 30h, 31h 34h 98h or E5h 97h or E3h 95h or E1h 99h or E6h 96h or E2h 94h or E0h ATA-standard security commands Security Set Password Security Unlock Security Erase Prepare F1h F2h F3h 26 Momentus 7200.2 SATA Product Manual, Rev. E Command name Security Erase Unit Security Freeze Lock Security Disable Password Command code (in hex) F4h F5h F6h 4.3.
1 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 on page 27. All reserved bits or words should be set to zero. Parameters listed with an "x" are drive-specific or vary with the state of the drive. See Section 2.
0 on page 3 for default parameter settings. The following commands contain drive-specific features that may not be included in the Serial ATA specification. Word Description 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) 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 ST9200420ASG ST9200420AS ST9160823ASG ST9160823AS ST9120823AS ST9100821AS ST980813ASG ST980813AS 8010H 0000H 2F00H 0000H 47 48 49 50 (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 Momentus 7200.2 SATA Product Manual, Rev.
E 27 Word 51 52 53 54 55 56 5758 59 6061 Description 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 Current capacity in sectors Number of sectors transferred during a Read Multiple or Write Multiple command Total number of user-addressable LBA sectors available (see Section 2.2 for related information) Value 0200H 0200H 0007H xxxxH xxxxH xxxxH xxxxH xxxxH ST9200420AS = 390,721,968 ST9200420ASG = 390,721,968 ST9160823AS = 312,581,808 ST9160823ASG = 312,581,808 ST9120823AS = 234,441,648 ST9100821AS = 195,371,568 ST980813AS = 156,301,488 ST980813ASG = 156,301,488 0000H xx07H 0003H 0078H 0078H 00F0H 0078H 0000H 0000H 0000H 003EH 0000H 306BH 4001H 4000H 30xxH 0001H 4000H xx3FH 0000H 62 63 64 65 66 67 68 6974 75 7679 80 81 82 83 84 85 86 87 88 89 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 ATA-reserved 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 28 Momentus 7200.2 SATA Product Manual, Rev. E Word 90 92 93 94 9599 100 103 Description Enhanced security erase time Master password revision code 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.

Value 0000H FFFEH xxxxH xxxxH 0000H ST9200420AS = 390,721,968 ST9200420ASG = 390,721,968 ST9160823AS = 312,581,808 ST9160823ASG = 312,581,808 ST9120823AS = 234,441,648 ST9100821AS = 195,371,568 ST980813AS = 156,301,488 ST980813ASG = 156,301,488 0000H 1 = Free Fall Protection supported 0 = Free Fall Protection not supported 1 = Free Fall Protection feature is enabled 0 = Free Fall Protection feature is disabled 0000H 0001H xxxxH 0000H xxA5H 104 118 119 120 121 127 128 129 159 160 254 255 ATA-reserved Free Fall Protection support (bit 5) Free Fall Protection enable/disable (bit 5) ATA-reserved Security status Seagate-reserved ATA-reserved Integrity word 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 Bit 0 1 2 3 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. 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. Momentus 7200.2 SATA Product Manual, Rev. E 29 4 8 9 10 11 12 13 Bit 13 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. Word 93 1 = 80-conductor cable detected, CBLID above VIH 0 = 40-conductor cable detected, CBLID below VIL 4.3.2 Set Features command This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt.
If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows: Table 8: 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 41H 55H 82H AAH Enable the Free Fall Protection feature (default on ST9160823ASG and ST980813ASG models) (C1H below disables the Free Fall Protection feature) Disable read look-ahead (read cache) feature. Disable write cache Enable read look-ahead (read cache) feature (default). 30 Momentus 7200.2 SATA Product Manual, Rev.

E Table 8: C1H F1H Set Features command values Disable the Free Fall Protection feature (41H above enables the Free Fall Protection feature) 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. S.M.A.R.T. commands 4.3.3 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 9: 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) S.M.A.
R.T. Read Log Sector S.M.A.
R.T. Write Log Sector 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 D5H D6H 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. Momentus 7200.2 SATA Product Manual, Rev. E 31 32 Momentus 7200.2 SATA Product Manual, Rev. @@@@@@@@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.
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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 USA, Canada, and Mexico 1-800-SEAGATE Data Recovery Services Call Center USA, Canada, and Mexico Direct dial +1-405-324-4700 Toll-free 1-800-475-01435 Direct dial +1-905-474-2162 FAX 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. 34 Momentus 7200.

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