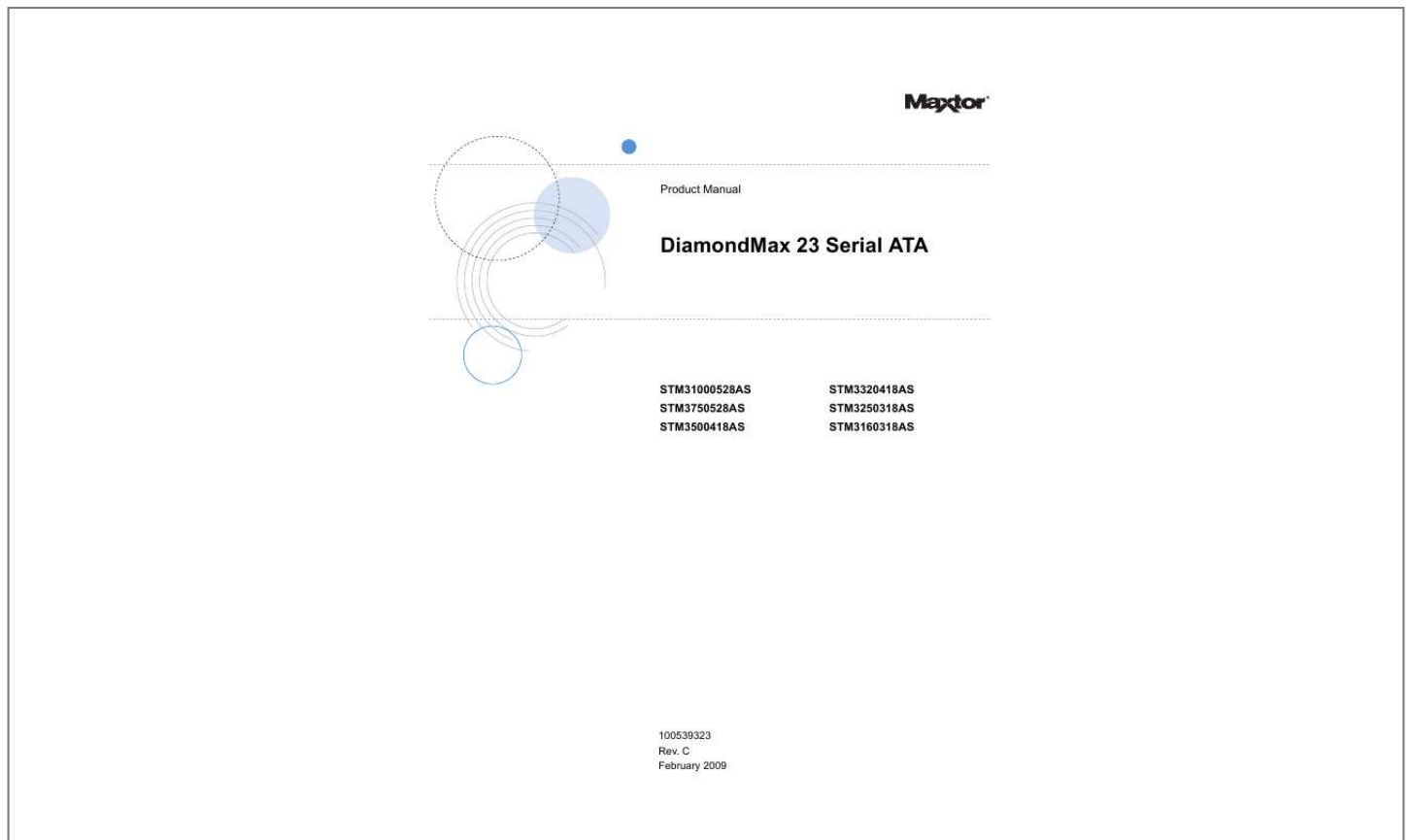




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You can read the recommendations in the user guide, the technical guide or the installation guide for MAXTOR DIAMONDMAX 23 SERIAL ATA. You'll find the answers to all your questions on the MAXTOR DIAMONDMAX 23 SERIAL ATA in the user manual (information, specifications, safety advice, size, accessories, etc.). Detailed instructions for use are in the User's Guide.

User manual MAXTOR DIAMONDMAX 23 SERIAL ATA
User guide MAXTOR DIAMONDMAX 23 SERIAL ATA
Operating instructions MAXTOR DIAMONDMAX 23 SERIAL ATA
Instructions for use MAXTOR DIAMONDMAX 23 SERIAL ATA
Instruction manual MAXTOR DIAMONDMAX 23 SERIAL ATA



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Manual abstract:

B Rev. C 02/05/09 02/12/09 02/20/09 Initial release. 5-7, 9-10, 12 & 14. @@All rights reserved. Printed in U.S.A. Publication number: 100539323, Rev. @@DiamondMax, MaxBlast, Maxtor and the Maxtor logo are either trademarks or registered trademarks of Seagate Technology LLC or one of its affiliated companies in the United States and/or other countries. All other trademarks or registered trademarks are the property of their respective owners.

When referring to hard drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Seagate reserves the right to change, without notice, product offerings or specifications.

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Serial ATA (SATA) interface

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Serial ATA was designed to allow you to install a Serial ATA host adapter and Serial ATA disk drive in your current system and expect all of your existing applications to work as normal. The Serial ATA interface connects each disk 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 International Organization: Serial ATA Revision 2.6". The specification can be downloaded from www.sata-io.org. 2 DiamondMax 23 Serial ATA Product Manual, Rev.

C 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 following drive models: STM31000528AS STM3750528AS Specification summary tables The specifications listed in the following tables are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual. STM3500418AS STM3320418AS STM3250318AS STM3160318AS DiamondMax 23 Serial ATA Product Manual, Rev. C 3 Table 1: Drive specifications summary for 1000 and 750 Gbyte models STM31000528AS 1000 Gbytes 1,953,525,168 4 2 512 63 16 16,383 1413 kbits/in max 236 ktracks/in avg 329 Gbits/in2 avg 7,200 RPM 1695 Mbytes/sec max 125 Mbytes/sec max 300 Mbytes/sec max PIO modes 04 Multiword DMA modes 02 Ultra DMA modes 06 32 Mbytes 26.1 mm (1.028 inches) 101.6 mm (4.000 inches) +/- 0.010 inches 146.99 mm (5.770 inches) max at 2 msec 350 Gs max at 2 msec STM3320418AS 320 Gbytes 625,142,448 Drive specification Formatted capacity (512 bytes/sector)* Guaranteed sectors Heads Discs Bytes per sector Default sectors per track Default read/write heads Default cylinders Recording density Track density Areal density Spindle speed Internal data transfer rate Sustained data transfer rate OD I/O data-transfer rate ATA data-transfer modes supported Cache buffer Height (max) Width (max) Length (max) Weight (typical) Average latency Power-on to ready Standby to ready Track-to-track seek time Average seek, read Average seek, write Startup current (typical) 12V (peak) Voltage tolerance (including noise) Ambient temperature Temperature gradient Relative humidity Relative humidity gradient Wet bulb temperature Altitude, operating Altitude, nonoperating (below mean sea level, max) Operational Shock Non-Operational Shock 6 DiamondMax 23 Serial ATA Product Manual, Rev. C Drive specification Vibration, operating STM3500418AS 222 Hz: 0.25 Gs, Limited displacement 22350 Hz: 0.

50 Gs 350500 Hz: 0.25 Gs 522 Hz: 2.0 Gs 22350 Hz: 5.0 Gs 350500 Hz: 2.0 Gs 2.

6 bels (typical) 2.7 bels (max) 2.8 bels (typical) 3.0 bels (max) 1 per 1014 bits read 0.32% STM3320418AS Vibration, nonoperating Drive acoustics, sound power Idle** Seek Nonrecoverable read errors Annualized Failure Rate (AFR) Warranty To determine the warranty for a specific drive, use a web browser to access the following web page: support.seagate.com/customer/warranty_validation.jsp From this page, click on the "Verify Your Warranty" link. @@The system will display the warranty information for your drive. 50,000 at 25°C, 50% rel.

humidity Yes Contact start-stop cycles Supports Hotplug operation per the 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 power to operational levels. DiamondMax 23 Serial ATA Product Manual, Rev.

C 7 Table 3: Drive specifications summary for 250 and 160 Gbyte models STM3250318AS 250 Gbytes 488,397,168 1 1 512 63 16 16,383 1413 kbits/in max 236 ktracks/in avg 329 Gbits/in2 avg 7,200 RPM 1695 Mbytes/sec max 125 Mbytes/sec max 300 Mbytes/sec max PIO modes 04 Multiword DMA modes 02 Ultra DMA modes 06 8 Mbytes 19.98 mm (0.787 inches) 101.6 mm (4.000 inches) +/- 0.010 inches 146.99 mm (5.787 inches) 415 grams (0.915 lb.) 4.

16 msec <8.5 sec max <8.5 sec max <1.0 msec typical read; <1.2 msec typical write <8.5 msec typical <9.5 msec typical 2.0 amps 5V +10% / -7.5% 12V +10% / -7.5% 0° to 60°C per hour max (operating) 40° to 70°C per hour max (nonoperating) 20°C per hour max (operating) 30°C per hour max (nonoperating) 5% to 95% (operating) 5% to 95% (nonoperating) 30% per hour max 37.

7°C max (operating) 40.0°C max (nonoperating) 304.8 m to 3,048 m (1000 ft. to 10,000+ ft.) 304.8 m to 12,192 m (1000 ft. to 40,000+ ft.) 70 Gs max at 2 msec 350 Gs max at 2 msec STM3160318AS 160 Gbytes 312,581,808 Drive specification Formatted capacity (512 bytes/sector)* Guaranteed sectors Heads Discs Bytes per sector Default sectors per track Default read/write heads Default cylinders Recording density Track density Areal density Spindle speed Internal data transfer rate Sustained data transfer rate OD I/O data-transfer rate ATA data-transfer modes supported Cache buffer Height (max) Width (max) Length (max) Weight (typical) Average latency Power-on to ready Standby to ready Track-to-track seek time Average seek, read Average seek, write Startup current (typical) 12V (peak) Voltage tolerance (including noise) Ambient temperature Temperature gradient Relative humidity Relative humidity gradient Wet bulb temperature Altitude, operating Altitude, nonoperating (below mean sea level, max) Operational Shock Non-Operational Shock 8 DiamondMax 23 Serial ATA Product Manual, Rev.



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C Drive specification Vibration, operating STM3250318AS 222 Hz: 0.25 Gs, Limited displacement 22350 Hz: 0.

50 Gs 350500 Hz:: 0.25 Gs 522 Hz: 2.0 Gs 22350 Hz: 5.0 Gs 350500 Hz:: 2.0 Gs 2.

6 bels (typical) 2.7 bels (max) 2.8 bels (typical) 3.0 bels (max) 1 per 1014 bits read 0.32% STM3160318AS Vibration, nonoperating Drive acoustics, sound power Idle** Seek Nonrecoverable read errors Annualized Failure Rate (AFR) Warranty To determine the warranty for a specific drive, use a web browser to access the following web page: support.

seagate.com/customer/warranty_validation.jsp From this page, click on the "Verify Your Warranty" link. @@The system will display the warranty information for your drive. 50,000 at 25°C, 50% rel. humidity Yes Contact start-stop cycles Supports Hotplug operation per the 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 power to operational levels. DiamondMax 23 Serial ATA Product Manual, Rev. C 9 2.1 Model Formatted capacity Formatted capacity* 1000 Gbytes 750 Gbytes 500 Gbytes 320 Gbytes 250 Gbytes 160 Gbytes Guaranteed sectors 1,953,525,168 1,465,149,168 976,773,168 625,142,448 488,397,168 312,581,808 512 Bytes per sector STM31000528AS STM3750528AS STM3500418AS STM3320418AS STM3250318AS STM3160318AS *One Gbyte equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. 2.1.

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.

2 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. 2.3 Interface Recording and interface technology Serial ATA (SATA) Perpendicular 1413 236 329 7,200 ± 0.2% 1695 125 300 Recording method Recording density (kbits/inch max) Track density (ktracks/inch avg) Areal density (Gbits/inch² avg) Spindle speed (RPM) Internal data transfer rate (Mbits/sec max) Sustained data transfer rate (Mbytes/sec max) I/O data-transfer rate (Mbytes/sec max) 10 DiamondMax 23 Serial ATA Product Manual, Rev. C 2.

4 Physical characteristics 26.1 mm (1.028 inches) 19.98 mm (0.787 inches) 101.6 mm (4.000 +/- 0.010 inches) 146.99 mm (5.787 inches) Maximum height (1000 and 750 GB models) Maximum height (500, 320, 250 and 160 GB models) Maximum width Maximum length Typical weight 1000 and 750 GB models 500, 320, 250 and 160 GB models Cache buffer 1000 - 750 GB models 500 and 320 GB models 250 and 160 GB models 622 grams (1.

371 lbs) 415 grams (0.915 lbs) 32 Mbytes (32,768 kbytes) 16 Mbytes (16,384 kbytes) 8 Mbytes (16,384 kbytes) 2.5 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 Average latency: Read <1.0 <8.5 4.16 Write <1.

2 <9.5 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.

2.6 Start/stop times 1000 and 750 GB models 500, 320, 250 and 160 GB models <8.5 <8.5 10 Power-on to Ready (typ / max sec) Standby to Ready (typ / max sec) Ready to spindle stop (typ / max sec) <10.0 <10.

0 DiamondMax 23 Serial ATA Product Manual, Rev. C 11 2.7 Power specifications The drive receives DC power (+5V or +12V) through a native SATA power connector. See Figure 2 on page 22. 2.7.1 Power consumption Power requirements for the drives are listed in the table on page 9. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

· Spinup power Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed. · Read/write power and current Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-msec delay, then a 16-sector read followed by a 32-msec delay. · Operating power and current Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode. · Idle mode power Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location. · Standby mode During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode. Table 4: DC power requirements Avg (watts 25° C) -- 5.0 5.40 6.57 0.79 0.

79 Avg 5V typ amps -- 0.168 0.153 0.496 0.35 0.

35 Avg 12V typ amps 2.0 (peak) 0.337 0.387 0.341 0.

01 0.01 Power dissipation (2-disc values shown) Spinup Idle* Idle* (with offline activity) Operating Standby Sleep Table 5: DC power requirements Avg (watts 25° C) -- 4.60 4.50 6.19 0.79 0.79 Avg 5V typ amps -- 0.378 0.250 0.656 0.

35 0.35 Avg 12V typ amps 2.0 (peak) 0.224 0.240 0.243 0.01 0.01 Power dissipation (1-disc values shown) Spinup Idle* Idle* (with offline activity) Operating 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 5W IDLE with DIPLM Enabled 12 DiamondMax 23 Serial ATA Product Manual, Rev. C 2.7.

2 Conducted noise Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line. · Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10 MHz.



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· Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10 MHz. Note. Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

2.7.3 Voltage tolerance (including noise): 5V +10% / -7.5% 12V +10% / -7.5% 2.7.4 Power-management modes The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes: Power modes Active Idle Standby Sleep Heads Tracking Tracking Parked Parked Spindle Rotating Rotating Stopped Stopped Buffer Enabled Enabled Enabled Disabled · Active mode The drive is in Active mode during the read/write and seek operations. · Idle mode The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

· Standby mode The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary. · Sleep mode The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact. · Idle and Standby timers Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary. DiamondMax 23 Serial ATA Product Manual, Rev. C 13 2.8 2.

8.1 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 69°C (156°F) within the operating ambient conditions. Operating: Nonoperating: 0° to 60°C (32° to 140°F) 40° to 70°C (40° to 158°F) 2.8.

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: 2.8.3 2.8.3.1 Operating: Humidity Relative humidity 5% to 95% noncondensing (30% per hour max) 5% to 95% noncondensing (30% per hour max) Nonoperating: 2.8.3.2 Operating: Wet bulb temperature 37.7°C (99.

9°F max) 40°C (104°F max) Nonoperating: 2.8.4 Operating: Altitude 304.8 m to 3,048 m (1000 ft. to 10,000+ ft.) 304.8 m to 12,192 m (1000 ft. to 40,000+ ft.) Nonoperating: 14 DiamondMax 23 Serial ATA Product Manual, Rev. C 2.

8.5 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. 2.8.

5.1 Operating shock These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 70 Gs based on half-sine shock pulses of 2 msec during read operations. Shocks should not be repeated more than two times per second. 2.8.

5.2 Nonoperating shock 1000 and 750 GB models The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration. 500, 320, 250 and 160GB models The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration. 2.8.6 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. 2.8.6.

1 Operating vibration The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below. 222 Hz 22350 Hz 350500 Hz 0.25 Gs (Limited displacement) 0.50 Gs 0.25 Gs 2.8.6.2 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. 522 Hz 22350 Hz 350500 Hz 2.0 Gs (limited displacement) 5.

0 Gs 2.0 Gs DiamondMax 23 Serial ATA Product Manual, Rev. C 15 2.9 Acoustics Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779.

Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward. Note. For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation: (Number of seeks per second) = 0.

4 / (average latency + average access time) Table 6: Fluid Dynamic Bearing (FDB) motor acoustics Idle* Seek 2.8 bels (typ) 3.0 bels (max) All models 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.

2.9.1 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 this threshold curve (originated in ISO 389-7) 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. 2.10

Electromagnetic immunity When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in the following table: Table 7: Test Electrostatic discharge Radiated RF immunity Electrical fast transient Surge immunity Conducted RF immunity Voltage dips, interrupts 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.



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5 kV on external I/O ± 1 kV differential, ± 2 kV common, AC mains 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 61000-4-11: 94 B B 150 kHz to 80 MHz, 3 Vrms, 80% AM with 1 kHz sine A 0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds C C C B 16 DiamondMax 23 Serial ATA Product Manual, Rev.

C 2.11 2.11.1 Reliability Annualized Failure Rate (AFR) and Mean Time Between Failures (MTBF) The product shall achieve an Annualized Failure Rate (AFR) of 0.32% (MTBF of 0.

75 million hours) when operated in an environment of ambient air temperatures of 25°C. Operation at temperatures outside the specifications in Section 2.8 may increase the product AFR (decrease MTBF). AFR and MTBF are population statistics that are not relevant to individual units. AFR and MTBF specifications are based on the following assumptions for desktop personal computer environments: · 2400 power-on-hours per year.

· 10,000 average motor start/stop cycles per year. · Operations at nominal voltages. · Temperatures outside the specifications in Section 2.8 may reduce the product reliability. · Normal I/O duty cycle for desktop personal computers. Operation at excessive I/O duty cycle may degrade product reliability. The desktop personal computer environment of power-on-hours, temperature, and I/O duty cycle affect the product AFR and MTBF. · The system will display the warranty information for your drive. · 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. · 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. 18 DiamondMax 23 Serial ATA Product Manual, Rev.

C 2.13 Environmental protection Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances. 2.13.1 European Union Restriction of Hazardous Substances (RoHS) Directive 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. 2.13.2 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 2.14 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. DiamondMax 23 Serial ATA Product Manual, Rev. C 19 20 DiamondMax 23 Serial ATA Product Manual, Rev. C 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: · Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure. · Handle the drive by its edges or frame only.

· The drive is extremely fragile--handle it with care. Do not press down on the drive top cover. · Always rest the drive on a padded, antistatic surface until you mount it in the computer. · Do not touch the connector pins or the printed circuit board. · Do not remove the factory-installed labels from the drive or cover them with additional labels.

Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination. DiamondMax 23 Serial ATA Product Manual, Rev. C 21 3.

2 Configuring the drive Each drive on the Serial ATA interface connects point-to-point with the Serial ATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. 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. Both drives behave as if they are Device 0 (master) devices. Serial ATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if you connect the drive and receive a "drive not detected" error, your SATAequipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.



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If you have a motherboard or host adapter that does not support autonegotiation: · Install a jumper as shown in Figure 1 below to limit the data transfer rate to 1.5 Gbits per second (and leave the drive connected to the SATA-equipped motherboard or host adapter that doesn't support autonegotiation) or · Install a SATA host adapter that supports autonegotiation, leave the drive jumper block set to "Normal operation" (see Figure 1 below), and connect the drive to that adapter. This option has the benefit of not limiting the drive to a 1.5 Gbits/sec transfer rate.

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 1. Serial ATA connectors 3.3 Serial ATA cables and connectors The Serial ATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See Table 8 for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host. For direct backplane connection, the drive connectors are inserted directly into the host receptacle.

The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable. For installations which require cables, you can connect the drive as illustrated in Figure 2. Signal connector Power connector Signal cable Power cable Figure 2. Attaching SATA cabling Each cable is keyed to ensure correct orientation. DiamondMax 23 Serial ATA drives support latching SATA connectors.

22 DiamondMax 23 Serial ATA Product Manual, Rev. C 3.4 Drive mounting You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 3 for drive mounting dimensions. Follow these important mounting precautions when mounting the drive: · Allow a minimum clearance of 0.

030 inches (0.76 mm) around the entire perimeter of the drive for cooling. · Use only 6-32 UNC mounting screws. · The screws should be inserted no more than 0.150 inch (3.81 mm) into the bottom or side mounting holes. · Do not overtighten the mounting screws (maximum torque: 6 inch-lb). Recommended case temperature measurement location Figure 3. Mounting dimensions (1000 and 750 GB models) DiamondMax 23 Serial ATA Product Manual, Rev. C 23 Recommended case temperature measurement location Figure 4.

Mounting dimensions (500, 320, 250 and 160 GB models) 24 DiamondMax 23 Serial ATA Product Manual, Rev. C 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. For detailed information about the Serial ATA interface, refer to the "Serial ATA: High Speed Serialized AT Attachment" specification. 4.1 Hot-Plug compatibility DiamondMax 23 Serial ATA drives incorporate connectors which enable you to hot plug these drives in accordance with the Serial ATA Revision 2.6 specification. This specification can be downloaded from www.serialio.org. DiamondMax 23 Serial ATA Product Manual, Rev. C 25 4.2 Serial ATA device plug connector pin definitions Table 8 summarizes the signals on the Serial ATA interface and power connectors..

Table 8: 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 P1 P2 P3 P4 P5 P6 P7 V33 V33 V33 Ground Ground Ground V5 V5 V5 Ground Ground or LED signal Ground V12 V12 V12 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 If grounded, drive does not use deferred spin 1st mate. 12V power, pre-charge, 2nd mate 12V power 12V power 2nd mate Differential signal pair B from Phy Definition 2nd mate Differential signal pair A from Phy Signal S7 Power P8 P9 P10 P11 P12 P13 P14 P15 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. 26 DiamondMax 23 Serial ATA Product Manual, Rev. C 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 International Organization: Serial ATA Revision 2.6 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 34 for details and subcommands used in the S.M.A.R.T. implementation. Table 9: Supported ATA commands Command code (in hex) E5H B1H / C1H B1H / C2H B1H / C0H B1H / C3H 08H 92H 90H E7H EAH 50H ECH E3H E1H 91H E4H C8H 25H C9H 2FH C4H 29H F8H 27H 20H 24H 21H 40H 42H 41H 10H F6H F3H Command name Check Power Mode Device Configuration Freeze Lock Device Configuration Identify Device Configuration Restore Device Configuration Set Device Reset Download Microcode Execute Device Diagnostics Flush Cache Flush Cache Extended Format Track Identify Device Idle Idle Immediate Initialize Device Parameters Read Buffer Read DMA Read DMA Extended Read DMA Without Retries Read Log Ext 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 Recalibrate Security Disable Password Security Erase Prepare DiamondMax 23 Serial ATA Product Manual, Rev. C 27 Command name Security Erase Unit Security Freeze Security Set Password Security Unlock Seek Set Features Set Max Address Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right. Set Max Address Extended Set Multiple Mode Sleep 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. Execute Offline 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 Log Sector Standby Standby Immediate Write Buffer Write DMA Write DMA Extended Write DMA FUA Extended Write DMA Without Retries Write Log Extended Write Multiple Write Multiple Extended Write Multiple FUA Extended Write Sectors Write Sectors Without Retries Write Sectors Extended Command code (in hex) F4H F5H F1H F2H 70H EFH F9H Address: Password: Lock: Unlock: Freeze Lock: 37H C6H E6H B0H / D9H B0H / D2H B0H / D8H B0H / D4H B0H / D1H B0H / D0H B0H / D5H B0H / DAH B0H / D3H B0H / D6H E2H E0H E8H CAH 35H CDH CBH 3FH C5H 39H CEH 30H 31H 34H 00H 01H 02H 03H 04H 28 DiamondMax 23 Serial ATA Product Manual, Rev.

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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 Table 9 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) (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 54-58, 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 8010H 0000H 2F00H 0000H 0200H 0007H xxxH xxxH xxxH xxxH xxxH Value 0 0C5AH 1 2 3 4 5 6 7 9 1019 20 21 22 2326 2746 47 48 49 50 51 52 53 54 55 56 5758 59 16,383 0000H 16 0000H 0000H 003FH 0000H ASCII 0000H 0400H 0000H x.xx DiamondMax 23 Serial ATA Product Manual, Rev. C 29 Word Description Total number of user-addressable LBA sectors available (see Section 2.1 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137 Gbytes). Drives with capacities over 137 Gbytes will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature. 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 Reserved for future Serial ATA definition Serial ATA features supported Serial ATA features enabled Major version number Minor version number Command sets supported Command sets supported Command sets supported extension (see note following this table) 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 Hardware reset value ATA-reserved Total number of user-addressable LBA sectors available (see Section 2.

1 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh. Value 60-61 0FFFFFFFh* 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 93 9599 0000H xx07H 0003H 0078H 0078H 00F0H 0078H 0000H 0000H xxxH xxxH xxxH xxxH 003EH 0000H 364BH 7C03H 4003H See Word 108-111 note. (4003H = 0100000000000011 binary) 30xxH 0001H 4000H xx3FH 0000H 0000H FFEH xxxH 0000H STM31000528AS = 1,953,525,168 STM3750528AS = 1,465,149,168 STM3500418AS = 976,773,168 STM3320418AS = 625,142,448 STM3250318AS = 488,397,168 STM3160318AS = 312,581,808 100103 30 DiamondMax 23 Serial ATA Product Manual, Rev. C Word 104107 108111 Description ATA-reserved The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support. ATA-reserved Security status Seagate-reserved ATA-reserved Integrity word Value 0000H Each drive will have a unique value. 0000H 0001H xxxH 0000H xxA5H 112127 128 129159 160254 255 Note. Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported Note.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data. Description (if bit is set to 1) Bit 0 1 2 8 9 10 Bit 0 1 2 3 4 5 6 7 8 9-10 11-12 13 14 15 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 84 SMART error loggin is supported. SMART self-test is supported. Media serial number is supported.

Media Card Pass Through Command feature set is supported. Streaming feature set is supported. GPL feature set is supported. WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported. WRITE DMA QUEUED FUA EXT command is supported. 64-bit World Wide Name is supported. Obsolete. Reserved for TLC. IDLE IMMEDIATE command with IUNLOAD feature is supported. Shall be set to 1.

Shall be cleared to 0. DiamondMax 23 Serial ATA Product Manual, Rev. C 31 Bit 0 1 2 3 4 5 6 8 9 10 11 12 13 14 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 5 is supported. Ultra DMA mode 6 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.

Ultra DMA mode 6 is currently active. 32 DiamondMax 23 Serial ATA Product Manual, Rev. C 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 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 10H 55H 82H 90H AAH F1H Enable use of SATA features Disable read look-ahead (read cache) feature.



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Disable write cache Disable use of SATA features 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. DiamondMax 23 Serial ATA Product Manual, Rev. C 33 4.3.3 S.M.A.R.T. commands S.

M.A.R.T. provides near-term failure prediction for disk 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. @@ 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 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 S.M.A.

R.T. Enable Operations S.M.A.

R.T. Disable Operations S.M.A.R.T. @@@@ @Presales Support: Presales@Seagate.com Technical Support: DiscSupport@Seagate.com Warranty Support: [\[seagate.com/www/en-us/support/warranty_&_returns_assistance\]\(http://seagate.com/www/en-us/support/warranty_&_returns_assistance\) mySeagate my.seagate.com is the industry's first Web portal designed specifically for OEMs and distributors. It provides self-service access to critical applications, personalized content and the tools that allow our partners to manage their Seagate account functions. Submit pricing requests, orders and returns through a single, passwordprotected Web interface-anytime, anywhere in the world. \[spp.seagate.com\]\(http://spp.seagate.com\) spp.seagate.](http://www.</p></div><div data-bbox=)

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