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User manual MAXTOR ST3491A
User guide MAXTOR ST3491A
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Instruction manual MAXTOR ST3491A



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ST3491 Family:

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ST3250A, ST3291A

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ST3391A, ST3491A

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AT Interface Drives

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Product Manual



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Manual abstract:

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... AT Interface Drives ..

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1 Formatted capacity The drive is low-level formatted at the factory. You cannot low-level format the drive. ST3250A Formatted capacity (Mbytes*) Total sectors 213.9 417,792 ST3391A Formatted capacity (Mbytes*) Total sectors 341.3 666,624 ST3291A 272.

7 532,700 ST3491A 428.1 836,070 * One megabyte equals one million bytes. 1.1.1 Physical organization ST3250A ST3291A 4 2 ST3491A 4 2 Heads Discs 2 1 ST3391A Heads Discs 4 2 2 ST3491 Family AT Product Manual, Rev.

B 1.1.2 Recommended logical configuration You can operate the drive using many different logical configurations, provided the number of sectors per track does not exceed 256. However, in DOS the number of sectors per track must be less than or equal to 63. When establishing the logical configuration, set the number of sectors per track and the number of heads to satisfy the following relationship: 16 (sectors per track) x (heads) 4,096 When you configure the drive in CMOS, the total sectors cannot exceed the physical capacity of the drive. The total sectors is determined by the following formula: total sectors = (logical heads) x (logical sectors per track) x (logical cylinders) To maximize the capacity of the drive, the following geometry is recommended: ST3250A Cylinders Heads Sectors per track 1,024 12 34 ST3391A Cylinders Heads Sectors per track 768 14 62 ST3291A 761 14 50 ST3491A 899 15 62 The drive is configured in translation mode. You can verify the number of cylinders, sectors per track and heads by using the Identify Drive (ECH) command. See the Seagate ATA Interface Reference Manual, publication number 36111-xxx, for details about the Identify Drive command. 1.2 Drive dimensions Height (max) Width (max) Depth (max) Weight (max) 1.

00 inch (25.4 mm) 4.02 inches (102.1 mm) 5.77 inches (146.6 mm) 1.3 lb (0.59 Kg) ST3491 Family AT Product Manual, Rev. B 3 1.2.

1 Interface Functional specifications AT 18.7 to 32* 11.1** 3,811 120 RLL (1,7) 512 55,200 41,400 3,081 Internal data transfer rate (Mbits/sec) External data transfer rate (Mbytes/sec) Spindle speed \pm 0.5% (RPM) SeaCache™ buffer (Kbytes) Zone Bit Recording method Bytes per sector Recording density, max (BPI) Flux density, max (FCI) Track density, max (TPI) * The internal data transfer rate for the ST3491A is 18.7 to 32.

** This is the external data transfer rate during a cache transfer. When the drive is not using the cache, the transfer rate is 5.0 Mbytes per second. 1.3 Reliability The MTBF specification assumes nominal power at sea level with an ambient temperature of 25°C.

Nonrecoverable errors MTBF Contact start-stop (CSS) MTTR Service life 1 per 1013 bits read 300,000 power on hours 40,000 cycles 30 minutes 5 years 1.4 Acoustics Sound pressure is measured at idle from 1 meter above the drive top cover. Sound pressure, typ Sound pressure, max 29 dBA 33 dBA 4 ST3491 Family AT Product Manual, Rev. B 1.5 Seek time All performance measurements are taken using a 25 MHz 486 AT computer (or faster) with a 8.3 MHz I/O bus. The measurements are taken with nominal power at sea level and 25°C ambient temperature. 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. · Full-stroke seek time is one-half the time needed to seek from the first data cylinder to the maximum data cylinder and back to the first data cylinder.

The full-stroke average is determined by measuring 100 full-stroke seeks in both directions.



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Model ST3250A ST3291A ST3391A ST3491A Track-to-track Average typ (msec) typ (msec) 5 5 5 15 13 14 15 Full-stroke typ (msec) 34 32 33 34 Latency (msec) 7.87 7.87 7.87 7.87 1.6 Auto-park Upon power-down, the read/write heads automatically move to the shipping zone. The heads park inside the maximum data cylinder. When power is applied, the heads recalibrate to track 0. 1.

7 Shock and vibration Shock measurements are based on an 11 msec, half sine wave shock pulse, not to be repeated more than twice per second. The specifications in the table below are defined as follows: · During normal operating shock and vibration, the drive sustains no physical damage and reads and writes data without errors. ST3491 Family AT Product Manual, Rev. B 5 · During abnormal operating shock and vibration, the drive sustains no physical damage, but performance is adversely affected. · During nonoperating shock and vibration, the read/write heads are in the shipping zone and the drive sustains no physical damage.

Normal operating Shock 522 Hz vibration 22500 Hz vibration 2 Gs 0.020-inch displacement 0.50 Gs Abnormal operating 10 Gs 0.030-inch displacement 0.75 Gs Nonoperating 75 Gs 0.

160-inch displacement 4.00 Gs 1.8 Environment The acceptable environmental conditions for the drive are specified below. The specifications in this section are defined as follows: · Operating specifications assume that the drive is powered up. · Nonoperating specifications assume that the drive is packaged as it was shipped from the factory. 1.8.1 Ambient temperature 5° to 55°C (41° to 131°F) 40° to 60°C (40° to 140°F) Operating Nonoperating 1.8.2 Temperature gradient 20°C per hour (36°F per hour) 30°C per hour (54°F per hour) Operating (max) Nonoperating (max) 1.

8.3 Relative humidity 8% to 80% noncondensing Maximum wet bulb 29.4°C (85.0°F) 5% to 95% noncondensing Maximum wet bulb 40.0°C (104°F) Operating Nonoperating 6 ST3491 Family AT Product Manual, Rev. B 1.8.4 Altitude 1,000 ft to 10,000 ft (305 m to 3,050 m) 1,000 ft to 40,000 ft (305 m to 12,200 m) Operating Nonoperating 1.9 Power requirements Except during a write operation, you can apply power to the drive or remove power from the drive in any sequence without losing data or damaging the drive. 1.

9.1 Input noise The drive is expected to operate with a maximum of 150 mV peak-to-peak triangular wave injected noise at the power connector. The frequency is 10 Hz to 20 MHz with equivalent resistive loads. +5V Voltage tolerance including noise ± 5% +12V ± 5% ± 10% during spinup 1.9.

2 Start and stop time After 10 seconds, the drive is ready. Typical and maximum start and stop times are shown in the following table. See Figure 1 on page 8 for the typical startup current profile. Typical Start time Stop time 7 sec 6 sec Maximum 10 sec 9 sec ST3491 Family AT Product Manual, Rev. B 7 1.

9.3 Idle and Standby timers The drive can enter the Idle mode or the Standby mode by either of two methods: · The computer sends either the Idle Immediate command or the Standby Immediate command. · The Idle timer or the Standby timer counts down to zero. At power-on, the Idle and Standby timers are disabled; this is the default mode of operation set at the factory. You can set the timer delays using the computer setup utility. If the Idle timer is enabled, each time the drive completes a read, write or seek, the drive reinitializes the Idle timer and it begins counting down from the specified delay to zero. If the Idle timer reaches zero before any drive activity is required, the drive switches to the Idle mode. Then, if the Standby timer is enabled, that timer begins counting down. For details, refer to the Seagate ATA Interface Reference Manual, publication number 36111-xxx. In both the Idle and Standby modes, the drive accepts all commands and returns to the Active mode any time disc access is necessary.

1.9.4 Power-management modes The following power-management modes 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 equipment 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, US Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

ST3491 Family AT Product Manual, Rev. B 11 2.0 Hardware description The ST3491 family drives use the industry-standard AT interface. These drives support 16-bit data transfers and DMA and PIO modes. (See Set Features command description.)

) You can connect up to two drives on the same bus using a daisy-chain cable. 2.1 Handling and static-discharge precautions After you unpack the drive, and before you install it in a computer, be careful not to damage it through mishandling. Observe the following standard handling and static-discharge precautions: Caution: · Keep the drive in its static-shielded bag until you are ready to complete the installation. Do not attach any cables to the drive while it is in its static-shielded bag.

· 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 touch the printed circuit cable between the circuit board and the head/disc assembly. · Avoid wool or synthetic clothing, carpeting, plastics, and Styrofoam; these items cause static discharge. · Do not remove the factory-installed labels from the drive or cover them with additional labels.

If you do, you void the warranty. Some factory-installed labels contain information needed to service the drive. Others are used to seal out dirt and contamination. 12 ST3491 Family AT Product Manual, Rev. B 2.2 Drive mounting You can mount the drive in any orientation using either the bottom or the side mounting holes, as described below.



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The sector buffer parameters for ST3491 family drives are listed in the table below. The Logical Configuration parameters shown below are for the ST3250A.

For a complete description of the Identify Drive command, see the Seagate ATA Interface Reference Manual, publication number 36111-xxx. Word 0 Description Configuration information Bit 10: 1 = disc transfer greater than 10 Mb/sect Bit 6: 1 = fixed drive Bit 4: 1 = head switch time > 15 µsec Bit 3: 1 = not MFM encoded Bit 1: 1 = hard sectored disc Number of fixed cylinders (default logical emulation) 045AH Value 1 2 3 ST3250A: ST3291A: ST3391A: ST3491A: 0000H ST3250A: ST3291A: ST3391A: ST3491A: 8D90H 0248H ST3250A: ST3291A: ST3391A: ST3491A: 0000H 400H 2F9H 300H 383H CH EH EH FH ATA reserved Number of heads (default) 4 5 Number of unformatted bytes per track Number of unformatted bytes per sector Number of sectors per track (default logical emulation) 6 22H 32H 3EH 3EH 79 ATA reserved (vendor unique) continued 26 ST3491 Family AT Product Manual, Rev. B Word 1019 Description Serial number: (20 ASCII characters, 0000H = not specified) Controller type = dual-ported multisector buffer with caching Buffer size (number of 512byte sectors) Number of ECC bytes available (R/W Long) Firmware revision (8 ASCII character string).

Drive model number (40 ASCII characters, padded to end of string) Maximum sectors per interrupt on read/write multiple Double word I/O (not supported) DMA data transfer and IORDY (supported) ATA reserved PIO data transfer cycle timing mode Single word DMA transfer cycle timing mode Bit 0 = 1 indicates the fields reported in words 5458 are valid; Bit 1 = 1 indicates the fields reported in words 648 are valid. Number of cylinders (current emulation mode) Number of heads (current emulation mode) Value Drive-unique value expressed as ASCII characters 0003H 20 21 22 2326 2746 00F0H 0010H (240D) (16D) Drive-dependent string Drive-dependent string: ST3xxxA-xx or ST3xxxA-xxx 0010H 47 48 49 50 51* 52 0000H 0900H 0000H 0200H 0200H 0003H 53 54 55 See Section 1. See Section 1. ST3491 Family AT Product Manual, Rev. B 27 Word 56 5758 59 6061 62 63 64 65 66 67 68 69 127 128 159 160 255 Description Number of sectors per track (current emulation mode) Number of sectors (current emulation mode) Current multiple sector setting LBA total sectors Single word DMA active / modes supported Multiword DMA active / modes supported Advanced PIO modes supported (Mode 3 supported) Minimum multiword DMA transfer cycle time per word Recommended multiword DMA transfer cycle time per word Minimum PIO cycle time without IORDY flow control Minimum PIO cycle time with IORDY * ATA reserved Seagate reserved ATA reserved Value See Section 1.

See Section 1. 01xxH 0000H 0000H 0103H 0001H 96H (150 nsec) 016BH (363 nsec) 016BH (363 nsec) 00B4H 0000H (180 nsec) xxxH 0000H * Cycle times less than 363 nsec require IORDY. 28 ST3491 Family AT Product Manual, Rev. B 3.6.

2 Set Features command (EFH) The Set Features command (command code EFH) is used by the host to establish parameters that affect the execution of certain drive features. To use the command: 1) write the Feature value to the Features register; 2) write the Set Features command to the command register.

Note. If the value in the Features register is not supported or is invalid, the drive posts an Aborted Command error. At power-on, or after a hard reset, the feature selections are restored to the factory default values. If 66H has been set, a software reset will not change the feature selections (this can be canceled by setting CCH). If 66H has not been set, a soft reset will return the settings to the factory defaults. The following table shows alterable features supported by the ST3941 family drives. Where a factory default value exists, that value is listed. Byte 02H 03H 44H 55H 66H 77H 82H 88H AAH BBH CCH Feature description Enable write cache (factory default).

Set value for Set Transfer mode based on value in Sector Count register. Use maximum length of ECC (16 bytes) on read long/write long commands (factory default). Disable read look-ahead feature. Use current settings as default (until hard reset or power off). Disable ECC. Disable write cache (factory default is OFF) Enable ECC (factory default). Enable read look-ahead feature (factory default). 4 bytes of ECC apply on read long/write long commands. Enable reverting to power-on defaults (factory default). ST3491 Family AT Product Manual, Rev.

B 29 3.6.2.1 PIO and DMA Data Transfer Modes The Set Features command can be used to set the type of data transfer mechanism and transfer mode used by the drive. To do this: 1.

Write Set Features command value 03H (Set Data Transfer mode) to the Features register, then 2. Write a Transfer Types value to the Sector Count register.

The upper 5 bits of this value define the type of data transfer, and the low order 3 bits encode the mode value. The following table identifies allowable Transfer Types values: Data Transfer Mechanism Mechanism name PIO Transfer Mode (default: Set PIO Mode 2) PIO Transfer Mode: Set PIO Mode 2 PIO Flow Control Transfer Mode: Set PIO Mode = 0 PIO Flow Control Transfer Mode: Set PIO Mode = 1 PIO Flow Control Transfer Mode: Set PIO Mode = 2 PIO Flow Control Transfer Mode: Set PIO Mode = 3 Multiword DMA Mode Multiword DMA Mode Reserved Notes: 1. If the drive does not support a commanded mode, the drive returns an Aborted Command error.

Mode value 2 2 0 1 2 3 0 1 Transfer Types value Data Lower 3 bits Upper 5 bits 00000 00000 00001 00001 00001 00001 00100 00100 01000 000 001 000 001 010 011 000 001 nnn continued 30 ST3491 Family AT Product Manual, Rev. B 2. If the drive receives a Set Features command with a Mechanism and Mode value of 0000 0001 and the drive supports disabling of IORDY, then the drive sets its default PIO transfer mode and disables IORDY. Reserved values are intended for use in a future specification of an alternative flow control mechanism. 3.6.3 Set Multiple Mode command (C6H) Command code C6H enables the drive to perform Read Multiple and Write Multiple operations and establishes the block count for these commands. It is not required that this command is issued prior to every Read Multiple or Write Multiple command. The Sector Count register is loaded with the number of sectors per block. Drives normally support block sizes of 2, 4, 8 and 16 sectors.

However, other block size values may also be supported, depending on the size of the drive's buffer. Upon receipt of the Set Multiple Mode command, the drive sets BSY=1 and checks the Sector Count register. If the Sector Count register contains a valid value and the block count is supported, the value is loaded for all subsequent Read Multiple and Write Multiple commands and execution of those commands is enabled. If a block count is not supported, an Aborted Command error is posted, and Read Multiple and Write Multiple commands are disabled.



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If the Sector Count register contains 0 when the command is issued, Read and Write Multiple commands are disabled. At power on, or after a hardware reset, the default mode is Read and Write Multiple disabled. If Disable Default has been set in the Features register, then the mode remains the same as that last established prior to a software reset, otherwise it reverts to the default of disabled. 3.6.4 Read Multiple command (C4H) This command (code C4H) is similar to the Read Sectors command.

Interrupts are not generated on every sector, but on the transfer of a block that contains the number of sectors defined by a Set Multiple Mode command. The number of sectors per block to be transferred without intervening interrupts is programmed by the Set Multiple Mode command, which must be executed prior to the Read Multiple command. Interrupts are generated when DRQ is set to 1 at the beginning of each block or partial block. ST3491 Family AT Product Manual, Rev. B 31 When the Read Multiple command is issued, the Sector Count register contains the number of sectors (not the number of blocks or the block count) requested.

@@The partial block transfer is for n sectors, where $n = \text{remainder}(\text{sector count} / \text{block count})$ If the Read Multiple command is attempted before the Set Multiple Mode command has been executed or when Read Multiple commands are disabled, the Read Multiple operation is rejected with an Aborted Command error. Disc errors encountered during Read Multiple commands are posted at the beginning of the block or partial block transfer, but DRQ is still set and the data transfer takes place as it normally would, including transfer of corrupted data, if any. The contents of the Command Block registers, following the transfer of a data block that had a sector in error, are undefined. The host should retry the transfer as individual requests to obtain valid error information. Subsequent blocks or partial blocks are transferred only if the error was a correctable data error.

All other errors cause the command to stop after transfer of the block that contained the error. 3.6.5 Write Multiple command (C5H) This command (command code C5H) is similar to the Write Sectors command. @@@@The partial block transfer is for n sectors, where $n = \text{remainder}(\text{sector count} / \text{block count})$ 32 ST3491 Family AT Product Manual, Rev. B If the Write Multiple command is attempted before the Set Multiple Mode command has been executed or when Write Multiple commands are disabled, the Write Multiple operation is rejected with an aborted command error. Disc errors encountered during Write Multiple commands are posted after the attempted disc write of the block or partial block transferred. The Write command ends with the sector in error, even if it was in the middle of a block. Subsequent blocks are not transferred in the event of an error. Interrupts are generated when DRQ is set to 1 at the beginning of each block or partial block.

The contents of the Command Block registers following the transfer of a data block that had a sector in error are undefined. The host should retry the transfer as individual requests to obtain valid error information. 3.7 Onboard drive diagnostics During startup, the drive executes a series of diagnostic tests. If the diagnostic tests detect an error, the drive LED indicates the nature of the error by emitting a flash code. A subset of the error flash codes are contained in the following table. Number of flashes Irregular flashes 2 3 4 5 Error code description Microprocessor error ROM checksum error External RAM error I/O chip error Buffer RAM error 3.8 ECC performance tests The drive does not report ECC errors when it performs on-the-fly error correction. This allows the drive to correct the data without sacrificing performance. Some older drive diagnostic utilities test the drive's ability to apply ECC by creating small data errors and then checking to see if these errors are reported.

If you run one of these tests on a drive that is functioning properly, the test may report that the drive is failing to detect ECC errors. However, this does not mean that the drive is malfunctioning. ST3491 Family AT Product Manual, Rev. B 33 3.9 Supported BIOS The drive uses 16 bytes of ECC with Read Long and Write Long commands.

If the computer BIOS expects 7 ECC bytes, some drive diagnostics may return false failures (typically time-out errors). If so, you must reconfigure the computer to receive 4 bytes of ECC. The BIOS revisions listed in the following table are fully compatible with the AT interface implemented on the ST3491 family drives. Earlier BIOS revisions than those listed may not fully support the AT interface as implemented on these drives. BIOS manufacturer American Megatrends Award Quadtel Phoenix Phoenix BIOS Version supported Dated 4/9/90 or later 3.

04 or higher Single drive, any version Dual drive, 3.04 or higher ROM BIOS Plus 286, 3.10 or higher ROM BIOS Plus 386, 1.10 or higher 1.00 or higher Seagate Technology, Inc. 920 Disc Drive, Scotts Valley, California 95066, USA Publication Number: 36254-004, Rev. B Printed in USA .



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