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Product Manual

Lyrion Series CE-ATA

ST760211CA
ST730212CA

100441950
Rev. A
May 2008

Revision history

Revision	Date	Sheets affected or comments
Rev. A	05/22/08	Initial release.

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Publication number: 100441950, Rev. A May 2008

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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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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following Seagate® Lyrion® Series CE-ATA drives:

- ST760211CA-60GB, ST730212CA-30GB disc drives with a CE-ATA interface.

These drives provide the following key features.

- 3,600-RPM spindle speed and a 2-Mbyte buffer combined for superior read/write performance.
- Quiet operation. Fluid Dynamic Bearing (FDB) motor.
- Perpendicular recording heads and EPRML technology, which provide the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- 1500 G nonoperating shock, and 500 G operating shock.
- SeaTools™ diagnostic software performs a drive self-test that eliminates unnecessary drive returns.

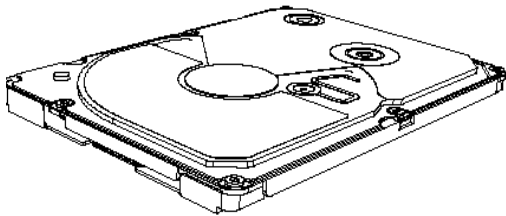


Figure 1. Lyrion Series (CE-ATA interface) disc drive

1.1 Disclaimer

Seagate Technology LLC makes no warranties whatsoever, including any warranty of merchantability, non-infringement, fitness for any particular purpose, or any warranty otherwise arising out of any proposal, specification or sample. Seagate may not be held liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, loss of use, data, or profits; procurement of substitute goods or services; or business interruptions) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way from the use of this kit, even if advised of the possibility of such damage.

1.2 Drive care

Do not use the Lyrion Series disc drives outside of the ranges of environmental conditions found in Section 2.8, "Environmental specifications." Doing so may void the warranty of the Lyrion Series disc drive.

2.0 Drive specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate ST760211CA and ST730212CA model drives.

2.1 Overview

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

Table 1: Specifications

Drive specification	ST760211CA	ST730212CA
Formatted Gbytes	60	30
Guaranteed sectors	117,210,240	58,605,120
Bytes per sector (logical)	512	
Cache (Mbytes)	2	
Recording density, BPI (bits/inch average)	1,025,000	
Track density, TPI (tracks/inch average)	165,000	
Areal density (Gbits/inch ² average)	169	
Spindle speed (RPM)	3,600	
Internal data transfer rate OD (Mbits/sec max)	350	
Sustained data transfer rate OD @ 8bit/52MHz (Mbytes/sec)	24.5	
Sustained data transfer rate OD @ 8bit/26MHz (Mbytes/sec)	18.0	
Height	5.0 + 0.15 mm(0.1968 + 0.006 inches)	
Width	54.0 +/-0.3 mm (2.1260 +/-0.0118 inches)	
Length	71.0 +/-0.3 mm (2.7953 +/-0.0118 inches)	
Weight	48.0 gm - 0.1058 lb. (typ)	
Average latency (msec)	8.3	
Power-on to ready (sec typical)	1.8	
Standby to ready (sec typical)	1.8	
Startup power (peak at 3.3v) (maximum RMS in 10ms window)	1.15 W	
Read/Write power (typical 3.3V)	1.19/1.09 W	

Table 1: Specifications

Drive specification	ST760211CA	ST730212CA
Performance idle power (typical 3.3V)	0.68 W	
Low power idle power (typical 3.3V)	0.48 W	
Standby/Sleep power (typical 3.3V)	0.20 W	
Voltage tolerance (including noise)	3.3V ± 5%	
Ambient temperature	0° to 60°C (operating) -40° to 70°C (nonoperating)	
Temperature gradient (°C per hour max)	20°C (operating) 30°C (nonoperating)	
Relative humidity (noncondensing)	5% to 90% (operating) 5% to 95% (nonoperating)	
Relative humidity gradient	30% per hour max	
Wet bulb temperature (°C max)	33°C (operating) 40°C (nonoperating)	
Altitude, operating	-60.98 m to 3,048 m (-200 ft to 10,000+ ft)	
Altitude, nonoperating (below mean sea level, max)	-60.98 m to 12,192 m (-200 ft to 40,000+ ft)	
Shock, operating (Gs max at 2 msec)	500	
Shock, nonoperating (Gs max at 1 msec)	1500	
Vibration, operating (max displacement may apply below 10 hz)	1.0 Gs (0 to peak, 10–500 Hz) @ 2 oct/min sweep rate	
Vibration, nonoperating (max displacement may apply below 22 hz)	5.0 Gs (0 to peak, 10–500 Hz) @ 0.5 oct/min sweep rate	
Idle sound power (bels) (typical)	1.6	
Operational sound power (bels) (typical)	2.2	
Nonrecoverable read errors	1 per 10 ¹⁴ bits read	
Load/Unload (LUL) cycles	300,000 software-controlled 20,000 power loss	
Warranty	Per agreement	

2.2 Formatted capacity

Model	Formatted capacity	Guaranteed sectors	Bytes per sector (logical)
ST760211CA	60 Gbytes	117,210,240	512
ST730212CA	30 Gbytes	58,605,120	512

LBA mode addressing

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

2.3 Default logical geometry

Model	Cylinders	Heads	Sectors
ST760211CA	116,280	16	63
ST730212CA	58,149	16	63

2.4 Recording and interface technology

Technology	Specification
Interface	CE-ATA
Recording method	Perpendicular Magnetic Recording
Recording density BPI (bits/inch average)	1,025,000
Track density TPI (tracks/inch average)	165,000
Areal density (Gbits/inch ² average)	169
Spindle speed (RPM) ($\pm 0.2\%$)	3,600
Internal data-transfer rate OD (Mbits/sec max)	350
Sustained data transfer rate OD @ 8bit/52MHz (Mbytes/sec)	24.5
Sustained data transfer rate OD @ 8bit/26MHz (Mbytes/sec)	18.0
Cache buffer (Mbytes)	2

2.5 Physical characteristics

Height	(mm) (inches)	5.0 + 0.15 0.1968 + 0.006
Width	(mm) (inches)	54.0 +/-0.3 2.1260 +/-0.0118
Length	(mm) (inches)	71.0 +/-0.3 2.7953 +/-0.0118
Typical weight	(grams) (pounds)	48.0 (typ) 0.1058 lb. (typ))
Interface Connector		18-way ZIF

2.6 Time to ready

Time to ready	Typical
Power-On to Ready (sec)	1.8
Standby to Ready (sec)	1.8

2.7 Power specifications

The drive receives DC power (+3.3V) through the ZIF connector (CE-ATA interface).

2.7.1 Power consumption

Power requirements for the drives are listed in the table on page 8. Typical power measurements are based on an average of drives tested, under nominal conditions, using +3.3V input voltage at 25°C ambient temperature.

- **Startup mode**

Startup 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 power is measured based on three random seek operations every 100 msec.

- **Read/write mode**

Read/write power is measured with the heads on track, while the head is reading/writing from/to disc. It is performed with 100 percent duty cycle of read/write operation.

- **Performance Idle mode**

During Performance Idle mode, the heads are on track but no reading or writing is done. The spindle motor is spinning at full speed.

- **Low power idle mode**

During Low power Idle mode, the heads are unloaded but the spindle motor is spinning at full speed. Servo and read/write electronics are in powered down mode.

- **Standby / Sleep mode**

During Standby/Sleep mode, the spindle motor is not spinning, and the servo and read/write electronics are in powered down mode.

Table 2: DC power

Power Consumption at 3.3V	Average (W)
Startup (max*)	1.15
Read	1.19
Write	1.09
Performance idle (typical)	0.68
Low power idle (typical)	0.48
Standby/Sleep (typical)	0.20

*Maximum is the average of the peak value in 10 msec window

2.7.1.1 Typical current profile

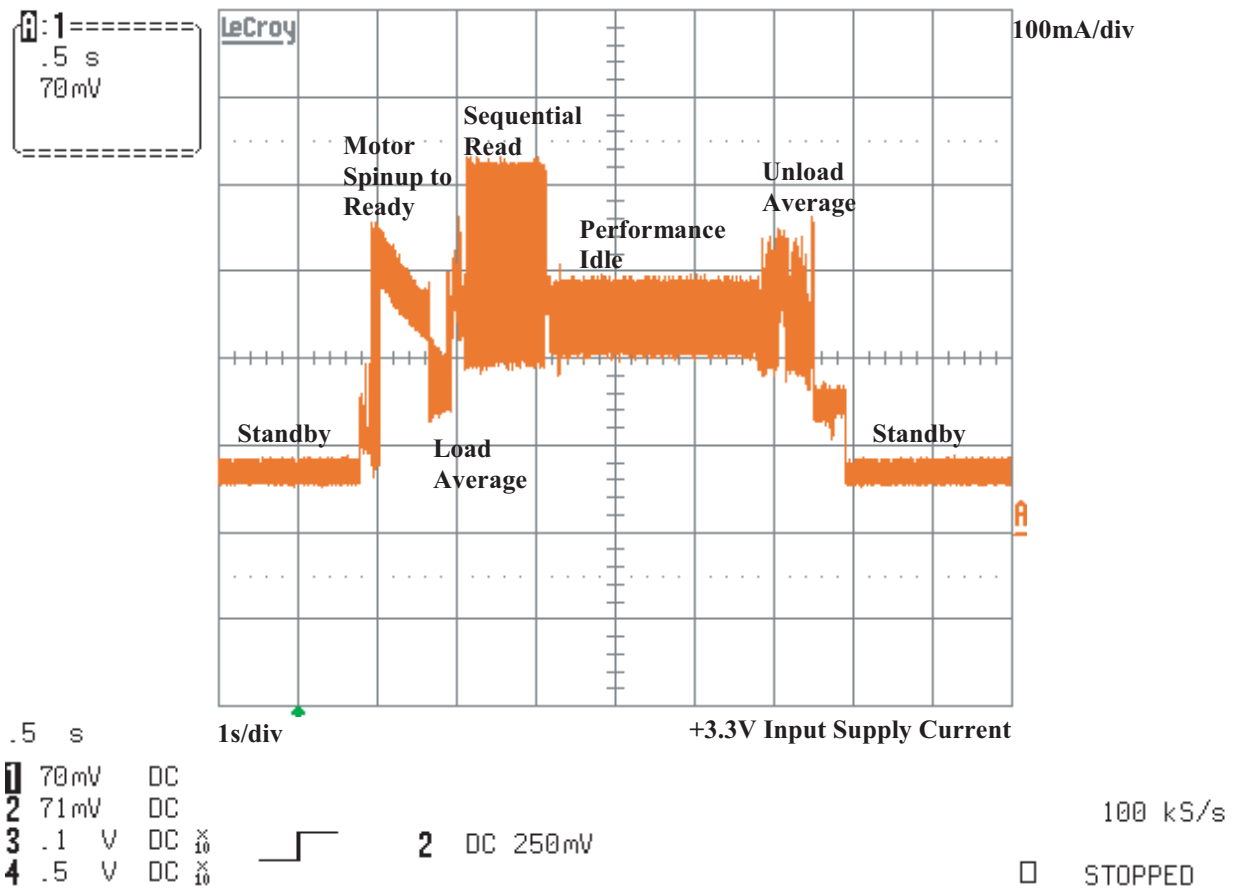


Figure 2. Typical 3.3V startup and operation current profile

2.7.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 15-ohm resistive load on the +3.3 volt line.

Using 3.3-volt power, the drive is expected to operate with a maximum of 70 mV peak-to-peak square-wave injected noise at up to 20 MHz.

Note. Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

2.7.3 Voltage tolerance

Voltage tolerance (including noise):

3.3V \pm 5%

2.7.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. The drive features the following power-management modes:

Table 3: Power-management modes

Power modes	Heads	Spindle	Buffer
Active (read/write/seek)	Tracking	Rotating	Enabled
Idle, performance	Tracking	Rotating	Enabled
Idle, low power	Parked	Rotating	Disabled
Standby/Sleep	Parked	Stopped	Disabled

- **Active mode**

The drive is in Active mode during the read/write and seek operations.

- **Performance idle mode**

The drive enters this mode once the read/write/seek activity is completed. The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disc access is necessary.

- **Low power idle mode**

Drive enters Low Power Idle mode from Performance Idle mode when the Advanced Power Management Level is set between 80h and FDh, and the Idle timer reaches 2 seconds (default setting). Disc is spinning and heads are parked and drive accepts all commands and returns to Active mode any time disc access is necessary.

- **Standby/Sleep mode**

The drive enters Standby mode when the host sends a Standby Immediate command. When the Advanced Power Management Level is set lower than 80h (default setting), the drive enters the Standby state after 2 seconds of interface inactivity. If the host has set the standby timer, the drive may also enter the Standby mode after the expiry of the standby timer. The standby timer can be set using the Standby or Idle command. In Standby mode, the drive buffer is disabled, 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.

2.8 Environmental specifications

2.8.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 70°C (158°F) within the operating ambient conditions. Case temperature of the drive operating at 60°C ambient may hit a maximum of 70°C at certain parts of the casing.

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

Operating	0° to 60°C (32° to 140°F)	(70°C max case temperature)
Nonoperating	–40° to 70°C (–40° to 158°F)	

2.8.2 Temperature gradient

Operating	20°C per hour (36°F per hour max), without condensation
Nonoperating	30°C per hour (54°F per hour max), without condensation

2.8.3 Humidity

2.8.3.1 Relative humidity

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

2.8.3.2 Wet bulb temperature

Operating	33°C (91.4°F max) [1]
Nonoperating	40°C (104°F max) [2]

[1] Operating: Wet bulb temperature is calculated by the operating Temperature and the Relative Humidity levels.

[2] Nonoperating: Wet bulb temperature is calculated by the nonoperating Temperature and the Relative Humidity levels.

2.8.4 Altitude

Operating	–60.98 m to 3,048 m (–200 ft to 10,000+ ft)
Nonoperating	–60.98 m to 12,192 m (–200 ft to 40,000+ ft)

2.8.5 Shock

All shock measurements in this section are carried out at drive level. For all linear shock test, operating or nonoperating, the input shock level is measured at the frame of the drive at the specific location as indicated in Figure 3 below.

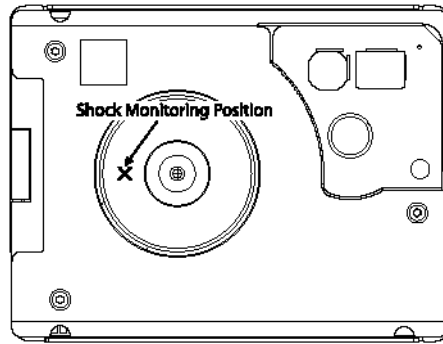


Figure 3. Location where tri-axial accelerometer will be placed on Lyrion Series drives

All shock test cover all the 6 directions, +/- x, y and z axes. The drive axis definition is shown in Figure 4 below.

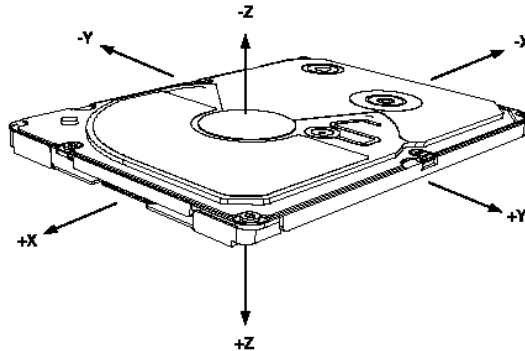


Figure 4. Drive axis definition for Lyrion Series drives

2.8.5.1 Operating shock

The drive is subjected to 10 shocks for each direction. During the shocks, there must be a minimum delay of 3 seconds between shock pulses. Soft errors and automatic retries are allowed during the test. No data loss or permanent damage occurs during a half sine shock pulse of:

500 G, 2 msec

2.8.5.2 Nonoperating shock

The nonoperating shock level that the drive can experience without incurring any physical damage when subsequently put into operation is 1500 Gs. The same applies for shock levels of 1500 G, 1 msec pulse duration on fresh drives for each level.

2.8.6 Vibration

All vibration specifications assume that the drive is mounted securely in a fixture that does not have fixture resonances in the frequency test range.

2.8.6.1 Operating sweep sine vibration

The following lists the maximum operating sweep sine vibration levels that the drive may experience while meeting the performance standards specified. It consists of a forward and backward sweep from 10 Hz to 500 Hz to 10 Hz. The drive operates without a hard error while being subjected to the following vibration levels.

10 Hz to 500 Hz @ 2 oct/min	1.0 Gs (0 to pk). Maximum displacement may apply below 10 Hz.
-----------------------------	---

2.8.6.2 Operating random vibration

The test consists of 30 minutes of random vibration using the power spectral density (PSD) levels specified in the table below. The vibration test level is 0.67 Gs RMS. The drive operates without a hard error while being subjected to the following vibration levels.

Table 4: Operating random vibration profile

Frequency (Hz)	G ² /Hz
17	1.1 x E-03
45	1.1 x E-03
48	8.0 x E-03
62	8.0 x E-03
65	1.0 x E-03
150	1.0 x E-03
200	5.0 x E-04
500	5.0 x E-04

2.8.6.3 Nonoperating sweep sine vibration

The following table lists the maximum nonoperating sweep sine vibration levels that the drive may experience while meeting the performance standards specified. It consists of a forward and backward sweep from 5 Hz to 500 Hz to 5 Hz. The drive does not incur any physical damage when subsequently put into operation.

10 Hz to 500 Hz @ 0.5 oct/min	5.0 Gs (0 to pk). Maximum displacement may apply below 22 Hz.
5 Hz to 10 Hz	25.4 mm peak to peak displacement.

2.8.6.4 Nonoperating random vibration

The test consists of 15 minutes of random vibration using the power spectral density (PSD) levels specified in the table below. The vibration test level is 3.01 Gs RMS. The drive does not incur any physical damage when subsequently put into operation.

Table 5: Nonoperating random vibration profile.

Frequency (Hz)	G ² /Hz
2.5	1.0 x E-03
5	3.0 x E-02
40	1.8 x E-02
500	1.8 x E-02

2.8.7 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to ten years of 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 percent. 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.

2.9 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). Discrete tone penalties are added to the A-weighted sound power (LW) with the following formula only when determining compliance:

$$LWt(\text{spec}) = LW + 0.1Pt + 0.3 < 4.0 \text{ (Bels)}$$

where

LW = A-weighted sound power level

pt = Value of discrete tone penalty [=dLt-6.0 (dBA)]

dLt = Tone-to-noise ratio taken in accordance with ISO 7779 at each octave band.

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.)

Table 6: Drive level acoustics

Acoustic mode	
Idle	Operational
1.6 bels (typ)	2.2 bels (typ)

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: Electromagnetic immunity

Test	Description	Performance level	Reference standard
Radiated RF immunity	80 to 1,000 MHz, 3 V/m, 80% AM with 1 kHz sine 900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz	A	EN 61000-4-3: 96 ENV 50204: 95
Electrical fast transient	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN 61000-4-4: 95
Surge immunity	± 1 kV differential, ± 2 kV common, AC mains	B	EN 61000-4-5: 95
Conducted RF immunity	150 kHz to 80 MHz, 3 Vrms, 80% AM with 1 kHz sine	A	EN 61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN 61000-4-11: 94

2.11 Reliability

Measurement type	Specification
Nonrecoverable read errors	1 per 10^{14} bits read, max.
Load/Unload (LUL) cycles	300,000 software-controlled 20,000 power loss
Power On Hours (POH) per year	500 hours
Warranty	Per agreement

2.12 Agency certification

2.12.1 Safety certification

The drives are recognized in accordance with UL60950-1, CAN/CSA-C22.2 No.60950-1, EN60950 and IEC 60950.

2.12.2 Electromagnetic compatibility

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

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

Korean RRL

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

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

- Family name: Lyrion Series
- Certificate numbers: STX-S181 (B)

Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZS3548 1995 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

2.12.3 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.

2.12.4 China Restriction of Hazardous Substances (RoHS) Directive

2.12.4 中国限制危险物品的指令

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.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Biphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"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”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"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”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

2.12.5 FCC verification

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

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

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

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

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

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

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:

- Do not cover or seal the breather hole! Covering or sealing the breather hole may result in loss of data.

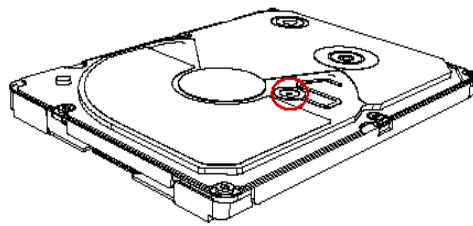


Figure 5. Lyrion Series breather hole location

- 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 drives, 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.

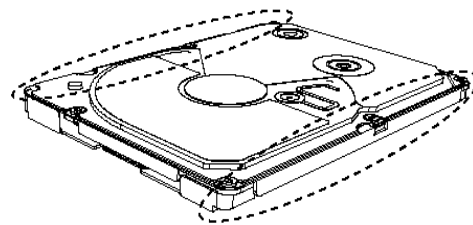


Figure 6. Lyrion Series proper handling example

- The drive is fragile—handle it with care. Do not press down on the drive top cover or attempt to use a pen to write on the drive's label.
- Do not apply more than 6.8N of force to the top cover.
- Always rest the drives on a padded, antistatic surface until you mount it in the system.

- 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.
- If provided, store drive in the protective casing when not in use.
- Turn the power off before installing or removing the drive.
- Do not apply any force to the drive during handling or installation.
- Do not touch the connector pins or the printed circuit board.
- Do not drop the drive.
- Do not expose the drive to wet conditions.
- Do not place the drive near a strong magnetic field.
- Do not expose the drive to extreme temperatures.
- The drive may become hot during operation. Be careful when removing the drive from the host device immediately after operation.

3.2 Drive installation

See Figure 7 for drive mechanical dimensions.

Follow these installation precautions when inserting the drive:

- Follow instructions for the installation of data storage devices, provided with your device's user manual.
- Do not obstruct the breather hole on the drive (see Figure 5).
- Handle the drive only by its edges or frame or designated finger grip region during mounting (see Figure 6).

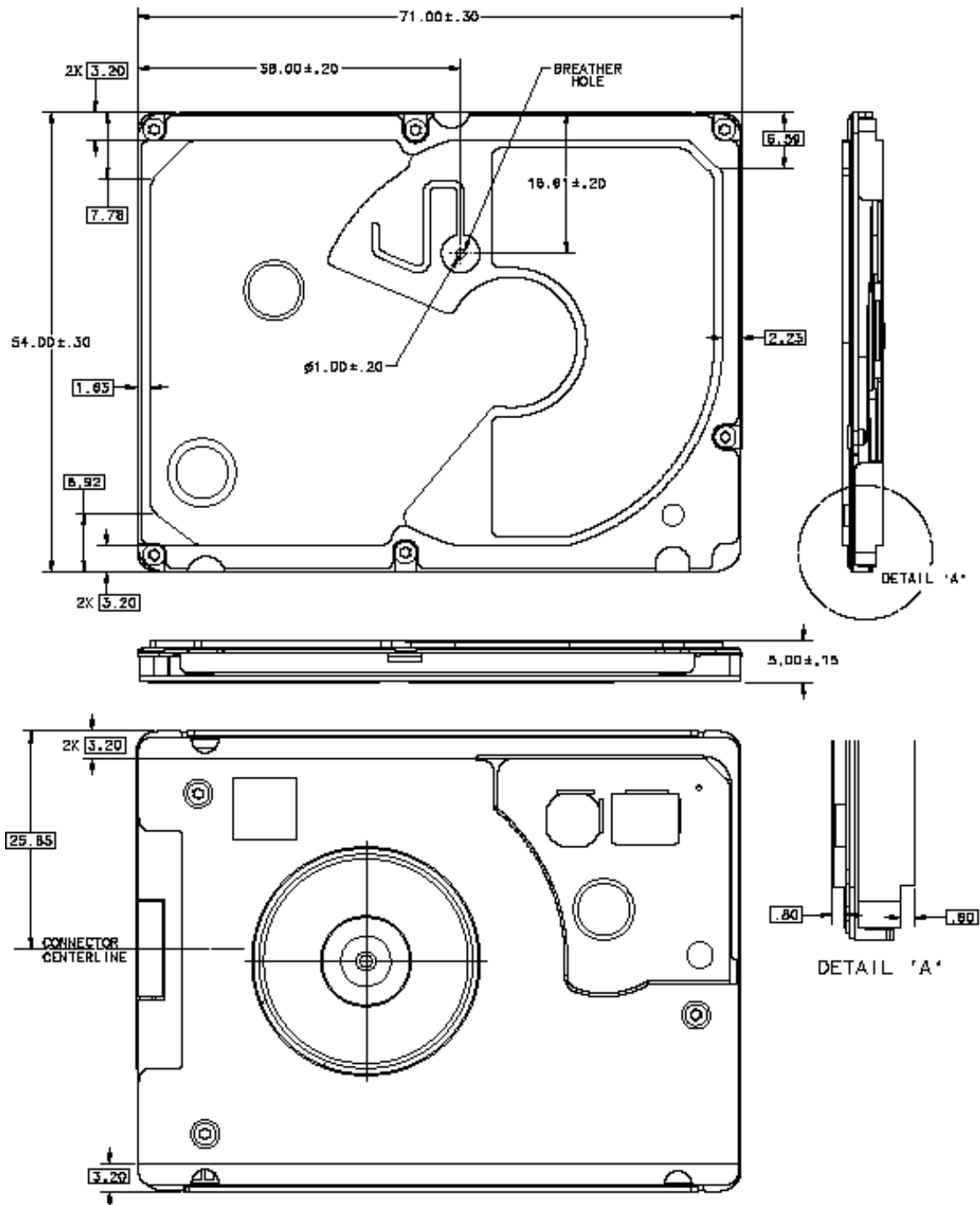
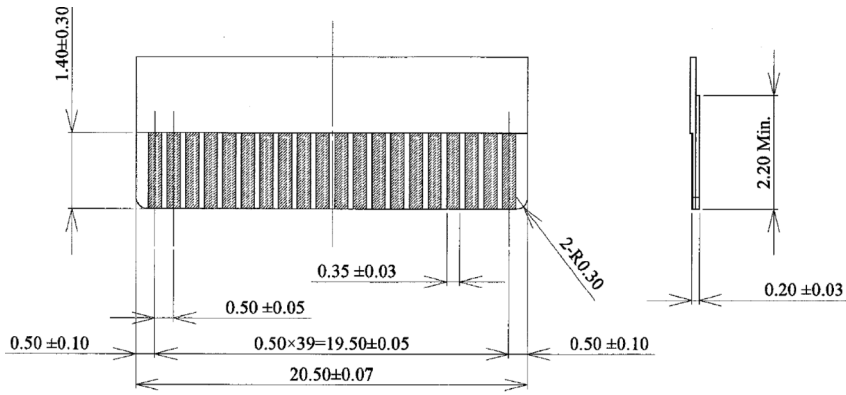


Figure 7. Lyrion Series mechanical dimensions—top, side and end view



Applicable FPC Dimension

Figure 8. Lyrion Series FPC dimensions

3.3 Mounting considerations

- Use an elastic mounting material to protect drives so as to ensure that more shock can be absorbed.
- There are guides along the side for mounting. Refer to figure on areas (refer to Figure 9, shaded area) where the mounting material can rest for mounting.
- As the drive is a sensitive device, it is not recommended to have any mounting force on the top and bottom surface of the drive other than the recommended mounting surfaces. Mounting force on non recommended surfaces shall not exceed 6.8N.”
- The drive can be operated in any orientation but horizontal or vertical orientation is preferred.
- Allow a minimum clearance of 0.012 inches (0.30 mm) around the entire perimeter of the drive for cooling, with the exception of the mounting edges for better airflow.
- In case the system design warrants bending of the FPC to the hard disc drive, care should be taken to maximize the radius.
- Mounting materials are available from many third-party vendors.
- The 18-way connector is design to meet minimum 6N Horizontal FPC retention after mating.
- The connector has a specification of 20 insertion cycles.

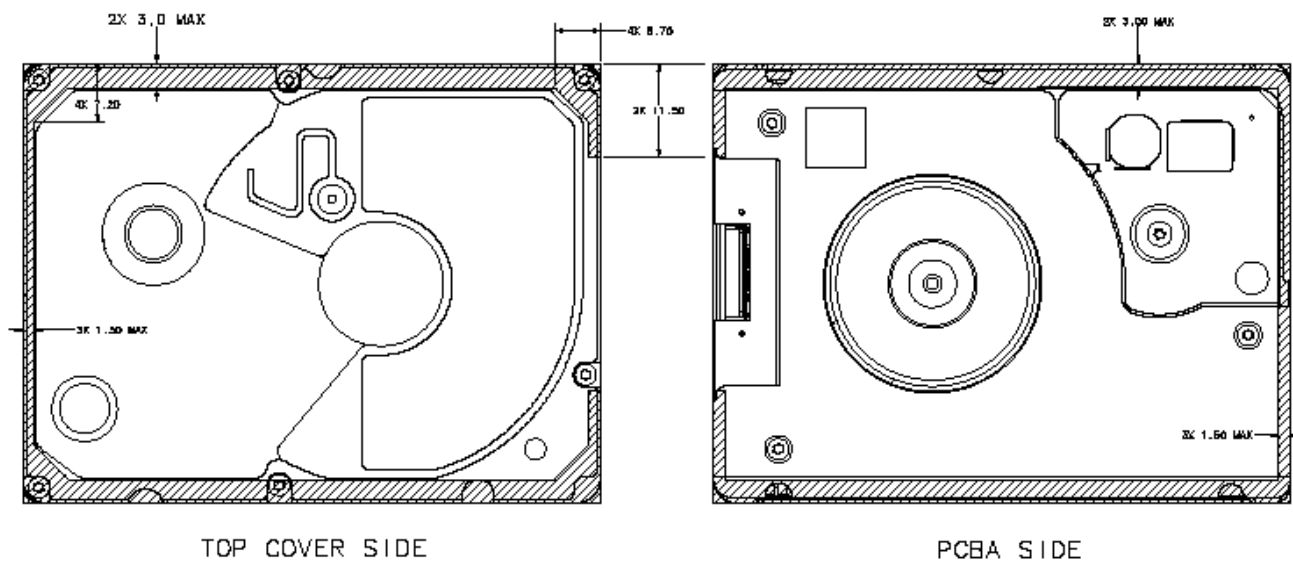


Figure 9. Lyrion Series Area for Protective Mounting

4.0 Interface description

The drives use the CE-ATA interface.

4.1 Interface signals and connector pins

The following table summarizes the signals on the 18-way ZIF CE-ATA interface connector.

Table 8: 18-way ZIF (CE-ATA interface) connector signals

Pin number	Signal Name	Definition
1	VSS	Ground
2	DAT2	Data line 02
3	DAT3	Data line 03
4	VSS	Ground
5	DAT4	Data line 04
6	DAT5	Data line 05
7	Supply Voltage	Supply voltage (Standard): 3.3V +/- 5%
8	CMD	Command line
9	Interface Voltage	Interface voltage reference (Dual range): 1.65V to 1.95V and 2.7V to 3.6V
10	CLK	Clock line, up to 52 MHz
11	VSS	Ground
12	DAT6	Data line 06
13	DAT7	Data line 07
14	VSS	Ground
15	DAT0	Data line 00
16	DAT1	Data line 01
17	VSS	Ground
18	Reserved	Reserved for future use

4.2 Supported command set and features

This section describes the MMC level commands supported by the drive followed the supported reduced ATA command set and a description of the supported Status and Control Registers (SCR).

4.2.1 MMC command set

The following table lists the supported and essential MMC command set for initializing, status checking, error handling, and transferring data. For a detailed description of these commands, refer to the MMC System Specification v 4.0 available to MMCA members under NDA.

Table 9: MMC command set

Command Index	Command Name	Command Description
CMD0	GO_IDLE_STATE	Hard resets the drive to MMC idle state
CMD1	SEND_OP_COND	Requests OCR contents in response from the drive
CMD2	ALL_SEND_CID	Requests CID in response from the drive
CMD3	SET_RELATIVE_ADDR	Assign relative address to the drive
CMD6	SWITCH	Switch mode of operation, modify the EXT_CSD register
CMD7	SELECT/DESELECT CARD	Toggles the MMC standby and MMC transfer states or the MMC programming and MMC disconnected states
CMD8	SEND_EXT_CSD	Request the drive to send its EXT_CSD register as a block of data
CMD9	SEND_CSD	Requests CSD in response from the drive
CMD10	SEND_CID	Requests CID in response from the drive
CMD12	STOP_TRANSMISSION	Forces the drive to stop MMC transmission
CMD13	SEND_STATUS	Requests the drive to send its MMC status in the response
CMD16	SET_BLOCKLEN	Sets the MMC transfer block length for data transfers.
CMD39	FAST_IO	Write or Read 8 bit register data.
CMD60	RW_MULTIPLE_REGISTER	Read or Write ATA register data and SCR register data.
CMD61	RW_MULTIPLE_BLOCK	Transfer data for the ATA command requested by CMD60

4.2.2 Reduced ATA command set

The following table lists CE-ATA defined reduced ATA command set. For a detailed description of these commands, refer to the CE-ATA specification revision 1.1 at www.ce-ata.org.

Table 10: Supported commands

Command opcode	Command name	Command description
25h	Read DMA EXT	Reads data from the drive in logical blocks
35h	Write DMA EXT	Writes data to the drive in logical blocks
E0h	Standby Immediate	Spins down the drive to enter its standby state
EAh	Flush Cache EXT	Flushes buffered data from the drive's cache to the media
ECh	Identify Device	Transfers information about the drive to the host

Identify Device command

The Identify Device command returns a single block of data (512 bytes or 256 words) to the host, the relevant contents per the CE-ATA specification of which are as shown in the following table

Table 11: Identify Device commands

Word	Description	Value
10-19	Serial number: (20 ASCII characters)	Drive serial number
23-26	Firmware revision (8 ASCII characters)	Current firmware revision
27-46	Drive model number (40 ASCII characters)	(ASCII) ST730212CA (for 30GB) (ASCII) ST760211CA (for 60GB)
80	Major version number Bit 15 : Set to 1 Bits 14-2 : Reserved (0) Bit 1 : 1 = supports CE-ATA version 1.0 Bit 0 : Set to 0	8002h
100-103	Maximum user LBA	37E3E3Fh (for 30GB) 6FC7C7Fh (for 60GB)
106	CE-ATA sector size	000Ch
206	CE-ATA Features Bits15-0 : Reserved (0)	0000h
255	Integrity word Bits 15-8 : Checksum (as defined in ATA) Bits 7-0 : Signature (as defined in ATA)	

4.2.3 Status and Control Registers

The Status and Control Registers (SCR) start at MMC register address 80h and can be accessed only by using CMD60 (RW_MULTIPLE_REGISTER) to read or write to them. The following SCR have been defined (RO = The register may be read only, RW = The register may be read or written to).

Table 12: Status and Control Registers

Index	Byte Address	Name	R/W	Description
0	80h	scrTempC	RO	Current temperature reading
1	84h	scrTempMaxP	RO	Peak maximum temperature reading
2	88h	scrTempMinP	RO	Peak minimum temperature reading
6	98h	scrCapabilites	RO	Capabilities and features of the drive
16	C0h	scrControl	RW	Control capabilities of the drive

The detailed description of each registers is as follows:

Byte Address	Name	Detailed description
80h	scrTempC	Bit 31 : Set to 1 (This register is supported) Bit 30 : If set to 1, indicates the values in bits 29-0 are valid If cleared to 0, indicates the values in bits 29-0 are invalid Bits 29-16 : Reserved (0) Bits 15-0 : Two's complement value of the number of degrees Celsius
84h	scrTempMaxP	Bit 31 : Set to 1 (This register is supported) Bit 30 : If set to 1, indicates the values in bits 29-0 are valid If cleared to 0, indicates the values in bits 29-0 are invalid Bits 29-16 : Reserved (0) Bits 15-0 : Two's complement value of the number of degrees Celsius
88h	scrTempMinP	Bit 31 : Set to 1 (This register is supported) Bit 30 : If set to 1, indicates the values in bits 29-0 are valid If cleared to 0, indicates the values in bits 29-0 are invalid Bits 29-16 : Reserved (0) Bits 15-0 : Two's complement value of the number of degrees Celsius
98h	scrCapabilites	Bit 31 : Set to 1 (This register is supported) Bit 30 : If set to 1, indicates the values in bits 29-0 are valid If cleared to 0, indicates the values in bits 29-0 are invalid Bits 29-3 : Reserved (0) Bit 2 : Cleared to 0 (MMC data block size of 4KB is not supported) Bit 1 : Cleared to 0 (MMC data block size of 1KB is not supported) Bit 0 : Set to 1 (MMC data block size of 512 bytes is supported)
C0h	scrControl	Bit 31 : Set to 1 (This register is supported) Bit 30 : If set to 1, indicates the values in bits 29-0 are valid If cleared to 0, indicates the values in bits 29-0 are invalid Bits 29-2 : Reserved (0) Bits 1-0 : 00b (Default value, MMC data block size is 512 bytes)

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Seagate Technology LLC
920 Disc Drive, Scotts Valley, California 95066-4544, USA
Publication Number: 100441950, Rev. A, Printed in U.S.A.

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