



# Surveillance HDD

Product Manual



ST8000VX0012

ST6000VX0011

ST5000VX0011

100767662, Rev. J

Gen 3 - August 2016

## Document Revision History

Revision	Date	Pages affected and Description of Change
Rev. A	11/13/2014	Initial release.
Rev. B	02/27/2015	fc, bc, 15 & 18.
Rev. C	04/27/2015	21-22. Replaced Mechanical Drawing.
Rev. D	05/06/2015	27. Added Streaming support commands.
Rev. E	05/06/2015	21. Removed former 5TB mechanical drawing & renamed the 6TB to 5TB and 6TB.
Rev. F	06/15/2015	5 - Added bullets: *Supports up to 64 cameras *Workload ratings of 180TB/year *Supports "8+" drive bays  Deleted bullet: *Number of drives supported in surveillance environment...
Rev. G	09/17/2015	8: Added Rated Workload statement to Table 1
Rev. H	01/21/2016	fc, 5, 7, 9-10 & 26: Added 8TB model and specs 4: Updated Support URL's 7: Corrected 5TB weight 7 & 12: Voltage tolerance = 12V: ±10% 8: Updated L/UL cycles = 300,000 and Warranty link text 8 & 13: Revised Wet bulb specs 8 & 14: Revised Non-Op Shock & Acoustic specs 11: Updated DC Power Table titles 15: Added Section 2.12.1 Storage 18: Changed Australian C-Tick to RCM 21: Changed fastener penetration depth to 0.140 inches 21: Added Temperature checkpoint to mech drawing
Rev. J	08/23/2016	10: Ready times revised 18: Added Korean text Class B device warning 19: Updated to China RoHS 2

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## 1.0 Introduction

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This manual describes the functional, mechanical and interface specifications for the following: Surveillance HDD model drives:

ST8000VX0012                      ST6000VX0011                      ST5000VX0011

These drives provide the following key features:

- 1M hour MTBF - designed for high write duty cycle across Surveillance HDD
- ATA AV Command support - streaming video command support across Surveillance HDD
- Best-in-class acoustic performance means virtually silent operation
- Built-in error recovery for non-stop video streaming
- Compliant with RoHS requirements in China and Europe
- Full-track multiple-sector transfer capability without local processor intervention
- Idle3 power mode support
- Low activity power
- Native Command Queuing with command ordering to increase performance in demanding applications
- Performance-tuned for seamless video applications
- Reliability for 24x7 video surveillance applications
- Rotational Vibration - mitigation of system level rotational vibration inside Surveillance HDD
- SeaTools™ diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- State-of-the-art cache and on-the-fly error-correction algorithms
- Streaming video optimization - consistent command completion times & ERC support across Surveillance HDD
- Support for S.M.A.R.T. drive monitoring and reporting
- Supports "8+" drive bays
- Supports ATA8 streaming commands
- Supports latching SATA cables and connectors
- Supports up to 64 cameras
- TGMR recording technology provides the drives with increased areal density.
- Thermal monitoring and reporting for 24x7 operations
- Transient power on management - <=1.8A spin-up current
- Uncompromising reliability supports flexible surveillance design with case temperatures up to 70°C
- Workload ratings of 180TB/year
- Worldwide Name (WWN) capability uniquely identifies the drive

## 1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA 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.

The SATA 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 SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.2”. The specification can be downloaded from [www.sata-io.org](http://www.sata-io.org).

**Note**

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA 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 SATA environment.

## 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:

ST8000VX0012                      ST6000VX0011                      ST5000VX0011

### 2.1 Specification summary tables

The specifications listed in [Table 1](#) are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

**Table 1 Drive specifications summary for 6TB and 5TB models**

Drive Specification*	ST8000VX0012	ST6000VX0011	ST5000VX0011
Formatted capacity (512 bytes/sector)**	8000GB (8TB)	6000GB (6TB)	5000GB (5TB)
Guaranteed sectors	15,628,053,168	11,721,045,168	9,767,541,168
Heads	12		10
Disks	6		5
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	2241kFCI	1941kFCI	
Track density (avg)	362ktracks/in	340ktracks/in	
Areal density (avg)	1333Gb/in <sup>2</sup>	642Gb/in <sup>2</sup>	
Internal data transfer rate (max)	2546Mb/s	2347Mb/s	
Average data rate, read/write (MB/s)	180MB/s	154MB/s	
Maximum sustained data rate, OD read (MB/s)	230MB/s	226MB/s	
ATA data-transfer modes supported	PIO modes: 0 to 4 Multiword DMA modes: 0 to 2 Ultra DMA modes 0 to 6		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	256MB	128MB	
Height (max)	26.1mm / 1.028 in		
Width (max)	101.6mm /4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	780g / 1.72 lb		700g / 1.54 lb
Average latency	4.0ms		
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current (typical) 12V	<=1.8A		
Voltage tolerance (including noise)	5V: ±5% 12V: ±10%		
Non-Operating (Ambient °C)	-40° to 70		
Operating temperature (Drive case min °C)	5		
Operating temperature (Drive case max °C)	70 †		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (nonoperating)		
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)		



**Table 1 Drive specifications summary for 6TB and 5TB models**

Drive Specification*	ST8000VX0012	ST6000VX0011	ST5000VX0011
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	26°C max (operating) 29°C max (nonoperating)		
Altitude, operating	-304m to 3048m (-1000 ft to 10,000 ft)		
Altitude, non-operating (below mean sea level, max)	-304m to 12,192m (-1000ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms (read) 40 Gs at 2ms (write)		
Non-operational shock (max)	250 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.7 bels (typical) 2.8 bels (max)		
Seek	2.8 bels (typical) 2.9 bels (max)		
Non-recoverable read errors	1 per 10 <sup>15</sup> bits read		
Mean Time Between Failure (MTBF)	1,000,000 hrs		
Rated Workload	Average annualized workload rating: <180 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 180 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: <a href="http://www.seagate.com/support/warranty-and-replacements/">http://www.seagate.com/support/warranty-and-replacements/</a> From this page, click on "Is my Drive under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/unload cycles (25°C, 50% rel. humidity)	300,000 at 25°C, 50% rel. humidity		
Supports hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

\*All specifications above are based on native configurations.

\*\* One GB equals one billion bytes and 1TB equals one trillion 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.

† Recommend 60°C or less case temperature under sustained work conditions.

## 2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST8000VX0012	8000GB	15,628,053,168	4K
ST6000VX0011	6000GB	11,721,045,168	
ST5000VX0011	5000GB	9,767,541,168	

\*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

### 2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ , 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 48-bit addressing support of drives with capacities over 137GB.

## 2.3 Default logical geometry

- **Cylinders:** 16,383
- **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  $n-1$ , where  $n$  is the number of guaranteed sectors as defined above.

## 2.4 Recording and interface technology

	8TB models	All others
<b>Interface</b>	SATA	
<b>Recording method</b>	TGMR	
<b>Recording density (kFCI)</b>	2241	1941
<b>Track density (ktracks/inch avg)</b>	362	340
<b>Areal density (Gb/in<sup>2</sup>)</b>	1333	642
<b>Internal data transfer rate (Mb/s max)</b>	2546	2347
<b>Maximum sustained data transfer rate, OD read (MB/s)</b>	230	226
<b>Average data rate, read/write (MB/s)</b>	180	154
<b>I/O data-transfer rate (MB/s max)</b>	600	

## 2.5 Physical characteristics

<b>Maximum height</b>	26.11mm / 1.028 in
<b>Maximum width</b>	101.6mm / 4.0 in ( $\pm$ 0.010 in)
<b>Maximum length</b>	146.99mm / 5.787 in
<b>Typical weight</b>	
	<b>8TB and 6TB</b> 780g / 1.72 lb
	<b>5TB</b> 700g / 1.54 lb
<b>Cache buffer</b>	
	<b>8TB</b> 256MB
	<b>6TB and 5TB</b> 128MB

## 2.6 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 5000 measurements of seeks between random tracks, less overhead.

<b>Typical seek times (ms)</b>	<b>Read</b>	<b>Write</b>
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.0	

### 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.

## 2.7 Start/stop times

The start/stop times listed below.

Power-on to ready (in seconds)	26 (typical) 30 (max)
Standby to ready (in seconds)	26 (typical) 30 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

## 2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to [Figure 1 on page 20](#).

### 2.8.1 Power consumption

Power requirements for the drives are listed in [Table 2](#). 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-ms delay, then a 16-sector read followed by a 32-ms 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 2 DC power requirements (5 & 6TB models)**

Power dissipation	Avg (25° C)	Avg 5V typ	Avg 12V typ
Spinup	—	—	<=1.8A
Idle* †	7.20W	0.20A	0.52A
Operating	9.00W	0.24A	0.65A
Standby	0.60W	0.12A	0.01A
Sleep	0.60W	0.12A	0.01A

**Table 3 DC power requirements (8TB models)**

Power dissipation	Avg (25° C)	Avg 5V typ	Avg 12V typ
Spinup	—	—	<=1.8A
Idle* †	7.60W	0.191A	0.553A
Operating	9.00W	0.24A	0.65A
Standby	0.60W	0.12A	0.01A
Sleep	0.60W	0.12A	0.01A

\*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

### 2.8.2 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 10MHz.
- 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 10MHz.

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

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V  
±5%
- 12V  
±10%

### 2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	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.

## 2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications for Surveillance HDDs. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft. Refer to [Section 3.4 on page 21](#) for base plate measurement location.

### 2.9.1 Temperature

<b>Non-Operating (Ambient °C)</b>	-40 to 70
<b>Operating (Drive case min °C)</b>	5
<b>Operating (Drive case max °C)</b>	70 <sup>†</sup>

<sup>†</sup> Recommend 60°C or less case temperature under sustained work conditions.

### 2.9.2 Temperature gradient

<b>Operating</b>	20°C per hour (68°F per hour max), without condensation
<b>Non-operating</b>	30°C per hour (86°F per hour max)

## 2.9.3 Humidity

### 2.9.3.1 Relative humidity

<b>Operating</b>	5% to 90% non-condensing (30% per hour max)
<b>Nonoperating</b>	5% to 95% non-condensing (30% per hour max)

### 2.9.3.2 Wet bulb temperature

<b>Operating</b>	26°C / 78.8°F (rated)
<b>Non-operating</b>	29°C / 84.2°F (rated)

### 2.9.4 Altitude

<b>Operating</b>	-304m to 3048m (-1000 ft. to 10,000 ft.)
<b>Non-operating</b>	-304m to 12,192m (-1000 ft. to 40,000+ ft.)

## 2.9.5 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.

### 2.9.5.1 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 2ms during read operations. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Non-operating shock

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 250 Gs based on a non-repetitive half-sine shock pulse of 2ms duration.

### 2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

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. Throughput may vary if improperly mounted.

## 2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

## 2.10 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.

<b>Note</b>	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 = $0.4 / (\text{average latency} + \text{average access time})$ )
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**Table 4 Fluid Dynamic Bearing (FDB) motor acoustics**

Idle*	Seek
2.7 bels (typical) 2.8 bels (max)	2.8 bels (typical) 2.9 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.

### 2.10.1 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.

## 2.11 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 [Table 5](#).

**Table 5** Radio frequency environments

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: $\pm 4$ kV; Air: $\pm 8$ kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	$\pm 1$ kV on AC mains, $\pm 0.5$ kV on external I/O	B	EN61000-4-4: 95
Surge immunity	$\pm 1$ kV differential, $\pm 2$ kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

## 2.12 MTBF and Warranty

The product will achieve an Mean Time Between Failure (MTBF) of 1,000,000 hours when operated in an environment of ambient air temperatures of 25°C. Operation at temperatures outside the specifications shown in Section 2.9, "Environmental specifications," may decrease the product MTBF. MTBF is a population statistics that is not relevant to individual units.

MTBF specifications are based on the following assumptions for Surveillance environments:

- 8760 power-on-hours per year
- 10,000 average motor start/stop cycles per year
- Operations at nominal voltages
- Temperatures outside the specifications in Environmental specifications on page 13 may reduce the product reliability.
- Normal I/O duty cycle for Surveillance environments. Operation at excessive I/O duty cycle may degrade product reliability.

The Surveillance environment of power-on-hours, temperature, and I/O duty cycle affect the product MTBF. The MTBF will be degraded if used in an enterprise application.

### 2.12.1 Storage

Maximum storage periods are 180 days within original unopened Seagate shipping package or 60 days unpackaged within the defined non-operating limits (refer to environmental section in this manual). Storage can be extended to 1 year packaged or unpackaged under optimal environmental conditions (25°C, <40% relative humidity non-condensing, and non-corrosive environment). During any storage period the drive non-operational temperature, humidity, wet bulb, atmospheric conditions, shock, vibration, magnetic and electrical field specifications should be followed.



## 2.12.2 Seagate® Rescue™ Data Recovery Service – 3-year coverage

(concurrent with bare drive warranty)

If you suffer a data loss event within the three year Seagate Rescue Data Recovery warranty period, and you are eligible to participate in and submit a case under the Rescue program, contact **SRS at (1-800-723-1183) in the US, or if you are calling from outside the US** please visit our website for numbers in your local and language: <http://www.seagate.com/contacts/contact-numbers/>.

In addition, you may visit <http://rescueandreplace.seagate.com/contact.jsp> to obtain information regarding how to contact a recovery expert online or by telephone from your location. An SRS representative will review your case to confirm your eligibility, and to assess whether your data may be recoverable by remote recovery services or whether you will need to send your device to SRS for in-lab servicing.

### Rescue™ General Terms

These Rescue™ General Terms together with the Rescue™ FAQ's make up the Rescue™ Program Terms. By submitting a case under the Rescue™ program ("Program") you agree to be bound by the Program Terms, including these General Terms and the FAQ. You must be a legal resident of the US to participate in the Program.

**Communications.** All communications relating to your request will be available on our web site in your account and sent via e-mail to the address you provide to us unless you request, in writing, to receive such communications via regular mail.

**Personal Data.** You must provide true, accurate and complete information about yourself as prompted by the request form, including, without limitation, your name, address, e-mail address, and telephone number, as applicable (collectively, "Personal Data"). You must maintain and promptly update your Personal Data. You acknowledge that we may send you important information and notices regarding your requests by e-mail and that we shall have no liability associated with or arising from your failure to maintain accurate Personal Data.

**Capacity; Legal Rights; Indemnity.** You represent to SRS that you are of the legal age of majority in your state or country of residence, with the full capacity to agree to these Program Terms. You warrant that you are the legal owner or the authorized representative of the legal owner of the device you submit to SRS (the "Device") and data. You warrant that the data on the Device is legal and that you have the unrestricted legal right to (a) give us remote access to the data, (b) have the data recovered and reproduced on a backup medium, (c) receive the recovered data, and (d) agree to these Program Terms. You will defend and indemnify us (including our directors, officers, employees, agents, delegates, and contractors) from any claims or actions relating to the Device or data, or your rights or lack of rights thereto.

**Confidentiality.** We will protect the confidentiality of your data against unauthorized disclosure using the same degree of care as we use to protect our own confidential information.

**Disclaimer of Warranties, Representations and Guarantees.** WE PROVIDE THE PROGRAM AND ANY SERVICES PROVIDED OR ATTEMPTED HEREUNDER "AS IS," WITH ALL FAULTS, AT YOUR SOLE RISK. WE DO NOT EXTEND ANY EXPRESS WARRANTIES, REPRESENTATIONS, CONDITIONS OR GUARANTEES REGARDING OUR RESCUE SERVICES OR ANY RESULTS THEREOF. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW AND SUBJECT TO ANY STATUTORY WARRANTIES THAT CANNOT BE EXCLUDED, WE EXPRESSLY DISCLAIM ALL IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OF ACCURACY OR COMPLETENESS WITH RESPECT TO THIS PROGRAM AND SERVICES. This Program and Disclaimer is unrelated to, and does not affect any warranties relating to your Device that we or the seller may have extended to you.

**Limitation of Liability.** WE WILL NOT BE LIABLE FOR ANY HARM CAUSED, UNLESS YOU PROVE THAT WE CAUSED SUCH HARM INTENTIONALLY. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, WE WILL NOT BE LIABLE FOR THE CONDITION, EXISTENCE, OR LOSS OF THE DATA YOU SEND US OR THE DATA WE RECOVER (IF ANY), ANY LOSS OF REVENUE OR LOSS OF PROFITS, OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES HOWEVER CAUSED. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, THIS LIMITATION SHALL APPLY TO ANY AND ALL DAMAGES, REGARDLESS OF THE LEGAL THEORY ON WHICH THEY ARE ASSERTED (INCLUDING, WITHOUT LIMITATION, CONTRACT, BREACH OF CONTRACT, AND TORT), AND REGARDLESS OF WHETHER WE HAVE BEEN ADVISED OF THE POSSIBILITY OF LOSS OR DAMAGES - UNLESS YOU PROVE THAT SRS CAUSED DAMAGES TO YOU INTENTIONALLY. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, THE AMOUNT OF OUR LIABILITY WILL NOT EXCEED THE TOTAL PRICE YOU ACTUALLY PAY FOR THE DEVICE, THE ESSENTIAL PURPOSE OF WHICH IS TO LIMIT OUR LIABILITY ARISING FROM OR RELATED TO THE PROGRAM AND ANY DATA RECOVERY SERVICES. THIS ALLOCATION OF RISK IS REFLECTED IN THE PRICE CHARGED FOR THIS PROGRAM OR SERVICES, IF ANY. YOU ACKNOWLEDGE THAT THE PRICE OF THIS PROGRAM WOULD BE MUCH GREATER IF WE UNDERTOOK

**MORE EXTENSIVE LIABILITY. THIS PARAGRAPH WILL APPLY NOTWITHSTANDING ANY OTHER PROVISIONS IN THESE TERMS, OR THE FAILURE OF ANY REMEDY.**

**Compliance with Laws.** You agree to comply with all such laws and regulations and all other applicable laws, statutes, ordinances and regulations relating to the Program. You acknowledge that violations of these Program Terms could subject you to criminal or civil penalties. The goods licensed or provided, or services provided, through the Program, which may include technology and software, are subject to the customs and export control laws and regulations of the U.S. and may also be subject to the customs and export laws and regulations of the country in which the products are manufactured or received. Further, under U.S. law, such goods may not be sold, leased or otherwise transferred to restricted countries, or used by a restricted end-user or an end-user engaged in activities related to weapons of mass destruction including, without limitation, activities related to designing, developing, producing or using nuclear weapons, materials, or facilities, missiles or supporting missile projects, or chemical or biological weapons. You acknowledge you are not a restricted end-user or involved in any of the restricted activities above, and that you will comply with and abide by these laws and regulations. Seagate reserves the right to refuse service to or the return of any storage devices that have been determined to violate these regulations.

**Cancellation.** You may cancel the Program at any time by contacting SRS at 1-800-SEAGATE (1-800-475-0143) in the US, or at such other number available at <http://services.seagate.com/contact.aspx>, or you simply may refrain from submitting a request for Rescue services. These Program Terms remain applicable to your and SRS's rights and obligations with respect to any services requested by you under this Program.

**Assignment.** You may not assign your rights or obligations under these Program Terms without SRS' express written consent.

**Dispute Resolution.** The parties will attempt to resolve any dispute arising out of or related to these Program Terms or any data recovery services requested or attempted hereunder through good faith negotiation. To the extent permitted by applicable law, if the parties are unable to resolve the dispute through good faith negotiation, then the dispute will be submitted to final and binding arbitration with the Judicial Arbitration and Mediation Services. Each party will bear its own costs in arbitration, provided that Seagate reserves the right, in its discretion, to pre-pay certain fees you may incur in connection with the arbitration subject to refund if you do not prevail. **Both parties waive their rights to a jury trial.** All proceedings will take place in Santa Clara County, California, USA. The laws of the State of California will exclusively govern these Program Terms and our provision of any data recovery services, without regard to California's conflicts of laws rules. You consent to the exclusive jurisdiction of the courts located in Santa Clara County, California, USA.

**Severability.** If any provision of these Program Terms is held invalid, illegal or unenforceable, such provision shall be enforced to the fullest extent permitted by applicable law and the validity, legality and enforceability of the remaining provisions shall not be affected thereby.

**Legal Effect.** These Program Terms describe certain legal rights. You may have other rights under applicable law. These Program Terms do not change your rights under applicable law if such laws do not permit these Program Terms to do so. Also, the Program and these Program Terms are in addition and unrelated to any rights you may have under a Seagate warranty statement.

**SRS Companies.** The following SRS companies may provide the services described in these Program Terms: (a) Seagate Technology LLC, with offices at 3101 Jay Street, Suite 110, Santa Clara, California 95054; (b) Seagate Technology Canada Inc., with offices at 2421 Bristol Circle, Suite A100, Oakville, Ontario, Canada L6H 5S9; and/or (c) Seagate Technology (Netherlands) B.V., with offices at Koolhovenlaan 1, 1119 PA, Schiphol-Rijk, The Netherlands.

## 2.13 Agency certification

### 2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

### 2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. 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.

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 Korean Communications Commission (KCC) 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) Communications Commission, 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.

B급 기기 (가정용 정보통신기기)	이 기기는 가정용으로 전자파적합등록을 한 기기로서 주거지역에서는 물론 모든 지역에서 사용할 수 있습니다.
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#### Australian RCM Compliance Mark

Models displayed with the RCM compliance mark, comply with the mandatory standards as per the Australian Communications and Media Authority (AMCA) Electromagnetic Compatibility (EMC) regulatory arrangement.

### 2.13.3 FCC verification

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

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk 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 non-certified 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, users 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, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users 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.

## 2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

### 2.14.1 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.

### 2.14.2 China Requirements — China RoHS 2

China RoHS 2 refers to the Ministry of Industry and Information Technology Order No. 32, effective July 1, 2016, titled Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. To comply with China RoHS 2, we determined this product's Environmental Protection Use Period (EPUP) to be 20 years in accordance with the *Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products*, SJT 11364-2014.

#### 中国电器电子产品有害物质限制使用管理办法

(Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products \_ China RoHS)

#### 产品中有害物质的名称及含量

(Name and Content of the Hazardous Substances in Product)



**Table 6 Hazardous Substances**

部件名称 Part Name	有害物质 Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (CF (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
印刷电路板组装 PCBA	X	O	O	O	O	O
机壳 Chassis	X	O	O	O	O	O

本表格依据 **SJ/T 11364** 的规定编制。

This table is prepared in accordance with the provisions of SJ/T 11364-2014

**O**: 表示该有害物质在该部件所有均质材料中的含量均在 **GB/T 26572** 规定的限量要求以下。

**O**: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T26572.

**X**: 表示该有害物质至少在该部件的某一均质材料中的含量超出 **GB/T 26572** 规定的限量要求。

**X**: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

## 2.15 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.

## 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 oneself 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 mounting 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.

### 3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA 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 SATA 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.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

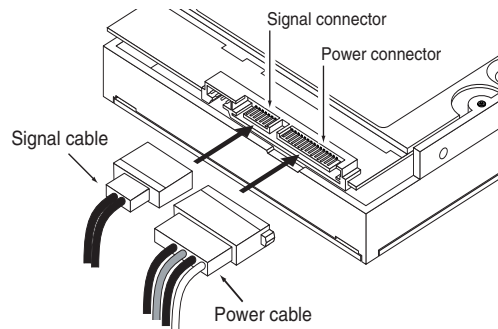
### 3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Table 7](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in [Figure 1](#).

**Figure 1 Attaching SATA cabling**



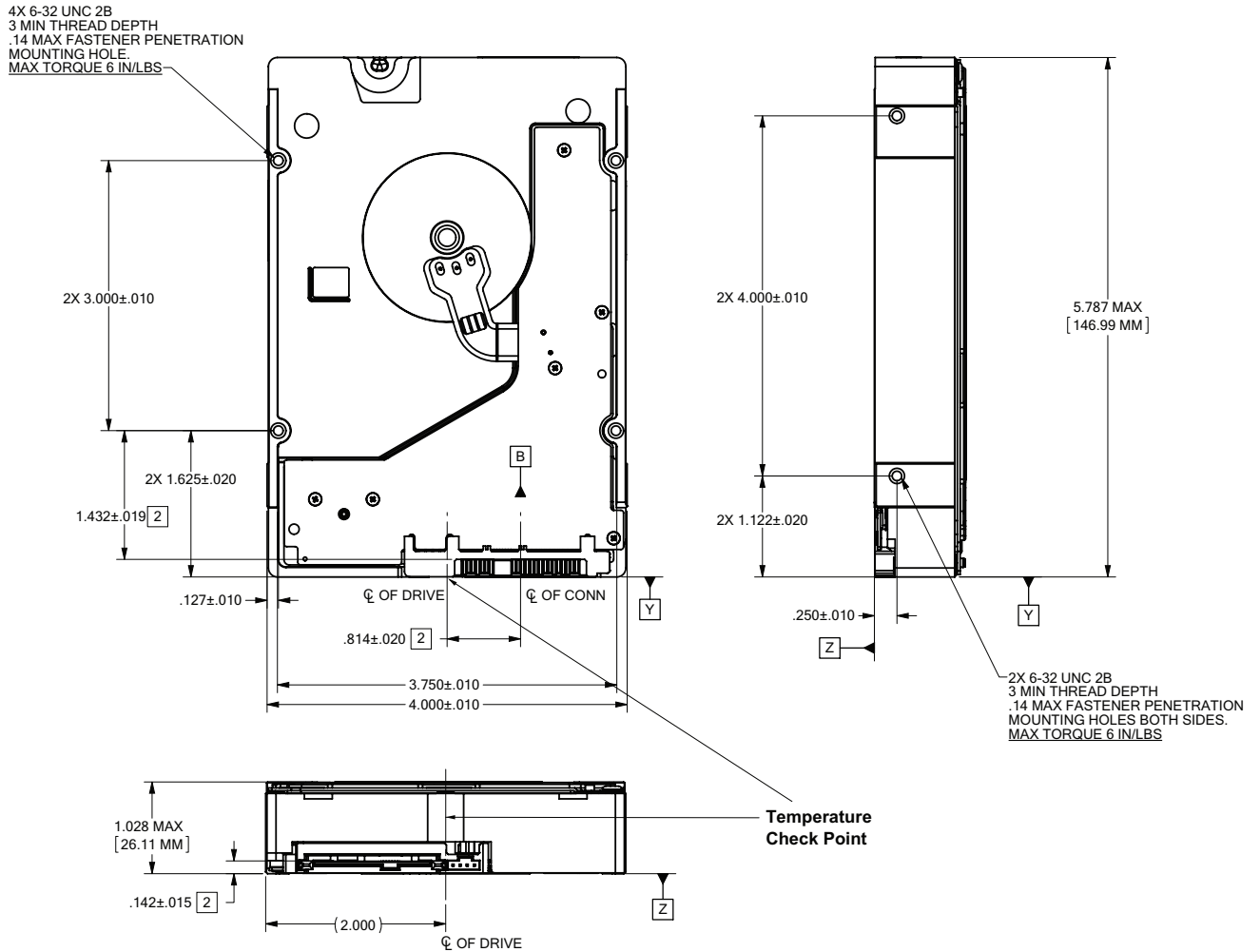
Each cable is keyed to ensure correct orientation. Surveillance +SRS HDD drives support latching SATA connectors.

### 3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- The screws should be inserted no more than 0.140 inch (3.56mm) into the bottom or side mounting holes.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

**Figure 2** Mounting dimensions



## 4.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

### 4.1 Hot-Plug compatibility

Surveillance +SRS HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from [www.serialata.org](http://www.serialata.org).

### 4.2 SATA device plug connector pin definitions

**Table 7** summarizes the signals on the SATA interface and power connectors.

**Table 7** SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
<b>Key and spacing separate signal and power segments</b>			
Power	P1	V <sub>33</sub>	3.3V power
	P2	V <sub>33</sub>	3.3V power
	P3	V <sub>33</sub>	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V <sub>5</sub>	5V power, pre-charge, 2nd mate
	P8	V <sub>5</sub>	5V power
	P9	V <sub>5</sub>	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V <sub>12</sub>	12V power, pre-charge, 2nd mate
	P14	V <sub>12</sub>	12V power
	P15	V <sub>12</sub>	12V power

#### Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- 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.
- 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.
  - All used voltage pins (V<sub>x</sub>) must be terminated.

### 4.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.2 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 29 for details and subcommands used in the S.M.A.R.T. implementation.

**Table 8** SATA standard commands

Command name	Command code (in hex)
Check Power Mode	E5 <sub>H</sub>
Device Configuration Freeze Lock	B1 <sub>H</sub> / C1 <sub>H</sub>
Device Configuration Identify	B1 <sub>H</sub> / C2 <sub>H</sub>
Device Configuration Restore	B1 <sub>H</sub> / C0 <sub>H</sub>
Device Configuration Set	B1 <sub>H</sub> / C3 <sub>H</sub>
Device Reset	08 <sub>H</sub>
Download Microcode	92 <sub>H</sub>
Execute Device Diagnostics	90 <sub>H</sub>
Flush Cache	E7 <sub>H</sub>
Flush Cache Extended	EA <sub>H</sub>
Format Track	50 <sub>H</sub>
Identify Device	EC <sub>H</sub>
Idle	E3 <sub>H</sub>
Idle Immediate	E1 <sub>H</sub>
Initialize Device Parameters	91 <sub>H</sub>
Read Buffer	E4 <sub>H</sub>
Read DMA	C8 <sub>H</sub>
Read DMA Extended	25 <sub>H</sub>
Read DMA Without Retries	C9 <sub>H</sub>
Read Log Ext	2F <sub>H</sub>
Read Multiple	C4 <sub>H</sub>
Read Multiple Extended	29 <sub>H</sub>
Read Native Max Address	F8 <sub>H</sub>
Read Native Max Address Extended	27 <sub>H</sub>
Read Sectors	20 <sub>H</sub>
Read Sectors Extended	24 <sub>H</sub>
Read Sectors Without Retries	21 <sub>H</sub>
Read Verify Sectors	40 <sub>H</sub>
Read Verify Sectors Extended	42 <sub>H</sub>
Read Verify Sectors Without Retries	41 <sub>H</sub>
Recalibrate	10 <sub>H</sub>
Security Disable Password	F6 <sub>H</sub>
Security Erase Prepare	F3 <sub>H</sub>
Security Erase Unit	F4 <sub>H</sub>
Security Freeze	F5 <sub>H</sub>
Security Set Password	F1 <sub>H</sub>
Security Unlock	F2 <sub>H</sub>
Seek	70 <sub>H</sub>
Set Features	EF <sub>H</sub>
Set Max Address	F9 <sub>H</sub>



**Table 8 SATA standard commands (continued)**

<b>Command name</b>  Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	<b>Command code (in hex)</b>	
Set Max Address Extended	Address:	00 <sub>H</sub>
Set Multiple Mode	Password:	01 <sub>H</sub>
Sleep	Lock:	02 <sub>H</sub>
S.M.A.R.T. Disable Operations	Unlock:	03 <sub>H</sub>
S.M.A.R.T. Enable/Disable Autosave	Freeze Lock:	04 <sub>H</sub>
S.M.A.R.T. Enable Operations	37 <sub>H</sub>	
S.M.A.R.T. Execute Offline	C6 <sub>H</sub>	
S.M.A.R.T. Read Attribute Thresholds	E6 <sub>H</sub>	
S.M.A.R.T. Read Data	B0 <sub>H</sub> / D9 <sub>H</sub>	
S.M.A.R.T. Read Log Sector	B0 <sub>H</sub> / D2 <sub>H</sub>	
S.M.A.R.T. Return Status	B0 <sub>H</sub> / D8 <sub>H</sub>	
S.M.A.R.T. Save Attribute Values	B0 <sub>H</sub> / D4 <sub>H</sub>	
S.M.A.R.T. Write Log Sector	B0 <sub>H</sub> / D1 <sub>H</sub>	
Standby	B0 <sub>H</sub> / D0 <sub>H</sub>	
Standby Immediate	B0 <sub>H</sub> / D5 <sub>H</sub>	
Write Buffer	B0 <sub>H</sub> / DA <sub>H</sub>	
Write DMA	B0 <sub>H</sub> / D3 <sub>H</sub>	
Write DMA Extended	B0 <sub>H</sub> / D6 <sub>H</sub>	
Write DMA FUA Extended	E2 <sub>H</sub>	
Write DMA Without Retries	E0 <sub>H</sub>	
Write Log Extended	E8 <sub>H</sub>	
Write Multiple	CA <sub>H</sub>	
Write Multiple Extended	35 <sub>H</sub>	
Write Multiple FUA Extended	3D <sub>H</sub>	
Write Sectors	CB <sub>H</sub>	
Write Sectors Extended	3F <sub>H</sub>	
Write Sectors Without Retries	C5 <sub>H</sub>	
Write Uncorrectable	39 <sub>H</sub>	
Write Sectors Extended	CE <sub>H</sub>	
Write Sectors Without Retries	30 <sub>H</sub>	
Write Sectors Extended	31 <sub>H</sub>	
Write Sectors Without Retries	34 <sub>H</sub>	
Write Sectors Extended	34 <sub>H</sub>	
Write Sectors Without Retries	45 <sub>H</sub>	

### 4.3.1 Identify Device command

The Identify Device command (command code EC<sub>H</sub>) 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 on page 23. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

**Table 9 Identify Device commands**

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	0C5A <sub>H</sub>
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 <sub>H</sub>
3	Number of logical heads	16
4	Retired	0000 <sub>H</sub>
5	Retired	0000 <sub>H</sub>
6	Number of logical sectors per logical track: 63	003F <sub>H</sub>
7–9	Retired	0000 <sub>H</sub>
10–19	Serial number: (20 ASCII characters, 0000 <sub>H</sub> = none)	ASCII
20	Retired	0000 <sub>H</sub>
21	Retired	0400 <sub>H</sub>
22	Obsolete	0000 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 <sub>H</sub>
48	Reserved	0000 <sub>H</sub>
49	Standard Standby timer, IORDY supported and may be disabled	2F00 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0200 <sub>H</sub>
52	Retired	0200 <sub>H</sub>
53	Words 54–58, 64–70 and 88 are valid	0007 <sub>H</sub>
54	Number of current logical cylinders	xxxx <sub>H</sub>
55	Number of current logical heads	xxxx <sub>H</sub>
56	Number of current logical sectors per logical track	xxxx <sub>H</sub>
57–58	Current capacity in sectors	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx <sub>H</sub>
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB 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.	0FFFFFFFh*
62	Retired	0000 <sub>H</sub>
63	Multword DMA active and modes supported (see note following this table)	xx07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>

**Table 9 Identify Device commands (continued)**

Word	Description	Value
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–74	ATA-reserved	0000 <sub>H</sub>
75	Queue depth	001F <sub>H</sub>
76	SATA capabilities	xxxx <sub>H</sub>
77	Reserved for future SATA definition	xxxx <sub>H</sub>
78	SATA features supported	xxxx <sub>H</sub>
79	SATA features enabled	xxxx <sub>H</sub>
80	Major version number	01F0 <sub>H</sub>
81	Minor version number	0028 <sub>H</sub>
82	Command sets supported	364B <sub>H</sub>
83	Command sets supported	7F09 <sub>H</sub>
84	Command sets support extension (see note following this table)	4163 <sub>H</sub>
85	Command sets enabled	30xx <sub>H</sub>
86	Command sets enabled	BE09 <sub>H</sub>
87	Command sets enable extension	4163 <sub>H</sub>
88	Ultra DMA support and current mode (see note following this table)	xx7F <sub>H</sub>
89	Security erase time	0039 <sub>H</sub>
90	Enhanced security erase time	0039 <sub>H</sub>
92	Master password revision code	FFFE <sub>H</sub>
93	Hardware reset value	xxxx <sub>H</sub>
94	Automatic acoustic management	8080 <sub>H</sub>
95	Stream Min. Request Size	0000 <sub>H</sub>
96	Streaming Transfer Time - DMA	0000 <sub>H</sub>
97	Streaming Access Latency- DMA and PIO	0000 <sub>H</sub>
98–99	Streaming Performance Granularity	2710 <sub>H</sub> / 0000 <sub>H</sub>
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST8000VX0012 = 15,628,053,168 ST6000VX0011 = 11,721,045,168 ST5000VX0011 = 9,767,541,168
104	Streaming Transfer Time - PIO	0000 <sub>H</sub>
105–107	ATA-reserved	0000 <sub>H</sub>
108–111	The mandatory value of the world wide name (WWN) for the drive. <b>NOTE:</b> This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 <sub>H</sub>
128	Security status	0001 <sub>H</sub>
129–159	Seagate-reserved	xxxx <sub>H</sub>
160–254	ATA-reserved	0000 <sub>H</sub>
255	Integrity word	xxA5 <sub>H</sub>

**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)	
	<b>Bit      Word 63</b>
0	Multiword DMA mode 0 is supported.
1	Multiword DMA mode 1 is supported.
2	Multiword DMA mode 2 is supported.
8	Multiword DMA mode 0 is currently active.
9	Multiword DMA mode 1 is currently active.
10	Multiword DMA mode 2 is currently active.
	<b>Bit      Word 84</b>
0	SMART error login is supported.
1	SMART self-test is supported.
2	Media serial number is supported.
3	Media Card Pass Through Command feature set is supported.
4	Streaming feature set is supported.
5	GPL feature set is supported.
6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
7	WRITE DMA QUEUED FUA EXT command is supported.
8	64-bit World Wide Name is supported.
9-10	Obsolete.
11-12	Reserved for TLC.
13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
14	Shall be set to 1.
15	Shall be cleared to 0.
	<b>Bit      Word 88</b>
0	Ultra DMA mode 0 is supported.
1	Ultra DMA mode 1 is supported.
2	Ultra DMA mode 2 is supported.
3	Ultra DMA mode 3 is supported.
4	Ultra DMA mode 4 is supported.
5	Ultra DMA mode 5 is supported.
6	Ultra DMA mode 6 is supported.
8	Ultra DMA mode 0 is currently active.
9	Ultra DMA mode 1 is currently active.
10	Ultra DMA mode 2 is currently active.
11	Ultra DMA mode 3 is currently active.
12	Ultra DMA mode 4 is currently active.
13	Ultra DMA mode 5 is currently active.
14	Ultra DMA mode 6 is currently active.

### 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 Set Features command**

02 <sub>H</sub>	Enable write cache ( <i>default</i> )
03 <sub>H</sub>	Set transfer mode (based on value in Sector Count register) Sector Count register values:
00 <sub>H</sub>	Set PIO mode to default (PIO mode 2)
01 <sub>H</sub>	Set PIO mode to default and disable IORDY (PIO mode 2)
08 <sub>H</sub>	PIO mode 0
09 <sub>H</sub>	PIO mode 1
0A <sub>H</sub>	PIO mode 2
0B <sub>H</sub>	PIO mode 3
0C <sub>H</sub>	PIO mode 4 ( <i>default</i> )
20 <sub>H</sub>	Multiword DMA mode 0
21 <sub>H</sub>	Multiword DMA mode 1
22 <sub>H</sub>	Multiword DMA mode 2
40 <sub>H</sub>	Ultra DMA mode 0
41 <sub>H</sub>	Ultra DMA mode 1
42 <sub>H</sub>	Ultra DMA mode 2
43 <sub>H</sub>	Ultra DMA mode 3
44 <sub>H</sub>	Ultra DMA mode 4
45 <sub>H</sub>	Ultra DMA mode 5
46 <sub>H</sub>	Ultra DMA mode 6
06 <sub>H</sub>	Enable the PUIS feature set
07 <sub>H</sub>	PUIS feature set device spin-up
10 <sub>H</sub>	Enable use of SATA features
4A <sub>H</sub>	EPC feature set 83h idle 3 mode
55 <sub>H</sub>	Disable read look-ahead (read cache) feature
82 <sub>H</sub>	Disable write cache
86 <sub>H</sub>	Disable the PUIS feature set
90 <sub>H</sub>	Disable use of SATA features
AA <sub>H</sub>	Enable read look-ahead (read cache) feature ( <i>default</i> )
F1 <sub>H</sub>	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.

### 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 D4<sub>H</sub>) 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. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

**Table 11 S.M.A.R.T. commands**

Code in features register	S.M.A.R.T. command
D0 <sub>H</sub>	S.M.A.R.T. Read Data
D2 <sub>H</sub>	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 <sub>H</sub>	S.M.A.R.T. Save Attribute Values
D4 <sub>H</sub>	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 <sub>H</sub>	S.M.A.R.T. Read Log Sector
D6 <sub>H</sub>	S.M.A.R.T. Write Log Sector
D8 <sub>H</sub>	S.M.A.R.T. Enable Operations
D9 <sub>H</sub>	S.M.A.R.T. Disable Operations
DA <sub>H</sub>	S.M.A.R.T. Return Status

**Note**

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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