

Document Revision History

Revision	Date	Pages affected and Description of change
Rev. A	09/06/2016	Initial release
Rev. B	11/21/2016	fc: Placed latest BarraCuda logo on cover 5: Recording technology bullet changed to SMR 9: Revised Section 2.7.1 Power consumption & Table 4 12: Revised Section 2.7.4 Power management modes & Table 5 16: Updated Korean text for MSIP statement
Rev. C	11/28/2016	6 & 13: Combined Operating Temperature spec lines into "Operating temperature = 0°C to 60°C"

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Publication number: 100807728, Rev. C November 2016

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following Seagate® BarraCuda® model drives:

Standard models
ST2000LM015
ST1000LM048
ST500LM030

These drives provide the following key features:

- 1000 Gs non-operating shock and 400 Gs of operating shock.
- 128MB buffer.
- 5400-RPM spindle speed.
- Full-track multiple-sector transfer capability without local processor intervention.
- High instantaneous (burst) data-transfer rates (up to 6Gb/s).
- MTC Technology™, proprietary data flow management
- Native Command Queuing (NCQ) with command ordering.
- Quiet operation. Fluid Dynamic Bearing (FDB) motor.
- SeaTools™ diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Shingled magnetic recording with perpendicular magnetic recording heads/media.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Support for Read Multiple and Write Multiple commands.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Worldwide Name (WWN) capability uniquely identifies the drive.

1.1 About the Serial ATA Interface

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

The Serial ATA interface connects each disk drive in a point-to-point configuration with the Serial ATA host adapter. There is no master/slave relationship with Serial ATA devices like there is with parallel ATA. If two drives are attached on one Serial ATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

Note

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate Serial ATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical Serial ATA environment.

The Serial ATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

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

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:

The specification summaries listed in the following tables are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

Table 1 Drive Specifications Summary

Drive Specification	ST2000LM015	ST1000LM048	ST500LM030
Formatted capacity ⁽¹⁾	2TB	1TB	500GB
Guaranteed sectors	3,907,029,168	1,953,525,168	976,773,168
Heads	4	2	
Disks	2	1	
Bytes per sector	512 (logical) / 4096 (physical)		
Recording density	2276 Kb/in		
Track density	580 Ktracks/in avg		
Areal density	1320 Gb/in ² avg		
Spindle speed	5400 RPM		
Maximum sustained data rate, OD read	140 MB/s		
Interface	SATA 6Gb/s		
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–6		
Cache buffer	128 MB		
Height (mm/in)	7.0 (± 0.2) / 0.276 (± 008)		
Width (mm/in)	69.85 (± 0.25) / 2.750 (± 0.010)		
Length (mm/in)	100.35 (+0.20/-0.25) / 3.951 (+0.008/-0.010)		
Weight (g/lb) max	90 / 0.198	85 / 0.187	
Average latency	5.6 ms		
Startup current, Max (+5V)	1.0 A		
Voltage tolerance (including noise)	5V ± 5%		
Non-Operating (Ambient °C)	–40° to 70°		
Operating temperature	0° to 60°		
Temperature gradient	20°C per hour max (operating) 35°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	–304.8 m to 3048 m (–1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	–304.8 m to 12,192 m (–1000 ft to 40,000+ ft)		
Operational Shock	400 Gs at 2 ms max		

Table 1 Drive Specifications Summary (continued)

Drive Specification	ST2000LM015	ST1000LM048	ST500LM030
Non-Operational Shock	1000 Gs at 1 ms max		
Vibration, operating	5–200 Hz: 2.0 Gs 201–500 Hz: 1.0 Gs		
Vibration, non-operating	5–500 Hz: 5.0 Gs		
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Rated workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 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: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on the "Is my Drive under Warranty" link. The following are required to be provided: 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	600,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

- One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.
- Seagate does not recommend operating at sustained case temperatures above 60°C. Operating at higher temperatures will reduce useful life of the product.

2.1 Formatted Capacity

Model	Formatted Capacity ⁽¹⁾	Guaranteed Sectors	Bytes per Sector
2TB model	2000 GB	3,907,029,168	512 (logical) / 4096 (physical)
1TB model	1000 GB	1,953,525,168	
500GB model	500 GB	976,773,168	

- One GB equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

2.1.1 LBA mode

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

Refer to [Configuring and Mounting the Drive](#) on page 18 (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137 GB.

2.2 Physical organization

Drive model	Read/write heads	Number of discs
ST2000LM015	4	2
ST1000LM048 and ST500LM030	2	1

2.3 Recording and Interface Technology

Interface	SATA 6Gb/s
Recording method	Perpendicular
Recording density	2276 Kb/in
Track density	580 ktracks/in avg
Areal density	1320 Gb/in ² avg
Spindle speed	5400 RPM
Data transfer rate (up to)	140 MB/s

2.4 Physical Characteristics

Height (mm/in)	7.0 (± 0.2) / 0.276 (± 008)
Width (mm/in)	69.85 (± 0.25) / 2.750 (± 0.010)
Length (mm/in)	100.35 (+0.20/-0.25) / 3.951 (+0.008/-0.010)
Typical weight (g/lb)	90 / 0.198 (ST2000LM015) 85 / 0.187 (ST1000LM048 & ST500LM030)
Cache buffer	128MB

2.5 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Table 2 Typical seek times

Typical seek times (ms)	Read
Track-to-track	1.5
Average	13.0
Average latency	5.6

Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

2.6 Start/stop times

Table 3 Start/stop times

Capacity	1-disk models	2-disk models	1-disk models	2-disk models
Typical seek times (ms)	Typical		Max @ 25°C	
Power-on to ready (sec)	2.8	3.3	3.0	3.5
Standby to ready (sec)	2.5		3.0	

2.7 Power Specifications

The drive receives DC power (+5V) through a native SATA power connector (refer to [Figure 3](#)).

2.7.1 Power consumption

Power requirements for the drives are listed in the table in [Table 4](#). Typical power measurements are based on an average of drives tested, under nominal conditions, at 25°C ambient temperature. These power measurements are done with DIPM enabled.

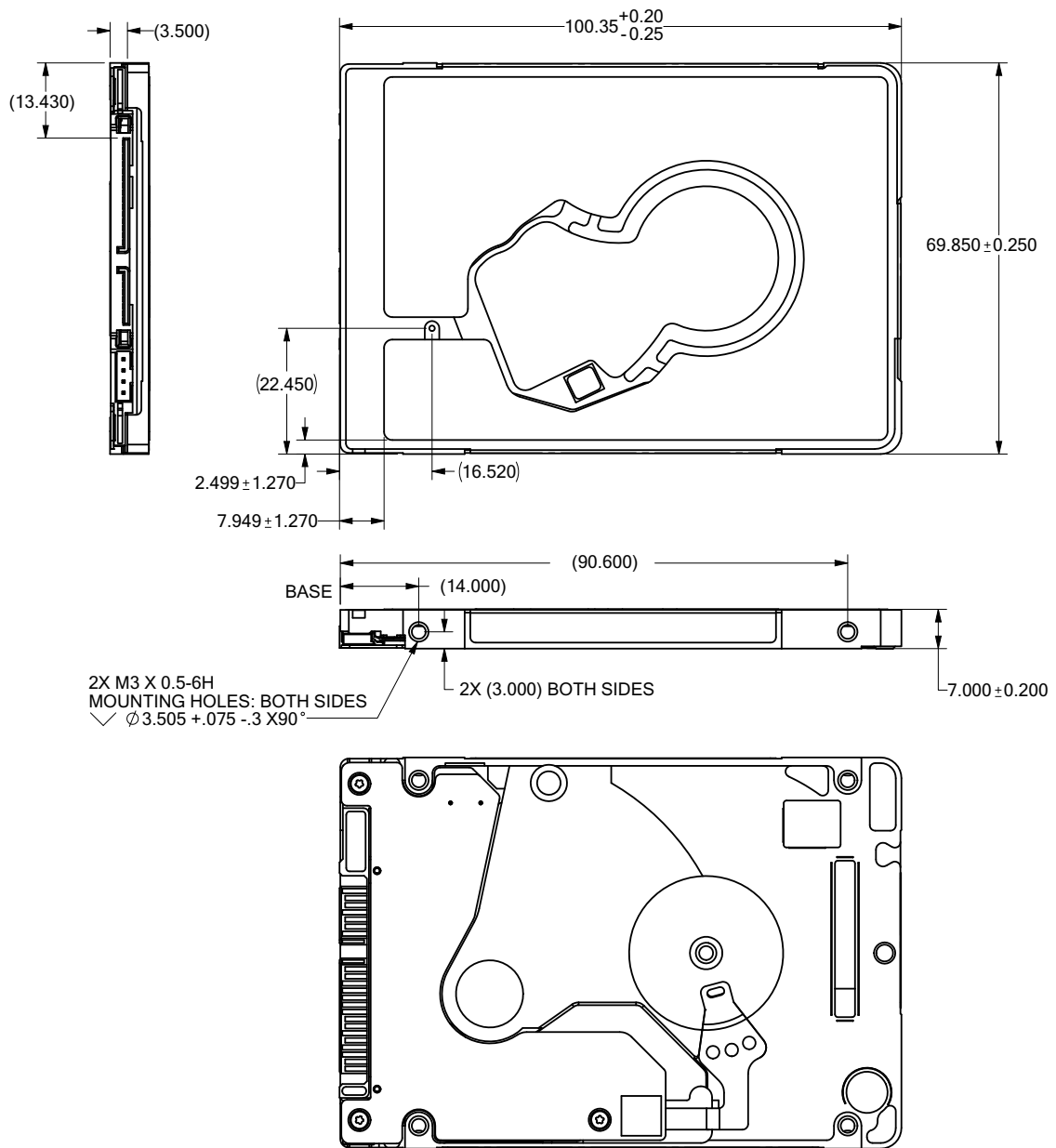
- Spinup current is measured from the time of power-on to the time that the drive spindle reaches operating speed.
- Read/Write current is measured with the heads on track, based on three 64 sector read or write operations every 100 ms.
- The drive supports three idle modes: Performance Idle mode, Active Idle mode and Low Power Idle mode. Refer to Section 2.7.4 for power-management modes.

Table 4 DC Power Requirements

Power Dissipation	1-disk models +5V input average (25° C)	2-disk models +5V input average (25° C)
Spinup (max)	1.00A	
Write average	1.70W	1.80W
Read average	1.60W	1.70W
Idle, low power mode	0.45W	0.50W
Standby ⁽¹⁾	0.13W	
Sleep	0.13W	

1. Standby power is measured at steady state (after 200ms from transition)

Figure 5 Mounting Dimensions (for 2-disk models)



4.0 Serial ATA (SATA) Interface

These drives use the industry-standard Serial ATA interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0–4; multiword DMA modes 0–2, and Ultra DMA modes 0–6. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

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

4.1 Hot-Plug Compatibility

BarraCuda drives incorporate connectors which enable users to hot plug these drives in accordance with the Serial ATA: High Speed Serialized AT Attachment specification revision 2.0. This specification can be downloaded from www.serialata.org. This device requires a COMRESET from the host after a hotplug event.

4.2 Serial ATA Device Plug Connector Pin Definitions

Table 11 summarizes the signals on the Serial ATA interface and power connectors. Refer to the **Notes** below.

Table 11 Serial ATA 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
Key and spacing separate signal and power segments			
Power	P1	V33	3.3V power
	P2	V33	3.3V power
	P3	V33	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V5	5V power, pre-charge, 2nd mate
	P8	V5	5V power
	P9	V5	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate
	P13	V12	12V power, pre-charge, 2nd mate
	P14	V12	12V power
	P15	V12	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_x) must be terminated.

4.3 Supported ATA Commands

Table 12 lists Serial ATA standard commands that the drive supports. For a detailed description of the ATA commands, refer to the *Serial ATA International Organization: Serial ATA* (Revision 2.6). Refer to www.sata-io.org.

Refer to **S.M.A.R.T. commands** on page 29 for details and subcommands used in the S.M.A.R.T. implementation.

Table 12 Supported ATA commands

ATA-standard commands names	Command code (in hex)	
Device Configuration Restore	B1h/C0h	
Device Configuration Freeze Lock	B1h/C1h	
Device Configuration Identify	B1h/C2h	
Device Configuration Set	B1h/C3h	
Download Microcode	92h	
Execute Device Diagnostics	90h	
Flush Cache	E7h	
Flush Cache Extended	EAh	
Identify Device	ECh	
Initialize Device Parameters	91h	
Read Buffer	E4h	
Read DMA	C8h	
Read DMA Extended	25h	
Read DMA without Retries	C9h	
Read Long with Retries	22h	
Read Long without Retries	23h	
Read Multiple	C4h	
Read Multiple Extended	29h	
Read Native Max Address	F8h	
Read Native Max Address Extended	27h	
Read Sectors	20h	
Read Sectors Extended	24h	
Read Sectors without Retries	21h	
Read Verify Sectors	40h	
Read Verify Sectors Extended	42h	
Read Verify Sectors without Retries	41h	
Seek	70h	
Set Features	EFh	
Set Max Address	F9h	
Note: Individual Set Max commands are identified by the value placed in the Set Max Features register as defined to the right.	Address:	00 _H
	Password:	01 _H
	Lock:	02 _H
	Unlock:	03 _H
	Freeze Lock:	04 _H
Set Max Address Ext	37h	
Set Multiple Mode	C6h	
S.M.A.R.T. Disable Operations	B0h/D9h	
S.M.A.R.T. Enable/Disable Autosave	B0h/D2h	
S.M.A.R.T. Enable Operations	B0h/D8h	

Table 12 Supported ATA commands

ATA-standard commands names	Command code (in hex)	
S.M.A.R.T. Enable/Disable Auto Offline	B0h/DBh	
S.M.A.R.T. Enable One Attribute Modification	B0h/E0h	
S.M.A.R.T. Execute Offline	B0h/D4h	
S.M.A.R.T. Free Fall Protection Host Interface	FEh	
S.M.A.R.T. Read Attribute Thresholds	B0h/D1h	
S.M.A.R.T. Read Data	B0h/D0h	
S.M.A.R.T. Read Log Sector	B0h/D5h	
S.M.A.R.T. Return Status	B0h/DAh	
S.M.A.R.T. Save Attribute Values	B0h/D3h	
S.M.A.R.T. Write Attribute Thresholds	B0h/D7h	
S.M.A.R.T. Write Attribute Values	B0h/E1h	
S.M.A.R.T. Write Log Sector	B0h/D6h	
Trusted Receive	5Ch	(SED only)
Trusted Receive DMA	5Dh	(SED only)
Trusted Send	5Eh	(SED only)
Trusted Send DMA	5Fh	(SED only)
Write Buffer	E8h	
Write DMA	CAh	
Write DMA Extended	35h	
Write DMA without Retries	CBh	
Write Long with Retries	32h	
Write Long without Retries	33h	
Write Multiple	C5h	
Write Multiple Extended	39h	
Write Sectors	30h, 31h	
Write Sectors Extended	34h	
ATA-standard power-management commands		
Check Power Mode	E5h	
Idle	E3h	
Idle Immediate	E1h	
Sleep	E6h	
Standby	E2h	
Standby Immediate	E0h	
ATA-standard security commands		
Security Set Password	F1h	
Security Unlock	F2h	
Security Erase Prepare	F3h	
Security Erase Unit	F4h	
Security Freeze Lock	F5h	
Security Disable Password	F6h	

4.3.1 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in [Table 13](#). 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. Refer to [Drive Specifications](#) on page 6 for default parameter settings.

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

Table 13 Identify Device command

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	0C5A _H
1	Number of logical cylinders	16,383
2	Specific configuration	C837 _H
3	Number of logical heads	16
4	Retired	0000 _H
5	Retired	0000 _H
6	Number of logical sectors per logical track: 63	003F _H
7–9	Retired	0000 _H
10–19	Serial number: (20 ASCII characters, 0000 _H = none)	ASCII
20	Retired	0000 _H
21	Retired	8000 _H
22	Obsolete	0004 _H
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)	ST1000LM048 ST2000LM015 ST500LM030
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 _H
48	Trusted Computing Feature set options	4001 _H
49	Standard Standby timer, IORDY supported and may be disabled	2F00 _H
50	Capabilities	4000 _H
51	PIO data-transfer cycle timing mode	0200 _H
52	Retired	0200 _H
53	Words 54–58, 64–70 and 88 are valid	0007 _H
54	Number of current logical cylinders	xxxx _H
55	Number of current logical heads	xxxx _H
56	Number of current logical sectors per logical track	xxxx _H
57–58	Current capacity in sectors	xxxx _H
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx _H
60–61	Total number of user-addressable sectors This field contains a value that is one greater than the total number of user-addressable sectors. The maximum value that shall be placed in this field is 0FFFFFFF _H . The 0FFFFFFF _H value applies to all capacities over 137GB (see Section 2.1, Formatted Capacity for related information).	ST1000LM048 = 0FFFFFFF _H ST2000LM015 = 0FFFFFFF _H ST500LM030 = 0FFFFFFF _H
62	Retired	0000 _H

Table 13 Identify Device command

Word	Description	Value
63	Multiword DMA active and modes supported (see note following this table)	xx07 _H
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 _H
65	Minimum multiword DMA transfer cycle time per word (120 ns)	0078 _H
66	Recommended multiword DMA transfer cycle time per word (120 ns)	0078 _H
67	Minimum PIO cycle time without IORDY flow control (240 ns)	0078 _H
68	Minimum PIO cycle time with IORDY flow control (120 ns)	0078 _H
69	Additional Supported bits Bit 4 means Device Encrypts All User Data on the device. Bit 7 means IEEE1667 protocol is supported.	xx1x _H or xx9x _H
70–74	ATA-reserved	0000 _H
75	Queue depth	001F _H
76	Serial ATA capabilities	0D06 _H
77	ATA-reserved	0000 _H
78	Serial ATA features supported	0048 _H
79	Serial ATA features enabled	0048 _H
80	Major version number	01F0 _H
81	Minor version number	0029 _H
82	Command sets supported	746B _H
83	Command sets supported	7D69 _H
84	Command sets support extension	61E3 _H
85	Command sets enabled	7469
86	Command sets enabled	BC49 _H
87	Command sets enable extension	61E3 _H
88	Ultra DMA support and current mode (see note following this table)	xx7F _H
89	Security erase time	xxxx _H
90	Enhanced security erase time	xxxx _H
91	Current APM values	8080 _H
92	Master password revision code	FFFE _H
93	Hardware reset value (see description following this table)	xxxx _H
94	Auto acoustic management setting	xxxx _H
95	Stream Min. Request Size	0000 _H
96	Streaming Transfer Time - DMA	0000 _H
97	Streaming Access Latency - DMA and PIO	0000 _H
98-99	Streaming Performance Granularity	0000 _H
100–103	Total number of user-addressable LBA sectors available (see Section 3.2, Configuring the Drive for related information) These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFF _H .	ST1000LM048 = 1,953,525,168 ST2000LM015 = 3,907,029,168 ST500LM030 = 976,773,168
104	Streaming Transfer Time - PIO	0000 _H
105	Reserved	0000 _H

Table 13 Identify Device command

Word	Description	Value
106	Physical sector size / Logical sector size	6003 _H
107	Seagate reserved	0000 _H
108-111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112-118	ATA-reserved	0000 _H
119	Free Fall Protection support (bit 5)	1 = Free Fall Protection supported 0 = Free Fall Protection not supported
120	Free Fall Protection enable/disable (bit 5)	1 = Free Fall Protection feature is enabled 0 = Free Fall Protection feature is disabled
121-127	ATA-reserved	0000 _H
128	Security status	0021 _H
129-159	Seagate-reserved	xxxx _H
160-221	ATA-reserved	0000 _H
222	Transport major version number	101F _H
223-254	ATA-reserved	0000 _H
255	Integrity word	xxA5 _H

Note	See the bit descriptions below for words 63, 88 and 93 of the Identify Drive data. (on next page)
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Table 14 Bit Descriptions

Description (if bit is set to 1)	
Bit	Word 63
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.
Bit	Word 88
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.
Bit	Word 93
13	1 = 80-conductor cable detected, CBLID above VIH 0 = 40-conductor cable detected, CBLID below VIL

4.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled.

The acceptable values for the Features register are defined as follows:

Table 15 Set Features command values

02 _H	Enable write cache (<i>default</i>).
03 _H	Set transfer mode (based on value in Sector Count register). Sector Count register values: 00 _H Set PIO mode to default (PIO mode 2). 01 _H Set PIO mode to default and disable IORDY (PIO mode 2). 08 _H PIO mode 0 09 _H PIO mode 1 0A _H PIO mode 2 0B _H PIO mode 3 0C _H PIO mode 4 (<i>default</i>) 20 _H Multiword DMA mode 0 21 _H Multiword DMA mode 1 22 _H Multiword DMA mode 2 40 _H Ultra DMA mode 0 41 _H Ultra DMA mode 1 42 _H Ultra DMA mode 2 43 _H Ultra DMA mode 3 44 _H Ultra DMA mode 4 45 _H Ultra DMA mode 5 46 _H Ultra DMA mode 6
55 _H	Disable read look-ahead (read cache) feature.
82 _H	Disable write cache
AA _H	Enable read look-ahead (read cache) feature (<i>default</i>).
C1 _H	Disable the Free Fall Protection feature (41 _H above enables the Free Fall Protection feature)
F1 _H	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_H) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at:

<http://www.seagate.com/support/downloads/seatools/>.

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 16 S.M.A.R.T. Commands

Code in features register	S.M.A.R.T. command
D0 _H	S.M.A.R.T. Read Data
D2 _H	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 _H	S.M.A.R.T. Save Attribute Values
D4 _H	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 _H	S.M.A.R.T. Read Log Sector
D6 _H	S.M.A.R.T. Write Log Sector
D8 _H	S.M.A.R.T. Enable Operations
D9 _H	S.M.A.R.T. Disable Operations
DA _H	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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*Publication Number: 100807728, Rev. C
November 2016*