

A decorative graphic on the left side of the page, featuring a large dashed circle, a solid blue circle, and several overlapping curved lines in blue and grey.

Product Manual

## **SV35.2 Series® PATA**

**ST3750640AV**

**ST3500630AV**

**ST3320620AV**

**ST3250820AV**

**ST3160815AV**

100440155

Rev. E

December 2007

## Revision history

| Revision | Date     | Sheets affected or comments |
|----------|----------|-----------------------------|
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| Rev. D   | 09/05/07 | 4, 6, and 10.               |
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One gigabyte, or GB, equals one billion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting. Seagate reserves the right to change, without notice, product offerings or specifications.

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## 1.0 Introduction

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This manual describes the functional, mechanical and interface specifications for the following Seagate® SV35.2 Series® PATA model drives:

ST3750640AV

ST3500630AV

ST3320620AV

ST3250820AV

ST3160815AV

These drives provide the following key features:

- 7,200-RPM spindle speed
- High instantaneous (burst) data transfer rates (up to 100 Mbytes per second) using Ultra DMA mode 6.
- Tunneling Magnetoresistive (TMR) recording heads.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Full-track multiple-sector transfer capability without local processor intervention.
- Quiet operation.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Support for Read Multiple and Write Multiple commands.
- Support for autodetection of master/slave drives that use cable select (CSEL).





## 2.0 Drive specifications

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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:

ST3750640AV

ST3500630AV

ST3320620AV

ST3250820AV

ST3160815AV

### 2.1 Specification summary table

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

**Table 1: Drive specifications summary for 750 and 500 Gbyte models**

| Drive specification                                   | ST3750640AV   | ST3500630AV                     |
|---|---|---------------------------------|
| Formatted capacity (512 bytes/sector)*                | 750 Gbytes  | 500 Gbytes                      |
| Guaranteed sectors                                    | 1,465,149,168   | 976,773,168                     |
| Heads   | 8   | 6                               |
| Discs   | 4   | 3                               |
| Bytes per sector                                      | 512   |                                 |
| Default sectors per track                             | 63  |                                 |
| Default read/write heads                              | 16  |                                 |
| Default cylinders                                     | 16,383  |                                 |
| Recording density                                     | 926 kbits/in max  | 813 kbits/in max                |
| Track density   | 145 ktracks/in avg  |                                 |
| Areal density   | 128.2 Gbits/in <sup>2</sup> avg                                   | 114.4 Gbits/in <sup>2</sup> avg |
| Spindle speed   | 7,200 RPM   |                                 |
| Internal data transfer rate                           | 1,030 Mbits/sec max   |                                 |
| Sustained data transfer rate OD                       | 78 Mbytes/sec max   | 72 Mbytes/sec max               |
| I/O data-transfer rate                                | 100 Mbytes/sec max  |                                 |
| ATA data-transfer modes supported                     | PIO modes 0–4<br>Multiword DMA modes 0–2<br>Ultra DMA modes 0–6   |                                 |
| Cache buffer  | 16 Mbytes   |                                 |
| Height (max)  | 26.11 mm (1.028 inches)   |                                 |
| Width (max)   | 101.6 mm (4.000 inches) +/- 0.010 inches                          |                                 |
| Length (max)  | 146.99 mm (5.787 inches)  |                                 |
| Weight (typical)                                      | 720 grams   | 635 grams                       |
| Average latency                                       | 4.16 msec   |                                 |
| Power-on to ready                                     | 16 sec max  |                                 |
| Standby to ready                                      | 16 sec max  |                                 |
| Track-to-track seek time                              | <0.8 msec typical read; <1.0 msec typical write                   |                                 |
| Average seek, read                                    | 17.0 msec typical   |                                 |
| Average seek, write                                   | 14.0 msec typical   |                                 |
| Startup current (typical) 12V (peak)                  | 2.0 amps  |                                 |
| Voltage tolerance (including noise)                   | 5V ± 5%<br>12V ± 10%  |                                 |
| Ambient temperature                                   | 0° to 60°C (operating)<br>–40° to 70°C (nonoperating)             |                                 |
| Temperature gradient                                  | 20°C per hour max (operating)<br>30°C per hour max (nonoperating) |                                 |
| Relative humidity                                     | 5% to 90% (operating)<br>5% to 95% (nonoperating)                 |                                 |
| Relative humidity gradient                            | 30% per hour max  |                                 |
| Wet bulb temperature                                  | 37.7°C max (operating)<br>40.0°C max (nonoperating)               |                                 |
| Altitude, operating                                   | –60.96 m to 3,048 m<br>(–200 ft. to 10,000+ ft.)                  |                                 |
| Altitude, nonoperating<br>(below mean sea level, max) | –60.96 m to 12,192 m<br>(–200 ft. to 40,000+ ft.)                 |                                 |
| Operational Shock                                     | 63 Gs at 2 msec max   |                                 |
| Non-Operational Shock                                 | 300 Gs at 2 msec max  |                                 |

| Drive specification                 | ST3750640AV  | ST3500630AV |
|-------------------------------------|--|-------------|
| Vibration, operating                | 5–22 Hz: 0.02 inches, Limited displacement, peak to peak<br>22–350 Hz: 0.50 Gs<br>350–500 Hz: 0.25 Gs  |             |
| Vibration, nonoperating             | 5–350 Hz: 5.0 Gs<br>350–500 Hz: 1.0 Gs   |             |
| Drive acoustics, sound power (bels) |  |             |
| Idle**                              | 2.8 (typical)<br>2.9 (max)   |             |
| Seek                                | 3.2 (typical)<br>3.4 (max)   |             |
| Nonrecoverable read errors          | 1 per 10 <sup>14</sup> bits read   |             |
| Annualized Failure Rate (AFR)       | 0.80%  |             |
| Warranty                            | To determine the warranty for a specific drive, use a web browser to access the following web page:<br><a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a><br><br>From this page, click on the “Verify Your Warranty” link. You 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 your drive. |             |
| Contact start-stop cycles           | 50,000 at 25°C, 50% rel. humidity  |             |

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

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

**Table 2: Drive specifications summary for 320, 250 and 160 Gbyte models**

| Drive specification                                   | ST3320620AV   | ST3250820AV | ST3160815AV                   |
|---|---|-------------|-------------------------------|
| Formatted capacity (512 bytes/sector)*                | 320 Gbytes  | 250 Gbytes  | 160 Gbytes                    |
| Guaranteed sectors                                    | 781,422,768   | 488,397,168 | 312,581,808                   |
| Heads   | 4   | 3           | 2                             |
| Discs   | 2   |             | 1                             |
| Bytes per sector                                      | 512   |             |                               |
| Default sectors per track                             | 63  |             |                               |
| Default read/write heads                              | 16  |             |                               |
| Default cylinders                                     | 16,383  |             |                               |
| Recording density                                     | 813 kbits/in max  |             | 824 kbits/in max              |
| Track density   | 145 ktracks/in avg  |             | 137.259 ktracks/in avg        |
| Areal density   | 114.4 Gbits/in <sup>2</sup> avg   |             | 101 Gbits/in <sup>2</sup> avg |
| Spindle speed   | 7,200 RPM   |             |                               |
| Internal data transfer rate                           | 1,030 Mbits/sec max   |             | 930 Mbits/sec max             |
| Sustained data transfer rate OD                       | 72 Mbytes/sec max   |             | 80 Mbytes/sec max             |
| I/O data-transfer rate                                | 100 Mbytes/sec max  |             |                               |
| ATA data-transfer modes supported                     | PIO modes 0–4<br>Multiword DMA modes 0–2<br>Ultra DMA modes 0–6                 |             |                               |
| Cache buffer  | 16 Mbytes   | 8 Mbytes    |                               |
| Height (max)  | 26.11 mm (1.028 inches)   |             | 20.0 mm (0.787 inches)        |
| Width (max)   | 101.6 mm (4.000 inches) +/- 0.010 inches  |             |                               |
| Length (max)  | 146.99 mm (5.787 inches)  |             |                               |
| Weight (typical)                                      | 600 grams   |             | 345 grams                     |
| Average latency                                       | 4.16 msec   |             |                               |
| Power-on to ready                                     | 16 sec max  |             |                               |
| Standby to ready                                      | 16 sec max  |             |                               |
| Track-to-track seek time                              | <0.8 msec typical read, <1.0 msec typical write                                 |             |                               |
| Average seek, read                                    | 17.0 msec typical   |             |                               |
| Average seek, write                                   | 14.0 msec typical   |             |                               |
| Startup current (typical) 12V (peak)                  | 2.0 amps  |             |                               |
| Voltage tolerance (including noise)                   | 5V ± 5%<br>12V ± 10%  |             |                               |
| Ambient temperature                                   | 0° to 60°C per hour max (operating)<br>–40° to 70°C per hour max (nonoperating) |             |                               |
| Temperature gradient                                  | 20°C (operating)<br>30°C (nonoperating)   |             |                               |
| Relative humidity                                     | 5% to 90% (operating)<br>5% to 95% (nonoperating)                               |             |                               |
| Relative humidity gradient                            | 30% per hour max  |             |                               |
| Wet bulb temperature                                  | 37.7°C max (operating)<br>40.0°C max (nonoperating)                             |             |                               |
| Altitude, operating                                   | –60.96 m to 3,048 m<br>(–200 ft. to 10,000+ ft.)                                |             |                               |
| Altitude, nonoperating<br>(below mean sea level, max) | –60.96 m to 12,192 m<br>(–200 ft. to 40,000+ ft.)                               |             |                               |
| Operational Shock                                     | 63 Gs max at 2 msec   |             |                               |
| Non-Operational Shock                                 | 300 Gs max at 2 msec  |             | 350 Gs max at 2 msec          |

| Drive specification                 | ST3320620AV   | ST3250820AV                | ST3160815AV                |
|-------------------------------------|---|----------------------------|----------------------------|
| Vibration, operating                | 5–22 Hz: 0.02 inches, Limited displacement, peak to peak<br>22–350 Hz: 0.50 Gs<br>350–500 Hz: 0.25 Gs   |                            |                            |
| Vibration, nonoperating             | 5–350 Hz: 5.0 Gs<br>350–500 Hz: 1.0 Gs  |                            |                            |
| Drive acoustics, sound power (bels) |   |                            |                            |
| Idle**                              | 2.8 (typical)<br>2.9 (max)  | 2.6 (typical)<br>2.7 (max) | 2.5 (typical)<br>2.6 (max) |
| Seek                                | 3.0 (typical)<br>3.1 (max)  |                            | 3.1 (typical)<br>3.2 (max) |
| Nonrecoverable read errors          | 1 per 10 <sup>14</sup> bits read  |                            |                            |
| Annualized Failure Rate (AFR)       | 0.80%   |                            |                            |
| Warranty                            | <p>To determine the warranty for a specific drive, use a web browser to access the following web page:<br/> <a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a></p> <p>From this page, click on the “Verify Your Warranty” link. You 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 your drive.</p> |                            |                            |
| Contact start-stop cycles           | 50,000 at 25°C, 50% rel. humidity   |                            |                            |

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

\*\*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

## 2.2 Formatted capacity

| Model       | Formatted capacity* | Guaranteed sectors | Bytes per sector |
|-------------|---------------------|--------------------|------------------|
| ST3750640AV | 750 Gbytes          | 1,465,149,168      | 512              |
| ST3500630AV | 500 Gbytes          | 976,773,168        | 512              |
| ST3320620AV | 320 Gbytes          | 781,422,768        | 512              |
| ST3250820AV | 250 Gbytes          | 488,397,168        | 512              |
| ST3160815AV | 160 Gbytes          | 312,581,808        | 512              |

\*One Gbyte equals one billion 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 4.1.2, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137 Gbytes.

## 2.3 Default logical geometry

| Cylinders | Read/write heads | Sectors per track |
|-----------|------------------|-------------------|
| 16,383    | 16               | 63                |

## 2.4 Recording and interface technology

|   | 750GB                  | 500GB | 320GB | 250GB   | 160GB |
|---|------------------------|-------|-------|---------|-------|
| Interface                                     | ATA                    |       |       |         |       |
| Recording method                              | Perpendicular          |       |       |         |       |
| Recording density, KBPI (kbits/inch max)      | 926                    | 813   |       | 824     |       |
| Track density, KTPI (ktracks/inch avg)        | 145                    |       |       | 137.259 |       |
| Areal density (Gbits/inch <sup>2</sup> avg)   | 128.2                  | 114.4 |       | 101     |       |
| Spindle speed (RPM) (± 0.2%)                  | 7,200                  |       |       |         |       |
| Internal data transfer rate (Mbits/sec max)   | 1,030                  |       |       |         |       |
| Sustained data transfer rate (Mbytes/sec max) | 78                     | 72    |       | 80      |       |
| I/O data-transfer rate (Mbytes/sec max)       | 100 (Ultra DMA mode 5) |       |       |         |       |

## 2.5 Physical characteristics

|                            |   |  |
|----------------------------|---|--|
| <b>Drive specification</b> |   |  |
| Maximum height             |   |  |
| 4, 3 and 2 disc models     | (mm)<br>(inches)  | 26.1<br>1.028  |
| 1 disc model               | (mm)<br>(inches)  | 20.0<br>0.787  |
| Maximum width              | (mm)<br>(inches)  | 101.6<br>4.000 +/- 0.010   |
| Maximum length             | (mm)<br>(inches)  | 146.99<br>5.787  |
| Typical weight             | 1 disc models<br>2 disc models<br>3 disc models<br>4 disc models            | 345 grams (0.76 lbs)<br>600 grams (1.32 lbs)<br>635 grams (1.40 lbs)<br>720 grams (1.59 lbs) |
| Cache Size                 | ST3750640AV<br>ST3500630AV<br>ST3320620AV<br><br>ST3250820AV<br>ST3160815AV | 16 Mbytes<br><br><br>8 Mbytes  |

## 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 5,000 measurements of seeks between random tracks, less overhead.

| *Typical seek times (msec) | Read | Write |
|----------------------------|------|-------|
| Track-to-track             | <0.8 | <1.0  |
| Average                    | 17.0 | 14.0  |
| Average latency:           | 4.16 | 4.16  |

\*Measured in quiet mode

**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 or exceed 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

|                             |          |
|-----------------------------|----------|
| Power-on to Ready (sec)     | 16 (max) |
| Standby to Ready (sec)      | 16 (max) |
| Ready to spindle stop (sec) | 10 (max) |

## 2.8 Power specifications

The drive receives

(+5V or +12V) through a four-pin standard drive power connector.

### 2.8.1 Power consumption

Power requirements for the drives are listed in the table on page 11. 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.

- **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 mode power represents the worst-case power consumption, using only random seeks with read or write latency time. This mode is not typical and is provided for worst-case information.

- **Read/write power and current**

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-msec delay, then a 16-sector read followed by a 32-msec delay.

- **Operating power and current**



Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

- **Idle mode power**

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

- **Standby mode**

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

**Table 3: DC power requirements**

| Power dissipation (4-Disc values shown)   | Avg (watts, 25° C)       | Avg 5V typ amps | Avg 12V typ amps |
|---|--------------------------|-----------------|------------------|
| Spinup  | —                        | —               | 2.0 (peak)       |
| Idle*   | 9.30                     | 0.611           | 0.540            |
| Idle with offline activity  | 10.40                    | 0.719           | 0.567            |
| Operating (40% r/w, 40% seek, 20% inop.)<br>ST3750640AV<br>ST3500630AV<br>ST3320620AV, ST3250820AV<br>ST3160815AV | 8.2<br>7.5<br>6.5<br>5.7 | 0.425           | 0.510            |
| Standby   | 0.80                     | 0.106           | 0.023            |
| Sleep   | 0.80                     | 0.106           | 0.023            |

\*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.

### 2.8.1.1 Typical current profile

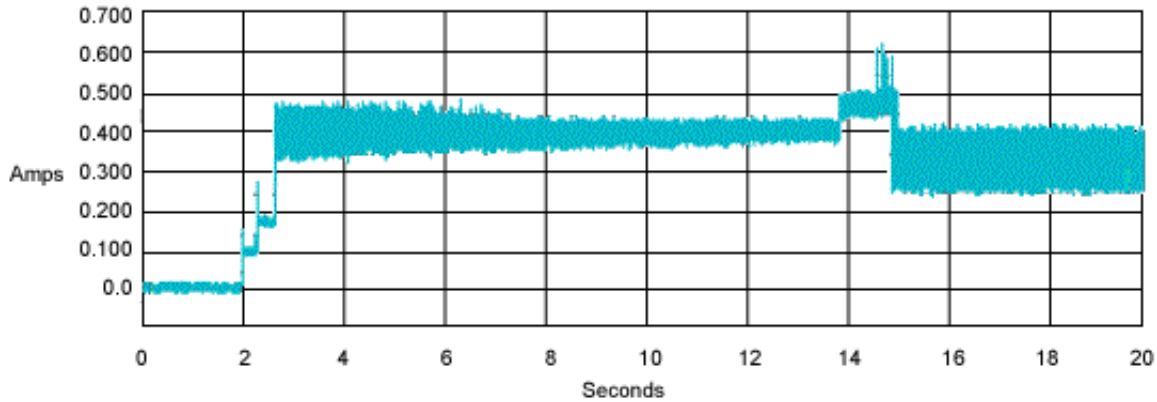


Figure 1 Typical 5V startup and operation current profile

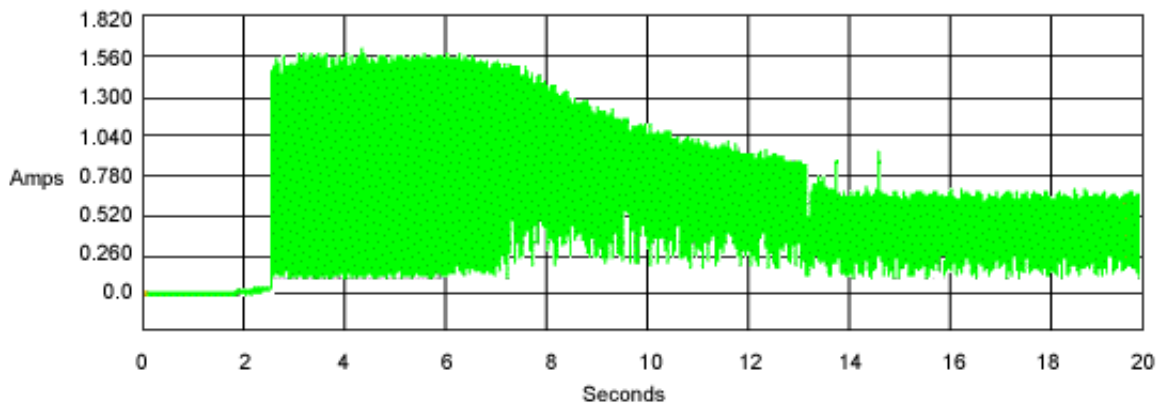


Figure 2 Typical 12V startup and operation current profile

### 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 10 MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10 MHz.

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

### 2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V  $\pm$  5%
- 12V  $\pm$  10%

## 2.8.4 Power management modes

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

| Power mode | 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 disc 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 disc 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 disc access is necessary.

## 2.9 Environmental specifications

### 2.9.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions. Recommended measurement locations are shown in See Figure 6 on page 25.

Above 1,000 feet (305 meters), the maximum temperature is derated linearly to 112°F (44°C) at 10,000 feet (3,048 meters).

|               |                              |
|---------------|------------------------------|
| Operating:    | 0° to 60°C (32° to 140°F)    |
| Nonoperating: | -40° to 70°C (-40° to 158°F) |

### 2.9.2 Temperature gradient

|               |   |
|---------------|---|
| Operating:    | 20°C per hour (68°F per hour max), without condensation |
| Nonoperating: | 30°C per hour (86°F per hour max)                       |

### 2.9.3 Humidity

#### 2.9.3.1 Relative humidity

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

#### 2.9.3.2 Wet bulb temperature

|               |                      |
|---------------|----------------------|
| Operating:    | 37.7°C (99.9°F max)  |
| Nonoperating: | 40.0°C (104.0°F max) |

### 2.9.4 Altitude

|               |  |
|---------------|--|
| Operating:    | -60.96 m to 3,048 m (-200 ft. to 10,000+ ft.)  |
| Nonoperating: | -60.96 m to 12,192 m (-200 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 63 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second.

### 2.9.5.2 Nonoperating shock

#### 1 Disc models

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

#### 2, 3 and 4 Disc models

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

## 2.9.6 Vibration

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis.

### 2.9.6.1 Operating vibration

The following table lists the maximum vibration levels that the drive may experience while meeting the performance standards specified in this document.

|            |  |
|------------|--|
| 5–22 Hz    | 0.02 inches (Limited displacement, peak to peak) |
| 22–350 Hz  | 0.50 Gs  |
| 350–500 Hz | 0.25 Gs  |

### 2.9.6.2 Nonoperating vibration

The following table lists the maximum nonoperating vibration that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation.

|            |        |
|------------|--------|
| 5–350 Hz   | 5.0 Gs |
| 350–500 Hz | 1.0 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.

**Note.** For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

**Table 4: Fluid Dynamic Bearing (FDB) motor acoustics**

| Acoustic mode              |                                  |                                  |
|----------------------------|----------------------------------|----------------------------------|
|                            | Idle*                            | Seek                             |
| ST3750640AV<br>ST3500630AV | 2.8 bels (typ)<br>2.9 bels (max) | 3.2 bels (typ)<br>3.4 bels (max) |
| ST3320620AV                | 2.8 bels (typ)<br>2.9 bels (max) | 3.0 bels (typ)<br>3.1 bels (max) |
| ST3250820AV                | 2.6 bels (typ)<br>2.7 bels (max) | 3.0 bels (typ)<br>3.1 bels (max) |
| ST3160815AV                | 2.5 bels (typ)<br>2.6 bels (max) | 3.1 bels (typ)<br>3.2 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.

## 2.11 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 the following table:

**Table 5: Radio frequency environments**

| Test                      | Description   | Performance level | Reference standard                |
|---------------------------|---|-------------------|-----------------------------------|
| Electrostatic discharge   | Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV  | B                 | EN 61000-4-2: 95                  |
| Radiated RF immunity      | 80 to 1,000 MHz, 3 V/m, 80% AM with 1 kHz sine<br>900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz | A                 | EN 61000-4-3: 96<br>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<br>0% short, 5 seconds<br>40%, 0.10 seconds<br>70%, 0.01 seconds             | C<br>C<br>C<br>B  | EN 61000-4-11: 94                 |

## 2.12 Reliability

### 2.12.1 Annualized Failure Rate (AFR) and Mean Time Between Failures (MTBF)

The product shall achieve an Annualized Failure Rate (AFR) of 0.80% (MTBF of 1+ million hours) when operated in an environment of ambient air temperatures of 25°C, assuming delta between ambient air temperature and HDD case temperature is less than 15°C. Operation at temperatures outside the specifications in Section 2.9 may increase the product AFR (decrease MTBF). AFR and MTBF are population statistics that are not relevant to individual units.

AFR and MTBF specifications are based on the following assumptions for Digital Video Surveillance computer 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 Section 2.9 may reduce the product reliability.
- Normal I/O duty cycle for desktop personal computers. Operation at excessive I/O duty cycle may degrade product reliability.

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

|                               |  |
|-------------------------------|--|
| Nonrecoverable read errors    | 1 per 10 <sup>14</sup> bits read, max  |
| Annualized Failure Rate (AFR) | 0.80% (nominal power, 25°C ambient temperature)  |
| Contact start-stop cycles     | 50,000 cycles<br>(at nominal voltage and temperature, with 60 cycles per hour and a 50% duty cycle)  |
| Warranty                      | To determine the warranty for a specific drive, use a web browser to access the following web page:<br><a href="http://www.seagate.com/support/service/">www.seagate.com/support/service/</a><br>From this page, click on the “Verify Your Warranty” link. You 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 your drive. |
| Preventive maintenance        | None required.   |

## 2.13 Agency certification

### 2.13.1 Safety certification

The drives are recognized in accordance with UL 1950 and CSA C22.2 (950) and meet all applicable sections of IEC950 and EN 60950.

### 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 (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.

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: SV35.2 Series
- Certificate number: STX-L3510(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).

### **2.13.3 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 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.

## **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)**

The European Union Restriction of Hazardous Substances (RoHS) Directive restricts the presence of chemical substances, including Lead (Pb), in electronic products effective July 2006.

A number of parts and materials in Seagate products are procured from external suppliers. We rely on the representations of our suppliers regarding the presence of RoHS substances in these parts and materials. Our supplier contracts require compliance with our chemical substance restrictions, and our suppliers document their compliance with our requirements by providing material content declarations for all parts and materials for the disc drives documented in this publication. Current supplier declarations include disclosure of the inclusion of any RoHS-regulated substance in such parts or materials.

Seagate also has internal systems in place to ensure ongoing compliance with the RoHS Directive and all laws and regulations which restrict chemical content in electronic products. These systems include standard operating procedures that ensure that restricted substances are not utilized in our manufacturing operations, laboratory analytical validation testing, and an internal auditing process to ensure that all standard operating procedures are complied with.

### **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

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This section contains the specifications and instructions for configuring and mounting the drive.

### 3.1 Handling and static discharge precautions

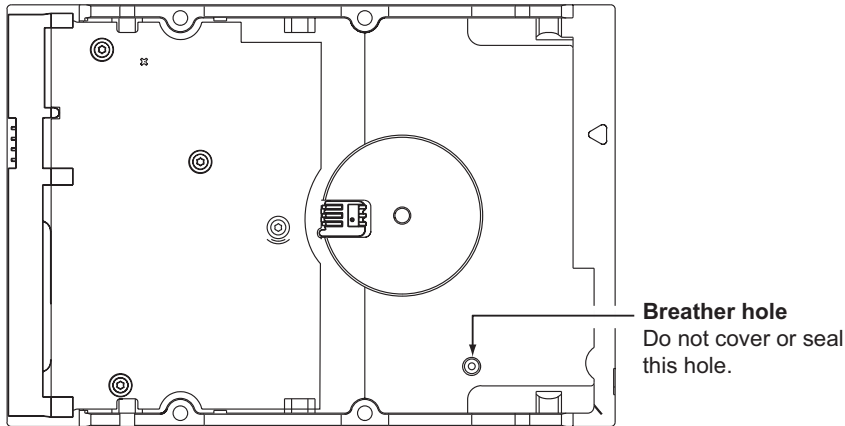
After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

**Caution:**

- Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until you mount it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

### 3.2 Breather filter hole precautions

This section contains information regarding the precautions which should be taken regarding the breather filter hole in Seagate hard disc drives. Proper precautions should be taken to ensure full functionality and prevent possible damage to the drive.



**Figure 3 Breather filter hole location**

**Caution: Do not cover, seal, or insert any object into this hole.**

This hole has two purposes:

- To allow condensation inside the hard disc to escape
- To allow air pressure inside the hard disc to equalize with ambient pressure

**Note.** If this hole is covered, sealed, or penetrated by any object, the drive reliability may be compromised and could lead to permanent damage. Covering or sealing this hole voids the warranty.

### 3.3 Jumper settings

#### 3.3.1 Master/slave configuration

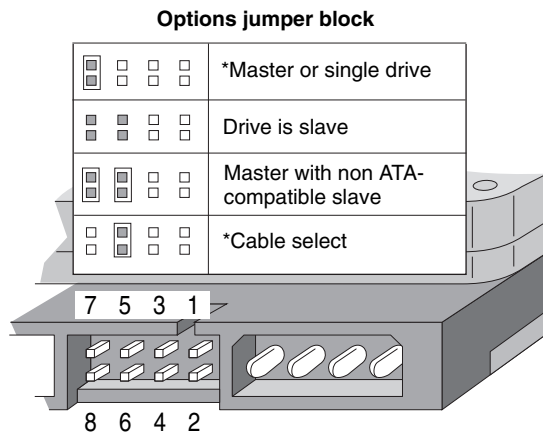
The options jumper block shown in Figure 4 is used to configure the drive for operation. It is the 8-pin dual header between the interface connector and the power connector. Use the following settings to configure the drive as a master or a slave.

**Master or single drive.** The drive is configured at the factory for a master or single drive operation with a jumper set on pins 7 and 8.

**Drive as slave.** Remove all jumpers.

**Drive as master with a non-ATA-compatible slave.**

Use this jumper setting *only* if the drive does not work as a master with no jumpers installed.



**Figure 4** Master/slave jumper settings

#### 3.3.2 Cable-select option

Computers that use cable select determine the master and slave drives by selecting or deselecting pin 28, CSEL, on the interface bus. Master and slave drives are determined by their physical position on the cable. To enable cable select, set a jumper on pins 5 and 6 as shown in Figure 4. Refer to your computer manual to determine whether your computer supports this option.

### 3.3.3 Ultra ATA/100 cable

An 80-conductor 40-pin cable is required to run Ultra DMA mode 3, mode 4, and mode 5. This cable uses even-numbered conductors connected to the ground pins to improve signal integrity.

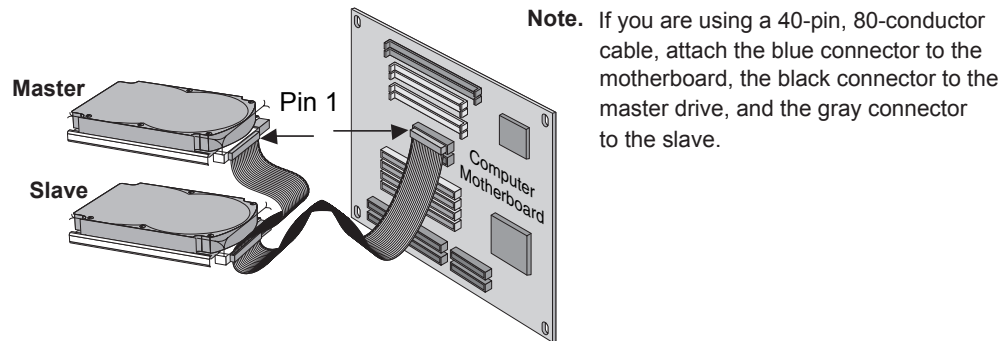


Figure 5 Ultra ATA cable connectors

**Note.** The drive supports both host and drive cable detection. The host detects the 80-conductor cable by sampling pin 34, CBLID-, on the interface bus. The drive detects the 80-conductor cable by sensing a capacitor at the host side through the CBLID- signal. The result is reported in a Fast Rise Detected bit (bit 13 of word 93 in the Identify drive parameter block).

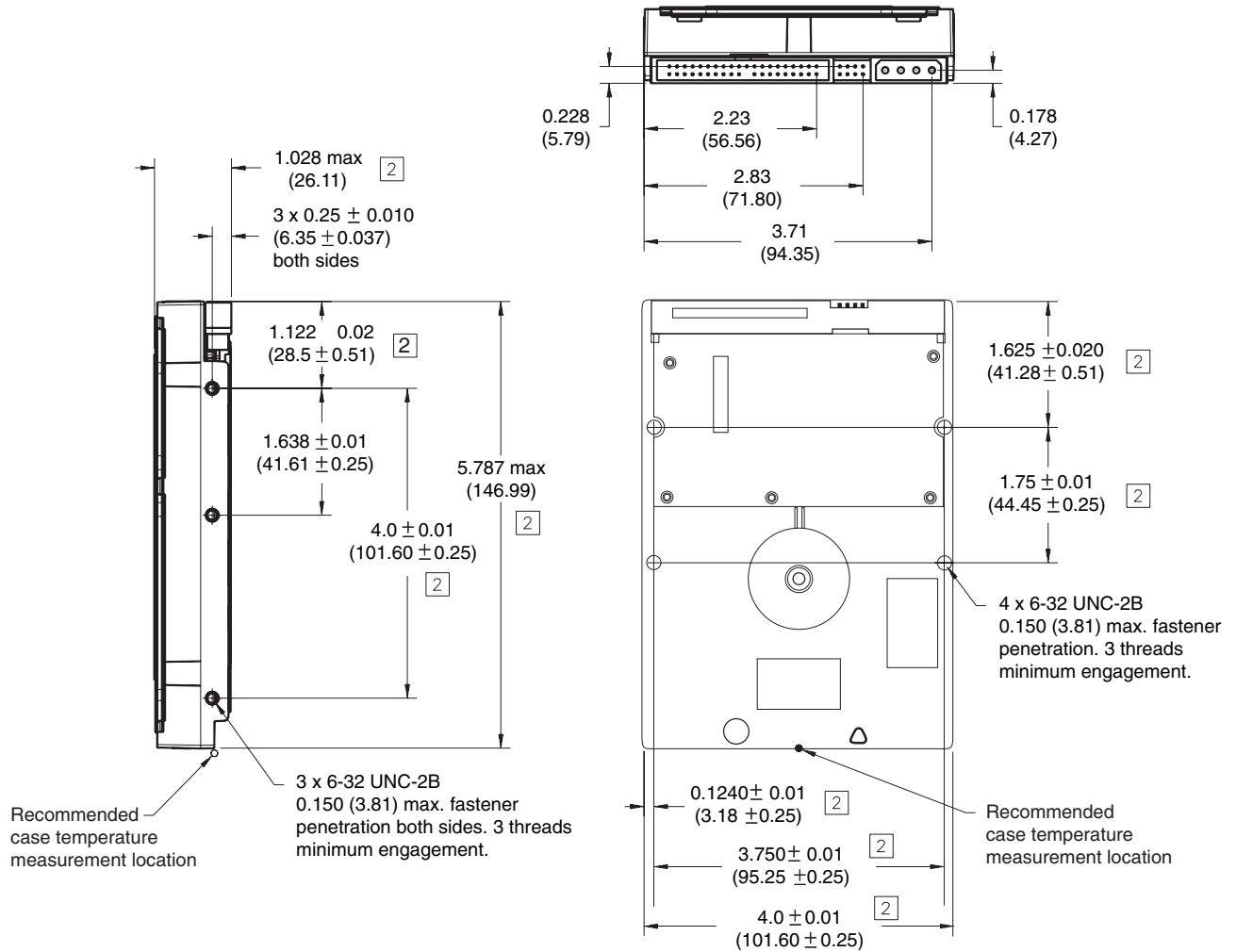
## 3.4 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 6 for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb.).
- Do not use a drive interface cable that is more than 18 inches long.

**Notes:**

- 1. Dimensions are shown in inches (mm).
- 2 Dimensions per SFF-8301 specification.



**Figure 6** Mounting dimensions—top, side and end view





## 4.0 ATA interface

These drives use the industry-standard ATA task file interface that supports 16-bit data transfers. It supports ATA programmed input/output (PIO) modes 0–4; multiword DMA modes 0–2, and Ultra DMA modes 0–5. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

You can use a daisy-chain cable to connect two drives to a single AT host bus. For detailed information about the ATA interface, refer to the draft of *AT Attachment with Packet Interface Extension (ATA/ATAPI-7)*, *NCITS T13 1410D*, subsequently referred to as the *Draft ATA-7 Standard*.

### 4.1 ATA interface signals and connector pins

Figure 7 on page 27 summarizes the signals on the ATA interface connector that the drive supports. For a detailed description of these signals, refer to the *Draft ATA-7 Standard*.

| Drive pin # | Signal name | Host pin # and signal description  |
|-------------|-------------|--|
| 1           | Reset-      | 1 Hardware Reset   |
| 2           | Ground      | 2 Ground   |
| 3           | DD7         | 3 Host Data Bus Bit 7  |
| 4           | DD8         | 4 Host Data Bus Bit 8  |
| 5           | DD6         | 5 Host Data Bus Bit 6  |
| 6           | DD9         | 6 Host Data Bus Bit 9  |
| 7           | DD5         | 7 Host Data Bus Bit 5  |
| 8           | DD10        | 8 Host Data Bus Bit 10   |
| 9           | DD4         | 9 Host Data Bus Bit 4  |
| 10          | DD11        | 10 Host Data Bus Bit 11  |
| 11          | DD3         | 11 Host Data Bus Bit 3   |
| 12          | DD12        | 12 Host Data Bus Bit 12  |
| 13          | DD2         | 13 Host Data Bus Bit 2   |
| 14          | DD13        | 14 Host Data Bus Bit 13  |
| 15          | DD1         | 15 Host Data Bus Bit 1   |
| 16          | DD14        | 16 Host Data Bus Bit 14  |
| 17          | DD0         | 17 Host Data Bus Bit 0   |
| 18          | DD15        | 18 Device Data (15:0)  |
| 19          | Ground      | 19 Ground  |
| 20          | (removed)   | 20 (No Pin)  |
| 21          | DMARQ       | 21 DMA Request   |
| 22          | Ground      | 22 Ground  |
| 23          | DIOW-       | 23 Device I/O Write:<br>Stop Ultra DMA Burst                               |
| 24          | Ground      | 24 Ground  |
| 25          | DIOR-       | 25 Device I/O Read:<br>Host Ultra DMA Ready:<br>Host Ultra DMA Data Strobe |
| 26          | Ground      | 26 Ground  |
| 27          | IORDY       | 27 I/O Channel Ready   |
|             | DDMARDY-    | Device Ultra DMA Ready   |
|             | DSTROBE     | Device Ultra DMA Data Strobe   |
| 28          | CSEL        | 28 Cable Select  |
| 29          | DMACK-      | 29 DMA Acknowledge   |
| 30          | Ground      | 30 Ground  |
| 31          | INTRQ       | 31 Device Interrupt  |
| 32          | IOCS16-     | 32 Reserved  |
| 33          | DA1         | 33 Host Address Bus Bit 1  |
| 34          | PDIAG-      | 34 Passed Diagnostics  |
|             | CBLID-      | Cable Assembly Type Identifier   |
| 35          | DA0         | 35 Device Address (2:0)  |
| 36          | DA2         | 36 Device Address (2:0)  |
| 37          | CS0-        | 37 Chip Select (1:0)   |
| 38          | CS1-        | 38 Chip Select (1:0)   |
| 39          | DASP-       | 39 Drive Active/Slave Present  |
| 40          | Ground      | 40 Ground  |

Pins 28, 34 and 39 are used for master-slave communication (details shown below).

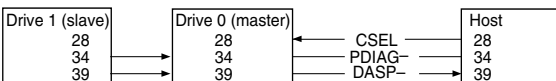


Figure 7 I/O pins and supported ATA signals

#### 4.1.1 Supported ATA commands

The following table lists ATA-standard commands that the drive supports. For a detailed description of the ATA commands, refer to the *Draft ATA-7 Standard*. See “S.M.A.R.T. commands” on page 34 for details and sub-commands used in the S.M.A.R.T. implementation.

**Table 6: Supported ATA commands**

| Command name                        | Command code (in hex)              |
|-------------------------------------|------------------------------------|
| Check Power Mode                    | 98 <sub>H</sub> or 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                                | 97 <sub>H</sub> or E3 <sub>H</sub> |
| Idle Immediate                      | 95 <sub>H</sub> or 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>                    |

| Command name  | Command code (in hex)  |
|---|--|
| 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<br>Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right. | F9 <sub>H</sub><br>Address: 00 <sub>H</sub><br>Password: 01 <sub>H</sub><br>Lock: 02 <sub>H</sub><br>Unlock: 03 <sub>H</sub><br>Freeze Lock: 04 <sub>H</sub> |
| Set Max Address Extended  | 37 <sub>H</sub>  |
| Set Multiple Mode   | C6 <sub>H</sub>  |
| Sleep   | 99 <sub>H</sub> or E6 <sub>H</sub>   |
| S.M.A.R.T. Disable Operations   | B0 <sub>H</sub> / D9 <sub>H</sub>  |
| S.M.A.R.T. Enable/Disable Autosave  | B0 <sub>H</sub> / D2 <sub>H</sub>  |
| S.M.A.R.T. Enable Operations  | B0 <sub>H</sub> / D8 <sub>H</sub>  |
| S.M.A.R.T. Execute Offline  | B0 <sub>H</sub> / D4 <sub>H</sub>  |
| S.M.A.R.T. Read Attribute Thresholds  | B0 <sub>H</sub> / D1 <sub>H</sub>  |
| S.M.A.R.T. Read Data  | B0 <sub>H</sub> / D0 <sub>H</sub>  |
| S.M.A.R.T. Read Log Sector  | B0 <sub>H</sub> / D5 <sub>H</sub>  |
| S.M.A.R.T. Return Status  | B0 <sub>H</sub> / DA <sub>H</sub>  |
| S.M.A.R.T. Save Attribute Values  | B0 <sub>H</sub> / D3 <sub>H</sub>  |
| S.M.A.R.T. Write Log Sector   | B0 <sub>H</sub> / D6 <sub>H</sub>  |
| Standby   | 96 <sub>H</sub> or E2 <sub>H</sub>   |
| Standby Immediate   | 94 <sub>H</sub> or E0 <sub>H</sub>   |
| Write Buffer  | E8 <sub>H</sub>  |
| Write DMA   | CA <sub>H</sub>  |
| Write DMA Extended  | 35 <sub>H</sub>  |
| Write DMA Without Retries   | CB <sub>H</sub>  |
| Write Log Extended  | 3F <sub>H</sub>  |
| Write Multiple  | C5 <sub>H</sub>  |
| Write Multiple Extended   | 39 <sub>H</sub>  |
| Write Sectors   | 30 <sub>H</sub>  |
| Write Sectors Without Retries   | 31 <sub>H</sub>  |
| Write Sectors Extended  | 34 <sub>H</sub>  |

#### 4.1.2 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 the Table 6 on page 28. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive. See Section 2.0 on page 3 for default parameter settings.

The following commands contain drive-specific features that may not be included in the *Draft ATA-7 Standard*.

| Word  | Description  | Value             |
|-------|--|-------------------|
| 0     | Configuration information:<br>• Bit 15: 0 = ATA; 1 = ATAPI<br>• Bit 7: removable media<br>• Bit 6: removable controller<br>• 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<br>(40 ASCII characters, padded with blanks to end of string)   | ST3xxxxxA         |
| 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> |

| Word    | Description   | Value   |
|---------|---|---|
| 60–61   | Total number of user-addressable LBA sectors available (see Section 2.2 for related information)<br>*Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137 Gbytes). Drives with capacities over 137 Gbytes will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature. | 0FFFFFFFh*  |
| 62      | Retired   | 0000 <sub>H</sub>   |
| 63      | Multiword 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 multiword DMA transfer cycle time per word (120 nsec)   | 0078 <sub>H</sub>   |
| 66      | Recommended multiword DMA transfer cycle time per word (120 nsec)   | 0078 <sub>H</sub>   |
| 67      | Minimum PIO cycle time without IORDY flow control (240 nsec)  | 00F0 <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   | 0000 <sub>H</sub>   |
| 76–79   | SATA-specific   | xxxx <sub>H</sub>   |
| 80      | Major version number  | 007E <sub>H</sub>   |
| 81      | Minor version number  | 0000 <sub>H</sub>   |
| 82      | Command sets supported  | 346B <sub>H</sub>   |
| 83      | Command sets supported  | 7D01 <sub>H</sub>   |
| 84      | Command sets support extension  | 4003 <sub>H</sub>   |
| 85      | Command sets enabled  | 34xx <sub>H</sub>   |
| 86      | Command sets enabled  | 3xxx <sub>H</sub>   |
| 87      | Command sets enable extension   | 4003 <sub>H</sub>   |
| 88      | Ultra DMA support and current mode (see note following this table)  | xx3F <sub>H</sub>   |
| 89      | Security erase time   | 0000 <sub>H</sub>   |
| 90      | Enhanced security erase time  | 0000 <sub>H</sub>   |
| 92      | Master password revision code   | FFFE <sub>H</sub>   |
| 93      | Hardware reset value (see description following this table)   | xxxx <sub>H</sub>   |
| 95–99   | ATA-reserved  | 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: 0000FFFFFFFFFFFFh.   | ST3750640AV = 1,465,149,168<br>ST3500630AV = 976,773,168<br>ST3320620AV = 781,422,768<br>ST3250820AV = 488,397,168<br>ST3160815AV = 312,581,808 |
| 104–127 | 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>   |

| Word | Description    | Value             |
|------|----------------|-------------------|
| 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, 88, and 93 of the Identify Drive data:

| Description (if bit is set to 1) |            |  |
|----------------------------------|------------|--|
|                                  | <b>Bit</b> | <b>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</b> | <b>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.   |
|                                  | 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.  |
|                                  | <b>Bit</b> | <b>Word 93</b>   |
|                                  | 13         | 1 = 80-conductor cable detected, CBLID above V <sub>IH</sub><br>0 = 40-conductor cable detected, CBLID below V <sub>IL</sub> |

### 4.1.3 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:

|                 |   |
|-----------------|---|
| 02 <sub>H</sub> | Enable write cache ( <i>default</i> ).  |
| 03 <sub>H</sub> | Set transfer mode (based on value in Sector Count register).<br>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  |
| 55 <sub>H</sub> | Disable read look-ahead (read cache) feature.   |
| 82 <sub>H</sub> | Disable write cache.  |
| 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.

#### 4.1.4 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disc 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-7 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. You 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.

| 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.



## 5.0 Seagate Technology support services

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### Internet

For information regarding Seagate products and services, visit [www.seagate.com](http://www.seagate.com). Worldwide support is available 24 hours daily by email for your questions.

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### Technical Support:

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### Warranty Support:

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## Seagate Service Centers

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Our Presales Support staff can help you determine which Seagate products are best suited for your specific application or computer system, as well as product availability and compatibility.

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**SeaTDD™ (+1-405-324-3655)** is a telecommunications device for the deaf (TDD). You can send questions or comments 24 hours daily and exchange messages with a technical support specialist during normal business hours for the call center in your region.

## Customer Service Operations

### Warranty Service

Seagate offers worldwide customer support for Seagate products. Seagate distributors, OEMs and other direct customers should contact their Seagate Customer Service Operations (CSO) representative for warranty-related issues. Resellers or end users of drive products should contact their place of purchase or Seagate warranty service for assistance. Have your serial number and model or part number available.

### Data Recovery Services

Seagate offers data recovery services for all formats and all brands of storage media. Our data recovery services labs are currently located throughout the world. . Additional information, including an online request form and data loss prevention resources, is available at <http://services.seagate.com/index.aspx>

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For an extensive list of telephone numbers to technical support, presales and warranty service in USA/Canada/Latin America, including business hours, go to the "Contact Us" page on [www.seagate.com](http://www.seagate.com).

## Global Customer Support

### Presales, Technical, and Warranty Support

| Call Center             | Toll-free     | Direct dial     |
|-------------------------|---------------|-----------------|
| USA, Canada, and Mexico | 1-800-SEAGATE | +1-405-324-4700 |

### Data Recovery Services

| Call Center             | Toll-free       | Direct dial     | FAX                               |
|-------------------------|-----------------|-----------------|-----------------------------------|
| USA, Canada, and Mexico | 1-800-475-01435 | +1-905-474-2162 | 1-800-475-0158<br>+1-905-474-2459 |

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