Seagate

Medalist 630xe

Medalist 850xe

ATA Interface Drive

Product Manual

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Contents

Contents

Introduction

This manual describes the functional, mechanical and interface specifications for the Medalist 630xe and the Medalist 850xe hard disc drives. The drives are referred to throughout this manual by their model numbers, ST3630A for the Medalist 630xe and ST3850A for the Medalist 850xe.

The ST3630A and ST3850A are designed to meet the needs of entry level-to-midrange desktop computers. They are standard 3.5-inch form-factor drives that feature advance transfer modes, Multiple block read/write, segmented cache and power management. Their respective 631.1-Mbyte and 850.5-Mbyte capacities provide ample space to store large software programs and for those programs to run efficiently.

Fast-ATA performance is available in both drives. The ST3850A supports advanced PIO modes 3 and 4 and advanced multiword DMA modes 1 and 2 for burst transfer rates up to 16.6 Mbytes per second. The ST3630A supports advanced PIO mode 3 and advanced multiword DMA mode 1 for burst transfer rates up to 13.3 Mbytes per second. Both drives support Multiple block read/write, which allows them to store contiguous blocks of data in their 120-Mbyte segmented cache and to transfer the blocks in a single burst.

The drives support power-management modes for energy-efficient operation. Power dissipation falls to 0.725 W (typical) in Standby mode. The drives enter power-saving modes at the request of the host. They can also be programmed to automatically enter power-saving modes using the Idle timer or Standby timer commands. The power-management modes the drives support are discussed in subsection 1.7.1 on page 8. The power-management commands the drives support are listed in the ATA-command table on page 24.

Quick specification chart

The following table serves as a quick reference for the ST3630A and the ST3850A performance specifications. These and other specifications are discussed in the Specification summary section following the table.

Drive specification	**ST3630A**	**ST3850A**
Guaranteed capacity (Mbytes[1]) (x10^6 bytes)	631.1	850.5
Guaranteed sectors	1,232,784	1,661,184
Bytes per sector	512	512
Sectors per track	63	63
Logical Read/Write heads	16	16
Logical cylinders	1,223	1,648
Physical Read/Write heads	4	4
Physical disc	2	2
Recording density (Kbits/inch)	68	70
Track density (tracks/inch)	3,384	4,300
Spindle speed (RPM)	3,811	3,811
Track-to-track seek time (msec typical)	5	5
Average seek time (msec typical)	14	14
Full-stroke seek time (msec typical)	34	34
Average latency (msec)	7.87	7.87
Internal data-transfer rate (Mbits per sec max)	22.9 to 39.6	23.1 to 42.3
External transfer rate (Mbytes per sec) PIO mode	11.1 (max)	16.6 (max)
External transfer rate (Mbytes per sec) DMA mode	13.3 (max)	16.6 (max)
Cache buffer (Kbytes)	120	120
Height (inches max)	1.00	1.00
Width (inches max)	4.02	4.02
Depth (inches max)	5.77	5.77
Typical weight (lb)	1.3	1.3
Power-on to ready (sec typical)	7	7
Spinup current (typical)	1.25A	1.25A

1. One Mbyte equals one million bytes.

Drive specification	**ST3630A**	**ST3850A**
Seek power (typical)	5.23 W	5.23W
Read/Write power (typical)	3.34W	3.34W
Idle total power (typical)	1.985W	1.985W
Standby(typical)	0.725W	0.725W
Voltage tolerance (including noise): +5V	±5%	±5%
Voltage tolerance (including noise): +12V	±5%	±5%
Operating temperature (°C)	5 to 55°C	5 to 55°C
Nonoperating temperature (°C)	–40 to 70°C	–40 to 70°C
Operating temperature gradient (°C per hr. max)	20°C	20°C
Relative humidity, operating gradient (max.)	10% per hr	10% per hr
Altitude operating	–1,000 to 10,000 ft.	–1,000 to 10,000 ft.
Altitude nonoperating	–1,000 to 40,000 ft.	–1,000 to 40,000 ft.
Shock, normal operating (Gs max at 11 msec)	2.0 Gs	2.0 Gs
Shock, nonoperating (Gs max at 11 msec)	75.0 Gs	75.0 Gs
Vibration (Gs max at 22-300 Hz without nonrecoverable errors), operating	1.0 Gs Peak to Peak	1.0 Gs Peak to Peak
Vibration (Gs max at 22-300 Hz with no physical damage incurred), Nonoperating	8.0 Gs Peak to Peak	8.0 Gs Peak to Peak
Drive acoustics, Idle mode (dBA), typ	29 dBA	29 dBA
Nonrecoverable read errors (per bits transferred)	10^{13}	10^{13}
Mean time between failures (power-on hours)	300,000	300,000
Contact start-stop cycles	40,000	40,000
Service life (years)	5	5

1.0 Specification summary

1.1 Format configuration

The drive is low-level formatted at the factory. You do not need to low-level format the drive.

You can operate the drive using many different address configurations, provided the number of sectors per track does not exceed 63. The following tables show the cylinder head sector (CHS) translation geometry for the drive. You can verify the parameters using the Identify Drive (EC_H) command.

ST3630A	**CHS**	**LBA**
Cylinders	1,223	
Heads	16	
Sectors per track	63	
Guaranteed capacity (bytes)	631,185,408	631,185,408
Guaranteed sectors	1,232,784	1,232,784

ST3850A	**CHS**	**LBA**
Cylinders	1,648	
Heads	16	
Sectors per track	63	
Guaranteed capacity (bytes)	850,526,208	850,526,208
Guaranteed sectors	1,661,184	1,661,184

1.2 Physical organization

Model	ST3630A	ST3850A
Heads	4	4
Discs	2	2

1.3 Functional specifications

Model	ST3630A	ST3850A
Interface	ATA	ATA
Internal data-transfer rate (Mbits/sec)	22.9 to 39.6	23.1 to 42.3
External data-transfer rate (Mbytes/sec)		
PIO Mode	11.1 (max)	16.6 (max)
DMA Mode	13.3 (max)	16.6 (max)
Spindle speed ± 0.5% (RPM)	3,811	3,811
Segmented cache (Kbytes)	120	120
Zone Bit Recording method	RLL (1,7)	RLL (1,7)
Bytes per sector	512	512
Recording density, max (BPI)	68K	70K
Flux density, max (FCI)	51K	52.5K
Track density, max (TPI)	3,384	4,300

1.4 Physical dimensions

Height (max)	1.00 inch (25.4 mm)
Width (max)	4.02 inches (102.1 mm)
Depth (max)	5.77 inches (146.6 mm)
Weight (max)	1.3 lb (0.59 Kg)

1.5 Seek time

All performance measurements are taken using a 25-MHz 486 AT computer (or faster) with an 8.3-MHz I/O bus. The measurements are taken using nominal power at sea level and at 25°C ambient temperature. The specifications in the table 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 10,000 measurements of seeks between random tracks, less overhead.
- Full-stroke seek time is one-half the time needed to seek from the first data cylinder to the maximum data cylinder and back to the first data cylinder. The full-stroke average is determined by measuring 100 full-stroke seeks in both directions.

Track-to-track typ (msec)	Average typ (msec)	Full-stroke typ (msec)	Latency (msec)
5	14	34	7.87

1.6 Start and stop time

The drive is ready within 10 seconds. Typical and maximum start and stop times are shown in the following table. Figure 1 on page 8 shows a typical startup current profile.

	Typical	Maximum
Start time	7 sec	10 sec
Stop time	6 sec	9 sec

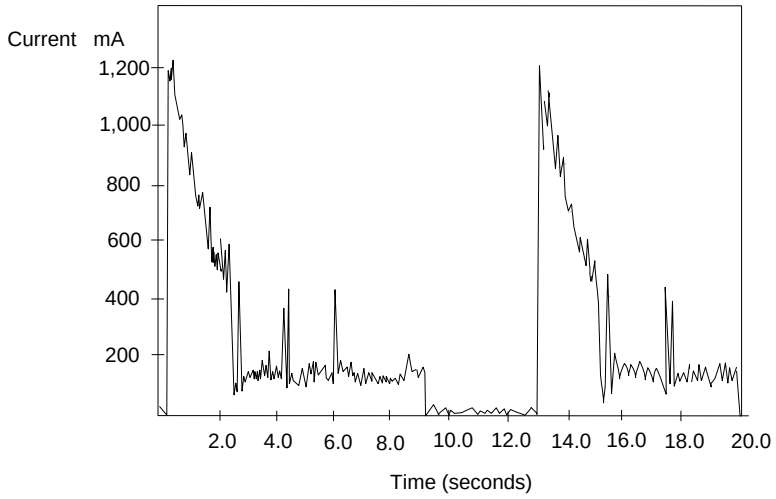

Figure 1. Typical startup current profile

1.7 Power specifications

Except during a write operation, you can apply power to the drive or remove power from the drive in any sequence without losing data or damaging the drive.

1.7.1 Power-management modes

The drive supports the following power-management modes:

- **Active mode.** The drive is seeking, reading or writing.
- **Idle mode.** The drive enters Idle mode when it receives an Idle Immediate command or the idle timer counts down to zero. In Idle mode the spindle remains up to speed, the segmented cache remains enabled, and the drive accepts all commands and returns to the Active mode whenever a seek, read or write operation is needed.
- **Standby mode.** The drive enters Standby mode when it receives a Standby Immediate command or the standby timer counts down to zero. In the Standby mode the segmented cache remains enabled, the heads are parked in the shipping zone and the spindle is stopped. The drive accepts all commands and returns to the Active mode whenever a seek, read or write operation is needed.
- **Sleep mode.** The drive enters Sleep mode when it receives a Sleep Immediate command. The heads are parked in the shipping zone and the spindle is at rest. A hard reset or a soft reset returns the drive to Active mode. A soft reset preserves the current emulation and translation parameters.

1.7.1.1 Idle and Standby timers

The drive can enter the Idle mode or the Standby mode by either of two methods:

- The computer sends an Idle Immediate command or a Standby Immediate command.
- The idle timer or the standby timer counts down to zero.

The Idle and Standby timers are disabled at the factory. Use the computer's setup utility to enable and set the timer delays. When the Idle timer is enabled, it is initialized each time the drive completes a read, write or seek.

If the Idle timer reaches zero before any drive activity is required, the drive goes into the Idle mode, and the Standby timer, if it is enabled, is initialized. If the Standby timer reaches zero before any drive activity is required, the drive goes into the Standby mode. See the *Seagate ATA Interface Reference Manual*, publication number 36111-*xxx,* for details.

In both the Idle and Standby modes, the drive accepts all commands and returns to the Active mode any time disc access is necessary. There may be a slight delay between the time the drive receives the command and the time drive activity begins.

1.7.1.2 Power consumption

The following guidelines are used to measure power consumption:

- All measurements are taken at sea level with an ambient temperature of 25°C.
- All typical measurements are taken using nominal voltages; the peak startup power is measured using the nominal voltages.
- Seek current measurements are taken using an RMS meter while the drive is randomly seeking with two spindle rotations between each seek.

Mode	Current (amps)		Power (watts)
	+12V	+5V	
Spinup (peak)	1.25	0.35	8.5[3]
Active			
Seeking (typ)	0.34	0.23	5.23
Read/write (typ)	0.145	0.32	3.34
Idle[2] (typ)	0.13	0.085	1.985
Standby[2] (typ)	0.025	0.085	0.725
Sleep[2] (typ)	0.025	0.070	0.650

1.7.2 Voltage tolerances

	+5V	+12V
Voltage tolerance including noise	± 5%	± 5% ± 10% during spinup

1.7.3 Conducted noise

The drive is expected to operate with a maximum of:

- 150 mV peak-to-peak triangular-wave injected noise at the power connector. The frequency is 10 Hz to 100 KHz with equivalent resistive loads.[4]
- 100 mV peak-to-peak triangular-wave injected noise at the power connector. The frequency is 100 KHz to 10 MHz with equivalent resistive loads.[4]

2. These values apply only when power management is enabled. To enable power management, use the computer setup utility.

3. Spinup power is averaged over 7 seconds.

4. Equivalent resistance is calculated by dividing the respective voltage by the typical RMS read/write current.

1.7.4 Environment

The acceptable environmental conditions for the drive are specified below. The specifications in this section are defined as follows:

- Operating specifications assume that the drive is powered up.
- Nonoperating specifications assume that the drive is packaged as it was shipped from the factory.

1.7.5 Ambient temperature

Operating	5° to 55°C (41° to 131°F)
Nonoperating	–40° to 70°C (–104° to 158°F)

1.7.6 Temperature gradient

Operating (max)	20°C per hour (36°F per hour)
Nonoperating (max)	30°C per hour (54°F per hour)

1.7.7 Relative humidity

Operating	8% to 80% noncondensing Maximum wet bulb 29.4°C (85.0°F)
Nonoperating	5% to 95% noncondensing Maximum wet bulb 40.0°C (104.0°F)

1.7.8 Altitude

Operating	–1,000 ft to 10,000 ft (–305 m to 3,050 m)
Nonoperating	–1,000 ft to 40,000 ft (–305 m to 12,200 m)

1.7.9 Shock and vibration

Shock measurements are based on an 11 msec, half sine wave shock pulse that are not to be repeated more than twice per second. The specifications in the table below are defined as follows:

- Normal operating—the drive sustains no physical damage, and reads and writes data without errors
- Abnormal operating—for a period of not more than 15 minutes duration at the major resonant frequency, the drive shall sustain no physical damage, but performance is adversely affected.
- Nonoperating—no power is applied to the drive and the read/write heads are in the shipping zone; the drive shall sustain no physical damage.

	Normal operating	**Abnormal operating**	**Nonoperating**
Shock	2.0 Gs	10.0 Gs	75.0 Gs
5–22 Hz vibration	0.020-inch displacement peak-to-peak	0.030-inch displacement peak-to-peak	0.160-inch displacement peak-to-peak
22–300 Hz vibration	1.0 G peak-to-peak	1.5 Gs peak-to-peak	8.0 Gs peak-to-peak

1.8 Acoustics

Sound pressure is measured at idle from 1 meter above the drive's top cover.

Model	**ST3630A**	**ST3850A**
Idle sound pressure, typ	29 dBA	29 dBA
Idle sound pressure, max	33 dBA	33 dBA

1.9 Reliability

The MTBF and contact start-stop specifications assume nominal power at sea level with an ambient temperature of 25°C.

Nonrecoverable errors	1 per 10^{13} bits read
MTBF	300,000 power-on hours
Contact start-stop (CSS)	40,000 cycles
MTTR	30 minutes
Service life	5 years

1.10 Auto-park

Upon power-down, the read/write heads automatically move to the shipping zone. The heads park inside the maximum data cylinder. When power is applied, the heads recalibrate to track 0.

1.11 Agency listings

This drive is listed with agencies as follows:

- UL 1950
- CSA C22.2 No. 0-M91 and CSA C22.2 No. 950-M89
- EN 60950/10.92 as tested by TUV-Rheinland, North America

1.12 EC compliance

Hard drives that display the CE marking comply with European Union requirements specified in Electromagnetic Compatibility Directive 89/336/EEC as amended by Directive 92/31/EEC of 28 April 1992 and Directive 93/68/EEC of 22 July 1993.

Seagate® uses an independent laboratory to confirm compliance with the EC directives specified in the previous paragraph. Drives are tested in representative end-user systems using 80486, Pentium and PowerPC microprocessors. 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. The computer manufacturer or system integrator should confirm EMC compliance and provide CE marking for their product.

1.13 FCC verification

The ST3630A drive is intended to be contained solely within a personal computer or similar enclosure (not attached to an external device). As such, a drive is considered to be a subassembly even when individually marketed to the customer. As a subassembly, no Federal Communications Commission authorization, verification or certification of the device is required.

Seagate Technology, Inc. has tested the drive in an enclosure 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 of 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 equipment into a different outlet so that the receiver and computer are on different branch outlets.

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

2.0 Configuration and mounting

This section discusses the configuration and mounting specifications for the drives. Figure 2 on page 16 shows the location of the connectors on the drives. A brief discussion of the connectors, the master/slave jumper block settings and on mounting the drives follow.

2.1 Handling and static-discharge precautions

After you unpack the drive, and before you install it in a computer, be careful not to damage it through mishandling. Wool and synthetic clothing, carpet, plastics and Styrofoam are contributors to the static build-up that can damage sensitive components that is discharged through touch. Observe these standard handling and static-discharge precautions:

Caution:

- Keep the drive in its static-shielded bag until you are ready to complete the installation. Do not attach any cables to the drive while it is in the static-shielded bag.
- Wear a wrist strap that is properly connected to earth ground, or ground yourself frequently by touching the metal chassis of a power supply that is plugged into a grounded outlet when handling the drive and 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. If you do, you void the warranty. Some factory-installed labels contain information needed to service the drive. Others are used to seal out dirt and contamination.

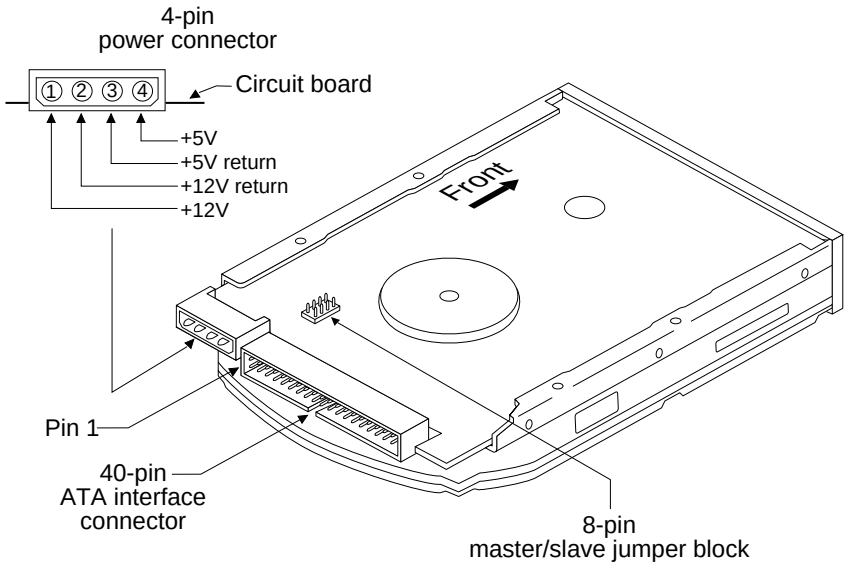

Figure 2. ST3850A Connectors and jumpers

2.2 The ATA interface connector

The drive uses a standard 40-pin interface connector with 2 rows of 20 male pins. Pin 20 is removed. The connector is shown in Figure 2.

For the mating connector, use a 40-pin, nonshielded connector with 2 rows of 20 female contacts. We recommend the following part numbers:

AMP	499496
Berg Electronics	66900-040

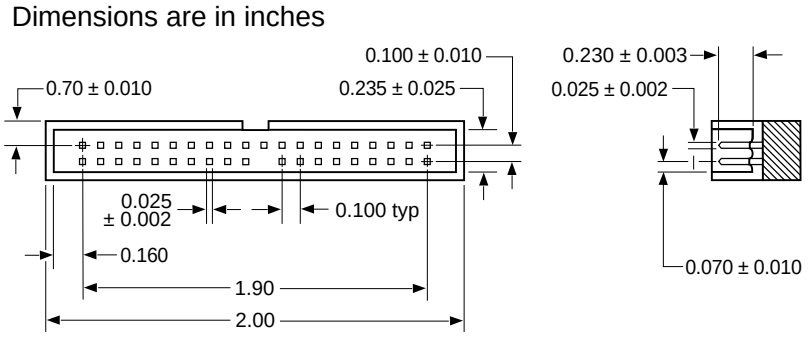

Figure 3. The drive interface connector

2.3 Power connector

The drive comes with a standard 4-pin power connector.

2.4 Master/slave jumper block

The master/slave jumper block allows you to configure the drive for operation. Figure 4 on page 18 shows the master/slave jumper block configuration options. A brief description of each option is follows the drawing.

A spare jumper is attached in a neutral position on pins 1 and 3 by the factory. The jumper block accepts 2-mm (0.079-inch) jumpers. If you need additional jumpers, use Seagate part number 10562-001 or an equivalent.

Caution. If you use a jumper that is not the correct size, you may damage the jumper block and the jumper.

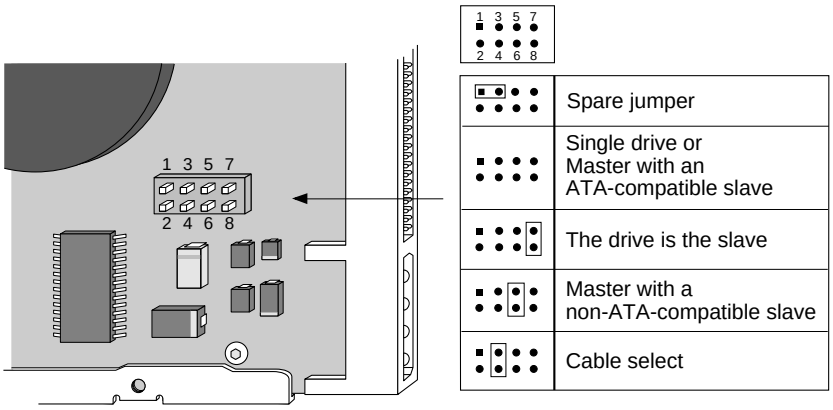

Figure 4. Master/slave jumper block settings

2.4.1 Single-drive or master with an ATA-compatible slave

This is the factory default configuration (the jumper place on pins 1 and 3 is a spare and does not affect drive operation). The drive operates as a single drive on the controller or as the master drive with an ATA-compatible slave.

2.4.2 The drive as slave

To make the drive the slave, attach the jumper to pins 7 and 8.

2.4.3 Master with a non-ATA-compatible slave

This setting allows you to configure the drive to work with some slaves that do not conform to the DASP– timing parameter of the ATA specification. When a jumper is placed on pins 5 and 6, the drive assumes a slave is present and ignores the initial DASP– signal. The slave must return the PDIAGS– signal.

2.4.4 Cable-select configuration

To configure the drive for computers that use cable select (CSEL), place the jumper on pins 3 and 4. The interface cable must be designed for cable-select interconnection. The cable construction determines whether the drive is the master or the slave.

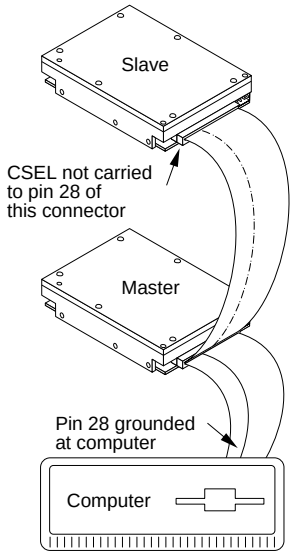

Figure 5. Connecting cable-selected drives

2.4.5 Factory-test configuration

Do not install jumpers on pins 5 and 6 and pins 7 and 8 at the same time. This configuration is used to test the drive at the factory. When jumpers are installed in both of these positions, the heads continuously seek back and forth across the media and the drive ignores all control signals sent through the interface.

2.5 Mounting the drive

You can mount the drive in any orientation using either the bottom or the side mounting holes as described below. Figure 6 on page 20 shows the drive dimensions and mounting holes.

Bottom mounting holes. Insert four mounting screws not more than 0.20 inches (6 full turns) into the drive frame.

Side mounting holes. Insert four mounting screws not more than 0.13 inches (4 full turns) into the drive frame.

Caution. To prevent damage to the drive:

- Use only mounting screws of the correct size and length.
- Lightly tighten the mounting screws—do not apply more than 6 inch-pounds of torque.

Figure 6 shows the dimensions in inches.

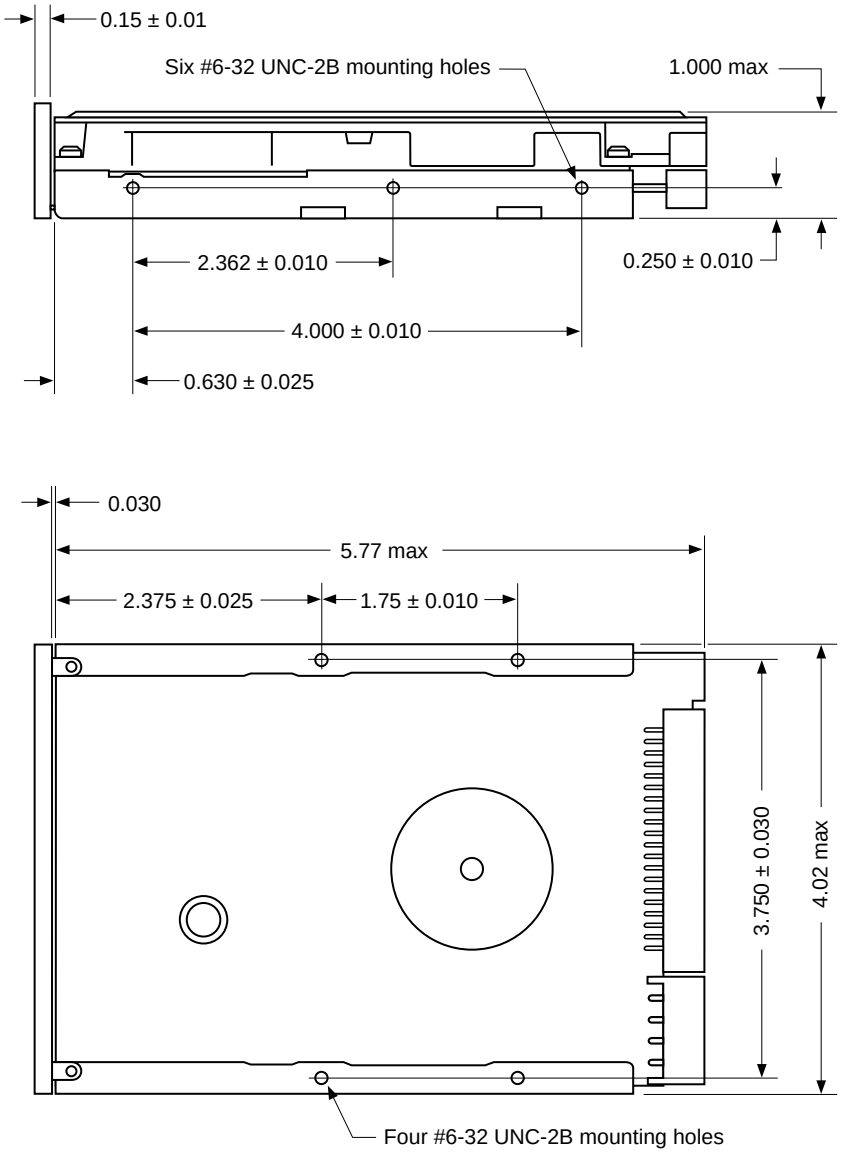

Figure 6. Standard mounting dimensions

3.0 ATA interface

The drives use an ATA interface. The interface is in compliance with ANSI *ATA (AT Attachment) Interface X3.221, Rev. 4*; *SFF 8011: ATA Timing Extension for Local Bus Attachments, Rev. 2.0*; *SFF 8019: Identify Drive Data for Drives Under 8 GB* and *Draft Proposal American National Standards AT Attachment Interface X3.310-948D, Rev. 2E*. The ATA commands the drives support are listed in the table on page 24. Commands and features with specific application for the drives are discussed in this section. For a general discussion of the Seagate ATA interface, refer to the *Seagate ATA Interface Reference Manual*, publication number 36111-*xxx*.

The ATA interface consists of single-ended, TTL-compatible receivers and drivers that use an asynchronous interface protocol. The drivers can sink up to 24 mA and drive a load up to 300 pF. The integrity of the ATA interface is affected by the interface cable. It is designed to support a 40-conductor, nonshielded interface cable with a maximum length of 18 inches (0.46 meters).

3.1 ATA interface connector pin assignments

The signal name and direction for each I/O connector pin is shown in Figure 7 on page 22. For a description of each pin, see the *Seagate ATA Interface Reference Manual*, publication number 36111-*xxx.*

Signal names are shown in upper-case letters. Signal name followed by a minus sign (–) indicate the signal is active low. Otherwise, the signal is active high.

Note. The drive does not use the SPSYNC– signal.

3.2 Bus signal levels

Signals that the drive sends have the following output characteristics measured at the drive connector.

Logic low	0 to 0.4V
Logic high	2.5 to 5.25V

Signals that the drive receives must have the following input characteristics measured at the drive connector.

Logic low	0 to 0.8V
Logic high	2.0 to 5.25V

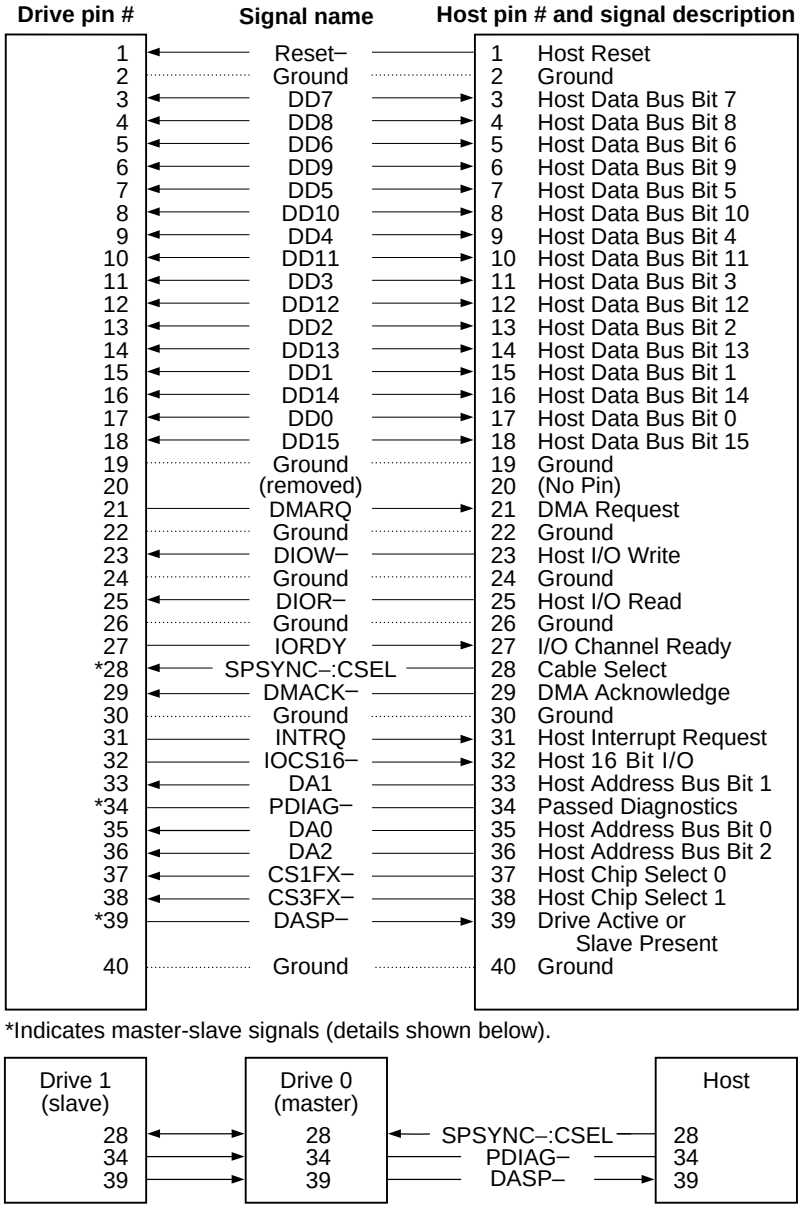

Figure 7. ATA connector pin assignments

3.3 Supported ATA commands

The table on page 24 lists all ATA commands the drives use. Commands that have a unique application or that may be of special interest are discussed in this manual. For a complete description of all ATA interface commands the drives use, refer to the *Seagate ATA Interface Reference Manual*, part number 36111-*xxx*. Additional information is provided by the *Small Form Factor specification, SFF-8011 Rev 1.1, September 18, 1993*.

The table on page 24 lists all of the ATA commands implemented in the drives. The table uses the following abbreviations:

FR	Features register
SC	Sector count register
SN	Sector number register
CY	Cylinder register
DH	Drive/head register
n	This register does not contain a valid parameter for this command.
y	This register contains a valid parameter for this command. In the drive/head register, both the drive and head parameters are valid for this command.
D	The drive/head register contains a valid drive parameter for this command. The head parameter is not valid for this command.

Command name	Command code (in hex)	Parameters used				
		FR	SC	SN	CY	DH
Active and Set Idle Timer	FB	n	y	n	n	D
Active Immediate	F9	n	n	n	n	D
Check Idle Mode	FD	n	y	n	n	D
Check Power Mode	98, E5	n	y	n	n	D
Execute Drive Diagnostics	90	n	n	n	n	D
Format Track	50	n	y	n	y	y
Identify Drive	EC	n	n	n	n	D
Idle	97, E3	n	y	n	n	D
Idle and Set Idle Timer	FA	n	y	n	n	D
Idle Immediate	95, F8, E1	n	n	n	n	D
Initialize Drive Parameters	91	n	y	n	n	y
Read DMA	C8, C9	—	y	y	y	y
Read Long	22, 23	n	y	y	y	y
Read Multiple	C4	n	y	y	y	y
Read Sector	20, 21	n	y	y	y	y
Read Sector Buffer	E4	n	n	n	n	D
Read Verify Sector	40, 41	n	y	y	y	y
Recalibrate	1X	n	n	n	n	D
Seek	7X	n	n	y	y	y
Set Features	EF	y	n	n	n	D
Set Multiple Mode	C6	n	y	n	n	D
Set Sleep Mode	99, E6	n	n	n	n	D
Standby	96, E2	n	n	n	n	D
Standby Immediate	94, E0	n	n	n	n	D
Write DMA	CA, CB	—	y	y	y	y
Write Long	32, 33	n	y	y	y	y
Write Multiple	C5	n	y	y	y	y
Write Sector	30, 31	n	y	y	y	y
Write Sector Buffer	E8	n	n	n	n	D

3.3.1 Identify Drive command (EC_H)

The Identify Drive command transfers information about the drive to the host after power up. The data is organized as a single 512-byte block. The block's contents are shown in the table below. All reserved bits or words must be set to zero. Parameters listed with an "x" are drive-specific or vary with the state of the drive.

The parameters for the drives are listed in the table below. For a complete description of the Identify Drive command, see the *Seagate ATA Interface Reference Manual*, publication number 36111-*xxx*.

Word	Description	Value
0	Configuration	$045A_H$ Bit 10: 1 = disc transfer rate > 10 Mbits/sec Bit 6: 1 = fixed drive Bit 4: 1 = head switch time > 15 µsec Bit 3: 1 = not MFM encoded Bit 1: 1 = hard-sectored disc
1	Default cylinders	ST3630A = 1,223 ST3850A = 1,648
2	Reserved	0000_H
3	Default heads (default)	16
4	Bytes per track	$8D90_H$
5	Bytes per sector	0248_H
6	Default sectors per track	63
7–9	Vendor-unique	0000_H
10–19	Serial number	Drive-unique: 20 ASCII characters
20	Buffer type	0003_H Multisector with caching
21	Buffer size (number of 512-byte sectors)	$00F0_H$ (240_D)
22	ECC bytes (R/W Long)	0010_H (16_D)
23–26	Firmware revision	Drive-dependent: 8 ASCII characters
27–46	Model number	ST3630A, ST3850A

continued

continued from previous page

Word	Description	Value
47	Maximum sectors per interrupt on read/write multiple	0010_H
48	Double word I/O	0000_H Not supported
49	Capabilities	$0B00_H$ DMA, IORDY and LBA supported
50	Reserved	0000_H
51	PIO timing mode	0200_H
52	DMA timing mode	0200_H Single-word DMA supported
53	Current valid	0003_H Bit 0 = 1 indicates the fields reported in words 54–58 are valid; Bit 1 = 1 indicates the fields reported in words 64–8 are valid
54	Current cylinders	ST3630A = 1,223 ST3850A = 1,648
55	Current heads	ST3630A = 16 ST3850A = 16
56	Current sectors per track	ST3630A = 63 ST3850A = 63
57–58	Current sectors	ST3630A = 1,232,784 ST3850A = 1,661,184
59	Current multiple sector setting	$01xx_H$
60–61	LBA total sectors	ST3630A = 1,232,784 ST3850A = 1,661,184
62	Single-word DMA	07_H No modes are active; Modes 0, 1 and 2 are supported
63	Multiword DMA	ST3630A 0103_H Mode 0 is active; Modes 0 and 1 are supported ST3850A 0107H Mode 0 is active; Modes 0, 1 and 2 are supported

Word	Description	Value
64	Advanced PIO	ST3630A 0001_H Mode 3 is supported ST3850A 0003H Modes 3 and 4 are supported
65	Minimum multiword DMA transfer per word	ST3630A = 150 nsec ST3850A = 120 nsec
66	Recommended multiword DMA transfer per word	ST3630A = 150 nsec (DMA mode 1) ST3850A = 120 nsec (DMA mode 2)
67	Minimum PIO without IORDY	ST3630A = 400 nsec ST3850A = 385 nsec
68	Minimum PIO with IORDY[5]	ST3630A = 180 nsec PIO mode 3 ST3850A = 120 nsec (PIO mode 4)
69–127	Reserved	0000_H
128–159	Reserved	*xxxx*$_H$
160–255	Reserved	0000_H

3.3.2 Format track command (50_H)

The drives accept a Format track command (50_H) and the 512 bytes of the format data transferred by the host. However, the command does not mark bad sectors, reassign sectors or unreassign sectors. The first sector data the host transfers is ignored. A 00 data pattern is written to the track specified in the command.

5. Cycle times less than 400 nsec require IORDY.

3.3.3 Set Features command (EF_H)

The host uses the Set Features command (EF_H) to establish parameters that affect the execution of certain drive features. To use the command:

1. Write the Feature value to the Features register.

2. Write the Set Features command to the command register.

Note. If the value in the Features register is not supported or is invalid, the drive posts an Aborted Command error.

Some Set Feature values are enabled at the factory and have default status. The drives revert to these values at power-on or after a hard reset. Value 66_H allows you to retain parameter modifications made to the Set Features command since power-on following a software reset.

The following table shows the alterable features the drives support. The factory default features are indicated in the feature description.

Value	Feature description
02_H	Enable write cache (factory default).
03_H	Set value for Set Transfer mode based on value in Sector Count register.
44_H	Use maximum length of ECC (16 bytes) on read long/write long commands (factory default).
55_H	Disable read look-ahead feature.
66_H	Use the current settings as default (until hard reset or power off).
82_H	Disable write cache.
AA_H	Enable read look-ahead feature (factory default).
BB_H	4 bytes of ECC apply on read long/write long commands.
CC_H	Enable reverting to power-on defaults (factory default).

3.3.3.1 PIO and DMA Data Transfer Modes

You can set the multiword DMA mode and identify the PIO data-transfer mechanism and transfer mode with the Set Features command. To set the multiword DMA mode:

1. Write Set Features command value 03_H (Set Data Transfer mode) to the Features register.
2. Write a transfer types value to the Sector Count register. The upper 5 bits of this value define the type of data transfer, and the lower 3 bits encode the mode value.

   This changes word 63 of the Identify Drive command to the mode you enter in the Sector Count register.

The following table identifies allowable transfer types values:

Data-Transfer Mechanism		Transfer Types value	
Mechanism name	**Mode value**	**Data Upper 5 bits**	**Lower 3 bits**
PIO Transfer Mode (default)	2	00000	000
PIO Transfer Mode: Set PIO Mode = 2	2	00000	001
PIO Flow Control Transfer Mode: Set PIO Mode = 0	0	00001	000
PIO Flow Control Transfer Mode: Set PIO Mode = 1	1	00001	001
PIO Flow Control Transfer Mode: Set PIO Mode = 2	2	00001	010
PIO Flow Control Transfer Mode: Set PIO Mode = 3	3	00001	011
PIO Flow Control Transfer Mode: Set PIO Mode = 4)	4	00001	100
Multiword DMA Mode	0	00100	000
Multiword DMA Mode	1	00100	001
Multiword DMA Mode	2	00100	010
Reserved	—	01000	*nnn*

If the drive does not support a commanded mode, the drive returns an Aborted Command error.

If the drive receives a Set Features command with a Mechanism and mode value of 00000 001 and the drive supports disabling of IORDY, then the drive sets its default PIO transfer mode and disables IORDY.

3.3.4 Set Multiple Mode command ($C6_H$)

The Set Multiple Mode command ($C6_H$) establishes the number of sectors that make a transferable block and enables the drive to perform Read and Write Multiple operations. You do not have to issue this command before every Read Multiple or Write Multiple command.

The Sector Count register is loaded with the number of sectors per block. Drives normally support block sizes of 2, 4, 8 and 16 sectors. However, other block-size values may also be supported, depending on the size of the drive's buffer. After receiving the Set Multiple Mode command, the drive sets BSY=1 and checks the Sector Count register.

If the Sector Count register contains a valid value and the block count is supported, the Read Multiple or Write Multiple command is enabled, and the Sector Count register value is used for all subsequent Read Multiple and Write Multiple commands. If a block count is not supported, an Aborted Command error is posted and the Read Multiple or Write Multiple command is disabled.

If the Sector Count register contains 0 when the command is issued, the Read Multiple or the Write Multiple command is disabled.

The drive reverts to Read Multiple disabled and Write Multiple disabled following a power-on or a hardware reset. If Disable Default (66_H) is set in the Set Features command, the current mode is retained following a software reset.

3.3.5 Read Multiple command ($C4_H$)

The Read Multiple command ($C4_H$) is similar to the Read Sectors command. However, instead of generating interrupts to transfer each sector, interrupts are generated to transfer blocks of sectors as defined by the Set Multiple Mode command.

The Set Multiple Mode command is used to determine the number of sectors that constitute a transferable block. It must be executed before the Read Multiple command. Interrupts are generated when DRQ is set to 1 at the beginning of each block or partial block.

When the Read Multiple command is issued, the Sector Count register contains the number of sectors (not the number of blocks or the block count) requested. If the number of requested sectors is not evenly

divisible by the block count, as many full blocks as possible are transferred followed by the final, partial block. The partial block transfer is for *n* sectors, where

n = remainder (sector count / block count)

If the Read Multiple command is attempted before the Set Multiple Mode is set or when the Read Multiple commands are disabled, the Read Multiple operation is rejected with an Aborted Command error.

Disc errors encountered during Read Multiple commands are posted at the beginning of the block or partial block transfer. DRQ is set and the data transfer takes place as normal. The corrupted data, if any, is included in the transfer.

The contents of the Command Block registers, following the transfer of a data block that had a sector in error, are undefined. The host should retry the transfer as individual requests to obtain valid error information.

Subsequent blocks or partial blocks are transferred only if the error was a correctable data error. All other errors cause the command to stop after the block containing the error is transferred.

3.3.6 Write Multiple command ($C5_H$)

The Write Multiple command ($C5_H$) is similar to the Write Sectors command. However, instead of generating interrupts to transfer each sector, interrupts are generated to transfer blocks of sectors as defined by the Set Multiple Mode command.

The Set Multiple Mode command is used to determine the number of sectors that constitute a transferable block. It must be executed before the Write Multiple command.

When the Write Multiple command is issued, the Sector Count register contains the number of sectors (not the number of blocks or the block count) requested. If the number of requested sectors is not evenly divisible by the block count, as many full blocks as possible are transferred followed by the final, partial block. The partial-block transfer is for *n* sectors, where

n = remainder (sector count / block count)

If the Write Multiple command is attempted before the Set Multiple Mode command is set or when Write Multiple commands are disabled, the Write Multiple operation is rejected with an aborted command error.

Disc errors encountered during Write Multiple commands are posted after the attempted disc write of the block or partial block. The Write

command ends with the sector in error, even if it was in the middle of a block. Subsequent blocks are not transferred in the event of an error. Interrupts are generated when DRQ is set at the beginning of each block or partial block.

The contents of the Command Block registers are undefined when they follow the transfer of a data block that had a sector in error. The host should retry the transfer as individual requests to obtain valid error information.

3.4 Onboard drive diagnostics

During startup, the drive executes a series of diagnostic tests. If the diagnostic tests detect an error, the drive uses the LED to indicate the nature of the error by emitting a flash code. A subset of the error flash codes is contained in the following table:

Number of flashes	Error code description
Irregular flashes	Microprocessor error
2	ROM checksum error
3	External RAM error
4	I/O chip error
5	Buffer RAM error

3.5 ECC performance tests

The drive does not report ECC errors when it performs on-the-fly error correction. This allows the drive to correct the data without sacrificing performance.

Some older drive diagnostic utilities test the drive's ability to apply ECC by creating small data errors and then checking to see if these errors are reported. If you run one of these tests on a drive that is functioning properly, the test may report that the drive is failing to detect ECC errors. However, this does not mean that the drive is malfunctioning.

3.6 Supported BIOS

The drive uses 16 bytes of ECC with Read Long and Write Long commands. If the computer BIOS expects less than 16 bytes, some drive diagnostics may return false failures (typically time-out errors). If so, you must reconfigure the computer to receive 4 bytes of ECC.

The BIOS revisions listed in the following table are fully compatible with the ATA interface the drive uses. Earlier BIOS revisions than those listed may not fully support the ATA interface as implemented on the drive.

BIOS manufacturer	**Version supported**
American Megatrends	Dated 4/9/90 or later
Award	3.04 or higher
Quadtel	Single drive, any version Dual drive, 3.04 or higher
Phoenix	ROM BIOS Plus 286, 3.10 or higher ROM BIOS Plus 386, 1.10 or higher
PhoenixBIOS	1.00 or higher

Seagate

Seagate Technology, Inc.
920 Disc Drive, Scotts Valley, California 95066, USA

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