



.....

Decathlon 850

.....

ATA Interface Drive

.....

.....

.....

Product Manual

.....

.....

Decathlon 850

.....

ATA Interface Drive

.....

.....

.....

Product Manual

.....



© 1995 Seagate Technology, Inc. All rights reserved

Publication Number: 36326-001, Rev. A, July 1995
Supersedes Publication Number 36279-xxx

Seagate, Seagate Technology and the Seagate logo are registered trademarks of Seagate Technology, Inc. Decathlon is a trademark of Seagate Technology, Inc. Other product names are trademarks or registered trademarks of their owners.

Seagate reserves the right to change, without notice, product offerings or specifications. No part of this publication may be reproduced in any form without written permission from Seagate Technology, Inc.

Contents

Introduction	1
1.0 Specifications	3
1.1 Formatted capacity	3
1.1.1 Standard configuration	3
1.2 528-Mbyte capacity barrier	3
1.3 Physical organization	4
1.4 Functional specifications	5
1.5 Physical dimensions	5
1.6 Seek time	6
1.7 Start and stop times	6
1.8 Typical power-up and power-down sequence	6
1.8.1 Power-up sequence	7
1.8.2 Power-down sequence	7
1.8.3 Auto-park	8
1.9 Power specifications	8
1.9.1 Power consumption	8
1.9.2 Voltage tolerance	9
1.9.3 Input noise	9
1.10 Environmental specifications	10
1.10.1 Ambient temperature	10
1.10.2 Temperature gradient	10
1.10.3 Altitude	10
1.10.4 Relative humidity	10
1.10.5 Shock and vibration	10
1.11 Acoustics	11
1.12 Reliability	11
1.13 Agency listings	12
1.14 FCC verification	12
2.0 Configuring and mounting the drive	15
2.1 Handling and static-discharge precautions	15

2.2 I/O connector	16
2.3 Power connector	16
2.4 Options jumper block (J8)	17
2.4.1 Spare jumpers	17
2.4.2 Master/slave configuration	17
2.4.3 Master/slave timing protocol	17
2.4.4 Dual-drive emulation	22
2.4.5 Remote LED connection	22
2.4.6 Cable-select option	22
2.5 Mounting the drive	23
3.0 ATA interface	25
3.1 ATA interface connector pin assignments	25
3.2 Command set	27
3.2.1 Identify Drive command (ECh)	29
3.2.2 Set Features command (EFH)	31
3.2.3 Sleep command (99H, E6H)	33
Appendix. Timing diagrams	35

Figures

Figure 1. Typical startup current profile	7
Figure 2. ATA interface connector	16
Figure 3. Type A connectors	18
Figure 4. Type A configuration settings	19
Figure 5. Type B connectors	20
Figure 6. Type B configuration settings	21
Figure 7. Connecting cable-selected devices	23
Figure 8. Mounting dimensions	24
Figure 9. ATA interface connector pin assignments	26
Figure 10. Programmed I/O timing without IORDY	35
Figure 11. Programmed I/O timing with IORDY	36
Figure 12. Multiword DMA timing	37

Introduction

This manual describes the functional, mechanical and interface specifications for the Decathlon 850 hard disc drive. The drive is referred to throughout this manual by its model number, ST5850A.

The ST5850A is a high-capacity, high-performance, energy-efficient drive that comes in the mini 3.5-inch form-factor. It is capable of meeting the needs of PCI, VL, ISA and EISA bus computers.

The drive features Fast ATA-2 performance. It supports PIO mode 4 and multiword DMA mode 2 transfer modes and multiple block read/write. When the host chooses either of these modes, the drive is capable of burst transfer rates of up to 16.6 Mbytes per second. Multiple block read/write allows the drive to gather several blocks of data in cache and transfers them in a single burst.

The interface is supported with a 256-Kbyte segmented cache and embedded servo technology. The segmented cache aids the flow of read and write data. The embedded servo allows for accurate positioning of the heads over the data and eliminates periodic thermal recalibration to assure data transfer without interruption.

Energy-saving features are designed into the ST5850A drive. The drive complies with the ATA interface specifications for Active, Idle and Standby power modes. Power-saving modes are entered upon request by the computer. Standby mode reduces the drive's power consumption to a typical 1 watt while retaining drive accessibility. (A complete listing of the ATA commands the drive supports is found on pages 27 and 28. ATA commands and features with specific applications for the drive are discussed in Section 3.0 on page 25.)

Decathlon drives conform to the standard 3.5-inch footprint but have a 0.75-inch (19-mm) high profile. The lower height gives the designer or integrator more room for air circulation, other peripherals or a smaller drive bay.

The following is a summary of the drive's features:

Capacity

- 854 Mbytes formatted
- LBA translation support
- Dual-drive emulation, which turns the drive into two logical drives for DOS computers that limit the drive's capacity to 528 Mbytes
- Available installation software to surpass the 528-Mbyte barrier imposed by some BIOSs

- Available software driver that provides expanded 32-bit disk access support for Windows

Performance

- Multiword DMA modes 0, 1 and 2 and PIO modes 0,1, 2, 3 and 4
- Multiple block read/write
- 5,400-RPM rotational speed
- 256-Kbyte segmented buffer
- 12-msec average seek time

Energy efficiency

- Implements an ATA-compliant power-management system using Active, Idle and Standby modes
- 1 watt typical power dissipation rating in Standby mode

Acoustics

- 30-dBA typical idle acoustic sound pressure level

Mini 3.5-inch form-factor

- 19-mm-high profile
- Fits standard 3.5-inch footprint

1.0 Specifications

The Seagate ST5850A comes with either of two printed circuit boards. The drives are referred to as Type A and Type B throughout this manual. This specification applies to both drives unless otherwise noted.

1.1 Formatted capacity

Decathlon drives are low-level formatted at the factory. You do not need to low-level format them.

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 CHS and LBA translation geometries for standard and dual-drive emulation configurations. You can verify the parameters using the Identify Drive (ECH) command.

1.1.1 Standard configuration

ST5850A	CHS	LBA
Cylinders	1,656	N/A
Heads	16	N/A
Sectors	63	N/A
Total sectors	1,669,248	1,669,260
Formatted capacity (Mbytes ¹)	854.7	854.7

1.2 528-Mbyte capacity barrier

Computers using some BIOSs impose a 528-Mbyte barrier on the hard disc drive. The BIOS in these systems use a CHS addressing scheme that does not acknowledge more than 1,024 cylinders in the translation geometry. To access the ST5850A's entire capacity, you must:

- Use a BIOS that acknowledges more than 1,024 cylinders or uses LBA addressing
- Use a host adapter that accepts more than 528 Mbytes
- Use dual-drive emulation
- Use a software driver that surpasses the 528-Mbyte barrier to install the drive

1. One Mbyte equals one million bytes.

1.2.0.1 Dual-drive emulation configuration

Dual-drive emulation is a jumper setting on the options jumper block—see Figure 3 on page 18 for Type A drives or Figure 4 on page 20 for Type B drives—that allows you to configure the drive as two logical drives. Each logical drive is assigned a drive type in CMOS and is partitioned and formatted. When dual-drive emulation is used, a second physical drive cannot be used on the controller.

ST5850A	CHS	LBA
Cylinders	827	N/A
Heads	16	N/A
Sectors	63	N/A
Total sectors	833,616	834,374
Formatted capacity (Mbytes)	426.8	427.2

1.2.0.2 Available software driver

The ST5850A is available with a software driver to surpass the 528-Mbyte barrier. Ask your Seagate representative for more information.

1.3 Physical organization

	ST5850A
Read/write heads	4
Discs	2

1.4 Functional specifications

	ST5850A
Interface	ATA
Zone Bit Recording method	RLL (1,7)
External data burst transfer rate:	
DMA mode 2 (Mbytes per sec)	16.6 ²
PIO mode 4 (Mbytes per sec)	16.6 ³
Internal data-transfer rate (Mbits per sec)	32.45 to 61.65
Spindle speed (RPM)	5,376 ± 0.5%
Cache size (Kbytes)	256
Physical cylinders	4,085
Bytes per sector	512
Recording density, max (BPI)	69,355
Track density (TPI)	4,250

1.5 Physical dimensions

The mounting dimensions are shown in Figure 8 on page 24.

Height (max)	0.748 inches (19.0 mm)
Width (max)	4.00 inches (101.6 mm)
Depth (max)	5.00 inches (127.0 mm)
Weight	1.0 lb (0.45 Kg)

2. See Figure 12 on page 37 for timing specifications.

3. See Figure 11 on page 36 for timing specifications.

1.6 Seek time

Seek time is the interval between the time the actuator begins to move and the time the head has settled over the target track. Seek time is a statistical average of at least 10,000 measurements of seek time. All measurements for maximum values are taken under nominal conditions of temperature and voltage with the drive mounted horizontally. The specifications in the table below are defined as follows:

- Track-to-track seek time is the average of all possible single-track seeks in both directions.
- Average seek time is measured by executing seeks in both directions between random cylinders.
- Full-stroke seek time is half the time needed to seek from track 0 to the maximum track and back to track 0.

Track-to-track seek time	Average/typical seek time	Full-stroke seek time	Average latency
3.5 msec typ	12 msec read	25 msec typ	5.56 msec
4.5 msec max	14 msec write	27 msec max	

Note. Host overhead varies between systems and cannot be specified. Drive internal overhead is measured by issuing a no-motion seek. Overhead is typically less than 0.5 msec.

1.7 Start and stop times

The drive is ready within 20 seconds after the power is applied. The drive spindle stops rotating within 15 seconds after the power is removed.

1.8 Typical power-up and power-down sequence

A typical power-up and power-down sequence is described below to assist you in evaluating the drive's performance. It is not a performance specification. Each drive has a unique startup current profile similar to Figure 1.

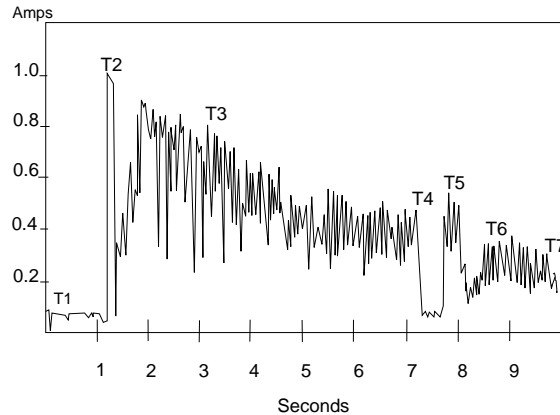


Figure 1. Typical startup current profile

1.8.1 Power-up sequence

1. Power is applied to the drive.
2. After a delay, the startup current is applied and the spindle begins to turn.
3. The accelerating current is applied, causing the spindle speed to increase.
4. The spindle speed is close to the final correct value. The drive begins to lock in speed-control circuits.
5. The magnetic arm-lock releases the arm.
6. The final speed control lock is achieved.
7. The heads are positioned over track 0 and the drive has completed its power-up sequence.

1.8.2 Power-down sequence

Caution. Do not move the drive until the motor has come to a complete stop.

1. The power is turned off.
2. Within 3 seconds, the motor begins to spin down.
3. The read/write heads automatically move to the shipping zone, which is inside the maximum data cylinder.
4. The magnetic actuator-lock locks the arm. This completes the power-down sequence.

1.8.3 Auto-park

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

1.9 Power specifications

1.9.1 Power consumption

The ST5850A supports Active, Idle and Standby power-management modes. The power-management commands the drive supports are listed in the command set table on page 27. The following table shows the average typical power consumption rates for each power-management mode. The test criteria for each mode is defined in the section following the table. The Idle and Standby timers are disabled at the factory.

All measurements were taken at the drive's power connector. A true RMS meter is used to measure all modes except Standby. A DMM is used for Standby measurements.

	Spinup	Seeking	Read/ write	Idle	Standby
Current at +12V					
Amps peak	1.1	—	—	—	—
RMS amps typ	—	0.408	0.231	0.158	0.014
Watts typ	—	4.896	2.772	1.896	0.168
Current at +5V					
RMS amps typ	—	0.420	0.445	0.240	0.166
Watts typ	—	2.100	2.225	1.200	0.830
Power					
Total watts typ	—	7.00	5.00	3.10	1.00

1.9.1.1 Active mode

During the Active mode, the drive is involved in spinup, seeking or read/write activities. The table shows the typical power consumption rates for these activities.

- **Spinup.** Spinup mode is entered from the Standby mode. The drive brings the spindle and discs up to operating speed. Power in this mode is defined as the peak power after starting spinup.
- **Seeking.** Seek mode is entered from Idle mode. The read/write heads are moved to a specific location on the disc surface in preparation for reading from or writing to the disc. Read/write electronics are powered down but servo electronics are active. Typical power is defined as the power average of executing random seeks with a 2-revolution (22.3 msec) dwell between Seek commands.
- **Read/write.** Read/write mode is entered from Idle mode. Read/write electronics are activated and the servo is on track. The drive reads from or writes to the disc.

1.9.1.2 Idle mode

The motor is up to speed, the servo electronics are inactive and the heads are in the landing zone.

1.9.1.3 Standby mode

The spindle is stopped, the heads are parked in the landing zone, the actuator is latched and some of the drive electronics are powered down.

1.9.2 Voltage tolerance

	+5V	+12V
Voltage tolerance (including noise)	± 5%	± 5%

1.9.3 Input noise

	+5V	+12V
Input noise frequency (max)	25 MHz	25 MHz
Input noise (max, peak-to-peak)	100 mV	240 mV

1.10 Environmental specifications

1.10.1 Ambient temperature

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

1.10.2 Temperature gradient

Operating	10°C per hour (18°F per hour)
Nonoperating	15°C per hour (27°F per hour)

1.10.3 Altitude

Operating	-1,000 to 10,000 ft (-305 to 3,048 m)
Nonoperating	-1,000 to 40,000 ft (-305 to 12,192 m)

1.10.4 Relative humidity

Operating	8% to 80% noncondensing Maximum wet bulb 26°C (79°F)
Maximum operating gradient	10% per hour
Nonoperating	5% to 95% noncondensing Maximum wet bulb 26°C (79°F)

1.10.5 Shock and vibration

All shock and vibration specifications assume that the drive is mounted as recommended in Section 2.5 on page 23, with the input levels measured at the drive mounting screws. Shock measurements are based on an 11 msec, half sine wave shock pulse, not to be repeated more than twice per second.

During normal operating shock and vibration, there is no physical damage to the drive or performance degradation. During nonoperating shock and vibration, the read/write heads are positioned in the shipping zone.

During abnormal operating shock and vibration, there is no physical damage to the drive, although performance may be degraded during the

shock or vibration episode. When normal operating shock levels resume, the drive meets its performance specifications.

	Operating	Abnormal	Nonoperating
Shock	2 Gs	10 Gs	75 Gs
5–22 Hz vibration	0.020-inch displacement	0.030-inch displacement	0.160-inch displacement
22–350 Hz vibration	0.50 Gs	0.75 Gs	4.00 Gs

1.11 Acoustics

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

Value	Idle	Seek
Sound pressure, typ (dBA)	30 dBA	34 dBA
Sound pressure, max (dBA)	34 dBA	38 dBA

1.12 Reliability

Read error rates are measured with automatic retries and data correction with ECC enabled and all flaws re-allocated (88 bit Reed Solomon code using 22 bit ECC span with 11 bit on-the-fly is used). Mean time between failures (MTBF) is measured at nominal power at sea level and an ambient temperature of 40°C.

Nonrecoverable read errors	1 per 10 ¹³ bits transferred
Seek errors	1 per 10 ⁷ physical seeks
Contact Start/Stop	40,000 cycles
MTBF	300,000 power-on hours
Service life	5 years

1.13 Agency listings

This drive is listed by agencies as follows:

- Recognized in accordance with UL478 and UL1950
- Certified to CSA C22.2 No. 220-M1986 and CSA C22.2 No. 950-M1989
- Certified to VDE 0806/05.90 and EN 60950/1.88 as tested by VDE

1.14 FCC verification

Decathlon family ATA interface drives are 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 these drives 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 Commis-

sion: *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.

Note This digital apparatus does not exceed the Class B limits for radio noise emissions from computer equipment as set out in the radio interference regulations of the Canadian Department of communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

Sicherheitsanleitung

1. Das Gerät ist ein Einbaugerät, das für eine maximale Umgebungstemperatur von 55°C vorgesehen ist.
2. Zur Befestigung des Laufwerks werden 4 Schrauben 6-32 UNC-2A benötigt. Bei seitlicher Befestigung darf die maximale Länge der Schrauben im Chassis nicht mehr als 5,08 mm und bei Befestigung an der Unterseite nicht mehr als 5,08 mm betragen.
3. Als Versorgungsspannungen werden benötigt:
+5V \pm 5% 0,6A
+12V \pm 5% 0,8A (1,9A für ca. 30 Sek. für \pm 10%)
4. Die Versorgungsspannung muß SELV entsprechen.
5. Alle Arbeiten auf dem Festplatte dürfen nur von Ausgebildetem Servicepersonal durchgeführt werden. Bitte schaffen Sie Festplatteetiketten nicht weg.
6. Der Einbaudes Drives muß den Anforderungen gemäß DIN IEC 950V DC 0805/05.90 entsprechen.

2.0 Configuring and mounting the drive

This section contains the specifications and instructions for configuring and mounting the drive. The drive may come configured with either of two printed circuit boards. This manual distinguishes the drives as Type A and Type B. The interface connector and the mounting procedure are the same for both drives. The drive is configured for use in the computer using the options jumper block (J8). The options jumper blocks are different sizes. Refer to Figure 3 on page 18 if you are configuring a Type A drive and Figure 5 on page 20 if you are configuring a Type B drive.

2.1 Handling and static-discharge precautions

After you unpack the drive, and before you install it in a system, be careful not to damage it through mishandling or static discharge. Wool and synthetic clothing, carpet, plastic and styrofoam are contributors to static-charge buildup. This charge is released when you touch another conductor and can damage sensitive components in the drive. Observe the following 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 its static-shielded bag.
- 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. Others are used to seal out dirt and contamination.

2.2 I/O connector

The ST5850A uses a 40-pin, male I/O connector with two rows of twenty pins each. The even-numbered pins are closest to the printed circuit board's edge. Pin 1 is near the 4-pin power connector. Pin 20 is removed for keying purposes. A drawing of the I/O connector is shown in Figure 2.

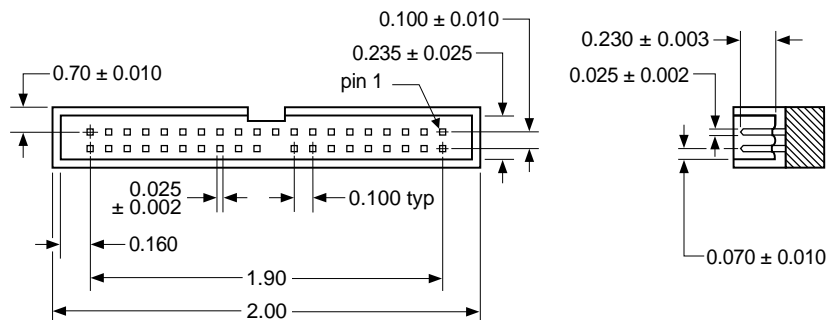


Figure 2. ATA interface connector

We recommend the following part numbers or their equivalents for the mating connector.

Part	Description	3M part number
Connector	40-pin	3M-3417-7000
Connector	40-pin	3M-3448-2040
Flat cable	AWG28 (stranded)	3M-3365-40

To ensure the integrity of your data, use a 40-connector, nonshielded I/O cable with a maximum length of 18 inches (0.46 meters).

2.3 Power connector

The drive uses a standard 4-pin, male power connector. We recommend the following part number or their equivalents for the mating connector.

Part	Description	Part number
Connector	Housing	AMP 1-480424-0
Connector	Pin (loose piece)	AMP 60619-4
Connector	Pin (Reel)	AMP 6117-4
Cable	18 AWG	

2.4 Options jumper block (J8)

The ST5850A is manually configured using the options jumper block (J8) shown in Figure 3 on page 18 for Type A drives and in Figure 5 on page 20 for Type B drives. The Type A options jumper block is a 12-pin header. The Type B options jumper block is a 34-pin header. The options jumper block allows you to:

- Install two drives on the hard disc controller.
- Install the drive using dual-drive emulation.
- Install a remote LED.
- Install the drive in systems that support cable select.

2.4.1 Spare jumpers

The factory ships the drives with spare jumpers attached to the options jumper block (J8). The locations of spares are shown in Figure 4 on page 19 for Type A drives and Figure 6 for Type B drives. Use these jumpers to configure your drive. The jumper block is designed to accept 2-mm connectors. If you need additional jumpers, order Seagate part number 13211-001 or an equivalent.

2.4.2 Master/slave configuration

Pins 1 and 2 and pins 3 and 4 are used to configure the drive as a master or a slave.

One drive only. No jumpers are used.

Drive as master. Use this setting if the drive is the master.

Drive as slave. Use this setting if the drive is the slave.

2.4.3 Master/slave timing protocol

This protocol involves the communication between the host and the disc drives during the boot up cycle. The host queries the master for the status of both drives. The slave must signal the master within a certain time period or the master reports that the slave has failed and the host won't recognize it. The ST5850A is shipped configured to work with other drives that use the standard ATA master/slave timing protocol.

Some drives use the signal differently. This setting allows the Seagate drive to communicate with those drives as the slave only. Try using this setting if the slave is not identified after power-on.

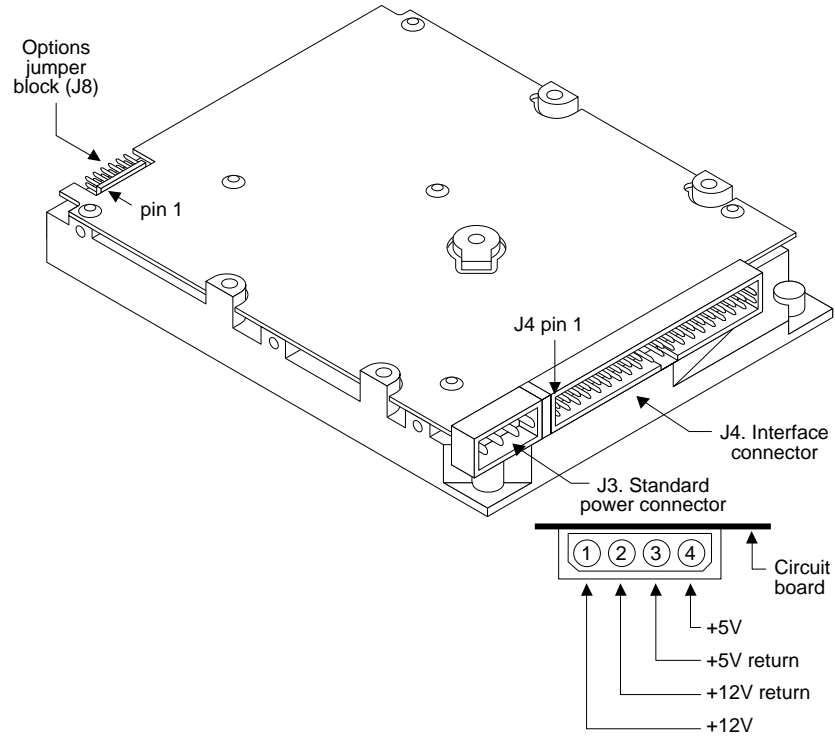


Figure 3. Type A connectors

Options jumper block (J8)

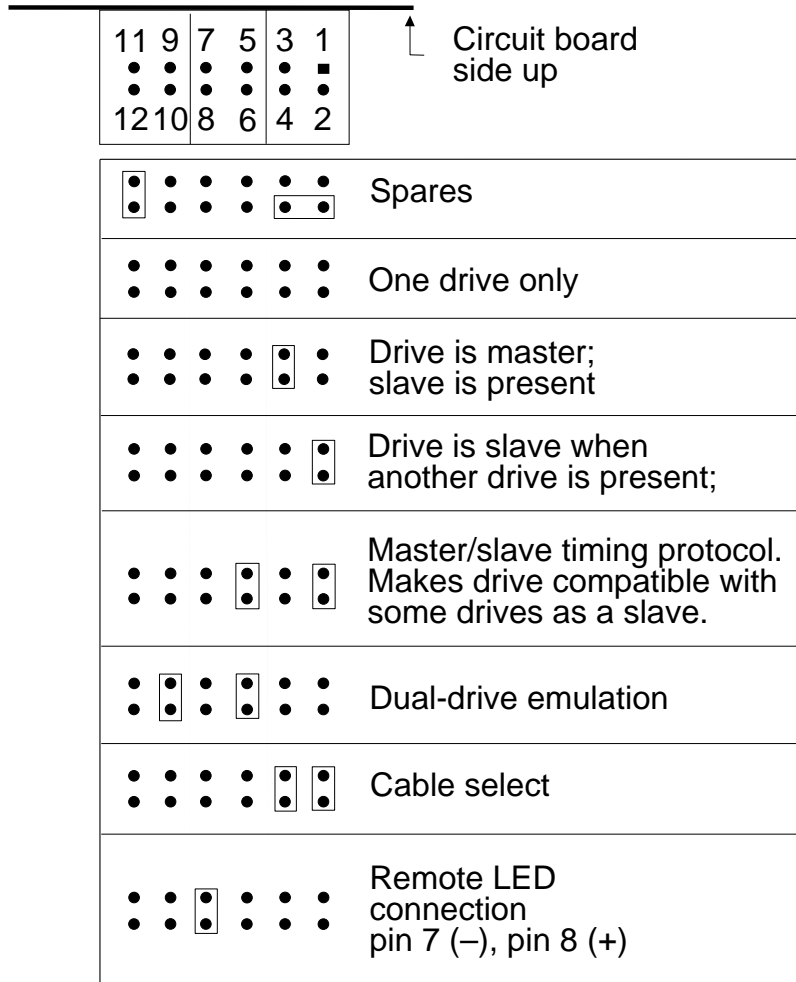


Figure 4. Type A configuration settings

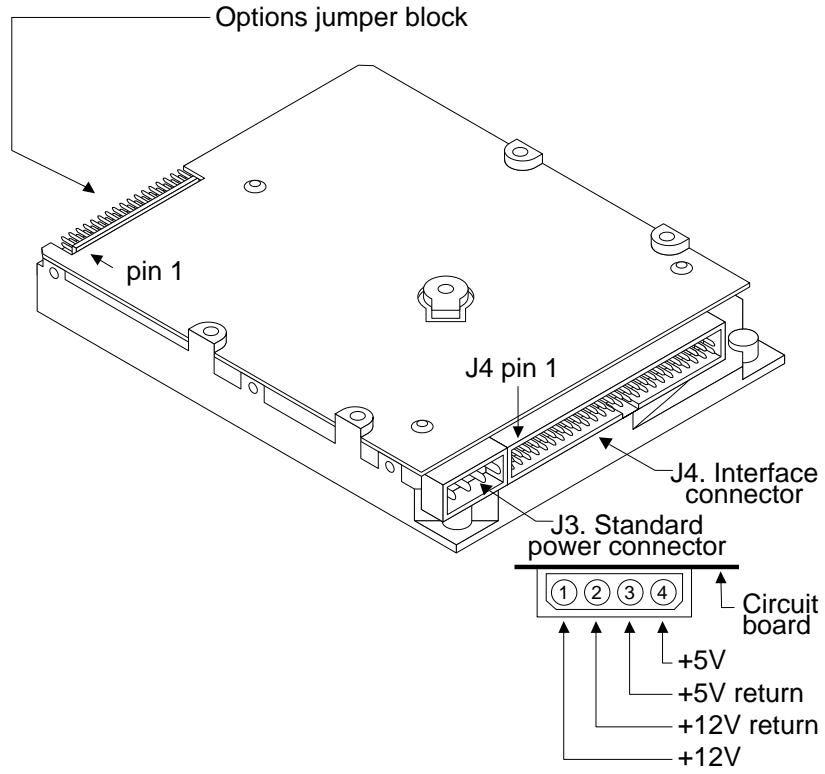
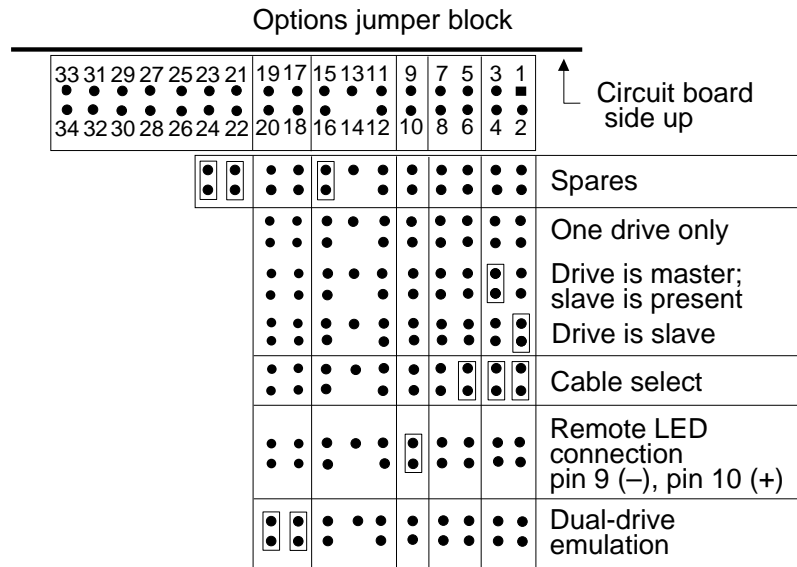


Figure 5. Type B connectors



Note. All other pins are reserved. Do not use them.

Figure 6. Type B configuration settings

2.4.4 Dual-drive emulation

Dual-drive emulation is a feature designed into drives with physical capacities greater than 528 Mbytes for computers whose BIOS limit the effective drive capacity to 528 Mbytes. This feature splits the drive into two logical drives with capacities the computer can manage. The one drive emulates two drives. Each logical drive is assigned a drive type in System Setup and must be partitioned and formatted independently. A second, physical drive cannot be used when dual-drive emulation is invoked.

Note. Dual-drive emulation cannot be used in computers that implement the cable-select configuration.

2.4.5 Remote LED connection

You can attach a remote LED cable to the options jumper block (J8) using the pins shown in the drawings. The jumper block is designed to accept a 2-mm connector. It may be necessary for you to replace the current connector on the LED cable. Use Seagate part number 13211-001 or an equivalent for the replacement jumper.

2.4.6 Cable-select option

Computers that use the cable-select method for determining the master and slave drive do so by selecting or deselecting pin 28, CSEL, on the interface bus. Master and slave drives are determined by their physical position on the bus:

- The drive plugged into the I/O connector that carries the CSEL signal is the master.
- The drive plugged into the I/O connector that does not carry the CSEL signal is the slave.

To configure the ST5850A for computers using cable select, refer to Figure 4 on page 19 for Type A drives or Figure 6 on page 21 for Type B drives. Figure 7 shows how the drives are connected to the interface cable in computers using cable-select.

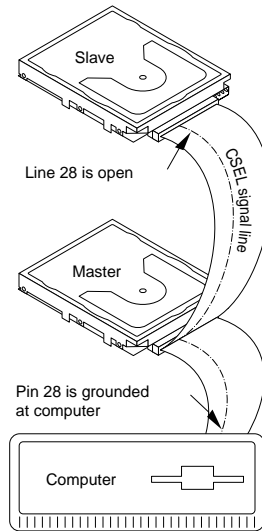


Figure 7. Connecting cable-selected devices

2.5 Mounting the drive

You can mount the drive in any orientation. Mount it securely in the computer using either the bottom or side mounting holes as described below. Position the drive so that you do not strain or crimp the cables. Figure 8 on page 24 shows the drive's dimensions, including the side and bottom mounting holes.

Bottom mounting holes. Insert 6-32 UNC-2A mounting screws in the four available bottom mounting holes. Do not insert the screws more than 0.20 inches (6 turns) into the drive frame.

Side mounting holes. Insert 6-32 UNC-2A mounting screws in any two of the side mounting holes on each side of the drive. If you have a Type A drive, do not insert the screws more than 0.240 inches (7 turns) into the drive frame. If you have a Type B drive, do not insert the screws more than 0.200 inches (6 turns) into the drive frame.

Caution. To avoid damaging the drive:

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

In the following figure, all dimensions are in inches and millimeters (mm).

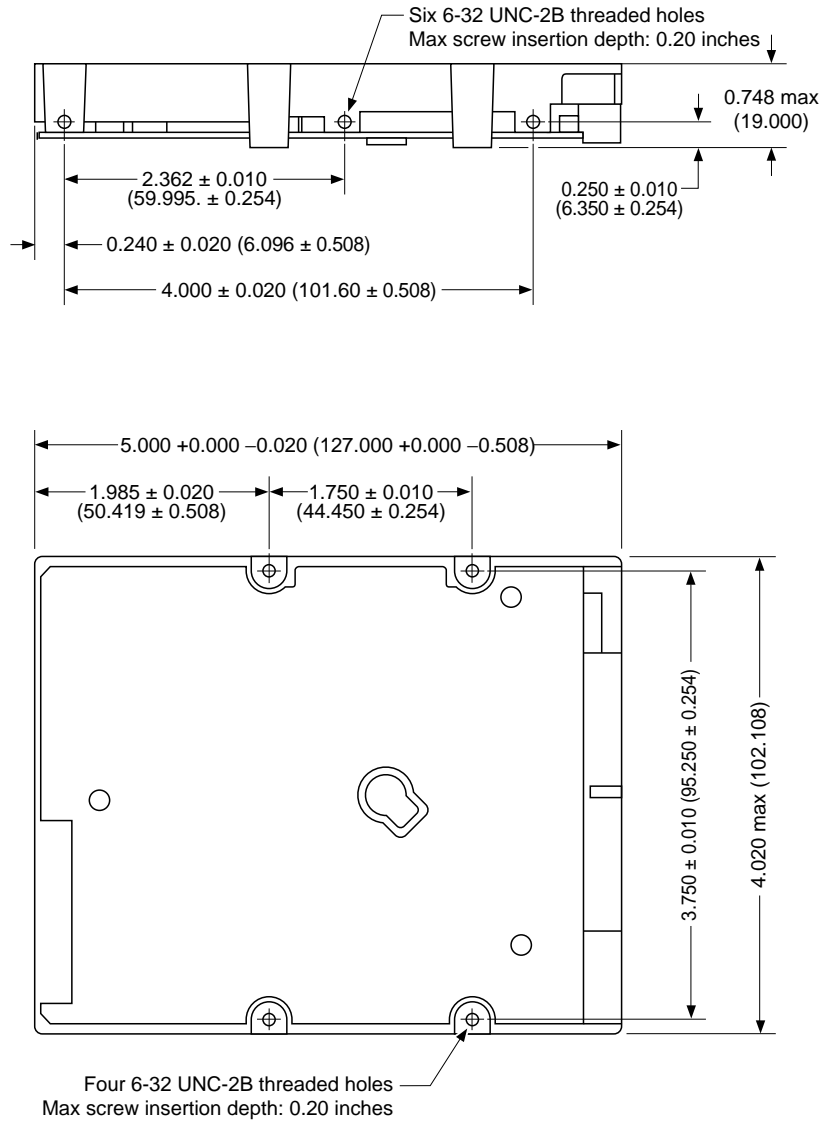


Figure 8. Mounting dimensions

3.0 ATA interface

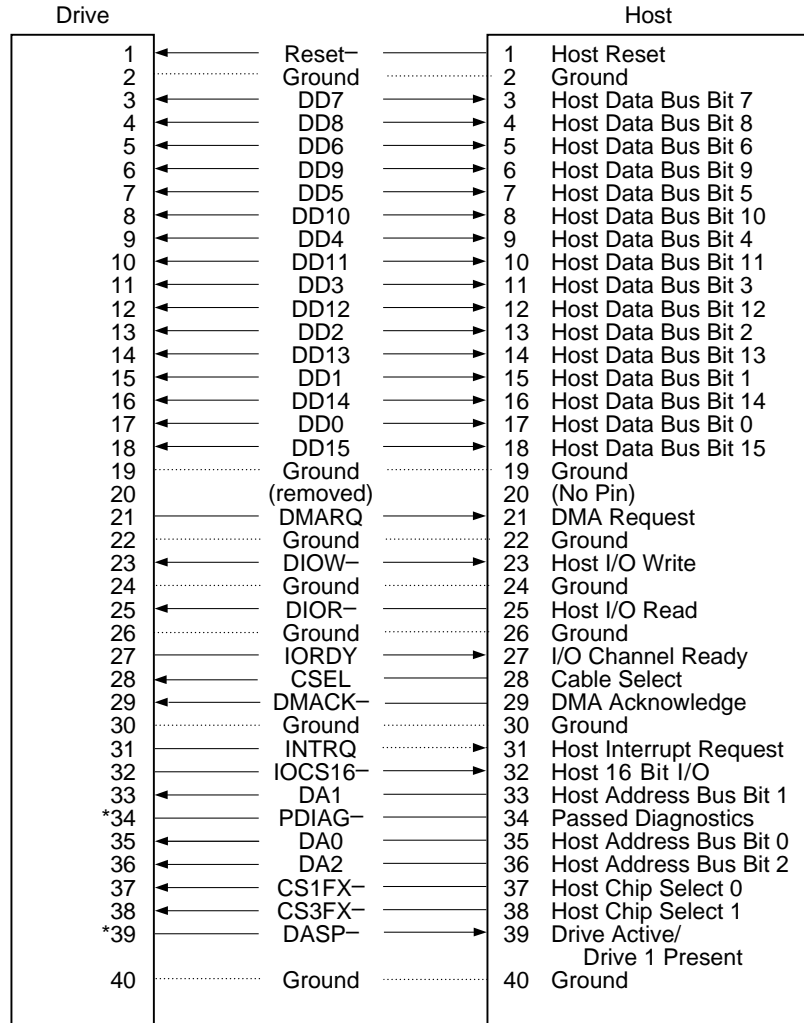
The ST5850A uses a Fast ATA-2 interface. The interface is in compliance with ANSI *ATA (AT Attachment) Interface X3T9.2/143 Rev. 4.0*, *SFF 8011: ATA Timing Extension for Local Bus Attachments, Rev. 2.0* and *SFF 8019: Identify Drive Data for Drives Under 8 GB*. This section lists the ATA commands supported by the drive on pages 27 and 28. Commands and features with specific application for the drive are also discussed in this section. For more information on Seagate's implementation of the ATA interface and commands, see the *Seagate ATA Interface Reference Manual*, publication number 36111-xxx.

The ATA interface consists of single-ended, TTL-compatible receivers and drivers using 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 signal direction for each I/O connector pin is described in Figure 9 on page 26. For a complete description of each pin, see the *Seagate ATA Interface Reference Manual*, publication number 36111-xxx.

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



*Drive-to-drive signals

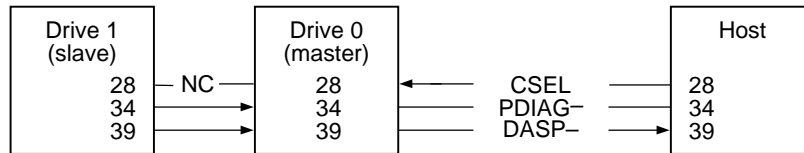


Figure 9. ATA interface connector pin assignments

3.2 Command set

This section lists all of the ATA commands the ST5850A uses. Commands whose implementation is specific for the drive are discussed in this manual. For information on Seagate's implementation on the other supported commands, refer to the *Seagate ATA Interface Reference Manual*, publication number 36111-xxx. Additional information on Fast ATA-related features is provided by the Small Form Factor specification, SFF-8011 Rev 1.1, September 18, 1993.

The following table lists all commands implemented in the ST5850A drive. 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

continued

continued from previous page

Command name	Command code (in hex)	Parameters used				
		FR	SC	SN	CY	DH
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 ⁴	C8, C9	—	y	y	y	y
Read Long ⁴	22, 23	n	y	y	y	y
Read Multiple	C4	n	y	y	y	y
Read Sector ⁴	20, 21	n	y	y	y	y
Read Sector Buffer	E4	n	n	n	n	D
Read Verify Sector ⁴	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
Sleep	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 ⁴	CA, CB	—	y	y	y	y
Write Long ⁴	32, 33	n	y	y	y	y
Write Multiple	C5	n	y	y	y	y
Write Sector ⁴	30, 31	n	y	y	y	y
Write Sector Buffer	E8	n	n	n	n	D

4. With retry and without retry commands supported

3.2.1 Identify Drive command (ECH)

The parameters for the drive are listed in the table below. The Seagate *ATA Interface Reference Manual*, publication number 36111-xxx, describes the Identify Drive command in detail.

Word	Description	Value
0	Configuration	047AH 0400H Disc transfer rate > 10 Mbytes per second 0040H Fixed drive 0020H Spindle motor control option implemented 0010H Head switch time > 15 μ sec 0008H Not MFM encoded 0002H Hard sectored
1	Default cylinders	See Sections 1.1.1 and 1.1.1 for value appropriate to model.
2	Reserved	0
3	Default heads	16
4	Bytes per track	8EBC _H (36540 decimal) (unformatted)
5	Bytes per sector	244 _H (580 decimal) (unformatted)
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)	0200 _H
22	ECC bytes (R/W Long)	0004 _H
23–26	Firmware revision	Drive-dependent: 8 ASCII characters
27–46	Model number	Drive-dependent: 40 ASCII characters

continued

continued from previous page

Word	Description	Value
47	Maximum Sectors per interrupt per R/W Multiple command	8020 _H R/W Multiple supported; 32 sectors per block
48	Double word I/O	0000 _H Not supported
49	Capabilities	0B01 _H IORDY, DMA, LBA supported
50	Reserved	0000 _H
51	PIO timing mode	0200 _H
52	DMA timing mode	0201 _H Multiword DMA mode 2 supported
53	Current valid	0003 _H , 54–58, 64–70 valid
54	Current cylinders	1,656
55	Current heads	16
56	Current sectors per track	63
57–58	Current sectors	1,669, 248 (CHS)
59	Current multiple mode	0000 _H
60–61	LBA total sectors	1,669, 260
62	Single-word DMA	0000 _H No modes are active; no modes are supported.
63	Multiword DMA	0107 _H Mode 0 is active; modes 0, 1 and 2 are supported.
64	Advanced PIO	0003 _H Modes 3 and 4 are supported.
65	Minimum multiword DMA transfer per word	120 nsec
66	Recommended multiword DMA transfer per word	120 nsec
67	Minimum PIO transfer without IORDY	240 nsec

Word	Description	Value
68	Minimum PIO transfer with IORDY	120 nsec
69–127	Reserved	xxxxH
128–159	Seagate-reserved	xxxxH
160–255	Reserved	xxxxH

3.2.2 Set Features command (EFH)

The Set Features command (command code EF_H) allows the user to enable and disable the multisegmented cache features and to identify the transfer modes the drive uses. The multisegmented buffer consists of Read Look-ahead and write-immediate and write-merging features. The table below lists the features supported by the ST5850A. The features that are set to default by the factory are indicated in the Feature column.

Feature Value	Feature
02 _H	Enable write immediate and write merging (default)
03 _H	Set transfer mode
55 _H	Disable read look ahead cache
82 _H	Disable write immediate and write merging
AA _H	Enable read look-ahead (default)

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 (04).

The factory-default values are restored at power-on or after a hard reset.

3.2.2.1 Multisegmented cache buffer

The drive uses a 256-Kbyte multisegmented cache buffer to improve performance by eliminating access times under certain conditions.

Read look-ahead. The drive uses the read segments to store additional logical sectors, after the last requested sector, into a buffer before the computer requests the additional sectors. The cache buffer stores data from the start of a read until the buffer segment is full or until another command is received.

Write immediate and write merging. Segments of the cache are reserved for write data. The drive will accept contiguous and sequential write commands and execute them as one command. When the buffer has received all of the data, the drive issues a write complete and writes the data to the disc. The last data written by the drive is retained in the buffer for future write or read use.

3.2.2.2 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: Set PIO Mode = 2)	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

Data-transfer mechanism	Transfer-types value		
Mechanism name	Mode value	Data Upper 5 bits	Lower 3 bits
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	<i>nnn</i>

If the drive does not support a commanded mode, it returns an 04 Aborted Command error.

3.2.3 Sleep command (99H, E6H)

When the computer issues the Sleep command, the drive enters Standby mode. The drive may return an interrupt before the transition to Standby mode is complete. A separate Sleep mode is not supported.

Appendix. Timing diagrams

Without IORDY, the drive operates at programmed I/O timing specifications, as shown below.

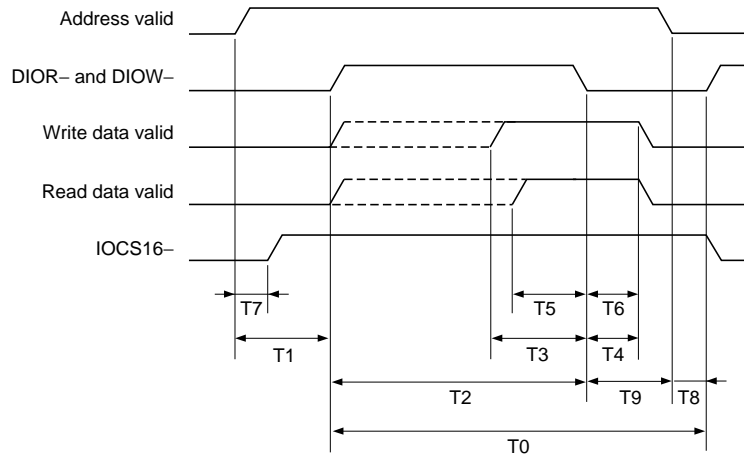


Figure 10. Programmed I/O timing without IORDY

Time	Description	Min	Max
T0	Cycle time	240 nsec	—
T1	Drive address (CS1FX-, CS3FX-, DA0, DA1 and DA2) valid and DIOR- and DIOW- setup	25 nsec	—
T2	DIOW- or DIOR- pulse width	70 nsec	—
T3	DIOW- data setup	20 nsec	—
T4	DIOW- data hold	10 nsec	—
T5	DIOR- data setup	20 nsec	—
T6	DIOR- data hold	5 nsec	—
T7	Address valid until IOCS16- is asserted	—	20 nsec
T8	Address invalid to IOCS16- tristate	—	5 nsec
T9	DIOR- false to read data hold	—	20 nsec

When using IORDY, the drive operates at programmed timing specifications, as shown below.

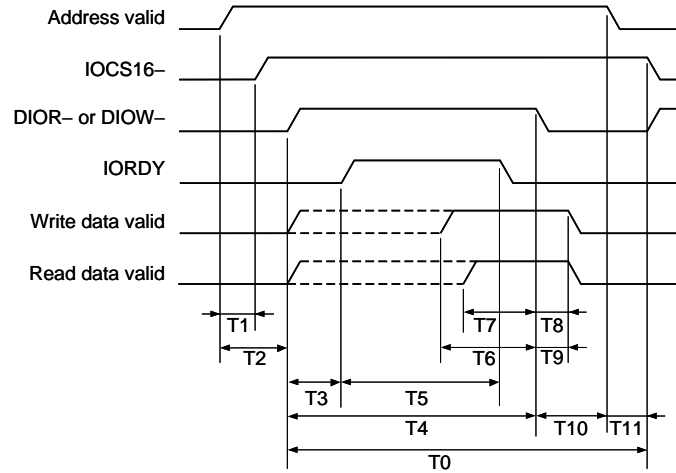


Figure 11. Programmed I/O timing with IORDY

Time	Description	Min	Max
T0	Cycle time	120 nsec	—
T1	Address valid until IOCS16- is asserted	—	20 nsec
T2	Drive address (CS1FX-, CS3FX-, DA0, DA1 and DA2) valid before DIOR- or DIOW- setup	25 nsec	—
T3	IORDY setup time	—	—
T4	DIOW- or DIOR- pulse width (8-bit)	70 nsec	—
	DIOW- or DIOR- pulse width (16-bit)	70 nsec	—
T5	IORDY pulse width	—	1,250 nsec
T6	DIOW- data setup	20 nsec	—
T7	DIOR- data setup	20 nsec	—
T8	DIOR- data hold	5 nsec	—
T9	DIOW- data hold	10 nsec	—
T10	DIOW- or DIOR- to address valid hold	5 nsec	—
T11	Address invalid until IOCS16- is negated	—	5 nsec

The drive operates at multiword DMA mode 2 timing specifications, as shown below.

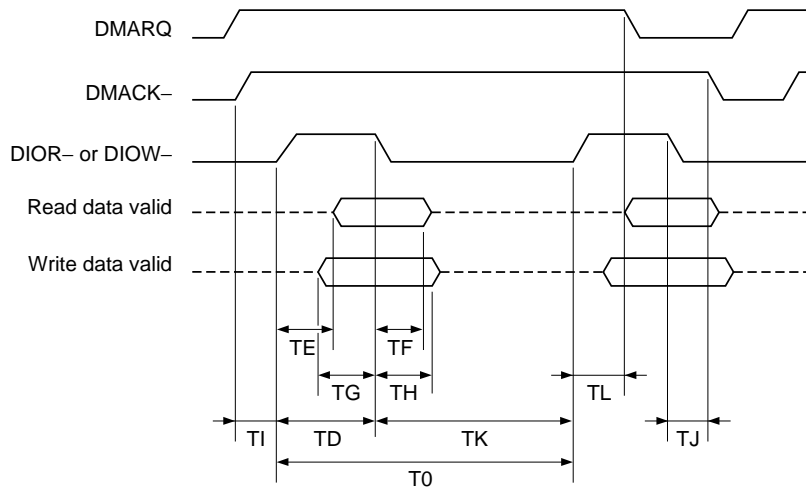


Figure 12. Multiword DMA timing

Time	Description	Min	Max
T0	Cycle time	120 nsec	—
TD	DIOW- or DIOR- pulse width (16-bit)	70 nsec	—
TE	DIOR- data access	—	—
TF	DIOR- data hold	5 nsec	—
TG	DIOW- data setup	20 nsec	—
TH	DIOW- data hold	10 nsec	—
TI	DMACK- to DIOR- or DIOW- setup	0 nsec	—
TJ	DIOR- or DIOW- to DMACK- hold	5 nsec	—
TK _R	DIOR- negated pulse width	25 nsec	—
TK _W	DIOW- negated pulse width	25 nsec	—
TL _R	DIOR- to DMARQ delay	—	35 nsec
TL _W	DIOW- to DMARQ delay	—	25 nsec



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

Publication Number: 36326-001, July 1995, Printed in USA