Seagate

Medalist 1270

ATA Interface Drive

Product Manual

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Introduction

This manual describes the functional, mechanical and interface specifications for the Medalist 1270 hard disc drive. The Medalist 1270 is referred to throughout this manual by its model number, ST31270A.

The ST31270A is a 1.2-Gbyte drive that features Fast ATA-2 performance, technology to smooth data flow and power management.

Fast ATA-2 performance means that the drive supports PIO mode 4 and multiword DMA mode 2 transfer modes and multiple block read/write. When the host chooses either transfer mode, the drive provides 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 drive uses a 256-Kbyte segmented cache and embedded servo technology to smooth data flow. The 256-Kbyte segmented cache provides a designated area where blocks of contiguous read or write data can be staged for transfer in a single burst. The embedded servo allows for accurate head positioning and eliminates periodic thermal recalibration for data transfers without interruption.

The drive supports Active, Idle and Standby power-management modes. Power-saving modes are entered by request of the computer. Standby mode reduces power consumption to 1 watt (typical) while retaining drive accessibility. (The power-management and other ATA commands the drive supports are listed on pages 27 and 28. Commands with specific applications for the drive are discussed in Section 3.0 on page 25.)

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

Capacity

- 1,282.8 Mbytes formatted
- LBA translation support
- Available software driver that surpasses the 528-Mbyte barrier imposed by some BIOSs
- Available software driver that provides expanded 32-bit disk access support for Windows

Performance

- Fast ATA-2 performance (Supports multiword DMA modes 2 and PIO modes 4 for up to 16.6-Mbyte-per-second transfer rates. Supports Multiple block read/write.)
- 256-Kbyte segmented buffer
- 12-msec average seek time

Energy efficiency

- Active, Idle and Standby power-management modes
- 1 watt typical power dissipation rating in Standby mode

Acoustics

- 30-dBA typical idle acoustic sound-pressure level

Quick specification chart

The following table serves as a quick reference for the ST31270A performance specifications. These and other specifications are discussed in “Specifications” on page 5.

Drive specification	**ST31270A**
Formatted capacity (Mbytes) ($\times 10^6$ bytes)	1,282.8
Total sectors	2,505,528
Bytes per sector	512
Sectors per track	63
Logical Read/Write heads	16
Physical cylinders	3,876
Physical Read/Write heads	6
Physical disc	3
Recording density (bits per inch)	73,530
Track density (tracks per inch)	4,250
Spindle speed (RPM)	4,500
Track-to-track seek time (msec typical)	3.5
Average seek time (msec typical)	12
Full-stroke seek time (msec typical)	25.0

Drive specification	**ST31270A**
Average latency (msec)	6.67
Internal-data transfer rate (Mbits per sec max)	29.6 to 57.2
External transfer rate (Mbytes per sec max)	16.6
Cache buffer (Kbytes)	256
Height (inches max)	1.00
Width (inches max)	4.02
Depth (inches max)	5.77
Typical weight (lb)	1.5
Spinup current (typical)	1.9A
Seek power (typical)	6.60W
Read/Write power and current (typical)	4.50W
Idle total power (typical)	2.75W
Standby/Sleep total power (typical)	1.0W
Voltage tolerance (including noise): +5V	±5%
Voltage tolerance (including noise): +12V	±5%
Operating temperature (°C)	5 to 55°C
Drive acoustics, Idle mode (dBA)	30 dBA
Drive acoustics, seeking (dBA)	34 dBA

1.0 Specifications

1.1 Formatted capacity

The drive was low-level formatted at the factory. You cannot low-level format it.

The drive was configured in translation mode at the factory. It supports cylinder-head-sector addressing (CHS) and logical-block addressing (LBA) modes. You can use the Identify Drive (EC_H) command to verify the address modes the drive supports, the number of cylinders, sectors per track, total number of sectors, heads and other drive parameters. The Identify Drive parameters are listed in Section 3.2.1 on page 29.

1.1.1 528-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 drive's entire capacity, you must:

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

  Note. A Seagate driver that surpasses the 528-Mbyte barrier is available. Ask your Seagate representative for details.
- Use the dual-drive emulation option available on the drive. This option makes the drive two logical drives for the computer. Both drive-type parameters are configured in the CMOS and each logical drive is partitioned and formatted independently. However, you can use only the maximum translation-geometry values the BIOS permits—1,024 cylinders, 16 heads and 63 sectors. This restricts each logical drive to less than 528 Mbytes.

1.2 Standard configuration

	CHS	LBA
Cylinders	2,485	N/A
Heads	16	N/A
Sectors	63	N/A
Total sectors	2,504,880	2,505,528
Formatted capacity (Mbytes[1])	1,282.4	1,282.8

1.3 Dual-drive emulation configuration

Dual-drive emulation makes the drive look like two logical drives to the computer. Enter translation geometries for both drive-type parameters in the CMOS. Partition and format each logical drive. Use the maximum translation geometry values allowed by the BIOS to configure the CMOS. Use the translation geometry values in the table below to configure the CMOS. These values provide each logical drive with 527.6 Mbytes.

A second, physical drive cannot be installed on the same port when dual-drive emulation is used. Dual-drive emulation does not support cable-select. Also, the drive responds as a single drive to power-management commands.

	CHS	LBA
Cylinders	1,024	N/A
Heads	16	N/A
Sectors	63	N/A
Total sectors	1,032,192	
Formatted capacity (Mbytes[1])	527.6	

1.4 Physical organization

	ST31270A
Read/write heads	6
Discs	3

1. One Mbyte equals one million bytes.

1.5 Functional specifications

Interface	ATA
Zone Bit Recording method	RLL (1,7)
External data burst transfer rate[2], DMA mode 2 (Mbytes per sec)	16.6
External data burst transfer rate[3], PIO mode 4 (Mbytes per sec)	16.6
Internal data-transfer rate (Mbits per sec)	29.62 to 57.25
Spindle speed (RPM)	4,500 ± 0.5%
Cache size (Kbytes)	256
Physical cylinders	3,876
Bytes per sector	512
Recording density, max (BPI)	73,530
Track density (TPI)	4,250

1.6 Physical dimensions

The mounting dimensions are shown in Figure 6 on page 24.

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	1.5 lb (0.68 Kg)

2. See Figure 10 on page 37 for timing specifications.

3. See Figure 9 on page 36 for timing specifications.

1.7 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 true statistical average of at least 10,000 measurements of seek time. All measurements 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 4.5 msec max	12.0 msec read 14.0 msec write	25.0 msec typ 27.0 msec max	6.67 msec

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.

1.7.1 Multisegmented cache buffer

The drive is available with a 256-Kbyte, multisegmented cache buffer that improves 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. The drive uses the write segment to store write commands and data. After the drive receives all of the data for the command, it issues a write complete. Then, the drive writes the data to the disc.

Write merging. The drive accepts contiguous write commands and executes them as one command.

1.8 Start/stop time

Within 20 seconds after power is applied, the drive is ready. Within 15 seconds after power is removed, the drive spindle stops rotating.

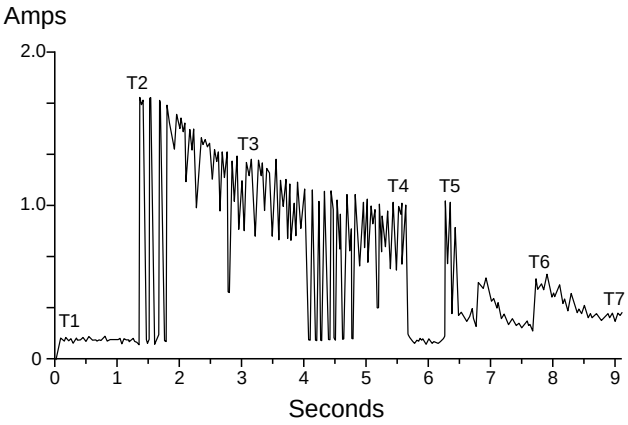

Figure 1. Typical startup current profile

1.9 Typical power-up and power-down sequence

This section describes typical power-up and power-down sequences to assist you in evaluating the drive's performance. They are not performance specifications. A typical startup current profile is shown in Figure 1. Startup current profiles are unique for each drive.

1.9.1 Power-up sequence

1. Power is applied to the drive.

2. When power is applied, the LED is on for about 1 second.

3. The spindle motor reaches operating speed in about 4 seconds.

4. The magnetic actuator-lock releases the actuator.

5. The drive achieves final speed-control lock.

6. The heads are positioned over track 0 and the drive is ready.

1.9.2 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.

1.10 Auto-park

Upon power-down, the read/write heads automatically move to the landing 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.

1.11 Power specifications

1.11.1 Power management

The drive supports Active, Idle and Standby power-management modes. The power-management commands that the drive supports are listed in the table on page 27. The table on page 12 shows the average typical power consumption rates for each power-management mode. The test criteria for each mode is defined below. 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.

1.11.1.1 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 (26.6 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.

1.11.1.2 Idle mode

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

1.11.1.3 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.

Note. When recovering from Standby or Sleep mode, you must allow the drive to post ready before reporting a time-out. The ST31270A can take up to 20 seconds to post ready. If it is the master with a slave, it can wait up to 31 seconds for the slave to complete diagnostics before posting ready.

1.11.1.4 Sleep mode

The sleep mode implementation is the same as Standby mode.

1.11.2 Power consumption

In the table below, the values apply at the drive power connector. Current was measured with an RMS DC ammeter.

	Spinup	Seeking	Read/ write	Idle	Standby
Current at +12V					
Amps peak	1.9	—	—	—	—
RMS amps typ	—	0.398	0.185	0.118	0.012
Watts typ	—	4.77	2.22	1.41	0.144
Current at +5V					
RMS amps typ	—	0.360	0.404	0.225	0.164
Watts typ	—	1.80	2.02	1.12	0.82
Power					
Total watts typ	7.00	6.60	4.50	2.75	1.0

1.12 Input noise

	+5V	+12V
Voltage tolerance (including noise)	± 5%	± 5%
Input noise frequency (max)	25 MHz	25 MHz
Input noise (max, peak-to-peak)	100 mV	240 mV

1.13 Environmental specifications

1.13.1 Ambient temperature

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

1.13.2 Temperature gradient

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

1.13.3 Altitude

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

1.13.4 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)

1.14 Shock and vibration

All shock and vibration specifications apply when 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 landing 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
22–400 Hz vibration	0.50 Gs	0.75 Gs	4.00 Gs

1.15 Acoustics

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

Value	Idle	Seek
Sound pressure, typ (dBA)	30	36
Sound pressure, max (dBA)	33	39

1.16 Reliability

Read error rates are measured with automatic retries and data correction with ECC enabled and all flaws re-allocated. The 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/stops	40,000 cycles
MTBF	300,000 power-on hours
Service life	5 years

1.17 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
- Certified to VDE 0805/05.90 and EN 60950/1.88 as tested by VDE

1.18 FCC verification

The ST31270A ATA interface 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 this 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.

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 Gerrät ist ein Einbaugerät, das für eine maximale Umgebungstemperatur von 55℃ 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 Versorgungsspannugen werden benötigt:
+5V ± 5% 0,6A
+12V ± 5% 0,8A (1,9A fur ca. 30 Sek. fur ± 10%)

4. Die Versorgungsspannung muβ 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 muβ den Anforderungen gemäβ 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.

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. 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 cable and connector

The drive uses a 40-pin, male I/O connector with two rows of twenty pins each and a notch for keying. Pin 20 is removed for keying purposes. A drawing of the I/O connector is shown in Figure 2. Pin 1 is located near the 4-pin power connector when the I/O connector is mounted.

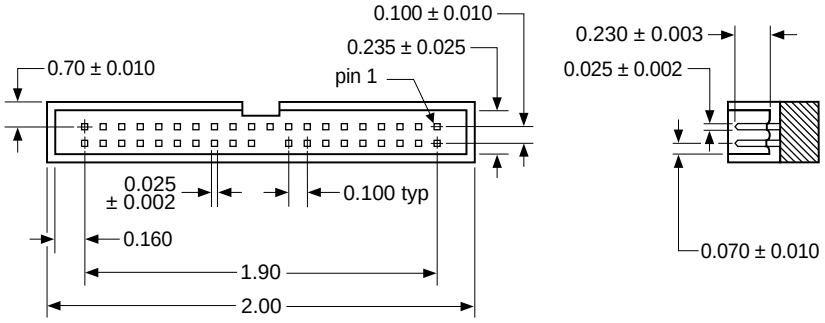

Figure 2. ATA interface connector

The table below lists recommended parts for the mating connector. You can use equivalent parts.

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 (46 centimeters).

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 The options jumper block (J8)

The options jumper block (J8), shown in Figure 3 on page 20, is used to configure the drive for operation. It is a 12-pin dual header and uses 0.1-inch connectors and jumpers. The options jumper block is used to:

- Configure the drive for single-drive operation
- Configure the drive as master or slave
- Configure the drive for dual-drive emulation
- Configure the drive for cable select
- Install a remote LED

The jumper settings for these options are shown in Figure 4 on page 21. Use 0.1-inch connectors to configure the options jumper block. The drive is shipped with spare jumpers attached to pins 7 and 5 and pins 3 and 1 of the options jumper block. Use these jumpers to configure the drive.

Caution. If you try to install a jumper that is not the correct size, you may damage the jumper and the jumper-block pins.

2.4.1 Master/slave configuration

Use the following settings to configure the drive as master or slave.

One drive only. The drive is configured at the factory for single-drive operation. No jumpers are required for single-drive operation.

Drive as master. Place a jumper on pins 3 and 4.

Drive as slave. Place a jumper on pins 1 and 2.

2.4.2 Dual-Drive emulation

To configure the drive for dual-drive emulation, place a jumper on pins 5 and 6 and on pins 11 and 12. Dual-drive emulation makes the drive look like two logical drives to the computer. Use the translation geometry values given for dual-drive emulation in the table on page 6 for both drive-type settings in CMOS. These are the maximum values the BIOS can accept if it cannot recognize more than 528 Mbytes. Partition and format both logical drives.

If you use dual-drive emulation, you cannot connect a second, physical drive to the same I/O port. Dual-drive emulation does not support cable-select. Also, the drive responds as one drive to power-management commands.

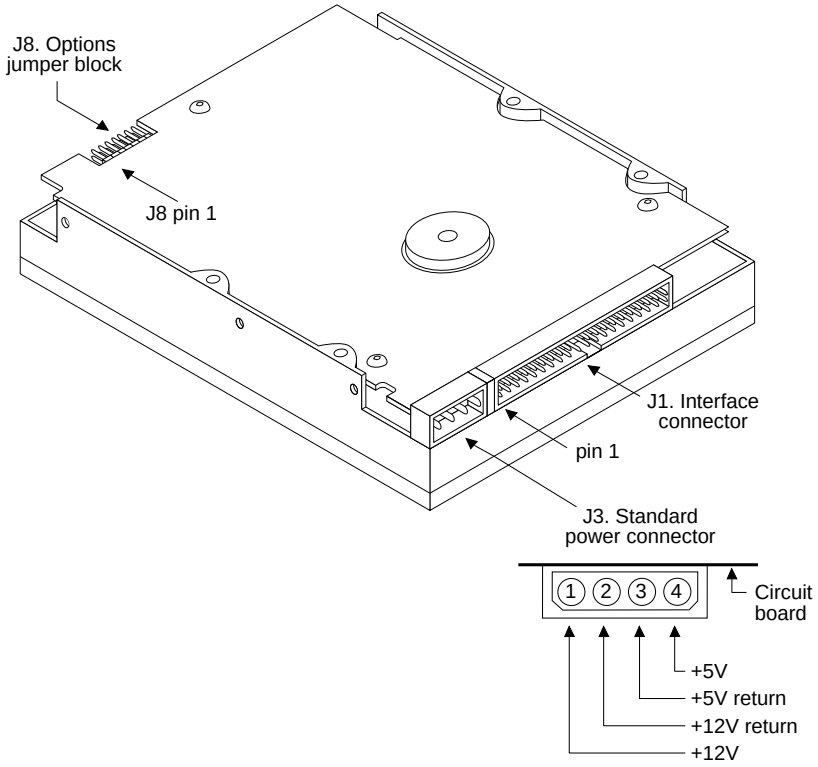

Figure 3. Connectors

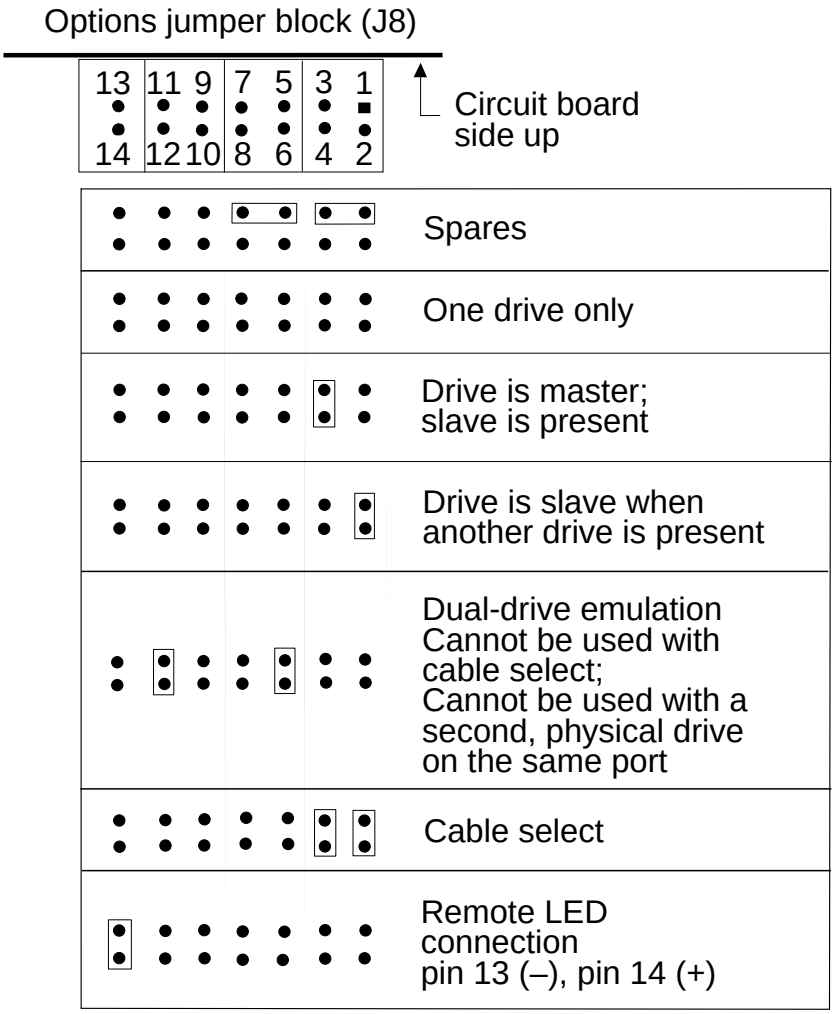

Figure 4. Configuration settings

2.4.3 Remote LED

You can connect a remote LED to pins 13 (–) and 14 (+) of the options jumper block (J8). The LED is polarized and can be damaged if it is installed incorrectly.

Because the jumper block uses a 0.1-inch connector, you may need to replace the current connector. Use Seagate connector part number 10562-001 or an equivalent.

2.4.4 Cable-select

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 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 drive for computers using cable select:

- Install jumpers on pins 1 and 2 and pins 3 and 4 as shown in Figure 4 on page 21.
- Connect the drive to the bus as shown in Figure 5.

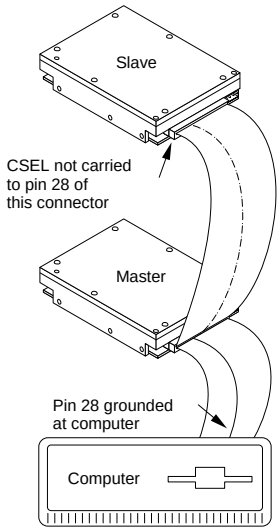

Figure 5. Connecting cable-selected drives

2.5 Mounting the drive

You can mount the drive in any orientation.

Note. If you format the drive before mounting it in the computer, it is best to format it in the same physical orientation it will have when it is mounted.

Use the set of mounting guidelines below that are appropriate to the type of mounting holes used: either bottom mounting holes or side mounting holes. Refer to Figure 6 on page 24 for mounting dimensions.

Mounting with the optional 1-inch faceplate adds 0.180 inches ± 0.010 inches (4.572 mm ± 0.254 mm) to the overall drive length.

Bottom mounting holes. Insert four 6-32 UNC screws in the four bottom mounting holes as shown in Figure 6.

Caution. Do not insert the bottom mounting screws more than 0.20 inches (6 turns) into the drive frame. If you use a screw that is too long, you risk damaging the drive's circuit board.

Side mounting holes. Use four 6-32 UNC screws in four of the six available side mounting holes as shown in Figure 6. Use two mounting holes on each side of the drive.

Caution. Do not insert the side mounting screws more than 0.20 inches (6 turns) into the drive frame. If you use a screw that is too long, you risk damaging the drive's circuit board.

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

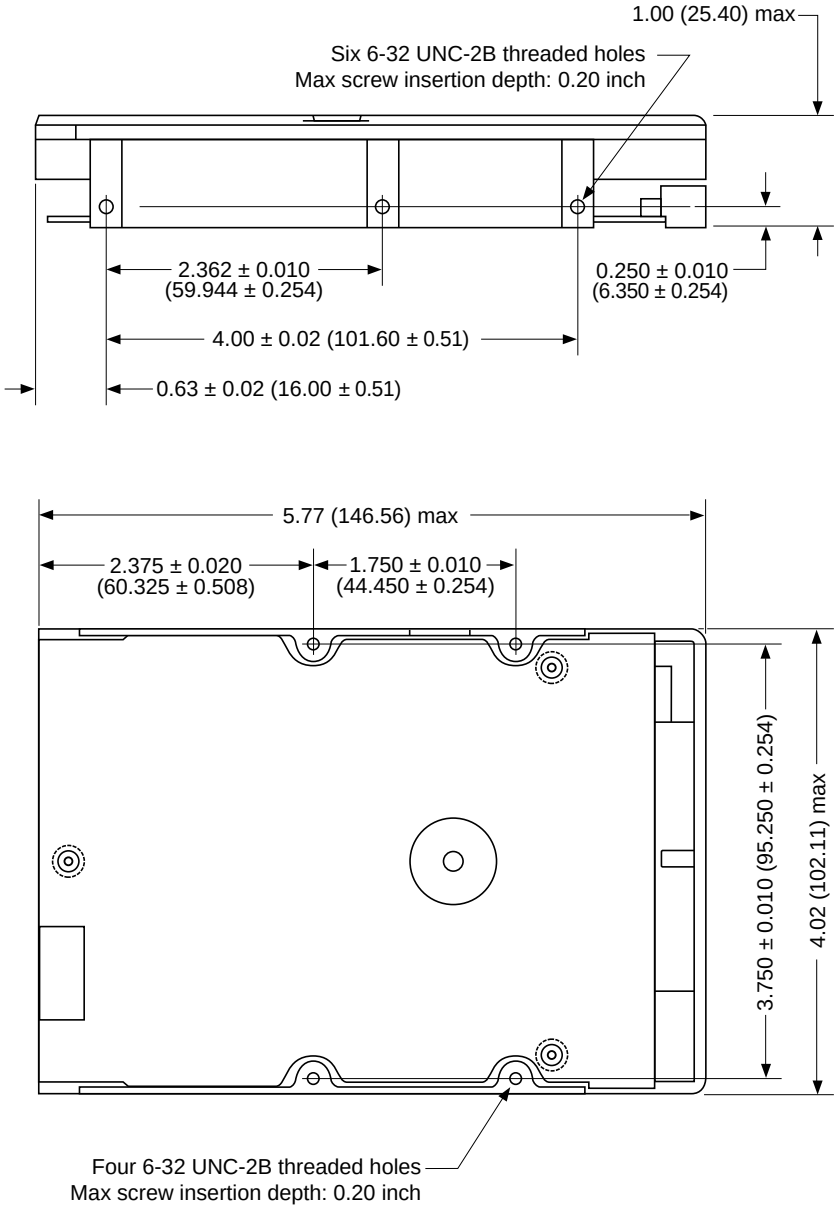

Figure 6. Mounting dimensions

3.0 ATA interface

The drive uses an 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 applications 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 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 (46 centimeters).

3.1 ATA Interface connector pin assignments

The signal name and signal direction for each I/O connector pin is shown in Figure 7 on page 26. See the *Seagate ATA Interface Reference Manual*, publication number 36111-*xxx*, for a complete description of each pin.

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.

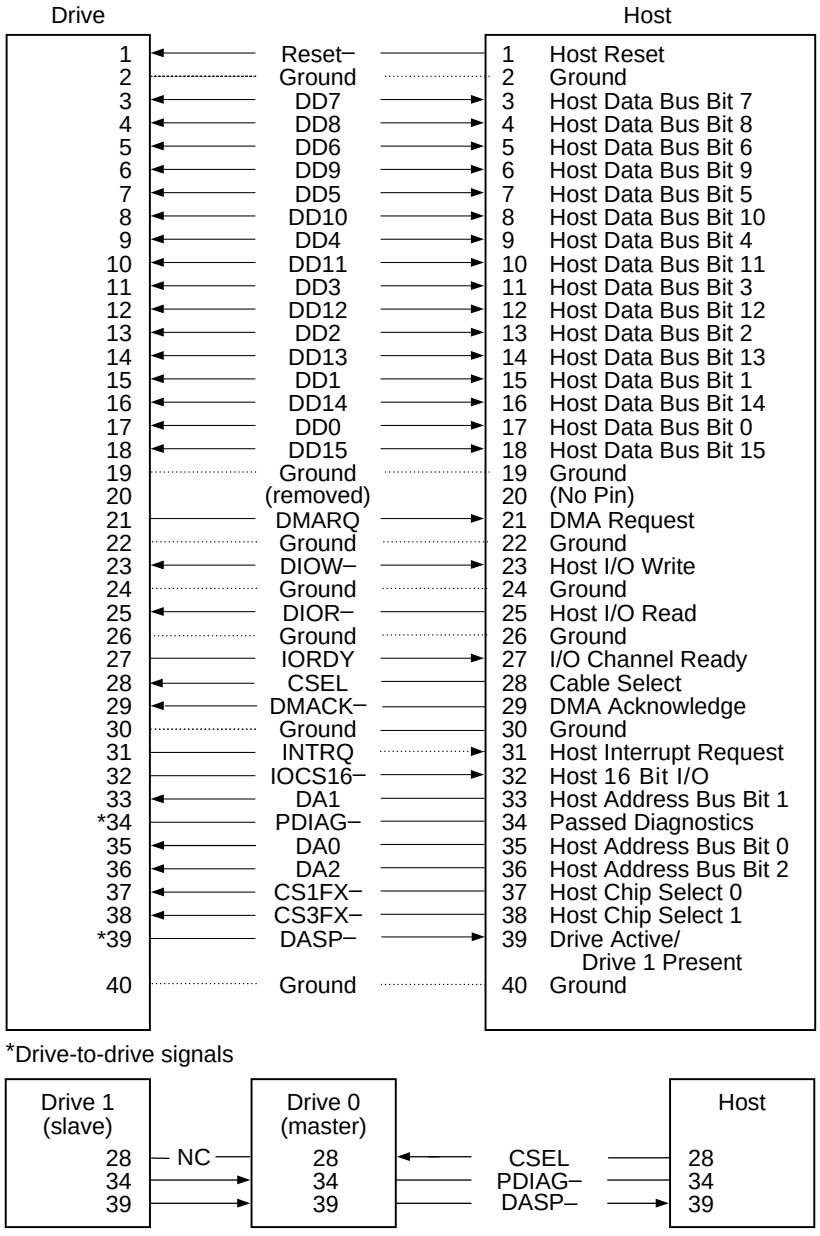

Figure 7. ATA interface connector pin assignments

3.2 Command set

This section lists all of the ATA commands the drive uses. Only the commands with unique implementation for the drive are discussed in this manual. For a complete description of all of the other ATA interface commands that are used, refer to the *Seagate ATA Interface Reference Manual*, part 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 Set Features command and the Sleep command, described in the *Seagate ATA Interface Reference Manual*, require further elaboration. These commands are described in Section 3.2.2 and 3.2.4.

The table below lists all commands implemented in the drive. It 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

continued

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Command name	Command code (in hex)	Parameters used				
		FR	SC	SN	CY	DH
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
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	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

3.2.1 Identify Drive command (EC_H)

The Identify Drive 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	$047A_H$ 0400_H Disc transfer rate > 10 Mbytes per second 0040_H Fixed drive 0020_H Spindle motor control option implemented 0010_H Head switch time > 15 µsec 0008_H Not MFM encoded 0002_H Hard sectored
1	Default cylinders	2,485
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

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Word	Description	Value
47	Maximum Sectors per interrupt per R/W Multiple command	8010H R/W Multiple supported; 16 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	0207_H Multiword DMA mode 2 supported
53	Current valid	0003_H, 54–58, 64–70 valid
54	Current cylinders	2,485
55	Current heads	16
56	Current sectors per track	63
57–58	Current sectors	2,504,880
59	Current multiple mode	0000_H
60–61	LBA total sectors	2,505,528
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 and 1 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	200 nsec

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

3.2.2 Set Features command (EF_H)

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 drive. The features that are set to default by the factory are indicated in the Feature column.

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.

At power-on or after a hard reset, the feature selections are restored to the factory-default values.

The following table shows alterable features supported by the drive. Values that are preset at the factory are indicated as default in the feature description.

Feature Value	Feature
02_H	Enable write immediate and write merging (default)
55_H	Disable cache
82_H	Disable write immediate and write merging
AA_H	Enable cache (default)
03_H	Set transfer mode

3.2.2.1 PIO and DMA Data-Transfer Modes

You can use the Set Features command to set the type of data-transfer mechanism and transfer mode that the drive uses. To do this:

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 low order 3 bits encode the mode value. 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
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 0000 0001 and the drive supports disabling of IORDY, then the drive sets its default PIO transfer mode and disables IORDY.

3.2.3 Standby timer timeout period

The Idle command and Standby command Sector Count registers are used to activate the Standby timer. The host can enable the Standby timer by placing a value in the sector-count register of the Idle command or Standby command. The value corresponds to a predetermined period of drive inactivity. The table below lists the values the Seagate drive uses and their corresponding timeout period.

Sector Count Register contents	Corresponding timeout period
0 (0_H)	Timeout disabled
1–12 (1_H–C_H)	value = 60 seconds
13–240 (D_H–$F0_H$)	(value * 5) seconds
241–251 ($F1_H$–FB_H)	(value – 240) * 30) minutes
252 (FC_H)	21 minutes
253 (FD_H)	8 hours
254 (FE_H)	Reserved
255 (FF_H)	21 minutes 15 seconds

The drive is shipped with the Standby timer disabled.

3.2.4 Sleep command (99_H, $E6_H$)

This command performs the same function as the Standby Immediate command (94_H, $E0_H$).

Appendix. Timing diagrams

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

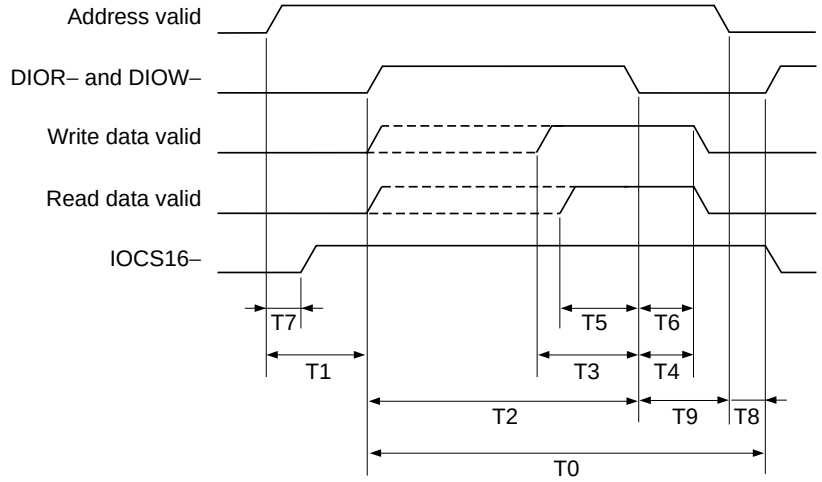

Figure 8. Programmed I/O timing without IORDY

Time	Description	Min	Max
T0	Cycle time	200 nsec	—
T1	Drive address (CS1FX–, CS3FX–, DA0, DA1 and DA2) valid and DIOR– and DIOW setup	30 nsec	—
T2	DIOW– or DIOR– pulse width	80 nsec	—
T3	DIOW– data setup	30 nsec	—
T4	DIOW– data hold	15 nsec	—
T5	DIOR– data setup	20 nsec	
T6	DIOR– data hold	5 nsec	—
T7	DIOW– or DIOR– to address valid hold	—	40 nsec
T8	DIOW– false to write data hold	—	30 nsec
T9	DIOR– false to read data hold	10 nsec	

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

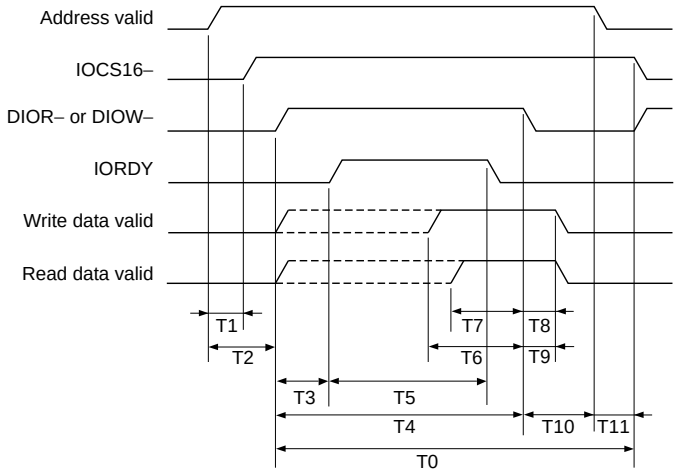

Figure 9. Programmed I/O timing with IORDY

Time	Description	Min	Max
T0	Cycle time	120 nsec	—
T1	Address valid until IOCS16– is asserted	—	30 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 valid until IOCS16– is negated	—	25 nsec

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

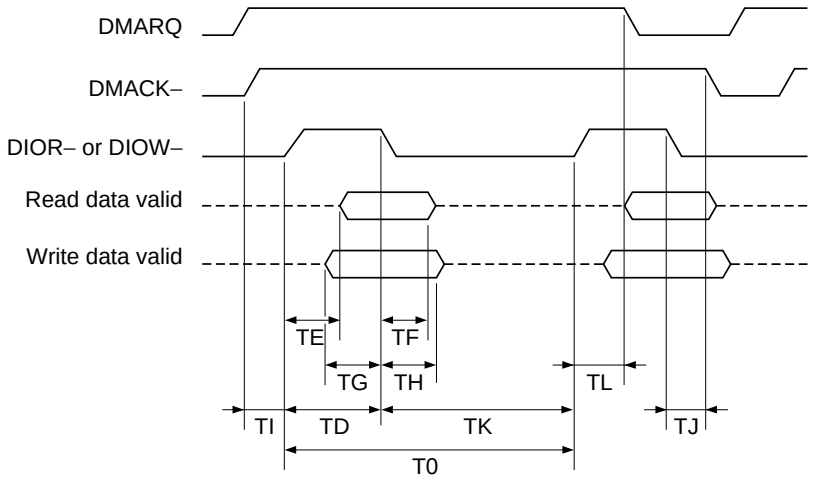

Figure 10. Multiword DMA timing

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

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