Seagate

Marathon 810

ATA Interface Drive

Product Manual

Marathon 810 (ST9816AG)

ATA Interface Drive

Product Manual

Publication Number: 36300-101, Rev. A, August 1995

Contents

Figures

Introduction

The Marathon™ 810 (ST9816AG) provides high storage capacity in a small, low-profile hard disc drive.

Key features:

- SafeRite™ shock protection
- Low power consumption
- Compact, MCC-compatible form-factor
- Quiet operation
- Advanced partial-response, maximum-likelihood (PRML) read channel
- Supports logical block addressing
- Supports PIO modes 0, 1, 2, 3 and 4, and DMA modes 0, 1 and 2.
- High instantaneous data-transfer rates (up to 16.6 Mbytes per second using PIO mode 4 and DMA mode 2).
- Fast microprocessor for lower command overhead
- 120-Kbyte multisegmented adaptive cache
- Advanced caching and on-the-fly error-correction algorithms
- Supports Read Multiple and Write Multiple commands
- Supports autodetection of master/slave drives using cable select and DASP– signals.

Specification summary table

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

Drive Specification	**ST9816AG**
Guaranteed Capacity ($\times 10^6$ bytes)	810
Guaranteed sectors	1,583,568
Bytes per sector	512
Default sectors per track	63
Default Read/Write heads	16
Default cylinders	1,571
Physical read/write heads	8
Discs	4
Recording density (bits/inch)	90,000
Track density (tracks/inch)	3,807
Areal density (Mbits/inch^2)	342
Spindle speed (RPM)	4,500
Internal data-transfer rate (Mbits/sec, max)	44
I/O data-transfer rate (Mbytes/sec, max)	16.6
ATA data-transfer modes supported	PIO modes 0, 1, 2, 3, 4; Multiword DMA modes 0, 1, 2
Cache buffer (Kbytes)	120
Height (inches, max)	0.754
Width (inches, max)	2.76
Depth (inches, max, excluding I/O pins)	4.010
Weight (ounces, typical)	7.4
Track-to-track seek time (msec, typical)	6 (read), 7 (write)
Average seek time (msec, typical)	16 (read), 20 (write)
Full-stroke seek time (msec, max)	26 (read), 28 (write)

Drive Specification	ST9816AG
Average latency (msec)	6.67
Power-on to ready (seconds, typical)	7
Standby to ready (seconds, typical)	3
Spinup power and current (typical)	3.50 watts, 0.700 amps
Seek power and current (typical)	2.10 watts, 0.420 amps
Read/Write power and current (typical)	2.10 watts, 0.420 amps
Idle mode power and current (typical)	1.30 watts, 0.260 amps
Standby mode power and current (typical)	0.40 watts, 0.080 amps
Sleep mode power and current (typical)	0.30 watts, 0.060 amps
Voltage tolerance (including noise)	+5 volts +5% –10%
Ambient temperature (°C)	5 to 55 (op.), –40 to 70 (nonop.)
Temperature gradient (°C per hour, max)	30
Relative humidity	8%–80% (10%/hr max grad.)
Wet bulb temperature (°C, max)	29 (op.), 40 (nonop.)
Altitude (meters above mean sea level, max)	–300 to 3,040 (op.), –300 to 12,190 (nonop.)
Shock, operating (Gs, max at 2 or 11 msec)	100
Shock, nonoperating (Gs, max)	250 (2 msec), 150 (11 msec)
Vibration (Gs max at 22–450 Hz)	0.50 (op.) 4.0 (nonop.)
Drive Acoustics, Idle mode (dBA)	26 (typical), 30 (max)
Drive Acoustics, seeking (dBA)	29 (typical), 33 (max)
Nonrecoverable read errors	1 per 10^{13} bits read
Mean time between failures (power-on hours)	300,000
Contact start-stop cycles	50,000
Service life (years)	5

1.0 Drive specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, at sea level, and nominal power.

1.1 Formatted capacity

	ST9816AG
Guaranteed Mbytes (1 Mbyte = 10^6 bytes)	810.7
Guaranteed sectors	1,583,568
Bytes per sector	512

1.1.1 Default logical geometry

	ST9816AG
Sectors per track	63
Read/Write heads	16
Cylinders	1,571

1.1.2 Supported translation geometries

The ST9816AG supports all head, cylinder and sector geometries, subject to the maximums specified below and to the following condition:

(sectors) × *(heads)* × *(cylinders)* ≤ *total sectors per drive*

	ST9816AG
Sectors per track (max)	63
Read/Write heads (max)	16
Cylinders (max)	1,571

1.2 Physical organization

	ST9816AG
Read/Write heads	8
Discs	4

1.3 Recording and interface technology

Interface	ATA
Recording method	RLL (1,7)
Recording density (bits/inch)	90,000
Flux density (flux change/inch)	67,500
Track density (tracks/inch)	3,807
Areal density (Mbits/inch^2)	342
Spindle speed (RPM) (± 0.5%)	4,500
Internal data-transfer rate (Mbits per sec max—ZBR)	44
I/O data-transfer rate (Mbytes per sec max)	16.6 (PIO mode 4 with IORDY) 16.6 (multiword DMA mode 2)
Interleave	1:1
Cache buffer (Kbytes)	120

1.4 Physical dimensions

Height (max) inches (mm)	0.754 (19.15)
Width (max) inches (mm)	2.76 (70.10)
Depth (max) inches (mm)	4.010 (101.85)
Weight (typical) ounces (kg)	7.4 (0.21)

Note. Maximum depth excludes I/O connector pins, which may extend up to 0.010 inches beyond the edge of the head/disc assembly.

1.5 Seek time

All seek times are measured using a 25 MHz 486 AT computer (or faster) with a 8.3 MHz I/O bus. The measurements are taken with nominal power at sea level and 25°C ambient temperature. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead.
- 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 typical value is determined by averaging 100 full-stroke seeks in both directions.

Seek type	Typical read (msec)	Typical write (msec)
Track-to-track	6	7
Average	16	20
Full-stroke	26	28

Average latency: 6.67 msec

1.6 Startup times

Power-on to Ready (sec)	7 (typical)
Standby to Ready (sec)	3 (typical), 10 (max.)

Note. The drive responds to nonmedia commands within 2 seconds (max) of power-up, and responds to media commands within 12 seconds (max) of power-up.

1.7 Power specifications

The drive receives DC power (+5V) through pin 41 and pin 42 of the ATA interface connector.

1.7.1 Power consumption

Power requirements for the drive are listed in the table below. Typical power measurements are based on an average of drives tested under nominal conditions, using 5.0V input voltage at 25°C ambient temperature at sea

level. Active mode current and power are measured with a 32-msec delay between each operation and the drive in default logical geometry. Seeking power and currents are measured during one-third-stroke buffered seeks. Read/Write power and current are measured with the heads on track, based on a 16-sector write followed by a 32-msec delay, then a 16-sector read followed by a 32-msec delay. Spinup power is measured from time of power-on to time of drive-ready for normal operation.

Mode	Typical watts RMS (at nominal voltage)	Typical amps RMS (at nominal voltage)
Spinup	3.50	0.700
Active		
Seeking	2.10	0.420
Read/Write	2.10	0.420
Idle	1.30	0.260
Standby	0.40	0.080
Sleep	0.30	0.060

1.7.1.1 Typical current profile

Figure 1 shows a typical current profile for the ST9816AG.

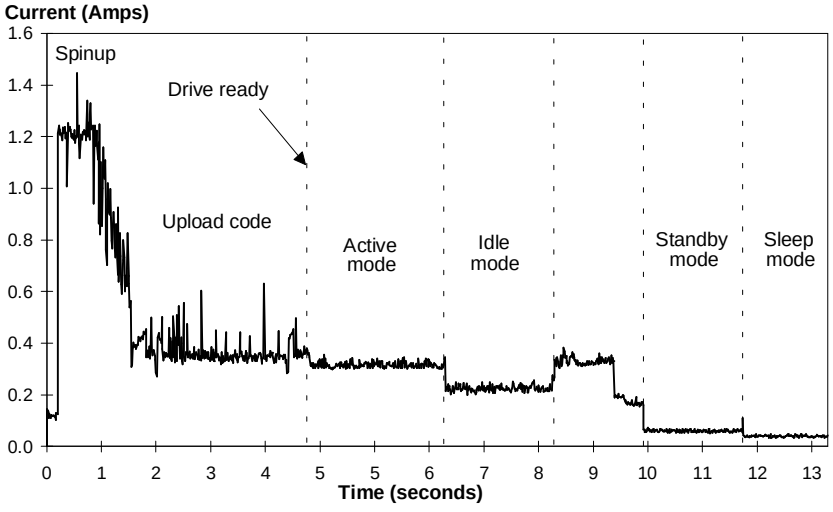


Figure 1. Typical startup and operation current profile for the ST9816AG

1.7.2 Power recovery

Except during execution of a write command, the drive's power can be interrupted without adversely affecting the drive or previously written data. If power is removed while the drive is performing a write operation, the integrity of the data being written cannot be guaranteed.

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.
- 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.

Note. Equivalent resistance (11.9 ohms) is calculated by dividing the nominal voltage (5.0V) by the typical RMS read/write current (0.420 amps).

1.7.4 Voltage tolerance

Voltage tolerance (including noise): +5 volts + 5% – 10%

1.7.5 Power-management modes

Power management is required for low-power and portable computer systems. In most systems, you can control power management through the system setup program. This Seagate® drive features several power-management modes, which are described briefly below:

Active mode. The drive is in Active mode during the read/write and seek operations.

Idle mode. At power-on, the drive sets the idle timer to enter Idle mode after 5 seconds of inactivity. You can set the idle timer delay using the system setup utility. In Idle mode, the spindle remains up to speed. The heads are parked away from the data zones for maximum data safety. The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disc access is necessary.

Standby mode. The drive enters Standby mode when the host sends a Standby Immediate command. If the standby timer has been set by the host system, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay

is system-dependent and is usually established using the system setup utility. In Standby mode, the buffer remains enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disc access is necessary.

Sleep mode. The drive enters Sleep mode after receiving a Sleep Immediate command from the host. The heads are parked and the spindle is at rest. The drive leaves Sleep mode when a Hard Reset or Soft Reset command is received from the host. After receiving a soft reset, the drive exits Sleep mode and enters Standby mode with all current emulation and translation parameters intact.

Idle and standby timers. The drive sets the default time delay for the idle timer at power-on. In most systems, you can set this delay using the system setup utility. Each time the drive performs an Active function (read, write or seek), the idle and standby timers are reinitialized and begin counting down from their specified delay times to zero. If the idle timer reaches zero before any drive activity is required, the drive enters Idle mode. If the host has set the standby timer, the standby countdown continues. If the host has not set the standby timer, the drive remains in Idle mode. If the standby timer reaches zero before any drive activity is required, the drive enters Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disc access is necessary.

1.8 Environmental tolerances

1.8.1 Ambient temperature

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

1.8.2 Temperature gradient

Operating	30°C / hr (54°F / hr) max, without condensation
Nonoperating	30°C / hr (54°F / hr) max, without condensation

1.8.3 Relative humidity

Operating	8% to 80% noncondensing (10% per hour max) Max. wet bulb temperature: 29.4°C (85°F)
Nonoperating	8% to 80% noncondensing (10% per hour max) Max. wet bulb temperature: 40°C (104°F)

1.8.4 Altitude

Operating	–300 m to 3,040 m (–1,000 ft to 10,000 ft)
Nonoperating	–300 m to 12,190 m (–1,000 ft to 40,000 ft)

1.8.5 Shock

All shock specifications assume that the drive is mounted in an approved orientation with the input levels at the drive mounting screws. The nonoperating specifications assume that the read/write heads are positioned in the shipping zone.

Note. At power-down, the read/write heads automatically move to the shipping zone. The head and slider assembly park inside of the maximum data cylinder. When power is applied, the heads recalibrate to Track 0.

1.8.5.1 Operating shock

This drive incorporates SafeRite shock protection and can withstand a maximum operating shock of 100 Gs without nonrecoverable data errors (based on half-sine shock pulses of 2 or 11 msec).

1.8.5.2 Nonoperating shock

The nonoperating shock level that the drive can experience with complete data recovery is 250 Gs (based on half-sine shock pulses of 2 msec duration) or 150 Gs (based on half-sine shock pulses of 11 msec duration). Shock pulses are defined by MIL-STD-202 F with the amplitude tolerance controlled to ± 5%.

1.8.6 Vibration

All vibration specifications assume that the drive is mounted in an approved orientation with the input levels at the drive mounting screws. The nonoperating specifications assume that the read/write heads are positioned in the shipping zone.

1.8.6.1 Operating vibration

The following table lists the maximum vibration levels that the drive may experience without incurring physical damage or degradation in performance.

5–450 Hz	0.50 Gs acceleration (peak)
450–5 Hz	0.50 Gs acceleration (peak)

1.8.6.2 Nonoperating vibration

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

5–22 Hz	0.162-inch displacement (double amplitude)
22–450 Hz	4 Gs acceleration (peak)
450–22 Hz	4 Gs acceleration (peak)
22–5 Hz	0.162-inch displacement (double amplitude)

1.9 Drive acoustics

Drive acoustics are measured as sound pressure 1 meter from the drive.

Mode	Typical	Maximum
Idle mode (dBA)	26	30
Seek (dBA)	29	33

1.10 Reliability

Nonrecoverable read errors	1 per 10^{13} bits read
Mean time between failures	300,000 power-on hours (nominal power, at sea level, 25°C ambient temperature)
Contact start-stop cycles	50,000 cycles (at nominal voltage and temperature, with 60 cycles per hour and a 50% duty cycle)
Preventive maintenance	None required
Service life	5 years

1.11 Agency certification

1.11.1 Safety certification

The ST9816AG is listed in accordance with UL 1950 and CSA C22.2 (950-M89) and meets all applicable sections of IEC 380, IEC 435, IEC 950, VDE 0806/08.81 and EN 60950 as tested by TUV-Rheinland, North America.

1.11.2 FCC verification

The ST9816AG is intended to be contained solely within a personal computer or similar enclosure (not attached to an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission authorization, verification or certification of the device is required.

Seagate Technology, Inc. has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disc drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference with radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications

Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

2.0 Drive mounting and configuration

2.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and ESD hazards. It is mandatory that you observe standard static-discharge precautions. A grounded wrist-strap is preferred.

Handle the drive only by the sides of the head/disc assembly. Avoid contact with the printed circuit board, all electronic components and the interface connector. Do not apply pressure to the top cover. Always rest the drive on a padded antistatic surface until you mount it in the host system.

2.2 Jumper settings

2.2.1 Master/slave configuration

You must establish a master/slave relationship between two drives attached to a single AT bus. You can configure a drive to become a master or slave by setting the master/slave jumpers, as described below and shown in Figure 2 on page 16.

Alternatively, you can configure the drive as a master or slave using the cable select option. This requires a specialized daisy-chain cable that grounds pin 28 (CSEL) on one of its two drive connectors. If you attach the drive to the grounded CSEL connector, it becomes a master. If you attach the drive to the ungrounded CSEL connector, it becomes a slave. To use this option, the host system and both drives must support cable select and both drives must be configured for cable select. To configure an ST9816AG for cable select, install both master/slave jumpers.

For the host to recognize the slave drive using the DASP– signal, the slave drive must assert the DASP– signal at power up, and the master drive must monitor DASP– at power up.

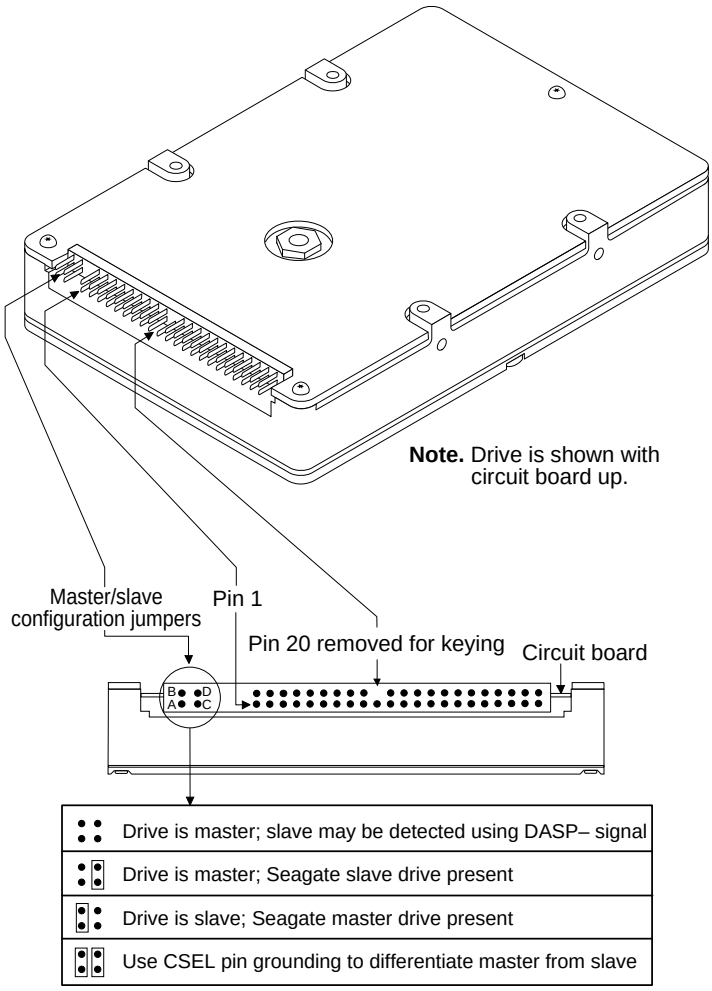


Figure 2. Connector and master/slave jumper setup for the ST9816AG

Jumper for pins A and B	Jumper for pins C and D	Configuration
Removed	Removed	Drive is master; slave drive may be detected using DASP– signal. CSEL is ignored.
Removed	Installed	Drive is master; slave drive is present. CSEL is ignored. DASP– is ignored.
Installed	Removed	Drive is slave (a master drive should be present also). CSEL is ignored.
Installed	Installed	Differentiate master and slave drives using cable select: If a drive is attached to a connector in which pin 28 is grounded, then it becomes a master. If a drive is attached to a connector in which pin 28 is ungrounded, then it becomes a slave.

2.3 Remote LED configuration

The drive indicates activity to the host through the DASP– line (pin 39) on the ATA interface. This line may be connected to a drive status indicator driving an LED at 5V. The line has a 30 mA nominal current limit. To avoid potential damage to the drive, the host should include a resistor in line with the LED for current limiting. This resistor should have a minimum resistance of 470 ohms (1,000 to 3,000 ohms is recommended).

2.4 Drive mounting

You can mount the drive in any orientation. Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling. The drive conforms to the industry-standard MCC direct-mounting specifications and requires MCC-compatible connectors for direct-mounting applications. See Figure 3 on page 18 for drive mounting dimensions.

Note. The I/O connector pins may extend up to 0.010 inches beyond the edge of the head/disc assembly.

Caution. To avoid damaging the drive:

- Use M3X0.5 *metric* mounting screws *only*.
- Do not insert mounting screws more than 0.150 inches (3.81 mm) into the mounting holes.
- Do *not* overtighten the screws (maximum torque: 3 inch-lb).

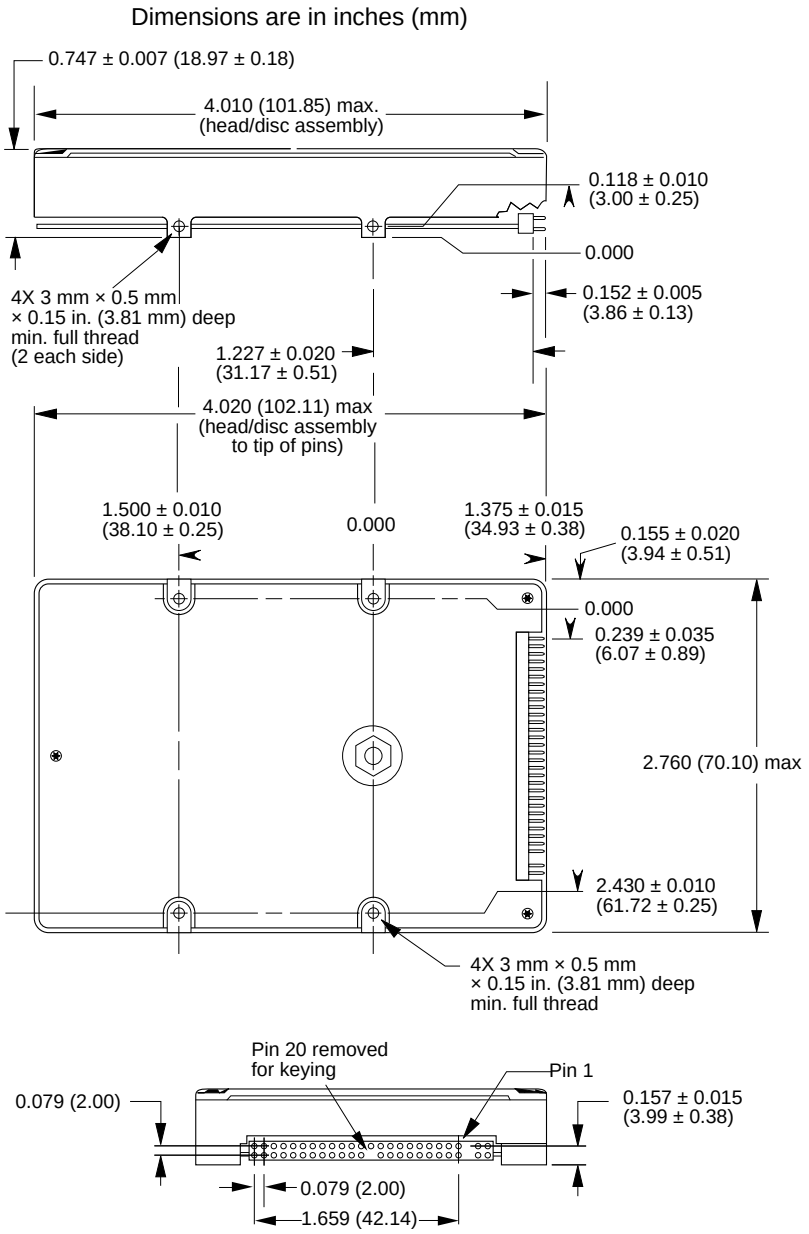


Figure 3. Mounting dimensions for the ST9816AG

2.5 ATA interface connector

The drive connector is a 44-conductor connector with 2 rows of 22 male pins on 0.079-inch (2-mm) centers (see Figures 4 and 5). The mating cable connector is a 44-conductor, nonshielded connector with 2 rows of 22 female contacts on 0.079-inch (2-mm) centers. The connectors should provide strain relief and should be keyed with a plug in place of pin 20.

These drives are designed to support the industry-standard MCC direct-mounting specifications. When installing these drives in fixed mounting applications, use only MCC-compatible connectors such as Molex part number 87368-442*x*. For applications involving flexible cables or printed circuit cables (PCCs), use Molex part number 87259-4413 or equivalent to connect the drive to the system. Select a connector that provides adequate clearance for the master/slave configuration jumpers if the application requires the use of such jumpers. The ATA interface cable should be no more than 18 inches long.

Note. The I/O connector pins may extend up to 0.010 inches beyond the edge of the head/disc assembly.

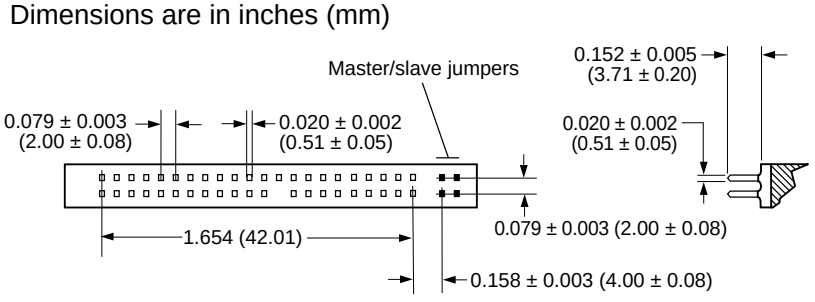


Figure 4. ATA Interface connector dimensions (for reference only)

3.0 ATA interface

The ST9816AG uses the industry-standard ATA interface. It supports both 8-bit and 16-bit data transfers. It supports ATA programmed input/output (PIO) modes 0, 1, 2, 3 and 4, ATA single-word DMA modes 0, 1 and 2, and ATA multiword DMA modes 0, 1 and 2. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

The drive can differentiate between a hard reset and a soft reset while in Sleep mode. You can use a daisy-chain cable to connect two drives to a single AT host bus. For detailed information regarding the ATA interface, refer to the *Proposed Working Draft of the ATA-2 Draft Proposed American National Standard*, document X3T9.2/948D (subsequently referred to as the Draft Proposed ATA-2 Standard).

3.1 ATA interface signals and connector pins

Figure 5 on page 22 summarizes the signals on the ATA interface connector that are supported by the ST9816AG. For a detailed description of these signals, refer to the *Draft Proposed ATA-2 Standard.*

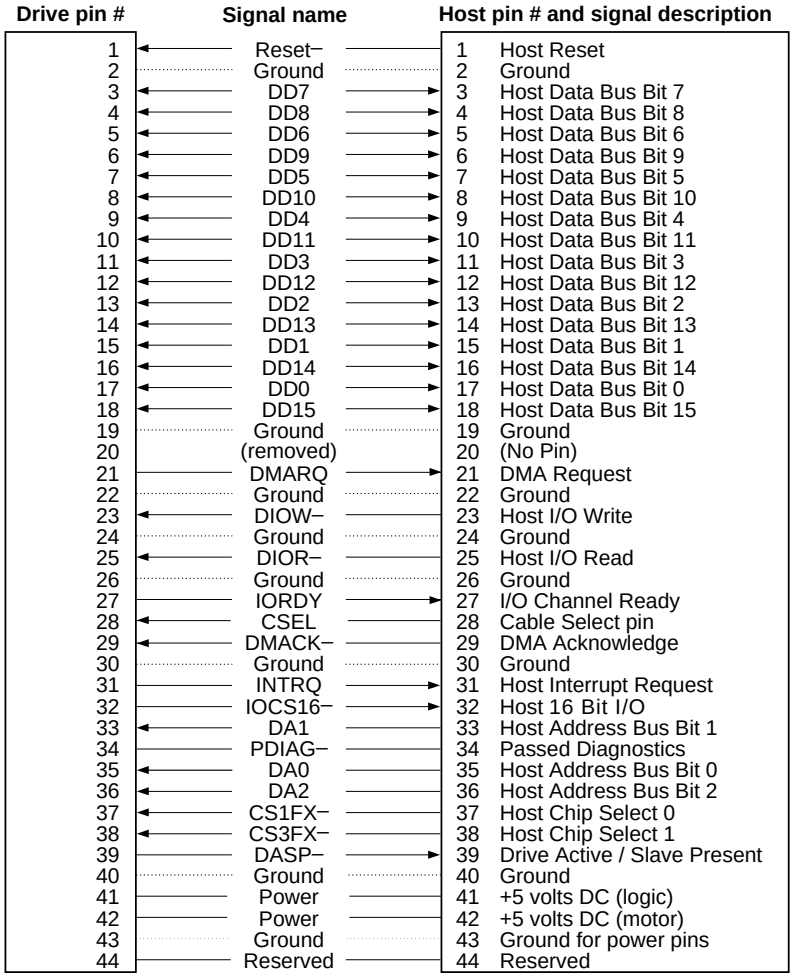
3.1.1 AT bus signal levels

Signals that the drive sends have the following output characteristics at the drive connector:

Logic Low	0.0V to 0.4V
Logic High	2.5V to 5.25V

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

Logic Low	0.0V to 0.8V
Logic High	2.0V to 5.25V



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

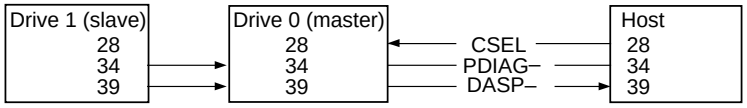


Figure 5. I/O pins and associated ATA signals supported by the ST9816AG

3.2 ATA Interface commands

3.2.1 Supported ATA commands

The following table lists ATA-standard and Seagate-specific drive commands that the ST9816AG supports. For a detailed description of the ATA commands, refer to the *Draft Proposed ATA-2 Standard.*

Command name	Command code	Supported by ST9816AG
ATA-standard commands		
Execute Drive Diagnostics	90_H	Yes
Format Track	50_H	Yes
Identify Drive	EC_H	Yes
Initialize Drive Parameters	91_H	Yes
NOP	00_H	No
Read Buffer	$E4_H$	Yes
Read DMA (w/retry)	$C8_H$	Yes
Read DMA (no retry)	$C9_H$	Yes
Read Long (w/retry)	22_H	Yes
Read Long (no retry)	23_H	Yes
Read Multiple	$C4_H$	Yes
Read Sectors (w/retry)	20_H	Yes
Read Sectors (no retry)	21_H	Yes
Read Verify Sectors (w/retry)	40_H	Yes
Read Verify Sectors (no retry)	41_H	Yes
Recalibrate	$1x_H$	Yes
Seek	$7x_H$	Yes
Set Features	EF_H	Yes
Set Multiple Mode	$C6_H$	Yes
Write Buffer	$E8_H$	Yes

Command name	Command code	Supported by ST9816AG
Write DMA (w/retry)	CA_H	Yes
Write DMA (no retry)	CB_H	Yes
Write Long (w/retry)	32_H	Yes
Write Long (no retry)	33_H	Yes
Write Multiple	$C5_H$	Yes
Write Same	$E9_H$	No
Write Sectors (w/retry)	30_H	Yes
Write Sectors (no retry)	31_H	Yes
Write Verify	$3C_H$	No
ATA-standard power-management commands		
Check Power Mode	98_H or $E5_H$	Yes
Idle	97_H or $E3_H$	Yes
Idle Immediate	95_H or $E1_H$	Yes
Sleep	99_H or $E6_H$	Yes
Standby	96_H or $E2_H$	Yes
Standby Immediate	94_H or $E0_H$	Yes
Seagate-specific commands		
Active and Set Idle timer	FB_H	Yes
Active Immediate	$F9_H$	Yes
Check Idle Mode	FD_H	Yes
Idle Immediate	$F8_H$	Yes
Idle and Set Idle timer	FA_H	Yes

The following commands contain drive-specific features or are not described in the *Draft Proposed ATA-2 Standard.*

3.2.2 Identify Drive command

The Identify Drive command (command code EC_H) transfers information about the drive to the host after power up. The data is organized as a single 512-byte block of data, whose contents are shown in the table below. All reserved bits or words should be set to zero. Parameters listed with an "*x*" are drive-specific or vary with the state of the drive. See Section 1 of this manual for default parameter settings for the ST9816AG.

Word	Description	ST9816AG
0	Configuration information: • Bit 10: disc transfer > 10 Mbits/sec • Bit 6: fixed drive • Bit 4: head switch time > 15 µsec • Bit 3: not MFM encoded • Bit 1: hard-sectored disc	$045A_H$
1	Number of fixed cylinders (default logical emulation): 1,571	0623_H
2	ATA reserved	0000_H
3	Number of heads (default logical emulation): 16	0010_H
4	Number of unformatted bytes per track (36,240)	$8D90_H$
5	Number of unformatted bytes per sector (584)	248_H
6	Number of sectors per track (default logical emulation): 63	$003F_H$
7–9	ATA reserved	0000_H
10–19	Serial Number: (20 ASCII characters, 0000_H = none)	ASCII
20	Controller type (dual-port multisector buffer with caching)	0003_H
21	Buffer size (240 sectors of 512 bytes each)	$00F0_H$
22	Number of ECC bytes available (16)	0010_H
23–26	Firmware revision (8 ASCII character string): *xx* = ROM version, *ss* = RAM version, *tt* = RAM version	*xx.ss.tt*

Word	Description	ST9816AG
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	ST9816AG
47	Maximum sectors per interrupt on read/write multiple	0010_H
48	Double word I/O (not supported)	0000_H
49	Standby timer (ATA compliant), IORDY (supported/can be disabled), LBA mode (supported), DMA mode (supported)	$2F00_H$
50	ATA reserved	0000_H
51	PIO data-transfer cycle timing mode	0200_H
52	DMA transfer cycle timing mode (not used)	0000_H
53	Validity of words 54–58 and words 64–70 (words may be valid)	0003_H
54	Number of cylinders (current emulation mode)	$xxxx_H$
55	Number of heads (current emulation mode)	$xxxx_H$
56	Number of sectors per track (current emulation mode)	$xxxx_H$
57–58	Number of sectors (current emulation mode)	$xxxx_H$
59	Number of sectors transferred during a Read Multiple or Write Multiple command	$01xx_H$
60–61	LBA sectors available (1,583,648)	$182A20_H$
62	Single-word DMA active/DMA modes supported (see Note following table)	$0x07_H$
63	Multiword DMA active/DMA modes supported (see Note following table)	$0x07_H$
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003_H
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078_H
66	Recommended multiword DMA transfer cycle time per word (180 nsec)	$00B4_H$

Word	Description	ST9816AG
67	Minimum PIO cycle time without IORDY flow control (363 nsec)	$016B_H$
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078_H
69–127	ATA reserved	0000_H
128–159	Seagate reserved	$xxxx_H$
160–255	ATA reserved	0000_H

Note. DMA mode settings in the Identify Drive command are reflected in the bit settings for words 62 and 63, as shown below.

Word	Bit	Description (if bit is set to 1)
62	0	Single-word DMA mode 0 available
62	1	Single-word DMA mode 1 available
62	2	Single-word DMA mode 2 available
62	8	Single-word DMA mode 0 currently active
62	9	Single-word DMA mode 1 currently active
62	10	Single-word DMA mode 2 currently active
63	0	Multiword DMA mode 0 available
63	1	Multiword DMA mode 1 available
63	2	Multiword DMA mode 2 available
63	8	Multiword DMA mode 0 currently active
63	9	Multiword DMA mode 1 currently active
63	10	Multiword DMA mode 2 currently active

3.2.3 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled and 4 bytes of ECC. The acceptable values for the Features register are defined as follows:

- 00_H Set PIO mode to default (PIO mode 2) and enable IORDY
- 01_H Set PIO mode to default (PIO mode 2) and disable IORDY
- 02_H Enable write cache *(default)*
- 03_H Set transfer mode (based on value in Sector Count register)
  Sector Count register values:
  - 00_H Set PIO mode to default (PIO mode 2)
  - 08_H PIO mode 0
  - 09_H PIO mode 1
  - $0A_H$ PIO mode 2 *(default)*
  - $0B_H$ PIO mode 3
  - $0C_H$ PIO mode 4
  - 10_H Single-word DMA mode 0
  - 11_H Single-word DMA mode 1
  - 12_H Single-word DMA mode 2
  - 20_H Multiword DMA mode 0
  - 21_H Multiword DMA mode 1
  - 22_H Multiword DMA mode 2
- 44_H Sixteen bytes of ECC apply on Read Long and Write Long commands
- 55_H Disable read look-ahead (read cache) feature
- 66_H Disable reverting to power-on defaults
- 82_H Disable write cache
- AA_H Enable read look-ahead (read cache) feature *(default)*
- BB_H 4 bytes of ECC apply on Read Long and Write Long commands *(default)*
- CC_H Enable reverting to power-on defaults *(default)*

Note. At power-on, or after a hardware reset, the default values of the features are as indicated above. A software reset also changes the features to default values unless a 66_H command has been received.

Appendix. Compatibility notes

ECC testing

When an ST9816AG performs hardware-based ECC error correction on-the-fly, the drive does not report an ECC error. This allows ECC correction without degrading drive performance. Some older drive diagnostic programs test ECC features by creating small data errors and then checking to see if they are reported. These tests, when run on an ST9816AG, may incorrectly report an ECC detection failure because the drive hardware corrects the data automatically, avoiding the error rather than reporting it. This type of report does not indicate a drive malfunction.

Seagate

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

Publication Number: 36300-101, August 1995, Printed in USA