

### Capacities

MODEL	MEGABYTES UNFORMATTED	MEGABYTES FORMATTED
ST406	6.38	5
ST412	12.76	10
ST419	19.14	15

### Reliability

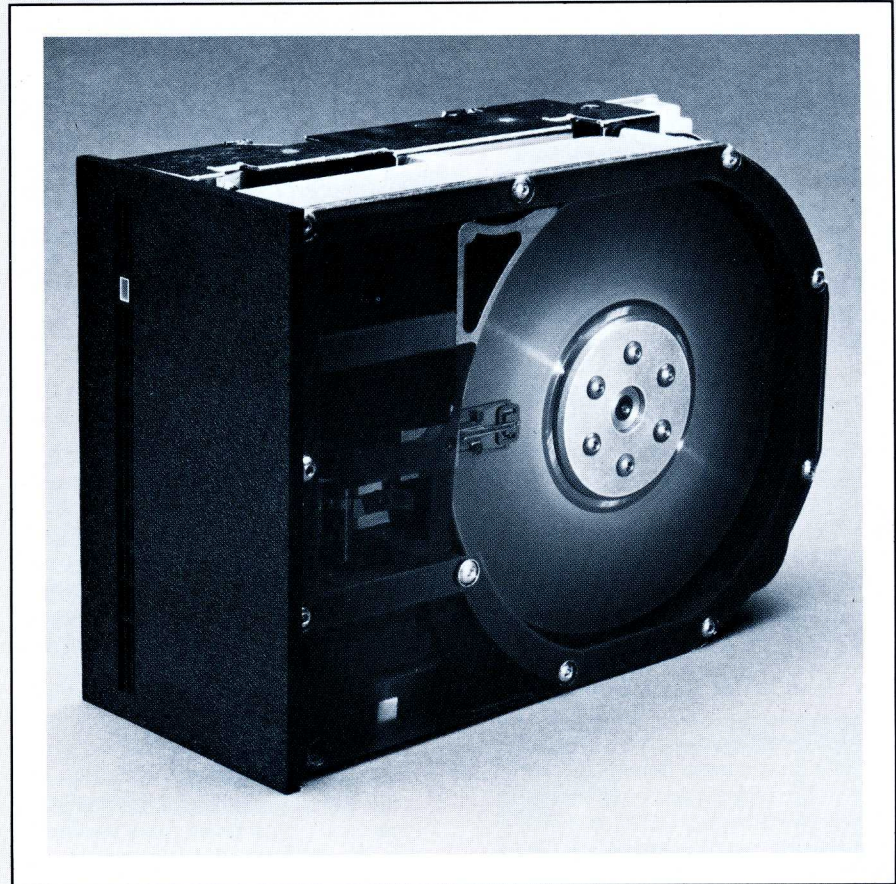
- Proven Seagate Winchester design
- Low heat dissipation (25 watts, typical)
- Proven band actuator (enclosed in sealed environment)
- Patented "air-flow" spindle pump
- Thermally isolated stepper and spindle motors
- Projected service life: in excess of 11,000 hours MTBF
- One year warranty (parts and labor)
- "105% Seagate Guarantee"

### Performance

- Advanced stepper motor design
- Manganese-zinc heads
- Onboard microcomputer (supports buffered or normal step modes)
- Access time (average 85 milliseconds, including settling)

### Extra Assurance of Quality

- All functional parameters are verified with extensive marginalized testing
- Data integrity is certified, and all media flaws are identified and mapped
- Proprietary data acquisition system records and reports to the buyer documented test results of every drive shipped
- Any Seagate disc drive protected under the "105% Seagate Guarantee" that fails an incoming inspection may be returned for a full credit and an additional 5% rebate upon replacement by Seagate



### Easy Integration

- Compatible interfacing with the industry standard Seagate ST506
- Same physical size and mounting as the ST506
- Same DC voltages as the ST506
- No AC power required

**"Turning the tide  
in disc technology"**

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## Seagate's Second Generation

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The ST400 Series is the second generation of 5¼-inch micro-Winchester disc drives from Seagate Technology. Based on the proven design of the world's first micro-Winchester, the ST506, the new series features greater capacity, performance and reliability, while maintaining compatibility in form factor and controller design with the earlier model.

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### More Capacity

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Manganese-zinc heads and advanced stepper motor design enable higher track density. The new head design allows increased bit packing, utilizing more of the disc surface and double the number of cylinders.

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### Greater Reliability

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High reliability is assured through the use of a proven metal band actuator, open loop stepper head positioner, and direct drive brushless DC drive motor. Dynamically balanced motor/spindle assembly and a shock mounted baseplate reduce vibration.

The low mass and load force of Winchester heads and the lubricated, oxide coated media on an aluminum substrate provide reliable contact start/stop operation. Each disc surface is read by a dedicated read/write head.

Fully enclosed discs, heads and band actuator are protected by an integral recirculation air system with a .3 micron absolute filter. Integral to the filter is a port which permits pressure equalization with ambient air while preventing entry of contaminants.

**No thermal stabilization delays are necessary with the ST400 Series.** Our patented spindle pump assures adequate air flow and uniform temperature distribution throughout the sealed head and disc areas. The stepper and spindle motors are thermally isolated, resulting in a very low temperature rise, providing significantly greater off-track margin and immediate read and write operations after power-up.

Only DC voltages (+12 and +5 VDC) are required. All electronics are packaged on two printed circuit boards. The boards are mounted outside the sealed media area, allowing quick access and easy field repair without risking media integrity.

Simplification of mechanical and electrical design provides a projected service life of more than 11,000 hours, MTBF.

The ST400 Series carries a full one year warranty. In addition, the "105% Seagate Guarantee," available under written contract, provides for an additional 5% rebate on any disc drive that fails incoming inspection.

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### Higher Performance

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An advanced stepper motor, metal band actuator and the onboard micro-computer's buffered seek mode improve average access time, including settling, to 85 milliseconds. Maximum access time is 205 milliseconds. Track-to-track access is three milliseconds.

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### Easier Integration

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The ST400 Series has the same physical dimensions, recording format, transfer rate, interface, power supply and controller requirements as the industry standard Seagate ST506.

Controllers are available from several sources that provide for interfacing the ST400 Series micro-Winchesters with most popular microcomputers.

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### Extra Assurance of Quality

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Seagate Technology manufactures, tests and ships disc drives of consistently high quality. The Seagate manufacturing facilities have been designed exclusively for the high volume production and testing of high quality Winchester disc drives.

Seagate tests every part and every assembly at every stage. This includes testing of every motor, metal part, disc, head assembly, and component, active or passive. Final assembly is conducted within a controlled Class 100 environment. Continuing tests for particulate matter and other potential contaminants in the factory assure a clean manufacturing environment. As an added precaution, all drive assemblies are purged and tested for particulate matter prior to final testing.

All functional parameters on every drive are verified with extensive marginalized testing. Data integrity is certified and all media flaws are identified and mapped. A proprietary data acquisition system records and reports any drive not meeting specifications. Faulty drives are repaired and recycled through the complete test system again and printed test results are shipped with all drives.

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### The "105% Seagate Guarantee"

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Under written contract, any Seagate disc drive protected under the "105% Seagate Guarantee" that fails an incoming inspection may be returned for a full credit. After Seagate receives, repairs and returns the drive, an additional 5% rebate is automatically issued upon rebilling.

Backing this guarantee is a complete incoming test program for the receiving department of qualified OEMs. The program includes a drive test system, on-site training for your people, a "gold standard" reference drive, and certification every ninety days.

The "105% Seagate Guarantee" is available, under written contract, to any volume purchaser of Seagate disc drives. To qualify, the customer must purchase 500 drives or more for U.S. delivery, and install Seagate's incoming test program.

# Specifications

## Capacity

MODEL	UNFORMATTED MEGABYTES PER DRIVE	FORMATTED MEGABYTES PER DRIVE
ST406	6.38	5
ST412	12.76	10
ST419	19.14	15

## Unformatted

Per Surface	3.19 Megabytes
Per Track	10416 Bytes

## Formatted (as shipped from Seagate)

Per Surface	2.5 Megabytes
Per Track	8192 Bytes
Per Sector	256 Bytes
Sectors Per Track	32
Transfer Rate	5.0 MBits per second

## Access Time

Track-to-Track	3 ms
Average	85 ms (inc. settling)
Maximum	205 ms (inc. settling)
Settling Time	15 ms
Latency (average)	8.33 ms

## Error Rates

Soft read errors	1 per 10 <sup>10</sup> bits read
Hard read errors*	1 per 10 <sup>12</sup> bits read
Seek errors	1 per 10 <sup>6</sup> seeks

\*Not recoverable within 16 re-tries.

## Functional

Rotational Speed	3600 RPM ± 1%
Recording Density	9074 BPI
Flux Density	9074 FCI
Track Density	345 TPI
Cylinders	306

MODEL	READ/WRITE		
	HEADS	DISCS	TRACKS
ST406	2	1	612
ST412	4	2	1224
ST419	6	3	1836

## Reliability

MTBF	11,000 POH typical usage
PM	Not required
MTTR	30 minutes
Component Design Life	5 years

## Environmental Limits (Operational)

Ambient Temperature	40° to 122°F (4° to 50°C)
Relative Humidity	8 to 80%
Maximum Wet Bulb	78°F (25.5°C) non-condensing

## Heat Dissipation

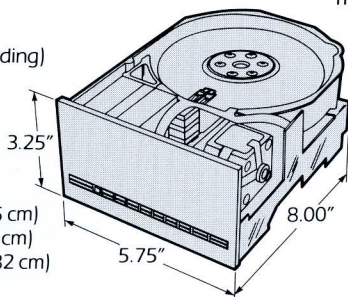
25 watts typical (85 BTU-HR)

## Power Requirements

DC Power only	
+12 VDC ± 10% starting (± 5% recording)	
3.7 amps max during motor start (1.8 amps running)	
+5 VDC ± 5%	
1.0 amps max	

## Mechanical

Height	3.25 inches (8.25 cm)
Width	5.75 inches (14.6 cm)
Depth	8.00 inches (20.32 cm)
Weight (typical)	4.2 lbs (1.9 kg)



## Functional Characteristics

### General Operation

The ST400 Series disc drives consist of read/write and control electronics, read/write heads, track positioning actuator, discs, and an air filtration system. The components perform the following functions:

1. Interpret and generate control signals
2. Position the heads over the desired track
3. Read and write data
4. Provide a contamination-free environment

### Read/Write and Control Electronics

Electronics are packaged on two printed circuit boards. The primary board to which power, control and data signals are connected includes these circuits:

1. Index detection
2. Microcomputer controlled head position/actuator circuit
3. Read/Write
4. Drive up to speed circuit
5. Head select circuit
6. Write fault detection circuit
7. Step motor drive circuit
8. Drive select circuit
9. Track zero detector circuit

The second PCB, mounted to the baseplate under the primary board, derives its power from the primary board and provides power and speed control to the spindle drive motor.

### Drive Mechanism

A brushless DC drive motor rotates the spindle at 3600 rpm. The direct drive spindle requires no belts or pulleys. The motor is thermally isolated from the baseplate to reduce heat within the sealed chamber containing heads, discs and actuator band. The dynamically balanced motor and spindle minimize vibration. A shock mounted baseplate reduces vibration to the head/disc assembly.

### Air Filtration System

Discs and read/write heads are fully enclosed in a protective module. This module uses an integral recirculation air

system with an absolute filter to maintain a clean environment. A port in the filter permits pressure equalization with the ambient air without contaminant entry.

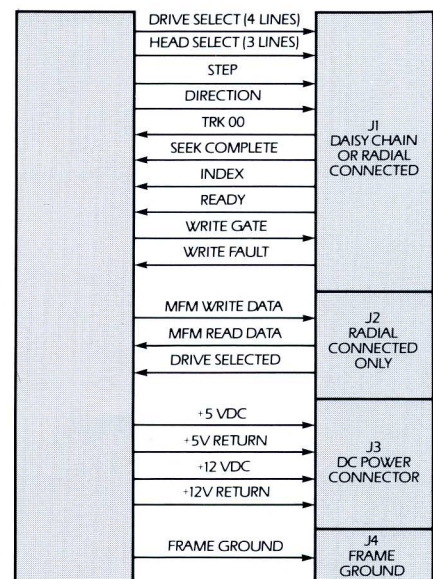
### Positioning Mechanism

Read/write heads are mounted on a ball bearing supported carriage. Heads are positioned by a band actuator, enclosed in the sealed chamber, connected to the stepper motor shaft. The stepper motor is thermally isolated from the baseplate to minimize temperature rise in the sealed chamber containing the heads and discs.

### Read/Write Heads and Discs

The recording media consists of a lubricated thin magnetic oxide coating on a 130 mm diameter aluminum substrate. This coating formulation, together with the low load force-low mass Winchester-type flying heads, permits reliable contact start/stop operation.

Data on each of the disc surfaces is read by a read/write head, which accesses 306 tracks.





## **Seagate Technology**

360 El Pueblo Road, Scotts Valley, California 95066 Telephone (408) 438-6550 TELEX 172114 SCVL

### **Regional Sales Offices:**

12 Grove Street, Hopkinton, Massachusetts 01748 Telephone (617) 435-6961

4000 McArthur Boulevard, Suite 3000, Newport Beach, California 92660 Telephone (714) 851-9964

888 South Greenville Avenue, Suite 100, Richardson, Texas 75081 Telephone (214) 783-6711

**Authorized U.S. Distributor:** Arrow Electronics

### **European Sales Office:**

Kreillerstrasse 21, 8000 Munich 80, West Germany Telephone 89 43 13 900 TELEX 5 213 379

### **Japan:**

Teac Corporation, 3-7-3 Naka-cho, Musashino, Tokyo Telephone (0422) 53-1111 TELEX 2822451