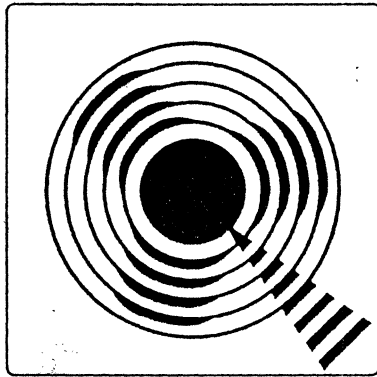


**SQ306RD
OEM
Manual**



SyQuest
TECHNOLOGY

TABLE OF CONTENTS

1.0	Introduction	4
1.1	General Description	4
1.2	Specification Summary	5
1.2.1	Physical Specifications	5
1.2.2	Reliability Specifications	6
1.2.3	Performance Specifications	6
1.2.4	Functional Specifications	7
2.0	Functional Characteristics	7
2.1	General Operation	7
2.2	Read/Write and Control Electronics	7
2.3	Drive Mechanisms	8
2.4	Door Mechanism	8
2.5	Air Filtration System	9
2.6	Positioning Mechanism	9
2.7	Read/Write Heads and Discs	9
2.8	Cartridge Interlock Mechanism (SQ306R Model)	9
3.0	Functional Operations	14
3.1	Power Sequencing	14
3.2	Drive Selection	15
3.3	Track Accessing	15
3.4	Recalibrate	15
4.0	Electrical Interface	16
4.1	Control Input Lines	21
4.1.1	Write Gate	22
4.1.2	Head Select 2°	22
4.1.3	Direction In	23
4.1.4	Step	23
4.1.5	Drive Select 1-4	25
4.1.6	Change Cartridge	25
4.2	Control Output Lines	26
4.2.1	Seek Complete	26

4.2.2	Track 0	26
4.2.3	Write Fault	27
4.2.4	Index	27
4.2.5	Ready	28
4.2.6	Drive Selected	28
4.2.7	Cartridge In	28
4.2.8	Write Protected	28
4.2.9	Cartridge Changed	28
4.2.10	Radial Index	28
4.3	Data Transfer Lines	29
4.3.1	MFM Write Data	29
4.3.2	MFM Read Data	30
4.3.3	Read/Write Timing	30
4.4	Drive Selected	31
4.5	Option Shunt Block	31
5.0	Physical Interface	32
5.1	J1/P1 Connector-Control Signals	32
5.2	J2/P2 Connector-Data Signals	33
5.3	J3/P3 Connector-DC Power	34
6.0	Physical Specifications	35
6.1	Mounting Orientation	35
6.2	Mounting Holes	35
6.3	Physical Dimensions	35
6.4	Shipping Requirement	35
7.0	Track Format	35
7.1	Gap 1	39
7.2	Gap 2	39
7.3	Gap 3	39
7.4	Gap 4	39
7.5	Sector Interleaving	40
7.6	Defective Sector Flags	40
8.0	Cartridge Acclimatization	40

Figures

1A	Air Filtration System with Switch Locations	10
1B	Cartridge Insertion	11
1C	Cartridge Removal	12
2	Track Format and Positioning Mechanism	13
3	Power Up Sequence	16
4	Control Signals	17
5	Data Signals	18
6	Typical Connection, 4 Drive System	19
7	Control Signals Driver/Receiver Combination	22
8A	Slow Seek Timing	24
8B	Buffered Seek	25
9	Index Timing	27
10	Data Line/Driver/Receiver Combination	29
11A	Read/Write Data Timings	30
11B	Option Shunt Block	31
12	Interface Connector Physical Locations	32
13	J1 Connector Dimensions	33
14	J2 Connector Dimensions	33
15	J3 Connector-Drive PCB Solder Side	34
16	Mounting Physical Dimensions	36
17	Dimensional View	36
18	Track Format as Shipped	38
19	"A1" Address Mark Byte	38

Tables

I	J1/P1 Connector Pin Assignments	20
II	J2/P2 Connector Pin Assignments	20
III	J3/P3 DC Connector Pin Assignments	21
IV	DC Power Requirements	37
V	Motor Start Current Requirements	37

1.0 Introduction

1.1 General Description

The SQ306 disc drives are random access storage devices utilizing removable or fixed 100mm discs as storage media. Each disc surface employs one movable head to service 306 data tracks. The total formatted capacity of the two heads and surfaces is 5 megabytes (32 sectors per track, 256 bytes per sector, 612 tracks).

The SQ306R Model has removable media in the form of a cartridge; the SQ306F Model has fixed media.

Low cost and unit reliability are achieved through the use of a band actuator and closed loop stepper head positioning mechanism. The inherent simplicity of mechanical construction and electronic controls permits maintenance free operation throughout the life of the drive. Both electronic PCB's are mounted outside the head disc assembly.

Mechanical and contamination protection for the heads, actuator, and discs is provided by an impact resistant aluminum enclosure. A self contained recirculation system supplies clean air through a 0.3 micron filter. The spindle and disc act as a pump assuring adequate air flow and uniform temperature distribution throughout the head and disc area. The onboard microcomputer does thermal compensation during power up. This provides significantly greater off track margin and the ability to immediately perform read and write operations after power up with no thermal stabilization delay.

The SQ306 electrical interface is identical to the pin-out, data transfer rates, and software track/sector formats as the Seagate ST506/412 or equivalent and insures full compatibility with a wide host of 5¼" Winchester disk drive controllers. The half-size form factor (half-height) design allows two SQ306 drives to fit within the space of one minifloppy or 5¼" Winchester envelope, and the DC power requirements and connector for the SQ306 are the same as for the industry standard minifloppy. No AC power is required.

KEY FEATURES

- ★ 6.38 Mbyte storage capacity
- ★ Half-height minifloppy form factor
- ★ Removable cartridge media that requires no purge cycle upon power-up (SQ306R Model)
- ★ Buffered seek mode for faster data access
- ★ Closed-loop servo system with imbedded digital servo for full cartridge interchangeability between any SQ306R drive
- ★ Same interface and track format as standard 5¼" winchester
- ★ Utilizes existing 5¼" winchester controllers
- ★ Ruggedized for portable system designs
- ★ 5.0 megabit/second transfer rate
- ★ Same DC voltages and current as the minifloppy
- ★ Band actuator and .9° stepper motor head positioning

1.2 Specification Summary:

1.2.1 Physical Specifications:

Environmental Limits:

Ambient Temperature

Operating: 40° to 122°F (4° to 50°C)

Non-Operating: -14° to 140°F (-10° to 60°C)

Max. Temperature Gradient

Operating: 18°F/hr. (10°C)

Non Operating: Below Condensation

Relative Humidity: 8 to 80% non-condensing

Maximum Elevation

Operating: 10,000 ft.

Non-Operating: -1000 to 35,000 ft.

Shock

Operating: 10G's

Non-Operating: 20G's (in shipping container)

DC Power Requirements

+12V ± 5% @ .7 amps

+5V ± 5% @ .9 amps

+12V/+ 5V Maximum Ripple 50 mV Peak-Peak

Mechanical Dimensions:

Height 1.625 inches

Width 4.8 inches

Depth 8.0 inches

Weight 2.4 lbs

Shipping Weight 4.3 lbs

Cartridge Mechanical Dimensions:

Height 0.43 inches

Width 4.33 inches

Length 4.41 inches

Weight 0.3 lbs

Heat Dissipation

13 watts (45BTU/Hr) maximum

1.2.2 Reliability Specifications:

MTBF 11,000 POH, typical usage

PM Not Required

MTTR 30 minutes

Component Design Life 5 years

Error Rates:

Soft read errors 1 per 10⁹ bits read

Hard read errors 1 per 10¹² bits read

Seek errors 1 per 10⁶ seek

Note: Error rate performance achieved with an available MFM data window of greater than 80 nsec.

1.2.3 Performance Specifications:

Capacity

Unformatted

Per Drive 6.38 Megabytes

Per Surface 3.19 Megabytes

Per Track 10416 Bytes

Formatted

Per Drive 5.0 Megabytes

Per Surface 2.5 Megabytes

Per Track 8192 Bytes

Per Sector 256 Bytes

Sectors per Track 32

Transfer Rate	5.0 Mbits/sec	
Access Time (includes settling)	MIN	MAX†
Track to Track	25	94
Average*	90	161
Maximum*	205	276
*using buffered seek		
Average Latency	8.46ms	

1.2.4 Functional Specifications:

Rotational speed	3547 rpm \pm 1%
Recording density	12000 bpl max
Flux density	12000 fci
Track density	435 tpi
Cylinders	306
Tracks	612
R/W Heads	2
Discs	1
Index	1

†ACCESS TIMES

To guarantee 100% interchangeability of cartridges between drives, the 306R Model uses a unique imbedded digital servo scheme (Digilok™). This results in a variance of access times which insures the customers data integrity.

2.0 Functional Characteristics

2.1 General Operation:

The SQ306 disc drive consists of read/write, servo, and control electronics, read/write heads, track positioning actuator, and air filtration system. The Model SQ306R also has a cartridge interlock mechanism. 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 cartridge interchangeability for SQ306R Model

2.2 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:

1. Index detection circuit
2. Head position/actuator circuit
3. Read/write circuits
4. Drive up to speed detector
5. Head select circuit
6. Write fault detection circuits
7. Servo decoder and control
8. Stepper motor drive circuit
9. Drive select circuit
10. Track zero detector

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

2.3 Drive Mechanism

A brushless DC drive motor rotates the spindle at 3547 rpm. The spindle is driven directly with no belt or pulley being used. The motor and spindle are dynamically balanced to insure a low vibration level. Dynamic braking (306R only) is used to quickly stop the spindle motor when power is removed. The head/disc assembly is shock mounted to minimize transmission of vibration through the chassis or frame.

2.4 Door Mechanism (SQ306R Model only)

The SQ306R door mechanism is shown in Figure 1C. The opening sequence is as follows:

1. Depress front panel switch. This cuts off 12 volts of power to the spindle motor while the microprocessor moves the heads to track 000 position and cuts off power to stepper.
2. Front door automatically opens partially.
3. Wait until front panel light stops flashing, and manually open door to right angle position with front opening. Carriage then moves to retract position at outer diameter, the heads unload and the cartridge is lifted off the spindle by the cartridge guides.

4. Depress fully opened front door and cartridge ejects. Note that the front door will return to right angle position when pressure is released.

2.5 Air Filtration System

The discs and read/write heads are fully enclosed in a module using an integral recirculation air system and absolute filter to maintain a clean environment. The total air volume of the drive and cartridge is purged through the absolute filter once per second.

2.6 Positioning Mechanism

The read/write heads are mounted on a ball bearing supported carriage which is positioned by a band actuator connected to the stepper motor shaft. The drive uses a microstepping stepper positioner which steps at 0.9° per step instead of the 1.8° of a conventional stepper. The closed-loop embedded servo control design extends the accuracy of the SQ306 metal band positioner to 75 micro-inches. The embedded burst servo scheme, where servo control data resides within a single wedge per track, affords users full definition control of sector formats.

2.7 Read/Write Heads and Discs

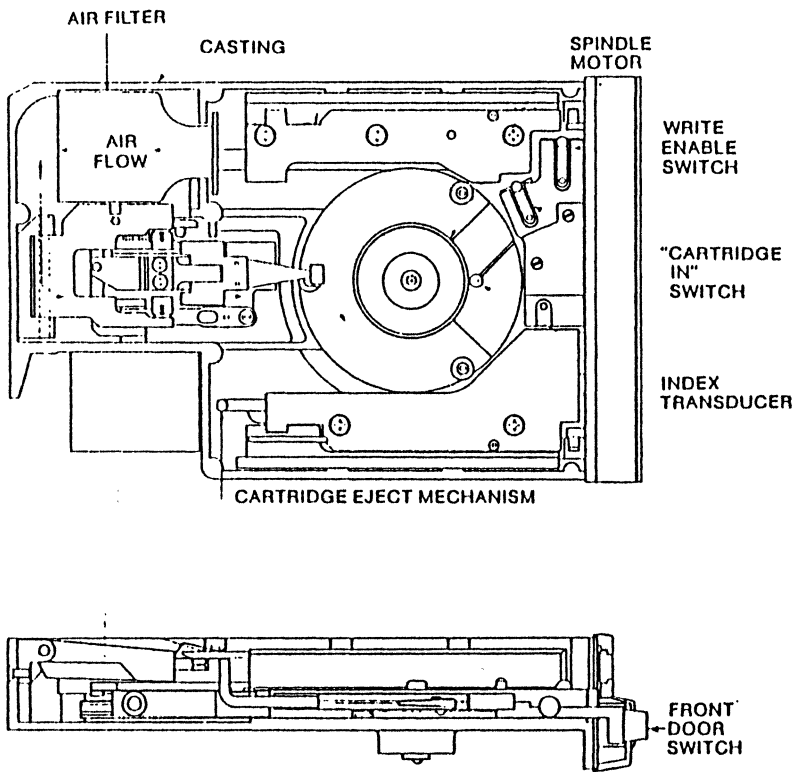
The recording media consists of a single, 100mm "thin film" metallic alloy platter. The glass-like carbon overcoat that protects the magnetic substrate makes the thin film discs impervious to environmental contaminants such as dust, smoke particles and ambient humidity, as well as "head crashes" that could result from jostling or sharp movements of an operating system. The carbon overcoat also eliminates the need for extended purge cycles; and coupled with the low load force/low mass flying heads, permits reliable contact start/stop operation and exceedingly high durability.

Data on each of the two disc surfaces is read by a read/write head, each of which accesses 306 tracks. The SQ306 utilizes industry standard ferrite heads.

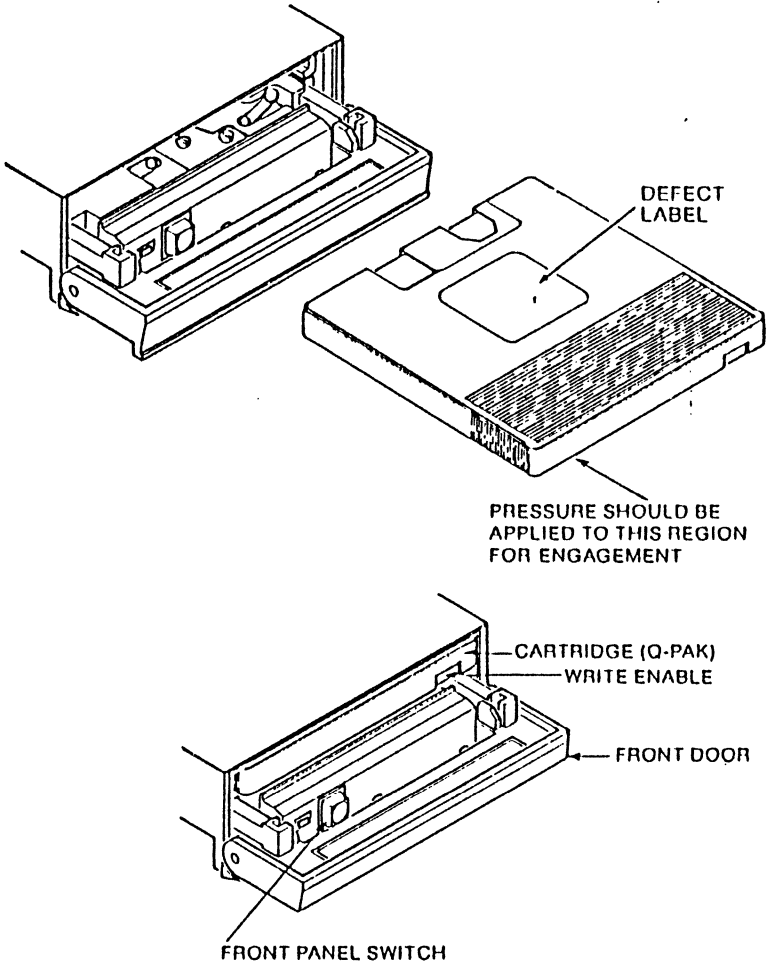
2.8 Cartridge Interlock Mechanism (SQ306R Model only)

The fail-safe cartridge interlock mechanism ensures procedural compliance by users as the cartridge is only permitted to be inserted in the appropriate position. The interlock mechanism disengages the ferrite heads from the media upon opening the front door.

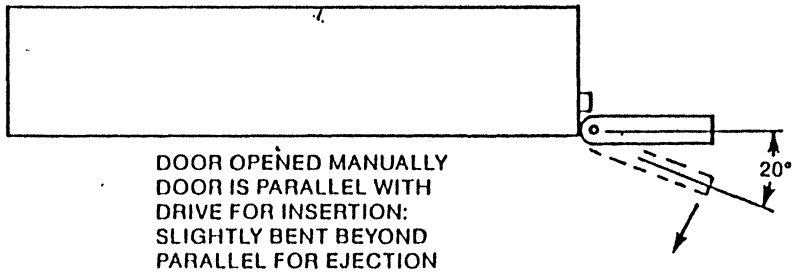
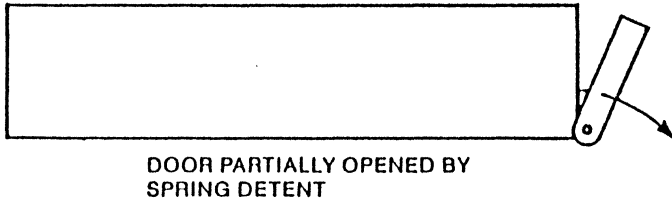
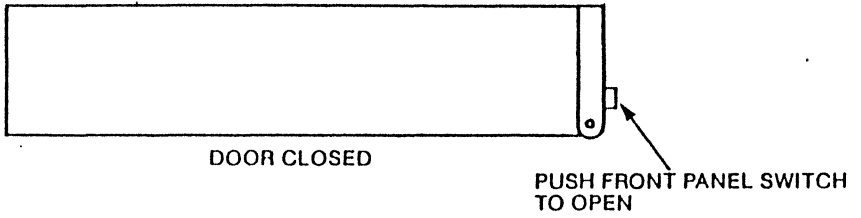
FIGURE 1A
AIR FILTRATION SYSTEM WITH SWITCH LOCATIONS



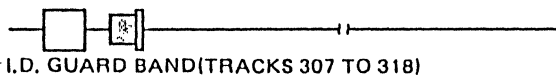
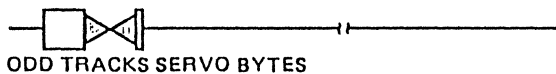
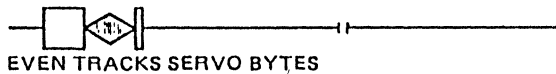
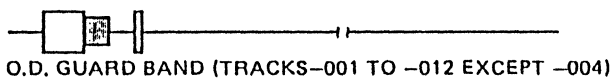
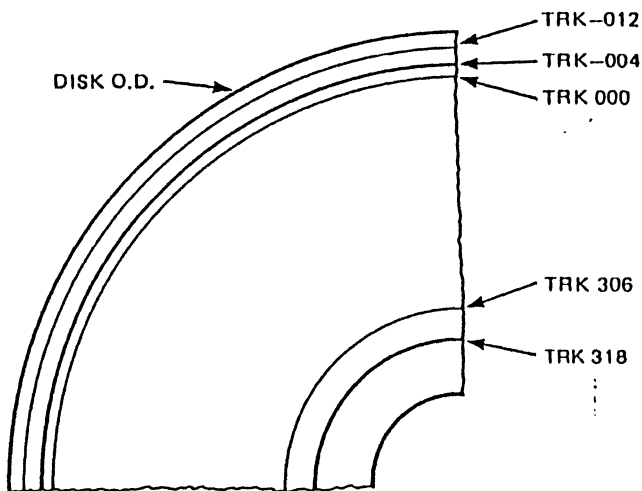
**FIGURE 1B
CARTRIDGE INSERTION**



**FIGURE 1C
CARTRIDGE REMOVAL**



**FIGURE 2
TRACK FORMAT AND POSITIONING SYSTEM**



3.0 Functional Operations

3.1 Power Sequencing

+5 and +12 volts may be applied in any order; however, +12 volts must be applied to start the spindle drive motor. A speed sense measures this Index time to within 2% of speed. After the spindle drive motor reaches operating speed, the on-board microcomputer initiates a calibration procedure. The procedure follows:

- a) Seek to track minus 4.
- b) Read the prerecorded Reference track on the cartridge.
- c) Divide the 306 cylinders on the cartridge into 20 different zones.
- d) Seek to each zone, read the servo information, and store head offset values in memory.
- e) After all 20 zones have been read successfully, seek to track 0.
- f) Set TRACK 0, SEEK COMPLETE and READY.

If the drive is unable to read the reference track, the spindle motor will power down and the LED on the front panel will flash. The operator should remove and reinsert the cartridge. If the drive is unable to read servo information during the zoning process, the heads will not seek to the next zone. If this happens, the drive will never come READY. The drive will not perform read, write or seek functions until READY becomes true.

During the power up sequencing the microcomputer monitors the WRITE FAULT condition. If a WRITE FAULT is detected, the spindle motor will power down. (Reference Paragraph 4.2.3). The controller can also cause a WRITE FAULT condition if Drive Select and Write Gate are true during the power up sequencing.

3.2 Drive Selection

Drive selection occurs when one of the DRIVE SELECT lines is activated. Only the selected drive will respond to the input signals, and only that drive's output signals are then gated to the controller interface. (See section 4.5 for exception; See Figure 11B for jumpering of drive select.)

3.3 Track Accessing

Read/write head positioning is accomplished by;

- a) Deactivating Write Gate.
- b) Activating the appropriate Drive Select Line.
- c) Being in the READY condition with SEEK COMPLETE true.
- d) Selecting the appropriate direction.
- e) Pulsing the Step Line.

Each step pulse will cause the heads to move either 1 track in or 1 track out depending on the level of the Direction line. A low level on the Direction line will cause a seek inward toward the spindle; a high, outward toward track 0.

3.4 Recalibrate

The controller can cause the drive to recalibrate to track 0 by any one of three methods.

3.4.1 The controller can execute a buffer seek command and issue 307 or more step pulses. This will cause the drive to slew to track 0. The Direction control line is ignored during this operation.

3.4.2 The controller can execute a buffer seek command and issue step pulse greater than the available tracks in the direction requested. This will cause the drive to slew to TRACK 0.

3.4.3 The controller can execute single track seeks towards the O.D. while checking for TRACK 0 after each SEEK COMPLETE.

The procedure described in Par. 3.4.1 is recommended for maximum drive performance.

4.0 Electrical Interface

The interface to the SQ306 can be divided into three categories, each of which is physically separated.

1. Control signals.
2. Data signals.
3. DC power.

All control lines are digital in nature (open collector TTL) and either provide signals to the drive (input) or signals to the host (output) via interface connection J1/P1. The data transfer signals are differential in nature and provide data either to (write) or from (read) the drive via J2/P2 (defined by EIA RS-422).

**FIGURE 3
POWER UP SEQUENCE**

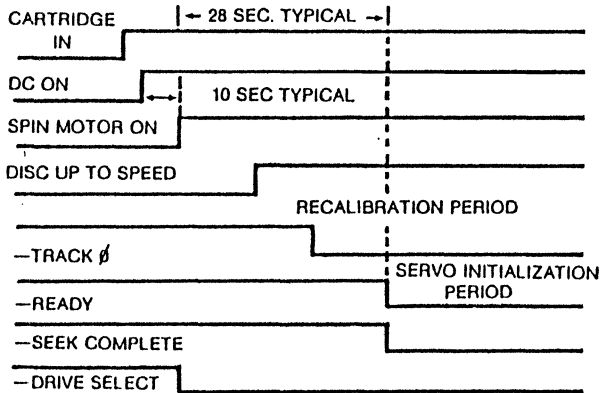
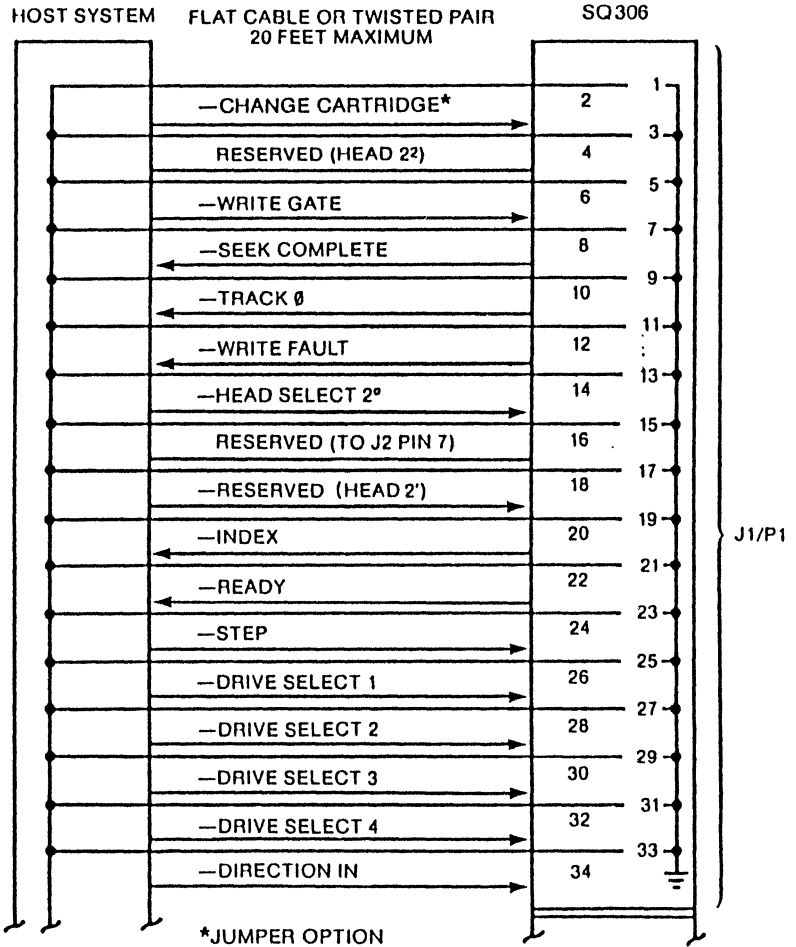


Table I through III and Figures 4 through 6 show connector pin assignments and interconnection of cabling between the host controller and drives.

**FIGURE 4
CONTROL SIGNALS**



**FIGURE 5
DATA SIGNALS**

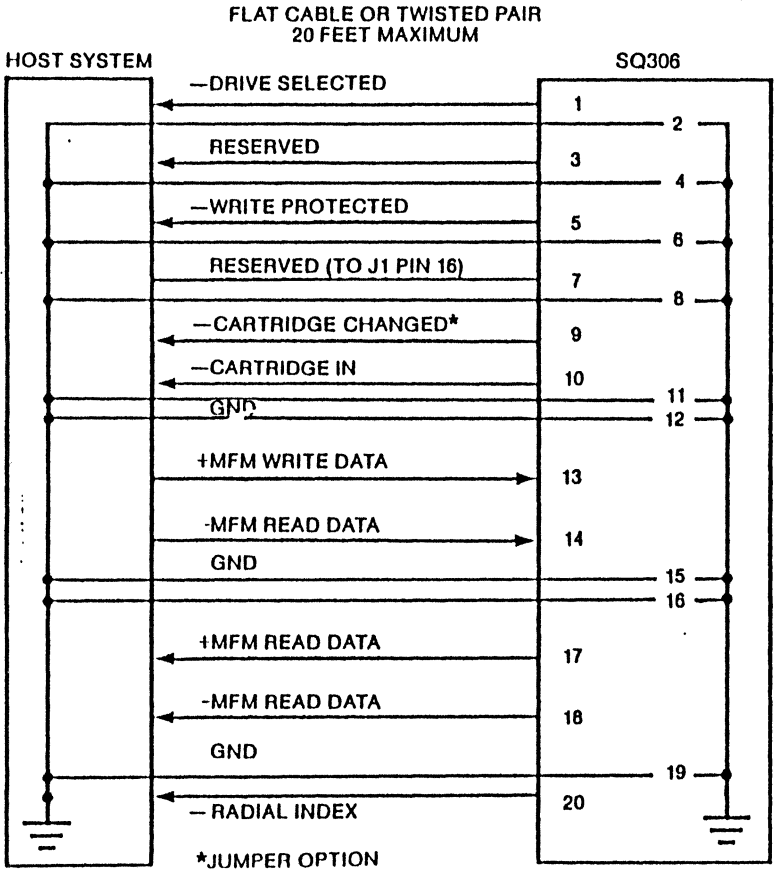


FIGURE 6
TYPICAL CONNECTION, 4 DRIVE SYSTEM

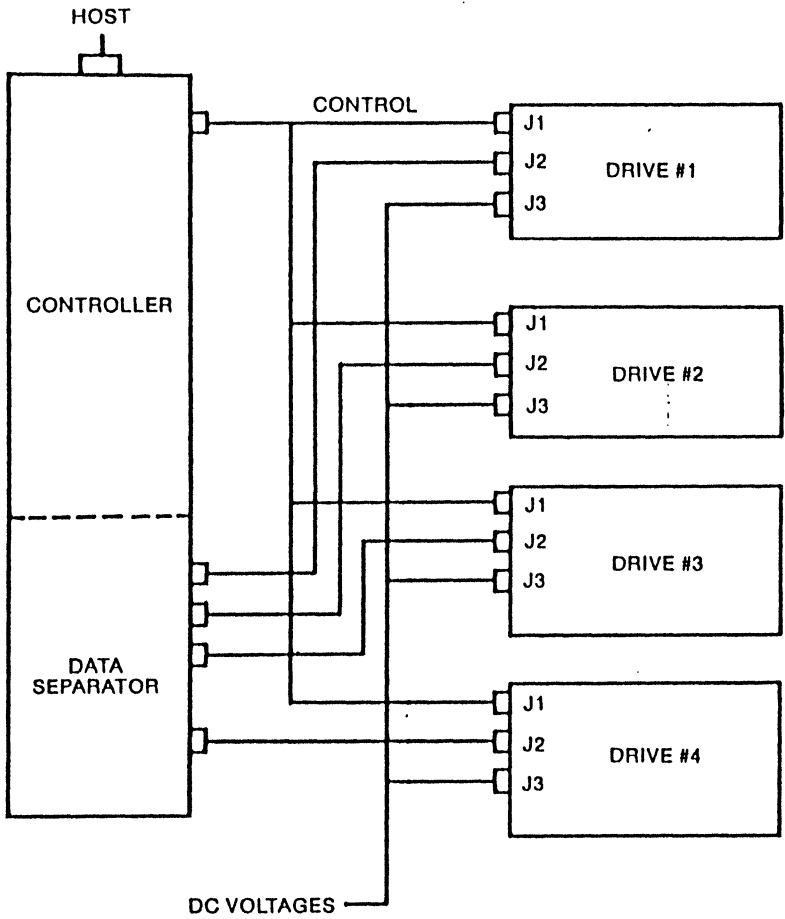


TABLE I
J1/P1 CONNECTOR PIN ASSIGNMENT

GND PIN	SIGNAL	SIGNAL NAME
1	2	-Change cartridge*
3	4	Reserved
5	6	-Write gate
7	8	-Seek complete
9	10	-Track zero
11	12	-Write Fault
13	14	-Head select 2°
15	16	J2-7
17	18	-Reserved
19	20	-Index
21	22	-Ready
23	24	-Step
25	26	-Drive select 1
27	28	-Drive select 2
29	30	-Drive select 3
31	32	-Drive select 4
33	34	-Direction in

TABLE II
J2/P2 CONNECTOR PIN ASSIGNMENT

GND PIN	SIGNAL	SIGNAL NAME
2	1	-Drive selected
4	3	Reserved
6	5	-Write protected
8	7	J1-16
	9	-Cartridge changed*
	10	-Cartridge in
12	11	GND
	13	+Write data
	14	-Write data
16	15	GND
	17	+Read data
	18	-Read data
	19	GND
	20	-Radial Index*

*JUMPER OPTION

TABLE III
J3/P3 POWER CONNECTOR PIN ASSIGNMENT

PIN	VOLTAGE
1	+12 volts DC @ .7 amps
2	GND
3	GND
4	+5 volts DC @ .9 amps

+12 volts requires 1.5 amps max at power on.

4.1 Control Input Lines

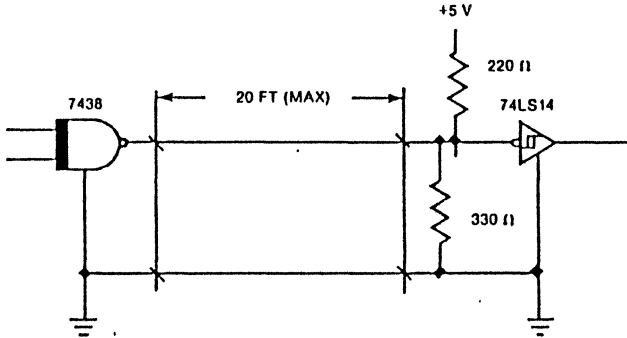
The control input signals are of two types; those to be multiplexed in a multiple drive system and those intended to do the multiplexing. The control input signals to be multiplexed are WRITE GATE, HEAD SELECT 2°, CHANGE CARTRIDGE, STEP and DIRECTION IN. The signals which do the multiplexing are DRIVE SELECT 1, DRIVE SELECT 2, DRIVE SELECT 3 or DRIVE SELECT 4.

The input lines have the following electrical specifications. Refer to Figure 7 for the recommended circuit.

TRUE: 0.0VDC to 0.4VDC @I = 40mA (MAX)

FALSE: +2.5VDC to +5.25VDC @I = 250 μ A
(OPEN COLLECTOR)

FIGURE 7
CONTROL SIGNALS DRIVER/RECEIVER COMBINATION



4.1.1 Write Gate

The active state of this signal, or low level, enables write data to be written on the disc. The inactive state of this signal, or high level, enables data to be transferred from the drive.

A 220/330 ohm resistor pack allows for line termination.*

4.1.2 Head Select 2°

This line allows selection of each individual read/write head in a binary coded sequence. HEAD SELECT 2° is the least significant line. Heads are numbered 0 through 1. When this signal is active, head one is selected, otherwise head zero is selected.

A 220/330 ohm resistor pack allows for line termination.*

4.1.3 Direction In

This signal defines direction of motion of the Read/Write head when the STEP line is pulsed. An open circuit or high level defines the direction as "out" and if a pulse is applied to the STEP line, the Read/Write heads will move away from the center of the disc. If this line is a low level, the direction of motion is defined as "in" and the Read/Write heads will move toward the center of the disc direction. Change must meet the requirements shown in Figure 8A and 8B.

A 220/330 ohm resistor pack allows for line termination.*

4.1.4 STEP

This interface line is a control signal which causes the Read/Write head to move in the direction of motion defined by the DIRECTION IN line.

The access motion is initiated at the high to low level transition of leading edge of the signal pulse. Any change in the Direction line must be made at least 100ns before the leading edge of the step pulse and 80 μ sec after the trailing edge of the last step pulse (refer to Figure 8A for general timing requirements).

A 220/330 ohm resistor pack allows for line termination.*

*Note, when drives are daisy chained, only the last drive in the string can have a Terminating R Pack installed. See Fig. 12 for the location of the R Pack.

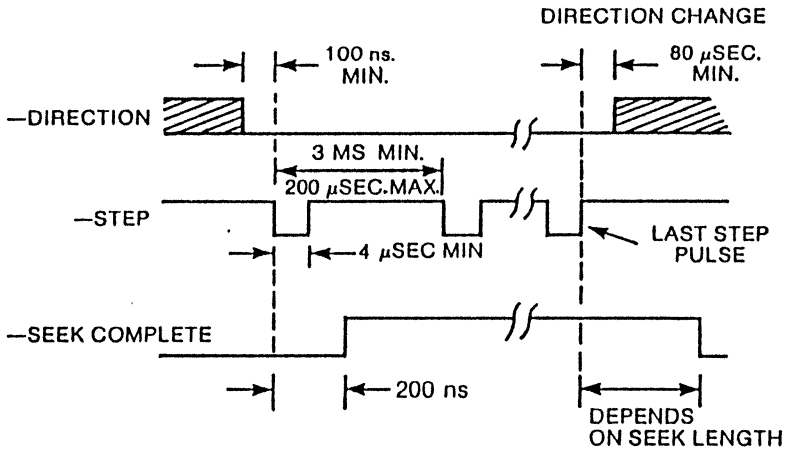
SEEK

Depending on incoming step pulse rate, the onboard microcomputer selects buffered or slow seek mode. For buffered seek, step rate is 10 μ sec minimum to 200 μ sec maximum; and for slow seek step rate is 3msec minimum. Any pulses issued at a rate between 200 μ sec and 3msec may be lost.

SLOW SEEK

The Read/Write head will move at the rate of the incoming pulses. The minimum time between successive steps is 3.0ms. The minimum pulse width is 4.0 μ sec. See Figure 8A for step timing.

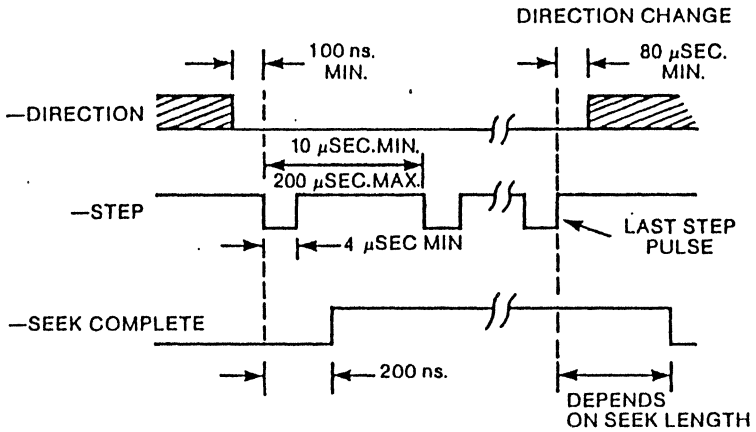
**FIGURE 8A
SLOW SEEK TIMING**



BUFFERED SEEK

The controller may burst pulses to the drive and they will be accepted until the time after the last pulse exceeds 200 μsec. At the occurrence of this condition, the microprocessor will stop accepting step pulses from the controller. Before the seek starts, the micro-computer will check for valid seek length. If the seek length is invalid (ie. forward seek to track beyond track 306 or reverse seek to track beyond track 0) it will recalibrate heads to track 0. If the seek is valid (ie. seek to track between track 0 to track 306) it will begin issuing them to the stepper motor. Depending on the length of seek, the microprocessor will select the optimum algorithm.

**FIGURE 8B
BUFFERED SEEK TIMING**



4.1.5 DRIVE SELECT 1 - 4 (Figure 11)

DRIVE SELECT, when a low level connects the drive interface to the control lines. The following table indicates location of DRIVE SELECT shunt:

DRIVE SELECT	SHUNT PLACEMENT
1	pins 1 and 2
2	pins 2 and 3
3	pins 4 and 5
4	pins 5 and 6
Radial	pins 7 and 8

4.1.6 CHANGE CARTRIDGE

The Change Cartridge line is a lumper option. This feature can be selected by installing a lumper at W4 on the control PCB. When selected, the spindle motor will cycle down when the Change Cartridge line becomes active. This feature can be used in conjunction with a message to the operator that a cartridge change is required. The operator must press the FRONT PANEL SW and open the drive door. The spindle motor will cycle back up to speed when a new cartridge is inserted and the door is closed.

4.2 CONTROL OUTPUT LINES

The control output signals are Seek Complete, Track 0, Write Fault, Index, Ready, Drive Selected, Cartridge In, Write Protected, Cartridge Changed*, and Radial Index.* The output control signals are driven with an open collector output stage capable of sinking a maximum of 48mA at low level or true state with maximum voltage of 0.4V measured at the driver. When the line drive is in the high level or false state the driver transistor is off and the collector leakage current is a maximum of 250 μ A.

All J1 output lines are enabled by their respective DRIVE SELECT line.

Figure 7 shows the recommended circuit.

4.2.1 SEEK COMPLETE

This line will go to a low level or true state when the Read/Write heads have settled on the final track at the end of a seek. Reading or writing should not be attempted when Seek Complete is false.

SEEK COMPLETE will not go true if the servo cannot correct the head offset.

SEEK COMPLETE will go false in three cases:

- 1) A recalibration sequence is initiated (by drive logic) at power on.
- 2) 200 ns (typical) after the leading edge of a step pulse or series of step pulses.
- 3) If +5 volts or +12 volts are lost momentarily but restored.

4.2.2 TRACK 0

This interface signal indicates a low level or true state when the drive's Read/Write heads are positioned at cylinder zero (the outermost data track). Track 0 is not valid if READY or SEEK COMPLETE is false.

4.2.3 WRITE FAULT

This signal is used to indicate a condition exists in the drive that may cause improper writing on the disc. When this line is a low level or true, further writing and stepping is inhibited in the drive until the condition is corrected. To insure data integrity, a Write Fault condition cannot be reset via the interface. If the Write Fault is persistent, the cause must be identified and corrected.

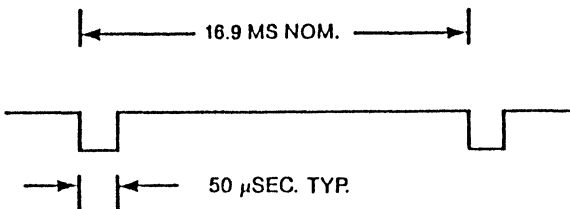
The following conditions will cause a Write Fault:

- a. Write Gate is active when the operating cartridge does not have a Write Enable Tab installed.
- b. Multiple heads selected, or no head selected.
- c. DC voltages are grossly out of tolerance.
- d. Write current during a READ operation.
- e. No write current during a WRITE operation.

4.2.4 INDEX (Figure 9)

This interface signal is provided by the drive once each revolution (16.9ms nom.) to indicate the beginning of a track. Normally, this signal is a high level and makes the transition to a low level to indicate INDEX. Only the transition from high to low is valid.

**FIGURE 9
INDEX TIMING**



4.2.5 READY

This interface signal when true together with SEEK COMPLETE indicates that the drive has completed servo initialization and is ready to read, write or seek, and that the I/O signals are valid. When this line is false, all writing and seeking is inhibited.

The typical time after power on for READY to be true is 28 seconds. READY will not go true if during servo initialization servo cannot correct head offset on any track.

The Q-Pak cartridge should be exposed and remain at room temperature of operating environment for a minimum of one hour prior to usage.

4.2.6 DRIVE SELECTED

An active state of this signal indicates the selected drive has received a Drive Select signal. The activity LED on the door is lit when the drive is selected.

4.2.7 CARTRIDGE IN

Active state of this signal indicates a cartridge has been inserted in the drive and the door is closed.

4.2.8 WRITE PROTECTED

When the cartridge's Write enable tab is removed, the drive is prevented from writing on the disc and this signal is active.

4.2.9 CARTRIDGE CHANGED

This signal is active during the first selection of the drive after a cartridge has been removed.

4.2.10 RADIAL INDEX

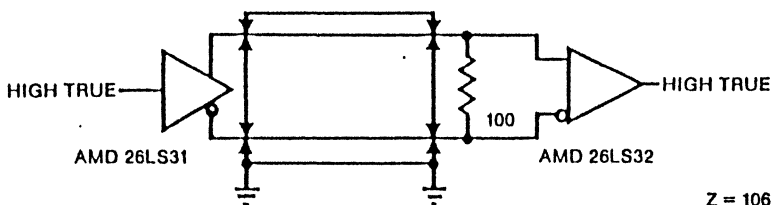
This signal is not gated with drive select in order to provide continuous sector timing. The timing for the signal is the same as the Index signal.

4.3 DATA TRANSFER LINES

All lines associated with the transfer of data between the drive and the controller are differential in nature and may not be multiplexed. These lines are provided at the J2/P2 connectors on all drives.

Two pair of balanced signals are used for the transfer of data; WRITE DATA and READ DATA. Figure 10 illustrates the driver/receiver combination used in the drive for data transfer signals.

**FIGURE 10
DATA LINE DRIVER/RECEIVER COMBINATION**



4.3.1 MFM WRITE DATA

This is a differential pair that defines the transitions to be written on the track. The transition of +MFM WRITE DATA line going more positive than the -MFM WRITE DATA will cause a flux reversal on the track provided WRITE GATE is active.

Note: NO WRITE PRECOMPENSATION is required by the SQ306 drive and should not be utilized. An optional 100 ohm resistor is used for termination.

4.3.2 MFM READ DATA

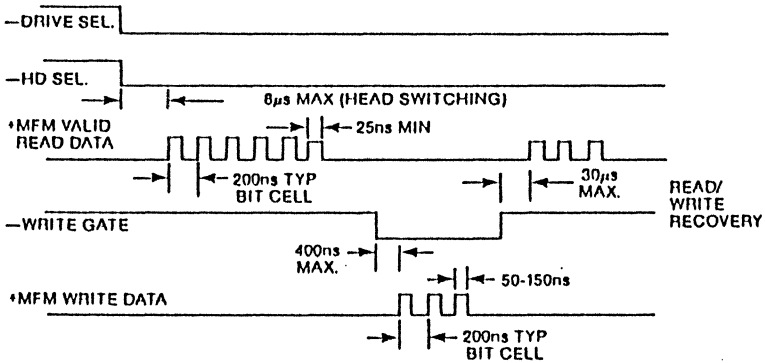
The data recovered by reading a pre-recorded track is transmitted to the host system via the differential pair of MFM READ DATA lines. The positive transition of the +MFM READ DATA line represents a flux reversal on the track of the selected head.

Note: An optional 100 ohm resistor is used for termination.

4.3.3 READ/WRITE TIMING

The timing diagram as shown in Figure 11A depicts the necessary sequence of events (with associated timing restrictions) for proper read/write operation of the drive.

FIGURE 11A
READ/WRITE DATA TIMINGS



4.4 DRIVE SELECTED

A status line is provided at the J2/P2 connector to inform the host system of the selection status of the drive.

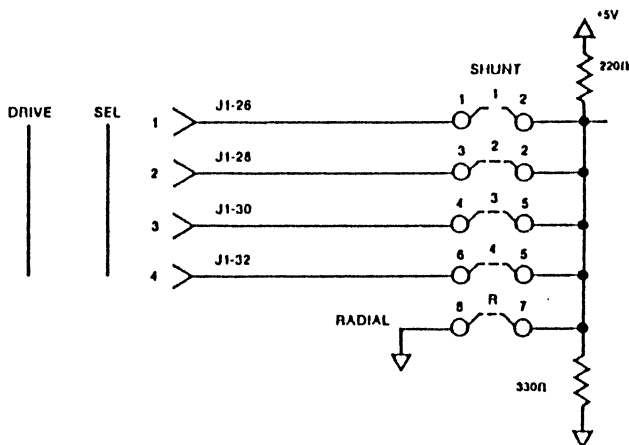
The DRIVE SELECTED line is driven by a TTL open collector driver as shown in Figure 7. This signal will go active only when the drive is programmed as drive x (x=1,2,3, or 4) (refer to Figure 11B by moving the shunt on the drive. The DRIVE SELECT X line at J1/P1 is activated by the host system.

4.5 OPTION SHUNT BLOCK

The Radial Option is Implemented via a shunt block at position R on the main printed circuit board for customer reconfiguration of drive functions.

As shipped, the shunt block is plugged in "1" position. This results in a daisy chain operation. Outputs are not active until the drive is selected. Moving the shunt block to "R" position results in radial operation. In this case all output signals are active, even if the drive is not selected. However, in this case, the front panel LED will be on at all times.

FIGURE 11B
OPTION SHUNT BLOCK



5.0 Physical Interface:

The electrical interface between the SQ306 and the host controller is via three (3) connectors:

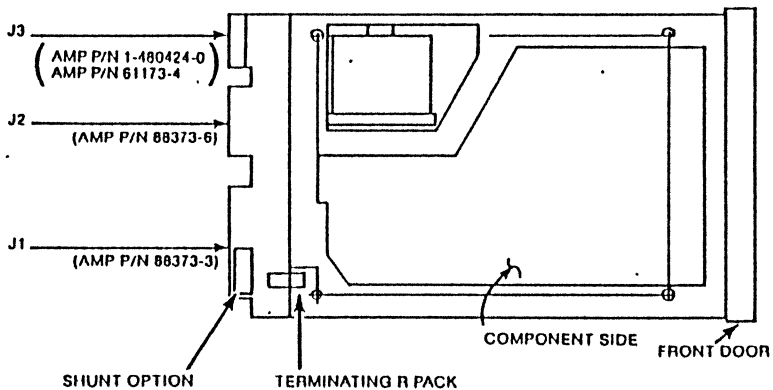
1. J1 - Control signals (multiplexed)
2. J2 - Read/write signals (radial)
3. J3 - DC power Input

Refer to Figure 12 for connector locations.

5.1 J1/P1 Connector - Control Signals

Connection of J1 is through a 34 pin edge connector. The dimensions for this connector are shown in Figure 13. The pins are numbered 1 through 34 with the even pins located on

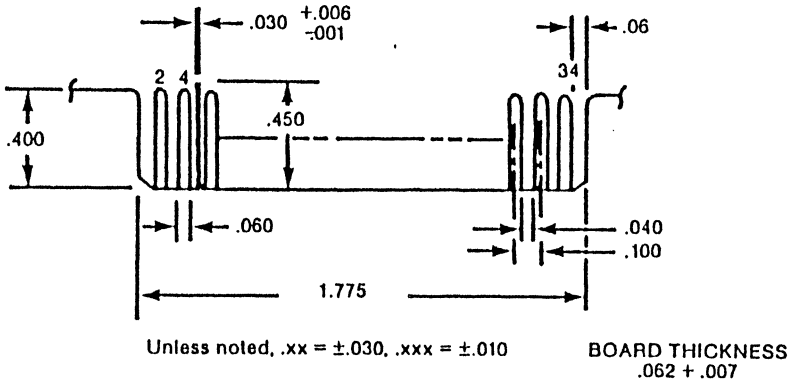
**FIGURE 12
INTERFACE CONNECTOR PHYSICAL LOCATIONS**



the component side of the PCB. Pin 2 is located on the end of the PCB connector closest to the DC Power connector J3/P3 and is labelled. The recommended mating connector for P1 is AMP ribbon connector P/N 88373-3 or Molex 15-35-1341. All odd pins are ground.

A key slot is provided between pins 4 and 6.

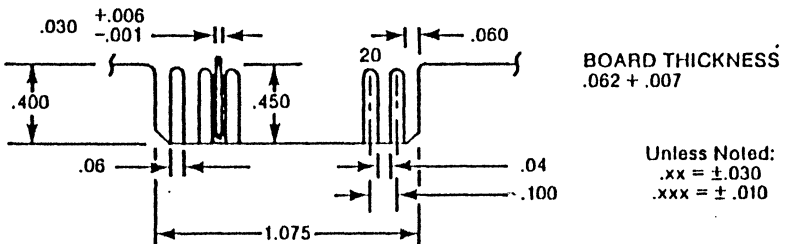
**FIGURE 13
J1 CONNECTOR DIMENSIONS**



5.2 J2/P2 Connector - Data Signals

Connection to J2 is through a 20 pin edge connector. The dimensions for the connector are shown in Figure 14. The pins are numbered 1 through 20 with the even pins located on the component side of the PCB. The recommended mating connector for P2 is AMP ribbon connector P/N 88378-6, or Molex P/N 15-35-1201.

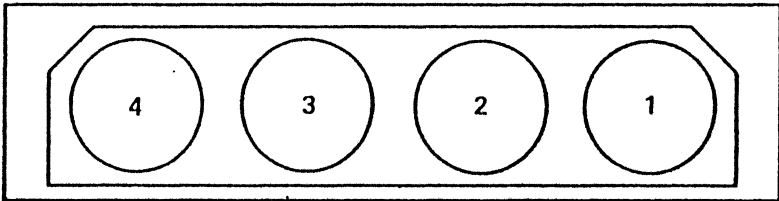
**FIGURE 14
J2 CONNECTOR DIMENSIONS**



5.3 J3/P3 Connector - DC Power

DC power connector (J3) is a 4 pin AMP Mate-N-Lok connector P/N 61173-4 mounted on the edge of the PCB. The recommended mating connector (P3) is AMP P/N 1-408424-0 utilizing AMP pins P/N 350078-4 (Strip) or P/N 61173-4 (Loose Piece).

FIGURE 15
J3 CONNECTOR—DRIVE PCB SOLDER SIDE



Note: The drive as shipped from the factory has the mounting frame as DC ground.

6.0 Physical Specifications

This section describes the mechanical dimensions and mounting recommendations for the SQ306.

6.1 Mounting Orientation

Recommended orientation is either vertical on either side or horizontal with PCB down. In final mounting configuration, insure that operation of *the four shock mounting screws should not protrude inside the frame more than 0.9 inches.*

6.2 Mounting Holes

Eight mounting holes, four on the bottom and two on each side are provided for mounting the drive in an enclosure. The size and location of these holes are shown in Figure 16. Insure that the four mounting screws do not protrude inside the drive frame more than 0.9 inches.

6.3 Physical Dimensions

Overall height/width/depth and other key dimensions are shown in Figures 16 and 17.

6.4 Shipping Requirement

For shipping the heads are positioned over track 000.

Prior to operation, remove the shipping restrainer on the stepper motor. A plastic "shipping cartridge" will be inserted and shipped with all drives to protect the head assemblies.

7.0 Track Format

The purpose of a format is to organize a data track into smaller sequentially numbered blocks of data called sectors. The format is a soft sector type which means that the beginning of each sector is defined by a prewritten identification (ID) field which contains the physical sector address plus cylinder and head information. The ID field is then followed by a user supplied data field.

The format is a slightly modified version of the IBM System 34 double density format which is commonly used on floppy disc drives. The encoding method is Modified Frequency Modulation (MFM).

Figure 18 shows the track format as shipped, 8192 bytes/user data are available on each track, based on 32 sectors, each having 256 bytes of user data.

FIGURE 16
MOUNTING PHYSICAL DIMENSIONS

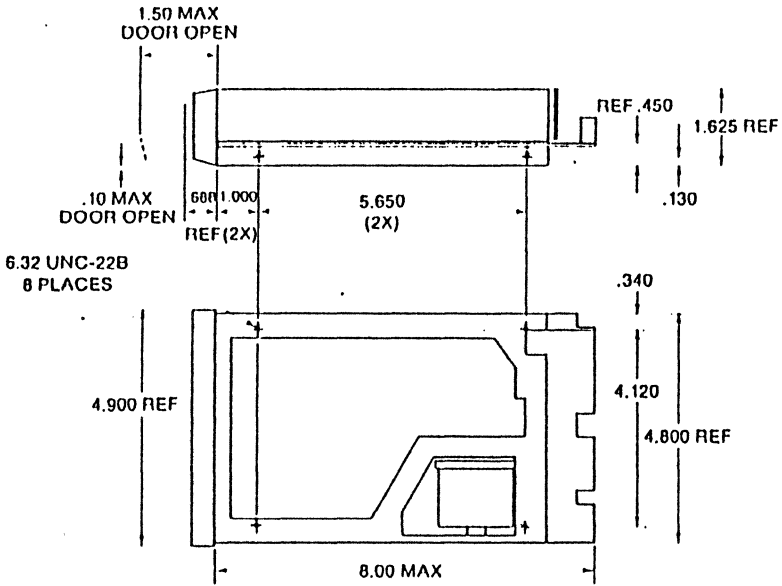
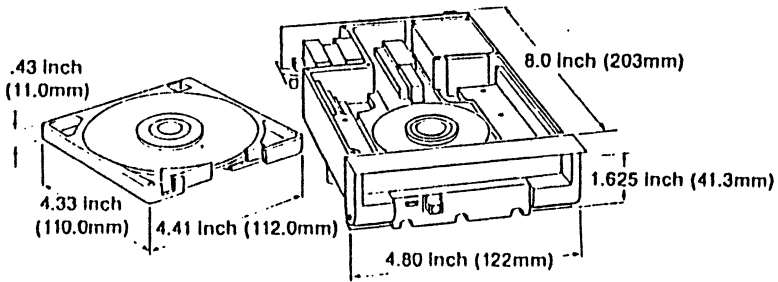


FIGURE 17
DIMENSIONAL VIEW



Current requirements and connector pin numbers are shown in Table IV.

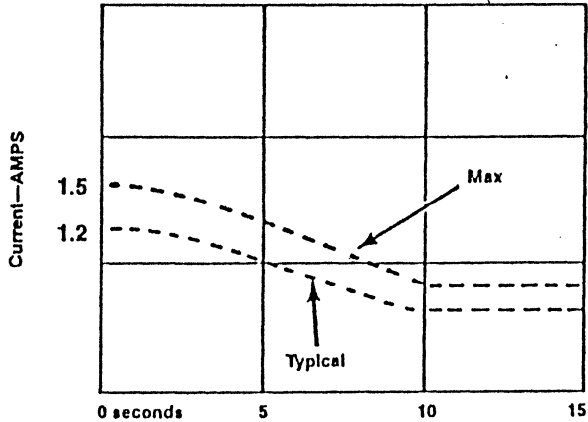
**TABLE IV
DC POWER REQUIREMENTS**

J3 Connector	Current AMPS	
	Max	Typ
Pin 4 +5 Volts DC $\pm 5\%$ Pin 3 +5 Volt Return	1.0	.9
Pin 1 +12 Volts DC $\pm 5\%$ Pin 2 +12 Volt Return	1.5	.7

* $\pm 10\%$ at power on or seeking, +5% for reading or writing.

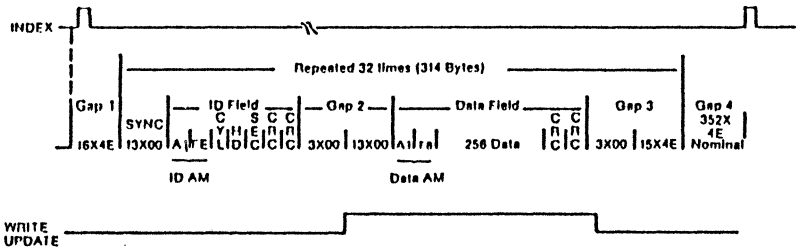
* Occurs only during power up, per curve below.

**TABLE V
MOTOR START CURRENT REQUIREMENTS**

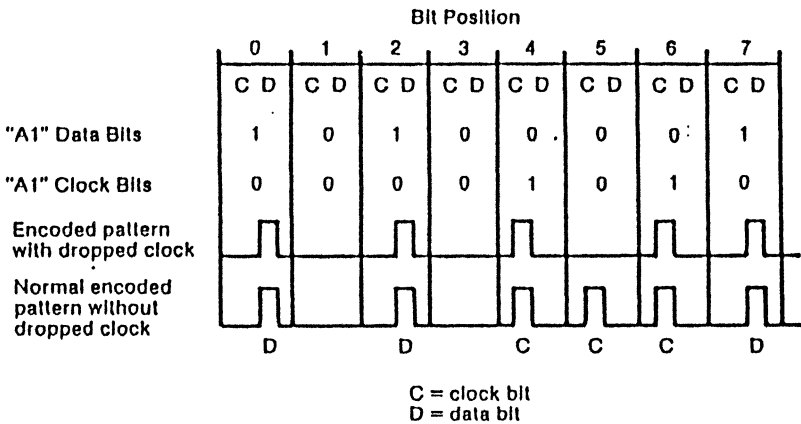


$\pm 12V$ current power up cycle

**FIGURE 18
TRACK FORMAT AS SHIPPED**



**FIGURE 19
"A1" ADDRESS MARK BYTE**



The beginnings of both the ID field and the data field are flagged by unique characters called address marks. An address mark is two bytes in length. The first byte is an "A1" data pattern. This is followed by either an "FE" pattern for an ID address mark, or an "F8" pattern for the data address mark.

The "A1" pattern is made unique by violating the encoding rules of MFM by omitting one clock bit. This makes the address mark pattern unique to any other serial bit combination that could occur on the track. See Figure 19 depiction of the "A1" byte. Each ID and data field is followed by a 16 bit cyclic redundancy check (CRC) character used for a particular data pattern.

Surrounding the ID and data fields are gaps to establish physical and timing relationships between these fields.

7.1 Gap 1

Gap 1 is to provide for variations in Index detection. Gap 1 must be at least 16 bytes. Gap 1 is immediately followed by a sync field preceding the first ID field.

7.2 Gap 2

Gap 2 follows the CRC bytes of the ID field and continues to the data field address mark. It provides a known area for the data field write splice to occur. The latter portion of this gap serves as the sync up area for the data field AM. Minimum length required is determined by the "lock up" performance of the phase-lock-loop in the data separator, which is part of the host control unit.

7.3 Gap 3

Gap 3 following each data field allows for the spindle speed variations. This allows for the situation where a track has been formatted while the disc is running faster than nominal, then write updated with the disc running slower than normal. Without this gap, or if it is too small, the sync bytes or ID field of the next field could be over written. As shipped, the gap allows a $\pm 3\%$ speed variation (actual drive spec is $\pm 1\%$). Minimum gap is 8 bytes for a 256 byte record size.

7.4 Gap 4

Gap 4 is a speed tolerance buffer for the entire track, which is applicable in full track formatting operations to avoid overflow into the Index area. The format operation which writes ID

fields begins with the first encountered index and continues to the next index. The actual bytes in Gap 4 depends on the exact rotating speed during the format operation.

7.5 Sector Interleaving

As shipped, the track format uses an interleave factor of 4. That is sequentially sector ID numbers are 0, 8, 16, 24, 1, 9, 17, 25, 2, 10, 18, 26, etc. This allows sufficient system turn around time to process multiple sectors during a single revolution, thus enhancing through-put of typical file read/write operations.

7.6 Defective Sector Flags

A printout will be provided with each cartridge which lists the location of defects in terms of head number, cylinder number, sector and byte.

No units will be shipped to customers if surface analysis identifies more than 10 hard errors per cartridge.

A hard read error (non-recoverable) is defined as an error which cannot be recovered within eight retries, providing that the data had previously been written correctly. No errors will be present on cylinder 0.

8.0 Cartridge Acclimatization

The Cartridge should be allowed to stabilize at room temperature of operating environment for a minimum of one hour to insure Cartridge Interchangeability and Data Reliability.

SYQUEST TECHNOLOGY

OEM MANUAL

SQT 022-1 (9/83)

HANDLING PROCEDURES FOR SYQUEST REMOVABLE CARTRIDGE DISK DRIVES

To safeguard information and eliminate potentially severe problems, this handling procedure describes proper care and handling for using the SyQuest removable cartridge disk drive.

It is suggested that the user adhere to the care and handling instructions to protect against unnecessary cartridge damage, disk drive damage or data loss.

DRIVE HANDLING:

The SyQuest removable cartridge drives are micro processor controlled Winchester technology drives. These random access magnetic data storage devices use a removable 100mm (3.9 inch) PLATED disk as the storage media in the cartridge.

PLEASE follow the handling techniques listed below when using the disk drive:

1. Keep the disk drive door closed at ALL times, even if the drive is not in use. This will prevent dust (contamination) build-up in the drive.
2. Insert only SyQuest approved cartridges or C-Paks.
3. **DO NOT** shut off the computer's power to remove the cartridge. If the computer power is removed WAIT 1 MINUTE BEFORE ATTEMPTING TO REMOVE THE CARTRIDGE. The control logic is off, so the disk must coast to a stop and this takes about 60 seconds.

DO NOT attempt to open the drive door while the disk is spinning. REMOVING THE CARTRIDGE WHILE THE DISK IS SPINNING WILL CAUSE DAMAGE TO THE DISK SURFACE AND THE READ/WRITE HEADS.

4. **DO NOT** blow into the disk drive to remove dust or other contaminants.
5. **ALWAYS REMOVE THE CARTRIDGE WHEN MOVING OR TRANSPORTING THE DRIVE OR SYSTEM.**
6. **DO NOT** allow a cartridge to fall when ejecting it from a drive. A damaged cartridge, may subsequently damage the drive.
7. **DO NOT** apply any lubricants or cleaners of any kind to any part of the disk drive other than FREON-TF which is used with a C-PAK to clean the spindle motor area of the drive.

CARTRIDGE HANDLING:

The cartridges are precision magnetic disk assemblies that require care for proper handling. Improper handling can cause damage to both the cartridge and drive. To insure reliable operation, please follow these special handling techniques:

1. **ALWAYS** keep the cartridge in its protective sleeve when not in use. This helps keep the circular metal armature plate on the bottom of the cartridge free of contaminants.
2. **DO NOT** open the black cartridge slide. This may let foreign objects or debris come in contact with the disk's surface. Moisture or contaminants that get on the disk's surfaces may cause head crashes and the destruction of the disk.
3. **ALWAYS** allow the cartridge to stabilize at room temperature for at least one hour if the cartridge was transported from another climate or environment. (Example: Do not use a cartridge taken from a cold car and use it immediately in a warm drive.)
4. **DO NOT** handle the cartridges roughly.
DO NOT drop or expose cartridges to hard shocks, or stray magnetic fields. This may cause corruption of the recorded data.
5. **DO NOT** apply any labels that will interfere with the insertion or removal of the cartridge. Peeling labels can cause contamination which may cause head crashes or prevent the proper seating of the cartridge on the drive spindle motor.
6. **DO NOT** apply any lubricant or cleaner to the cartridge.
7. **DO NOT** blow into the cartridge to remove dust or other contaminants.
8. **DO NOT** write on any labels attached to the cartridge with a lead (graphite) pencil.

LOADING AND REMOVING A CARTRIDGE:

Loading and removing the cartridge from a disk drive is easy - provided a few simple steps are followed. The disk drive has a front panel LED which indicates the operating condition of the drive. It is important that you observe the front panel LED in the procedure below.

LOADING A CARTRIDGE: With the LED out - no previous cartridge installed.

1. Press the front drive door button. The drive door will partially open.
2. Swing the door to the full open position.
3. Place the cartridge to be loaded into the disk drive, positioning it as follows:
 - * The side of the cartridge with the black slide should be inserted first.
 - * The exposed metal armature plate should be next to the open drive door as the cartridge is slid into the drive.
 - * Gently slide the cartridge into the drive until resistance is felt, then push the cartridge a little further until it locks in place.
4. Gently close the front drive door fully. It should snap and lock when fully closed. The front panel LED will glow RED indicating the drive is in a power-up sequence.
5. Before proceeding, wait until the front panel LED turns from RED to GREEN (drive READY) or ORANGE (drive READY and SELECTED). The disk drive is now ready for use.

REMOVING A CARTRIDGE:

DO NOT turn system power off for the purpose of removing a cartridge.

1. Press the front drive door button.
The cartridge's disk will now brake to a halt. The front panel LED flashes RED until it spins down. This spin down takes about 10 seconds.

DO NOT attempt to open the drive door while the disk is spinning.
This is very important - if the system power was accidentally turned off, the spin down time will be increased. Wait 60 seconds before opening door. Head and/or disk damage may occur if disk is spinning during removal.
2. Wait until the front panel LED goes out before removing the cartridge or turning power off to the computer system.
3. Press the front door button again. The drive door will partially open.
4. Swing the drive door to the full open position. The cartridge will eject.
Place a hand in front of the drive door as the door is opened to prevent the cartridge from accidentally falling out as it ejects.
5. Remove the cartridge from the drive and place the cartridge in its protective sleeve.

PLACING THE CARTRIDGE DOWN ON A DIRTY SURFACE PRIOR TO USING THE PROTECTIVE SLEEVE MAY CAUSE PARTICLES TO ADHERE TO THE ARMATURE PLATE.

6. Close the drive's front door.

CARTRIDGE INSTALLED

RED LED:

When a cartridge is installed and the front door is closed, the SyQuest disk drive goes through a power on diagnostic routine. During this time the front panel LED is red. The drive will become ready in approx. 25 seconds.

RED LED BLINKING RAPIDLY: Indicates drive is not working properly.

If the cartridge does not seat correctly, the micro processor will indicate this malfunction by rapidly blinking the front panel LED red until the door button is depressed. The cartridge must be removed and the cartridge armature plate area cleaned. The drive motor spindle should be cleaned using only a SyQuest cleaning pack (C-PAK) to remove dirt build up. Please read the instructions provided with the C-PAK before proceeding with its usage.

GREEN LED OR ORANGE LED: GREEN = drive READY. ORANGE =drive SELECTED AND READY

If the cartridge seats correctly, the drive will complete it's diagnostics and light the GREEN or ORANGE LED. The drive is now READY.

After the drive becomes READY, the computer's Operating System checks for the proper configuration of the cartridge.

NOTE: Every cartridge MUST be prepared before it can be recognized by the system. This must be done before the drive is used. Each cartridge must first be PREP'ed (primary formatted with addressed sectors), FDISK'ed (partitioned and have the file allocation table properly installed), and then FORMAT'ed (put the data, and system files if required, in the proper format to be recognized by the system).

INVALID DEVICE type is displayed if the cartridge's data cannot be recognized.

CHANGING A CARTRIDGE

Do not change a cartridge without updating the computer memory with the new cartridge directory data. If a cartridge is removed and a new cartridge installed after the system is operating, the operating system must be made aware of a cartridge change. The system may NOT read the directory before doing a disk operation. It uses the directory from the computer's memory, NOT the directory on the new cartridge that has been inserted.

If a disk change operation is performed without updating the system's memory with the new directory, CORRUPTION OF DATA may occur.

The operating system can be rebooted to insure that the operating system is aware of the cartridge change.

OPERATING SYSTEM SOFTWARE

Avoid the use of different versions of operating systems. Performing operations between two different versions of the operating system can lead to corruption of data. (Example: DOS 2.1 & DOS 3.3.)

ANY TECHNICAL PROBLEMS OR QUESTIONS CAN BE REFERRED TO SYQUEST TECHNICAL SUPPORT IN FREMONT, CA (415) 490-7511.