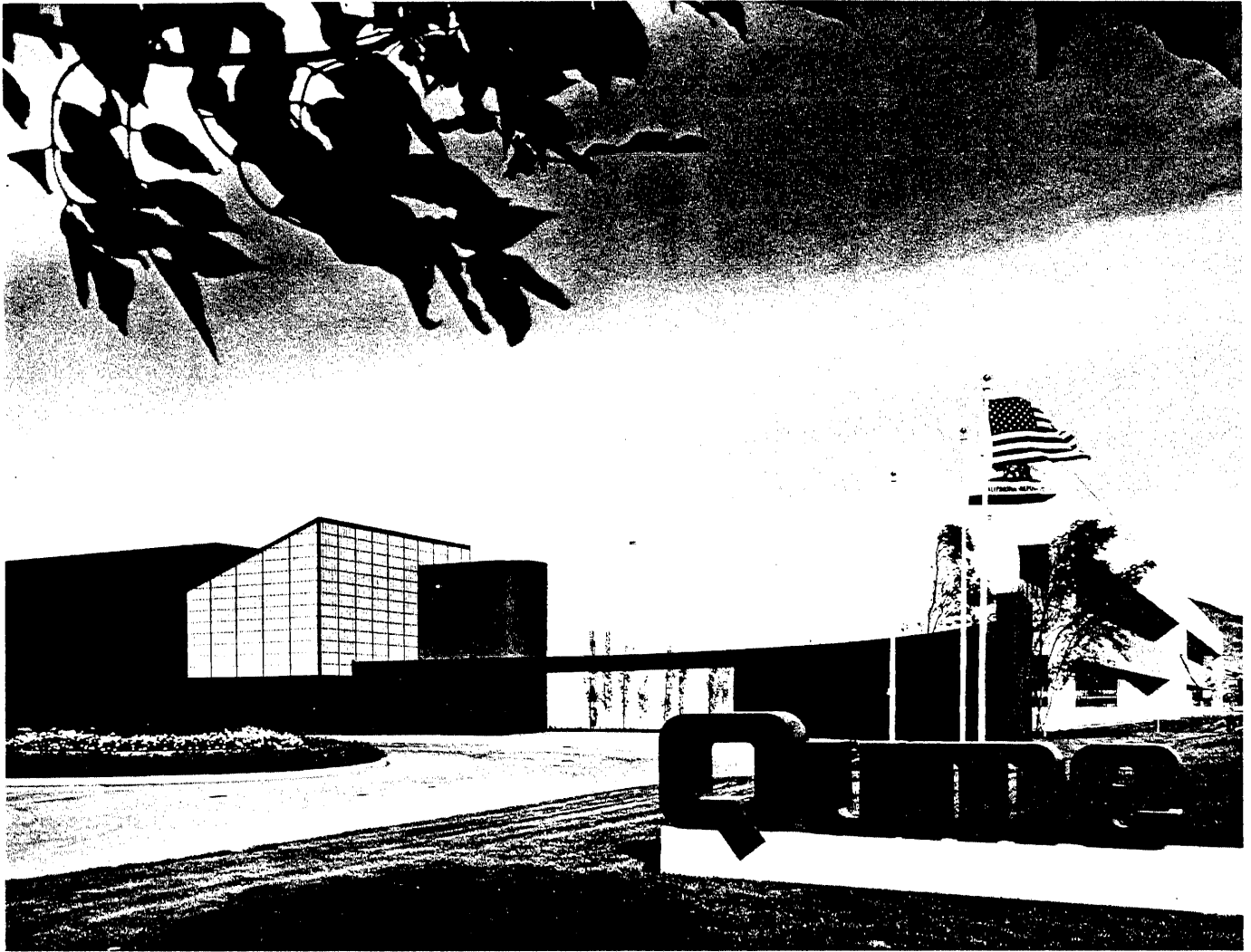




Maintenance

**QumeTrak 592
Maintenance**

March 1983



FOREWORD

This manual is one of a group of documents describing the QumeTrak 592 floppy disk drive. For additional information consult the following related publications:

Title	Publication Number
QumeTrak 592 Product Description	36033
Memory Products Service and Spares Catalog	37052

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INTRODUCTION

This manual describes the operation and maintenance of the QumeTrak 592 Floppy Disk Drive. The first section of the manual provides a product overview and performance and reliability specifications. The INSTALLATION section supplies unpacking, inspection, installation, and mounting instructions. The INTERFACE section describes the physical interface connections and the I/O signal lines. The CUSTOMER STRAPPABLE OPTIONS section describes how to select various drive options by adding or deleting jumpers on the printed circuit board. The MAINTENANCE section supplies preventive maintenance techniques, illustrated assemblies and parts locations, removal and replacement procedures, adjustment instructions, and troubleshooting procedures. A section listing RECOMMENDED SPARE PARTS and a section containing typical SCHEMATIC DIAGRAMS are also included.

The QumeTrak 592 is available in two configurations: the QumeTrak 592 A and the QumeTrak 592 B. The model A version is Qume's standard 96 TPI drive. The model B version is designed for total compatibility with industry standard 96 TPI floppy drives. QumeTrak 592 B mechanical assemblies distinct from those available on the standard QumeTrak 592 A are identified in the ILLUSTRATED ASSEMBLIES AND PARTS LOCATIONS section of this manual under Front Bezel and Door, Carrier and Collet, and Media Guide Components. The industry standard configuration of the QumeTrak 592 B printed circuit board is discussed under CUSTOMER STRAPPABLE OPTIONS.

PRODUCT DESCRIPTION

The QumeTrak 592 Floppy Disk Drive is a low cost, direct access data storage device for 5.25 inch, two-sided flexible (floppy) diskettes. The QumeTrak 592 provides a formatted storage capacity of 328K bytes on a two-sided single density flexible diskette and 655K bytes on a two-sided double density flexible diskette. The unformatted storage capacity of the QumeTrak 592 provides 500K bytes on a two-sided single density flexible diskette and 1M bytes on a two-sided double density flexible diskette.

The QumeTrak 592 is an advanced design that is based on Qume's manufacturing experience with the QumeTrak 542 and the larger QumeTrak 842, eight-inch drive. It employs a two-sided head carriage assembly with a ceramic Read/Write (R/W) tunnel erase head for long media life. A precision steel band drive mechanism provides fast access time (3ms track-to-track) and affords minimal wear with low power dissipation.

A direct drive DC spindle motor is used for media drive. This design eliminates drive belt maintenance. A door interlock prevents the door from being closed until the media is properly inserted. Other standard features include:

- . Four drive daisy chain capability
- . Internal write protect circuitry
- . In Use LED activity indicator on the front panel
- . Capability to read diskettes recorded in conventional 48TPI
- . Low heat dissipation

INTRODUCTION

The QumeTrak 592 can be mounted horizontally or vertically. A single restriction is made when the drive is mounted horizontally. The proper side must be up, as is described later under MOUNTING.

The QumeTrak 592 complies with the American National Standards Institute (ANSI) interface specification for 5.25 inch flexible disk drives.

SPECIFICATION SUMMARY

Table 1. Performance Specifications

	SINGLE DENSITY	DOUBLE DENSITY
CAPACITY PER DISKETTE UNFORMATTED FORMATTED (16 SECTORS/TRACK)	500K bytes 328K bytes	1M bytes 655K bytes
RECORDING DENSITY (TRACK NO. 79)	2961 BPI	5922 BPI
TRACK DENSITY	96 TPI	96 TPI
NUMBER OF CYLINDERS	80	80
NUMBER OF TRACKS	160	160
RECORDING METHOD	FM	MFM
ROTATIONAL SPEED	300 RPM	300 RPM
TRANSFER RATE	125K bits/sec	250K bits/sec
LATENCY (AVERAGE)	100 ms	100 ms
ACCESS TIME AVERAGE TRACK TO TRACK SETTLING	95 ms 3 ms 15 ms	95 ms 3 ms 15 ms
HEAD LOAD TIME	50 ms typ.	50 ms typ.
MOTOR START TIME	1 sec typ.	1 sec typ.

Table 2. Reliability Specifications

ERROR RATE	
SOFT ERROR RATE	ONE ERROR PER 10^9 BITS READ
HARD ERROR RATE	ONE ERROR PER 10^{12} BITS READ
SEEK ERROR RATE	ONE ERROR PER 10^6 SEEKS
MTBF	8000 POWER ON HOURS, 25% DUTY CYCLE
MTTR	30 MINUTES
PREVENTIVE MAINTENANCE	EVERY TWO YEARS
DESIGN LIFE	15,000 POWER ON HOURS OR 5 YEARS
MEDIA LIFE	
PASSES PER TRACK	3×10^6
INSERTIONS	30,000

INSTALLATION

RECEIVING AND INSPECTION

Each disk drive is wrapped in a plastic bag to prevent dust contamination of the R/W heads.

Unpack and inspect the disk drive as follows (refer to Figure 1, Unpacking the QumeTrak 592 Disk Drive).

1. Inspect the container for external signs of damage. If any damage is observed, have the delivery agent note the damage on the shipping document. Some shippers may wish to be present when the container is opened if external damage is apparent.
2. Open the container and remove the drive from its cradled position. Lift the drive from the bottom, up and out of the container.
3. Remove the drive from the plastic bag.
4. Open the drive door and remove the cardboard shipping insert.
5. Retain all packing materials for possible reshipment. Always install the cardboard insert between the heads should reshipment be necessary.

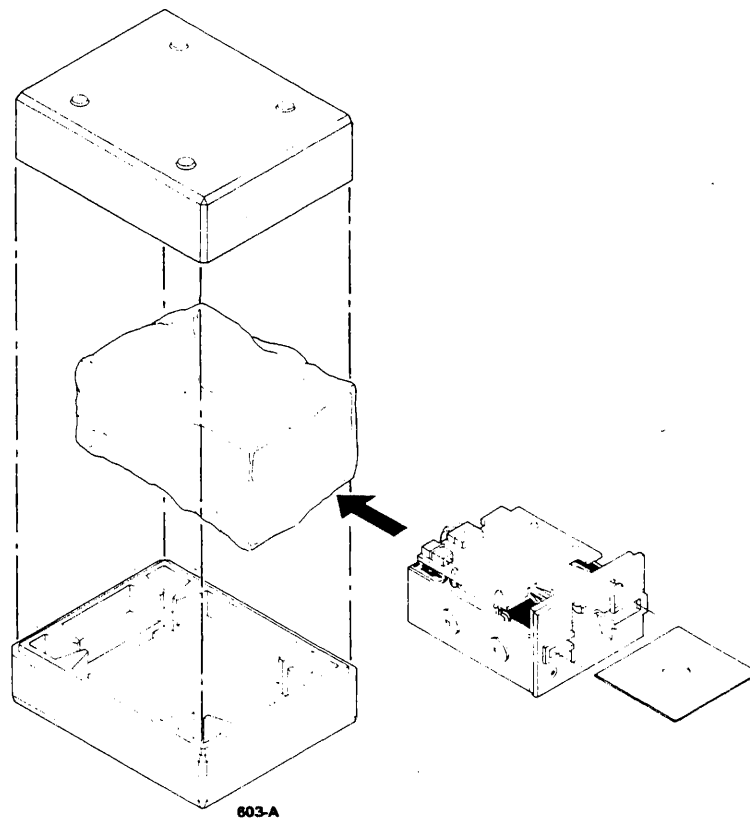


Figure 1. Unpacking the QumeTrak 592 Disk Drive

INSTALLATION

6. Inspect the drive for scratches, dents, loose components, and other obvious damage. Note any evidence of such damage on the invoice and file a claim with the carrier immediately, if the condition of the unit so warrants.
7. If damage that might impair drive operation is detected, do not attempt to operate the disk drive. Contact Qume for advice and instructions.
8. Refer to these instructions when repacking the drive.

INSTALLATION REQUIREMENTS

Table 3. Installation Requirements

DC POWER REQUIREMENTS (AT THE DC POWER CONNECTOR J2)	VOLTAGE	MAX. RIPPLE	CURRENT
	+12 VDC \pm 5%	0.1 V (P-P)	1.2 A MAX. (START) 1.0 A MAX. (RUNNING)
	+5 VDC \pm 5%	0.05 V (P-P)	0.6 A TYPICAL 1.0 A MAX.
POWER DISSIPATION	10 W TYPICAL		
ENVIRONMENT		OPERATING	STORAGE
TEMPERATURE		5° C TO 43° C (41° F TO 110° F)	-20° C TO 50° C (-4° F TO 122° F)
RELATIVE HUMIDITY		20 to 80% RH	NO CONDENSATION
MAX. WET BULB		29° C (84° F)	NO CONDENSATION
MECHANICAL DIMENSIONS EXCLUSIVE OF FRONT BEZEL		WIDTH	146 mm (5.75 in)
		HEIGHT	82.6 mm (3.25 in)
		DEPTH	203.2 mm (8.0 in)
		WEIGHT	1.4 Kg (3 lbs.)
MOUNTING POSITIONS	HORIZONTAL FRONT LOAD (PCB SIDE UP ONLY) VERTICAL FRONT LOAD		

MOUNTING

Mechanical Dimensions

The mounting and clearance dimensions (shown in inches) for the QumeTrak 592 are indicated below. Review these dimensions carefully before installation.

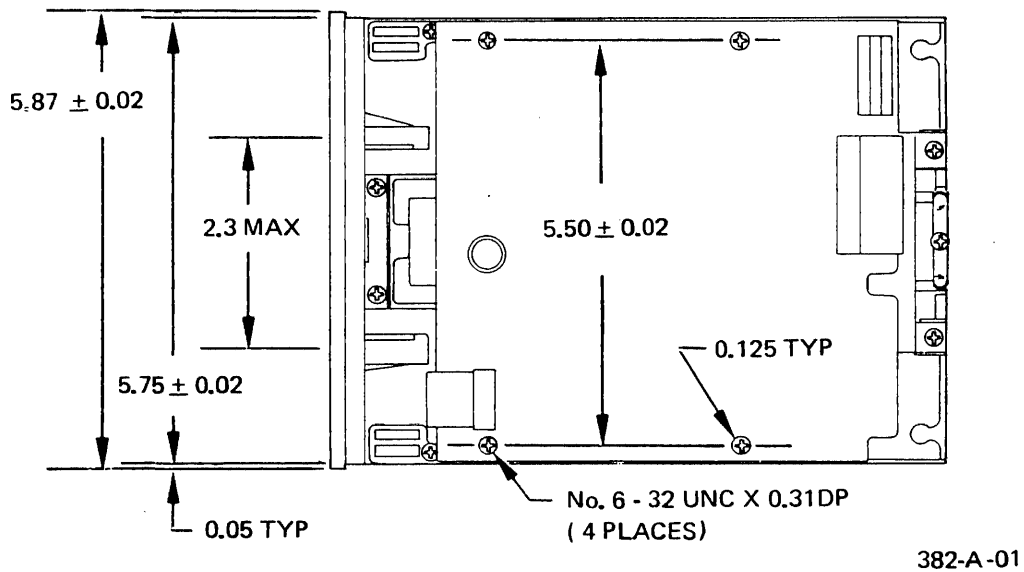


Figure 2. QumeTrak 592 - Top View

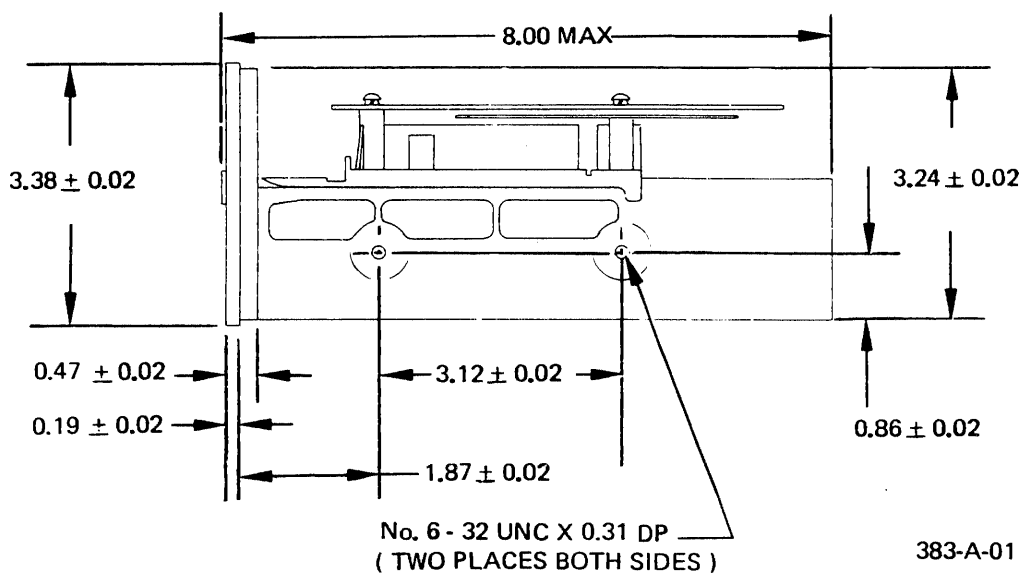


Figure 3. QumeTrak 592 - Side View

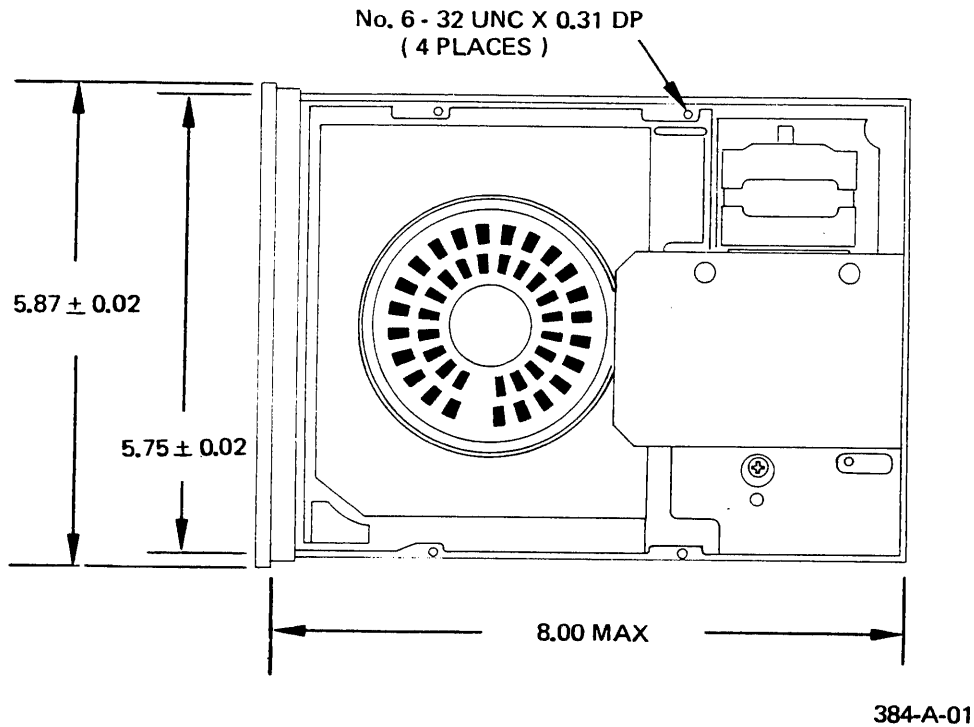
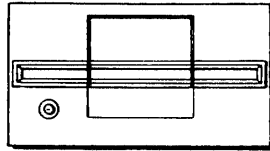
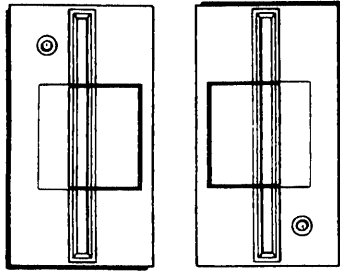


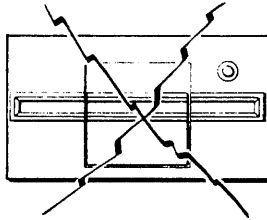
Figure 4. QumeTrak 592 - Bottom View

Recommendations

The QumeTrak 592 can be mounted horizontally or vertically for front loading. However, when the disk drive is mounted in a horizontal front load position, it must be situated such that the door opens upward and the In Use LED on the front bezel is below the door (refer to Figure 5, Mounting the QumeTrak 592).



PROPERLY INSTALLED
(PCB UP)



IMPROPERLY INSTALLED
(PCB DOWN)

592-A-01

Figure 5. Mounting the QumeTrak 592

INTERFACE

PHYSICAL INTERFACE

The interface between the QumeTrak 592 and the host system is via two connectors: I/O signals (P1/J1), DC power (P2/J2). In Figure 6, Interface Connection, drives #1 and #2 have been deleted for clarity.

Refer to the CONNECTORS AND CABLES discussion for specific pin assignments.

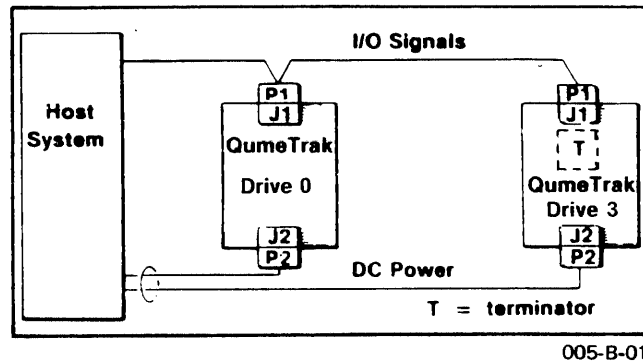


Figure 6. Interface Connection

Connectors and Cables

I/O SIGNALS (P1/J1)

Connection to J1 is through a 34-pin PCB edge card connector. The dimensions for this connector are shown in Figure 7.

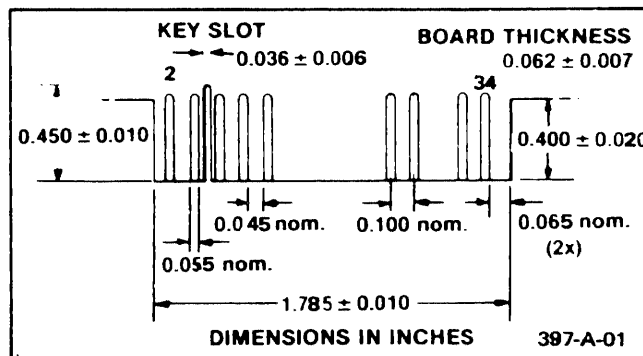


Figure 7. Connector J1 Dimensions (component side)

AWG 26	AWG 26	TWISTED PAIR (10 FEET MAX.)
91073-1	91073-1	EXTRACTOR TOOL
N/A	90268-1	CRIMP TOOL
583274-1	583274-1	POLARIZING KEY
583854-3	1-583616-1	CONTACT
583717-5	583717-5	HOUSING
AMP P/N	AMP P/N	PARTS
SOLDER TYPE	CRIMP TYPE	

Table 5. Connector P1 Requirements For Twisted Pairs

3M P/N	PARTS	
3463-0001	CONNECTOR	
3439-0000	POLARIZING KEY	
3440	PRESS	CRIMP TOOL
3443-11	LOCATOR PLATE	
3442-3	PLATEN	
3365-34	FLAT CABLE (10 FEET MAX.)	

Table 4. Connector P1 Requirements For a Flat Cable.

Table 6. I/O Signal Connector Pin Assignments

SIGNAL RETURN	SIGNAL	SIGNAL NAME
PIN NO.	PIN NO.	STANDARD
1	2	RESERVED
3	4	IN USE/HEAD LOAD (OPTION)
5	6	DRIVE SELECT 3
7	8	INDEX
9	10	DRIVE SELECT 0
11	12	DRIVE SELECT 1
13	14	DRIVE SELECT 2
15	16	MOTOR ON
17	18	DIRECTION SELECT
19	20	STEP
21	22	WRITE DATA
23	24	WRITE GATE
25	26	TRACK 00
27	28	WRITE PROTECT
29	30	READ DATA
31	32	SIDE SELECT
33	34	READY

INTERFACE

POWER (P2/J2)

Table 7. Connector P2/J2 Requirements

PARTS	P2 (CABLE SIDE)	J2 (DRIVE SIDE)
	AMP P/N	AMP P/N
HOUSING	1-480424-0	641737-1
CONTACT (4 PINS)	60619-1	—
CRIMP TOOL	90124-2	—
EXTRACTOR TOOL	1-305183-2	—
CABLE (10 FEED MAX.)	AWG 18	—

Table 8. Power Connector Pin Assignment

PIN NO.	SIGNAL NAME
1	+12 VDC
2	+12 V RETURN
3	+5 V RETURN
4	+5 VDC

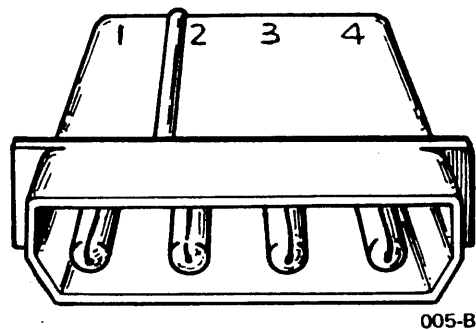


Figure 8. Connector J2

Terminator

The terminator is a DIP resistor module which must be plugged into the DIP socket on the PCB of a single drive, or into the last drive of a daisy chain. No other drives in a daisy chain should have terminator resistors installed.

Frame Ground

The QumeTrak 592 must be grounded to the controller to insure proper operation and low noise susceptibility. The system frame ground wire should be connected to the disk drive frame. A fast-on tab is provided on the drive.

Table 9. Frame Ground Requirements

Fast-on Tab	Mating Connector
AMP P/N 60920-1	AMP P/N 60972-1

I/O SIGNAL INTERFACE

All the I/O signal interface lines are TTL compatible and are active (true) when low. The disk drive uses 7438 NAND buffers (open collector) as output line drivers, and TTL logic level receivers on the input lines. The input of all receiver lines in a single drive, and those in the last drive of a daisy chain, must be terminated in 150 ohms pulled up to +5 volts (refer to the Terminator description in the INTERFACE section). Figure 9 shows the recommended controller interface circuit.

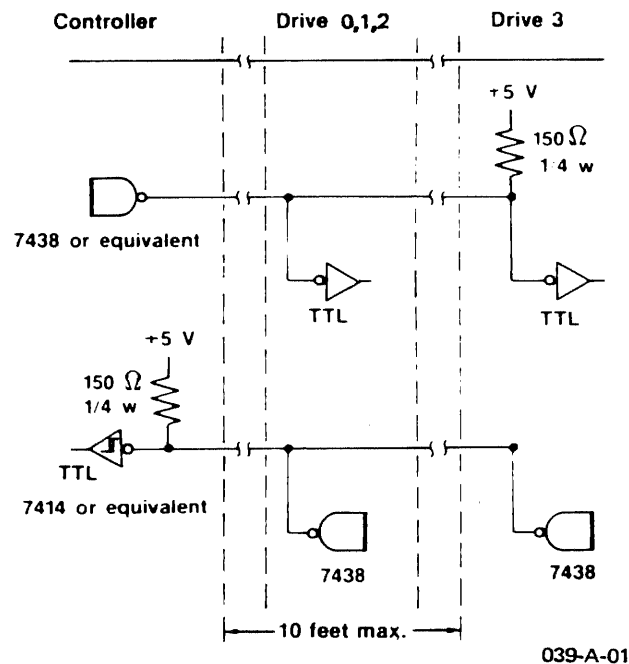
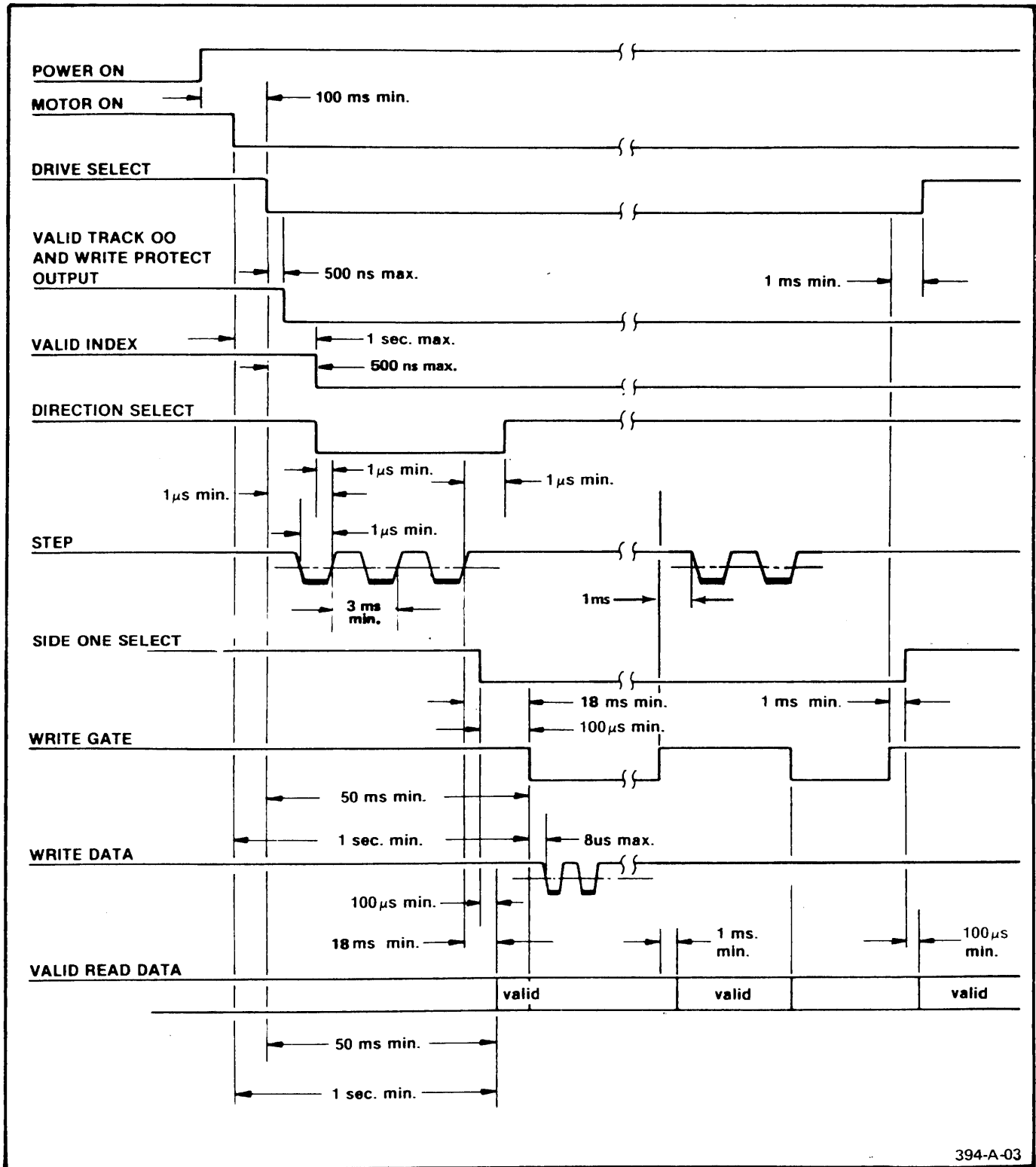


Figure 9. Recommended Controller Interface Circuit

INTERFACE



394-A-03

Figure 10. Interface Connections

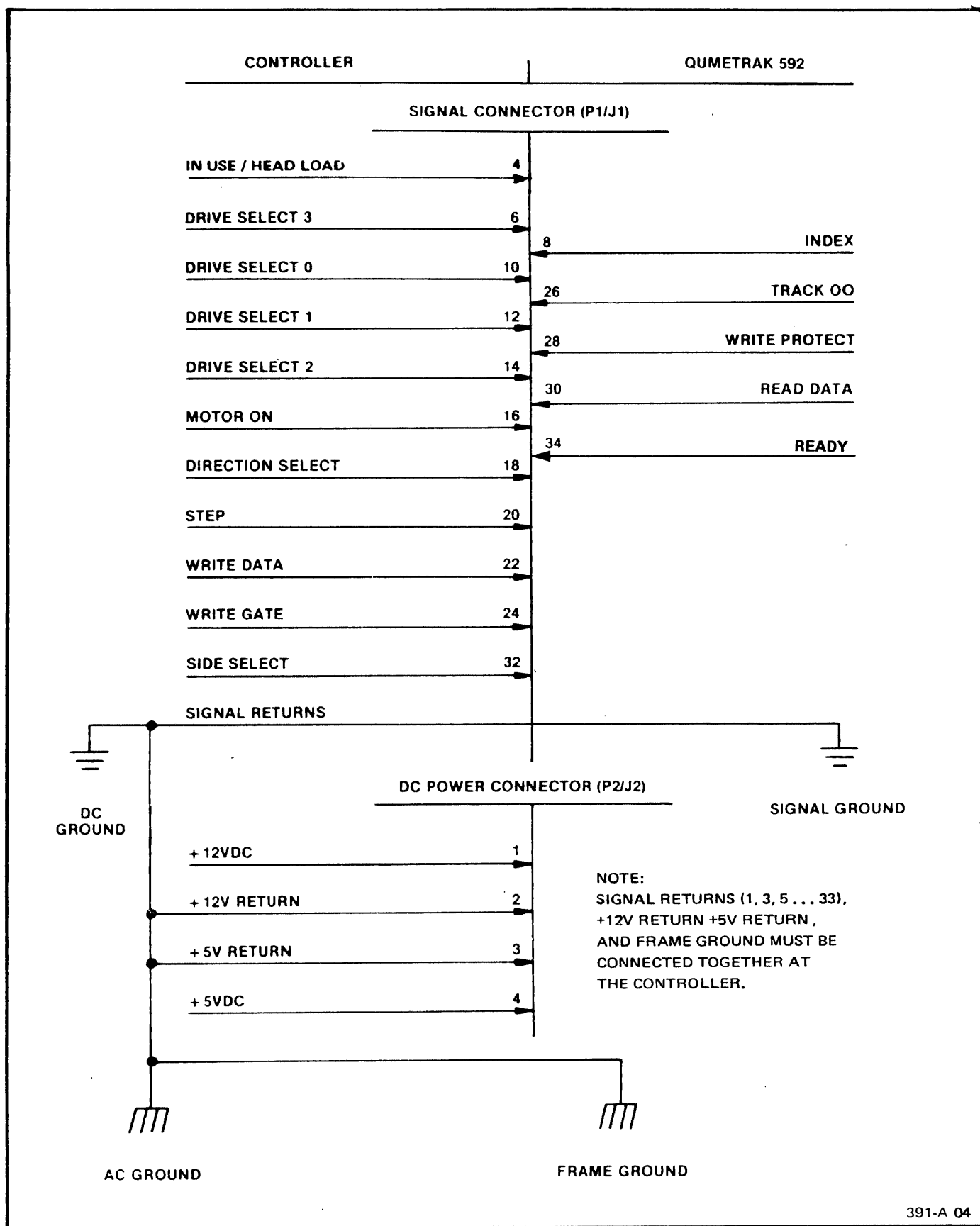


Figure 11. Control and Data Timing Requirements

INTERFACE

Input Lines

There are eleven active low TTL input lines to the QumeTrak 592. Individual signal line characteristics are as follows: High Level - 2.4 to 5.25V (logical false); Low Level - 0 to 0.4V (logical true); Input Impedance - 150 ohms to 5V.

IN USE/HEAD LOAD

With the proper options selected, an active low level on this line (pin 4) loads the R/W head against the diskette and activates the In Use LED.

DRIVE SELECT 0-3

An active low level on this line (pin 6, 10, 12, or 14) enables communication between an individual drive and the controller. With trace HS shorted, DRIVE SELECT will cause the drive to load its R/W heads and turn on the In Use LED.

The QumeTrak 592 is configured from the factory to operate in a single drive system. However, it can be modified by the customer to operate in a multiple drive system. Four separate input lines are provided for the host system to select which drive on the interface is to be used. When two, three or four, drives are daisy chained, each drive must have a unique DRIVE SELECT address. The DRIVE SELECT address is selectable on the 14 pin programmable shunt. When DS0 is shorted, Drive 0 will be activated by an active low signal on the DRIVE SELECT 0 line. If DS1 is shorted, the drive will be activated when the DRIVE SELECT 1 line is active low. The same system applies to DS2 and DS3. Refer to CUSTOMER STRAPPABLE OPTIONS for more detailed information.

MOTOR ON

An active low level on this line (pin 16) enables the drive motor. The spindle takes one second after MOTOR ON is activated to come up to speed before reading or writing on the diskette. This line may be deactivated for maximum motor life, if no commands are to be issued to the drive within two seconds (10 media revolutions) after completion of a previous command.

DIRECTION SELECT

DIRECTION SELECT (pin 18) defines the direction of R/W head movement. A low level on this line causes the head positioning mechanism to move the R/W heads toward the center of the diskette when the STEP line is pulsed. With the DIRECTION SELECT line at a high level, a pulse on the STEP line causes the head positioning mechanism to move the R/W heads away from the center of the diskette. The logic state of DIRECTION SELECT must not change while STEP is active. Any change on this line must be made at least 1 microsecond before the trailing edge of the STEP pulse.

STEP

A low to high transition on this line (pin 20) will cause the R/W heads to be moved one track. The direction of movement is controlled by the DIRECTION SELECT line. Pulses applied to the STEP line have the timing characteristics shown in Figure 12, Step Timing.

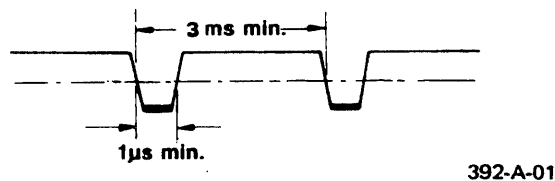


Figure 12. Step Timing

WRITE DATA

This interface line (pin 22) provides the data to be written on the diskette. Each transition on this line from a high level to an active low level causes the write current polarity through the heads to be reversed. The timing characteristics for WRITE DATA Frequency Modulation (FM) and Modified Frequency Modulation (MFM) formats are shown in the following illustrations.

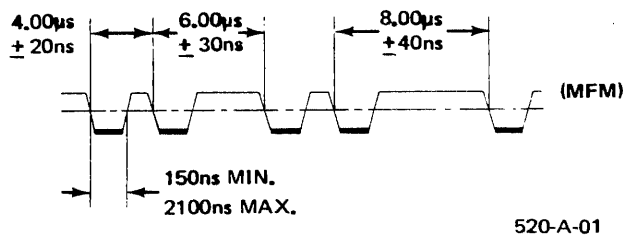
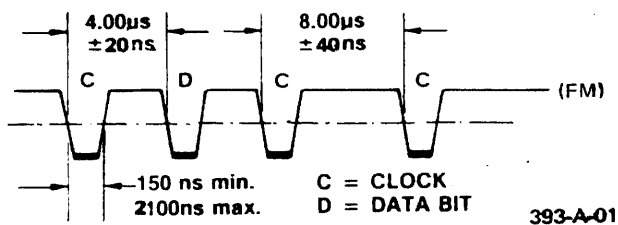


Figure 13. Write Data Timing

WRITE GATE

An active low level on this line (pin 24) enables the write current source and disables the stepping (head positioning) circuitry. A high level on this line

INTERFACE

enables the read circuitry. Deactivation of DRIVE SELECT, and/or changing SIDE SELECT must be delayed at least 1 ms following a write operation to assure that the track is fully tunnel erased. FIGURE 11, Control and Data Timing Requirements, illustrates these timing relationships.

SIDE SELECT

SIDE SELECT defines which side of a two-sided diskette is to be used for data recording or retrieval. An active low level on this line (pin 32) selects the R/W head for side 1 of the diskette (the diskette surface that faces the PCB); a high level selects the R/W head for side 0 of the diskette (the diskette surface that faces the main frame). When switching from one side to another, a 100 microsecond delay is required before any read or write operation can be initiated.

Output Lines

There are five active low TTL output lines. The low (true) voltage level is 0 to 0.4 volt, with a maximum sink of 40 milliamps when the 7438 NAND buffers draw current. The high (false) voltage level is 2.4 to 5.25 volts, with a maximum leakage current of 250 microamps when the 7438 NAND buffers are at cutoff. The characteristics of the individual output lines are described in the following paragraphs.

INDEX

This interface signal (pin 8) is provided by the drive once each revolution. The leading (negative going) edge of the INDEX pulse indicates to the controller the beginning of the next track. INDEX timing characteristics are shown below.

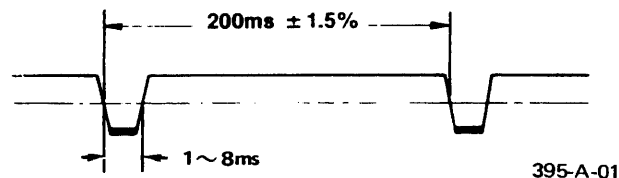


Figure 14. Index Timing

TRACK 00

An active low level on this line (pin 26) indicates that the R/W heads are positioned at Track 00 (the outermost track).

WRITE PROTECT

An active low level on this line (pin 28) indicates when a write protected

diskette is installed in the drive. Under normal operation, the drive will inhibit writing and notify the interface when a protected disk is installed.

READ DATA

Data from the diskette is output to the host system in the same form as it was received on the WRITE DATA line. Each flux reversal that is sensed on the diskette produces an active low pulse on the READ DATA line (pin 30). Refer to the Read Data Timing illustration for the timing characteristics.

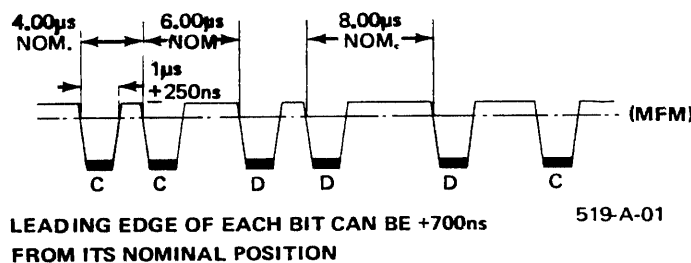
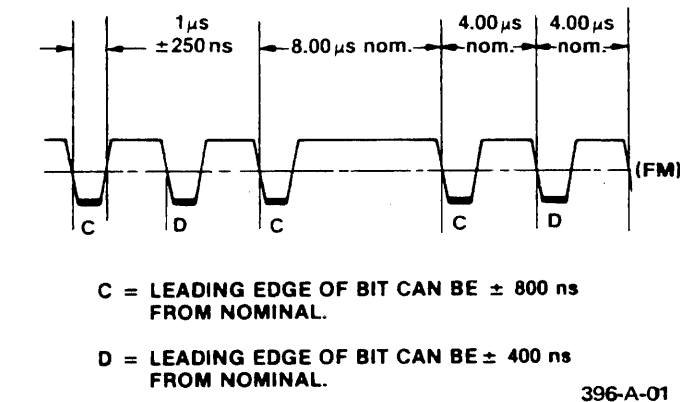


Figure 15. Read Data Timing

READY

An active low level on this line (pin 34) indicates that the drive is in a ready condition. The definition READY is dependent upon the status of jumpers 12-21 and jumper 23. As configured from the factory, READY indicates that the proper DC voltages are being supplied and that the Index pulse has been counted more than four times after the diskette started rotating. Refer to CUSTOMER STRAPPABLE OPTIONS for additional details.

CUSTOMER STRAPPABLE OPTIONS

The QumeTrak 592 can be modified by the user to alter some of the functions described in the ELECTRICAL INTERFACE section. This section provides instructions on how to install some of the more typical modifications. A 14 pin programmable shunt is provided to select the most commonly used options (the last seven listed in Table 10). The remaining modifications are made by adding or deleting jumpers and/or cutting traces. The table below shows the configuration of all option traces and jumpers as shipped from the factory. The PCB Component and Trace/Jumper Locations illustration identifies their position on the disk drive PCB.

Table 10. Factory Configuration of the Option Traces and Jumpers

JUMPER	DESCRIPTION (WHEN SHORTED)	OPEN	SHORT
1	IN USE LED ACTIVATED FROM "DRIVE SELECT"		X
2	IN USE LED ACTIVATED FROM "IN USE/HEAD LOAD"		X
3	"INDEX" COMBINES "READY 1" AND "INDEX 1"	X	
4	"INDEX" COMBINES "DRIVE SELECT" AND "INDEX 1"		X
5	"SIDE SELECT" FROM "DIRECTION"	X	
6	"SIDE SELECT"		X
7	"WRITE PROTECT" DISABLE	X	
8	"WRITE PROTECT" ENABLE		X
9	STEPPER ENABLED FROM "DRIVE SELECT" (R47 OUT)	X	
10	"HEAD LOAD" FROM "IN USE/HEAD LOAD" (HM AND HS MUST BE OPEN)	X	
11	READ DATA PULSE WIDTH 250 NS (STD.) OR 1000 NS (OPEN)		X
12	"READY" DISABLED (GROUNDED AT J1-34)	X	
13	"READY" ENABLED ("READY" PRESENT AT J1-34)		X
14	"READY" INDICATES DRIVE SELECT AND DOOR STATUS ONLY (MOTOR UP TO SPEED CIRCUIT DISABLED)	X	
15	MOTOR UP TO SPEED CIRCUIT ENABLED		X
16	READY OPTION	X	
17	READY OPTION		X
18	READY OPTION		X
19	READY OPTION	X	
20	READY OPTION		X
21	READY OPTION		X
22	DOOR LOCK FROM "IN USE/HEAD LOAD" AND "DOOR LOCK"	X	
23	"READY" DELAY OPTIONS		X
MS	"MOTOR ON" ANDED with "DRIVE SELECT"	X	
DS0	DRIVE SELECT ADDRESS (PIN 10)		X
DS1	DRIVE SELECT ADDRESS (PIN 12)		X
DS2	DRIVE SELECT ADDRESS (PIN 14)		X
DS3	DRIVE SELECT ADDRESS (PIN 6)		X
HS	HEAD LOAD FROM "DRIVE SELECT"		X
HM	HEAD LOAD WHEN MOTOR UP TO SPEED (INDEX GENERATED)	X	
MX	INTERNAL DRIVE SELECT (SINGLE DRIVE SYSTEMS)	X	

NOTE

Cutting traces or installing jumpers on the PCB may void your warranty. In some cases improperly installed modifications could damage board components. For more detailed information consult your authorized Qume representative.

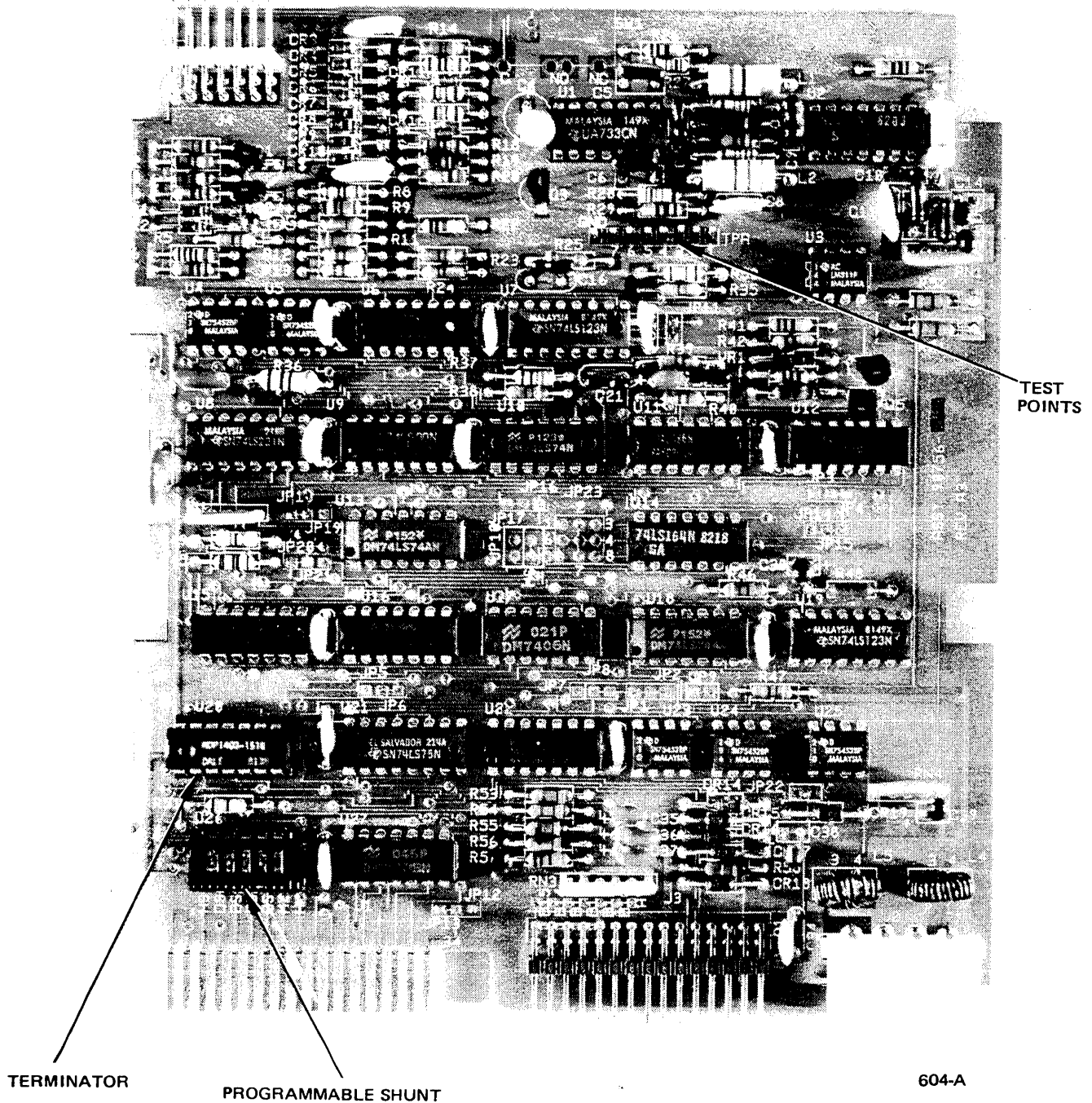


Figure 16. PCB Component and Trace/Jumper Locations

CUSTOMER STRAPPABLE OPTIONS

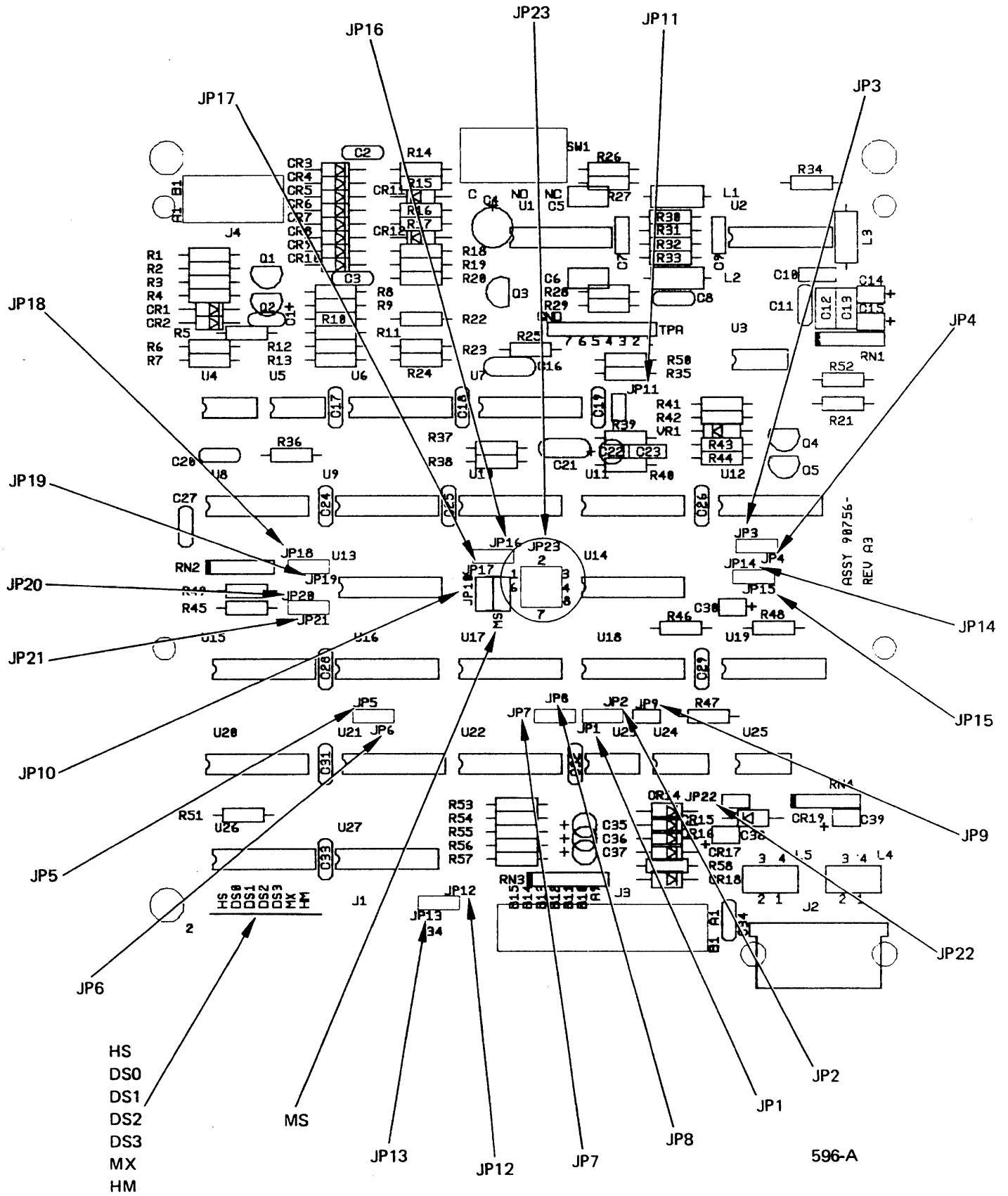


Figure 16. PCB Component and Trace/Jumper Locations

DRIVE SELECT OPTIONS

When shipped from the factory, DS0-DS3 are shorted on the programmable shunt. If DS0 and HS are left shorted and DS1-DS3 are opened, the drive will load its R/W heads when the Drive Select 0 line is activated. In like manner, if DS1 and HS are shorted and DS0, DS2, and DS3 are opened, the drive will be activated when the Drive Select 1 line is active low. Table 11 illustrates the available Drive Select options. Note that only one Drive Select jumper can be installed within a single drive.

Table 11. Drive Select Options

Drive Number	Drive Select Input				Drive Select Traces			
	0	1	2	3	DS0	DS1	DS2	DS3
0	L	H	H	H	0	0	0	0
	L	H	H	H	S	0	0	0
1	H	L	H	H	0	S	0	0
2	H	H	L	H	0	0	S	0
3	H	H	H	L	0	0	0	S
L = low level S = short H = high level 0 = open								

When DS0-DS3 are not desired, an optional Drive Select can be used by shorting MX. HM must then also be shorted to activate the head load solenoid when the MOTOR ON signal is true.

HEAD LOAD OPTIONS

Three head load options are available. With HS shorted and HM open, the R/W heads are loaded against the diskette when any DRIVE SELECT signal (DS0-DS3) is activated. When HM is shorted and HS is opened, the heads are loaded whenever the spindle motor is up to speed (INDEX is sensed). When JP10 is shorted and HM and HS are open, the heads are loaded from the IN USE/HEAD LOAD signal.

SIDE SELECT OPTION

When JP5 is shorted and JP6 is open, the SIDE SELECT function is controlled when DIRECTION SELECT (pin 18) goes active low. Under this configuration, DIRECTION SELECT controls side (head) selection during Read/Write operations and controls the direction of head motion during stepping operations.

READY OPTIONS

As indicated in Figure 17, the conditions under which READY (pin 34) is active are jumper selectable. Given the large number of possible jumper configurations, only a few of the more typical modifications are discussed here. Note that the Door Open switch shown in Figure 17 is only available on the QumeTrak 592 B, the industry standard version of the drive.

READY Disabled

With JP12 shorted, the READY signal is tied to ground and effectively disabled.

READY - DRIVE SELECT and Door Status

With JP13 shorted and pins 1 and 6 of JP23 shorted, READY only indicates that DRIVE SELECT is active and the door is closed (QumeTrak 592 B only).

READY Delayed

Figure 17 illustrates one possible READY delayed configuration with jumpers JP13, JP15, JP17, JP18, JP20, and JP23 pins 4, 5, and 6 installed.

With this configuration, the INDEX pulse must be counted more than four times before READY goes active (600-800 ms delay). Shorting pins 7 and 8 of JP23, installing jumpers JP19 and JP21, or installing JP16 all reduce the number of INDEX pulses required before READY becomes active. Thus, the time delay is shorter. A longer delay can be obtained by jumpering pins 2 and 3 of JP23.

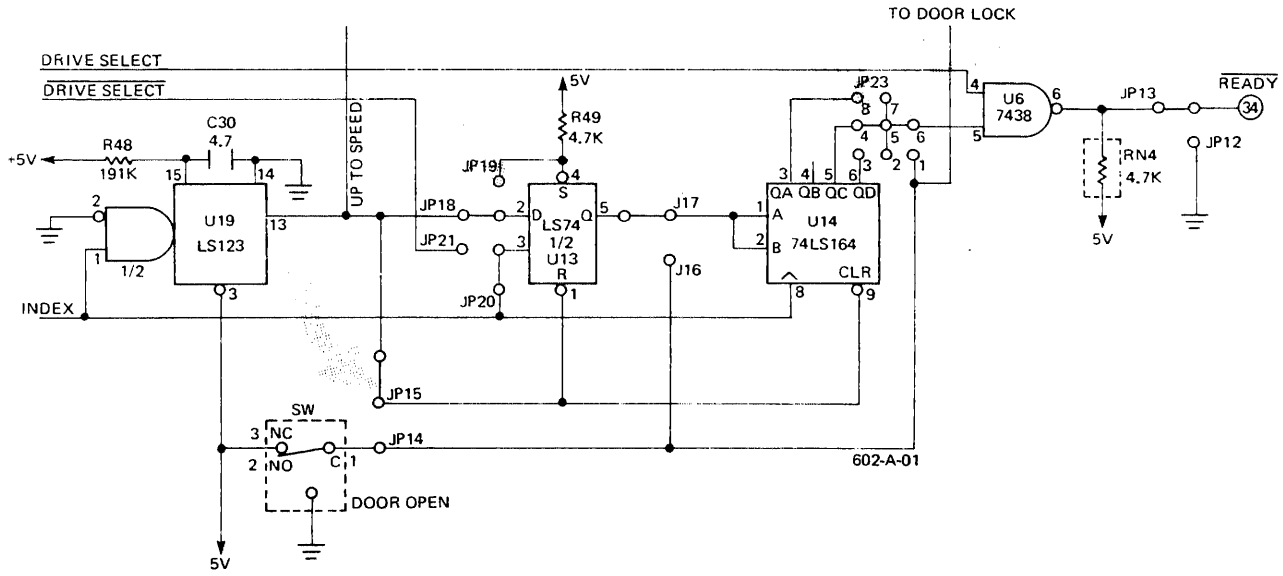


Figure 17. READY Delayed (600-800 ms)

READY - Industry Standard Configuration

In this configuration, as shown in Figure 18, the following jumpers are installed: JP13, JP14, JP17, JP19, JP21, JP23 pins 7,8 and 5,6. A READY signal indicates that (1) the door is closed, (2) the door has not been opened since the drive was last deselected, and (3) an INDEX pulse has been sensed after conditions 1 and 2 were met.

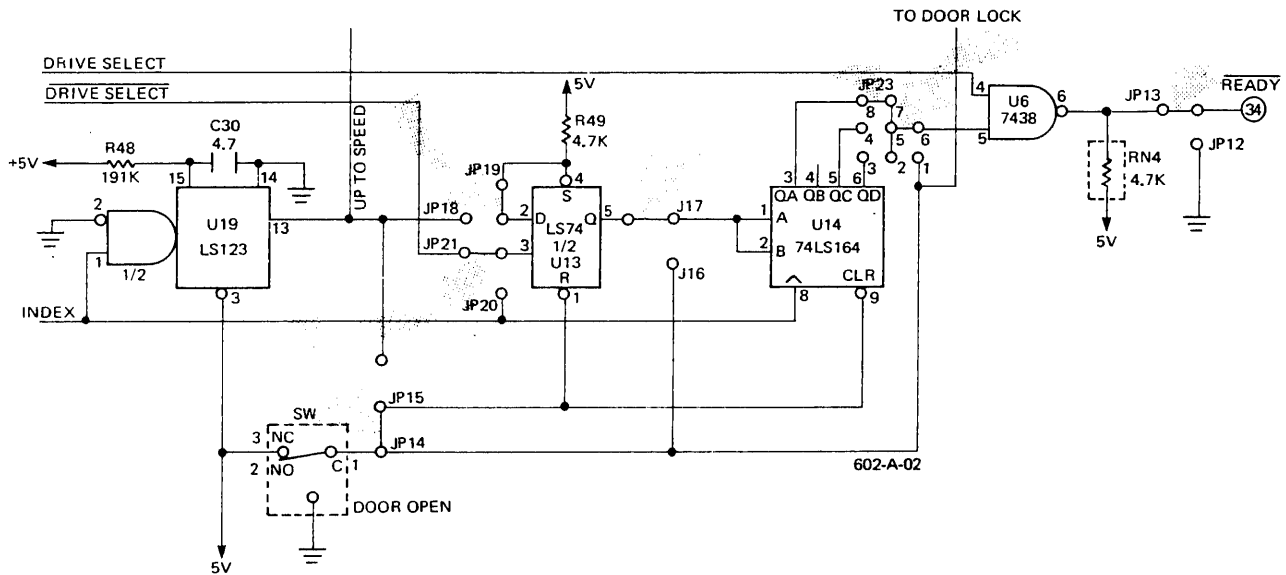
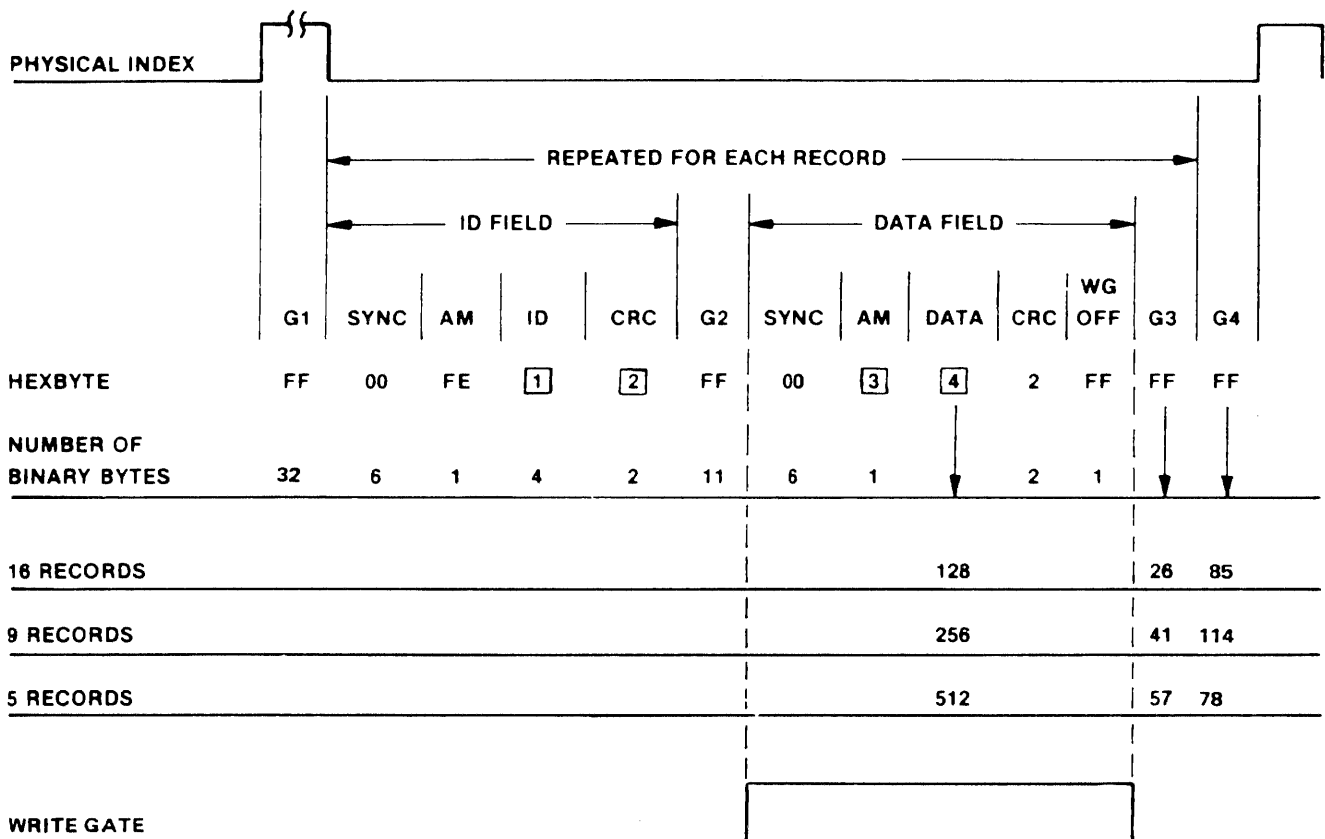


Figure 18. READY - Industry Standard Configuration

RECORDING FORMAT

FM FORMAT

The data format is totally a function of the host system. The figure below shows the recommended soft sector format using Frequency Modulation (FM) as the recording mode. The format described is similar to the IBM format with the inter-record gaps G1 and G4 modified and the index mark omitted. All drive tolerances have been accommodated in developing this format.



443-A-02

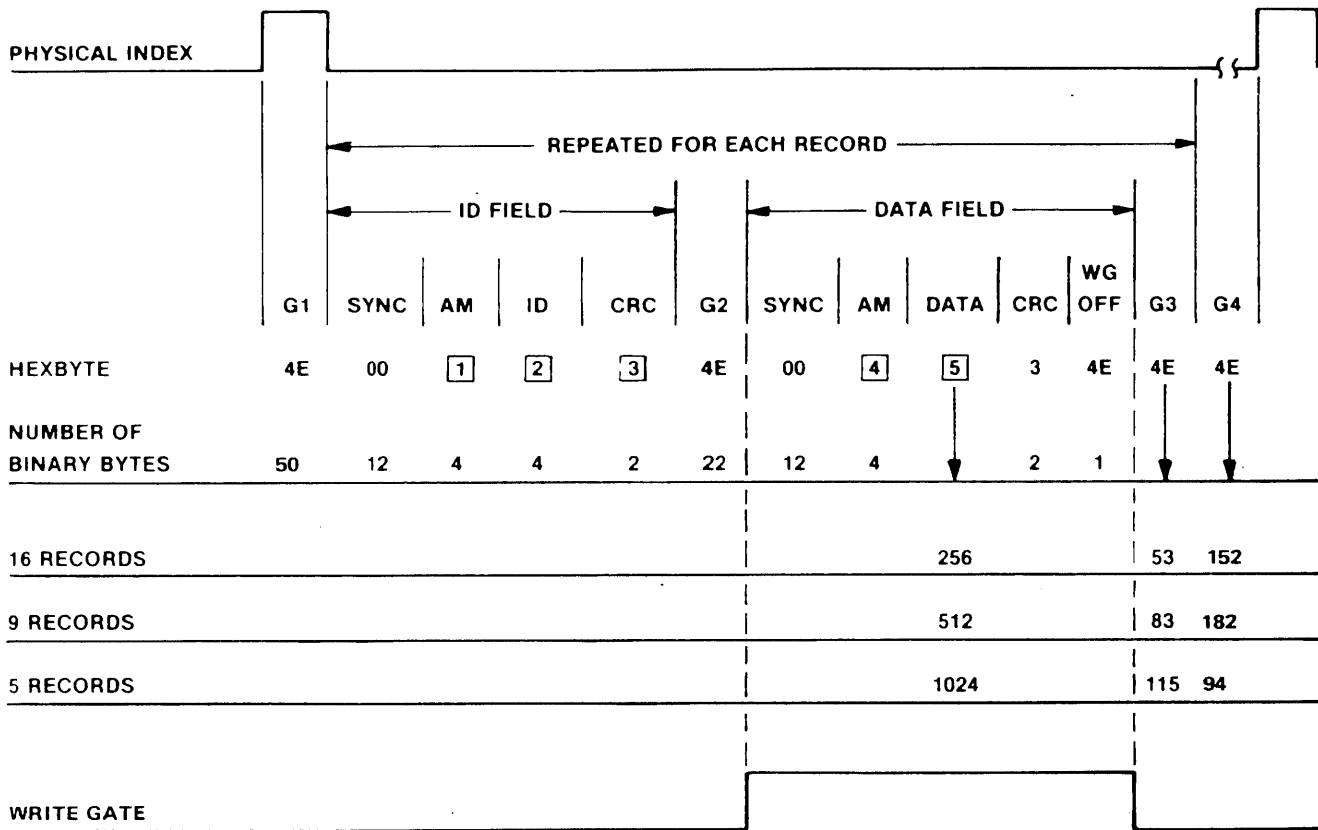
- Notes:
1. Cylinder number, head number, record number, physical record length.
 2. Generated by CRC generator (IBM) $G(X) = X^{16} + X^{12} + X^5 + 1$
 3. FB for data field or F8 for deleted data field with missing clock.
 4. User data.

Figure 19. Soft Sectored Format (FM)

RECORDING FORMAT

MFM FORMAT

The data format for Modified Frequency Modulation (MFM) is also totally a function of the host system. The figure below shows the recommended soft sector format using MFM as the recording mode. The format described is similar to the IBM double density format with the inter-record gaps G1 and G4 shortened and the index mark omitted. All drive tolerances have been accommodated in developing this format.



444-A -01

- Notes:
1. ID Addressmark "A1A1A1FE" with missing clock.
 2. Cylinder number, head number, record number, physical record length.
 3. Generated by CRC Generator. $G(X) = X^{16} + X^{12} + X^5 + 1$.
 4. Data Addressmark "A1A1A1FB" with missing clock. Deleted Data Addressmark "A1A1A1F8" with missing clock.
 5. User data.

Figure 20. Soft Sectored Format (MFM)

MAINTENANCE

PREVENTIVE MAINTENANCE

Under normal conditions the QumeTrak 592 does not require periodic adjustment. However, cleanliness is extremely important to the proper care of the disk drive. Always look for dirt and corrosion, as well as wear, binds, and loose connections.

CAUTION

The head/carriage is a factory adjusted and tested assembly. Do not try to repair this internal component.

Keep the disk drive as free from dirt as possible. Place the unit in a clean plastic bag or sealable box for storage. The entire drive should be cleaned every six months. Always use a clean, lint-free cloth.

A general service check should be made on the QumeTrak 592 every two years. The servicing of each assembly is described in the following section. During the service check inspect the main frame for loose connectors, switches, and other components. Secure all loose parts.

MAINTENANCE AND ADJUSTMENT TOOLS

The tools listed in the table below are required to perform general maintenance and adjustment procedures for the QumeTrak 592. The tools are available at most hardware stores; the test instruments are standard electronic maintenance equipment.

Table 12. Maintenance and Adjustment Tools

TOOL	SIZE (LENGTH)
PHILLIPS SCREWDRIVER (2)	#1 HEAD, 4 INCH SHANK; #2 HEAD, 4 INCH SHANK
TWEEZERS	4 TO 6 INCHES (NEEDLE POINT)
ALLEN WRENCH	1.5mm
FLAT HEAD SCREWDRIVER	4 INCH SHANK
FEELER GAUGE	0.027 INCH (0.7 MM)
CE DISKETTE	Q.P.N. 53067-01
MULTIMETER	
OSCILLOSCOPE	TEKTRONICS 465 OR EQUIVALENT
DISKETTE EXERCISER	SYSTEM CONTROLLER OR DRIVE EXERCISER/TESTER

MAINTENANCE

INTERNAL CONNECTIONS

The drive internal connections between the PCB, various transducers (sensors, stepper motor, solenoid), and the R/W heads are established by way of two connectors: transducer connector J3 and head connector J4. Tables 13 and 14 correlate pin assignments, signal names, and wire colors.

Refer to the INTERFACE section for external drive connection information.

Table 13. Transducer (J3) Connector Wiring Table

PIN NO.	SIGNAL NAME	COLOR
A1	DC MOTOR	BLUE
B1	DC MOTOR	RED
A2	FRAME GROUND	BROWN
B2	DC MOTOR	BLACK
A3	RESERVED	
B3	RESERVED	
A4	HEAD LOAD SOLENOID	GREEN
B4	HEAD LOAD SOLENOID	WHITE
A5	STEPPER MOTOR	BLACK
B5	STEPPER MOTOR	RED
A6	STEPPER MOTOR	YELLOW
B6	STEPPER MOTOR	RED
A7	STEPPER MOTOR	BROWN
B7	STEPPER MOTOR	ORANGE
A8	NOT USED	
B8	POLARIZING KEY	
A9	TRACK 00 LAMP	BLACK
B9	TRACK 00 LAMP	GREEN
A10	IN USE DISPLAY LAMP	BLACK
B10	IN USE DISPLAY LAMP	RED
A11	INDEX LAMP	BLACK
B11	INDEX LAMP	WHITE
A12	INDEX SENSOR	BLACK
B12	INDEX SENSOR	BLUE
A13	WRITE PROTECT LAMP	BLACK
B13	WRITE PROTECT LAMP	YELLOW
A14	WRITE PROTECT SENSOR	BLACK
B14	WRITE PROTECT SENSOR	ORANGE
A15	TRACK 00 SENSOR	BLACK
B15	TRACK 00 SENSOR	BROWN

Table 14. Head Connector (J4) Pin Assignments

PIN NO.	SIGNAL NAME	COLOR
A1	SHIELD (HEAD 0)	BLACK
B1	SHIELD (HEAD 1)	BLACK
A2	NOT USED	
B2	KEY	
A3	ERASE HEAD 0	RED
B3	ERASE HEAD 1	RED
A4	ERASE RETURN (HEAD 0)	GREEN
B4	ERASE RETURN (HEAD 1)	GREEN
A5	R/W HEAD 0	BLACK
B5	R/W HEAD 1	BLACK
A6	NOT USED	
B6	NOT USED	
A7	R/W HEAD 0	WHITE
B7	R/W HEAD 1	WHITE

TEST POINTS

Available on the PCB are a number of test points in the form of wire wrap pins for easy attachment of test equipment. Test point designators and signal names are identified in Table 15 as they are silkscreened on the PCB and called out in the schematic diagrams.

Table 15. Test Points

PIN NO.	SIGNAL NAME
GND	GND
1	Read/Write Head
2	Read/Write Head
3	INDEX
4	ERASE
5	TRACK 00
6	Write Protect
7	Read Data

MAINTENANCE

ILLUSTRATED ASSEMBLIES AND PARTS LOCATIONS

The following pages show the location of various disk drive components that are described in the REMOVAL AND REPLACEMENT PROCEDURES. It is recommended that the technician become familiar with these components and their locations before continuing further into the MAINTENANCE section. Please note that part numbers are supplied for those components available from Qume. Piece parts for which no part number is provided can only be purchased as part of a larger assembly. For additional information on service and repair policies, training policies, and spare parts pricing and availability, see the Memory Products Service and Spares Catalog, Reorder Number 37052.

Upper Unit Components

ITEM	QUME PART NO.	DESCRIPTION
1	53030-01	Stepper Motor Assembly
2	53050-01	Carriage Assembly
3	53036-01	Guide Bar
4		Carrier Assembly
5		Front Bezel Assembly
6		Casting
7	53010-01	Track 00 Sensor Assembly (not visible)
8	53019-01	Write Protect Assembly
9	53020-01	Index Sensor Assembly (not visible)
10	53025-01	Head Load Solenoid Assembly
11	53034-01	Media Guide
12		Terminal Ground Assembly
13		J3 Connector Housing Assembly
14	90756	Printed Circuit Assembly (note 1)
15		Guide Bar Clamp
16		Cable Tie
17		In Use LED Assembly
18		Front Door Assembly
19		J4, Read/Write Head Connector
20		Shield
21		Insulating Pad

Note:

(1) Contact your Qume Sales Representative for information on specific PCB configurations.

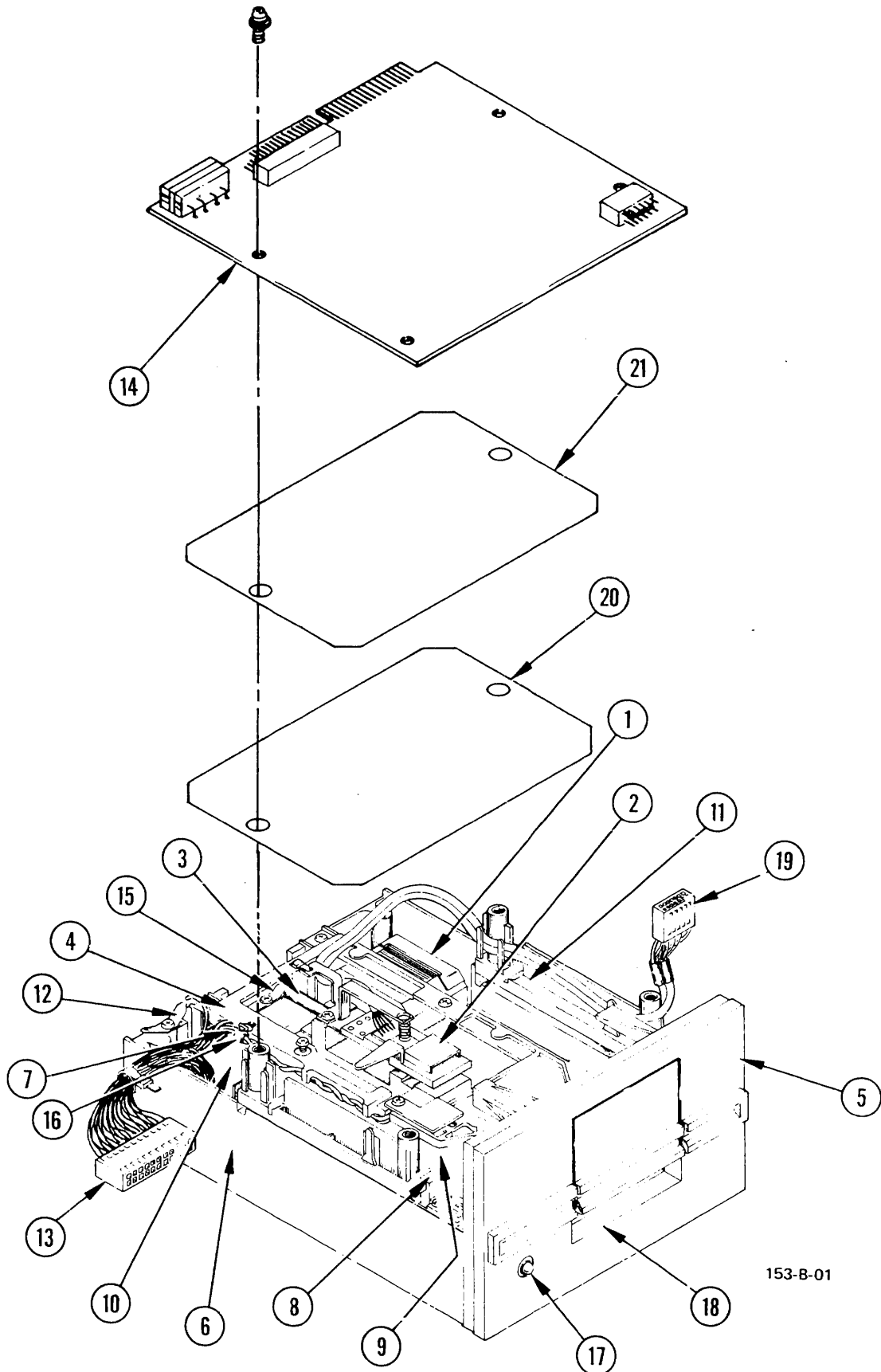
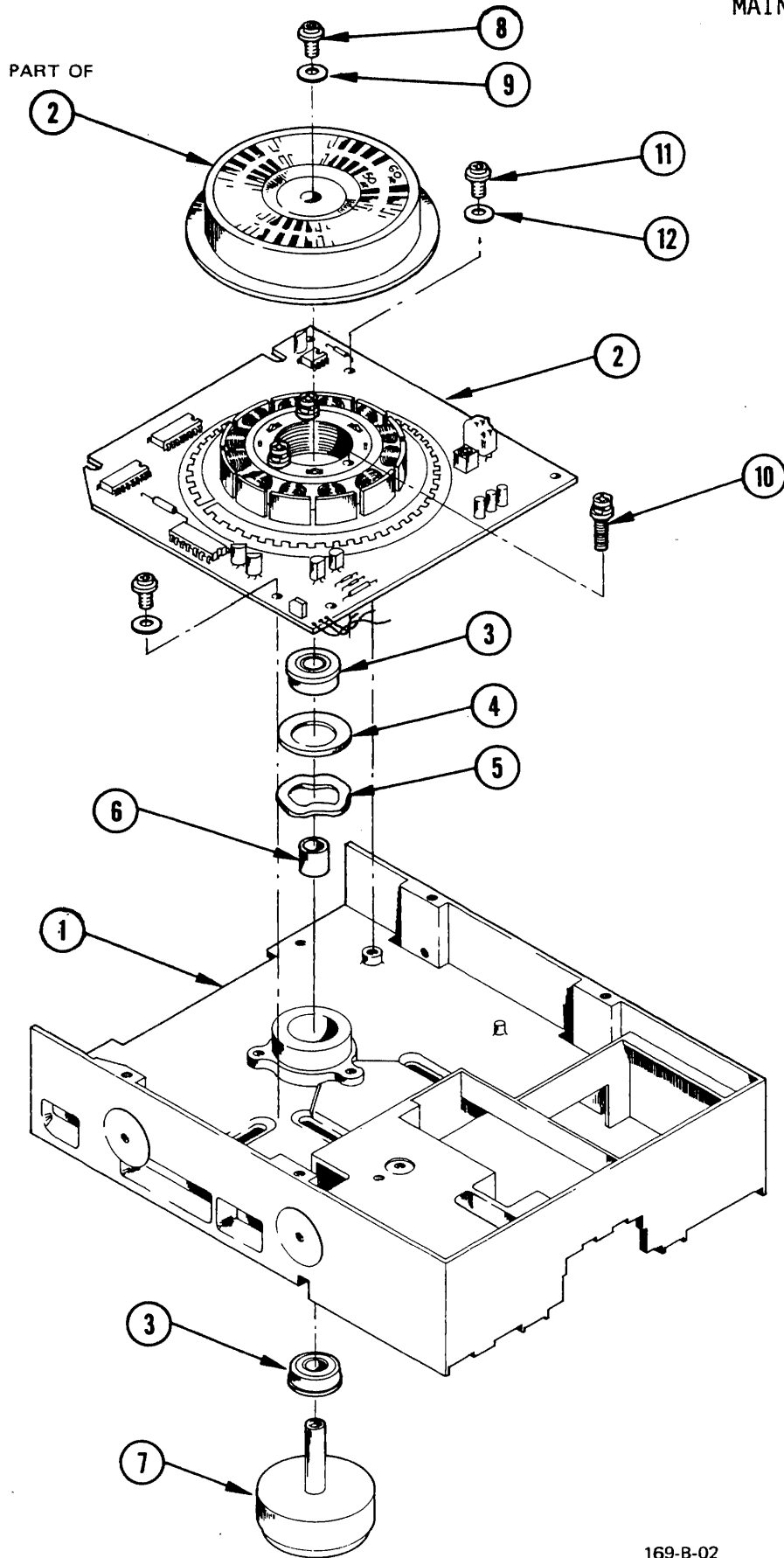


Figure 21. Upper Unit Components

MAINTENANCE

Spindle Motor Components

ITEM	QUME PART NO.	DESCRIPTION
1		Frame
2		Spindle Motor
3		Bearing
4		Spindle Washer
5		Wave Washer
6		Collar
7		Spindle Hub
8	55173-08	Screw
9	55200-08	Washer
10		Screw
11		Screw
12		Washer



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Figure 22. Spindle Motor Components

MAINTENANCE

Head Carriage and Stepper Motor Components

ITEM	QUME PART NO.	DESCRIPTION
1	53030-01	Stepper Motor
2	53050-01	Head Carriage
3	53036-01	Guide Bar
4		Guide Bar Clamp
5	55173-08	Screw
6		Washer
7		Steel Belt Assembly
8		C-Clamp
9	55181-04	Screw

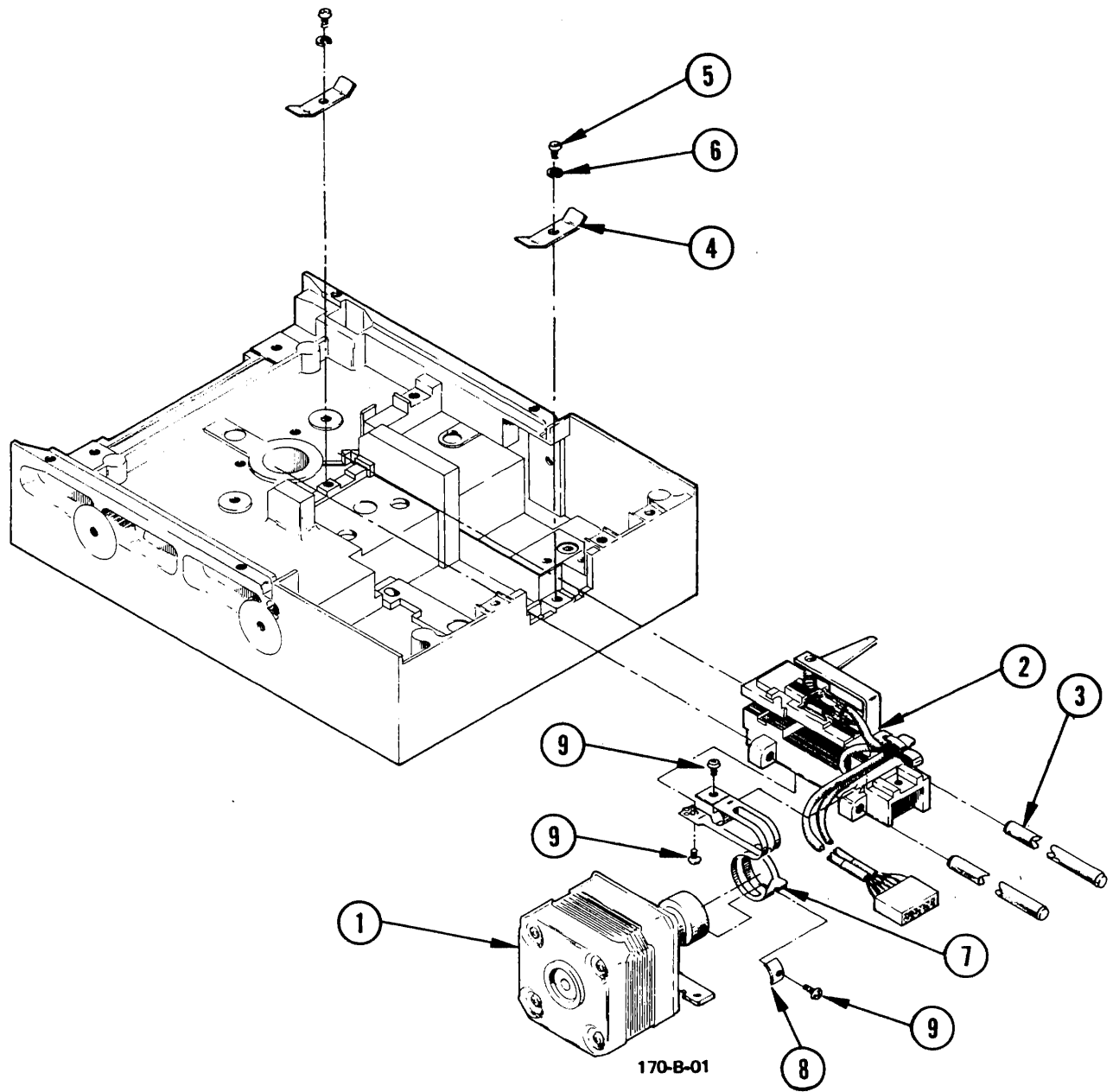


Figure 23. Head Carriage and Stepper Motor Components

MAINTENANCE

Head Load Solenoid and Electronic Sensor Components

ITEM	QUME PART NO.	DESCRIPTION
1	53025-01	Head Load Solenoid
2	55173-12	Screw
3	53020-01	Index Sensor
4	55163-08	Screw
5	53010-01	Track 00 Sensor
6	53019-01	Write Protect Sensor

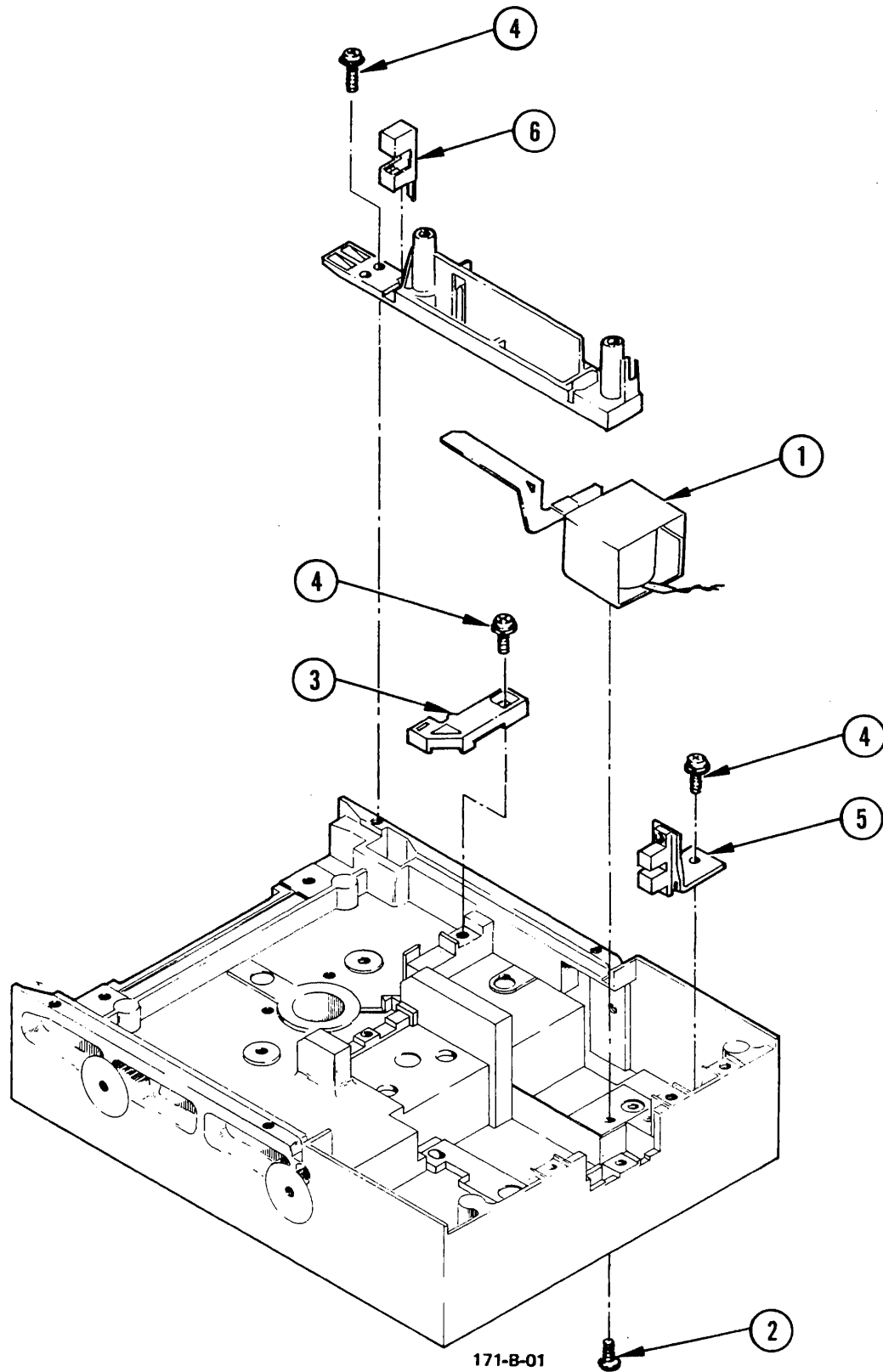


Figure 24. Head Load Solenoid and Electronic Sensor Components

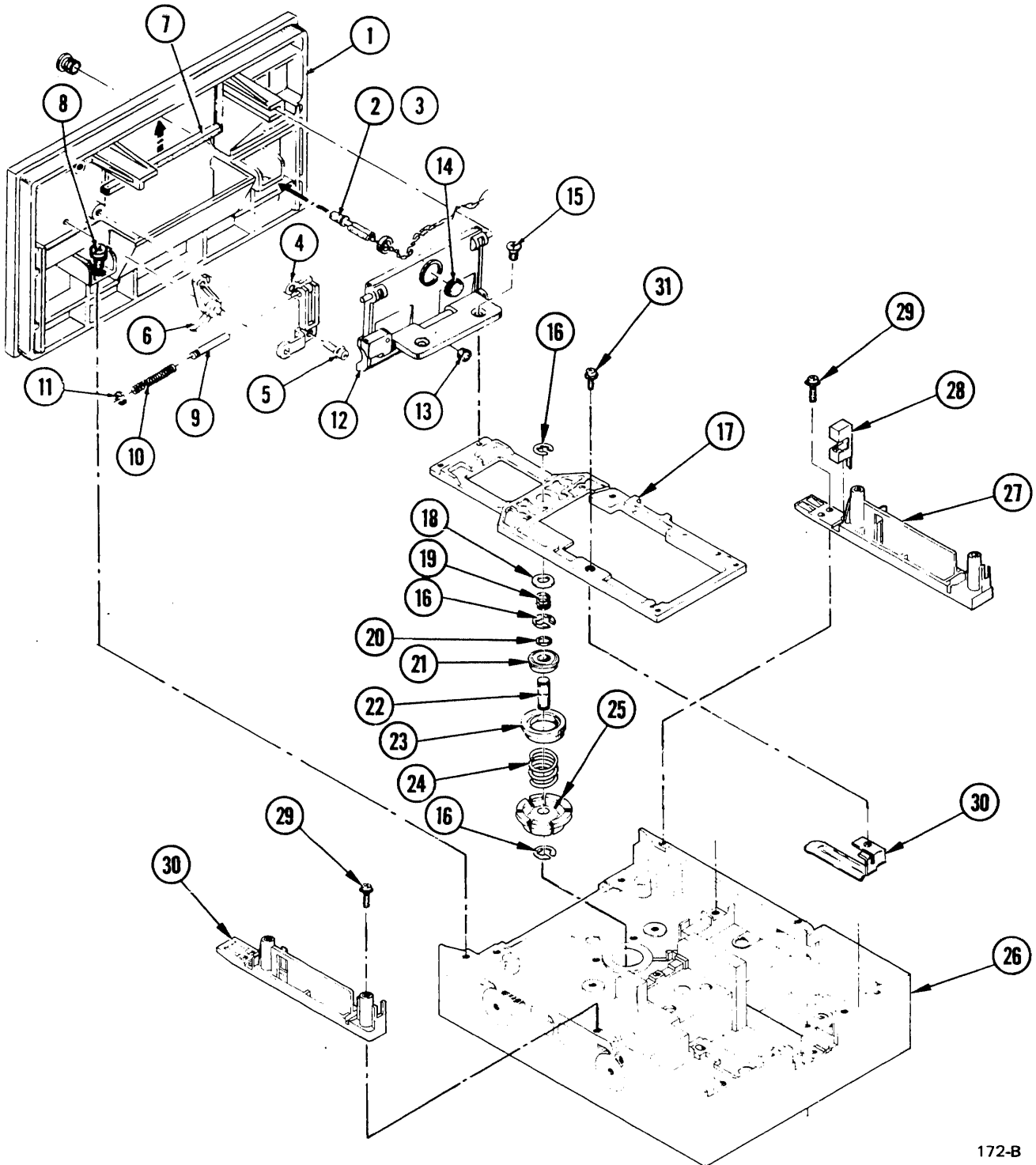
MAINTENANCE

Front Bezel and Door, Carrier and Collet, and Media Guide Components

ITEM	QUME PART NO.	DESCRIPTION
1		Front Bezel Subassembly
2		LED Assembly (includes item 3)
3		LED
4		Anti-Crunch Holder
5		Screw
6		Anti-Crunch Lever
7		Rubber Bumper
8	55173-08	Screw
9		Door Stop Pin
10		Pin Return Spring
11		E-Ring
12		Front Door Assembly
13		Media Push Rubber
14		Door Bumper
15		Screw
16		E-Ring
17		Carrier
18		Washer
19		Cone Spring
20		Shim
21		Bearing
22		Shaft
23		Cone
24		Collet Spring
25		Collet
26		Chassis
27	53034-01	Left Media Guide
28	53019-01	Write Protect Sensor
29	55163-08	Screw
30	53034-01	Right Media Guide
31	55173-06	Screw
32	53074-01	Media Lifter

Parts unique to the QumeTrak 592 B:

QUME PART NO.	DESCRIPTION
	Front Door
	Door Clamp
	Collet
	Collet Cone
	Collet Shaft
	Cone Spring
	Front Bezel
	Media Lifter Shim
	Frame Spacer
	Front Door Shim
	Front Door Assembly
	Carrier
	Frame Casting



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Figure 25. Front Bezel and Door, Carrier and Collet, and Media Guide

REMOVAL AND REPLACEMENT PROCEDURES

Printed Circuit Board

1. Disconnect the DC power cable connector J2, the data cable connector J1, the transducer cable connector J3, and the R/W head cable connector J4 from the PCB.
2. Remove the four screws securing the PCB to the drive. Remove the PCB.
3. Reverse the procedure for installation.

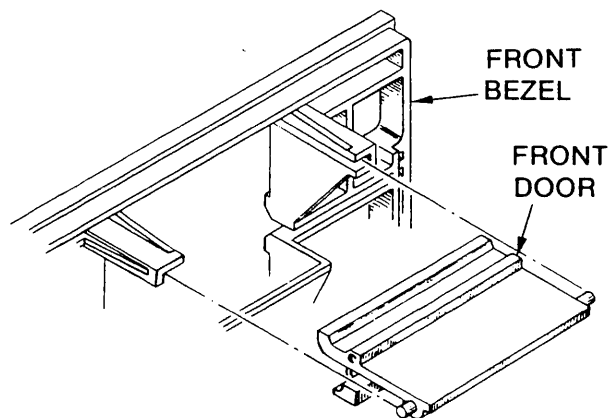
Front Door Assembly

Removal (refer to the illustration below)

1. Remove the diskette if installed, and the PCB (refer to the Printed Circuit Board paragraph).
2. Remove the two screws securing the front door to the carrier assembly.
3. Slide the front door toward the back of the drive to separate it from the front bezel assembly.

Installation (refer to the illustration below)

1. While holding the carrier assembly down, slide the front door into the slot located on the back of the front bezel assembly.
2. When the front door is in place, the door hinge should rest on the top front edge of the carrier. Secure the front door to the carrier with two screws.
3. Install the PCB (refer to the Printed Circuit Board paragraph).



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Figure 26. Front Door Installation

Front Bezel Assembly

Removal

1. Remove the diskette if installed, the PCB, and front door assembly (refer to the Printed Circuit Board and Front Door assembly paragraphs).
2. Remove the two screws securing the front bezel to the main frame.
3. Carefully remove the front bezel from the main frame, being aware that the In Use LED is still secured to the front bezel.
4. With a small screw driver, carefully lift one edge of the LED collar from the LED holder (refer to the illustration below).

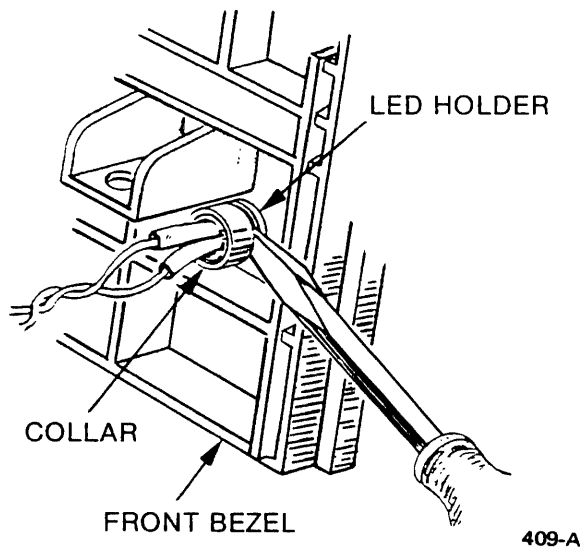
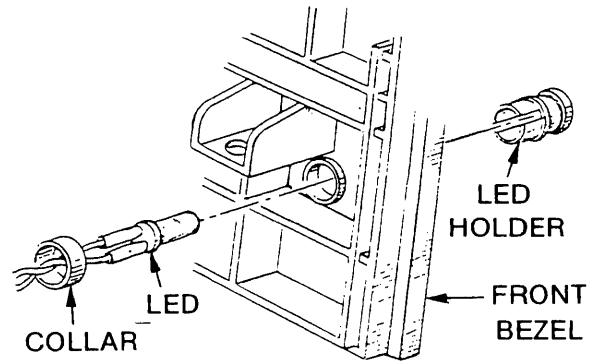


Figure 27. In Use LED Removal

5. Push the In Use LED through the front bezel to break the LED holder loose from the LED collar.
6. Remove the LED holder from the LED. Push the LED back through the front bezel.

Replacement

1. Push the In Use LED through the front bezel.
2. Press the LED holder onto the LED.
3. Push the LED and LED holder into the front bezel. Secure the In Use LED to the front bezel by slipping the LED collar over the LED holder. Be sure the In Use LED is secure in the front bezel (refer to the following illustration).



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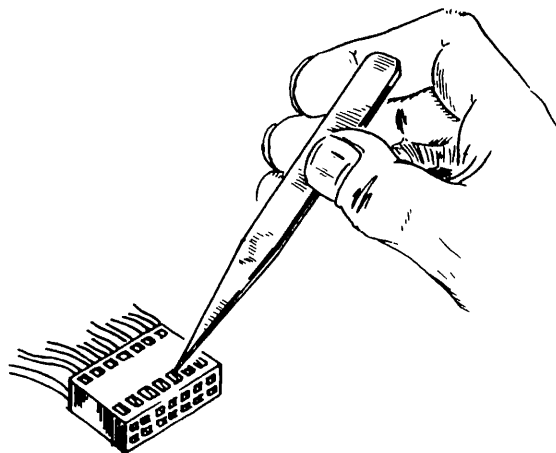
Figure 28. In Use LED Installation

4. Place the front bezel on the main frame and secure with two screws.
5. Install the front door assembly and PCB (refer to the Front Door Assembly and Printed Circuit Board removal descriptions).

In Use LED

Removal

1. Remove the diskette if installed, the PCB, and front bezel assembly (refer to the Printed Circuit Board and Front Bezel Assembly paragraphs).
2. Cut the tie wrap securing the wires near the base of transducer cable connector J3.
3. Remove the two In Use LED leads from connector J3 by pushing down on the LED lead tabs in the connector with tweezers: black to A10, red to B10 (refer to the illustration below).



020-A

Figure 29. Connector Lead Removal (typical)

4. Separate the two In Use LED leads from the transducer cable, and remove the LED as described in the front bezel assembly removal paragraph. Note the routing of the leads along the cable for later replacement.

Replacement

1. Install the two In Use LED leads in connector J3 (refer to step 3, Removal). Be sure the locking tabs on the leads engage in the connector slots. This will prevent the leads from being pushed out when the connector is plugged into the PCB.
2. Secure the two leads to the transducer cable with a tie wrap near the base of connector J3.
3. Route the In Use LED leads along the transducer cable.
4. Install the In Use LED in the front bezel, (refer to the Front Bezel Assembly Replacement paragraph). Install the front bezel on the main frame.
5. Install the PCB (refer to the Printed Circuit Board paragraph).

Media Guides

Removal

1. Remove the diskette if installed, the PCB, insulating pad, and shield (refer to the Printed Circuit Board removal description).
2. Remove the two R/W head cables (connector J4) from the right media guide (as viewed from the front of the disk drive). Note how the cables are attached to the guide for later replacement.
3. Remove the two screws securing the right media guide to the main frame and remove the guide.
4. Remove the two screws securing the left media guide to the main frame.
5. Carefully remove the left media guide from the main frame, being aware that the write protect sensor and lamp are still secured to the guide. Note how the write protect lamp leads are routed between the guide and the main frame for later replacement.
6. Remove the write protect sensor and lamp from the media guide.

Replacement

1. Install the write protect sensor and lamp in the left media guide. The lamp (yellow and black leads) is installed from the top, and the sensor (orange and black leads) is installed from the bottom.
2. Install the left media guide in the main frame. Be sure the write protect lamp leads are routed between the guide and the main frame through the indentation on the guide.

MAINTENANCE

3. Secure the media guide to the main frame with two screws.
4. Install the right media guide on the main frame and secure with two screws.
5. Attach the two R/W head cables to the right media guide. The cable to side A of connector J4 should be above the cable to side B of the connector. Make sure that the cables do not scrape the carrier when the carriage moves.
6. Install the PCB (refer to the Printed Circuit Board paragraph).

Write Protect Sensor And Lamp Assembly

Removal

1. Remove the diskette if installed, and the PCB (refer to the Printed Circuit Board paragraph).
2. Remove the two screws securing the left media guide, as viewed from the front of the disk drive, to the main frame.
3. Carefully remove the left media guide from the main frame, being aware that the write protect sensor and lamp leads are routed between the guide and the main frame.
4. Remove the write protect sensor and lamp from the media guide.
5. Cut the tie wrap securing the wires near the base of transducer cable connector J3.
6. Remove the four write protect sensor and lamp leads from connector J3 by pushing down on the sensor and lamp lead tabs in the connector with tweezers: (sensor) black to A14, orange to B14, (lamp) black to A13, yellow to B13.
7. Separate the four write protect sensor and lamp leads from the transducer cable, and remove the sensor and lamp. Note the routing of the leads along the cable for later replacement.

Replacement

1. Install the four write protect sensor and lamp leads in connector J3 (refer to step 6 above, Removal). Be sure the locking tabs on the leads engage in the connector slots. This will prevent the leads from being pushed out when the connector is plugged into the PCB.
2. Secure the four leads to the transducer cable with a tie wrap near the base of connector J3.
3. Route the write protect sensor and lamp leads along the transducer cable.
4. Snap the write protect sensor into the recess in the left media guide. The sensor should sit flat in the recess. The lamp (yellow and black

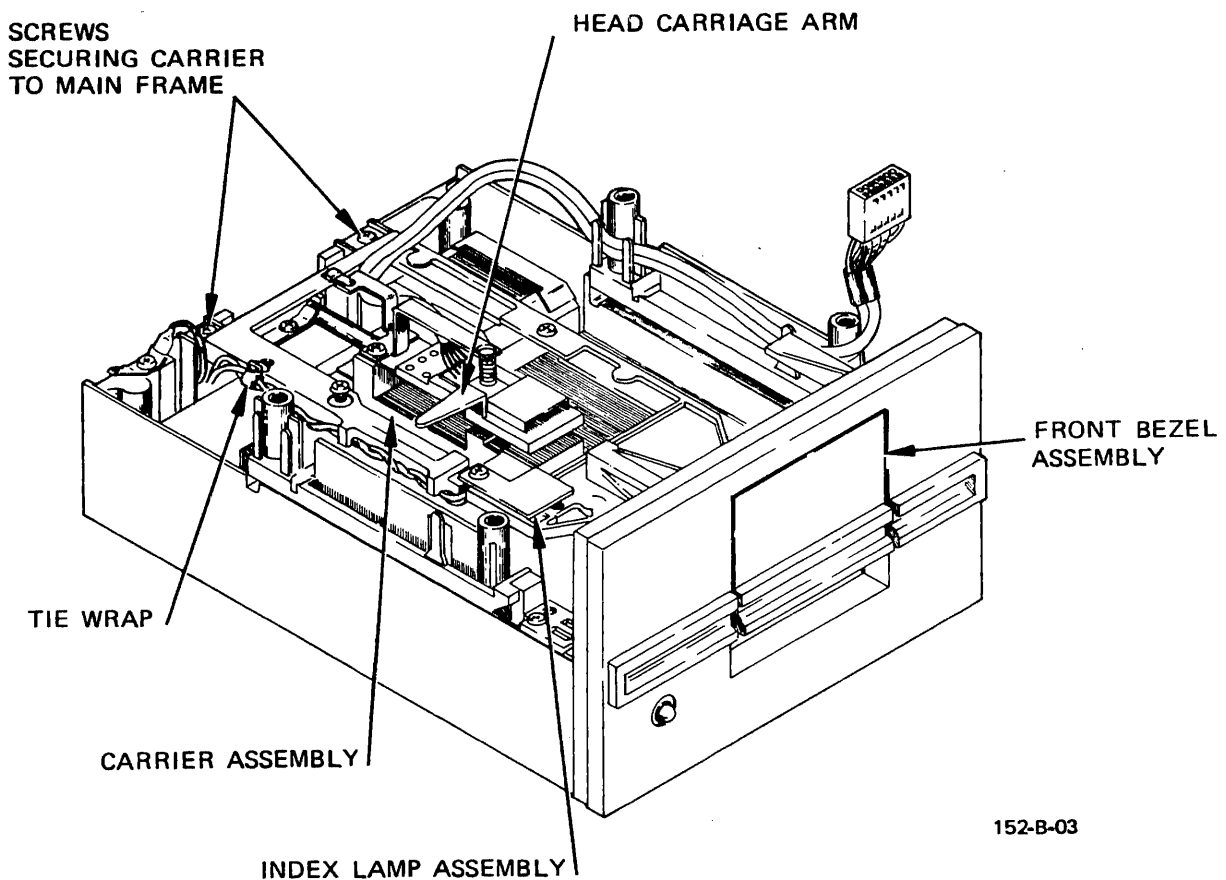
leads) is installed from the top, and the sensor (orange and black leads) is installed from the bottom.

5. Install the left media guide on the main frame. Be sure the write protect lamp leads are routed between the guide and the main frame through the indentation on the guide.
6. Secure the media guide to the main frame with two screws.
7. Install the PCB (refer to the Printed Circuit Board paragraph).

Carrier Assembly

Removal (refer to the illustration below)

1. Remove the diskette if installed, PCB, insulating pad, shield, and the front door assembly (refer to the Printed Circuit Board and Front Door removal descriptions).
2. Unscrew the index lamp PCB and detach it from the carrier assembly.



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Figure 30. Carrier Assembly Removal and Replacement

MAINTENANCE

3. Cut the tie wrap and remove the index lamp lead from the carrier assembly. Note the location of the tie wrap and the manner in which the lead is routed along the carrier for later replacement.
4. Remove the two R/W head cables (connector J4) from the right media guide. To ensure correct replacement, note the exact routing of the cables.
5. Remove the two screws securing the carrier to the main frame.
6. Carefully slide the carrier out from under the head carriage arm and the leads for R/W connector J4. Remove the carrier assembly.

Replacement (refer to Figure 30, Carrier Assembly Removal and Replacement)

1. Carefully install the carrier assembly under the head carriage arm and over the leads for the R/W connector. Position the carrier on the main frame, making certain that the door is centered and flush with the bezel. Secure the carrier with two screws.
2. Route the index lamp lead along the carrier as shown and install a new tie wrap.
3. Reposition the index lamp PCB into the recess on the carrier. Press the index lamp PCB towards the front bezel before screwing it to the carrier.
4. Install the front door assembly (refer to the Front Door Assembly description).
5. Adjust the R/W head gap to 0.5 ± 0.2 mm by rotating the carrier stop screw while observing the head gap with the door closed. Turning the stop screw clockwise will bring the heads closer together.

CAUTION

Do not allow the R/W heads to come together without a clean piece of paper or a diskette inserted between the head surfaces.

6. Install the shield, insulating pad, and PCB (refer to the Printed Circuit Board replacement description).
7. Adjust the index sensor (refer to the ADJUSTMENTS section).

Collet Assembly

Removal (refer to Figure 31, Collet Assembly Removal and Replacement)

1. Remove the diskette if installed, the PCB, front door assembly, and carrier assembly (refer to the Printed Circuit Board, Front Door Assembly, and Carrier Assembly paragraphs).

2. Remove the E-ring securing the collet assembly to the carrier and remove the carrier.
3. Remove the E-ring at other end of the collet shaft to remove the collet assembly.

Replacement

1. Install the collet assembly parts on the shaft as shown in the Collet Assembly illustration.
2. Install the carrier on the collet assembly and secure with an E-ring.
3. Install the carrier assembly, front door assembly, and PCB on the disk drive (refer to the Carrier Assembly, Front Door Assembly, and Printed Circuit Board replacement instructions).

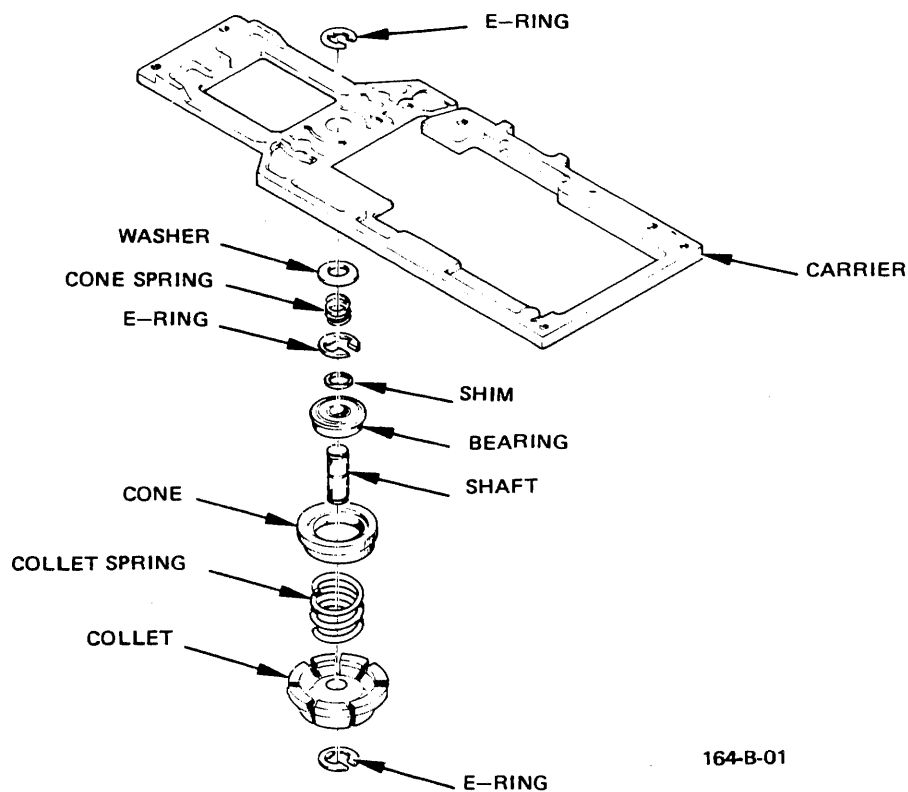


Figure 31. Collet Assembly Removal and Replacement

Spindle Components

Removal (refer to Figure 32, Spindle Components Removal and Replacement)

1. Remove the diskette if installed. Remove the PCB, insulated pad, shield,

MAINTENANCE

front door assembly, and carrier assembly (refer to the Printed Circuit Board, Front Door Assembly, and Carrier Assembly removal instructions) only if the spindle hub, bearing, and collar are to be removed.

2. If the PCB has not been removed, disconnect transducer cable connector J3 from the PCB.
3. Separate the three drive motor leads from connector J3 by pushing down on the switch lead tabs in the connector with tweezers: red to B1, black to B2, and blue to A1. Separate these leads from the transducer cable by cutting the tie wrap near the base of connector J3.
4. Remove the screw and washer securing the spindle. Remove the spindle.
5. With the spindle removed, remove the three screws still securing the spindle motor to the main frame.
6. Remove the two screws securing the spindle motor PCB to the chassis.
7. Remove the drive motor and PCB assembly, being careful not to damage the board on the copper shield.
8. Remove the desired spindle components.

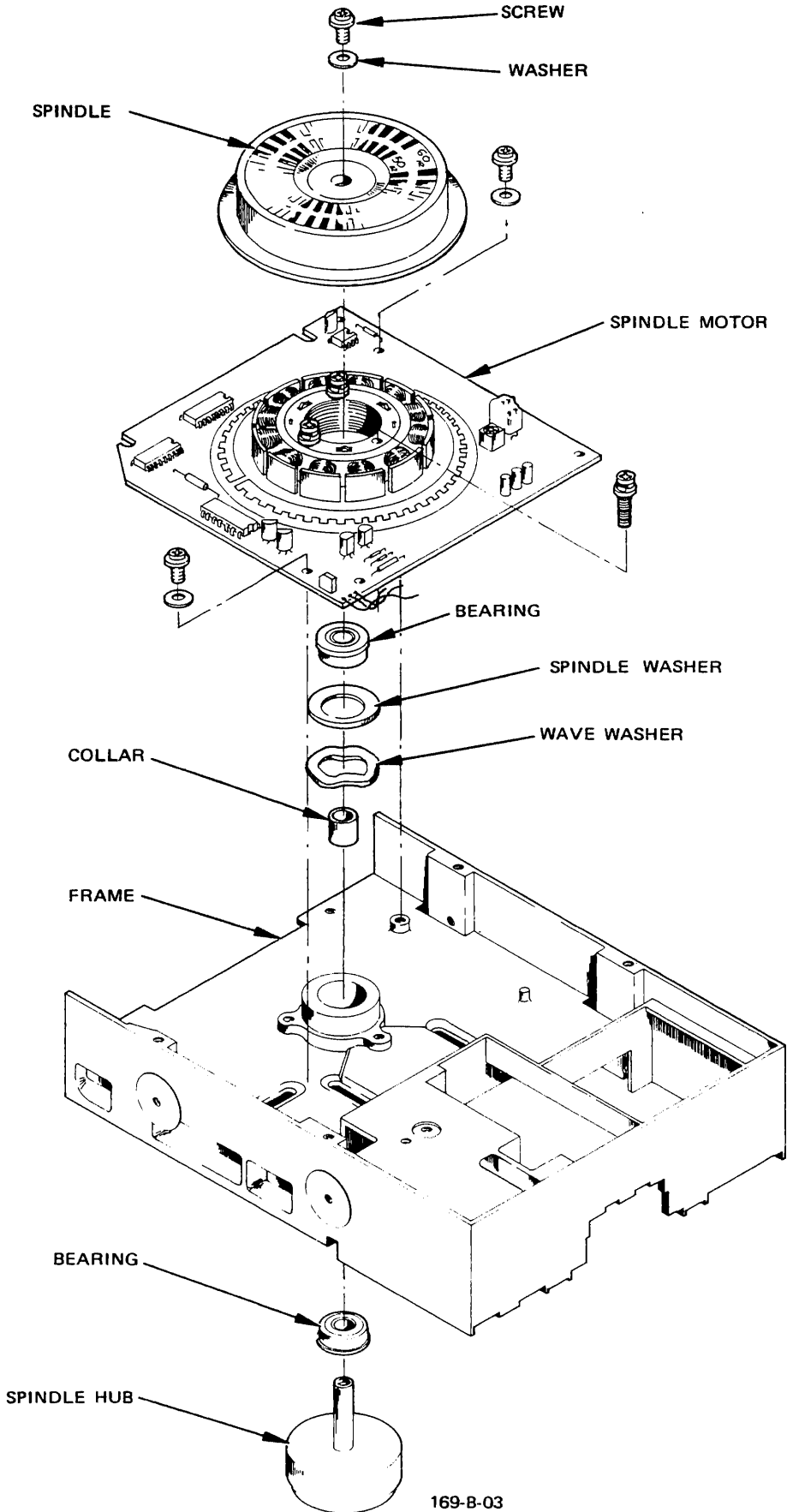
Replacement (refer to Figure 32, Spindle Components Removal and Replacement)

1. Install the spindle hub, bearing, and collar, if removed.
2. Install the wave washer, spindle washer, bearing, and spindle motor PCB as shown.
3. Secure the spindle motor PCB to the drive chassis with five screws.
4. Replace the spindle and secure with a screw and washer.
5. If the spindle hub, bearing, and collar were removed, install the carrier assembly, front door assembly, shield, insulating pad, and PCB (refer to the Carrier Assembly, Front Door Assembly, and Printed Circuit Board replacement sections).

Index Sensor and Lamp Assemblies

REMOVAL

1. Remove the diskette if installed, the PCB, insulating pad, and shield (refer to the Printed Circuit Board removal instructions).
2. Remove the screw and washer securing the index sensor assembly to the main frame. Remove the sensor. Note how the two sensor leads (blue and black) are routed along the main frame to the transducer cable connector J3.



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Figure 32. Spindle Components Removal and Replacement

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3. Cut the tie wrap securing the wires near the base of connector J3.
4. Remove the four index sensor and lamp leads from connector J3 by pushing down on the sensor and lamp lead tabs in the connector with tweezers: (sensor) black to A12, blue to B12, (lamp) black to A11, white to B11.
5. Separate the four index sensor and lamp leads from the transducer cable, and remove the sensor and lamp.

REPLACEMENT

1. Install the four index sensor and lamp leads in connector J3 (refer to step 4 above, REMOVAL). Be sure the locking tabs on the leads engage in the connector slots. This will prevent the leads from being pushed out when the connector is plugged into the PCB.
2. Secure the four leads to the transducer cable with a tie wrap near the base of connector J3.
3. Install the index sensor in the main frame shown in the illustration below. Press the sensor toward the front bezel and secure the sensor with a screw and washer.
4. Install the carrier assembly and index lamp (refer to the Carrier Assembly paragraph).
5. Install the front door assembly and PCB (refer to the Front Door Assembly and Printed Circuit Board paragraphs).
6. Adjust the index sensor with the index lamp (refer to the ADJUSTMENTS section).

Head Load Solenoid Assembly

Removal

1. Remove the diskette if installed, the PCB, insulating pad, shield, front door assembly, and carrier assembly, (refer to the Printed Circuit Board, Front Door Assembly, and Carrier Assembly removal descriptions).
2. Remove the screw on the bottom side of the drive securing the head load solenoid to the main frame. Note how the two solenoid leads are routed along the main frame to the transducer cable connector J3.
3. Cut the tie wrap securing the wires near the base of connector J3.
4. Remove the two head load solenoid leads from connector J3 by pushing down on the solenoid lead tabs in the connector with tweezers: green to A4, white to B4.
5. Separate the two head load solenoid leads from the transducer cable, and remove the solenoid.

Replacement

1. Install the two head load solenoid leads in connector J3 (refer to step 4 above, Removal). Be sure the locking tabs on the leads engage in the connector slots. This will prevent the leads from being pushed out when the connector is plugged into the PCB.
2. Secure the two leads to the transducer cable with a tie wrap near the base of connector J3.
3. Route the two head load solenoid leads along the main frame and install the solenoid. Slide the metal solenoid arm under the head carriage arm. Be sure the boss at the bottom of the solenoid rests in the hole in the frame.
4. Align the bail of the solenoid so that it is parallel with the media support of the frame before tightening the screw that holds the solenoid to the main frame.
5. Apply a small amount of petroleum base, non-Ester grease (Qume Part Number 85596-01) to the top of the bail.
6. Install the carrier assembly, front door assembly, insulating pad, shield, and PCB (refer to the Carrier Assembly, Front Door Assembly, and Printed Circuit Board replacement descriptions).

Direct Drive Spindle Motor Assembly

Removal

1. Remove the diskette if installed and transducer cable connector J3 from the PCB.
2. Separate the three drive motor leads from connector J3 by pushing down on the switch lead tabs in the connector with tweezers; red to B1, black to B2, and blue to A1. Separate these leads from the transducer cable by cutting the tie wrap near the base of connector J3.
3. Remove the screw securing the spindle cap. Remove the cap.
4. Remove the two screws securing the spindle motor PCB to the main frame.
5. With the spindle removed, remove the three screws still securing the spindle motor to the main frame.
6. Remove the drive motor and PCB assembly, being careful not to damage the board on the copper shield.

REPLACEMENT

1. Install the spindle drive motor and PCB on the main frame and secure with three screws. Allign all three screws before tightening.
2. Replace the two screws that secure the drive motor PCB to the main frame.

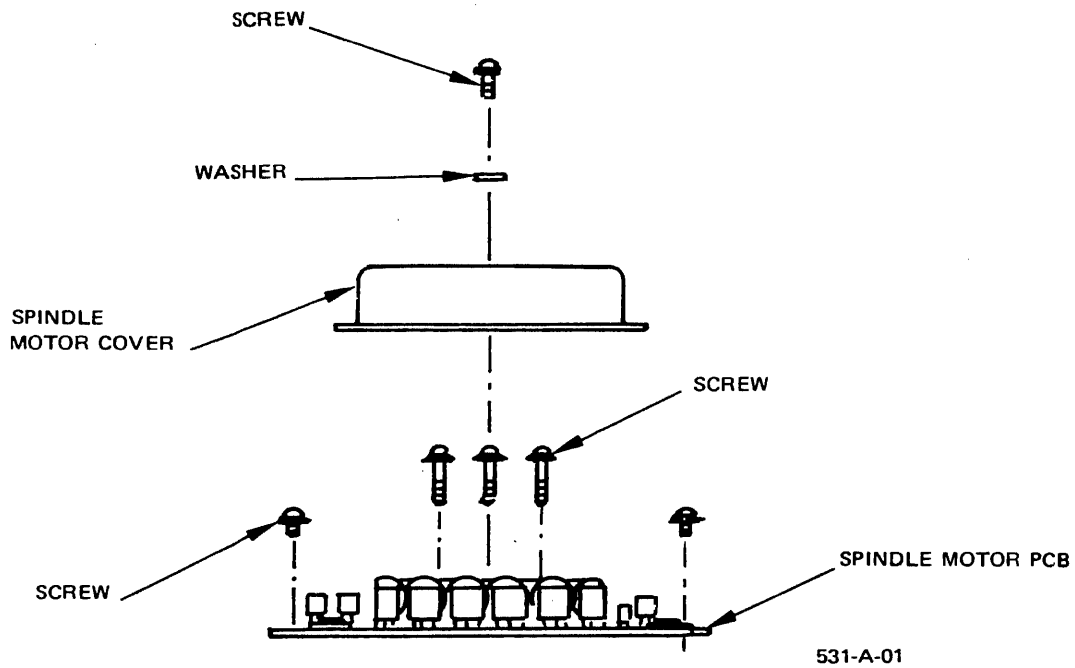


Figure 33. Direct Drive Spindle Motor Assembly Removal and Replacement

3. Install the spindle with one screw. Note that the front door must be closed to install this screw.
4. Route the three drive motor leads through the main frame and reconnect to J3. Replace any tie wraps that were removed.
5. Replace the tie wrap at the base of J3 and any other tie wrap that may have been removed.
6. Install connector J3 on the PCB.
7. Adjust the drive motor (refer to the ADJUSTMENTS section).

Track 00 Sensor and Lamp Assembly

Removal

1. Remove the diskette if installed, the DC power cable connector J2, and transducer cable connector J3 from the PCB. Remove the PCB, insulating pad, and shield.
2. Cut the tie wrap securing the wires near the base of connector J3.
3. Separate the four track 00 sensor leads from connector J3 by pushing down on the switch lead tabs in the connector with tweezers; black to A9, green to B9, black to A15, brown to B15.

4. Remove the screw securing the track 00 sensor bracket to the chassis. Ease the bracket and sensor assembly out of the drive.
5. Remove the two screws securing the track 00 sensor assembly to the sensor assembly frame. Note that the top screw requires a nut.

Replacement

1. Secure the track 00 sensor assembly to the sensor bracket with two screws and one nut.
2. Push the track 00 sensor bracket back until it touches the rear of the chassis and secure with one screw.
3. Install the four track 00 sensor and lamp leads in connector J3 (refer to step 3 of the removal procedures. Verify that the locking tabs on the leads engage in the connector slots.
4. Replace the tie wrap near the base of connector J3.
5. Install connectors J2 and J3 on the PCB.
6. Adjust the track 00 sensor (refer to the ADJUSTMENTS section).

Head Carriage Assembly

Removal (refer to Figure 34)

1. Remove the diskette if installed, the PCB, insulating pad, shield, and the door carrier assembly (refer to the Printed Circuit Board and Carrier Assembly removal instructions).

CAUTION

The R/W heads must not be allowed to come together. Insert a clean piece of paper between the head surfaces.

2. Remove the two R/W head cables (connector J4) from the right media guide (as viewed from the front of the disk drive). Note how the cables are attached to the guide for later replacement.
3. Remove the three screws that secure the steel belt to the pulley of the stepper motor (1 place) and to the carriage (2 places). Remove the steel belt. Carefully note the manner in which the belt is routed around the stepper motor pulley.

CAUTION

Handle the steel belt very gently. Do not nick or scratch the surface of the belt.

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4. Remove the two screws and clamps that secure the guide rails to the casting.
5. Lift the guide rails, and slide the carriage off.

REPLACEMENT (refer to Figure 34, Stepper Motor and Head Carriage Removal and Installation)

1. Insert a guide rail through the holes in the carriage and position both pieces on the chassis.

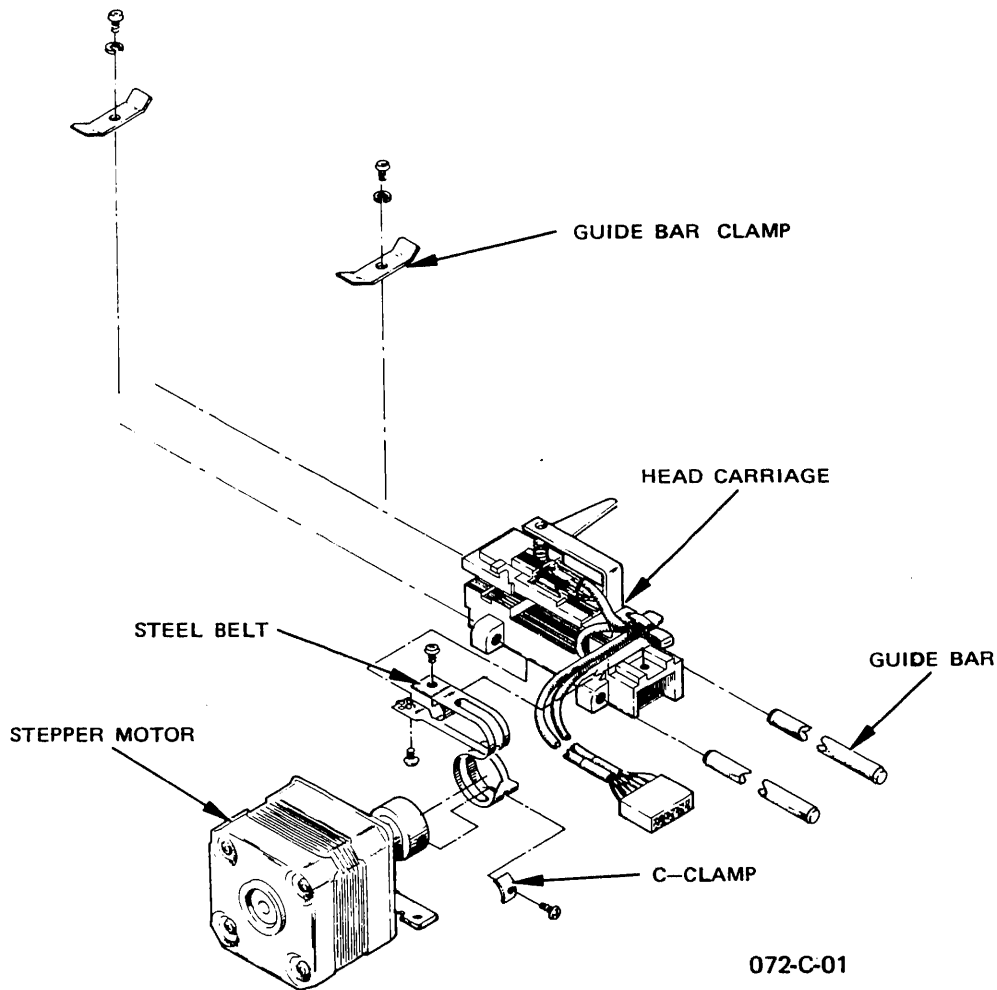


Figure 34. Stepper Motor and Head Carriage Removal and Installation

2. Insert the second guide rail through the slot of the carriage. The arm of the carriage should rest on the top of the head load solenoid bail.

3. Push both guide rails in the direction of the collet until they contact the chassis stops. Secure with a guide rail clamp and screw (two places).
4. Push the carriage forward (toward the front door) and loosely screw one end of the steel belt to the top of the carriage as illustrated in Figure 35 (Use a narrowed down version of a screw starter to fit in the Phillips screws; avoid using magnetic tools). Ensure that the two holes in the end of the belt slip over the bosses on the carriage. Route the belt over the top and around the stepper motor pulley. Then slip the belt through itself and attach the end of the belt to the bottom of the carriage by depressing the belt spring. Again ensure that the holes in the end of the steel belt slip over the carriage bosses.

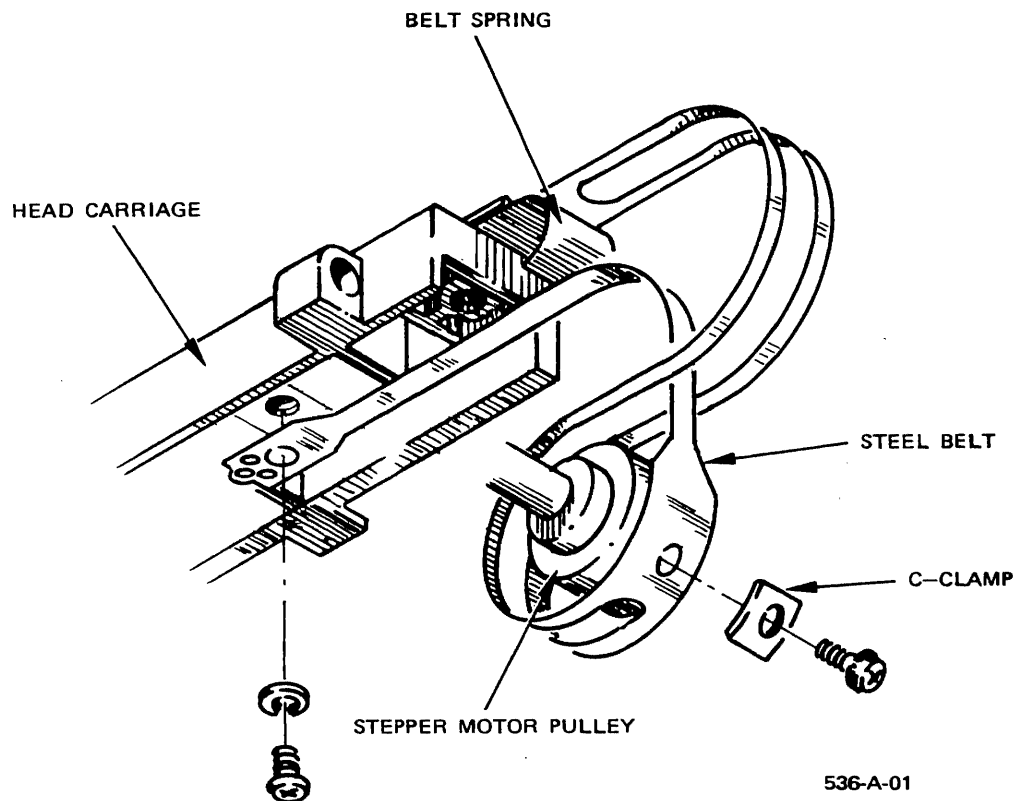


Figure 35. Steel Belt Installation

5. Center the belt on the pulley and align the hole on the steel belt with the screw hole on the stepper motor pulley. Secure with the belt clamp and screw.
6. Move the carriage back and forth by hand several times. Then before tightening the three screws to 5 kg-cm. Make sure that the belt does not kink.

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7. Adjust the track 00 sensor and head alignment as necessary (refer to the ADJUSTMENTS section).

Stepper Motor Assembly

Removal (refer to Figure 34, Stepper Motor and Head Carriage Removal and Installation)

1. Remove the diskette if installed, and the PCB, insulating pad, shield, carrier, head carriage, and steel belt assemblies (refer to the Printed Circuit Board, Carrier Assembly, and Head Carriage removal instructions).

CAUTION

The R/W heads must not be allowed to come together. Insert a clean piece of paper between the head surfaces.

2. Cut the tie wrap securing the wires near the base of connector J3.
3. Remove the six stepper motor leads from connector J3 by pushing down on the motor lead tabs in the connector with tweezers: black to A5, yellow to A6, brown to A7, red to B5, red to B6, and orange to B7.
4. From the underside of the drive, remove the two Phillips screws and washers securing the stepper motor to the main frame. These two screws can be accessed through the two holes cut in the copper shield.
5. Lift the stepper motor out of the top side of the drive.

Replacement (refer to Figure 34, Stepper Motor and Head Carriage Removal and Installation)

1. Set the stepper motor in through the top of the drive and secure with two screws and washers. Note that the screws are attached from the underside of the unit through the holes cut in the copper shielding.
2. Route the six stepper motor leads along the back of the chassis and insert in connector J3: black to A5, yellow to A6, brown to A7, red to B5, red to B6, and orange to B7.
3. Secure all leads terminating in connector J3 with a tie wrap near the base of the connector.
4. Install the head carriage, steel belt, carrier, shield, insulating pad, and PCB (refer to the appropriate installation procedures).
5. Adjust the track 00 sensor and head alignment as necessary (refer to the ADJUSTMENTS section).

ADJUSTMENTS AND CHECKS

CAUTION

The R/W heads must not be allowed to come together without a diskette or clean piece of paper inserted between the head surfaces.

Drive Motor Adjustment

The QumeTrak 592 drive motor speed can be visually verified by referencing the "strobing effect" produced by the decal on the spindle pulley. The decal has two scales: a 50 Hz scale for use under artificial light produced by 50 Hz voltage, and a 60 Hz scale for use under artificial light produced by 60 Hz voltage. To check and/or adjust the drive motor speed proceed as follows:

1. Position the drive on its side in a well lighted area. Good lighting is important so that the "strobing effect" produced by the decal can be more easily recognized.
2. Install a diskette of known integrity in the disk drive.
3. Power up the disk drive so that the drive motor is turning the spindle pulley.
4. While observing the appropriate ring (50 Hz or 60 Hz) on the spindle pulley decal, slowly adjust R31 on the spindle motor PCB until a "strobing effect" is seen. Motor speed is properly adjusted when the white/black pattern on the decal ring appears to be motionless and pulsate or flash - that is, to strobe.

Head Alignment Adjustment

NOTE

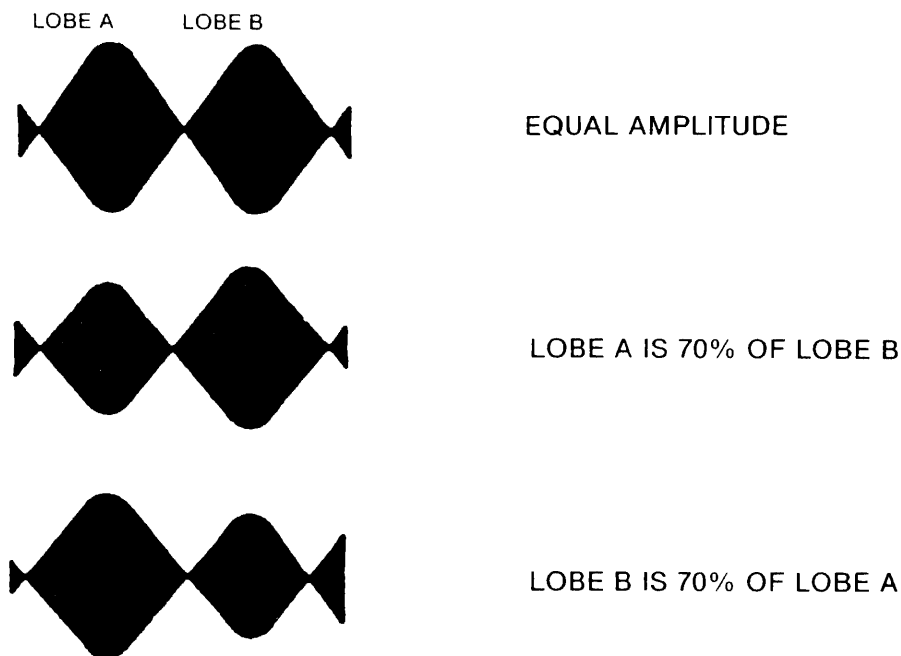
For a more precise adjustment it is recommended that the disk drive be oriented (vertically or horizontally) while on the test bench, in its "inservice" condition.

1. Set the oscilloscope controls as follows:

VOLTS/DIV (CH1 & CH2)	50 mv
VAR KNOB (CH1 & CH2)	CAL
CH2	INVERT
VERT MODE	ADD
AC/GND/DC (CH1 & CH2)	AC
HORZ DISPLAY	A
TRIG MODE	NORM
TRIG COUPLING	AC
A/B TIME/DIV	20 ms
SLOPE	+
SOURCE	EXTERNAL

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2. Power up the disk drive.
3. Install a CE diskette, Q.P.N. 53067-01, in the disk drive. Acclimate the diskette to the use environment at the rate of one hour for each 5°F or 5% relative humidity that differs from the previous environment.
4. Connect the oscilloscope channel probes 1 and 2 to TP1 and TP2 (R/W head signals) respectively, and the trigger probe to TP3 (Index) on the PCB. Connect the probe ground leads to the GND test point.
5. Step the head carriage "IN" on the diskette to track 32. A "cats-eye" pattern will be displayed on the oscilloscope as shown below. For optimum performance LOBE A should equal LOBE B, or at least relate such that $A/B \geq 70\%$.



415-A-01

Figure 36. "Cats-eye" Pattern

6. Observe both the head 0 and head 1 cat eyes. Each should be closely identical. If there is some offset, do not adjust the head itself. Adjust the carriage position so that each side shows an equal amount of offset but in the opposite direction.
7. If the carriage position requires adjustment, loosen the two stepper motor mounting screws about one sixteenth of a turn (mounting screws should be snug enough to maintain position while handling). While observing the oscilloscope, gently move the motor with a screw driver (as illustrated in Figure 37), pushing the motor into a position where LOBE A equals LOBE B. Secure the mounting screws.

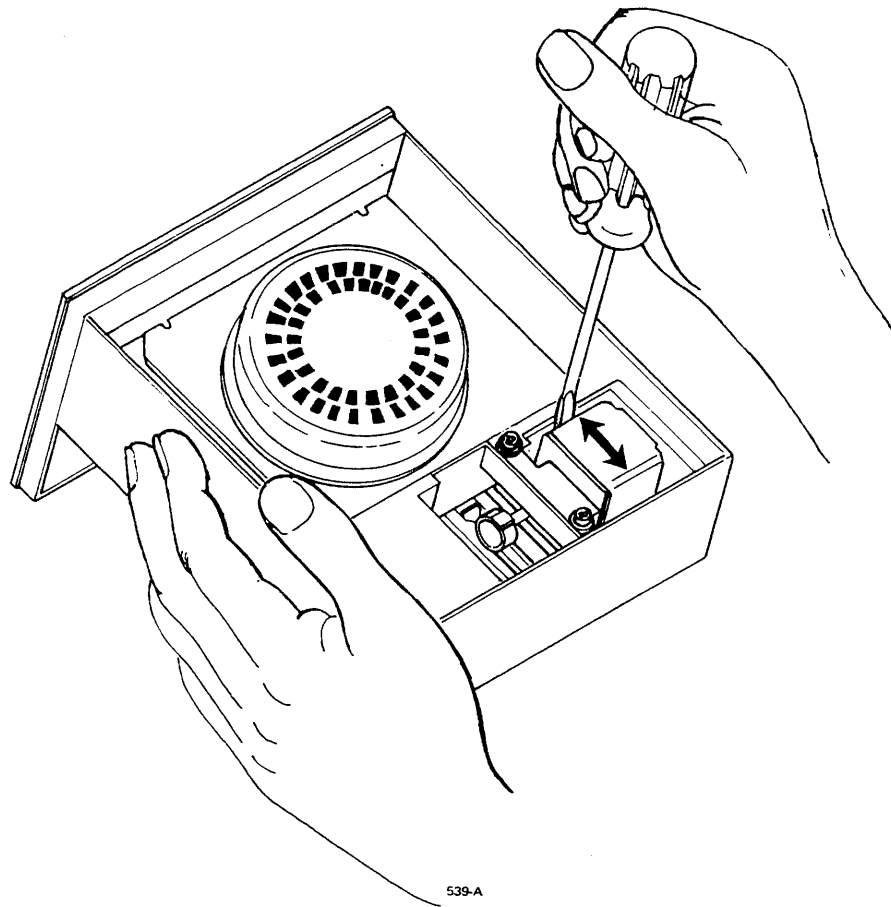


Figure 37. Head Alignment Adjustment

8. Disconnect the oscilloscope probes from the PCB and remove the diskette from the drive. Power down the disk drive.

Track 00 Sensor Adjustment

1. Verify head alignment (refer to the HEAD ALIGNMENT ADJUSTMENT section).
2. Single step the head carriage "OUT" 32 times. This will locate the head carriage on TRACK 00.
3. Disconnect the oscilloscope probes from the PCB.
4. Set the oscilloscope controls as follows:

VOLTS/DIV (CH1)	2
VAR KNOB (CH1)	CAL
VERT MODE	CH1
AC/GND/DC	DC
TRIG MODE	AUTO

MAINTENANCE

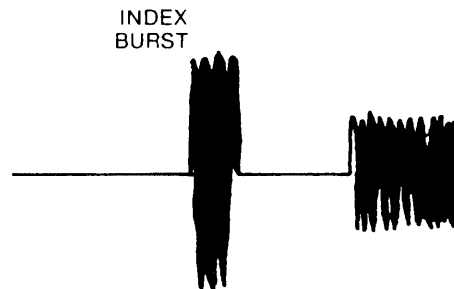
5. Connect the oscilloscope channel 1 probe to TP5 (Track 00) on the PCB. Connect the probe ground to the GND test point.
6. Observe on the oscilloscope a high (5V) level. If necessary, loosen the TRACK 00 switch mounting screws and reposition the switch to obtain the desired 5V level. Secure the bracket mounting screws.
7. Alternate the head carriage between TRACK 00 and TRACK 01 several times. Observe that on TRACK 00 a high (5V) is indicated on the oscilloscope, and on TRACK 01 a low (0V) level. Repeat step 6 as necessary to obtain the proper levels.
8. Disconnect the oscilloscope probes from the PCB and remove the diskette from the drive. Power down the disk drive.

Index Sensor Adjustment

1. Set the oscilloscope controls as follows:

VOLTS/DIV (CH1 & CH2)	50 MV
VAR KNOB (CH1 & CH2)	CAL
CH2	INVERT
VERT MODE	ADD
AC/GND/DC (CH1 & CH2)	AC
HORZ DISPLAY	A
TRIG MODE	NORM
TRIG COUPLING	AC
A/B TIME/DIV	0.5 ms
SLOPE	+
SOURCE	EXTERNAL

2. Power up the disk drive.
3. Install a CE diskette, Q.P.N. 53067-01, in the disk drive.
4. Connect the oscilloscope channel probes 1 and 2 to TP1 and TP2 (R/W head signals) respectively, and the trigger probe to TP3 (Index) on the PCB. Connect the probe ground leads to the GND test point.
5. Step the head carriage "IN" to TRACK 68.
6. Observe on the oscilloscope the index burst pattern shown in Figure 38.



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Figure 38. Index Burst Pattern

7. If the index burst occurs 400 us \pm 200us after the start of the index pulse, no adjustment is necessary. Otherwise, loosen the index sensor bracket mounting screw. With the blade of a screwdriver, gently move the sensor bracket until the proper adjustment (400us \pm 200us) is indicated on the oscilloscope. Tighten the mounting screw.
8. Disconnect the oscilloscope probes from the PCB and remove the diskette from the drive. Power down the disk drive.

Azimuth Alignment Check

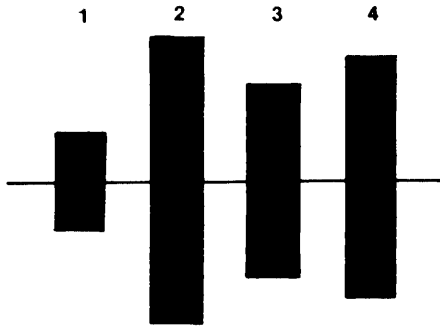
The Azimuth Alignment Check procedure is presented as a guideline for determining the degree of R/W head alignment integrity. The entire head/carriage assembly is factory adjusted and tested; there is no field adjustment. Replace the entire assembly if defective.

1. Set the oscilloscope as follows:

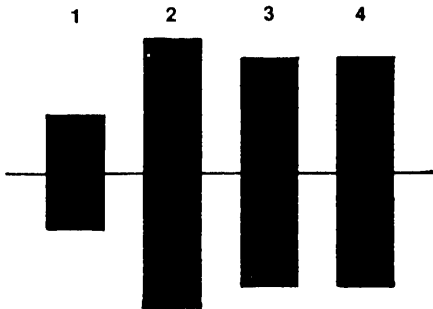
VOLTS/DIV (CH1 & CH2)	50 mv
VAR KNOB (CH1 & CH2)	CAL
CH2	INVERT
VERT MODE	ADD
AC/GND/DC (CH1 & CH2)	AC
HORZ DISPLAY	A
TRIG MODE	NORM
TRIG COUPLING	AC
A/B TIME/DIV	0.5 ms
SLOPE	+
SOURCE	EXTERNAL

2. Power up the disk drive.
3. Install a CE diskette, Q.P.N. 53067-01, in the disk drive and step the head carriage "IN" to TRACK 68. Activate SIDE SELECT 0.
4. Connect the oscilloscope channel probes 1 and 2 to TP1 and TP2 (R/W head signals) respectively, and the trigger probe to TP3 (Index) on the PCB. Connect the probe ground leads to the GND test point.
5. Observe the oscilloscope for a pattern similar to that shown in Figure 39. Azimuth Check.
6. Activate SIDE SELECT 1 and repeat step 5.
7. Disconnect the oscilloscope probes from the PCB and remove the diskette from the drive. Power down the disk drive.

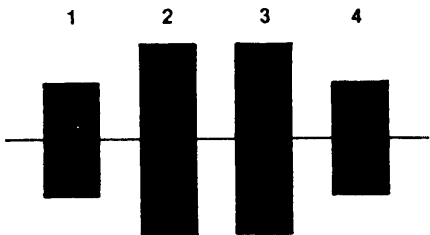
MAINTENANCE



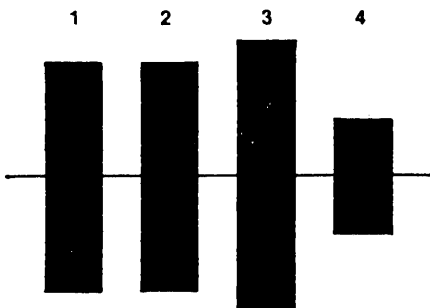
MAXIMUM ALLOWABLE AZIMUTH ERROR OF +18 MINUTES. BURST #4 IS 25% LARGER IN AMPLITUDE THAN BURST #3.



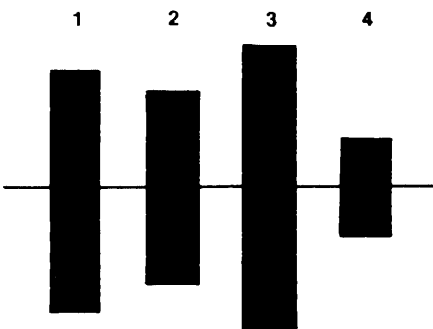
TYPICAL AZIMUTH ERROR OF +12 MINUTES. BURSTS #3 AND #4 ARE EQUAL IN AMPLITUDE.



AN OPTIMUM ALIGNMENT OF ZERO MINUTES AZIMUTH ERROR. BURSTS #1 AND #4 ARE EQUAL IN AMPLITUDE, AS ARE BURSTS #2 AND #3.



TYPICAL AZIMUTH ERROR OF -12 MINUTES. BURSTS #1 AND #2 ARE EQUAL IN AMPLITUDE.



MAXIMUM ALLOWABLE AZIMUTH ERROR OF -18 MINUTES. BURST #1 IS 25% LARGER IN AMPLITUDE THAN BURST #2.

USING A QUME CERTIFIED CE DISK (QUME P.N. 53067-01) THE AZIMUTH SHALL BE ACCEPTABLE IF A DRIVE SHOWS LESS THAN THE MAXIMUM ALLOWABLE 18 MINUTE AZIMUTH. THE MAXIMUM ALLOWABLE AZIMUTH IS CONSIDERED TO BE ATTAINED WHEN BURST #1 IS 25% LARGER THAN BURST #2, OR IF BURST #4 IS 25% LARGER THAN BURST #3.

Figure 39. Azimuth Check

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TROUBLESHOOTING

General

This section presents troubleshooting information dealing with the most common QumeTrak 592 functional errors: Not Ready, Seek Error, Read Error, Write errors, and No Head Load. The troubleshooting of these errors is accomplished in flowchart format.

Definition of QumeTrak 592 Functional Errors

NOT READY

A condition in which the controller fails to receive a Ready signal from the disk drive when it expects to receive one.

SEEK ERROR

A condition in which the drive is unable to access a particular diskette side or track or to confirm track 00 access to the controller.

READ ERROR

A condition in which the drive is unable to recover data previously written onto the diskette.

WRITE ERROR

A condition in which the drive is unable to write data onto a diskette.

NO HEAD LOAD

A condition in which the R/W head fails to load onto the diskette. This condition may be associated with any of the above errors.

Troubleshooting Technique

Effective troubleshooting should always begin with a visual inspection. Look for such things as faulty wiring, damaged or misaligned components, and the presence of any foreign matter such as dust. Inspect for anything that can obviously alter performance of the drive.

Next, proceed to isolate the problem to the diskette, drive, or controller. Malfunctions that are diskette related can be easily detected by comparing the performance of the suspect diskette to one known to be in good condition. Most diskette problems can be attributed to either soft or hard errors. Soft errors resulting from contamination by dust and/or body oil on the diskette surface are usually caused by careless handling. Soft errors diminish the accurate read/write capability of the diskette but do not necessarily render the diskette unusable. Conversely, hard errors caused by such things as scratches and abrasions permanently damage the medium.

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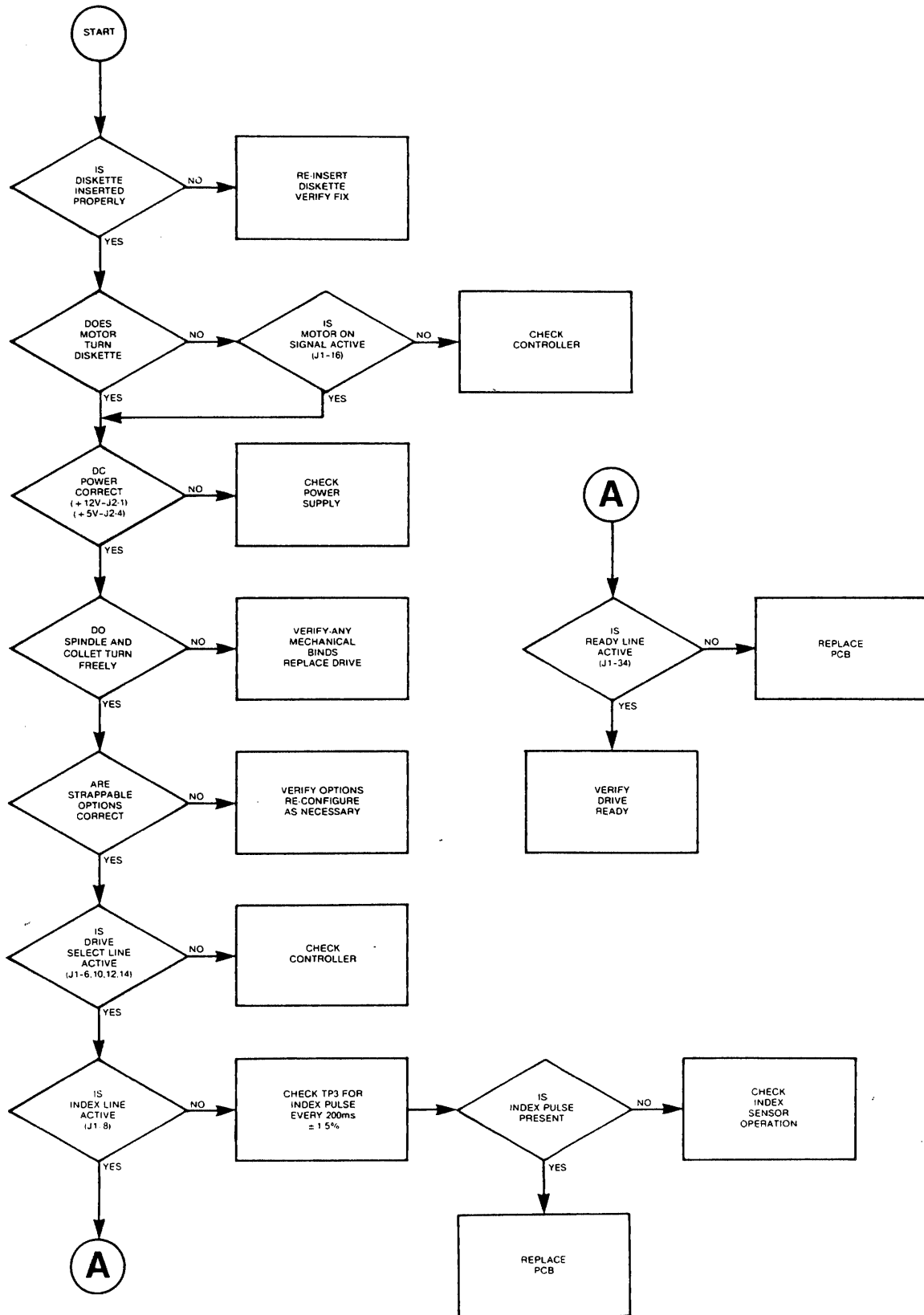
Likewise, the drive unit can be determined defective or not by exchanging the original unit with one that is known to be operable. Verify that the drive is installed correctly. Specifically, check to see that the voltage requirements are supplied and that the strappable options are correctly installed. Proceed to the troubleshooting flowcharts for further isolation of a drive unit fault.

Once the drive unit is found to be functional, verify that the interface and controller programming are viable.

Troubleshooting Flowcharts

The following equipment is required to proceed through the troubleshooting flowcharts.

- o A diskette of known integrity;
- o CE alignment diskette, Qume Part Number 53067-01.
- o Multimeter, 20,000 ohms/volt (Triplet, model 310 or equivalent)
- o Oscilloscope, dual trace (Tektronics model 465 or equivalent).



088-B-01

Figure 40. Not Ready Troubleshooting Flowchart

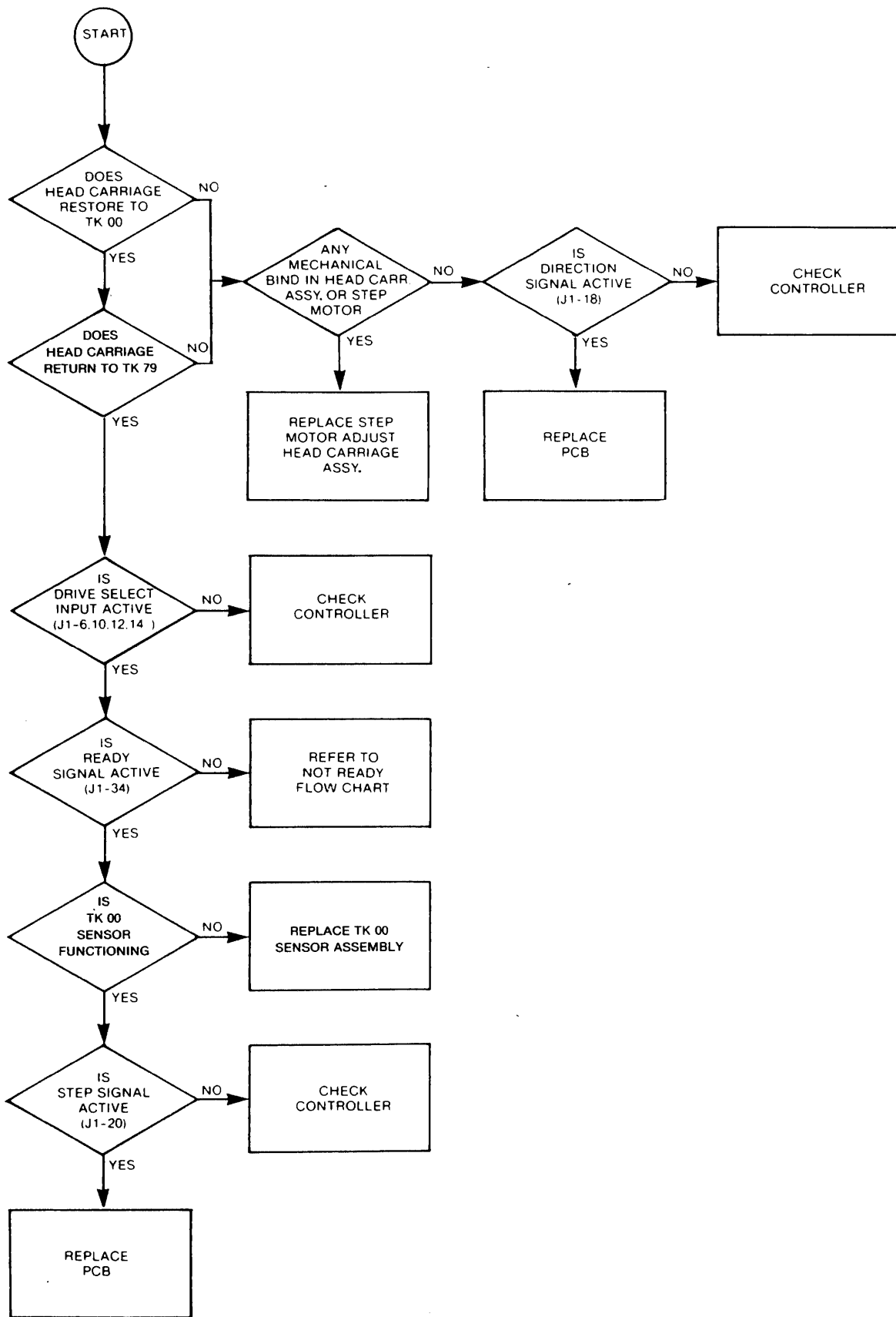
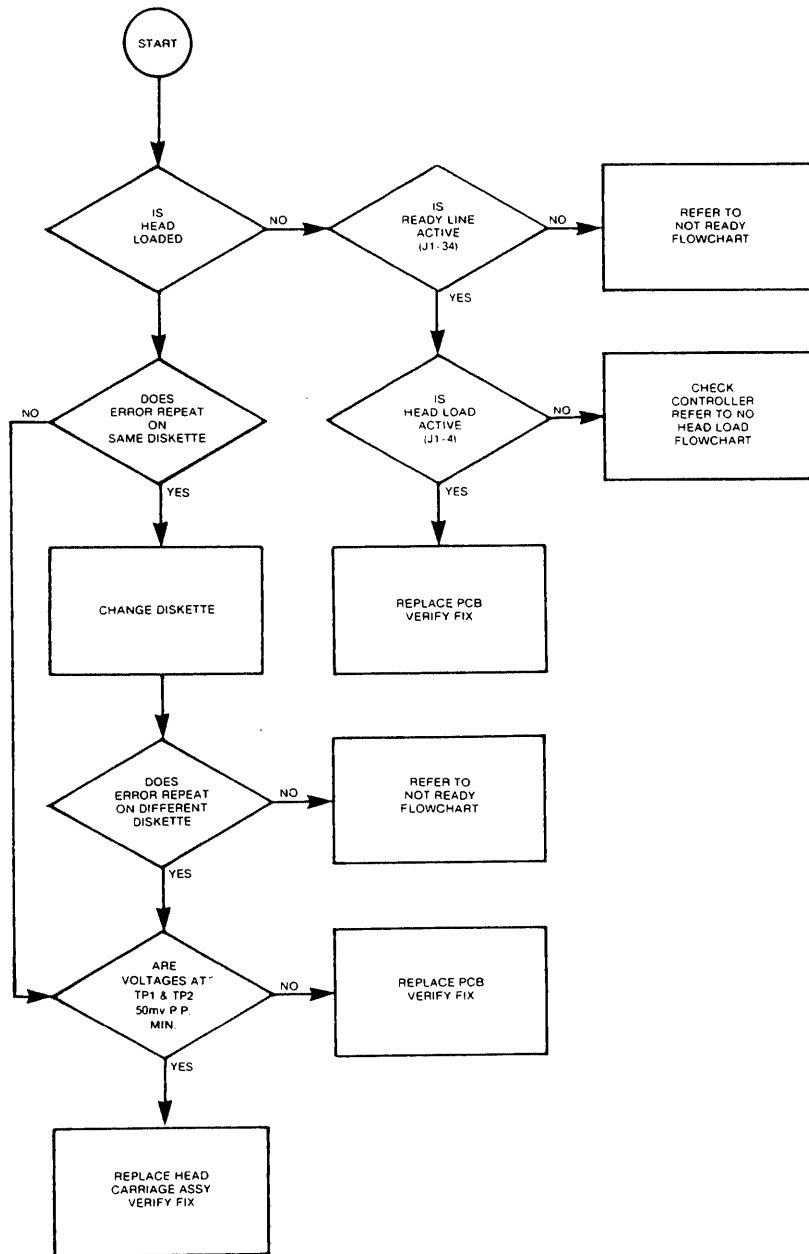
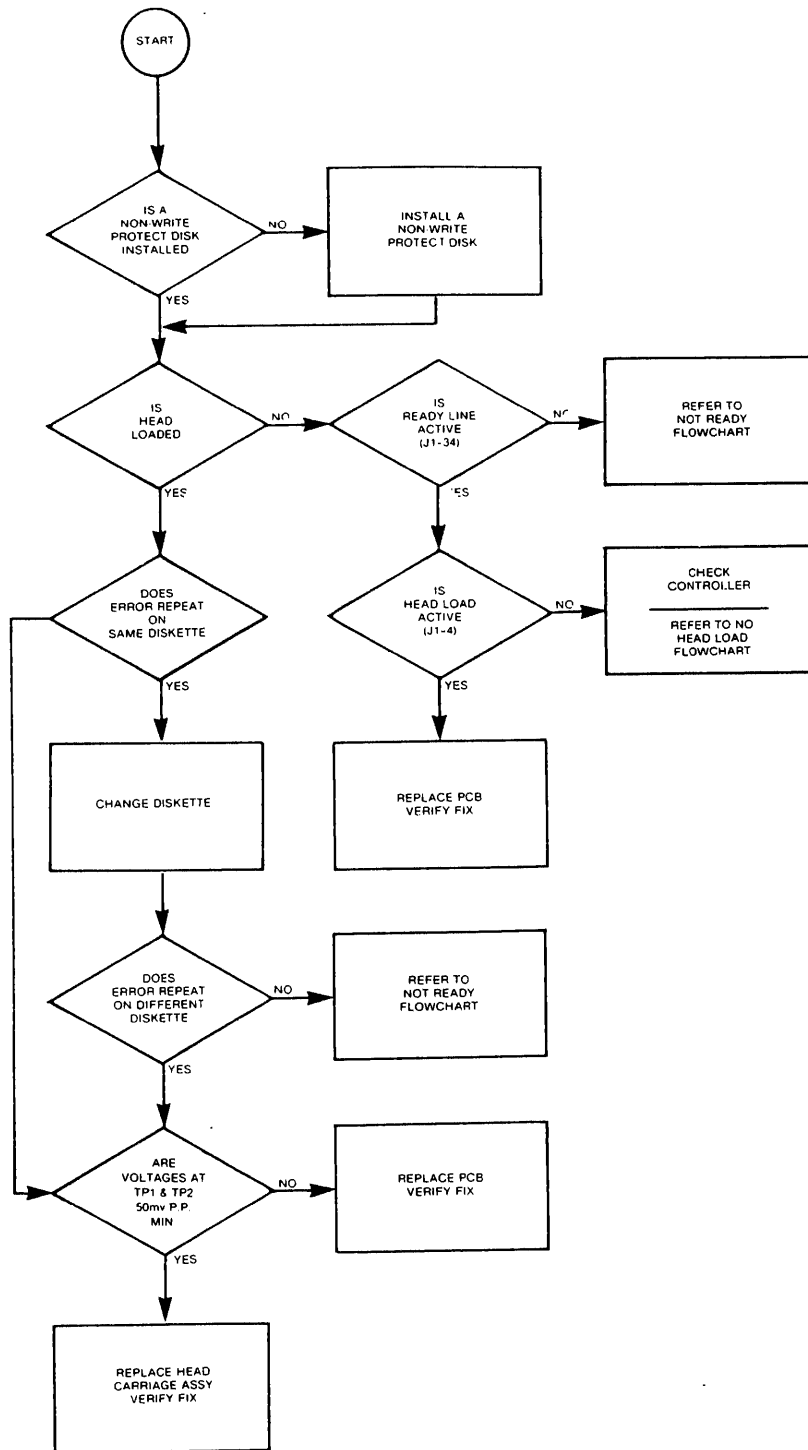


Figure 41. Seek Error Troubleshooting Flowchart



011-B-01

Figure 42. Read Error Troubleshooting Flowchart



009-B-01

Figure 43. Write Error Troubleshooting Flowchart

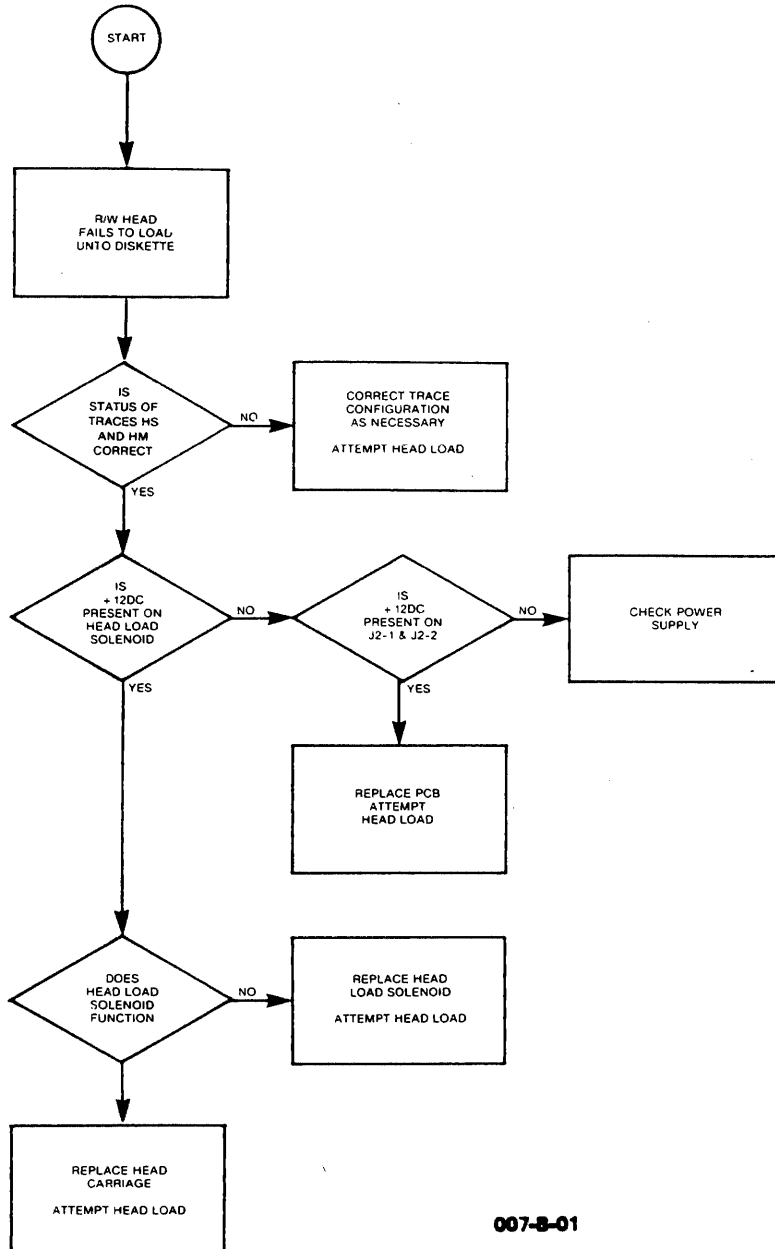


Figure 44. No Head Load Troubleshooting Flowchart

RECOMMENDED SPARE PARTS

Listed in the following tables are the recommended spares parts according to description, Qume part number, and quantity for supporting the QumeTrak 592 disk drive. Refer to the Illustrated Assemblies and Parts Locations paragraph for parts identification.

The Qume Memory Products Service and Spares Catalog, publication number 37052, offers a complete list of all QumeTrak 592 replaceable parts and defines basic service policy.

Table 16. Recommended Spare Parts - Field Level

DESCRIPTION	PART NUMBER	QUANTITY PER NUMBER OF DISK DRIVES BEING SERVICED			
		10	50	100	500
Track 00 Sensor Assembly	53010-01	2	4	8	16
Index Sensor Assembly	53020-01	2	3	3	6
Head Load Solenoid Assembly	53025-01	2	2	3	6
Stepper Motor Assembly	53030-01	1	2	3	6
Steel Belt Assembly	53040-01	2	4	7	14
Carriage Assembly	53050-01	4	7	9	18
Petroleum base, Non-Ester Grease	85596-01	2	2	2	4
Printed Circuit Board	90756-01	2	4	6	12

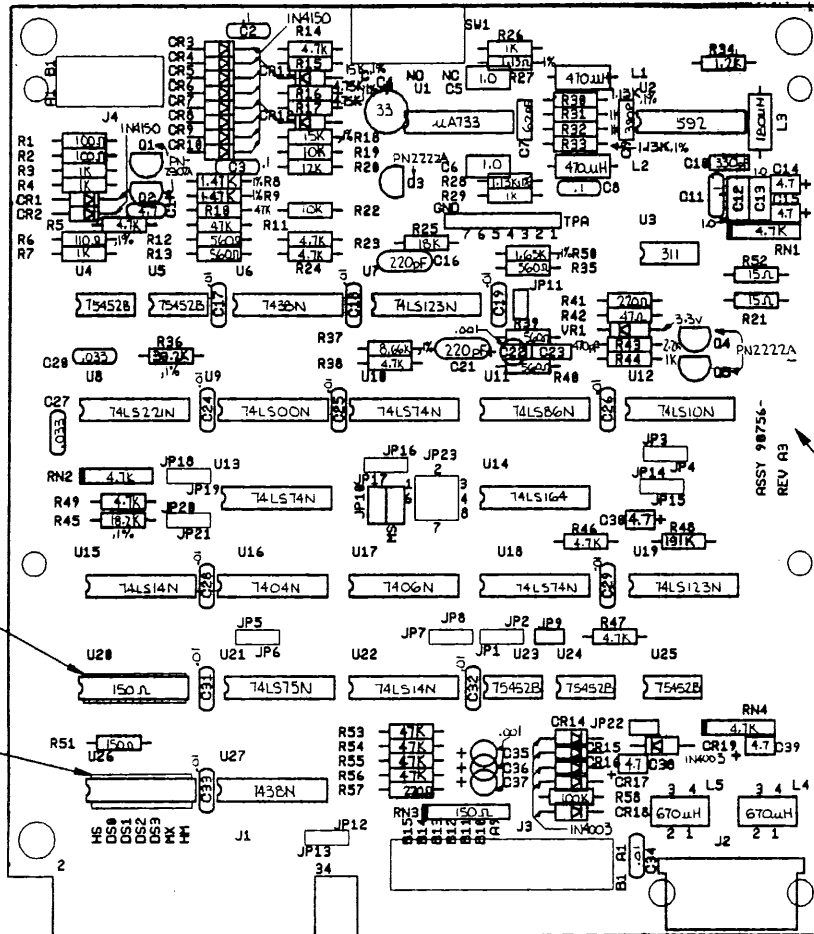
RECOMMENDED SPARE PARTS

Table 17. Recommended Spare Parts - Depot Level

DESCRIPTION	PART NUMBER	QUANTITY PER NUMBER OF DISK DRIVES BEING SERVICED			
		50	250	500	1000
Track 00 Sensor Assembly	53010-01	2	4	8	16
Write Protect Assembly	53019-01	2	2	3	6
Index Sensor Assembly	53020-01	2	3	3	6
Head Load Solenoid Assembly	53025-01	2	2	3	6
Media Guide	53034-01	1	2	3	6
Guide Bar	53036-01	2	4	6	12
Steel Belt Assembly	53040-01	2	4	7	14
Carriage Assembly	53050-01	4	7	9	18
Screw	55163-08	10	20	30	60
Screw	55173-08	10	20	30	60
Screw	55173-12	10	20	30	60
Screw	55181-01	10	20	30	60
Petroleum Base, Non-Ester Grease	85596-01	2	2	2	4
Printed Circuit Board	90756-01	2	4	6	12
Spindle Motor	53009-01	2	4	8	16

SCHEMATIC DIAGRAMS

This section includes assembly and schematic diagrams for the QumeTrak 592 printed circuit board, drawing number 90756 - pages 2, 3, 4, and 5. A schematic diagram of an earlier version of the board (PCB assembly 53048) is also included.



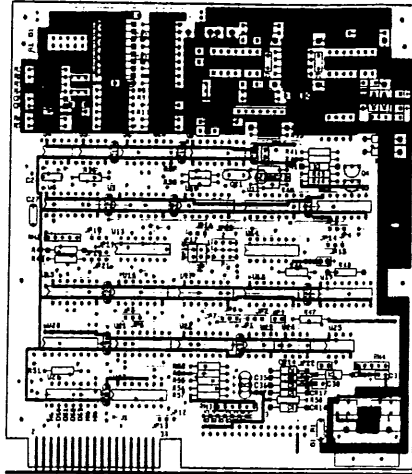
NOTES: UNLESS OTHERWISE SPECIFIED

- 1) ALL RESISTANCE VALUES ARE IN OHMS .14W .5%.
- 2) ALL CAPACITANCE VALUES ARE IN MICROFARADS.
- 3) STAMP APPROPRIATE. DASH (D) WITH NON CONDUCTIVE INK APPROXIMATELY WHERE SHOWN.
- 4) SCHEMATIC REV. A IS VALID TO ASSY. 90756-01 REV. A, 90756-02 REV. A
- 5) PARTS USED FOR -01 ONLY

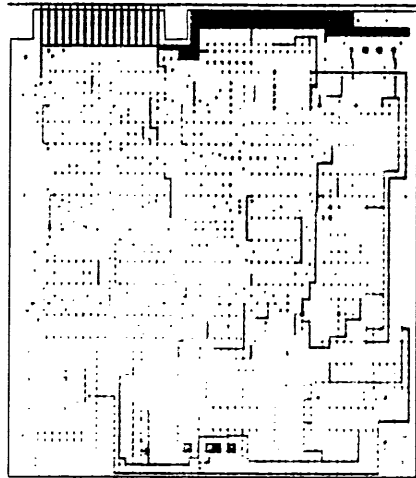
96

91



J	K		DRAWN	G HSING	DATE		
G	H		8-4-82				
E	F		CHECKED	G.D.	9-13-82		
C	D		DESIGNED	F. Low	9-15-82		
A	B		DATE	9-15-82			
3622 B		MATERIAL	SCALE		2/1	SHEET	2/11
PART USED		FINISH	PROPRIETARY INFORMATION. UNLESS OTHERWISE INDICATED OR USE PROHIBITED.		REV		D
					90756-XX A		



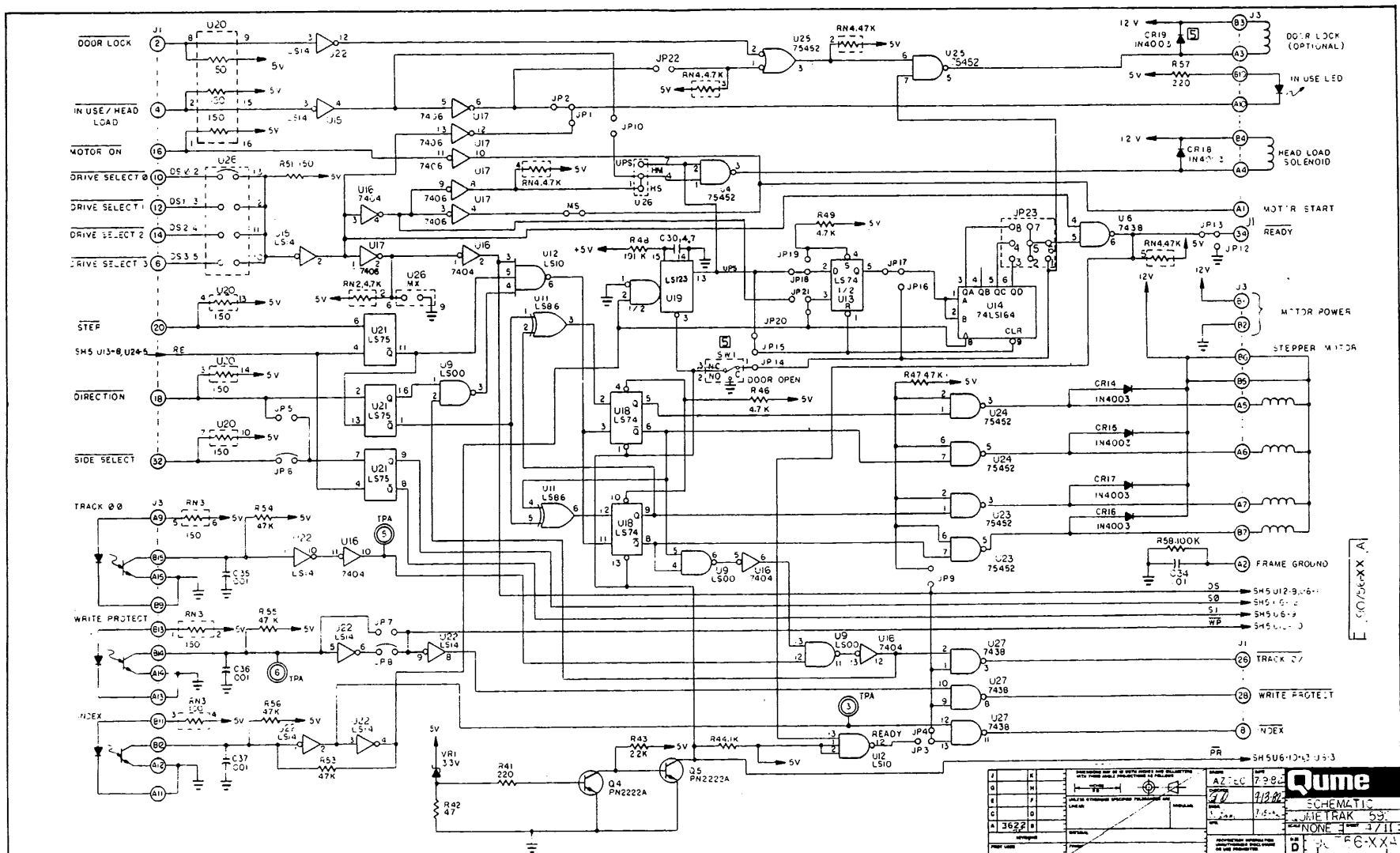
COMPONENT SIDE



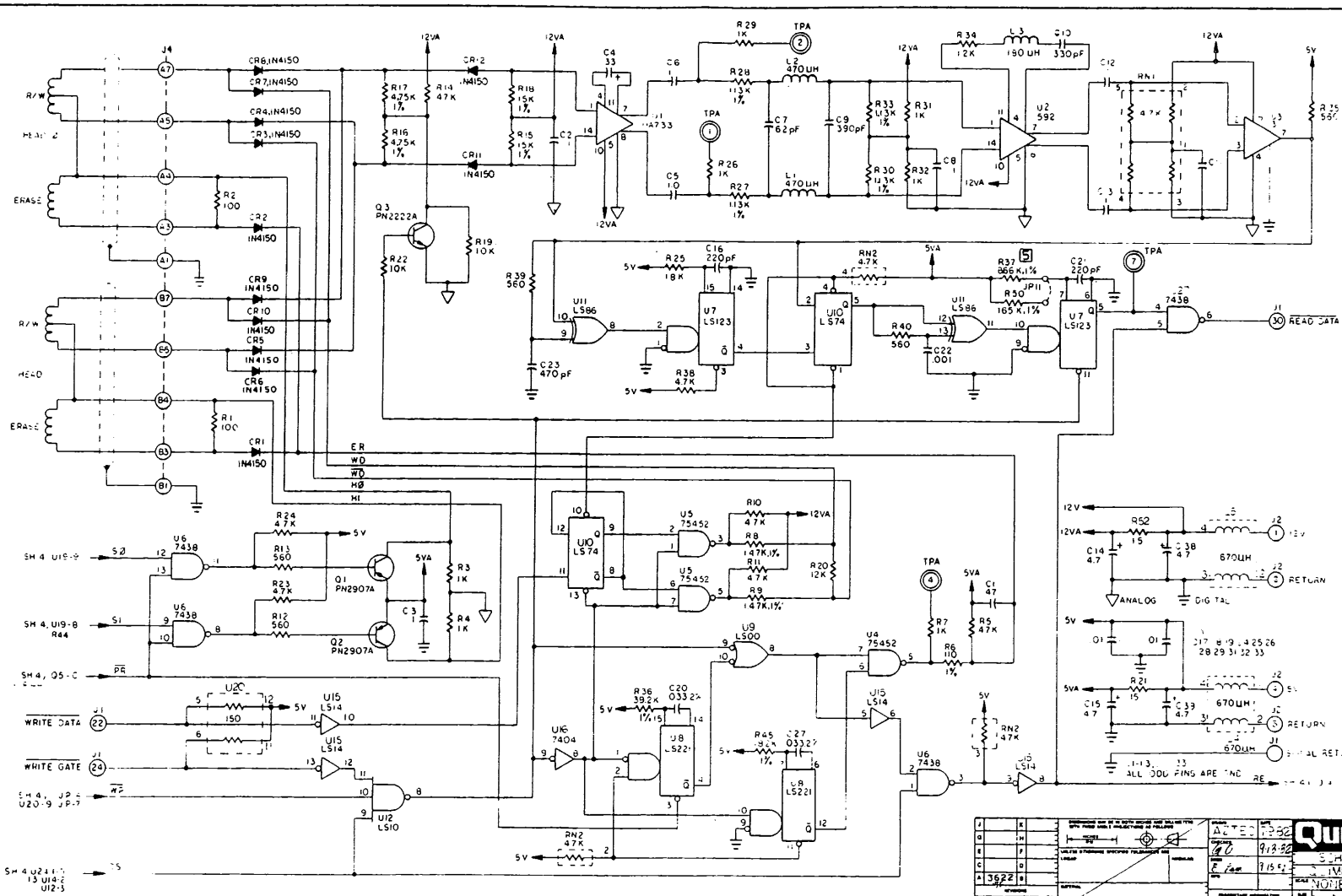
SOLDER SIDE

J	K	DIMENSIONS MAY BE IN BOTH INCHES AND MILLIMETERS WITH THIRD ANGLE PROJECTIONS AS FOLLOWS  UNLESS OTHERWISE SPECIFIED TOLERANCES ARE LINEAR .010 ANGULAR .010	DRAWN G. SING	DATE 8-4-82	
G	H		CHECKED G.D.	9-13-82	
E	F		ENGR P. Lam	9-15-82	
C	D		MFG		
A	B		MATERIAL	PCB ASSY	
REVISIONS 3622		MATERIAL PCB ASSY	PROPRIETARY INFORMATION UNAUTHORIZED DISCLOSURE OR USE PROHIBITED	SCALE 1/1	SHEET 3/11
FIRST USED		FINISH	SIZE D	90756-XX,4	

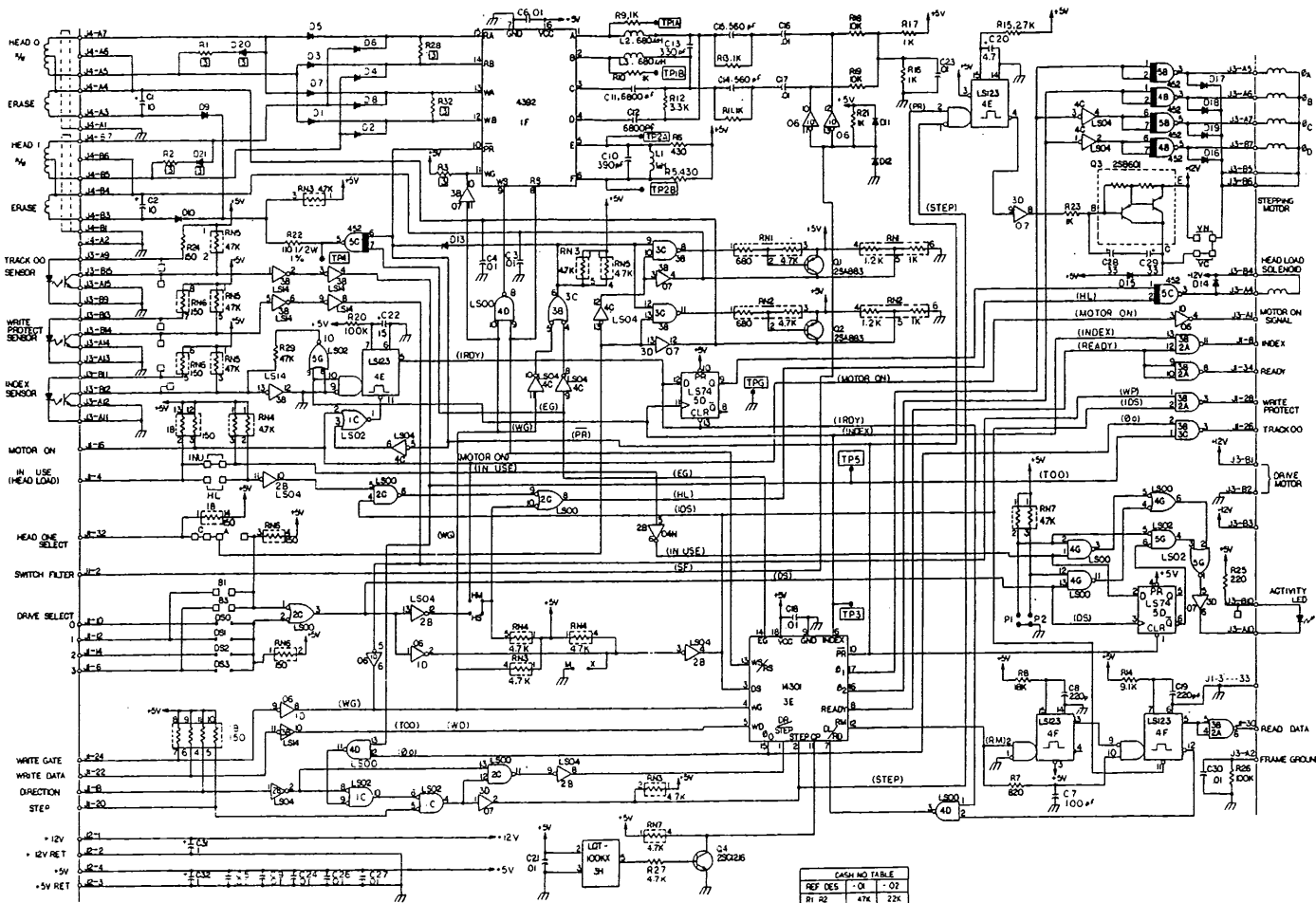
QUME - SAN JOSE, CA FORM 30-44 1079



Q	1	Q4	PN2222A
Q	2	Q5	PN2222A
C	1	C30	100K
C	2	C31	100K
C	3	C32	100K
C	4	C33	100K
C	5	C34	100K
C	6	C35	100K
C	7	C36	100K
C	8	C37	100K
R	1	R41	220
R	2	R42	47
R	3	R43	22K
R	4	R44	1K
R	5	R45	47K
R	6	R46	47K
R	7	R47	47K
R	8	R48	47K
R	9	R49	47K
R	10	R50	47K
R	11	R51	150
R	12	R52	47K
R	13	R53	47K
R	14	R54	47K
R	15	R55	47K
R	16	R56	47K
U	1	U17	7406
U	2	U18	LS74
U	3	U19	LS123
U	4	U20	LS104
U	5	U21	LS75
U	6	U22	LS14
U	7	U23	75452
U	8	U24	75452
U	9	U25	75452
U	10	U26	75452
U	11	U27	7438
U	12	U28	7438
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J	99	JP99	Header
J	100	JP100	Header



REV	DATE	BY	CHKD	APP'D	DESCRIPTION
1	9/18/82				SCHEMATIC
2	9/15/82				SCHEMATIC
3					NOISE
4					90756-XX 4



□ SEE DASH NUMBER TABLE FOR COMPONENT VALUES OR DEVICE NUMBER
 2 ALL CAPACITOR VALUES ARE IN MICROFARADS
 1 ALL RESISTOR VALUES ARE IN OHMS 1/4W 5%
 NOTES: UNLESS OTHERWISE SPECIFIED

DASH NO TABLE			
REF	DES	VAL	DEV
R1	R2	47K	22K
DD0	DD1	-	74LS00
R3	R4	10K	10K
R28	R29	10K	511K
R32	-	-	OK

DATE	11-1-77	DESIGNED BY	W. J. ...
APP'D BY		CHECKED BY	
Qume			
SCHEMATIC DIAGRAM			
NONE 1-4/5			
53048-XX			