

SECTION 2

COMMON PROBLEMS WITH PERSCI DRIVES

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PART I

MECHANICAL

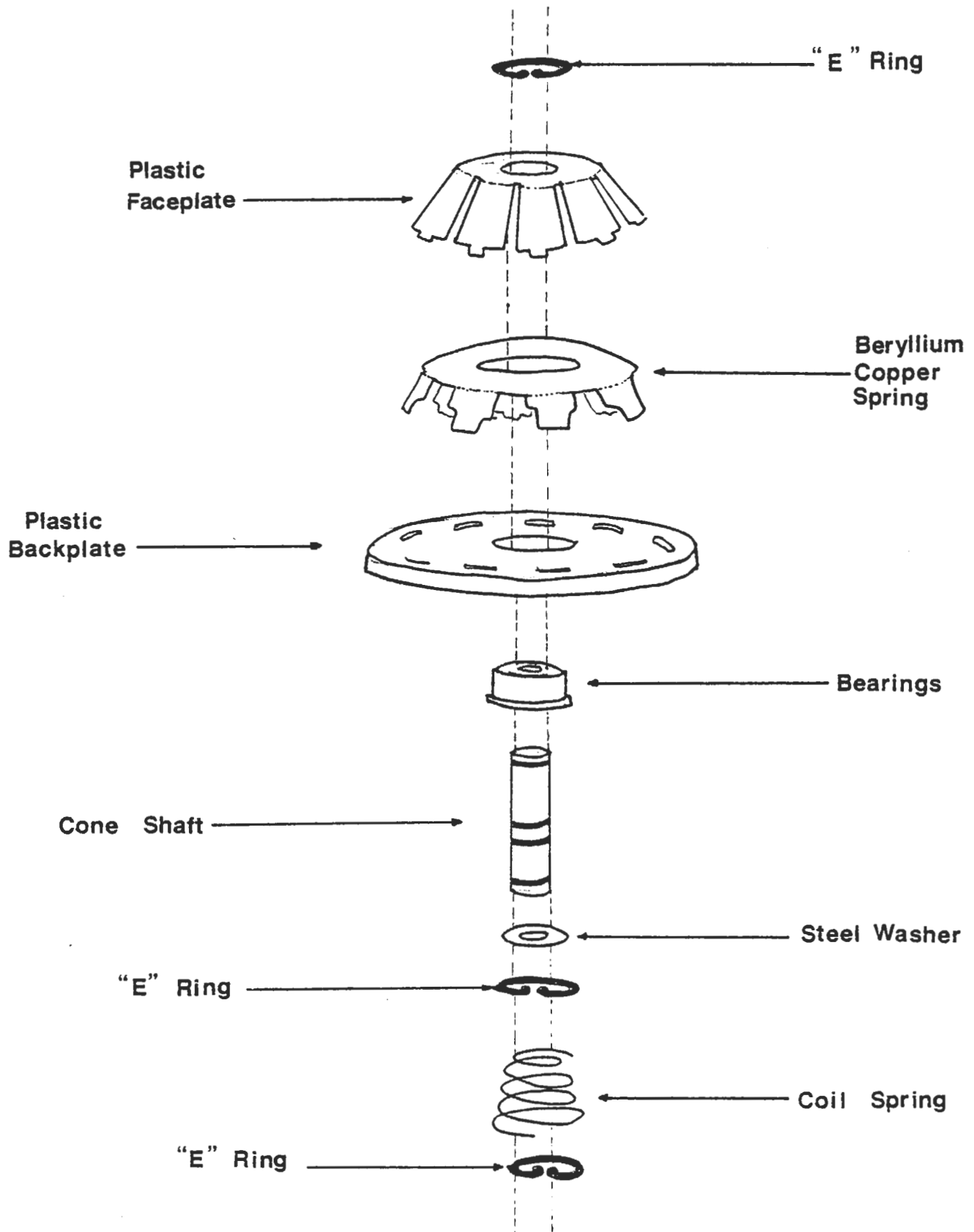
There are a number of service tips on the maintenance and repair of the Helios and Persci drive. It is the intent of this section to explore some of the more common mechanical problems associated with the drive in particular. A good deal of the problems listed here are related to runs of serial numbers and, where applicable, these serial numbers will be mentioned. As of this writing, Persci is entering the 6000 range in serial numbers and many of these problems have been solved. If you are at all uncomfortable about performing these or any other adjustments, Processor Technology factory personnel are available in the mornings (Western Time) to assist you. If any of the procedures are unclear please make note and inform us directly as the purpose of this manual is to assist you in the service of this product. On the other hand, if you have not attended at least one of the technical seminars, we urge you not to perform this maintenance and to return the unit to the factory for service.

CONES:

There have been two types of cones used on Persci drives, white and black ones. Of the two, the black have a superior bearing and superior bearing and design, meaning in the long run, less replacement. However, the black cones also tend to stick inside the spindle even when they should release. One cure is replacement of the cone; the other is to disassemble the cone and bend the beryllium copper support spring tangs back in slightly towards the center bearing shaft. This reduces the pressure on the plastic cone to prevent it from sticking. (See the accompanying illustration for details.) The only other cone-related problem is a worn bearing. This is usually accompanied by loud squeals of protest and excessive slop when the spindle grasps the diskette.

TRIM POTS:

A run of bad trim pots surfaced in the early serial numbers (before the 1500's) caused by a manufacturer error. Most of these have been replaced by now, but if during alignment, the adjustments are erratic or keep changing then the pot should be replaced. This is especially a problem if the pot is on the reference oscillator (R154) for the spindle servo.



DISK DRIVE CONE ASSEMBLY

LAMPS:

With time, the lamps on the lamp amp PCB burn out as well as in shipping, the filaments sometimes break. See the alignment procedure, step 1, to determine this. The following is a replacement procedure for the lamp:

1. Remove drive from cabinet and remove 2 screws at bottom of D & I PCB to swing board up for service.
2. Remove four small phillips screws from black lamp housing (it may be necessary to remove head load paddle, side 1).
3. With solder iron and solder wick remove lamp leads from Lamp Amp PCB.
4. Replace lamp, solder and trim leads and reverse procedure. Re-align drive as necessary.

SPINDLE MOTOR:

The frequency of problems with the spindle motor is very small, the most common being arcing internally. This arcing causes intermittent operation. Another problem with the motor is freezing which usually shorts the motor supply 8 volt line and can cause the trace on the drive to fry. Since the motor is not repairable, it should be replaced. This is the procedure:

1. Remove drive from cabinet and remove screws at bottom of D & I PCB. Remove motor connector wires.
2. Remove drive pulley and diskette guide rails on lower portion of drive (side 0).
3. Remove side 0 door assembly by removing screws in bottom plate connecting to the hinge block and the screws (allen) holding eject motor support bracket.
4. Remove 3 slotted screws securing motor to chassis, and making note of where washers are installed, remove motor.
5. Install new motor with washers in same location and reverse procedure. Check spindle speed.

SPINDLE BEARINGS:

In a few instances, drive spindle bearings will wear to the point at which the spindle will become very noisy. There was a run of serial numbers (around 3300) where this has been a problem after constant use. If you have a drive of this vintage and the spindle becomes noisier, be sure to return the drive to the factory for service. Bearings cannot be replaced in the field.

EJECT MOTOR SHAFT SUPPORT BRACKET:

Persci has used 3 different styles for these brackets. The oldest one is the gray molded plastic, then the black molded piece very similar to the gray, and most recent is an extra sturdy black plastic quite larger than the former two. The first two will occasionally crack and cone will no longer retract. The newest brackets will no longer do this and the following procedure for replacement is recommended:

1. Remove drive from cabinet.
2. Remove the 2 springs connecting the support bracket to the door door assembly and the two allen screws mounting the bracket to the drive.
3. Remove set screw in steel cam at end of shaft and remove the steel cam (since lock-tight may have been used on this screw, it may be necessary to apply heat and then pull cam off).
4. Slide bracket off end of shaft and replace with the new heavy duty style.
5. Reverse procedure above.

EJECT CAM ADJUSTMENT:

Because the eject cam (mounted over the two rocker switches if front of eject motor) is made of plastic and the set screw is steel, there is a tendency in some units for this to become loose and the cam to become mis-aligned. In this case, the cone will not engage the diskette properly. Adjustment procedure is:

1. Loosen set screw securing eject cam with power off.
2. Turn power on press eject switch. Rotate cam manually until door is fully unloaded.
3. With the door unloaded, the set screw should be in the 12 o'clock position. Tighten screw until snug.
4. Manually trip diskette presense switch and check to see if cone seats completely into spindle.
5. Re-adjust as necessary and tighten screw. Be sure after adjustment, the door still operates correctly.

PLASTIC DISK EJECT ARM:

There have been in recent months, a few cases where the plastic arm which pushes the diskette out upon eject switch closure breaking. This also means a diskette cannot be re-inserted as the spring will kick it out again. Replacement is the only cure.

1. Remove eject cam motor assembly, eject shaft support bracket.
2. Remove plastic eject arm guide (fastened using 2 slotted screws).
3. Remove "E" ring holding eject arm onto shaft. Remove eject arm and spring assembly.
4. Install new eject arm (the spring is turned one full turn (360 Deg.) for correct tension.
5. Reverse procedure.

POSITIONER SERVO REPLACEMENT:

The following is the procedure for replacing the positioner voice coil servo:

1. Remove the following connectors: P8, P5 (on servo board), P8, P7, P15, P16 (D & I PCB) and all the plastic wire restraints.
2. Swing D & I PCB to its up position for servicing.
3. Remove black scale cover and 4 slotted screws which hold the rear of the positioner servo from moving (2 on top plate and 2 on bottom plate).
4. Remove positioner servo control PCB by removing 3 slotted screws from the bottom plate.
5. Remove Allen azimuth adjust screws (see azimuth alignment procedure for diagrams) and the Allen screw at the pivot point.
6. Carefully pull servo out towards back of drive being cautious not to damage scale or circuitry.
7. Reverse procedure.
8. Re-align drive on both sides as well as lamp amp voltages.

SPINDLE MOTOR SERVO CONTROL PCB REPLACEMENT:

1. Lift D & I PCB to the service position.
2. Disconnect the following connectors to the spindle control PCB: P5, P4, P1 and P2.
3. Remove 2 slotted screws (some models may have Phillips) from the steel diskette guide shield. There are 2 spacers which these screws go through. Remove these as well.
4. Remove screw located near Q1 and Q6 on the PCB. Reverse the procedure being sure to use the spacers.

5. Remove old board and re-install new control PCB. Reverse the procedure being sure to use the spacers.

CAUTION

The motor supply jack, J1, must have the red wire to the right and black to the left (when the board is mounted and the view is from the D & I PCB side) for proper polarity.

PART II: CIRCUITRY

SEEK RELATED PROBLEMS

Head oscillating, humming or squealing:

1. Lamp Voltage too low or too high.
2. U3 on Lamp Amp PCB breaking into oscillation due to noise or a heat sensitive op amp.
3. Bad Lamp or photocell assembly. If this is the case, most likely the head will have very little resistance when it is moved back and forth by hand.
4. Seek times adjusted wrong (too fast or too slow).

Head will not seek or slams to extremes and won't restore:

1. Positioner voltage adjusted incorrectly (3 v P-P min!).
2. Seektime mis-adjusted.
3. J8 to positioner servo loose or intermittently contacting.
4. Can't find track 0 on power up.
 - a) P8 pin 1 should be high when at track 0.
 - b) P8 pin 5 should be low when at track 0 and high otherwise.

5. When at track 0 the following pins on P8 should be high:

Pins 1, 6 and 12

When at track 0 the following pins on P8 should be low:

Pins 2, 3, 4, 5 and 9

6. FET (U6 on Positioner Servo Control PCB) is blown or malfunctioning.

7. Support logic/op amps/output amps and drivers are malfunctioning (Positioner Control PCB).

Head Skips Tracks:

1. Crack, dirt or flaw on lamp scale.
2. Excessive track overshoot.

SPINDLE SPEED PROBLEMS

1. Diskette presence not switching due to D & I problem.
2. Spindle enable (P1 pin 24) not grounded.
3. U28 pin 9 (D & I PCB) should be at 200 KHz.
U28 pin 10 should be high.
4. Q4 or Q5 (Power transistors) shorted ==> Spindle free runs.
open ==> Spindle won't turn.
5. U4 on spindle control PCB has one of its inputs tied low at all times.
6. Power supply voltages are incorrect or not present.
7. Photo transistor on tach not switching op amp (U7 on spindle control PCB).
8. Servo loop broken where U6 pin 7 not switching the counters on the servo control PCB.
9. Push Pull amp, Q2 & Q3, malfunctioning.
10. Intermittent connectors.
11. Spindle motor internally shorting and drawing too much current.

DRIVE NOT READY

NOTE: The signal drive ready depends on three signals. They are:

1. Spindle turning (at least 50% up to speed).
 2. Index pulse present on selected unit.
 3. Diskette presense micro switch depressed.
1. Data and Interface P1 pin 22 low when unit 0 is ready.
 2. Data and Interface P1 pi 6 is low when unit 1 is ready.
 3. Index pulse should be present at: U30 pin 3 for unit 0
(D & I PCB) U30 pin 11 for unit 1
 4. U6 pin 6 (D&I) should be low for unit 0 ready.
U6 pin 2 should be low for unit 1 ready.
 5. If diskette presense micro switch is tripping, U32 pin 2 should go high.
 6. J5 pin 5 on D & I PCB should go high as spindle reaches correct speed.

INDEX/SECTOR MISSING

Drives previous to serial # 2500

1. U22 pin 7 should have switching TTL levels for Sector unit 0.
U18 pin 7 should have switching TTL levels for Sector unit 1.
2. Photo transistor should be saturating (see alignment procedure, step 15).
3. Timing on one-shots (U10) incorrect:
 - a) pins 5 and 12 switch with each sector mark.
 - b) pins 4 and 13 switch with each index mark.
4. Hard sectored diskette requires 32 sector holes + 1 index.

Drives after serial # 2500:

1. Identical to step 1, above.
2. Identical to step 2, above.
3. U19 not enabled by the unit select and/or drive select logic.
4. U60 pin 4 should be high.
U60 pin 5 should be switching with every sector hole.

5. Index unit 0: a) U26 pin13 has an index pulse every 166.7 msec
b) U26 pin 12 held high
6. Index unit 1: a) U26 pin 12 has index pulse every 166.7 msec
b) U26 pin 13 held high

NO SEPARATED CLOCKS OR DATA

1. U1 pin 1 on PLO PCB for read data pulses.
2. PLO Clock on P6 pin 1 should be relatively stable (output from U5 pin 11 on PLO board).
3. Stable 500 KHz sawtooth on TP 3 of PLO board with heads loaded. If it is unstable, adjust R13 for stability.
4. TP 1 and TP 2 on PLO board should be biased correctly (see alignment procedure, step 9).
5. Check one-shots (U10 pins 4 and 12) for pulses.
6. Check the Johnson Code Counter (U4, U6 and U7) for counting pulses. This is a common problem area.
7. If all these signals are present, check the connections from J6 on D & I to the PLO board for cold solder joints, broken wires or loose crimp connectors. This is a common problem on the drives.
8. Check the drivers on the D & I board (U13).

WRITE PROBLEMS

Drive won't write at all:

1. PLO Clock is off.
2. No Index pulse or "Drive Not Ready."
3. U20 (D & I) pins 4 and 2 should be switching during a write.
4. U24 (D & I) pins 8 and 9 should be switching TTL levels:
 - a) Pulses close together for logical ones
 - b) Pulses far apart for logical zero
 - c) Pulses mixed for pattern of ones and zeros
5. The read back FETs should be biased off during a write or the FETs will "steal" the current from the write heads.

6. Biasing for the write transistor circuitry (Q19 - Q25) is not correct. The bases of Q20 for unit 0 and Q23 for unit 1 from track 0 to track 43 should be at 24 Volts. From track 44 to track 76, however, they should be biased at 12 Volts. If not, check track sense (alignment step 4) and the supporting analog circuits to the write logic (e.g., tunnel erase).
7. U21 pin 13 should be low when reading and high when writing. The following logic should switch accordingly.

NOTE

The PERSCI drive is set up in such a way that when the unit is not writing it is reading. This means the units are always reading unless told to write.

8. Write protect (U29 pin 13 on D & I) is being held low.
9. Write protect LED installed and connected to J19 or J20 on the D & I PCB.
10. Power on delay (U29 pin 12 on D & I) held low or waiting for the spindle to come up to speed.
11. Faulty drive select logic on D & I board.
12. Cable or indicator panel malfunction.
13. Bad head or crimp connector at P15 or P16 connecting the heads to the write drivers.

Write Retry during a DISKCOPY:

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1. Head penetration on side 1 incorrectly adjusted (refer to alignment procedure, step 19).
 2. Dirty head (clean with a gauze pad and 95% Isopropyl Alcohol).
 3. Head motion being mechanically impeded by head cable (unit 1) catching on the IC socket pins (solder side) of D & I board. Re-route head wires through restraints.
 4. Short or open in the head connecting wire harness or loose connection inside the head itself. These problems might be aggravated during a rapid or extreme seek and relatively undetected at other times. The SEEK TEST should catch these.

5. Worn heads (this is most unlikely due to the superior construction of the heads). The heads are specified to last 5 years.
6. Bad or worn diskette, wrong diskette. PERSCI recommends the following diskettes with their drives:

*DYSAN and MAXELL

*NOTE: Of the two, it is our experience DYSAN has a longer life and is more durable.

PART III

SIMU-CISER

PERSCI DRIVE EXERCISER PROGRAM

This program simulates the operation of the PERSCI Drive exerciser by using the HELIOS II hardware in conjunction with the Sol.

Requirements for using this program are:

1. Functional Sol.
2. Functional HELIOS controller boards.
3. 8K of contiguous memory starting at location 0.
4. PROCESSOR TECHNOLOGY SERVICE and MAINTENANCE MANUAL.

To load this program from cassette use the SOLOS command:

XEQ SIMU (Carriage Return)

SOLOS will respond by removing cursor.

The program will now be loaded and will automatically execute. The starting address is at 0.

COMMAND SYNTAX RESTRICTIONS

This program is written to start and restart at location 0. The command name must start at the first location after the '*' prompt. All parameters must be separated from each other or the command name with a minimum of 1 space and a maximum of 9 spaces. Only the first 2 characters of the command name are significant, but the command name cannot be more than 11 characters long.

DEFINITION OF TERMS:

- trkn Track number in the range of 0 to 76.
- patrn A number in the range of 0 to 76. This number does not represent the actual pattern but is used as a key as to the pattern to write.
- { } Denotes an optional parameter.

SPECIAL KEYS:

Global:

- escape Unconditional return to Solos/Cuter.
- mode select Abort current command and return to Simu-Ciser
or ctrl-@, command mode.

Local:

- 'T'oggle Used only by the HLoad command. Causes head on selected unit to unload if loaded and load if unloaded.
- 'A'utomatic Set mode of SEek of SStep to automatic. Between each step or seek, the consol input is checked for a change of mode or abort. If a 'M' is the character that was received, the mode of the step or seek is changed to manual.
- 'M'anual Set mode of SEek or SStep to manual. When in this mode the program will wait for input from the consol. If the character received is an 'A', the mode of the seek is changed to automatic.
- 'Y'es Used only as a verification of the WRite command. Your only chance to abort the WRite command is when the program is waiting for this character.

COMMAND DEFINITIONS:

WRite trkl unit ptrn

WRite a pattern, signified by 'ptrn', on track 'trkl' of the disk in unit 'unit'. The argument 'ptrn' is interpreted as follows:

0 means a pattern of all zero bits.
1 means a pattern of all one bits.
A number greater than 1 means a pattern of eight zero bits and eight one bits.

Your only chance to abort this command is when the program is waiting for a response to the 'Insert disk...' prompt. At this point pressing the 'Y' key and return will allow the program to continue. Any other key will abort the write.

SStep trkl trk2

Single step from trkl to trk2. This command will single step from trkl to the next track in the direction of trk2 and wait for seek complete. At this point the consol is checked for a change of mode or an abort. Upon reaching trk2 the direction of the seek will change.

SEek trkl {trk2}

This command will seek directly from trkl to trk2 with no delay. The program will ask the user to select the unit desired (Unit 0, type "0", unit 1, type "1"). The program will also ask whether Automatic Mode or Manual Mode is sought (type "M" for Manual and "A" for AUTOMATIC). When trk2 is reached the consol will be checked for a change of mode or an abort. If an abort is not received, the direction of the seek is reversed. If the optional second parameter is not present, the program will seek to trkl and return to the command mode.

HLoad unit

This command causes the read/write head of unit 'unit' to be loaded. After the head is loaded the program will wait for a 'T' or an abort from the consol. If a 'T' was the character received, the program will toggle the state of the head, i.e., if the head is loaded, it will be unloaded. This sequence will be repeated until aborted.

REstore

Restore drive to track.

EXit

Return to the Solos/Cuter monitor.

ALIGNMENT CHECKLIST

TECHNICIAN _____

STEP	COMMENTS
1. LAMP VOLTAGE	_____
2. TACH VOLTAGE	_____
3. POSITIONER VOLTAGE	_____
4. TRACK SENSE	_____
5. DIRTY SCALE	_____
6. A) SEEKTIME	_____
B) 1-Ø OVERSHOOT	_____
C) 75-76 OVERSHOOT	_____
D) STEP SEEK	_____
7. SPINDLE SPEED	_____
8. ISV	_____
9. PLO	_____
10. SEP CLOCK & DATA	_____
11. RESOLUTION SIDE Ø	_____
12. HEAD CONTACT Ø	_____
13. HEAD LOAD Ø	_____
14. CONE SIDE Ø	_____
15. INDEX SIDE Ø	_____
16. AZIMUTH SIDE Ø	_____
17. CATSEYE SIDE Ø	_____
18. RESOLUTION SIDE 1	_____
19. HEAD CONTACT 1	_____
20. HEAD LOAD 1	_____
21. CONE SIDE 1	_____
22. INDEX SIDE 1	_____
23. AZIMUTH SIDE 1	_____
24. CATSEYE SIDE 1	_____

PART IV

ALIGNMENT PROCEDURE

The following is the recommended alignment procedure for the PerSci Model 270 Disk Drive. The procedure is to be used in conjunction with the Processor Technology Simucisor program available on cassette and a Solos/Cuter computer with Helios II disk controller boards.

A general alignment is recommended under the following circumstances:

1. Disk Drive fails the "Seek" portion of DISKT test program or has erratic seeking problems.
2. Disk Drive gets an inordinate amount of errors during the "Automatic" portion of DISKT test program and the problem has been isolated away from memory/controllers.
3. Disk Drive cannot read Diskettes written on other units or written on unit 1. This will be referred to as incompatibility between drives.
4. Miscellaneous problems such as missing Index/Sector pulses, spindle speed problems, inability to write to a diskette or routine maintenance.

It is recommended that the technician read through the procedure first before attempting to align the disk drive, and that the procedure be followed in order.

The following tools are required:

1. Dual trace Scope with external sync and at least 25Mhz bandwidth and ability to invert one of the channels.
2. Set of allen wrenches similar to Xcelite # 99-PS-40.
3. Set of screwdrivers ranging from 1/8" blade to 3/8" blade as well as Phillips type.
4. 4" Piece of heat shrink tubing used to insulate the above screwdrivers and allen wrenches from possible shorts during catseye/azimuth adjustments on unit 0.
5. 95% Isopropyl Alcohol and cotton swabs.
6. Dysan Alignment Diskette (obtained from Processor Technology).
7. Scratch diskette (32 Sector holes).

NOTE: The waveforms in this section are ideal representatives.

CAUTION!! IF DRIVE IS TO BE REMOVED FROM CABINET, BE SURE DISKETTE EJECT SWITCH SOLDER CONTACTS DO NOT SHORT TO DRIVE BASE OR CHASSIS WITH POWER ON. THIS WILL SHORT 24 VOLTS TO GROUND AND BURN OUT R126 OR R137 ON DATA AND INTERFACE PCB. ALSO BE SURE TO CHECK ALIGNMENT AFTER DRIVE IS RE-INSTALLED IN CABINET AS THERE IS A TENDENCY FOR THE CABINET TO TORQUE SLIGHTLY ON THE DRIVE CHASSIS.

GENERAL ALIGNMENT PROCEDURE

1. POSITIONER LAMP VOLTAGE:

The Positioner lamp is a 6 volt incandescent lamp mounted on the Lamp Amp PCB and provides the light source for the solar cells which detect markings on the positioner scale.

This lamp adjustment affects all the other adjustments on the Lamp Amp PCB and should always be done first.

Connect scope probe to TP 7 on the Lamp Amp PCB and DC couple. Scope should read +1.5 volts. If not, adjust R3 (pot) on Lamp Amp PCB for +1.5 VDC. NOTE: 1.6v absolute maximum

If lamp voltage reads 5 volts and cannot be brought into spec, the most likely cause is a burned out lamp. In this case, with the power turned off, the resistance between TP 7 and ground will be infinite and the lamp should be replaced.

2. TACH VOLTAGE:

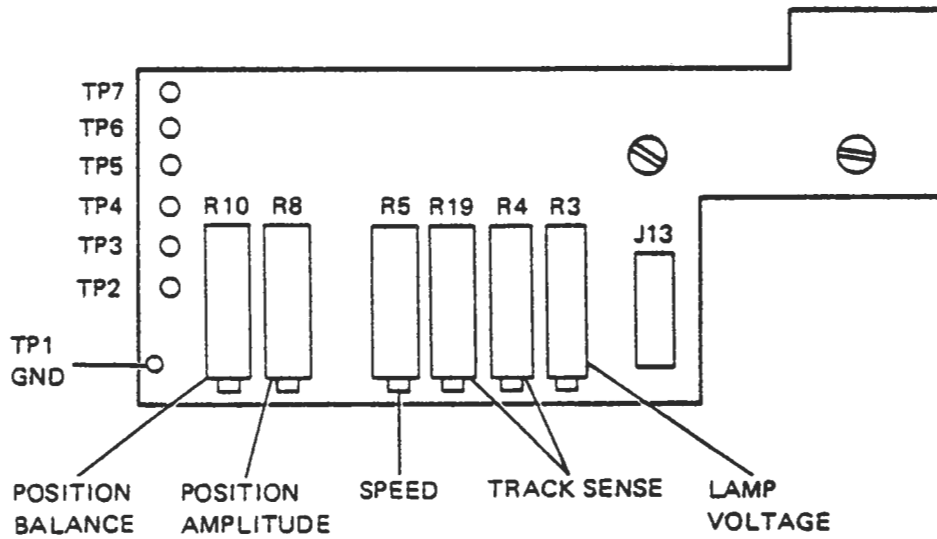
This adjustment is a coarse adjustment of the circuit which controls the speed at which the head seeks between tracks.

Later in the procedure this will be adjusted more accurately. Symptoms of a problem here would be head either seek too slowly or too fast and "hunting" for tracks.

Connect scope probe to TP 5 on Lamp Amp PCB and disconnect P8 from the Positioner Servo PCB. This allows manual movement of the head assembly. Manually move the head to track 0 and note the reading on the scope. Manually move the head to track 76 and note the reading on scope. Adjust R5 for a -1.5 volt difference from the track 0 reading. called J8 on schem.

3. POSITIONER VOLTAGE:

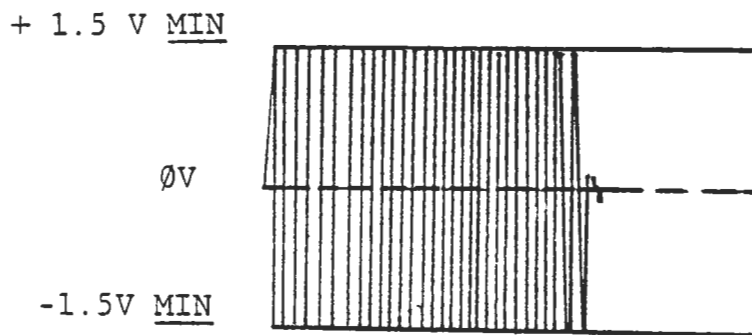
This adjustment is to set up the correct voltage for the detent pulses (one sine wave cycle for every track that the head moves) which enable the drive to "know" how many tracks it has traversed. Symptoms of a problem here might be seek errors, "hunting" or head slamming to extremes during a seek.



Lamp Amplifier PCB



1. Lamp Voltage



3. Positioner Voltage

best;
3.4V.P-P

Connect scope to TP 2 on Lamp Amp PCB and leave disconnected as in previous step, P8. Manually move head between track 76 and 0 and note voltage on scope. The voltage should be an absolute minimum of 3 Volts Peak to Peak, and should be centered about the 0 Volts line. Adjust R8 for amplitude change and R10 for balance through zero.

4. TRACK SENSE ADJUST:

The purpose of this adjustment is to allow the drive to sense the point at which it reaches track 43-1/2 at which point it is necessary for the bias on the write head transistors to decrease. This keeps the drive from over saturating the media on the innermost tracks which are moving at a slower velocity but are being written at the same clock rate.

NOTE

At this point it is necessary to have the SIMU-CISOR program loaded into memory and to be in the command mode which is indicated by an asterisk prompt. Also be sure that P8, removed in the last 2 steps, is reconnected.

Type: SE 44 43 <CR>
SIMU will respond "Automatic or manual?"

Type: A <CR>

The head should now be seeking between tracks 44 and 43. Place scope probe on TP 6 of Lamp Amp PCB and adjust R4 (gain) and R19 (balance) for a voltage swing of +0.5V and -1.25V centered about the zero volt line:

5. DIRTY SCALE:

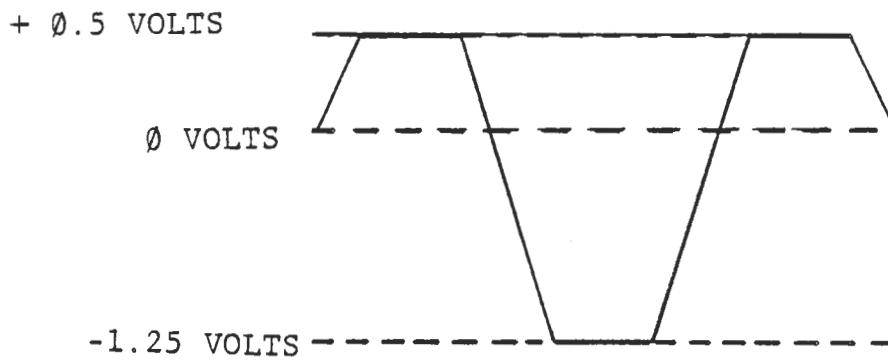
Under normal operation the scale is sheltered from dust particles by the scale cover and the filtered air system of the Helios II cabinet. However, under certain circumstances, the scale will become dirty and must be cleaned. In particular, the wedged-shaped window on the bottom of the scale which is used for the tach output is most sensitive. A problem here might cause erratic seek problems and skipping tracks as well as slamming against stops.

TYPE: SE 0 76 <CR>
SIMU will respond "Manual or automatic?"

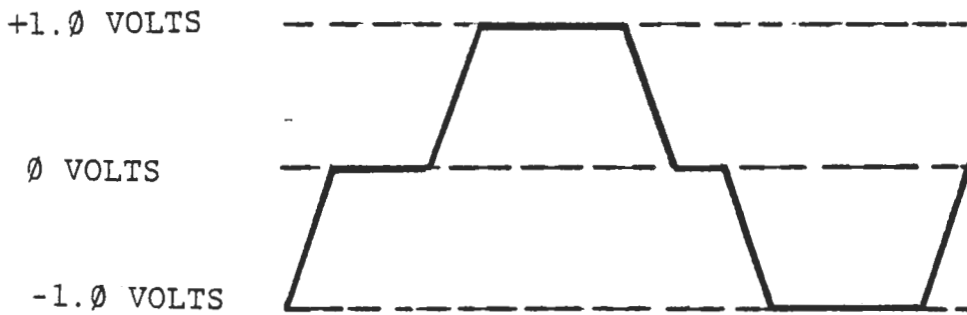
TYPE: A <CR>
SIMU will respond "Unit?"

TYPE: 0 <CR>

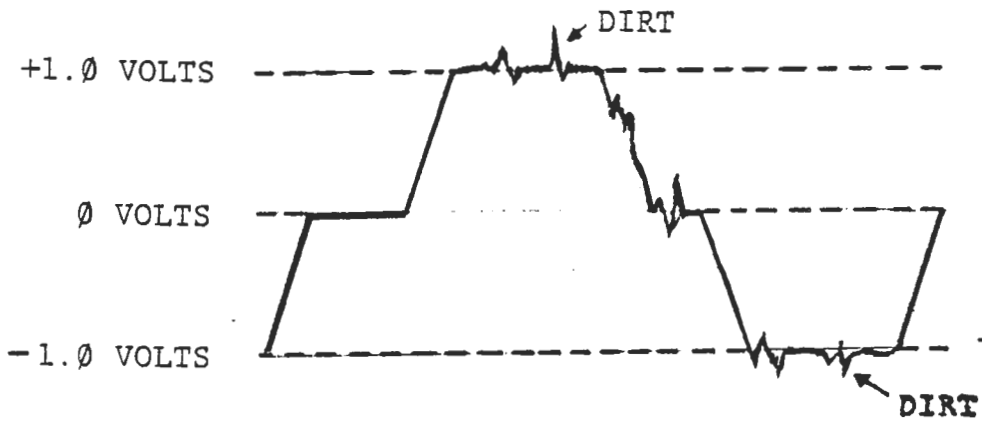
The head should now be doing a fast seek between tracks 76 and 0. Trigger scope on P1 pin 10 (Seek Complete), move probe to C8 (U13 pin 7) on Positioner Servo PCB. Normally there will be a small amount of noise riding on this signal. Any spikes greater than 0.25 Volts



4. Track Sense



5. CLEAN SCALE (NO SPIKES)



5. Dirty Scale

usually indicate dirt on the scale. Both sides of the scale should be cleaned with a dry cotton swab or, if a really hard to remove spec is found, use a small amount of alcohol, and then wipe again with a dry swab. Replace the scale.

6A. SEEK TIME (Track 0 to Track 76)

This is a coarse adjustment to bring the seek time between tracks 0 and 76 into specification which is a maximum of 95 msec.

TYPE: SE 0 76 <CR>

SIMU: Automatic or manual?

TYPE: A <CR>

SIMU: Unit?

TYPE: 0 <CR>

The head should be seeking between 0 and 76 as in the previous step. Move scope probe to TP 2 on Lamp Amp PCB and trigger on Seek Complete (P1 pin 10 on Data and Interface PCB). There should be a 3 Volt pk-pk signal balanced about 0 line (as adjusted statically in step 3 above). If not adjust R8 and R10 to bring into spec (this is a dynamic adjustment, while the head is in motion). With the the scope set on 10 msec/division trigger to see burst. The burst should be 9.5 cm long, i.e., 95 msec. (See Illustration.) If necessary, adjust R5 on Lamp Amp PCB to speed up or slow down positioner.

6B. SEEK TIME (Track 0-1)

TYPE: SE 0 1 <CR>

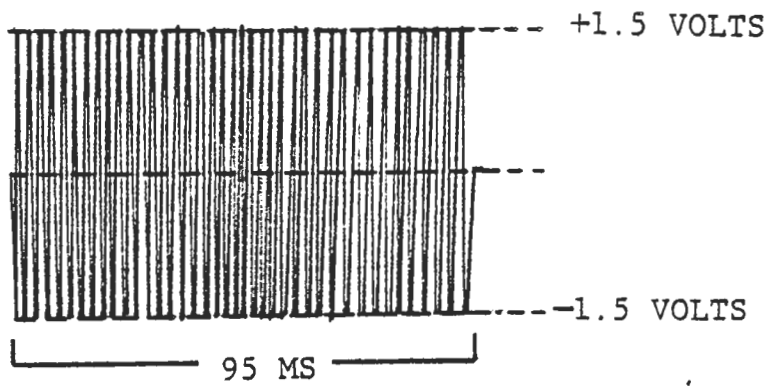
SIMU: "Automatic or manual?"

TYPE: A <CR>

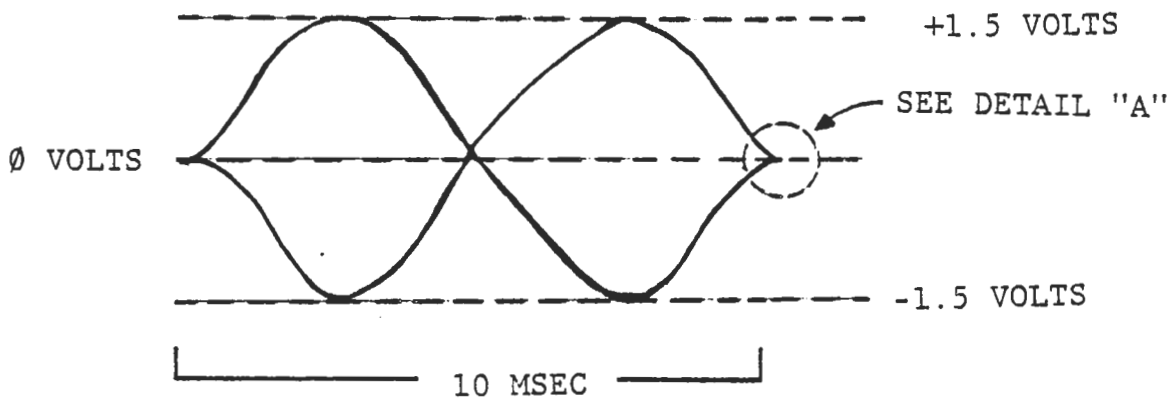
SIMU: "UNIT"

TYPE: 0 <CR>

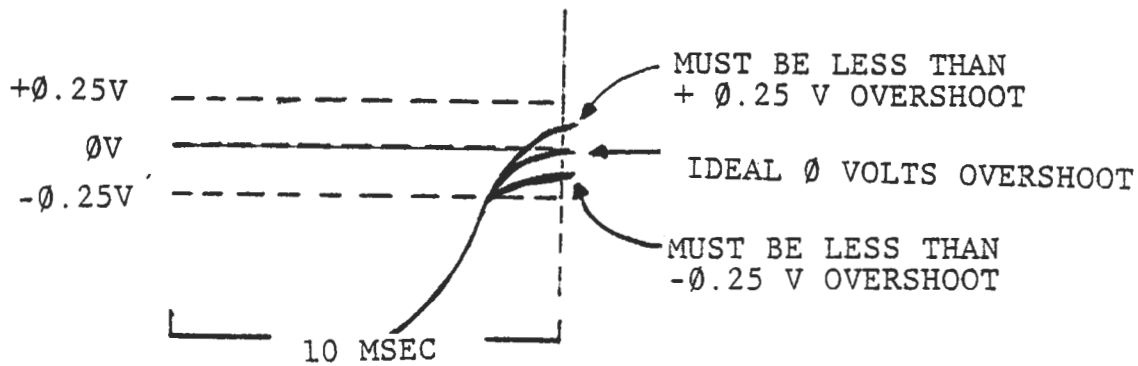
The head should now be seeking between tracks 0 and 1 and the scope should be on TP 2 and triggered on Seek Complete (as in part A). Time base should be on 1 msec/division. Trigger to see one full cycle as in diagram. There are actually two waves, both sinusoidal, but 180 deg. out of phase. They should have a duration of 10 msec and be relatively symmetrical. Adjust R5 for speed variation and R33 on Positioner Servo PCB for symmetry.



6 A. SEEK TIME 0 - 76



6 B & C Seektime [Track 0-1 & 75-76]



Detail "A"

6C. SEEK TIME (Track 75-76)

TYPE: SE 76 75 <CR>
SIMU: "Automatic or manual?"

TYPE: A <CR>
SIMU: "Unit?"

TYPE: 0 <CR>

The heads should now be seeking between tracks ⁷⁵ and 76 and scope should be on same setup as part 6B. Again, adjust R5 and R33 for 10 msec duration and symmetry as in step 6B above.

6D. STEP SEEK AND OVERSHOOT (Tracks 0 through 76)

This is the most crucial of the seek adjustments in that the adjustment is to check the overall range of seeking (tracks 0-76) and correct excessive overshoot and speed problems encountered throughout that range.

TYPE: SS 0 76 <CR>
SIMU: "Automatic or manual?"

TYPE: A <CR>

The heads should now be doing a rapid step seek from track 0 to track 76 and back again. The head is actually stepping to each individual track stopping and then proceeding to the next track. Scope should be in same setup as previous two steps except the time base should be on 2 msec/division. Trigger to see one full cycle (it will change phase everytime the head reaches an extreme). The period of the wave should again be 10 msec and should have settled within 0.25 Volts of the zero line by the time 10 msec is up. (See diagrams.) If this is not the case, adjust R5 and R33 (as in previous steps) to bring into spec.

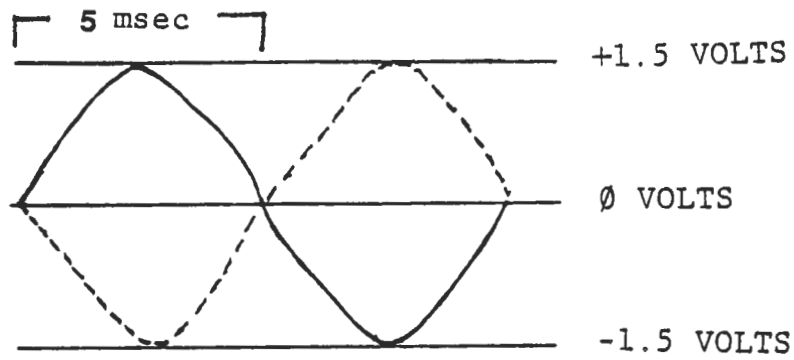
NOTE

If excessive jitter occurs on the scope display of the last waveform, this is an indication of an excessive amount of dirt on the positioner scale and a repeat of step 5 is advised.

7. SPINDLE SPEED

It is critical to the controller hardware that the spindle speed be as close to 360 RPM as possible. For that reason, the spindle is controlled by a DC Servo loop which constantly monitors its speed. The reference oscillator for this circuit is on the D & I PCB (Page 3 top most op amp on the D & I schematics) and free runs at 200 KHz.

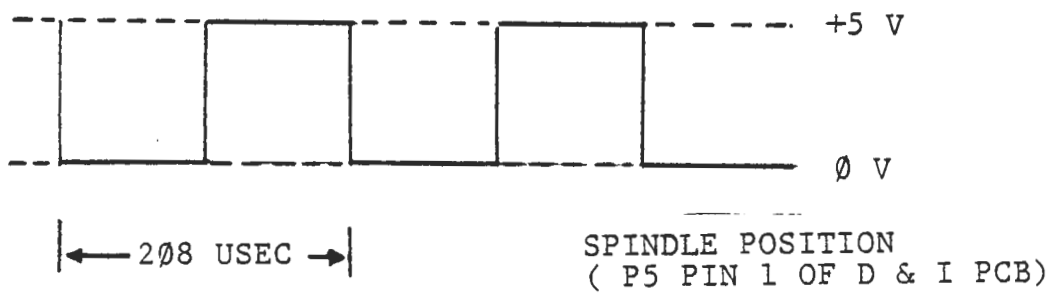
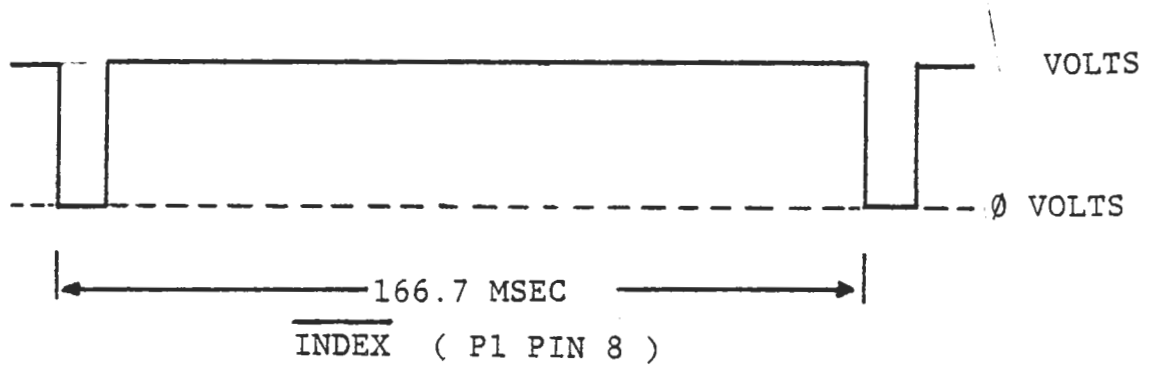
The most common problem in this circuitry is a worn motor or spindle bearing (usually preceded by noise) or the output transistors to the spindle motor itself.



~ REPRESENTS SINGLE TRACK SEEKS FROM 75 TO 76

~ REPRESENTS 180° PHASE DIFFERENCE IN STEP SEEK 76 TO 75

6D Step Seek Overshoot



7. Spindle Speed

If no counter is available, place diskette in either unit, and measure the interval of the Index pulse on P1, pin 8 (D & I PCB), it should be approximately 166.7 msec (use 32 sector hole diskette). Next measure P5, pin 1, (D & I PCB) it should have a period of 208.3 usec with the spindle in motion. If these are off, adjust R154 on D & I PCB until they come into spec. If a frequency counter is available, connect to P5, pin 1, as above, and measure the frequency.

It should be 4.8 KHz with a diskette spinning. Pin 3 of P5 should be a 200KHz square wave whether or not a diskette is inserted.
 $f_0 \approx 250\text{KHz}$

8. INSTANTANEOUS SPEED VARIATION:

This is a check of the spindle servo to ensure that it can track the rotational speed of the spindle and compensate for any variation in speed. There are no adjustments to be made.

Connect scope to P5, pin 1 as in last step, and display about ten cycles on scope (diskette should be turning). Next go to 10X magnification on the scope. The pulse must not wander more than 3 cm total. Slow spindle slightly with pressure on the diskette, the pulse will drift considerably but should return rapidly to original location when pressure is released and as the servo again locks in. Problems in this area are very rare.

9. PHASE LOCKED OSCILLATOR:

The Persci drive is responsible for providing separated clocks and data to the controller board. To accomplish this, a phase-locked loop detects the pulses much like the cassette interface of the Sol except discreet components are used. Problems in this area most often occur in this PLL circuit, and most can be eliminated by proper DC bias. Rarely is there a problem in the Johnson Code Counter circuit or the following one-shots.

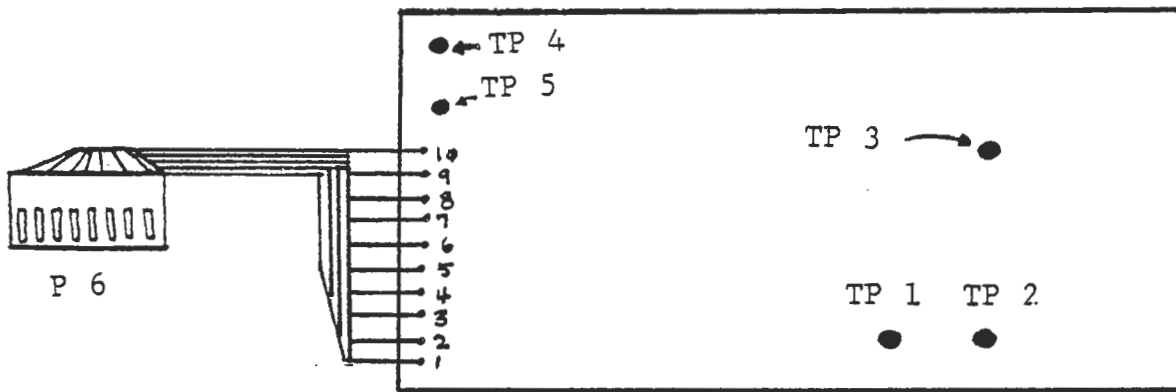
TYPE: WR 0 0 2 <CR>

SIMU: "Insert diskette and verify command"

TYPE: Y <CR>

TYPE: HL 0 <CR>

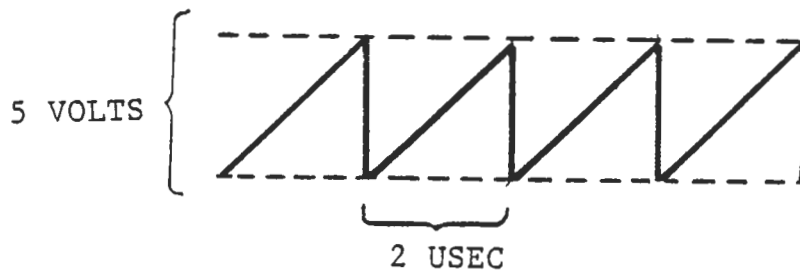
This will now have written a pattern of ones and zeroes to track 0 and loaded the head on unit 0 for a read. Now connect channel one of the scope to TP 1 and invert channel 2 and connect it to TP 2 on the Phase Locked Oscillator PCB. The scope should be in the add mode and with the inputs to the scope removed should be centered at zero reference. The scope inputs should be switched on again, should be at .2 V/division, DC coupled and the time base set at about 20 msec/division. You should see basically a DC level centered about zero reference with small fluctuations above and below 0 reference. Adjust R13 on PLO PCB if necessary to change this DC level. Also check TP 3 on this board, it should be a 500 KHz sawtooth waveform and relatively stable, tracking with disk speed variations.



PHASE LOCKED DOUBLE DATA SEPARATOR



9. Phase Locked Loop DC Bias



9. 500 KHz Sawtooth [TP 3]

10. SEPARATED CLOCKS AND DATA:

Whenever a pattern of data is written to the disk, a series of clocks are also written to the disk. It is between these clocks that we see the data. In the case of FM recording, a one is represented by the presence of a pulse between the clock pulses and a zero is represented by no pulse between these clock pulses.

```
=====
WRITE ALL ONES
=====
```

```
TYPE: WR 0 0 1 <CR>
SIMU: "Insert disk ..."
TYPE: Y <CR>
TYPE: HL 0 <CR>
```

```
=====
WRITE ALL ZEROES
=====
```

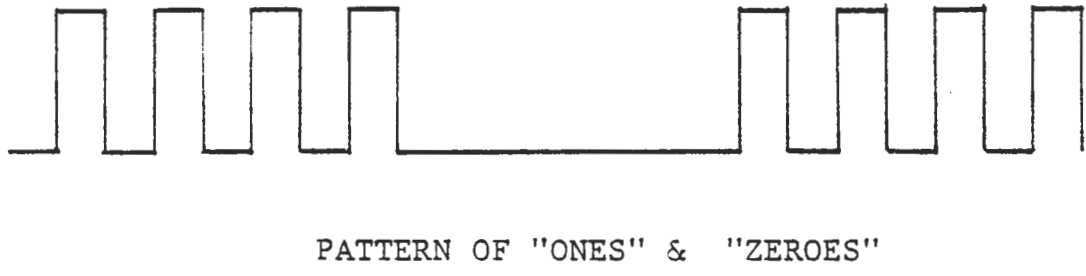
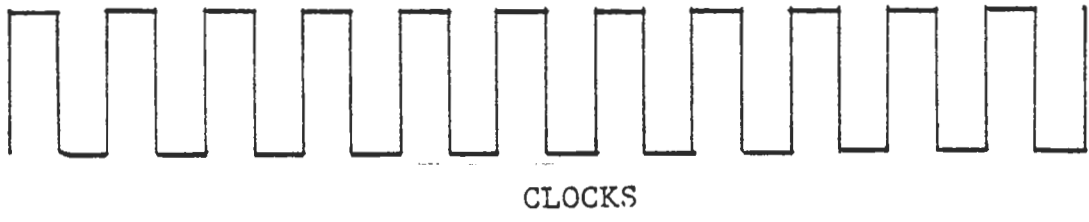
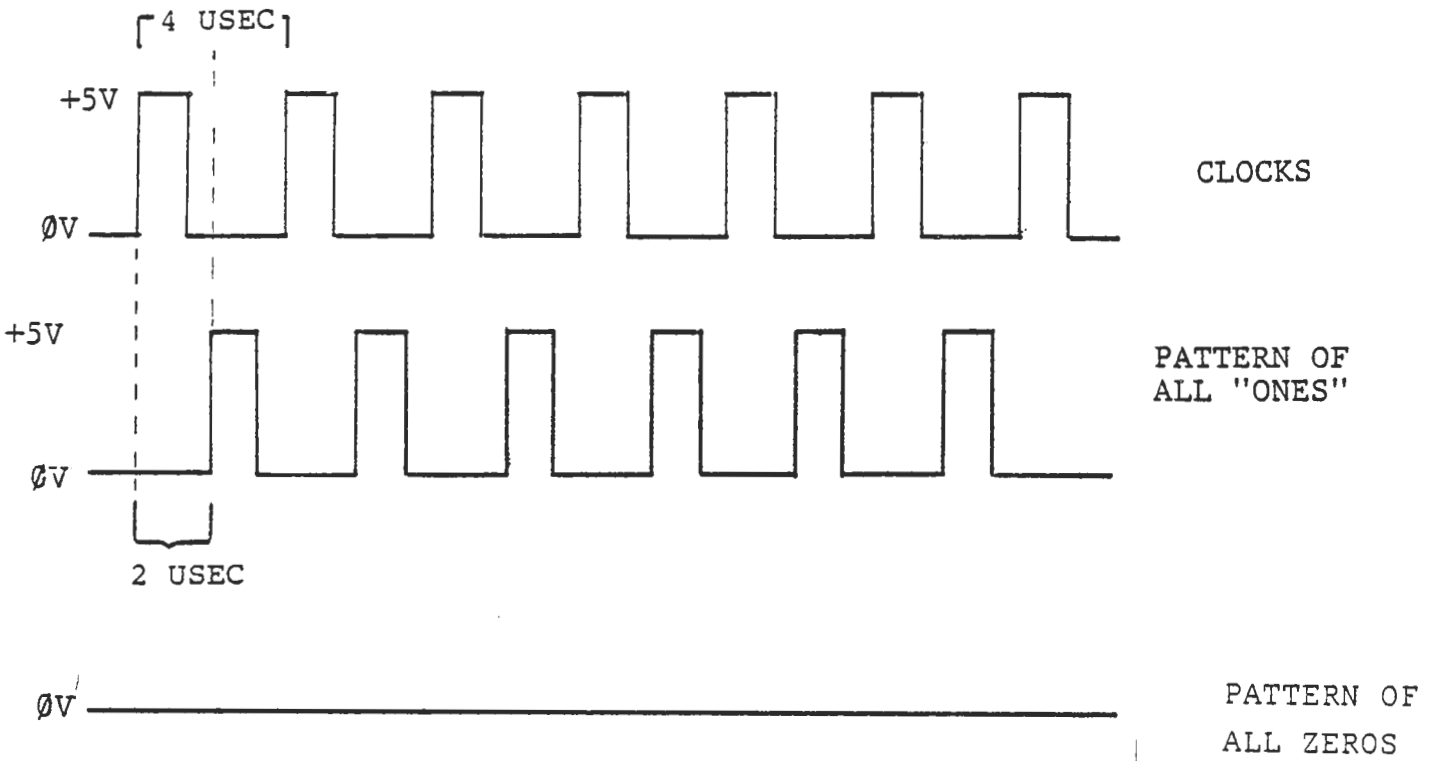
```
TYPE: WR 0 0 0 <CR>
SIMU: "Insert disk ..."
TYPE: Y <CR>
TYPE: HL 0 <CR>
```

With scope on alternate sweep, connect probes to TP 4 and TP 5 of PLL Data Separator PCB. Sync on TP 4 (clock). Time base should be .5 usec/div, and 2 volts/division. Write a pattern of all ones using the commands above. The data should be a positive pulse following 2.0 usec after each clock pulse. Write a pattern of all zeroes as in the above command and note the absence of data pulses in between the clocks.

NOTE

Since the hardware of the controller must write a header before writing the data block of all zeroes or ones their will appear "ghost" ones during the all zeroes data and some flickering of ones when all ones are written.

This is the end of part one of the alignment procedure, all the steps following this pertain to Heads, Cones or Index Sensor alignment. Symptoms of problems concerned in this part are Write/Read errors or problems of drive incompatibility.



PLL TP 4 & 5

===>> THE FOLLOWING STEPS ARE MADE WITH THE <<===
SCOPE CONNECTED ACROSS C21, TP 4 AND TP 5
OF THE DATA & INTERFACE PCB. SCOPE SHOULD
BE IN ADD MODE WITH CHANNEL B INVERTED AND
SHOULD BE AC COUPLED, .2 VOLTS/DIVISION AND
SYNC SHOULD BE ON INDEX, P1 PIN 20.

11. RESOLUTION SIDE 0:

TYPE: WR 0 0 2 <CR>

SIMU: "Insert a diskette and verify command"

TYPE: Y <CR>

TYPE: HL 0 <CR>

Sync scope on P1 pin 20 of the Data and Interface PCB. Insert a blank diskette in unit 0 and write a pattern of ones and zeroes with command above. The scope is presently connected across the outputs of the head on unit 0 and should display a pattern as illustrated. At track 0 there should be at least 10% difference between the two frequencies.

TYPE: WR 76 0 2 <CR>

SIMU: "Insert disk and verify command"

TYPE: Y <CR>

TYPE: HL 0 <CR>

This will write a pattern of ones and zeroes on track 76. On this track there should be a minimum of 50% difference between the two frequencies.

12. HEAD CONTACT SIDE 0:

TYPE: SE 0 76 <CR>

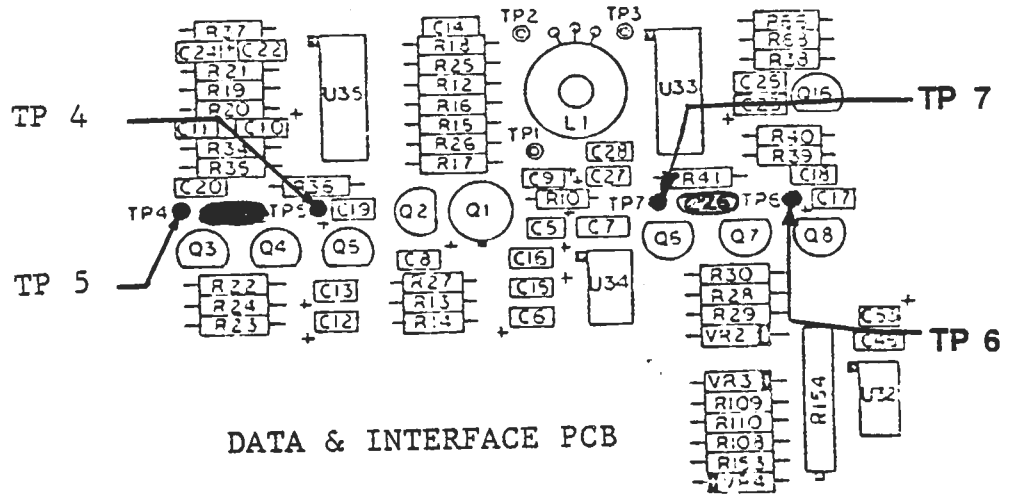
SIMU: "Automatic or manual?"

TYPE: M <CR>

SIMU: "Unit?"

TYPE: 0 <CR>

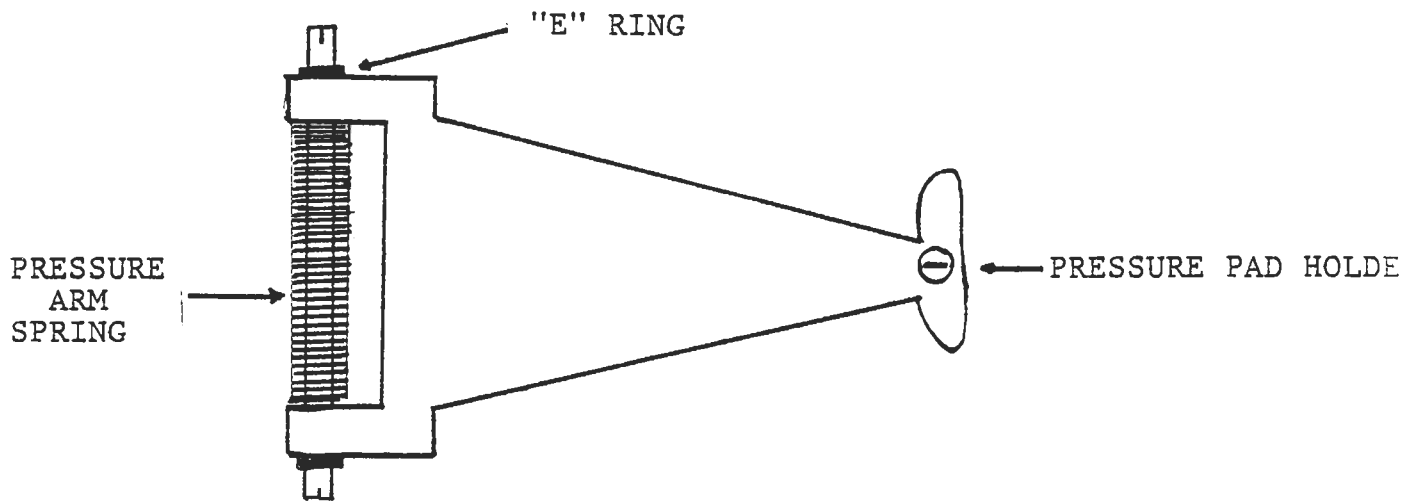
With the diskette used in the previous step and the same scope configuration, observe the waveform. Place finger on pressure pad arm and apply slight pressure. Signal should decrease or remain the same. If the signal increases, rotate pressure pad until there is no increase in signal or replace pressure pad as necessary. This check is to be made at tracks 0 and 76.



DATA & INTERFACE PCB



II. Resolution



Pressure Pad Arm

NOTE

Persci has used two different style pressure pads. One style is a fine rabbit hair, the other is a red synthetic material. Both appear to have good durability.

13. HEAD LOAD SIDE 0:

TYPE: RE <CR>

TYPE: HL 0 <CR>

With the scope in the same configuration as the past 2 steps, use the "T" key on the keyboard to toggle the head from its' loaded to unloaded position. Ensure the head lifts off the media. If the head does not lift off the media, loosen the two #2 allen screws on underside of the head load solenoid arm and adjust. After making this adjustment, check at tracks 0 and 76 to be sure head load is even over entire range.

14. CONE SIDE 0:

TYPE: RE <CR>

TYPE: HL 0 <CR>

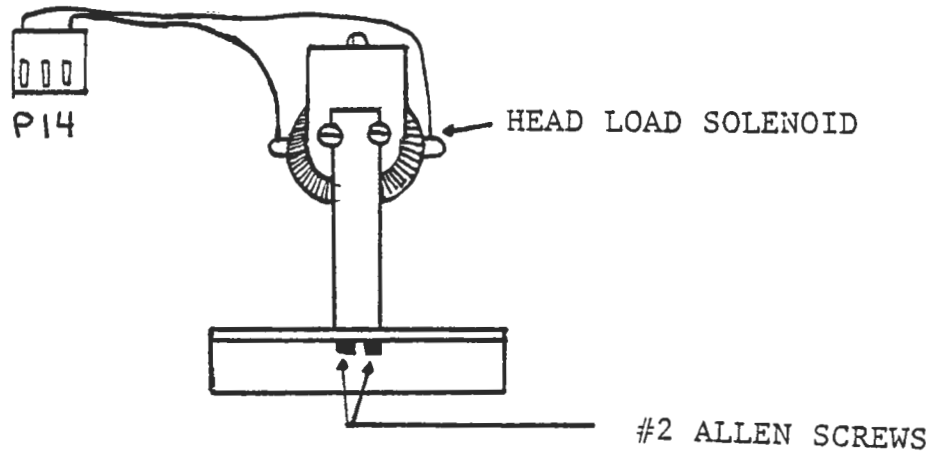
This check is to ensure cone is seating properly. With the scope still in the same previous configuration observe amplitudes of ones and zeroes previously written on the diskette. Remove and re-install the diskette several times, each time noting the amplitudes. If there is any change in amplitude of the signal, replace the cone. Also note to be sure cone is not sticking inside spindle and releasing with a loud snap.

NOTE

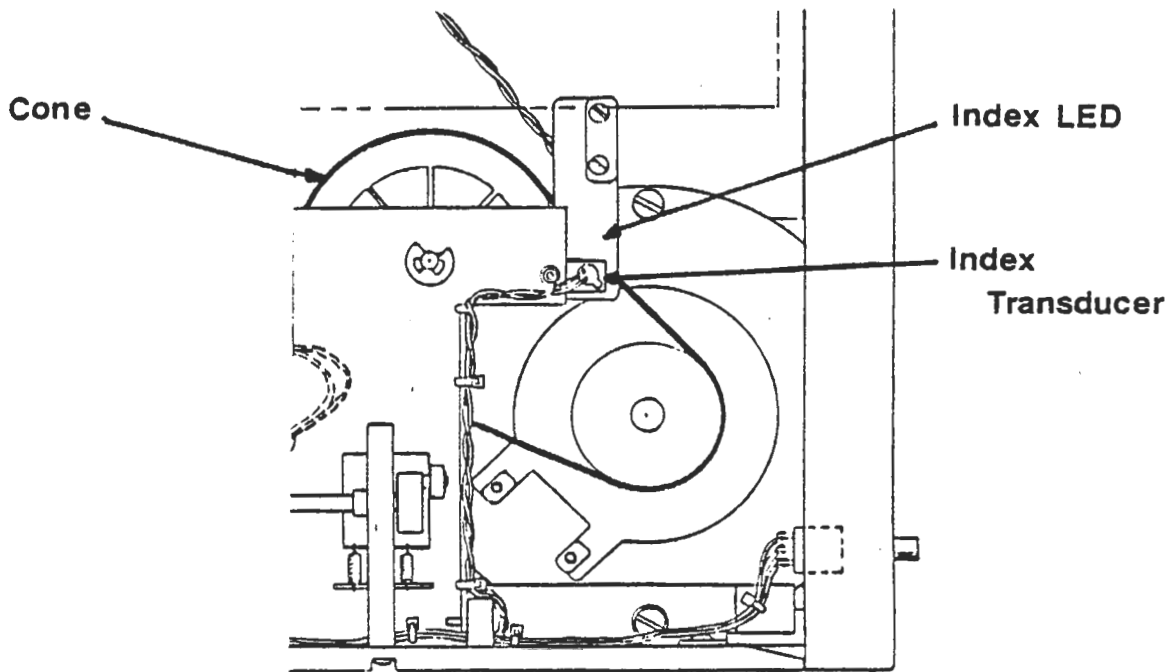
To replace cone, manually trip diskette presense switch to bring cone into spindle. Remove E ring from spindle shaft and press eject switch. Cone should now be free to remove with spring. Reverse the procedure to re-install new cone.

15. INDEX SIDE 0:

a. The first part of this step is to align the index phototransistor with the light source that drives it (they are both infrared). The index phototransistor on side 0 is located near the cone on the door and is mounted by a #2 allen screw. The transmitter section is mounted to the drive chassis with two slotted screws. When the two are in perfect alignment, maximum saturation is achieved and the steepest response curve is possible. Since the index and sector pulses are critical, the faster we can trigger the following op amps the more precise is the timing.



13. Head Load ø



15. Index ø

Place scope probe on P 11 pin 2 on the D & I PCB and trigger on that channel (2 volts/division). Insert diskette and note waveform. For every sector and index mark there should be an excursion towards zero volts. Maximum saturation occurs when this excursion is at 0 volts (or allowing for one diode drop, .3 - .6 V). If this does not happen, an adjustment must be made by loosening the two slotted screws on the emitter and the allen screw of the reciever. Manual loading of the door makes this easier. As the door closes, the scope should change from +5V to 0V. Adjust as necessary.

TYPE: RE <CR>
TYPE: SE 1 <CR>
TYPE: HL 0 <CR>

b. This part of the procedure aligns the index sensor to a data burst written on the alignment diskette. Re-connect scope probes across TP 4 and TP 5 as in steps before, in the add mode with channel B inverted and trigger should be on negative edge of P1 pin 20 (50 usec/division).

Insert Dysan alignment diskette and trigger to see waveform as illustrated. Data burst should occur 200 usec after trigger, plus or minus 20 usec. If it does not occur, loosen allen screw on receiver portion and align to spec. If index cannot be brought into spec, repeat step a and try this adjustment again. Eject and re-insert diskette several times to be sure the adjustment remains correct.

CAUTION

Do not over torque the allen screw as this could cause the plastic housing to crack.

16. AZIMUTH SIDE 0:

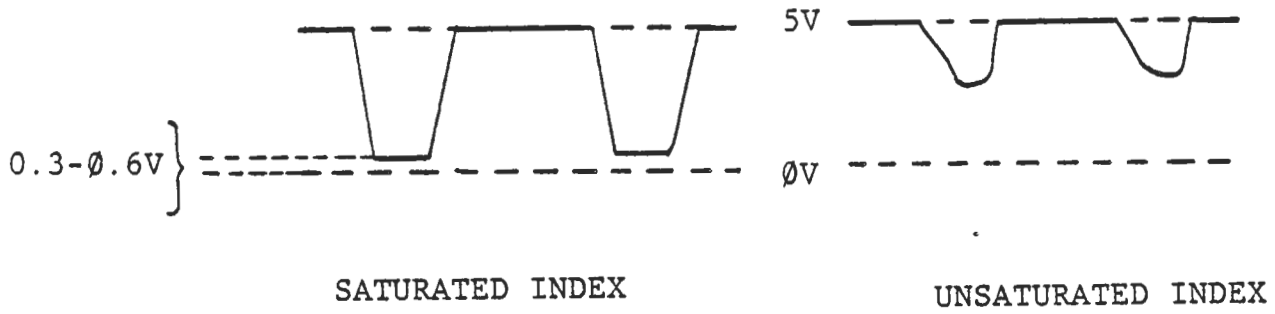
This adjustment checks the index data burst of the previous step on track 1 and track 76. Ideally, i.e., when azimuth is perfect, there should be no difference between these data burst. They should both occur at 200 usec after index and should be no more than 20 usec different from each other. (IF AN ADJUSTMENT IS MADE HERE, SIDE ONE MUST BE ADJUSTED ALSO SINCE IT'S THE SLAVE TO SIDE ZERO.)

TYPE: SE 1 76 <CR>
SIMU: "Automatic or manual?"

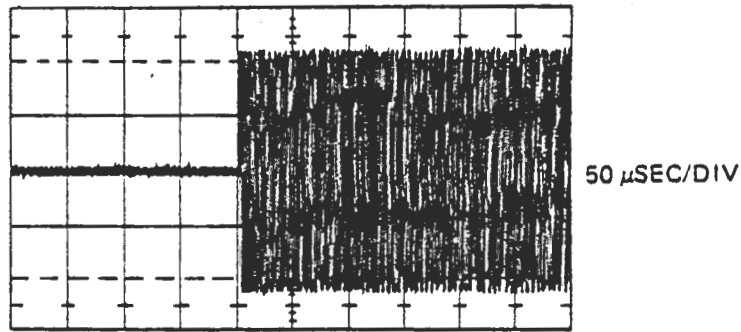
TYPE: M <CR>
SIMU: "Unit?"

TYPE: 0 <CR>

With the scope in the same configuration as last step, insert align diskette and note waveform. It should be 200 usec after index. Now toggle the "M" key to make the head move to track 76. If there is a difference, make the following adjustment:



15. Index ϕ



Index Pulse and Data Burst

Index & Azimuth [Units I & ϕ]

1. Loosen two Allen screws holding brace to servo (large black cylinder at rear of drive)
2. Loosen two Allen screws holding positioner servo to chassis.
3. With a screwdriver, gently pry up on the bottom of the servo mounting assembly (directly behind the diskette eject motor) where it meets the chassis.
4. Seek between tracks 1 and 76 and move servo up or down as necessary to bring into spec.
5. Tighten screws and check to be sure azimuth is correct after tightening.

17. CATSEYE SIDE 0:

This adjustment is needed to enable all drives to be able to read information written on all other drives. For this reason track 38 of the alignment disk (track 38 is nearly the center of the diskette) has a pattern referred to as a catseye (see diagram). (IF AN ADJUSTMENT IS MADE HERE, SIDE 1 CATSEYE MUST ALSO BE ADJUSTED SINCE IT IS THE SLAVE TO SIDE 0.)

TYPE: RE <CR>

TYPE: SE 38 <CR>

TYPE: HL 0 <CR>

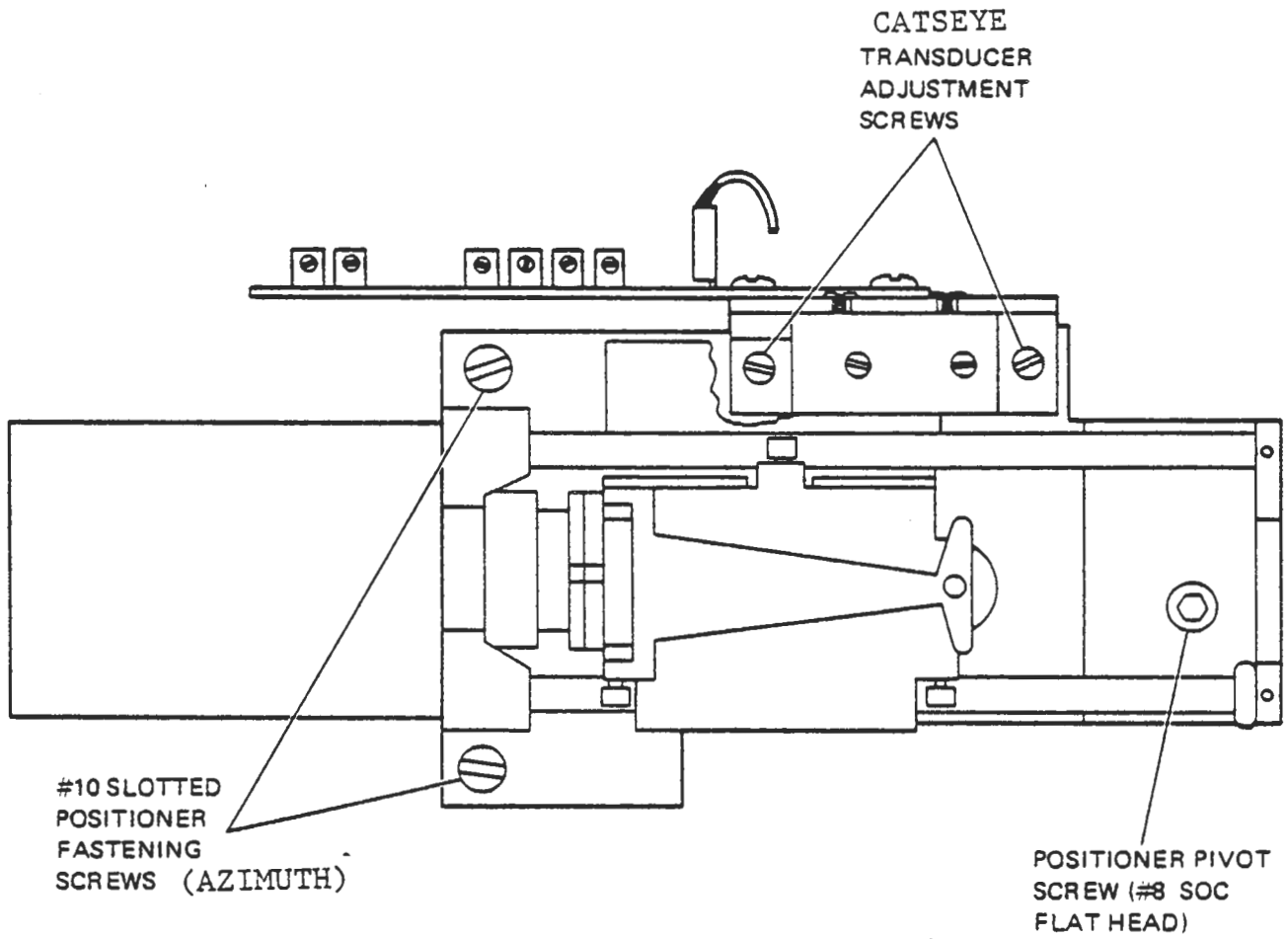
The scope is in the same configuration but this time is now 20 msec./division to allow a display of one entire track. The head should be on track 38 and loaded. Scope now shows the catseye pattern and both eyes should have the same amplitude. The maximum allowable difference is 10% which represents 1/2 mil off track. Ideally, this difference will be 0%. The following steps should be performed if the catseye is out of spec:

1. Remove black scale cover and restore drive to track 0.
2. Loosen two Allen screws mounting the black lamp housing to the chassis (on older models these may be slotted screws).

CAUTION

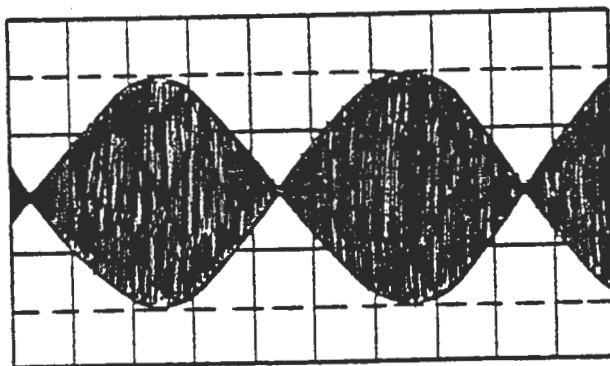
Be sure shrink tubing is installed on Allen wrench or screwdriver to prevent shorting to chassis.

3. Seek to track 38 and load the head on side 0.
4. Tap the Lamp Amp PCB in the appropriate direction (toward front increases left catseye, towards rear increases right catseye).



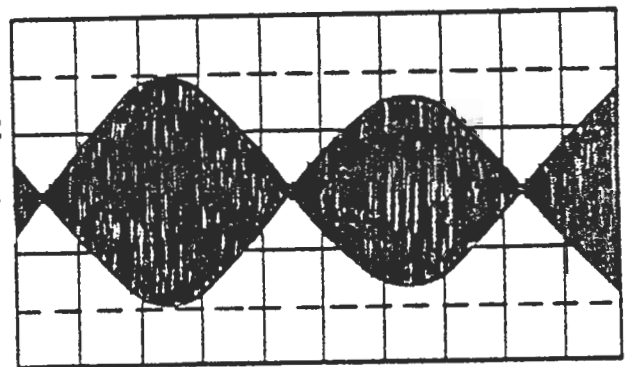
Positioner Track and Azimuth Adjustment (Side 0)

STEPS 16 and 17



EVEN AMPLITUDE 100% ON TRACK

20
MSEC
PER
DIV.



80% AMPLITUDE 1 MIL OFF TRACK

CATSEYE Track Alignment

5. Tighten Allen screws (be sure to recheck the catseye after tightening as this tends to change change the catseye alignment).

With a little effort, the catseye adjustment can be made close to perfect.

```
====>> THE FOLLOWING ADJUSTMENTS WILL BE MADE WITH <<====
        THE SCOPE PROBES ACROSS C26, TP 6 AND TP 7 ON
        THE DATA & INTERFACE PCB. CHANNEL B SHOULD BE
        INVERTED, SYNC SHOULD BE ON NEGATIVE EDGE OF
        INDEX (P 1, PIN 20) AND 0.2 VOLTS/DIVISION.
```

18. RESOLUTION SIDE 1:

```
=====
          TRACK 0
          =====
TYPE:  WR 0 1 2 <CR>
SIMU:  "Insert disk..."
TYPE:  Y <CR>
TYPE:  HL 1 <CR>

=====
          TRACK 76
          =====
TYPE:  WR 76 1 2 <CR>
SIMU:  "Insert disk..."
TYPE:  Y <CR>
TYPE:  HL 1 <CR>
```

Repeat step 11 with blank diskette inserted in unit 1 and use the commands written above.

19. HEAD CONTACT SIDE 1:

Problems most often seen if this is out of adjustment is "Write Retry" during a diskcopy, bad diskcopy or unable to complete a diskcopy.

Using the same commands as step 18, use the "T" key load and unload the heads. On this side, when the head is unloaded, the signal should disappear. Step between tracks 0 and 76 loading and unloading the heads. Side 1 has an adjustment for head penetration, the #2 Allen screw in the center of the plastic arm the head is mounted in. With head unloaded, adjust screw until signal disappears. Repeat for track 76. Check to make sure when head is loaded, signal returns. Also check condition of pressure pad. Caution is advised with this adjustment as too much head penetration can cause extreme problems with diskette wear. may be 50% down for unloaded heads.

20. HEAD LOAD SIDE 1:

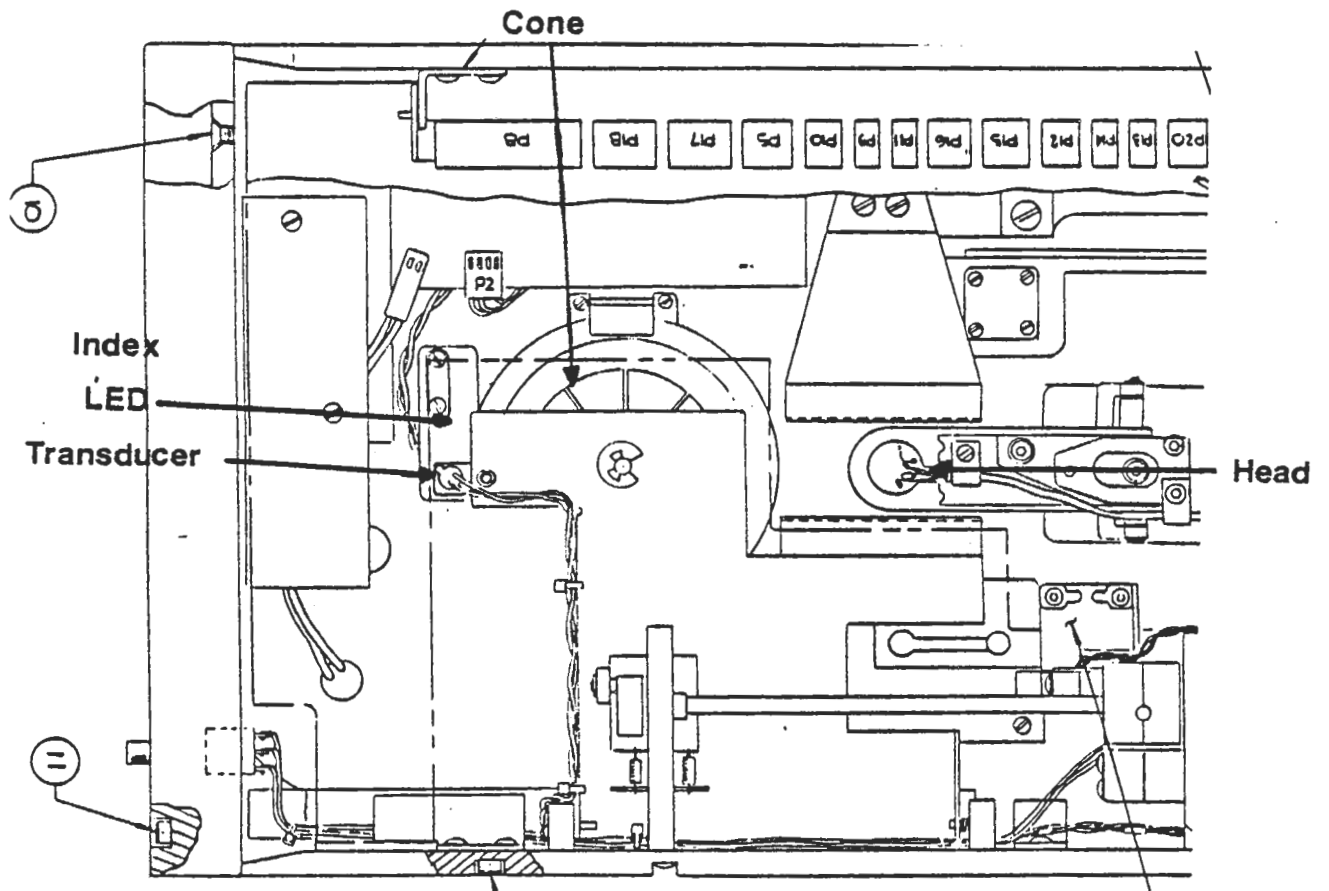
```
TYPE:  HL 1 <CR>
```

This is the same as step 13 except the adjustment, if necessary, is different. Manually trip the diskette presense sensor and using the "T" key, toggle the head of unit 1. When the head is loaded, the pressure pad should be in direct contact with the head. When the head is unloaded, the pressure pad should lift away from the head. If not, it is necessary to sharpen the bend in the paddle that lifts the pad.

21. CONE SIDE 1:

```
TYPE:  RE <CR>
TYPE:  HL 1 <CR>
```

Repeat the procedure in step 14 for side 1 using the above command.



Unit I Assembly

22. INDEX SIDE 1:

a. Repeat the procedure for side 0 (step 15) to adjust saturation of the index photo-transistor on side 1. However, move scope probe to P9 pin 2 to see the index pulse for side 1.

b. Repeat the procedure for index data burst alignment using the alignment diskette (and moving probes back to TP 6 and TP 7 (C26)) that was used in step 15, part b.

23. AZIMUTH SIDE 1:

TYPE: RE <CR>

TYPE: SE 1 76 <CR>

SIMU: "Automatic or manual?"

TYPE: M <CR>

SIMU: "Unit?"

TYPE: 1 <CR>

With scope in same configuration, insert alignment diskette and repeat the procedure for step 15. If data burst is more than 20 usec difference, an adjustment is necessary. There are two Allen screws (older models have slotted screws) which mount the whole head assembly to the positioner servo. Loosen both of these screws until they are just short of being snug. This will allow the head to pivot up and down. Using the "M" key seek between track 1 and 76, pivoting the head as necessary to bring azimuth into spec. Retighten screws and re-check azimuth.

24. CATSEYE SIDE 1

TYPE: RE <CR>

TYPE: SE 38 <CR>

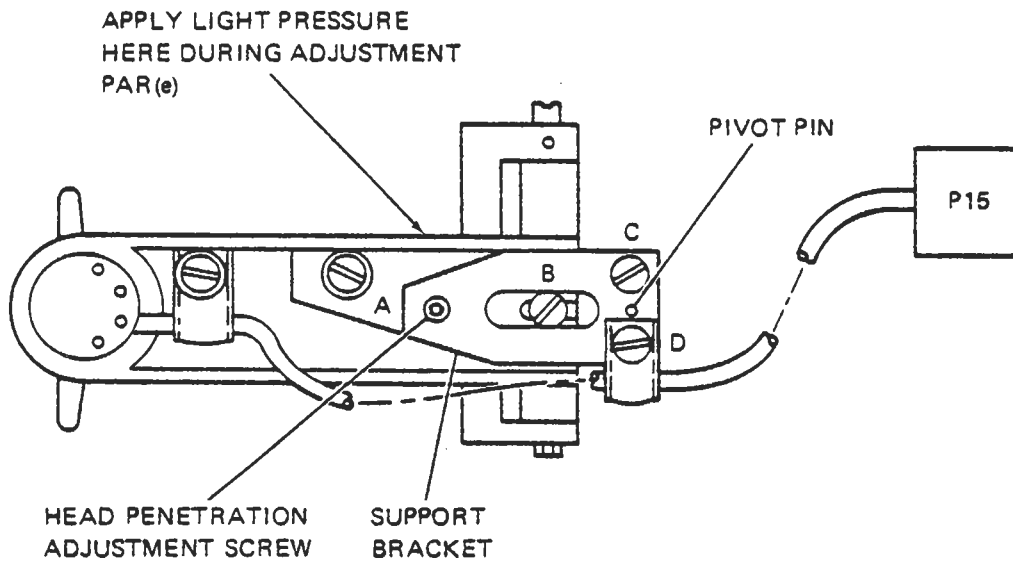
TYPE: HL 1 <CR>

With the scope probes in the same set-up as the previous step, insert alignment diskette. Head should be loaded and at track 38. If catseye is out of spec, i.e., more than 10% difference between the eyes, an adjustment is necessary. To adjust the catseye loosen the two Allen screws (older models have slotted screws) in the center of the head arm which will allow the head to move horizontally and front to back. When catseye is in alignment, tighten screws and re-check the catseye.

NOTE

The catseye, azimuth and head penetration on unit 1 are all inter-dependent adjustment. If an adjustment is made to any one of these three, the other two should be checked. Likewise, after this last catseye adjustment, it is advisable to return to the azimuth adjustment and check it. Repeat as necessary.

HEAD ASSEMBLY [unit 1]



A and B → Catseye

C and D → Azimuth

Steps 23 - 24

Drive Assembly Jacks and Plugs

PCB	CONNECTOR	FUNCTION
Data and Interface PCB	P1	Customer signal interface
	J3	Power
	J4	Power distribution to spindle servo
	J5	Spindle servo interface
	J6	Data separator interface
	J7	Power distribution to positioner servo
	J8	Positioner servo interface
	J9	Index - sector phototransistor, Side 1
	J10	Index - sector LED power, Side 1
	J11	Index - sector phototransistor, Side \emptyset
	J12	Index - sector LED power, Side \emptyset
	J13	Head load mechanism, Side 1
	J14	Head load mechanism, Side \emptyset
	J15	Read/Write head, Side 1
	J16	Read/Write head, Side \emptyset
	J17	Eject assembly, Side 1
	J18	Eject assembly, Side \emptyset
	Positioner Servo PCB	P7
P8		Interface with data and interface PCB
J8		Drive to voice coil motor
J5		Interface to lamp amplifier PCB
Spindle Servo PCB	P4	Power
	P5	Signal interface with data and interface PCB
	J1	Drive to spindle motor
	J2	Interface with photosense module
Lamp Amplifier PCB	P5	Interface with positioner servo PCB
	J13	Interface with optical transducer
Data Separator PCB	P6	Interface with data and interface PCB

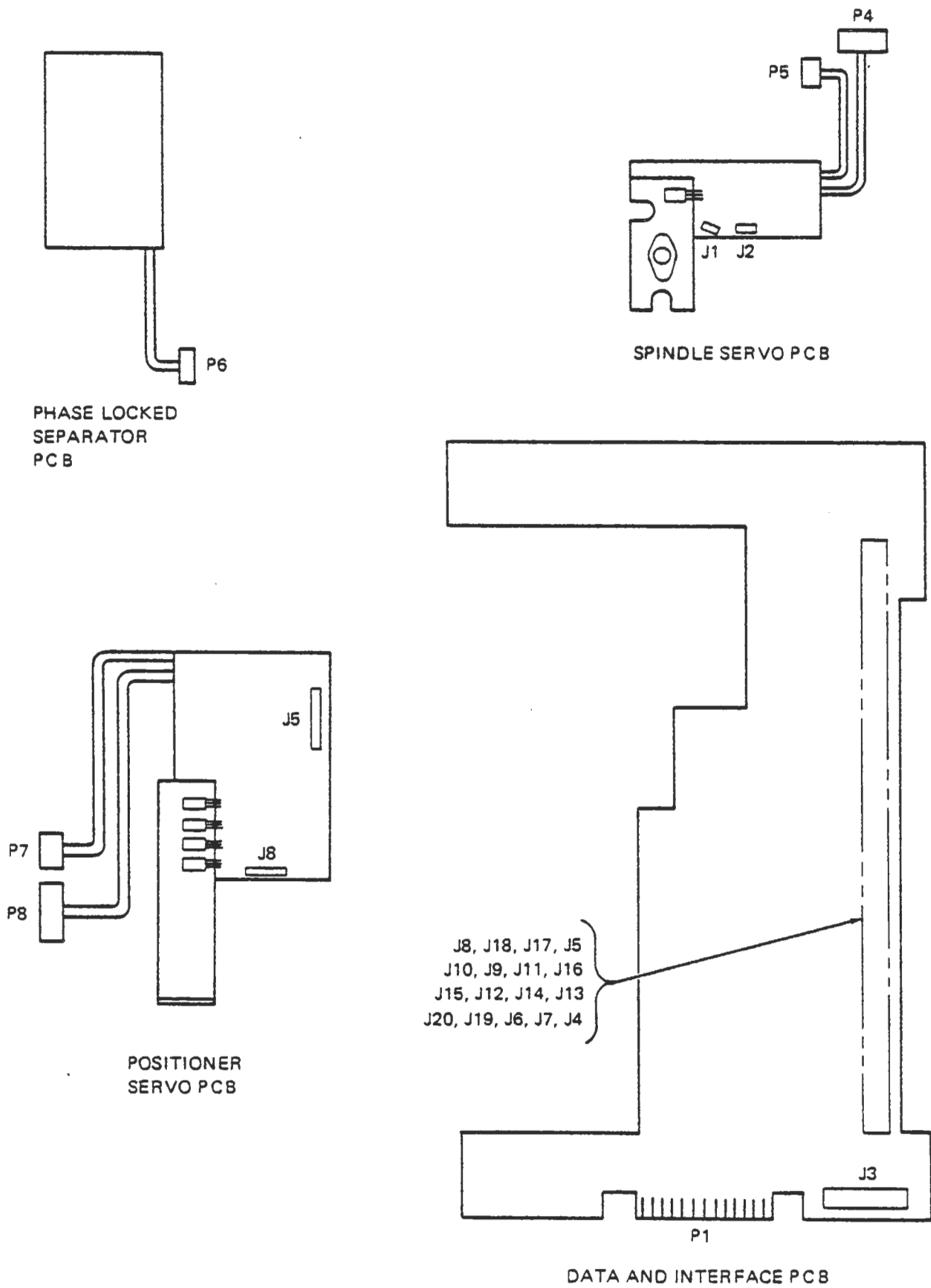


Figure 2-1. Plugs and Jacks Identification

Table 7-8. Diskette Drive Power and Interface Pin Connections

P1 - SIGNAL CONNECTOR (50 Pin PCB Edge Connector-0.1" Centers)			P3 - POWER CONNECTOR (10-Pin Molex-0.156" Centers)	
Pin Numbers			Pin No.	Signal
Gnd	Signal			
1	2	DISK SELECT	1	Chassis Gnd
3	4	HEAD LOAD 1	2	+5V DC
5	6	READY 1	3	+8V Unreg.
7	8	INDEX 1	4	Key
9	10	SEEK COMPLETE	5	+24V DC
11	12	RESTORE	6	Gnd
13	14	REMOTE EJECT Ø	7	Gnd
15	16	SPINDLE POSITION PULSES	8	Gnd
17	18	HEAD LOAD Ø	9	Gnd
19	20	INDEX Ø	10	-5V DC
21	22	READY Ø		
23	24	SPINDLE MOTOR ENABLE		
25	26	DRIVE SELECT 2		
27	28	DRIVE SELECT 1		
29	30	WRITE PROTECT 1		
*	32	REMOTE EJECT 1		
33	34	DIRECTION SELECT		
35	36	STEP		
37	38	WRITE DATA		
39	40	WRITE GATE		
41	42	TRACK ØØ		
43	44	WRITE PROTECT Ø		
45	46	READ DATA		
47	48	SEPARATED DATA		
49	50	SEPARATED CLOCK		
Mating Connectors			Mating Connector	
Flat Cable			Connector-Molex 09-50-7101	
Scotchflex 3415-0000			Terminal - 08-50-0106	
or			Polarizing Key - 15-04-0219	
T&B Ansley 609-5005				
Solder Connector				
Viking Connector 3VH25/1JN-5				
or				
TI Connector H312125				
* Pin 31 space is occupied by a polarizing key.				

LOGIC LEVELS

Interface line logic levels are as follows:

Negative level = 0.0V to +0.5V, -0.5V.

Positive level = +2.5V, -2.5V to +5.5V, -5.5V or open circuit.

I/O signals are negative when selected (True).

DISK SELECT

A positive level on this line selects the left unit for connection to the controller read/write interface signals; a negative level similarly selects the right unit. Selection of one of the two heads for the Write operation automatically selects the other head for the Read operation.

HEAD LOAD 1

Head 1 remains loaded for the length of time that a negative level is held on this line. This signal is gated by the Drive Select line. Head 1 is the head of the right unit.

READY 1

A negative level on this line indicates that a diskette is loaded in unit 1 and is within 90% of operating speed. This signal is gated by the Drive Select line.

INDEX 1

This line is normally at the positive level. A one ms pulse to the negative level is transmitted on this line once for each revolution of the diskette in unit 1 as the diskette index hole passes the index hole sensor. This signal is gated by the Drive Select line.

SEEK COMPLETE

A negative level on this line indicates that a seek or restore operation has been completed. A positive level on this line indicates that a seek operation is in process. This signal is gated by the Drive Select line.

RESTORE

A negative level on this line causes a low-speed repositioning of the heads to Track 00. This line takes priority over the Track Address Difference Register lines within the drive. This signal is gated by the Drive Select line.

REMOTE EJECT 0

A negative level on this line energizes a relay that ejects the diskette in unit 0. This line is held at the negative level for 1 second to allow operation of the eject mechanism. This signal is gated by the Drive Select line.

SPINDLE POSITION PULSES

A 4800 Hz +2%, -2% square wave, symmetrical to within +5%, -5%, is presented on this line, synchronized to change in spindle position. The signal is derived from the 800 equally-spaced pulses on the spindle code wheel, each cycle representing 0.45 degree of spindle rotation. This signal is gated by the Drive Select line.

HEAD LOAD 0

Head 0 remains loaded for the length of time that a negative level is held on this line. This signal is gated by the Drive Select line. Head 0 is the head of the left unit.

INDEX 0

This line is normally at the positive level. A one ms pulse to the negative level is transmitted on this line once for each revolution of the diskette in unit 0 (left side when viewed from front panel looking toward rear of drive) as the diskette index hole passes the index hole sensor. This signal is gated by the Drive Select line.

READY 0

A negative level on this line indicates that a diskette is loaded in unit 0 and is within 90% of operating speed. This signal is gated by the Drive Select line.

SPINDLE MOTOR ENABLE

Pin 24 of the diskette drive provides controller control of the spindle motor. A logic low on this line enables the spindle servo, such that the spindle turns when a diskette is installed. A logic high inhibits the spindle motor, thus allowing the system to "stand by" at very low power consumption with a diskette loaded.

The spindle motor attains operating speed within 1 second after application of the negative level to this line. This signal is gated by the Drive Select line. Drive interface signal lines Ready 0 and Ready 1 remain at the negative (True) level if the Spindle Motor Enable line is positive (False) and the diskette is present.

DRIVE SELECT 2

A negative level on this line selects the drive containing units 4 and 5, and the drive containing units 6 and 7 (the drives in cabinet 2). A positive level on this line selects the drive containing units 0 and 1 and the drive containing units 2 and 3 (the drives in cabinet 1).

DRIVE SELECT 1

A negative level on this line selects the drive containing units 2 and 3, and the drive containing units 6 and 7 (the drives in the right-hand side of a cabinet.) A positive level on this line selects the drive containing units 0 and 1 and the drive containing units 4 and 5 (the drives on the left side of a cabinet.)

WRITE PROTECT 1

A negative level on this line indicates that the diskette in unit 1 is Write Protected and that the drive write circuitry is prevented from writing on this diskette. (The Helios II does not use the write-protect lines.)

REMOTE EJECT 1

A negative level on this line energizes a relay that ejects the diskette in unit 1. This line is held at the negative level for 1 second to allow operation of the eject mechanism. This signal is gated by the Drive Select line.

DIRECTION SELECT

The level on this line defines the direction of motion of the head positioner when the Step line is pulsed. A negative level defines the direction as inward (higher track number) and a positive level as outward (lower track number and away from the center).

STEP

A 200 ns to 1 usec pulse to the negative level is presented on this line for each track to be crossed by the head during a seek to a new address. The Direction Select level shall be stable for 100 ns prior to the leading edge of this Step pulse. Pulse trains representative of up to 76 tracks of address change may be transmitted at pulse recurrent frequencies up to 500 kHz. The entire pulse train representative of an address change must be transmitted in less than 2.0 ms.

WRITE DATA

Write current changes polarity for each positive level to negative level transition on this line. This line shall stay at a negative level for at least 180 ns after such a transition, but should be at a positive level for at least 180 ns before the next positive level to negative level transition. This signal is gate by the Drive Select line.

WRITE GATE

Write current is turned on for the duration of time that this line is held at a negative level. The selection of one head for writing automatically selects the other head for reading. This signal is gated by the Drive Select line. Erase current is also controlled by this line.

TRACK 00

This line is normally at the positive level. A negative level is presented on this line when the heads are positioned over Track 00. This signal is gated by the Drive Select line.

WRITE PROTECT

A negative level on this line indicates that the diskette in unit 0 is Write Protected and that the drive write circuitry is prevented from writing on this diskette. (Not used in Helios II.)

READ DATA

This line transmits the output of the selected head at all times except when the Write Gate is enabled, at which time it transmits the output of the other drive head. Each flux transition on the diskette is represented by a 200 ns +20%, -20% pulse to the negative level on this line. This signal is gated by the Drive Select line.

SEPARATED DATA

Separated data pulses from the selected head are presented on this line except when the Write Gate is enabled, whereupon the output is from the other drive head. Data separation is performed by a phase-locked oscillator. Each data pulse is represented by a 200 ns +20%, -20% pulse to the negative level on this line. This signal is gated by the Drive Select line.

SEPARATED CLOCK

Separated clock pulses from the selected head are presented on this line except when the Write Gate is enabled, whereupon the output is from the other drive head. Clock separation is performed by a phase-locked oscillator which omits missing clock pulses. Each clock pulse is represented by a 200 ns +20%, -20% pulse to the negative level on this line. This signal is gated by the Drive Select line.

NOTE: When they are designated on the controller/formatter, the signals between controller P2 and drive P1 are prefixed by a minus sign to denote that they are drive signals as opposed to controller/formatter signals and that they are active low with regard to the drive. They do not have this minus sign on the drive vendor documentation. Once processed on either the controller or formatter, they are inscribed with a "not-bar." If inverted the "not-bar" is dropped.

