



# **Floppy Disk Drive Maintenance Notes**

**Model: SA901**

First Edition (February 1984)

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## CONTENTS

### CHAPTER 5 INTRODUCTION

	PAGE
1.0 Introduction	5-1
2.0 Corrective Maintenance Procedures	5-1
3.0 Special Tools and Test Equipmnet	5-1
3.1 Alignment Diskette	5-1
3.2 WCS Test PROMS	5-2
4.0 Alignment and Adjustment Procedures	5-4
4.1 Head Cleaning Procedure	5-4
4.2 Cartridge Guide Adjustment	5-4
4.3 Head Load Actuator Adjustment	5-5
4.4 Index/Sector Phototransistor Potentiometer Adjustment	5-7
4.5 Head Radial Alignment	5-8
4.6 Track 00 Detector Adjustment	5-11
4.7 Track 00 Stop Adjustment	5-13
4.8 Index/Sector Timing Adjustment	5-13
4.9 Write Protect Detector Adjustment	5-14
4.10 PCB Potentiometer Adjustments	5-15
5.0 Removal and Replacement Procedures	5-16
5.1 Drive Motor Removal	5-16
5.2 Cartridge Guide Removal	5-16
5.3 Light Emitting Diode Assembly Removal	5-16
5.4 Write Protect Detector Removal	5-18
5.5 Head Load Actuator Removal	5-18
5.6 Track 0 Detector Removal	5-18
5.7 Index/Sector Phototransistor	5-18
5.8 Spindle Assembly Removal	5-19
5.9 Front Plate Assembly Removal	5-19
5.10 Stepper/Carriage Assembly Removal	5-19
5.11 Read/Write Head Load Button	5-20
5.12 Floppy Disk Drive Conversion	5-20
6.0 Jumper Conversions	5-22
6.1 Model Identification	5-23

## ILLUSTRATIONS

FIGURE	TITLE	PAGE
1	Logic PCB Test Points	5-3
2	Cartridge Guide Adustment	5-5
3	Head load Actuator Up Stop Adjustment	5-6
4	Head Load Actuator Down Stop Adjustment	5-6
5	Sector Phototransistor	5-7
6	Head Radial Alignment	5-8
7	R/W Head Radial Alignment	5-10
8	Track 00 Flag Screw	5-12
9	Index Timing	5-14
10	Test Points	5-15
11	Cartridge Guide Removal	5-17
12	Stepper Carriage Assembly Installation	5-20
13	Logic Card Conversion P/N (726-1009)	5-21
14	Logic PCB Jumper Location	5-24

## TABLES

TABLE	TITLE	PAGE
	SA901 Floppy Disk Drive Configuration Table	5-22

**CHAPTER**

**5**

**INTRO-  
DUCTION**

SA901  
MAINTENANCE NOTES

1.0 INTRODUCTION

This section provides maintenance procedures that may be required to service the SA901 Floppy Disk Drive. This document is an updated reprint of Service Bulletin 46.3/46.3A, released September 29, 1979. This document also contains information that appeared in a Shugart SA901, Product Service Notice, released July 9, 1980. This information concerned conversion from a WPS 928 floppy disk drive to an OIS floppy disk drive.

Maintenance procedures concerning the SA901 Disk Drive may be categorized as preventive or corrective in nature. Preventive maintenance procedures such as test sequences to detect a potential problem are not provided in this document. Corrective maintenance procedures are provided to take action on problems as they occur.

2.0 CORRECTIVE MAINTENANCE PROCEDURES

Adjustment procedures

Removal and replacement procedures

Disk Drive Conversion (928 Floppy Disk Drive to OIS 140 Floppy Disk Drive)

Jumper configurations for operation when used on 2200, WPS, or VS Systems

3.0 SPECIAL TOOLS AND TEST EQUIPMENT

<u>Description</u>	<u>OEM Part #</u>	<u>Wang Part #</u>
SA120 Alignment Diskette	SA120	726-9611
Cartridge Guide Adj. Tool	50377	726-9612
Head Load Bail Gauge	50391	726-9613
SA901 Alignment Program	N/A	701-0372
WCS Test PROMs	N/A	378-0510, 378-0511, 378-0512, 378-0513

3.1 Alignment Diskette

The SA120 alignment diskette is used for the following adjustment procedures.

- a. Read/Write head radial alignment using track 38.
- b. Index/Sector phototransistor adjustment using tracks 01 and 76
- c. Track 00 is recorded with standard IBM 3740 format.

NOTE: The write protect notch should always be left open on the SA120 alignment diskette to prevent accidental loss of data.

### 3.2 WCS Test PROMS

The Index/Sector timing adjustment on an SA901 Floppy Disk Drive is performed at track 01 and track 76. The normal set of WCS PROMs allows access up to track 63. Because of this, a special set of PROMs has to be installed in the microprocessor to allow access to track 76. The PROMs can be installed on a PCBs, P/N (210-6718, 210-7018). Refer to the Variation Chart on the 210-7018 schematic for the procedure to install PROMs on a 210-7018 PCB. Locations for the PROMs are as follows:

<u>Location</u>	<u>PROM #</u>
L111	378-0510
L112	378-0512
L113	378-0511
L114	378-0513

#### Test Points On PCB, P/N 726-1009 (Reference Figure 1)

TP0	+Door Closed
TP1	Read Data Signal 1
TP2	Read Data Signal 2
TP3	Read Data 1 (Differentiated)
TP4	Read Data 2 (Differentiated)
TP5	Ground
TP6	Ground
TP7	+Power On Reset
TP8	Ground
TP9	-Write Data +Write Gate
TP11	-Load Head
TP12	+Index/Sector
TP13	+File Inop.
TP14	Ground
TP15	+Write Gate -Write Protect
TP16	+Read Data
TP21	-2.9 usec window S.S.
TP24	-3.1 usec window S.S.
TP26	+Track 0
TP27	-Step -Read Gate
TP35	-Write Gate -File Inop.
TP20	-Write Data

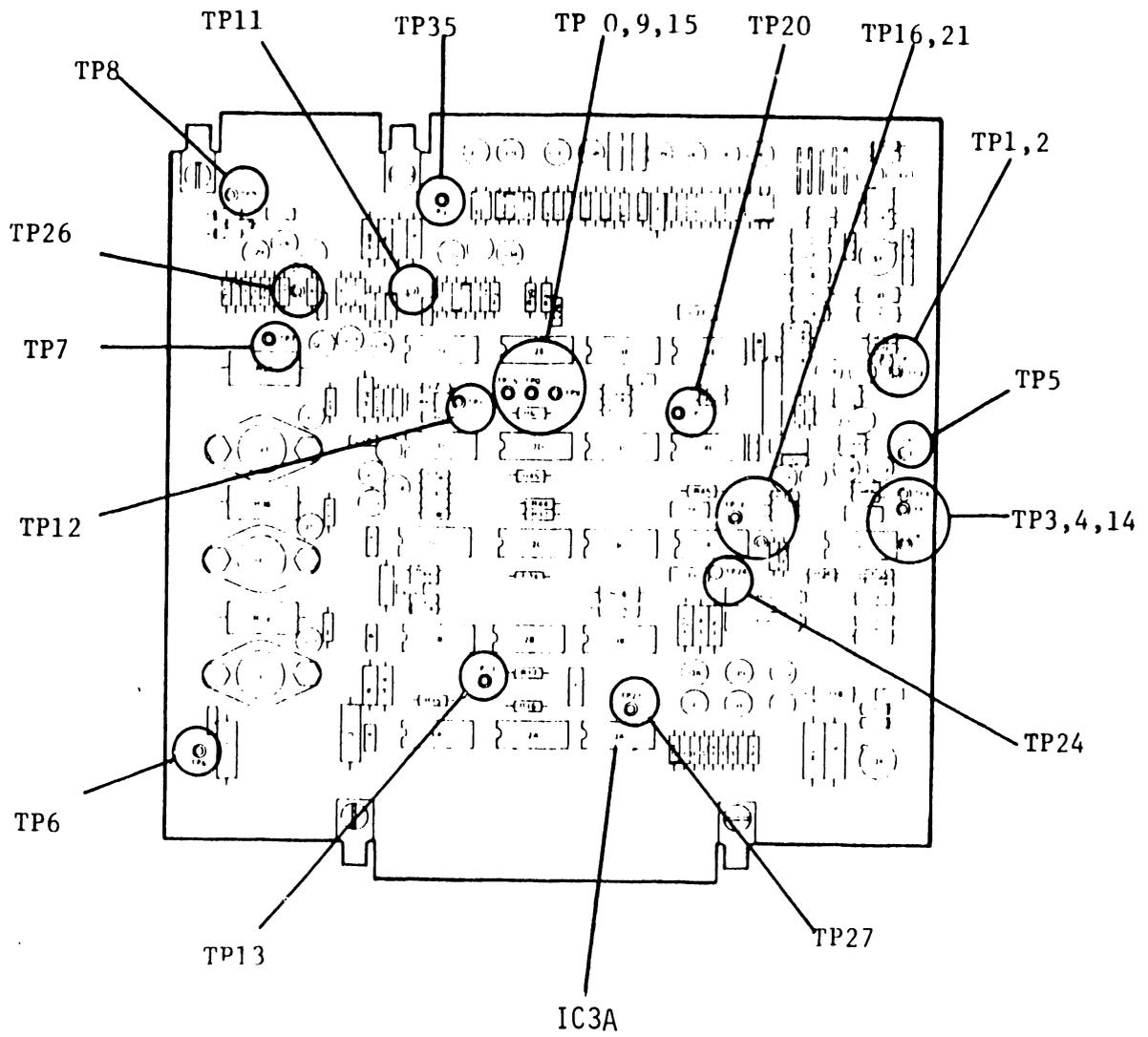


Figure 1 Logic PCB Test Points

#### 4.0 ALIGNMENT AND ADJUSTMENT PROCEDURES

NOTE: This procedure along with the alignment program cassette are designed to allow for repair of the SA901 on the fixed drive only. It is a sequential procedure that should be followed from beginning to end to insure proper operation of the SA901.

##### 4.1 Head Cleaning Procedure

Inspect head load pad and head for dirt and/or damage (Refer to Section 5.11 for head load pad removal procedure). The head should ONLY be cleaned if an oxide build-up is visible. Cleaning methods and materials other than those listed can permanently damage the head and should be avoided.

- a. Lightly dampen a piece of clean lintless tissue with Isopropyl alcohol (use sparingly).
- b. Lift the load arm off the head, being careful not to touch the load button.
- c. Gently wipe the head with the moistened portion of the tissue.
- d. After the alcohol has evaporated, gently polish the head with a clean dry piece of lintless tissue.
- e. Lower the load arm onto the head. Do not let it snap back.

##### 4.2 Cartridge Guide Adjustment

- a. Insert the adjustment tool P/N (726-9612), through the hold in the cartridge guide and screw completely into the casting (hand tight). Refer to Figure-2.
- b. Loosen two screws holding the cartridge guide to the latch plate.
- c. Move the handle into the latched position and hold it lightly against the latch fingers.
- d. Tighten two screws holding the cartridge guide to the latch plate.
- e. Depress push bar on front panel and check that door stays in latched position. If door latch was released, repeat adjustment.
- f. Insert diskette, close and open door, checking for proper operation.
- g. When complete, install known good PCB and continue.

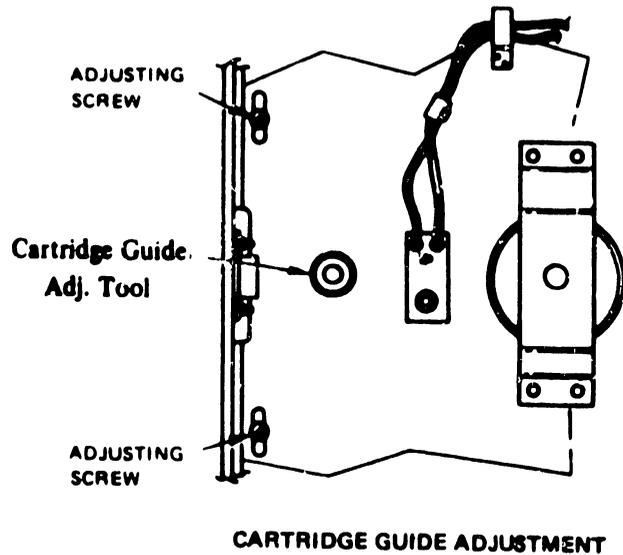


Figure 2 Cartridge Guide Adjustment

#### 4.3 Head Load Actuator Adjustment

- a. Turn stepping motor lead screw until head carriage is approximately at track 00.
- b. Place bail adjustment tool P/N (729-9613) on R/W head and place load button in cup of tool
- c. Adjust up stop on actuator so that bail just touches head load arm (Refer to Figure 3 and Figure 4).
- d. Remove adjustment tool.
- e. Energize head load coil by grounding TP11.
- f. Adjust down stop on actuator so there is  $.020'' \pm .010''$  clearance between head load bail and head load arm (Refer to Figure 3 and Figure 4).
- g. Turn stepping motor lead screw until head carriage is approximately at track 76. Insure  $.020''$  clearance is still maintained. If not, readjust down stop.

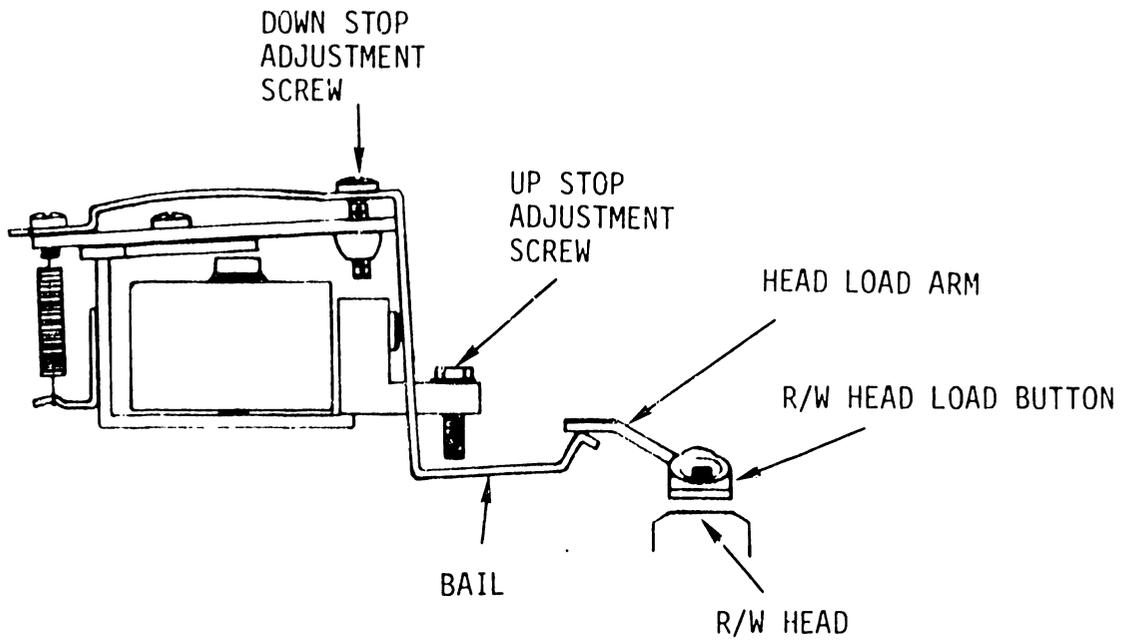


Figure 3 Head Load Actuator Up Stop Adjustment

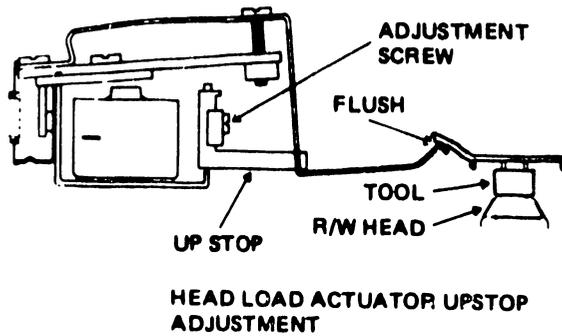


Figure 4 Head Load Actuator Down Stop Adjustment

NOTE: The following procedure require the SA120 alignment diskette.

#### 4.4 Index/Sector Phototransistor Potentiometer Adjustment

- a. Insert the alignment program cassette into a disk drive and load the program. Key RUN,EXEC to start the program.
- b. Connect oscilloscope probe to TP12. Set oscilloscope as follows:

TIME/DIV	0.5 MSEC.
VERT SENS	2V/DIV.
VERT MODE	DC COUPLED
TRIGGER SOURCE	INT
TRIGGER MODE	NORM
SLOPE	NEG

- c. Adjust the potentiometer on the Index/Sector phototransistor to obtain a pulse of 1.7 msec.  $\pm$  .5 msec. duration (Figure 5).

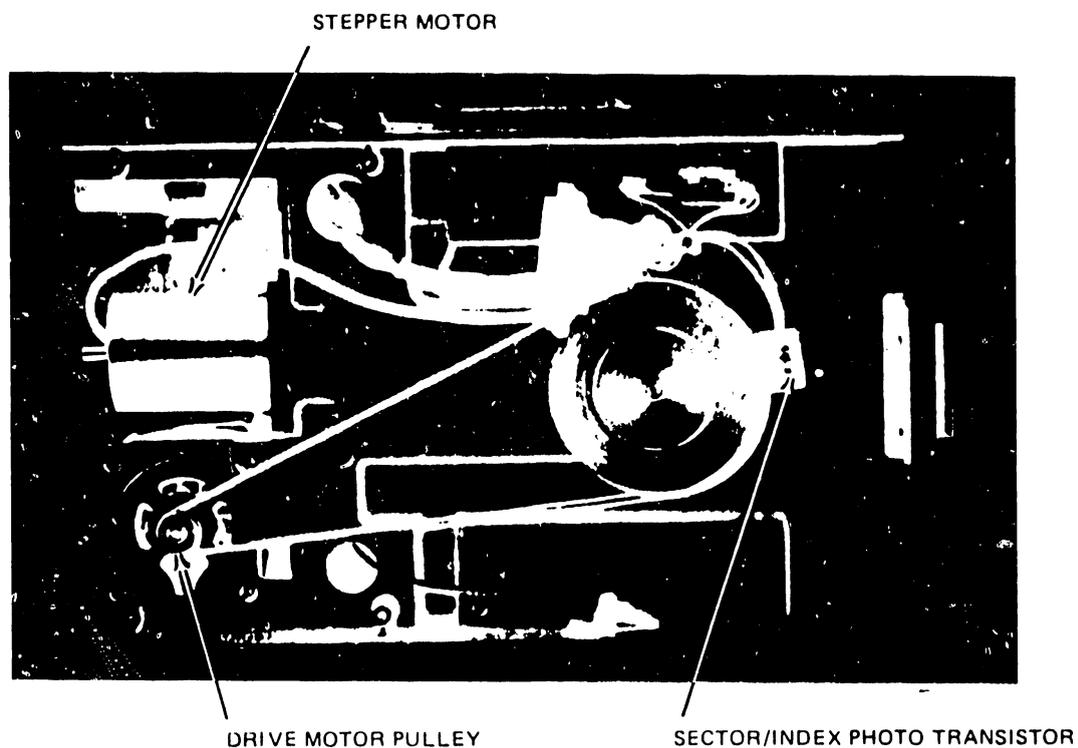


Figure 5 Sector PhotoTransistor

#### 4.5 Head Radial Alignment

NOTE: If either the head alignment or the track zero adjustment is incorrect, the track 00 stop could possibly interfere with the following two adjustments. It is recommended that the stop be loosened and moved toward the stepping motor until it no longer inhibits correct head positioning.

- a. Jumper pins 5 & 6 of IC 1A (Shugart PCB) to ground (-Head Load and -Drive Select).
- b. Connect Channel 1 probe to TP 1 and Channel 2 probe to TP2. Connect ext. trigger to TP12. Set the oscilloscope as follows:

TIME/DIV	20 MSEC.
VERT SENS	0.2 V/DIV.
VERT MODE	ADD, CHAN. 2 INVERTED, AC COUPLED
TRIGGER SOURCE	EXT.
TRIGGER MODE	NORM.
SLOPE	NEG.

- c. Depress SF Key '3 (this accesses track 38). Refer to Figure 6.

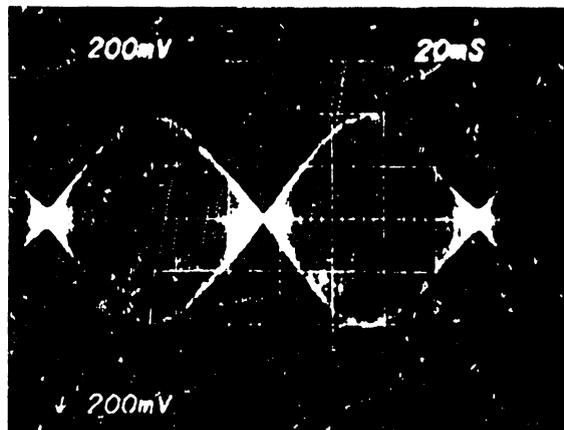


Figure 6 Head Radial Alignment

NOTE: Because the alignment diskette does not have sector holes and is not formatted, an error condition will exist when a track is read. This will initiate one reseek.

- d. A cat's eye pattern should be observed.
- e. The two lobes must be within 80% amplitude of each other (Refer to Figure 7). If the lobes do not fall within the specification, continue on with this procedure. If correct proceed to the Track 00 Detector Adjustment procedure in Paragraph 4.6.
- f. Loosen 2 or 3 mounting screws which hold the motor to the mounting plate. Do not loosen three screws holding the mounting plate to the casting as these screws are coated with glyptol.
- g. Rotate the stepping motor to radially move the head in or out. If the left lobe is less than 80% of the right, turn the stepping motor counterclockwise as viewed from rear of drive. If the right lobe is less than 80% of the left lobe, turn the stepping motor clockwise as viewed from the rear of the drive.
- h. When the lobes are of equal amplitude, tighten the motor mounting screws.
- i. check the adjustment by doing a reseek (key RESET, then depress SF key '3) and readjust as required.

NOTE: If the cat's eye pattern is not observed at all after the reseek, the track 00 detector is set incorrectly and must be adjusted prior to performing the head alignment. Proceed to Paragraph 4.6, to perform the Track 00 Detector Adjustment procedure.

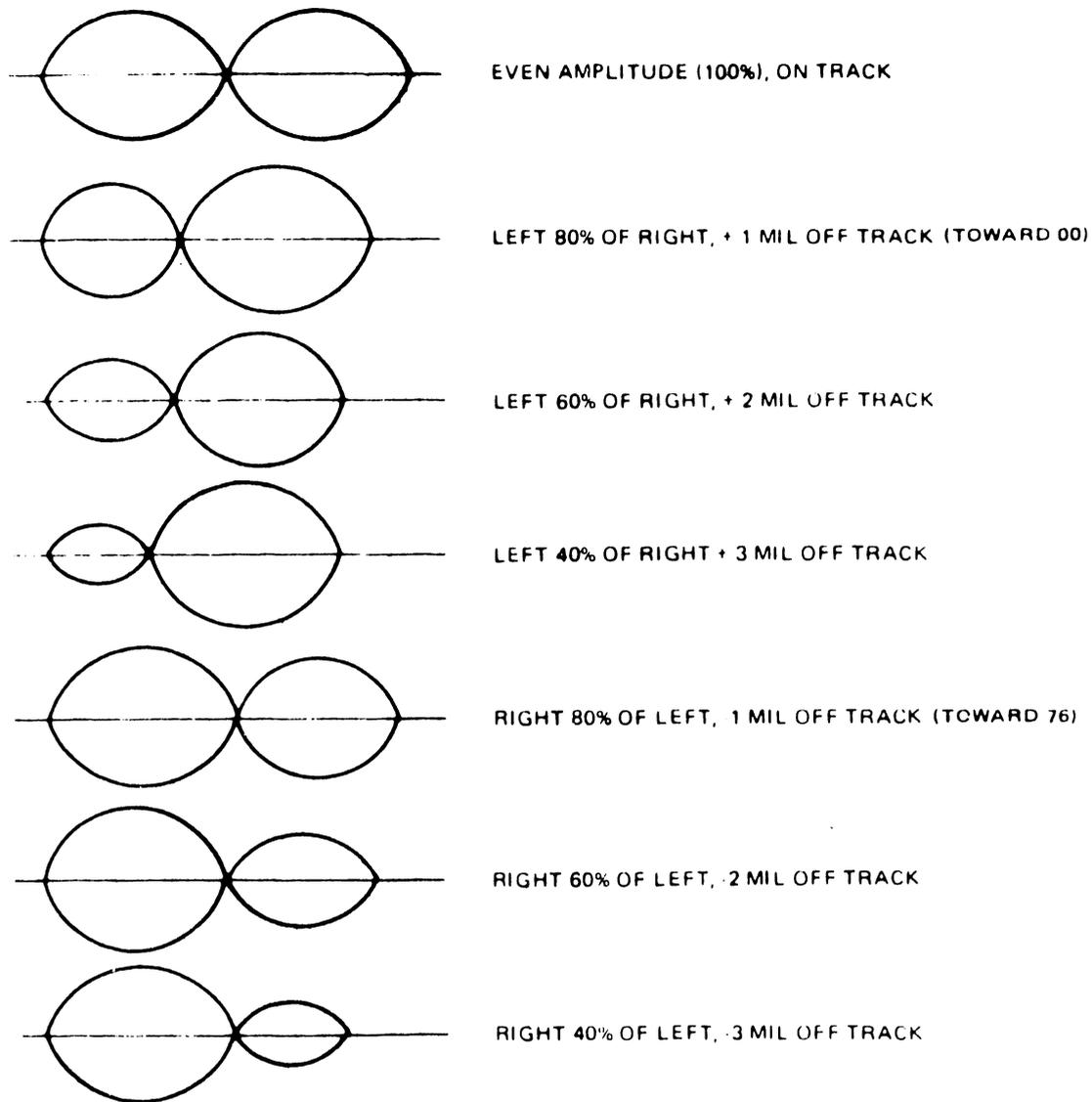


Figure 7 R/W Head Radial Alignment

NOTE: If, when performing the head radial alignment, the cat's eye pattern was observed after the reseek and the adjustment was performed with no problem the track 00 detector adjustment is correct. Therefore, only steps A and E-I of the following procedure will have to be performed.

#### 4.6 Track 00 Detector Adjustment

- a. Remove ground from pins 5 & 6 of IC 1A (Shugart PCB). Connect Channel 1 probe to TP1 and Channel 2 probe to TP2. Connect ext. trigger to TP12. Set oscilloscope as follows:

TIME/DIV	50 USEC.
VERT SENS	0.2 V/DIV
VERT MODE	ADD. CHAN. 2 INVERTED, AC COUPLED
TRIGGER SOURCE	EXT.
TRIGGER MODE	NORM.
SLOPE	NEG.

- b. Load the head by grounding TP11.  
c. Manually turn the stepping motor lead screw slowly to track 01 as shown in Figure 8.  
d. Observe the index/sector timing waveform. Adjust for maximum amplitude (middle of track) above and below reference.

- NOTES: 1) The IBM 3740 format that is recorded on track 00 can be used as a reference point to find track 01.  
2) If the index/sector timing adjustment is incorrect by a large margin, the horizontal sweep time will have to be increased so the waveform can be observed.  
3) Once track 01 has been found, caution must be taken not to move the head assembly or the lead screw.

- e. Remove the probes from TP1 and TP2.  
f. Connect a probe to TP26. Set oscilloscope to observe a 5V DC level.  
g. TP26 should be at a +5V level when at track 01.  
h. If TP26 is not a logic level high, loosen screw on track 00 flag and move flag in or out of photosensor until TP26 just goes high.  
i. Key reset, then depress SF'2. This steps head carriage to track 02. TP 26 should go low. Adjust flag if not low.  
j. Check adjustment keying Reset and depressing SF'1 (this accesses track 01). Insure TP26 goes high at track 01.

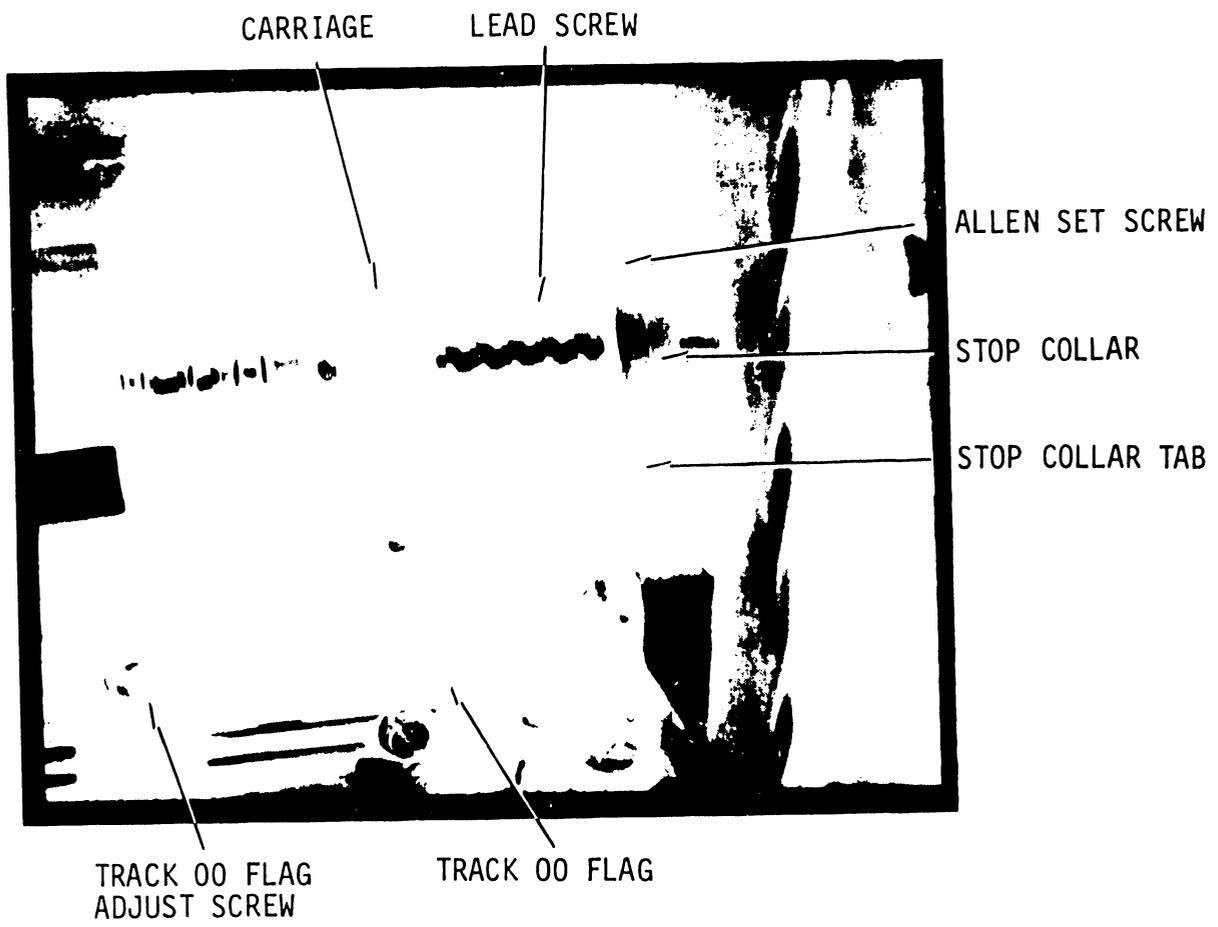


Figure 8 Track 00 Flag Screw

#### 4.7 Track 00 Stop Adjustment

- a. Key Reset then depress SF'0 (this accesses track 00)
- b. Check that there is  $.030 \pm .010$  clearance between stop and carriage. Manually rotate lead screw moving the carriage toward the stop collar until it stops. Insure there is  $.020'' \pm .010''$  clearance between collar and carriage.
- c. If clearances are within tolerance, proceed to Paragraph 4.8, and perform the Index/Sector Timing Adjustment procedure.
- d. Ground pins 5 & 6 of IC 1A (Shugart PCB).
- e. Key Reset then depress SF'2 (this accesses track 02).
- f. Loosen Track 00 stop collar.
- h. Grasp end of lead screw in back of stepping motor with pair of pliers and manually turn lead screw CW (from rear of drive) to the track 01 position. (Next detent position on stepping motor.)
- i. Position the stop collar axially along lead screw so there is a  $.020'' \pm .010''$  between collar and carriage. Rotate the collar toward the inside of the drive until the tab on the collar contacts the carriage stop surface. Tighten stop collar set screw.
- j. Turn power OFF and back ON. Carriage should move to track 00. Verify that there is data at track 00.

#### 4.8 Index/Sector Timing Adjustment

- a. Key RESET, then depress S.F. key '1 (this accesses track 01).
- b. Connect Channel 1 probe to TP 1 and Channel 2 probe to TP2. Connect ext. trigger to TP12. Set oscilloscope as follows:

TIME/DIV	50 USEC.
VERT SENS	0.2 V/DIV.
VERT MODE	ADD, CHAN. 2 INVERTED, AC COUPLED
TRIGGER SOURCE	EXT.
TRIGGER MODE	NORM.
SLOPE	NEG.

- c. Observe the timing between the start of the sweep and the first data pulse. This should be 200 usec  $\pm$  50 usec (Refer to Figure 9). If the timing is not within tolerance, continue on with this procedure. If correct, proceed to Paragraph 4.9, and perform the Write Protect Detector Adjustment procedure.
- d. Loosen the screw holding the index detector assembly to the casting until the assembly is just able to move.
- e. Observing the timing, adjust the detector until the timing is correct. Insure that the detector assembly is against the registration surface on the casting.
- f. Tighten the screw and recheck the timing.
- g. Key RESET, then depress S.F. key '4 (this accesses track 76).
- h. Observe the timing and insure it is within tolerance. If not, readjust, then recheck the timing at track 01 (S.F. key '1).

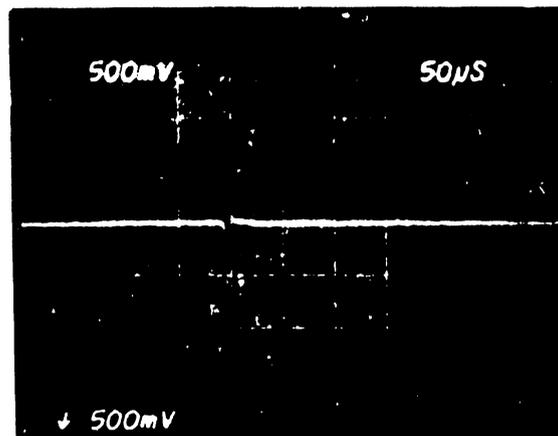


Figure 9 Index Timing

#### 4.9 Write Protect Detector Adjustment

- a. Set oscilloscope to observe a DC level and monitor P2L4.
- b. Loosen screw on detector assembly and adjust until maximum amplitude is achieved. Tighten screw.

NOTE: After adjustment, insure the detector assembly does not interfere with the inserting of a diskette. If it does, the ejector will not catch and the diskette will pop out when door is being closed.

#### 4.10 PCB Potentiometer Adjustments

- a. Insert a scratch platter and format.
- b. Key RESET, then depress S.F. key '4 (this accesses track 76).
- c. Connect oscilloscope probe to TP 21. Set oscilloscope as follows:

TIME/DIV	0.5 USEC.
VERT SENS	2V/DIV.
VERT MODE	DC COUPLED
TRIGGER SOURCE	INT.
TRIGGER MODE	NORM.
SLOPE	NEG.

- d. Adjust R31 until a negative pulse of 2.9 usec duration is obtained.
- e. Connect oscilloscope probe to TP24.
- f. Adjust R30 until a negative pulse of 3.1 usec duration is obtained.
- g. While observing the trailing edge of the positive pulse that is also displayed, adjust R127 until the trailing edge is one solid transition (Refer to Figure 10).

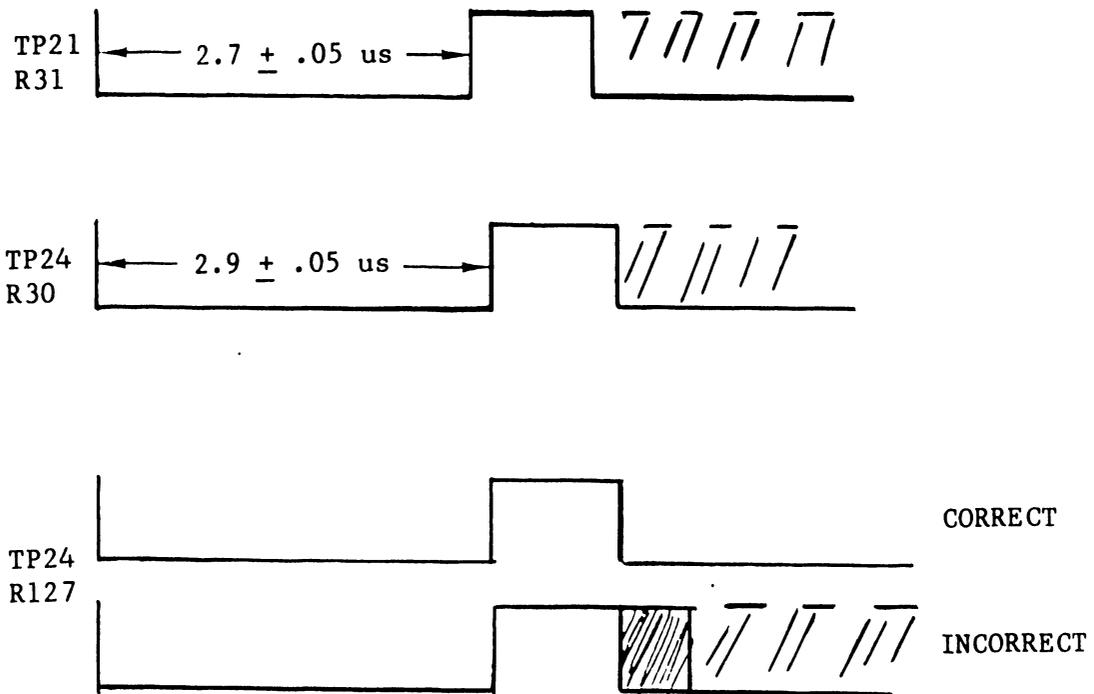


Figure 10 Test Points

## 5.0 REMOVAL AND INSTALLATION PROCEDURES

### 5.1 Drive Motor Removal

- a. Extract 3 contacts to disconnect motor from AC connector.
- b. Loosen 2 screws holding capacitor clamp to the base. Remove rubber boot and disconnect motor leads from capacitor.
- c. Remove 4 screws holding PCB to base and swing PCB out.
- d. Remove belt from drive pulley.
- e. Remove 4 screws holding the motor to the base casting and remove motor.
- f. Reverse the procedure for installation.

NOTE: Insure ground lead is installed between capacitor for clamp and base.

### 5.2 Cartridge Guide Removal

- a. Position head to approximate center of head load bail (to prevent load arm tab from slipping off end of bail).
- b. Loosen 2 screws holding cartridge guide to door latch plate.
- c. Swing cartridge guide out.
- d. Swing out the cartridge guide assembly.
- e. Remove the LED assembly, the head load actuator, and write protect detector assembly (Refer to Paragraph 5.3, 5.4, and 5.5).
- f. Pull up on the upper pivot cap screw until the shoulder contacts the base casting (Refer to Figure 11). Push up on the cartridge guide until the lower pivot clears the casting.

NOTE: For new style cartridge guide, remove C-clamp on upper pivot post and push up on cartridge guide.

- g. Tilt the cartridge guide slightly, and remove it from the upper pivot.
- h. Reverse the procedure for installation.

### 5.3 Light Emitting Diode Assembly Removal

- a. Disconnect the wires to the LED terminals (solder joints).
- b. Swing out the cartridge guide assembly (Reference Section 5.2).

NOTE: This step is not necessary if the drive has a new style (cast) cartridge guide.

- c. Remove the screw, nut, and washer holding the LED assembly to the cartridge guide.
- d. Reverse the procedure for installation.

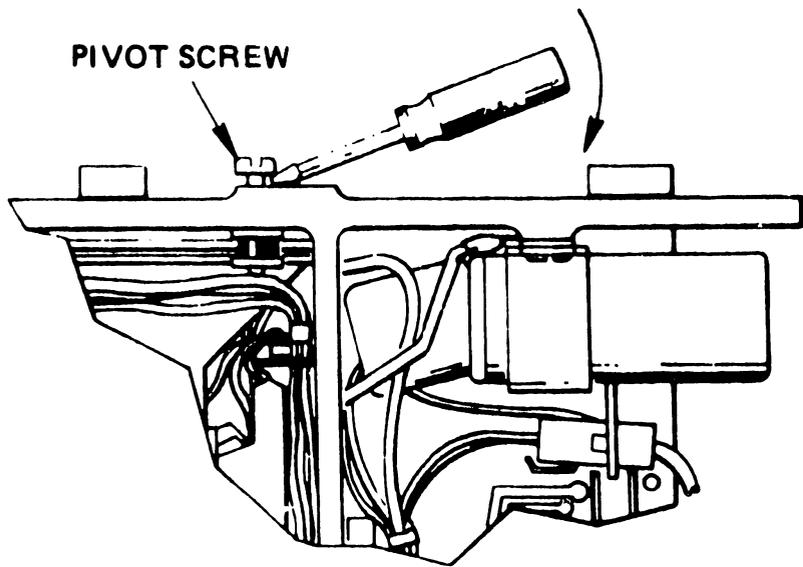


Figure 11 Cartridge Guide Removal

#### 5.4 Write Protect Detector Removal

- a. Remove connectors from PCB and remove PCB.
- b. Extract wires from P2 connector, pins 3 (Red), 4 (Grey), E (Black), and J (White).
- c. Remove cable clamp.
- d. Swing out cartridge guide assembly.
- e. Remove screw holding the detector bracket and remove assembly.
- f. Reverse the procedure for installation.

#### 5.5 Head Load Actuator Removal

- a. Disconnect the wires to the actuator terminals (solder joints).
- b. Swing out the cartridge guide assembly.
- c. Remove screw holding the actuator to the cartridge guide.

CAUTION: Restrain the head load arm to prevent its impact with the head.

- d. Reverse the procedure for installation.

#### 5.6 Track 0 Detector Removal

- a. Remove connectors from PCB and remove PCB.
- b. Extract wires from P2 connector, pins A (Brown), C (Black), F (Red), and K (Orange).
- c. Remove cable clamp.
- d. Swing out the cartridge guide assembly.

NOTE: This step may not be useful if the drive has an old style (black) cartridge guide.

- e. Manually rotate stepper shaft and move carriage away from the detector assembly.
- f. Remove cable clamp, and R/W head cable from bracket.
- g. Remove 2 screws holding detector assembly bracket to base casting and remove assembly.
- h. Reverse procedure for installation.

#### 5.7 Index/Sector Phototransistor Assembly Removal

- a. Disconnect the wires to the terminals (solder joints). The spindle pulley may be removed for easier access.
- b. Remove screw holding transistor assembly to base.
- c. Reverse the procedure for installation.

## 5.8 Spindle Assembly Removal

- a. Swing out the cartridge guide (Refer to Paragraph 5.2).
- b. Remove the nut and washers holding the spindle pulley.

CAUTION: The pre-loaded rear bearing and spacer may fly out when spindle pulley is removed.

- c. Withdraw spindle hub from opposite side of base casting.
- d. Reverse the procedure for installation.

## 5.9 Front Plate Assembly Removal

- a. Swing out the cartridge guide assembly (Refer to Paragraph 5.2).
- b. Remove 4 screws holding the front plate assembly to the casting.
- c. Reverse the procedure for installation.

## 5.10 Stepper/Carriage Assembly Removal

- a. Remove the connectors from the PCB and remove the PCB.
- b. Remove cable clamp holding R/W head cable.
- c. Extract wires from P2 connector, pins 2 (Red), 5 (Brown), 8 (Orange), and 10 (Black).
- d. Loosen three motor clamp screws and rotate clamps to allow withdrawal of motor. On new units with redesigned stepper mounting clamp, loosen two screws and swing clamp down to allow withdrawal of motor.

CAUTION: Do not loosen the three screws coated with Glyptol.

- e. Swing out the cartridge guide assembly (Refer to section 5.2).
- f. Remove cable clamp and spacer holding R/W head cable to track 0 detector bracket. On new units a grommet on the cable is inserted into a slot on the bracket.
- g. Manually rotate the lead screw to run the carriage assembly off the lead screw while withdrawing the stepper motor.
- h. To install stepper/carriage assembly reverse procedure. Note steps i. and j.
- i. When installing the carriage, set the pre-load nut in the #3 notch (Refer to Figure 12).
- j. When threading lead screw into carriage assembly, push the pre-load nut slightly against the spring in order to start thread. After threading, insure there is a gap between preload nut and rear of carriage.

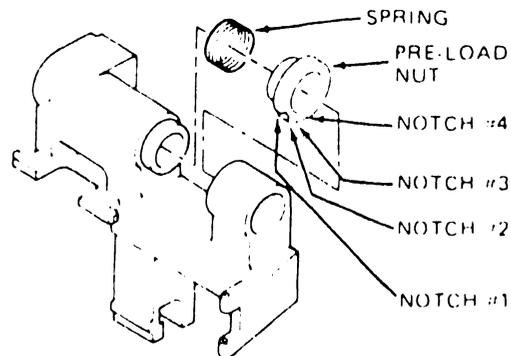


Figure 12 Stepper Carriage Assembly Installation

#### 5.11 Read/Write Head Load Button

- a. To remove the old style button (attached with a clip and washer), grasp the button with pliers and rock the button back and forth while pulling.
- b. To remove the new style button, hold the load arm out away from head, squeeze the locking tabs together with a pair of needle nose pliers and press forward.
- c. To install old style button, place button in head load arm and press rubber washer onto button stem. Press clip onto stem and insure button does not move.
- d. To install new style button, press the button into the head load arm and it will snap into place.

#### 5.12 Floppy Disk Drive Conversion

Perform the following procedure to convert a 928 Floppy Disk Drive WL (278-4003), for conversion to an OIS 140 Floppy Disk Drive W/L (278-4003-M).

- a. Lock the drive door and remove five Phillips-Head screws that fasten the face plate to the drive.
- b. Remove two hex head screws that secure the handle to the door.
- c. Remove four 1/4 in. hex-head screws that secure the door to the main chassis.
- d. Replace the old door with a new door (Door Lock Kit WL# 720053-93).
- e. Access the logic board P/N (729-1009).
- f. Cut the etch between U3E and U3F as shown in Figure 13.
- g. Jumper a wire between point "B" and pin 7 of U3F.
- h. Insert and solder the pin removed in step D into the feed-thru next to pin eight. Connect the red wire from the new door onto the pin just installed.
- i. Plug the 2-wire drive/connector into J6 (Figure-14).

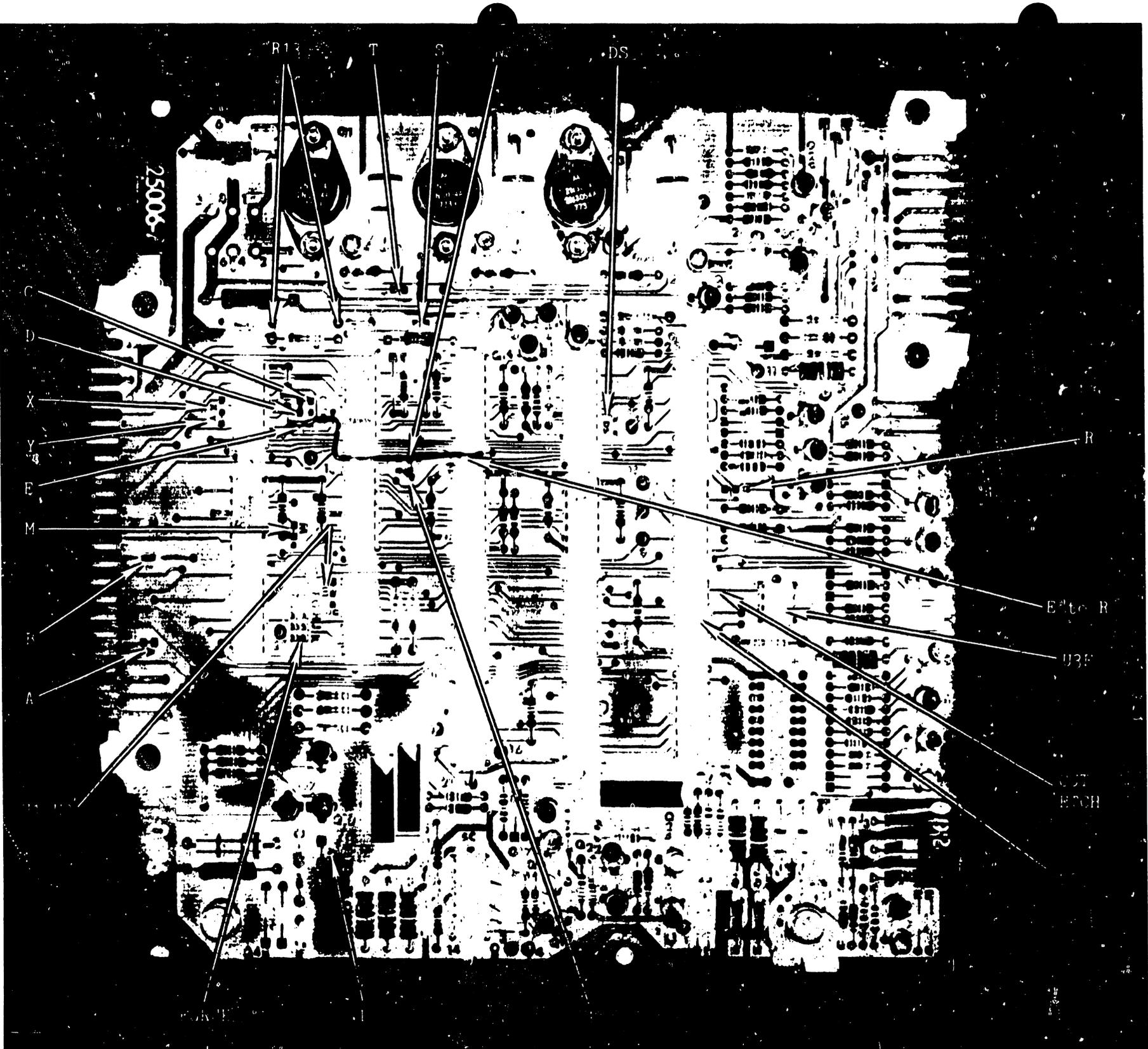


Figure 13 Logic Card Conversion P/N (726-1009)

## 6.0 JUMPER CONFIGURATIONS

The following Paragraphs provide reference to jumper configurations of the SA 901 Floppy Disk drive when used on 2200, WPS, and VS Systems. The configurations apply to the follow model numbers.

Model	WL Number
278-4000	Shugart Drive.
278-40001	Shugart Drive, 50 Hertz.
278-4001	Shugart Drive with Guide Bar.
278-4002	Shugart Drive on VS Systems.
278-4002-1	Shugart Drive on VS Systems (50 Hz).
278-4003	Shugart Drive on WP Systems.
278-4003-1	Shugart Drive on WP Systems (50 Hz).
278-4003-M	Shugart Drive on OIS 140 WP Systems.

Table 1 lists three versions of the logic PCB P/N (25006-7), Wang P/N WL# (726-1009). Jumper configurations for 2200 and WP Systems are identical. Remove the jumper between E and R for VS operation. This jumper alters the head loading circuitry of the SA901 Floppy Disk Drive when used on 2200 and WP Systems.

Table 1 SA 901 Floppy Disk Drive  
Configuration Table

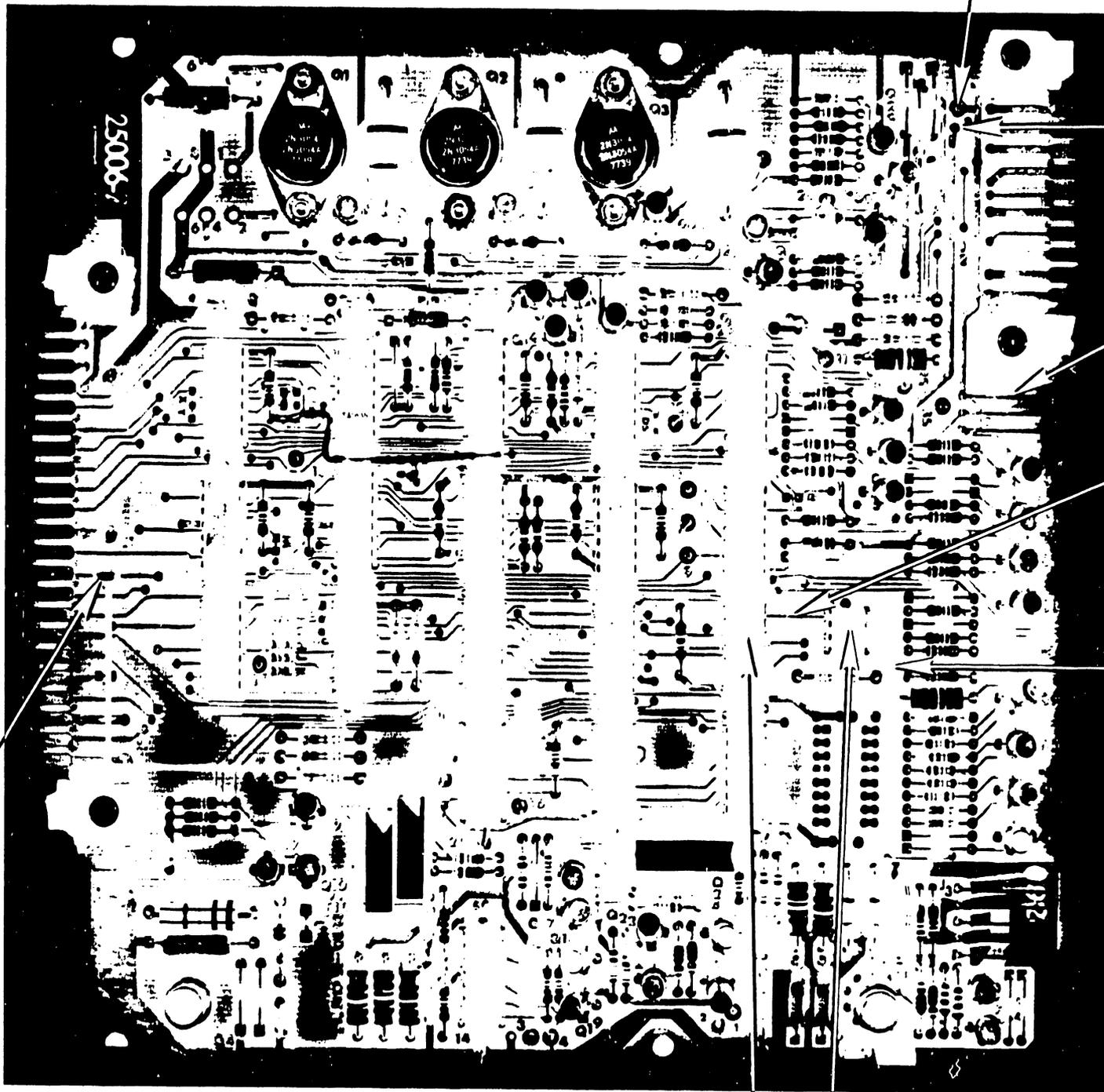
Jumper	2200/WPS	2200 VS and 10 Meg Drive	2200 VS w/o 10 Meg Drive	OIS 140
A	IN	IN	IN	IN
B	IN	IN	IN	IN
C	OUT	OUT	OUT	OUT
D	OUT	OUT	OUT	OUT
E	IN	IN	IN	IN
F	OUT	OUT	IN	OUT
G	OUT	IN	IN	OUT
H	OUT	OUT	IN	OUT
J	OUT	OUT	OUT	OUT
K	OUT	IN	IN	OUT
L	IN	IN	IN	IN
M	IN	IN	IN	IN
N	IN	IN	IN	IN
P	OUT	OUT	OUT	OUT
R	OUT	IN	IN	OUT
S	OUT	OUT	OUT	OUT
T	OUT	OUT	OUT	OUT
X	OUT	IN	IN	OUT
Y	IN	OUT	OUT	IN
U1	IN	IN	IN	IN
U2	OUT	OUT	OUT	OUT
DS	IN	OUT	OUT	IN
*R13	OUT	IN	IN	IN
B/U3F-pin 7				IN
U3E/U3/F				OPEN See Figure 13

**NOTE**

Remove the jumper wire between E and R for VS operation. The jumper is only used for operation in the 2200 and the WPS to alter the head-loading circuitry. Cut the etch between U3E and U3F as shown in Figure 13, for conversion of the SA901 drive from WPS to OIS 140.

6.1 Model Identification

- a. When used on VS Systems the logic PCB will contain R13.
- b. R13 is not contained on the logic PCB of the SA901 when used on 2200 and WP Systems.
- c. VS models configured without a 10 Meg drive should have jumpers f and H installed. All VS System.



PIN 8

D

C (J6)

A

B

Figure 14 Logic PCB Jumper Locations

POINT "B"

U3E

U3F

**WANG**

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