SERVICE BULLETIN NO.78

EDITED BY CUSTOMER ENGINEERING DIVISION August 26, 1977

SHUGART SA400 MINIFLOPPY MAINTENANCE INFORMATION

1. INTRODUCTION

This bulletin covers all the maintenance information and procedures that may be required to align and/or repair an SA400 minifloppy in a PCS-II or 2210. Section 2 deals with removal and installation procedures for the associated assemblies of the SA400. Section 3 contains a list of special tools that are required to adjust and align the drive, a description of the SA124 alignment diskette, a list of test points on the SA400 PCB for easy reference and the alignment and adjustment procedure itself.

These procedures should be used instead of those written in Section 2 of the SA400 SERVICE MANUAL.

2. REMOVAL AND INSTALLATION PROCEDURE

2.1 FACE PLATE: REMOVAL AND INSTALLATION

a. Open the door.
b. Remove the mounting screw on each side of the faceplate. Pull the faceplate forward and away from the drive casting.
c. No readjustment is required after replacement.

2.2 DRIVE MOTOR ASSEMBLY: REMOVAL AND INSTALLATION (includes the motor and PCB)

a. Remove drive belt.

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b. Disconnect connector P-3 from drive PCB and extract pins K (orange), 13 (brown) and 14 (black).

c. Remove the drive motor PCB and drive motor as an assembly by removing their respective mounting screws.

d. To reinstall, reverse the above procedure insuring the PCB spacers and fastening tab are in place.

e. Motor speed must be adjusted as per section 3.4.4.

2.2.1 DRIVE MOTOR: REMOVAL AND INSTALLATION

a. Remove drive belt.

b. Remove the drive motor PCB from its mounting to the frame by removing the mounting screws.

c. Desolder the following wires: red, blue, yellow, and green.

d. Remove drive PCB.

e. Remove the 2 mounting screws from the motor and remove the motor from the casting.

f. To reinstall, reverse the above procedure ensuring the wires are soldered by the color codes.

g. Readjust motor speed per section 3.4.4.

2.2.2 DRIVE MOTOR CONTROL PCB: REMOVAL AND INSTALLATION

a. Remove the 2 screws mounting the PCB to the casting.

b. Desolder the 7 wires from the PCB.

c. To reinstall, resolder the 7 wires to the new PCB being careful to follow the color codes.

d. Remount the PCB to the frame, ensuring the spacers are installed.

e. Readjust motor speed per section 3.4.4.

2.3 STEPPER MOTOR AND ACTUATOR CAM

These assemblies are not field replaceable.

2.4 HEAD AND CARRIAGE ASSEMBLY

a. Remove the drive PCB and disconnect the head connector from the PCB.

b. Unclamp the head cable from the drive.

c. Remove the guide rod nearest the read/write head.

d. Pivot the carriage away from the cam and off the lower guide rod.

e. To reinstall, reverse the above. IMPORTANT: Insure that after installing the head cable there is enough slack to allow the carriage to go to track zero.

f. Readjust the carriage limiter if a new carriage is installed. Reference section 3.4.7.

g. Head alignment should not be required but if interchange (diskette compatibility) problems exist check and adjust head alignment per section 3.4.5.

2.4.1 READ/WRITE HEAD LOAD BUTTON: REMOVAL AND INSTALLATION

a. Remove drive PCB.

b. To remove the old 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 load button, press the button into the arm, from the head side, and it will snap into place.

2.5 SPINDLE HUB AND PULLEY/ASSEMBLY

These assemblies are not field replaceable.

2.6 CLAMP HUB REMOVAL

a. Remove faceplate, reference section 2.1.

b. Remove the drive PCB.

c. Remove the E-ring from the hub shaft. The entire assembly can now be removed from the hub frame. Care should be taken not to overstress the hub frame mounting pivot springs.

d. To reinstall: Place the hub clamp with spacer and spring in place onto the spindle hub (the large end of the spring is placed against the hub frame).

e. Press the hub frame down towards the spindle until the hub shaft protrudes through its mounting hole in the hub frame.

f. Install the E-ring onto the hub shaft.

g. Reinstall the faceplate. Readjustment is not required.

2.7 HUB FRAME ASSEMBLY REMOVAL

Removal of this assembly is not normally required or recommended. The only time removal would be required in the field is to replace the entire assembly.

a. Remove the drive PCB.

b. Remove the 2 mounting screws that hold the pivot springs to the casting.

c. The hub frame assembly can now be lifted clear of the casting.

2.7.1 HUB FRAME ASSEMBLY INSTALLATION AND ADJUSTMENT

a. Put the hub frame onto drive and lightly tighten mounting screws removed in step b of paragraph 2.7.

b. Latch the hub frame closed.

c. Position the hub frame until the hub shaft is centered in its mounting hole in the hub frame. Now tighten the mounting screws for the hub frame pivot springs.

d. Check that the door latch assembly does not bind in the faceplate. If binding occurs, loosen the door latch mounting screws and reposition until it is free of binds.

e. Reinstall the drive PCB.

f. Check and readjust the index timing. Refer to section 3.4.8.

2.8 WRITE PROTECT SWITCH REMOVAL

a. Remove the two mounting screws for the switch.

b. Desolder the brown wire from the C terminal and the black wire from N/C terminal on the switch.

c. Install new switch by reversing the above procedure. After reinstallation, adjust per section 3.4.10.

2.9 INDEX DETECTOR ASSEMBLY REMOVAL

a. Remove drive PCB.
b. From connector P-3 extract pins from 5 (orange) and E (red).
c. Remove the detector mounting screw from the hub frame. This will free the detector.
d. When installing a new assembly, insure the detector mounting block is flush against the side of the hub frame.
e. Readjust the index timing per section 3.4.8.

2.10 INDEX LED REMOVAL

a. Remove the drive PCB.
b. From connector P-3 extract the pins from 8 (blue) and J (violet).
c. Remove the platen from the base casting that the LED is mounted to.
d. Squeeze the LED mounting block locking tabs together and press the assembly out of the mounting hole in the platen.
e. To reinstall, reverse the removal procedure.
f. When remounting the platen, insure it is flush with the machine surface on the casting. Position it laterally so a diskette can be inserted without binding when the door is closed.
g. Readjust the index timing per section 3.4.8.

2.11 TRACK ZERO SWITCH REMOVAL

a. Remove the drive PCB.
b. The Track Zero switch is removed by removing its two mounting screws.
c. Desolder the wires N/C (white), N/O (yellow) and COM (green).
d. To reinstall, reverse the above procedure.
e. Readjust the switch per section 3.4.6 and 3.4.5.

3. ALIGNMENT AND ADJUSTMENT PROCEDURES

3.1 SPECIAL TOOLS

The following special tools are available for performing maintenance on the SA400.

Description	OEM Part Number	Wang Part Number
SA124 Alignment Diskette	54087	726-9614
Head Cable Extender	54143	726-9640
Disk Drive Cable Extender		220-3046
Power Cable Extender		220-1164
SA400 Alignment Program	N/A	701-8115
Alignment PROMs		378-2125
		378-2126

3.2 ALIGNMENT DISKETTE

The SA124 alignment diskette is used for alignment of the SA400. The following adjustments and checks can be made using the SA124.

1) Read/Write head radial alignment using track 16.
2) Index/sector photo detector adjustment using Track 01.
3) Track 00 is recorded with a 62.5 kHz signal (2F). This track can be used to tell if the head is positioned over track 00 when the track 00 indication is true.
4) Track 34 has a 62.5 kHz signal (2F) recorded on it and can be used to tell if the head is positioned over track 34 and for reference purposes.

Caution should be used in order not to destroy pre-recorded alignment tracks. The write protect notch should always be left open on the SA124 to prevent accidental loss of data.

NOTE:

1. The alignment diskette should be at room conditions for at least twenty minutes before using.
2. 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 and is normal.

3.3 TEST POINTS ON 25060 PCB

Reference Figure 1.

TP1 Read Data Signal 1
TP2 Read Data Signal 2
TP3 Read Data 1 (Differentiated)
TP4 Read Data 2 (Differentiated)
TP5 Signal Ground
TP6 +Read Data
TP7 +Index/Sector
TP8 -Detect Track 00
TP9 +Write Protect
TP10 Ground
TP11 -Head Load
TP12 +Gated Step Pulses

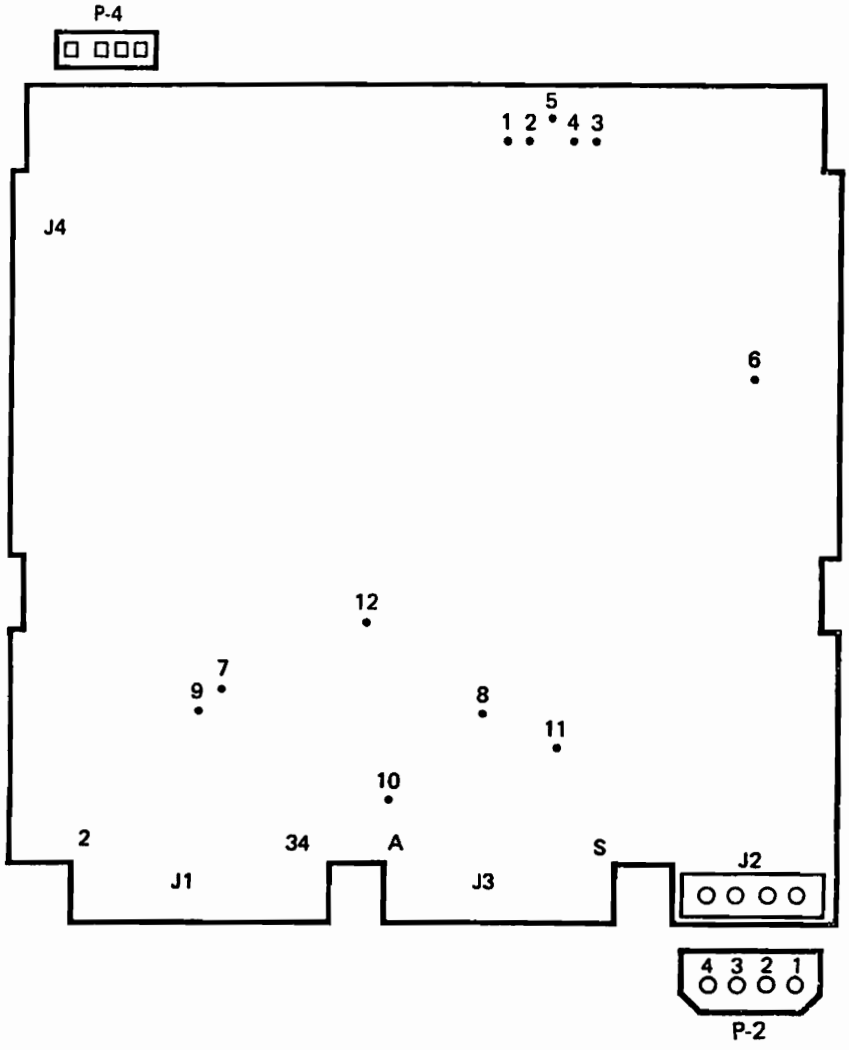

FIGURE 1 TEST POINT LOCATIONS

3.4 ALIGNMENT AND ADJUSTMENT PROCEDURE

NOTE:

This procedure along with the alignment program diskette is designed to allow for repair of the SA400 on the left (fixed) drive only. The right (removable) drive is used to load the alignment program. It is a sequential procedure that should be followed from beginning to end to insure complete operation of the SA400.

Remove the two PROMs from the 7180 module in the PCS-II or 7279 module in the 2210. Install 378-2125 in place of 378-2058 and 378-2126 in place of 378-2059.

3.4.1 HEAD CLEANING PROCEDURE

Remove PCB and inspect head load pad and head for dirt and/or damage (refer to Section 2.4.1 for head load pad removal procedure). The head should ONLY be cleaned if it has an oxide build up that is visible to the naked eye. Cleaning methods and materials other than those listed can permanently damage the head and will not be used.

a. Lightly dampen a piece of clean lintless tissue with Isopropyl alcohol (use sparingly), or use Wang head cleaning pads.
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.

3.4.2 TRACK 00 SWITCH ADJUSTMENT

Install known good PCB allowing access to the track 00 switch and head load bail by swinging PCB out away from the disk drive. Connect the three extension cables, then perform the track 00 switch adjustment as follows:

a. Rotate head actuator cam until the cam follower is opposite the track 00 dimple on the cam (Ref. Figure 2).

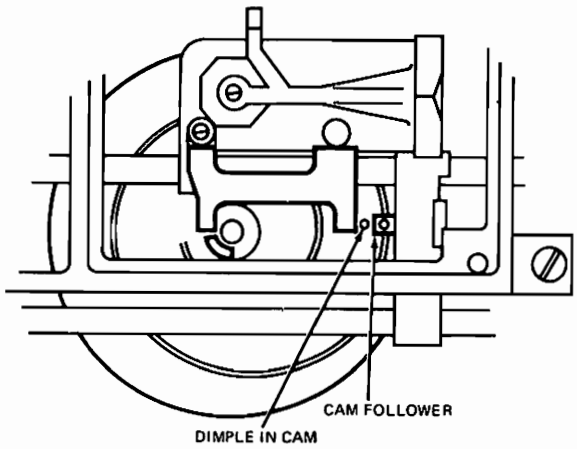

FIGURE 2 TRACK ZERO POSITION

b. Adjust the switch so it just makes by moving its mounting bracket.

c. Power up the drive being careful not to short out the PCB. This will energize phase A in the stepper motor. The dimple should remain within $\pm$ .050" of the cam follower and the switch should not break. This procedure insures that the track 00 switch is set approximately correct. The final check and adjustment will be performed later in Section 3.4.6.

3.4.3 HEAD LOAD BAIL ADJUSTMENT

a. Close disk drive door.

b. Ground TP11 to energize the head load solenoid.

c. Adjust the down stop screw to obtain 3/16" to 1/4" from the top flat surface of the load bail to the platen (Ref. Figure 3).

d. Check for a minimal clearance of .020" between the load bail and the load arm.

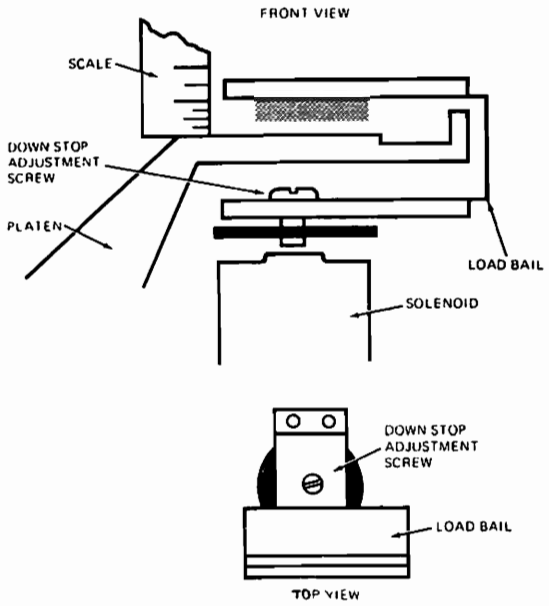

FIGURE 3 HEAD LOAD BAIL ADJUSTMENT

e. Turn power off and rotate the head actuator cam until the carriage is at its innermost limit.

f. Turn power on and insure .020" clearance between the head load bail and the load arm is maintained. If not, readjust down stop.

NOTE:

At this time, insert the alignment program diskette into the right (removable) drive and load the program. Key RUN, EXEC to start the program, then continue with this procedure.

3.4.4 MOTOR SPEED ADJUSTMENT

a. Insert a 'scratched' diskette, start the motor and load the head by keying SF'02 to access Track 16.

b. Turn the pot R-12 located on the motor control PCB until the dark lines on the spindle pulley appear motionless. For 60 Hz use the outside ring of lines for the 50 Hz observe the inside ring.

NOTE:

This adjustment can be made only in an area where there is flourescent lighting. Otherwise, refer to the alternate method below.

MOTOR SPEED ADJUSTMENT (ALTERNATE METHOD)

a. Insert 'scratched' platter, depress SF key '02 to access track 16.

b. Connect oscilloscope probe to TP7 (+Index/Sector). Set the oscilloscope as follows:

TIME/DIV ..... 5 MSEC
VERT SENS ..... 2 V/DIV
VERT MODE ..... DC COUPLED
TRIGGER SOURCE ..... LINE
TRIGGER MODE ..... AUTO
SLOPE ..... POS

c. Free-running pulses will be observed. Adjust potentiometer R12 located on the motor control PCB so the sector pulses are stable (referenced to the 60 Hz line). Note: An unstable index pulse will also be observed.

3.4.5 HEAD RADIAL ALIGNMENT

Remove the 'scratched' platter and insert the SA124 alignment diskette.

a. Connect channel 1 probe to TP1 and channel 2 probe to TP2. Connect the ext. trigger to TP7. Set the oscilloscope as follows:

TIME/DIV	20 MSEC
VERT SENS	0.1 V/DIV
VERT MODE	ADD CHAN 2 INVERTED, AC COUPLED
TRIGGER SOURCE	EXT
TRIGGER MODE	NORM
SLOPE	POS

b. A cat's eye pattern should be observed (Ref. Figure 4).

c. The two lobes must be within 70% amplitude of each other (Ref. Figure 5). If the lobes do not fall within the specification, continue on with this procedure. If correct, proceed to step 3.4.6.

d. Loosen the two screws which mount the stepper motor to the drive casting.

e. Rotate the stepper motor to radially move the head in or out. If the left lobe is less than 70% of the right, turn the stepper motor clockwise as viewed from the stepper motor side of the drive. If the right lobe is less than 70% of the left lobe, turn the stepper motor counterclockwise as viewed from the stepper motor side of the drive.

f. When the lobes are of equal amplitude, tighten the motor mounting screws.

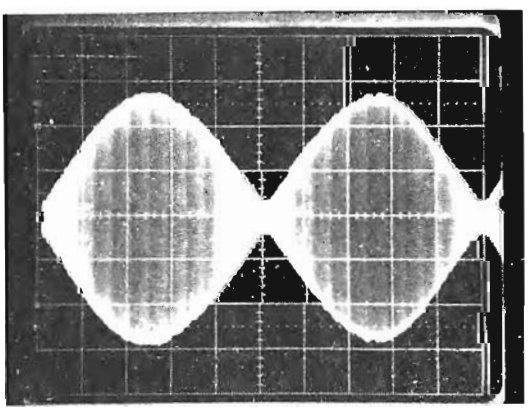

FIGURE 4 HEAD RADIAL ALIGNMENT

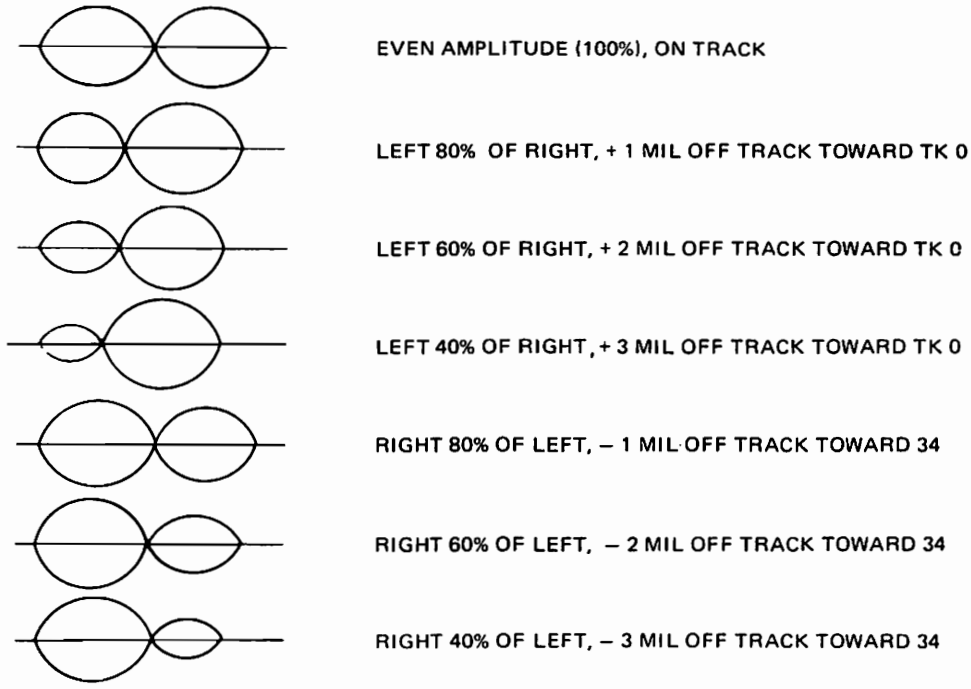

FIGURE 5 HEAD RADIAL ALIGNMENT

g. Check the adjustment by doing a reseek (key RESET, then depress SF key '02) and readjust as required.

h. Whenever the head radial alignment has been adjusted, the carriage limiter and track 00 switch adjustment must be checked. Proceed to Section 3.4.6 for the track 00 switch check.

3.4.6 TRACK 00 SWITCH CHECK

a. Key RESET, then depress SF key '00. This accesses track 00.

b. Connect oscilloscope probe to TP8. A 0 volt DC level should be observed. If not, readjust the track 00 switch.

c. Key RESET, then depress SF key '01. This accesses track 01. A 5 volt DC level should now be observed at TP8. If not, readjust the microswitch.

d. Whenever the track 00 switch has been adjusted, the head radial alignment and carriage limiter adjustment must be checked. Proceed to Section 3.4.5 to recheck the head alignment. When complete, recheck the track 00 switch.

Because the head alignment and track 00 switch adjustments affect each other they must be re-checked after every adjustment.

3.4.7 CARRIAGE LIMITER ADJUSTMENT

a. Key RESET, then depress SF key '00. This accesses track 00. Remove SA124 alignment diskette.

b. Loosen the screw securing the carriage limiter to head carriage.

c. Position the limiter until it is flush with stop post on the carriage assembly (Ref. Figure 6). NOTE: Some carriage assemblies do not have a stop post. On these the limiter is inserted into a notch cut into the carriage.

d. Adjust the carriage limiter horizontally and vertically until there is .020" $\pm$ .005" between the front leg of the limiter, the stop on the actuator cam, and the stepper motor shaft (Ref. Figure 6).

e. Insert SA124 alignment diskette and key RESET, then depress SF key '03. This accesses track 34.

f. Remove SA124 diskette and insure there is clearance between the rear leg of the limiter and the stepper motor shaft (Ref. Figure 7).

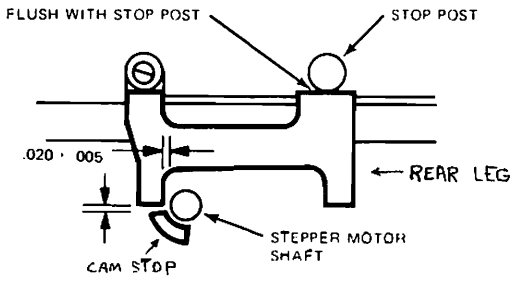

FIGURE 6 CARRIAGE LIMITER ADJUSTMENT

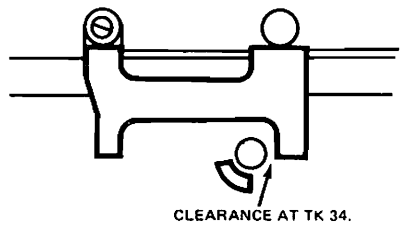

FIGURE 7 CARRIAGE LIMITER CLEARANCE

3.4.8 INDEX/SECTOR TIMING ADJUSTMENT

a. Insert SA124 diskette and key RESET, then depress SF key '1.

b. Connect channel 1 probe to TP1 and channel 2 probe to TP2. Connect ext. trigger to TP7. Set the 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	POS

c. Observe the timing between the start of the sweep and the first data pulse. This should be 200 ± 100 usec (Ref. Figure 8). If the timing is not within tolerance, continue with this procedure. If correct, proceed to step 3.4.9.

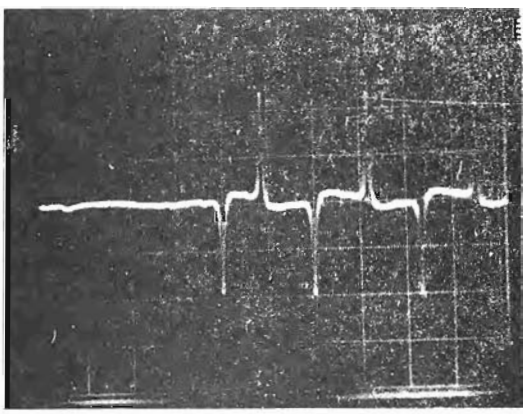

FIGURE 8 INDEX TIMING

d. Loosen the mounting screw in the Index/Sector detector block until the assembly is just able to be moved.

e. Observing the timing, adjust the detector until the timing is 200 ± 50 usec. Insure that the detector block is against the registration surface on the hub frame.

f. Tighten the mounting screw and recheck the timing.

3.4.9 HEAD AMPLITUDE CHECK

a. Remove the SA124 diskette, insert a 'scratched' platter and format. NOTE: Insure the diskette used for this check is not "worn" or "weak".

b. Key RESET, then depress SF key '04. This accesses track 34 and also writes an FF data pattern.

c. Connect channel 1 probe to TP1 and channel 2 probe to TP2. Connect ext. trigger to TP7. Set the oscilloscope as follows:

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

d. The average minimum read back amplitude, peak to peak, should be 80 millivolts. If the amplitude is below specifications, replace the head load pad and clean the head, then recheck by depressing SF key '04.

e. If amplitude is still below specification, install a different platter and recheck.

f. If still incorrect, change the PCB and recheck.

g. If d, e and f do not correct the problem, the head and carriage assembly will require replacement.

3.4.10 WRITE PROTECT SWITCH ADJUSTMENT

Remove write enable tab from the 'scratched' platter and insure write protect switch is operating correctly by depressing SF key '04. If drive is write protected, an ERR 71 will occur on the DATA SAVE statement. If no error is observed, adjust the switch as follows:

a. Remove 'scratched' platter.

b. Adjust the switch so that the actuator will just transfer the switch when its point is ± .010" from the top of the groove in the guide rail (Ref. Figure 9).

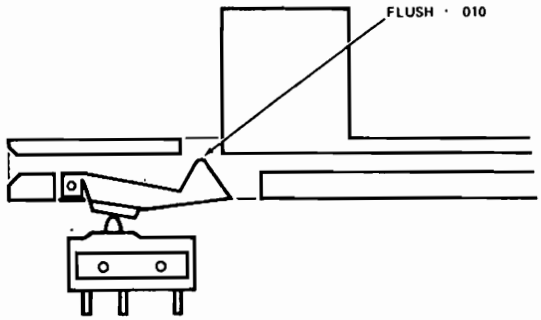

FIGURE 9 WRITE PROTECT SWITCH ADJUSTMENT

SERVICE BULLETIN NO. 78A

EDITED BY CUSTOMER ENGINEERING DIVISION

September 11, 1978

SA400 MINIFLOPPY

ADDITIONS/CORRECTIONS TO SERVICE BULLETIN NO. 78

1. ADDITIONAL SPECIAL TOOLS

When Service Bulletin No. 78 was written, three part numbers in the special tools section (3.1) were inadvertently left out. They are as follows:

DESCRIPTION	WANG PART#
Disk Drive Cable Extender	220-3040
Power Cable Extender	220-1164
SA400 Alignment Program	701-8115

2. ALIGNMENT PROMS

The alignment PROMs (378-2125, 378-2126) that are mentioned in S.B. 78 are not absolutely necessary for performing SA400 alignments. The standard PROMs are capable of accessing the required alignment locations. However, correct address accessing may not be accomplished for every seek initiated. If enough attempts are made, the desired track will eventually be reached. This inconsistent accessing is due to the fact that the standard PROMs ensure that there is a platter in the drive by monitoring the index and sector marks. An alignment platter has no sector marks and therefore a seek will only be completed if the index mark is detected at the time the seek is initiated. If the index mark is not "seen", an error will be displayed immediately, and no head movement will occur. When the desired track has been accessed, there will be a short delay before the error message is displayed.

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The only difference between the standard PROMs and the alignment PROMs is compensation for the lack of sector marks in the alignment platter. It is recommended that the alignment PROMs be used whenever possible to eliminate the chance of accidently trying to align or adjust a drive when the head is not over the correct track.

3. MOTOR SPEED ADJUSTMENT

The alternate method for the motor speed adjustment as stated in S.B. 78 should have specified; a) that an alignment platter be used, not a 'scratch' platter, b) the trigger LEVEL should be set at midrange.

There is a third method by which the motor speed can be adjusted. With an alignment platter in the drive, TP7 (INDEX/SECTOR) can be monitored with the scope triggered internally, positive slope. The speed should be set so there is 200 msec. between index pulses (leading edge to leading edge). Likewise, a 'scratch' platter may be used and the speed set so there is 20 msec between sector marks (leading edge to leading edge).

4. TRACK 00 SWITCH ADJUSTMENT AND HEAD RADIAL ALIGNMENT

Section 3.4.2 of S.B. 78 (Track 00 Switch Adjustment) should be located after Section 3.4.5 (Head Radial Alignment). The head alignment should be performed prior to the "coarse" track 00 adjustment because it is in the head alignment procedure that it is determined whether the track 00 switch is set correctly or not. If the cat's eye pattern cannot be found by rotating the stepping motor, the "coarse" track 00 adjustment (Section 3.4.2) must be performed and then the head alignment checked again. When aligned, the track 00 switch check (Section 3.4.6) should be executed. If the Cat's eye can be found by rotating the stepping motor but is not observed on the reseek (step g.), the track 00 switch is set incorrectly and Section 3.4.6 should be performed. Step a-c of Section 3.4.6 can be substituted with:

a) Insert good 'scratch' platter

b) Monitor TP8 for DC level

c) Run program 1 VERIFY F (0,0): VERIFY F (10,10): GOTO 1. TP8 should alternate between ±0 volts and +5 volts when the switch is set correctly.

If difficulty is encountered in aligning the head or adjusting track 00, follow Section 3.4.2 to help remedy this situation.

5. SECTION 3.4.7 OF S.B. 78

The alignment platter does not have to be inserted at step e of the Carriage Limiter Adjustment (Section 3.4.7). Track 34 will be accessed whether there is a platter in the drive or not.

6. MINOR INCOMPATIBILITY BETWEEN BOARD REVISIONS

A design improvement was incorporated in all PCBs with a revision level of 2 and above. The revision level is located in the small block to the right of the board number (25060). This improvement changed R35 from 100 ohms, 1/4W to 39 ohms, 1/2W. For this reason, the Index/Sector Timing Adjustment (Section 3.4.8) MUST be performed when a PCB revision 0 or 1 is replaced by a revision 2 PCB or vice versa. When two boards of the same revision are interchanged, the index/sector timing should not change sufficiently enough to warrant readjustment. To eliminate any possibility of intermittent or compatibility errors, the index/sector adjustment should be set as close to 200 usec as possible.

7. READ CIRCUIT ADJUSTMENT

There is one potentiometer (R13) located in the read circuit which should be checked (adjusted) every time a drive is aligned or repaired. The procedure follows. Connect channel 1 probe to TP6. Set oscilloscope at 1 usec/DIV; 2V/DIV and trigger INTERNAL, NEGATIVE, NORMAL with channel 1 as the source. Insert a 'scratch' platter and depress SF'04 (SA400 Alignment Program) to write a HEX(FF) pattern at

sector 349. Perform a continuous verify of sector 349 (EXAMPLE: 1 VERIFY F (349,349): GOTO 1). Three negative pulses should be observed. The first will be stable and the second and third unstable. Adjust R13 until the second (middle) pulse is as stable as possible. Glyptol the potentiometer when the adjustment is complete.

8. OSCILLOSCOPE INTERFERENCE

It should be noted that if attempting to format a platter or run a diagnostic with an oscilloscope probe connected to certain test points on the PCB (primarily TP1 and TP2) intermittent errors may occur.

9. WANG OPTIONS FOR SA400

When floppy drives are purchased from Schugart Associates, some are checked and modified to include Wang required options and are then put into stock as 278-4004. The remainder are placed into stock under P/N 725-0057 unchecked and unmodified. Before installing the latter, the following modifications must be performed. See Figure 1.

NOTE:

THIS ONLY CONCERNS THE -3 BOARDS.

1) Open location WP
2) Place six position shunt block such that HL does not have the capability of being jumpered (HL should be 7th position)
3 Lift the appropriate shunt pin so MX is not jumpered.

After these modifications have been performed, the drive should be adjusted and aligned to specifications mentioned in this bulletin and in Service Bulletin 78 before installing in a customer site.

b) Monitor TP8 for DC level

c) Run program 1 VERIFY F (0,0): VERIFY F (10,10): GOTO 1. TP8 should alternate between ±0 volts and +5 volts when the switch is set correctly.

If difficulty is encountered in aligning the head or adjusting track 00, follow Section 3.4.2 to help remedy this situation.

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The alignment platter does not have to be inserted at step e of the Carriage Limiter Adjustment (Section 3.4.7). Track 34 will be accessed whether there is a platter in the drive or not.

6. MINOR INCOMPATIBILITY BETWEEN BOARD REVISIONS

A design improvement was incorporated in all PCBs with a revision level of 2 and above. The revision level is located in the small block to the right of the board number (25060). This improvement changed R35 from 100 ohms, 1/4W to 39 ohms, 1/2W. For this reason, the Index/Sector Timing Adjustment (Section 3.4.8) MUST be performed when a PCB revision 0 or 1 is replaced by a revision 2 PCB or vice versa. When two boards of the same revision are interchanged, the index/sector timing should not change sufficiently enough to warrant readjustment. To eliminate any possibility of intermittent or compatibility errors, the index/sector adjustment should be set as close to 200 usec as possible.

7. READ CIRCUIT ADJUSTMENT

There is one potentiometer (R13) located in the read circuit which should be checked (adjusted) every time a drive is aligned or repaired. The procedure follows. Connect channel 1 probe to TP6. Set oscilloscope at 1 usec/DIV; 2V/DIV and trigger INTERNAL, NEGATIVE, NORMAL with channel 1 as the source. Insert a 'scratch' platter and depress SF'04 (SA400 Alignment Program) to write a HEX(FF) pattern at

sector 349. Perform a continuous verify of sector 349 (EXAMPLE: 1 VERIFY F (349,349): GOTO 1). Three negative pulses should be observed. The first will be stable and the second and third unstable. Adjust R13 until the second (middle) pulse is as stable as possible. Glyptol the potentiometer when the adjustment is complete.

8. OSCILLOSCOPE INTERFERENCE

It should be noted that if attempting to format a platter or run a diagnostic with an oscilloscope probe connected to certain test points on the PCB (primarily TP1 and TP2) intermittent errors may occur.

9. WANG OPTIONS FOR SA400

When floppy drives are purchased from Schugart Associates, some are checked and modified to include Wang required options and are then put into stock as 278-4004. The remainder are placed into stock under P/N 725-0057 unchecked and unmodified. Before installing the latter, the following modifications must be performed. See Figure 1.

NOTE:

THIS ONLY CONCERNS THE -3 BOARDS.

1) Open location WP
2) Place six position shunt block such that HL does not have the capability of being jumpered (HL should be 7th position)
3 Lift the appropriate shunt pin so MX is not jumpered.

After these modifications have been performed, the drive should be adjusted and aligned to specifications mentioned in this bulletin and in Service Bulletin 78 before installing in a customer site.

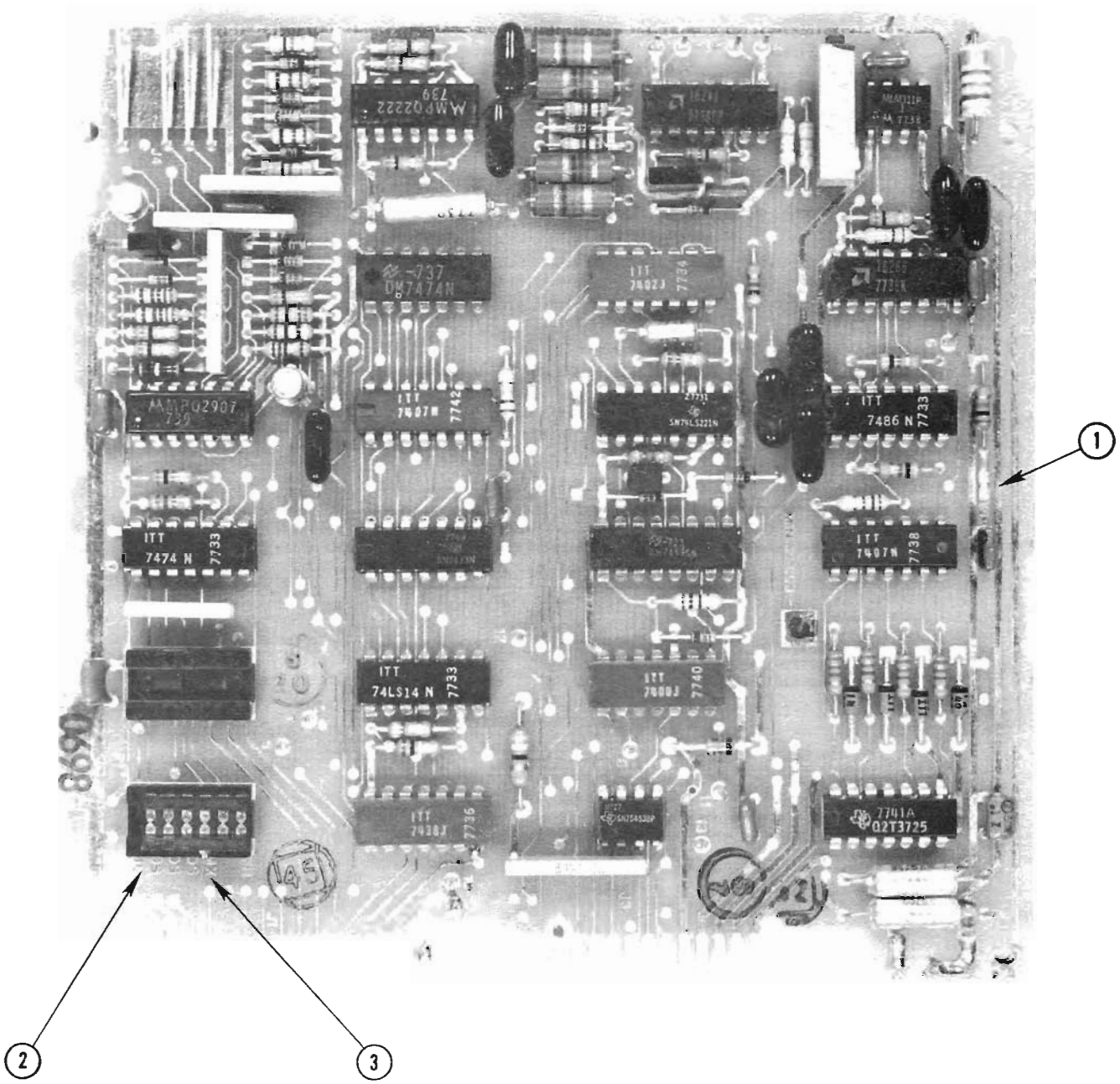


FIGURE 1

10. MOST COMMONLY USED SA400 PARTS CROSS REFERENCE

SHUGART #	DESCRIPTION	WANG #
11312	Activity Lamp Assy	726-1069
17211	Track 0 Switch	726-1052
25060	Logic PCB	726-1062
25063	Motor Control PCB	726-1063
54026	Hub Collet	726-1057
54040	PCB Guide L (New Style)	726-1086
54041	PCB Guide R (New Style)	726-1055
54047	Drive Motor	726-1054
54048	Drive Belt	726-1053
54055	Head Carriage Assy.	726-1058
54064	Head Load Solenoid Assy.	726-1059
54089	PCB Guide R (Old Style)	726-1083
54090	PCB Guide L (Old Style)	726-1084
54135	Load Bail	726-1068
54136	Index Detector Assy.	726-1060
54137	Index Led Assy.	726-1061
54145	Load Button	726-1056
54908-0	Door Hinge Assy.	726-1087
	7400 IC	376-0002
	7402 IC	376-0016
	7407 IC	376-0056
	74LS14 IC (7414 #)	376-0139
	7433 IC (74LS33 #)	376-0229
	7438 IC	376-0128
	7474 IC	376-0006
	7486 IC	376-0036
	74195 IC	376-0097
	75452P IC	726-0356
	75453B IC	726-1079
	9602 IC	376-0104
	NE 592A IC	376-0239
	2 QT 2222 IC	726-1081
	2 QT 2905 IC	726-1082

SHUGART #	DESCRIPTION	WANG #
	IN 4003 Diode	726-0913
	IN 4148 Diode	726-0908
	IN 5235B Diode	726-0124
	2N 2222 Xstor	726-0179
	TIP 140 Xstor	726-1080
	1 uh Inductor	726-0308
	.1 uf 50V +80% - 20% Ceramic	300-1901
	300 pf 500V 5% MICA	726-5047
	680 pf 300V 5% MICA	300-5003
	750 pf 300V 5% MICA	300-5014
	1500 pf 200V 10% MICA	300-5000
	4.7 uf 50V 10% Tantalum	726-1074
	50 uf 25V 10% Electrolytic	300-3010
	150 ohm Res Pack	726-1078
	330 ohm Res Pack	726-1076
	680 ohm Res Pack	726-1077
	100 K Potentiometer	726-1075
	75 ohm 1/8W 1%	333-0054
	274 ohm 1/8W 1%	333-0055
	909 ohm 1/8W 1%	333-0059
	18 ohm 1/4W 1%	330-1019
	100 ohm 1/4W 1%	330-2011
	1K 1/4W 5%	330-3011
	10K 1/4W 5%	330-4011
	18K 1/4W 5%	330-4019
	20K 1/4W 5%	330-4021
	39K 1/4W 5%	330-4040
	47K 1/4W 5%	330-4048
	100K 1/4W 5%	330-5010
	1 ohm 1/2W 5%	331-0011
	29 ohm 1/2W 5%	331-1040

PART NO 25061-1

R/W 1 XS401
R/W CT. XS401
R/W 2 XS401
+READ ENABLE XS401
+WRITE PROT.
+OUTPUT ENABLE XS401
- INDEX/SECTOR
+ PULL UP XS401
- READ DATA
+ WRITE PROT. XS401
- WRITE PROTECT
-INDEX/SECTOR
INDEX/SECTOR LED

+12VA
+5V
±0V
150Ω
R2 9.09K 1/8W 1%
R6 20K
R1 3K
R5 8
R4 3K
R7 20K
R3 9.09K 1/8W 1%
R8 845 1/8W 1%
R9 845 1/8W 1%
R14 20K
R15 10K
R26 300
R28 300
R32 100K
R31 47K
R35 35 1/2W
R29 510
R10 75
R11 36K
R12 36K
R13 100K
C30 [7]
C3 1.0 15V 20%
C4 680pf 300V 5%
C5 300pf 300V 5%
C6 1500pf 200V 10%
C7 .1
C8 .1
C11 300pf 300V 5%
C10 300pf 300V 5%
C18 750pf 300V 5%
C13 750pf 300V 5%
L1 680
L2 150
L3 150
L4 680
RP1
RP2
RP3
RP4
RP5
CR1
CR2
CR3
CR4
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP9
TP10
1A
2A
3A
4A
4B
2B
4C
2C
2E
2F
3F
015

XS400

+12V RTN
GND
+5V RTN
LS 100
C28 4.7 10%
C2,9 0.1
C27 4.7 10%
C14,15 22, 25,26 0.1
10,11, 12,13
4,5,6, 8,14
1 THRU 34

RESISTOR ARRAY		
VALUE	POSITION	UNUSED
330Ω	RP2, 3	
680Ω	RP1	
150Ω	RP5	
1K	RP4	

TYPE	POS.	UNUSED	VCC (PIN)	GND (PIN)	VDD (PIN)
7400	3E		14	7	—
7402	3B		14	7	—
74LS14	2E		14	7	—
7407	2C	2C4	14	7	—
7433	2D		14	7	—
7438	2F		14	7	—
7474	2B,1D	D1 8	14	7	—
74S5	3D		16	8	—
75452P	4D,4E		8	4	—

TYPE	POS.	UNUSED	VCC (PIN)	GND (PIN)	VDD (PIN)
75453B	3F		8	4	—
LM311N	4A		—	1	8
NE592A	3A		—	5	10
7486	4C	4C1, 2	14	7	—
9602	4B,3C		16	8	—
2QT2222	2A		—	—	—
2QT2905	1C		—	—	—
150Ω	1E	2	—	—	—

REF DESIGNATION LAST USED	REF DESIGNATION NOT USED
C31	C19,20,23,24,29,30(RESERVED)
CR18	
LS	
Q2	
R35	
RP5	
TP13	

NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL CAPACITORS ARE IN MICROFARADS, 50V, +80, -20%.
2. ALL DIODES ARE 1N4148.
3. ALL INDUCTORS ARE IN MICROHENRIES, 10%.
4. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
5. O—O INDICATES CUT TRACE OPTION.
6. * INDICATES J1, ▽3 INDICATES J2, ▽3 INDICATES J3, ▽4 INDICATES J4.

[7] COMPONENT NOT INSTALLED.

8 PIN 4 OF ID IS GROUND.

[9] R13 VALUE MAY BE 50K.

MUST CONFORM TO ENGINEERING SPEC ES 30000-0

MATERIAL

TOLERANCE UNLESS OTHERWISE NOTED: LINEAR .XX ±, .XXX ±; ANGULAR ±

CASE DEPTH

HARDNESS

SURFACE TREATMENT ES

CORNERS EDGES BROKEN: OUTSIDE MAX; INSIDE MAX

EC HISTORY

DATE	NO
8-76	0600
8-76	0613
9-76	0618
0-76	0628
11-76	0643
2-76	0649

SHUGART ASSOCIATES

TITLE SCHEMATIC DIAGRAM SKETTE, MINI

DETAIL 7-27-76 RELEASED FOR ASSEMBLY

DESIGN 25061

APPRO 8-76 SHEET 1 OF 2

D SCALE — DWG. CODE SC PART NO. 25061-2 REV. 0649

PART NO 25061-1

REMOVE

-MOTOR ON
-WRITE DATA
-WRITE GATE
+WRITE PROT. X5400
-DRIVE SELECT 1
-DRIVE SELECT 2
-DRIVE SELECT 3
-STEP
DIRECTION
+ PULL UP X5400
-TRACK ZERO N.O.
+TRACK ZERO N.C.

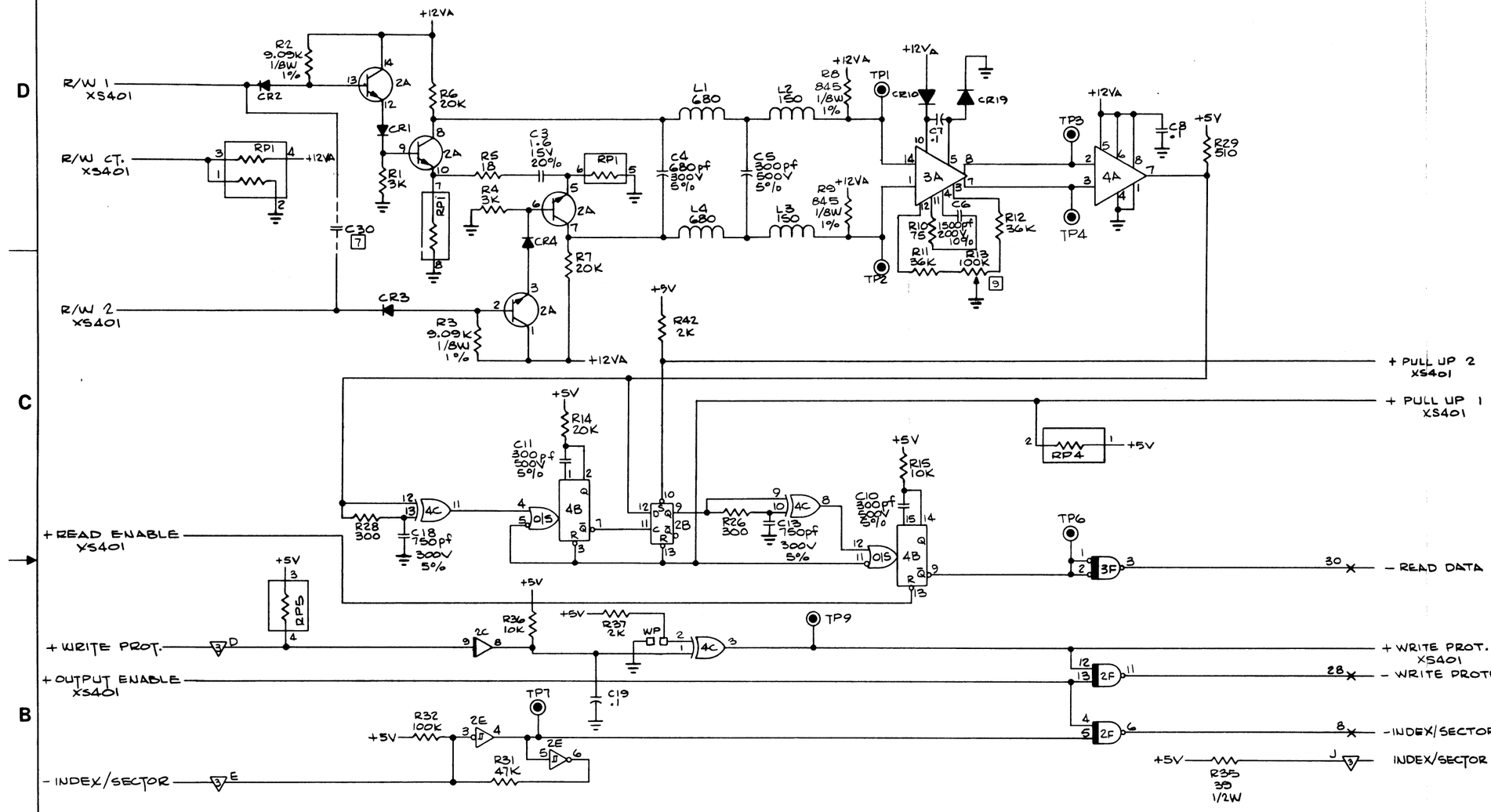
- MTR ON
R/W 1 X5400
R/W 2 X5400
R/W CT. X5400
- ACTIVITY LED
ACTIVITY LED
- HEAD LOAD
+ READ ENABLE X5400
+ OUTPUT ENABLE X5400
ERASE
-TRACK ZERO
ΦD
ΦC
ΦB
ΦA

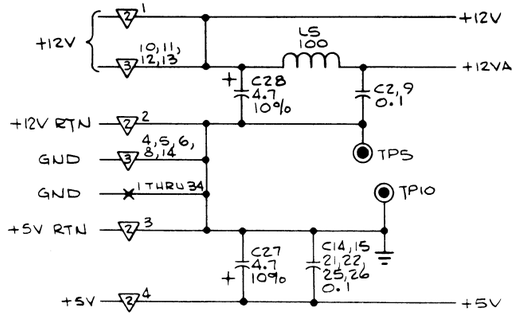
XS401

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0			EC HISTORY		SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO	TITLE SCHEMATIC DIAGRAM DISKETTE, MINI
	LINEAR	± XX			DETAIL JJ 8-76 RELEASED FOR ASSEMBLY
CASE DEPTH		± XX			DESIGN T25061
HARDNESS	ANGULAR	±			APPRO 8-76 SHEET 2 OF
SURFACE TREATMENT ES	CORNERS EDGES BROKEN	OUTSIDE MAX / INSIDE MAX			SCALE ~ DOC CODE SC PART NO 25061-2 REV EC 0049

D

PART NO 25061-4





XS400

RESISTOR ARRAY		
VALUE	POSITION	UNUSED
330Ω	RP2, 3	
680Ω	RP1	
150Ω	RP5	
1K	RP4	

TYPE	POS.	UNUSED	VCC (PIN)	GND (PIN)	VDD (PIN)	TYPE	POS.	UNUSED	VCC (PIN)	GND (PIN)	VDD (PIN)
7400	3E		14	7	—	75453B	3F		8	4	—
7402	3B		14	7	—	LM311N	4A		—	1	8
74LS14	2E		14	7	—	NE592A	3A		—	5	10
7407	2C,4D		14	7	—	7486	4C	4C2	14	7	—
7433	2D		14	7	—	9602	4B		16	8	—
7438	2F		14	7	—	2QT2222	2A		—	—	—
7474	2B,1D	1D1 B	14	7	—	2QT2905	1C		—	—	—
7419S	3D		16	8	—	150Ω	1E	2	—	—	—
74LS221	3C		16	8	—	MPQ3725	4F		—	—	—

REF DESIGNATION LAST USED	REF DESIGNATION NOT USED
C31	C20,23,24
CR19	
LS	
Q2	
R42	
RP5	
TP13	

NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL CAPACITORS ARE IN MICROFARADS, 50V, +80, -20%.
2. ALL DIODES ARE IN4148.
3. ALL INDUCTORS ARE IN MICROHENRIES, 10%.
4. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
5. ⊓⊓ INDICATES SHUNT SELECTABLE OPTION.
6. ✕ INDICATES J1, ▽2 INDICATES J2, ▽3 INDICATES J3, ▽4 INDICATES J4.

[7] COMPONENT NOT INSTALLED.

8 PIN 4 OF ID IS GROUND.

[9] R13 VALUE MAY BE 50K.

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE SCHEMATIC DIAGRAM DISKETTE, MINI
		12-76	0649	
	LINEAR .XX	10-77	0673	DETAIL [illegible] 7-27-76 RELEASED FOR ASSEMBLY
CASE DEPTH	.XXX	11-77	0691	DESIGN ✓ 125061
HARDNESS	ANGULAR ±	2-77	0692	APPRO [illegible] 8-16 SHEET 1 OF 2
SURFACE TREATMENT ES	CORNERS OUTSIDE MAX. / EDGES BROKEN INSIDE MAX.			SCALE D 4 DOC CODE SC PART NO 25061-4 REV EC 0692

PART NO. 25061-4

REMOVE

-MOTOR ON
+PULL UP 2 X5400
-WRITE DATA
-WRITE GATE
+WRITE PROT. X5400
-DRIVE SELECT 1
-DRIVE SELECT 2
-DRIVE SELECT 3
-STEP
DIRECTION
+PULL UP 1 X5400
-TRACK ZERO N.O.
+TRACK ZERO N.C.

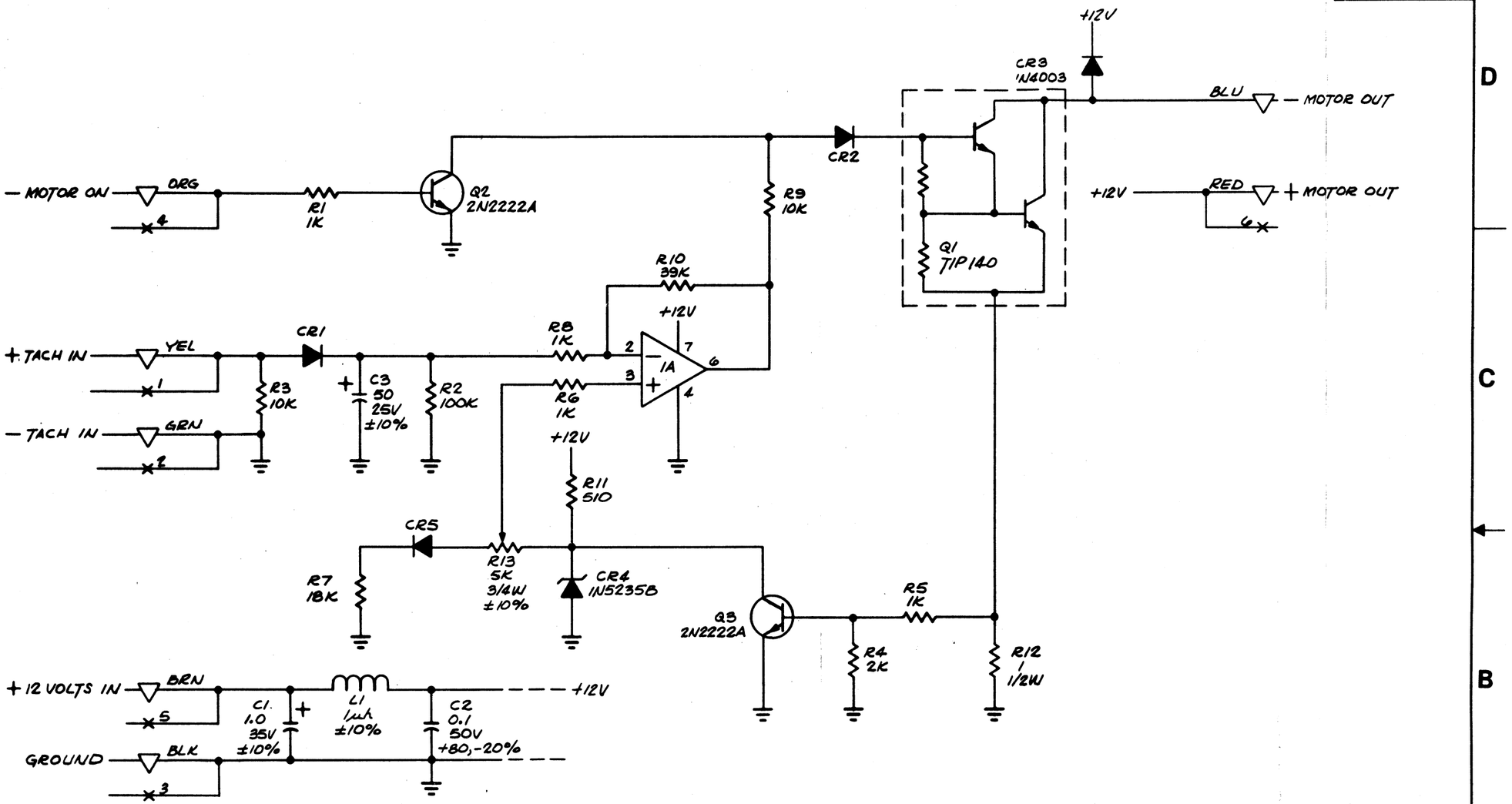
- MTR ON
R/W 1
R/W 2
ERASE
R/W CT.
- ACTIVITY LED
ACTIVITY LED
- HEAD LOAD
+ READ ENABLE X5400
+ OUTPUT ENABLE X5400
ϕD
ϕC
ϕB
ϕA
-TRACK ZERO

R17 2.26K 1/8W 1%
R16 2.26K 1/8W 1%
R20 604 1/8W 1%
R19 20K
R18 20K
R22 274 1/8W 1%
R23 909 1/8W 1%
R24 75 1/8W 1%
R21 20K
R34 150
R33 300
R30 100
R25 14.3K
R27 4.7K
R38 270
R39 270
R40 270
R41 270
C1 .033 ±20%
C12 1.0 10%
C17 .1 10%
C31 750pf 3000V 5%
C29
C16 300pf 500V 5%
CR6
CR5
CR9
CR13 CR12 CR11
CR14 IN4003
CR15 IN4003
CR17 IN4003
CR18 IN4003
CR16 IN4003
Q2 2N2222
Q1 2N2222
TP13
TP12
TP11
TP8
RP2
RP3
RP4
RP5
MX
HM
HS
DS1
DS2
DS3
1C
1D
1E
1F
2B
2C
2D
2E
2F
3B
3C
3D
3E
3F
4-BIT SREG
4D
4F
+5V
+12V

XS401

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE / NO	TITLE SCHEMATIC DIAGRAM DISKETTE, MINI
CASE DEPTH	LINEAR ± .XX ± .XXX		DETAIL J.J. 8-76 RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR ±		DESIGN
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX		APPRO L.L.T. 9-76 SHEET 2 OF
			D SCALE ~ FSC CODE 9C PART NO 25061-4 REV EC 0692

PART NO. 25062-1



NOTES; UNLESS OTHERWISE SPECIFIED,

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL DIODES ARE IN4148.
3. ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
4. ▽ INDICATES SOLDERED WIRE CONNECTION.

REF DESIGNATION LAST USED	REF DESIGNATION NOT USED
C3	
CR5	
L1	
Q3	
R13	

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTORY	
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO.
				8-76	0600
		LINEAR	±.XX	8-76	0613
CASE DEPTH			±.XXX	9-76	0622
HARDNESS		ANGULAR±			
SURFACE TREATMENT	ES	CORNERS EDGES BROKEN	OUTSIDE MAX		
			INSIDE MAX		

SHUGART ASSOCIATES

TITLE SCHEMATIC DIAGRAM
DRV MTR & SPEED CTRL (AM)

DETAIL	J.W.	5-76	RELEASED FOR ASSEMBLY
DESIGN			
APPRO	L.L.F	8-76	SHEET 1 OF 1

SCALE	DOC CODE	PART NO.	REV/EC
C	~	SC	25062-1	0622