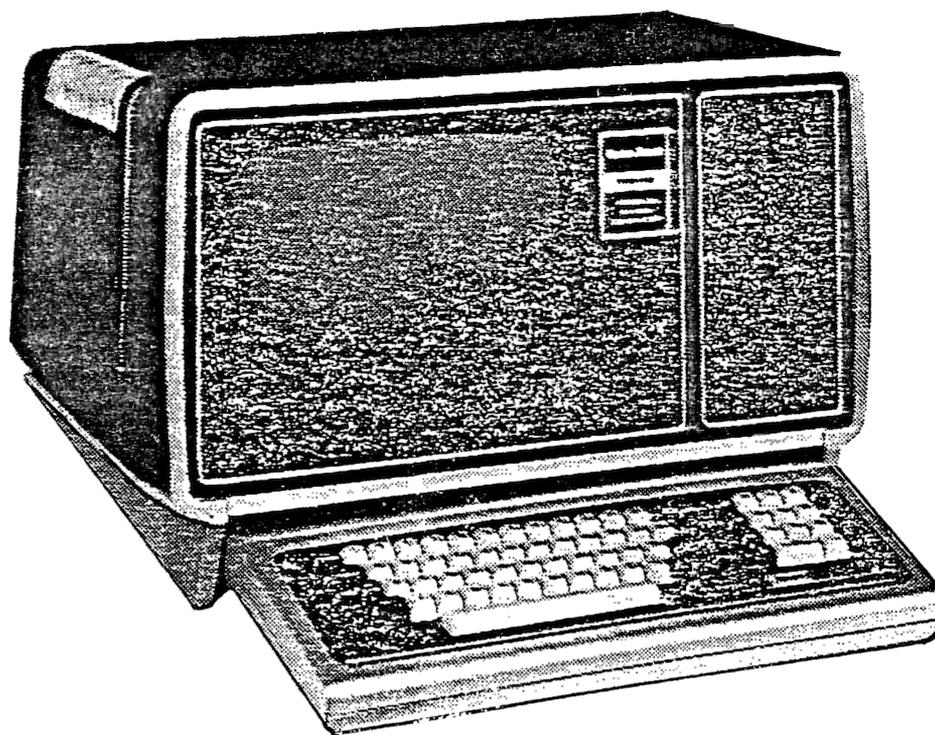


Radio Shack

Troubleshooting Manual

26-4001/-4002

TRS-80 MODEL II



Catalog Number 26-4001/-4002

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I. INTRODUCTION

A. System Description

The TRS-80 Model II Microcomputer is a powerful desk-top business computer with many advanced features. This troubleshooting manual is intended as a guide to assist in the diagnosis of system problems to the subassembly level.

Board level repair down to the gate level is beyond the intended scope of this manual.

B. Subassembly Description

The TRS-80 Model II consists of eleven major subassemblies. Each subassembly can be considered as a single component of the computer system. If it has been determined that a subassembly is malfunctioning, that entire subassembly should be replaced.

1. Case:

The case subassembly has three major parts, the bottom tray, the top cover and the front bezel. These parts provide the attractive housing for the TRS-80 Model II. Care should be exercised during service operations so that the painted case parts are not marred or scratched.

2. Chassis:

The metal chassis is mounted to the bottom tray of the case. The chassis has mounting provisions for the other subassemblies in the TRS-80 Model II.

3. Power Supply.

The power supply subassembly in the TRS-80 Model II is an open frame, 150 watt, switching power supply. It has four outputs with the following ratings:

5	Volts	@	8.6	Amps
12	Volts	@	4.5	Amps
24	Volts	@	1.7	Amps
-12	Volts	@	0.2	Amps

The power supply rectifies the AC line to DC, chops it at 20 KHz, then transforms the chopped DC to the required output voltages and finally rectifies the transformed output to low voltage isolated DC. Feedback loops are provided for voltage regulation and over current protection.

Because of its design, this power supply must have a load present, (ie. the computer and CRT electronics), or damaging oscillations may result. Never test the power supply without a suitable load. The minimum currents required by the power supply are:

5	Volts	@	2.15	Amps
12	Volts	@	1.25	Amps
24	Volts	@	0.00	Amps
-12	Volts	@	0.05	Amps

4. Card Cage:

The card cage provides mechanical support for and electrical connections to the digital electronics boards. Up to eight boards can be accommodated in the card cage. The main component of the card cage subassembly is the "Motherboard". The Motherboard holds the eight 80 pin card edge connectors and has the printed wiring defining the TRS-80 Model II bus.

As shipped from the factory, the cards should be in the following order: (slot one being the one closest to the power supply).

CPU	Slot 1
FDC	Slot 2
Memory	Slot 3
Video	Slot 4
Expansion Mem	Slot 5 (ie. the 32K memory add on board)

5. CPU Card:

The CPU card in the TRS-80 Model II has several powerful features. The first of these is, of course, the CPU itself, a 4 MHz Z80A Microprocessor, running at its full rated speed.

The bootstrap ROM on the CPU card provides the necessary instructions to the Microprocessor for the required initialization of the computer system on power-up or after a front panel reset. The ROM then "disappears", allowing the user to take full advantage of the memory space as RAM.

The DMA (Direct Memory Access) circuit on the CPU board allows memory to peripheral or peripheral to memory data transfers without CPU intervention. This allows for a much greater program and I/O throughput. One of the most often used applications of the DMA is in data transfers to and from the floppy disk controller.

The dual serial interface is also on the CPU card. The baud rate is fully user programmable.

6. Memory Card:

The memory card in the TRS-80 Model II uses 16K dynamic RAMs to give either 32K bytes or 64K bytes of read/write memory. The necessary refresh signals for the memory come from the CPU board.

7. Video Card:

The video card supports both 80 character and 40 character lines, with 24 lines displayed. The character set includes upper and lower case alphabetic, numeric, symbols (↑, .., #, etc.), and a set of forms drawing characters. Reverse video can be selected on a character-by-character basis.

The heart of the video controller is a 6845 CRT controller chip, which is software programmable for various formats.

The video card also contains the logic for the keyboard interface. This serial handshake interface receives data and clock signals from the keyboard and issues an interrupt when the entire character has been received.

8. Floppy Disk Controller Card:

The floppy disk controller card provides all the circuitry necessary to read and write in both single density (FM) and double density (MFM) formats on an eight inch floppy disk drive. The board uses a 1791 floppy disk controller chip to generate the proper write signals. The read signals from the drive are passed through a phase-locked loop data separator before going on to the 1791 to insure high reliability reads.

CAUTION

The phase-locked loop is factory adjusted for optimum performance. Do not adjust any of the potentiometers on the FDC board!

The parallel printer interface is also on the floppy disk controller card.

9. CRT:

The 12 inch CRT (Cathode Ray Tube) and associated electronics form the video monitor for the TRS-80 Model II. This subassembly receives video, horizontal drive, and vertical drive signals from the video card and +12 volts from the power supply. The CRT's high resolution complements the upper/lower case character set of the video card.

10. Floppy Disk Drive

The floppy disk drive is a standard eight inch drive capable of supporting both single and double density recording formats. All of the disk drive control signals come from the floppy disk controller card. The drive contains two motors; one rotates the media at a constant speed while the other positions the read/write head over one of the 77 tracks. Electronics on the disk drive convert digital signals into read/write head signals and vice-versa.

11. Keyboard:

The keyboard of the TRS-80 Model II is a 76-key microcomputer controlled capacitive keyboard. The microcomputer and its associated electronics scans the key matrix, converts switch closures to an eight bit digital code and transmits it serially to the keyboard interface on the video card. The keyboard is connected to the main console via a cable from the front bezel of the computer

II. TROUBLESHOOTING PROCEDURE

A. General

This section of the manual will guide service personnel through the system checkout procedure. Functionality of the subassemblies with operational problems can then be removed and replaced.

Connect the power cord and keyboard as described in the Operator's Manual.

Remove the top cover of the display console by removing the two screws at the rear of the unit. Carefully set the top cover aside to prevent accidental scratching. If the unit has an interlock switch, enable the test mode by pulling up on the interlock switch plunger.

At this point, there should be no diskette in the drive, and the disk terminator should be installed as described in the Operator's Manual.

B. Synopsis of Power-On Diagnostics

When the power switch on the TRS-80 Model II is raised to the "ON" position, the Z80 microprocessor automatically starts executing the program in the bootstrap ROM on the CPU board. The program performs the following functions in order:

1. The initialization parameters are sent to the CRT controller and the screen memory is set to the value 0A0H. This causes the CRT to come on with a solid white screen.
2. The ROM checksum is verified to assure that the ROM is present and functioning properly. If the checksum indicates that the ROM data is bad, "CK ERROR" will be output to the CRT and the computer will halt.
3. A CPU test program is run to verify proper data transfers between registers in the Z80 CPU. Any failure of this test will cause "Z8 ERROR" to be output to the CRT and the computer will halt.
4. The RAM memory from 1000H to 7FFFH is then tested with a simple read-complement-write-compare-complement-write routine. Any faulty memory locations in this 28K byte range will cause "MF ERROR" to be output to the CRT and the computer will halt.
5. The keyboard will be "flushed" of any characters input up until this time.
6. The message "INSERT DISKETTE" is displayed on the CRT.

Bootstrap Sequence

7. Wait until diskette is inserted and door is closed.
8. Screen is cleared to spaces (all black).
9. Track 0 seek command is sent to floppy disk controller.
10. Wait three seconds and check disk status.
11. "DC ERROR" if floppy disk controller is still busy or seek error is indicated or drive not restored to track 0.
12. "D0 ERROR" if drive 0 indicates not ready.
13. "SC ERROR" if there is a CRC error in the track ID field.
14. Read track 0 into RAM.
15. "TK ERROR" if record not found on track 0.
16. "SC ERROR" if there is a CRC error in the record ID.
17. "LD ERROR" if a lost data error occurs.
18. "RS ERROR" if the data loaded in is not in Radio Shack boot record format.

19. Call diagnostic routine.
20. Jump to TRSDOS.

C. Detailed Troubleshooting Instructions

1. Turn on the Model II Computer by raising the power switch to "ON". Wait a few seconds for the CRT to warm up. Adjust brightness and contrast controls at the front of the console. If the video display comes on, go to 10.
2. If the pilot light is on, go to 4. If the pilot light/reset switch connector is in place on the CPU board, go to 3. Put the connector on correctly. Go to 2.
3. Check for +5 volts on one of the P. C. boards. If this is not in the range from 4.8 to 5.2 volts, go to 5. The LED must be burned out. Replace and go to 1.
4. Check the filament of the CRT. If it is lit, go to 7.

Check the +12 volt supply at the CRT electronics board (pin 1 is ground, pin 7 is +12V).

If +12 volts is present, go to 6.

5. Switch off power. Check the power supply fuse and replace if necessary. Check for shorts across the power supplies. If shorts are found, remove cards from card cage until the shorts disappear, then replace the offending board. Reassemble and go to 1.

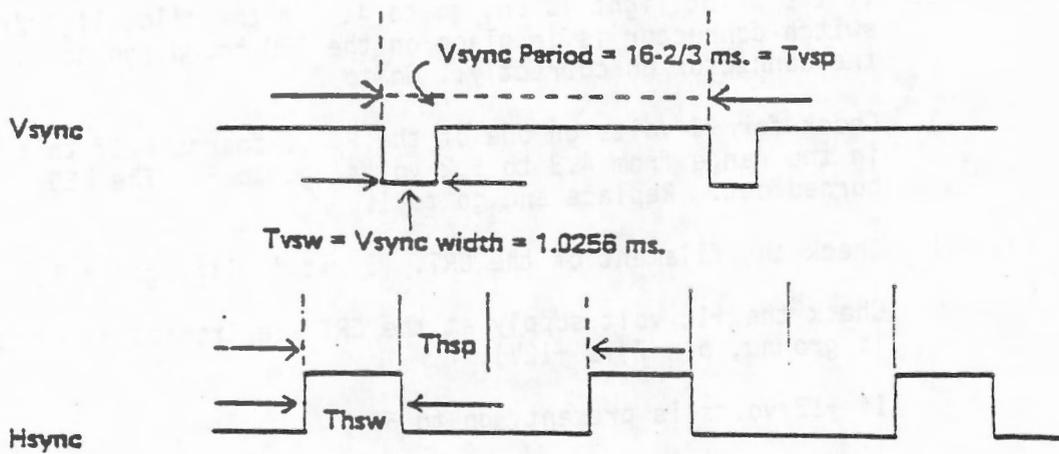
Otherwise, power supply may have malfunctioned. Remove and replace the power supply. Go to 1.

6. CRT bulb has burned out filament. Replace and go to 1.
7. Look at pins 6 and 9 on the CRT electronics board and compare to Figure 1. If the respective signals are the same, go to 9.

Turn off power. Swap video board with known good one. Try again. If video display comes on, go to 10.

8. Call Fort Worth.
9. Replace CRT Electronics and try again. If video display comes on, go to 10.

Go to 8.



T_{hsw} = Horizontal Sync width = $27 \mu s$

T_{hsp} = Horizontal Sync Period = $64.1 \mu s$

FIGURE 1. SYNC SIGNALS

10. If CRT displays white screen with "INSERT DISKETTE" in the center, go to 12.

If CRT displays white screen with some other message, go to 11.

Turn off power and replace video card. If that cures the problem, go to 10.

Turn off power and reinsert original video card. Replace CPU board. If that cures problem, go to 10.

Turn off power and reinsert original CPU card. Go to 8.

11. If message says "CK ERROR", there is a ROM checksum error. This means the bootstrap ROM does not check out good. Either replace ROM or CPU board and go to 1.

If message says "Z8 ERROR", there is a CPU error. Either replace the Z80 CPU on the CPU board or replace the entire CPU board and go to 1.

If message says "MF ERROR", a RAM error has been detected in the lower 32K bytes. Replace the memory card and go to 1.

12. Insert the system test diskette in the drive and close the door. The screen should clear and the diskette will be read. If the "TRSDOS READY" message appears on the screen, go to 13.

If the system "hangs up" or has any of the following errors, (DC, DO, SC, TK, LD, or RS), one or more problems may exist.

First, the system test diskette may be damaged. To test for this, an attempt should be made to load the system test diskette into a known good TRS-80 Model II. If the diskette fails to load, replace system test diskette and go to 1.

The floppy disk controller board in the system under test may not be in proper adjustment. Try replacing it with a spare floppy disk controller board. If the diskette loads OK, go to 13.

At this point, there is a reasonable probability that the problem exists with the disk drive itself. Problems associated with the disk drive may include, but are not limited to, head misalignment, improper use of line terminators and motor problems.

A good way to narrow disk related problems down to the drive is to verify that the floppy disk controller card from the system under test and the system test diskette will work in a known good TRS-80 Model II.

If both work, the disk drive should be replaced.

Go to 1.

Software Diagnostics

The AUTO2 test checks in the following order:

- a. Video Memory - rapidly changing patterns should appear on the screen for approximately one second.
- b. Printer Test - one line of test data is printed.
- c. Floppy Disk Test - a file is opened on the disk, written to and verified and then closed and deleted.
- d. SIO Test - the SIO's channels A and B are tested at 110 baud through 9600 baud, (approximately one min. 12 sec.).
- e. Memory Test - the memory test runs approximately 15 minutes and prints "MEMORY PASSES TEST" or "MEMORY FAILS TEST". Errors are displayed on the screen as they occur.

Note: The line printer is also used for hardcopy of some test results.

Equipment needed for this test are:

1. System Test Diskette
2. SIO Loopback Connector (two male DB-25 connectors with 2 wired to 3, 3 wired to 2, 1 wired to 1, and 7 wired to 7).
3. Printer (ready and on line). If printer is not on line, then this section of the test is skipped.

13. (See note above). Type in on the keyboard, "AUTO2" and enter, (AUTO2 should be typed with caps on. Enter is a single key). Refer to AUTO2 test synopsis for normal chain of events.

If screen flashes momentarily (approximately one second) with characters and then says "THE VIDEO TEST HAS FINISHED", we will proceed with the printer test. If OK, go to 14.

If test hangs up with screen full of characters or message on screen says "MACHINE FAILS", remove and replace video board. Go to 1.

14. The CRT screen should say "LINE PRINTER TEST IN PROGRESS". If printer prints one line of test data and types "LINE PRINTER TEST FINISHED" on the CRT, the printer test is finished -- compare data with sample listing. Go to 15 for disk IO test.

If "PRINTER IS NOT READY" is displayed on CRT, check that the printer is correctly connected and is on line. To restart test, go to 1.

If printer is not needed, continue on.

15. The CRT should say "DISK I/O TEST IN PROGRESS". The Disk I/O test consists of writing, reading, and verifying a file on the diskette. If CRT says "DISK I/O TEST FINISHED", the disk IO test has passed. Go to 16.

If test hangs up here, or CRT says "MACHINE FAILS TEST", remove and replace FDC board. Go to 1.

16. The screen should say "SIO TEST IN PROGRESS". We are now in the SIO test. If both channels A and B pass all tests from 110 baud to 9600 baud as displayed on the CRT, and CRT says "SIO TEST FINISHED", go to 19.

If either A or B fail or the test hangs up, (the whole SIO test takes approximately one minute to run), check that the test connector is properly installed and that the internal cable from the CPU to the computer IO panel is installed correctly. If cables are OK, go to 17.

If cable is incorrectly installed, reinstall and go to 18 for restart of test.

17. Remove and replace CPU card. Go to 1.

18. Raise reset switch on the front panel. Go to 12.

19. If CRT says "64K MEMORY TEST" and your system contains a 64K memory board, then go to 21.

If CRT says "32K MEMORY TEST" and your system contains a 32K memory board, then go to 21.

If CRT says "64K MEMORY TEST" and your system contains a 32K memory board, then go to 20.

If CRT says "32K MEMORY TEST" and your system contains a 64K memory board, then remove memory board and check memory jumpers. If they are correct, go to 20.

Correct memory jumpers and replace memory board. Go to 1.

The following table summarizes all the jumper options. Also see Figure 2.

Memory Page	Memory Bank	Memory Page Jumpers	Memory Bank Jumper
0	0	J16-J17, J15-J18	
1	0	J9-J13, J10-J14	J19-J27
1*	0	J9-J11, J10-J12	J19-J27
2	1	J7-J11, J8-J12	J20-J28
3	1	J9-J13, J10-J14	J20-J28
4	2	J7-J11, J8-J12	J21-J29
5	2	J9-J13, J10-J14	J21-J29
6	3	J7-J11, J8-J12	J22-J30
7	3	J9-J13, J10-J14	J22-J30
8	4	J7-J11, J8-J12	J23-J27
9	4	J9-J13, J10-J14	J23-J27
10	5	J7-J11, J8-J12	J24-J28
11	5	J9-J13, J10-J14	J24-J28
12	6	J7-J11, J8-J12	J25-J29
13	6	J9-J13, J10-J14	J25-J29
14	7	J7-J11, J8-J12	J26-J30
15	7	J9-J13, J10-J14	J26-J30

For example: A 32K memory board will have Page 0 and jumpers as above. The first 64K memory board will have Page 0 and Page 1 and jumpers as above.

20. Replace memory board with a new board that is properly jumpered. Go to 1.
21. If CRT says "MEMORY PASSES TEST" all auto2 tests are complete, no errors were found, (this takes approximately 17 minutes).
22. Bulk erase a good disk and format it on the system to ensure a good working system before returning system to the customer.
23. One Final Note

Certain individual tests can be run without going through all of the AUTO tests. These are named MEMTST/CMD, SIOTST/CMD, DIAG/CMD, CRTST/CMD and may be executed by typing in the name when TRSDOS is ready.

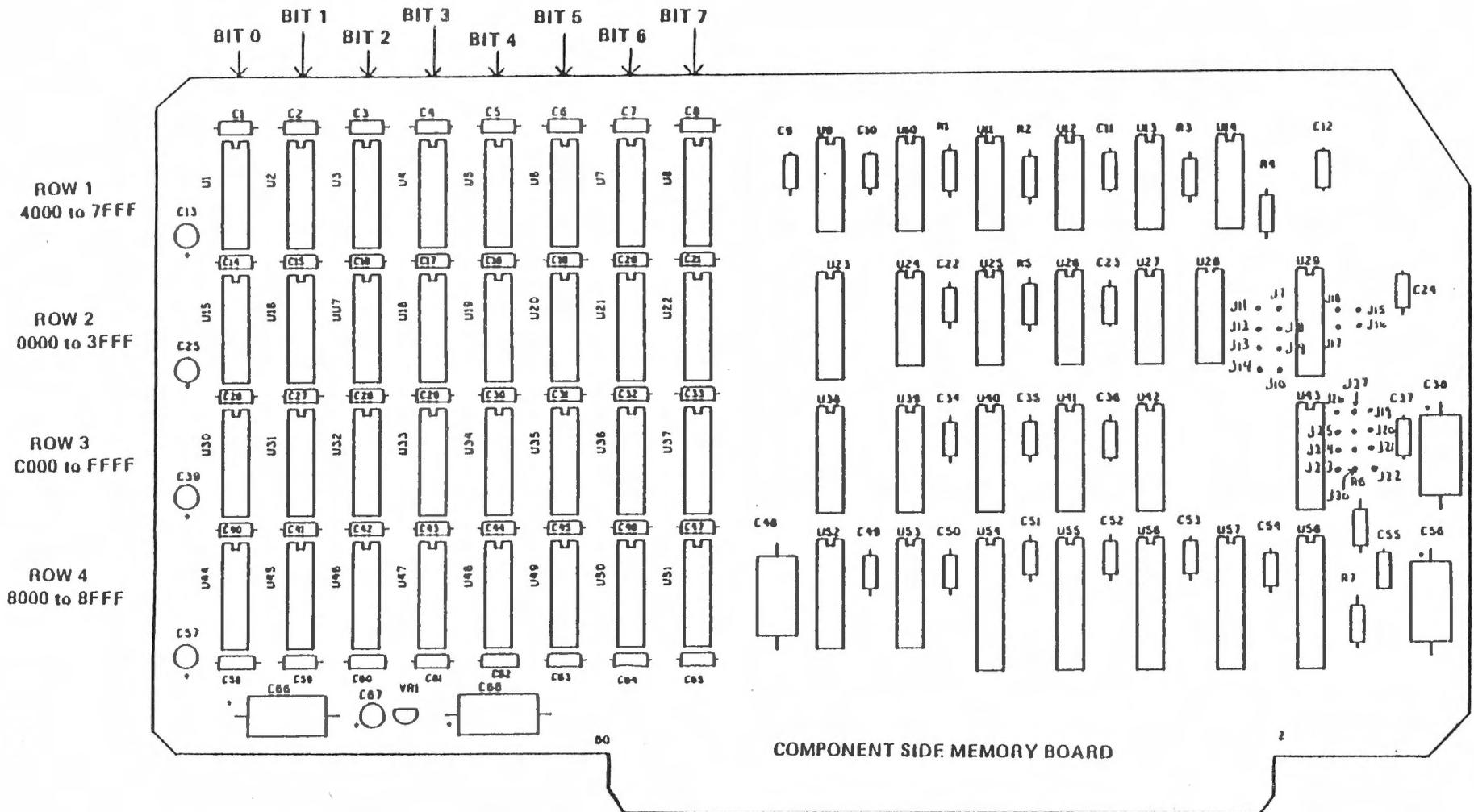


Figure 2. Jumper Options

III. REPAIR PROCEDURE

Repair procedures contained in this manual are limited to system disassembly, removal and replacement of subassemblies and system assembly.

There are potentially hazardous areas inside the case, so use caution during disassembly and be sure to read and observe the warning and caution notes.

Disconnect all external cables from the rear connector panel before beginning repair.

A. System Disassembly

1. Case

- a. Remove the two machine screws from the back of the case.
- b. Lift up on the rear of the top case and rotate it toward the front panel and lift the top case away from the bottom.
- c. Remove the screw that secures the mounting bracket on top of the disk drive to the bezel (inside of front panel).
- d. Remove the screw from the video display mounting bracket and bezel.
- e. Pull out the keyboard cable only as far as necessary to allow the front panel to lay flat (face down).
- f. Pull the front panel forward to clear the chassis and lay it face down.

2. Chassis

- a. Remove five #8 screws, flat washers and lock washers from locations illustrated. Notice that one of the screws is used to help mount the power supply.
- b. Lift up chassis slightly (to clear ribs in the bottom case) and slide it forward.
- c. Remove screws holding the AC power connector to the connector panel and separate the connector from the panel.
- d. Disconnect two wires from the fuseholder.
- e. Disconnect all I/O cables from disk drive, CPU card and FDC card.
- f. Remove chassis from the bottom case.

3. Power Supply

WARNING

If the power supply is faulty, the large heat sink may have a potential of 330 volts above line common. Use extreme caution when handling the power supply.

- a. Remove the three-wire AC plug and the 13 wire DC plug from the power supply PCB.
 - b. Remove two #8 thread forming screws from the power supply mounting bracket.
 - c. Tilt the power supply toward the outside of the chassis and remove four screws, nuts and spacers that mount the video board to the power supply mounting bracket.
 - d. Remove five screws, nuts, flat washers and spacers that secure the power supply to its mounting bracket.
 - e. Remove the power supply from the chassis.
4. Card Cage
- a. If not previously done, disconnect the signal and control cables from the video/keyboard card and I/O cables from the floppy disk controller and CPU cards.
 - b. Disconnect the DC cable on the lower right front of the mother board.
 - c. Remove four #8 thread forming screws from the card cage mounting bracket.
 - d. Remove card cage from the chassis.
5. Removal of Cards from Card Cage
- a. Remove two thread forming screws that connect the PCB stabilizer to the card cage mounting brackets and remove the stabilizer.
 - b. Notice the location of the CPU, FDC, video/keyboard and memory cards. Ensure that like replacement cards are inserted in the same relative positions.
 - c. Remove and replace cards as necessary for repair.
 - d. Remove six screws, nuts and flat washers that mount the mother board to its mounting brackets and remove the mother board.

6. Video Display (CRT) and Video Board

CAUTION

The CRT and video board are matched sets.
Do not remove and replace individual pieces.
Remove one matched set and replace with another
matched set.

- a. If the video board is not free from the power supply mounting bracket, perform the steps for removal of the power supply down to removal of the video board.
- b. Disconnect four color coded wires with spade lugs from the CRT yoke.
- c. Disconnect the connector on the rear of the CRT neck

WARNING

There may be a high voltage charge on the high voltage anode. To discharge, connect one end of a wire to a known good ground and connect the other end of the wire to the blade of a common screwdriver. Insert the screwdriver blade under the suction cup and touch it to the clip holding the wire to the CRT.

- d. Insert a common screwdriver under the rubber grommet on the high-voltage anode wire on the side of the CRT. Use the screwdriver to compress the clip holding the wire to the tube and pull the wire free.
- e. Remove the upper right and lower left screws, nuts and washers from the video display mounting bracket.

CAUTION

If dropped, the CRT will implode. To avoid this kind of accident, support the CRT while performing the next step.

- f. Remove the lower right and upper left screws, nuts and washers from the video display mounting bracket.
- g. Lift the CRT and PCB out of the chassis.

7. Disk Drive

- a. Disconnect two power connectors from the disk drive PCB.
- b. Disconnect the large (50 pin) card edge connector from the disk drive PCB.
- c. Remove four screws from the disk drive mounting bracket.
- d. Lift the drive and mounting brackets out of the chassis.
- e. Lay the drive on its side (PCB up) and remove two screws from the bottom of the mounting bracket.
- f. Separate the drive from the bracket.

8. Fan

NOTE

The following steps can only be performed with the chassis removed from the case.

- a. Position the chassis so that the four nuts on the bottom of the chassis are accessible.
- b. Disconnect the power cable on the fan.
- c. Secure the screw heads while removing the nuts from the bottom of the chassis and remove four nuts.
- d. Raise the fan away from the chassis to provide clearance for the screws while removing the fan.

10. Keyboard (See Figure 3)

- a. Disconnect the keyboard external cable from the keyboard (DIN plug).
- b. Place the keyboard with keys down on a soft surface.
- c. Remove four thread forming screws and two machine screws.
- d. Place the keyboard with keys up and remove the bezel.
- e. Disconnect the five-pin connector at J1 on the PCB.
- f. Lift the keyboard with PCB out of the case.

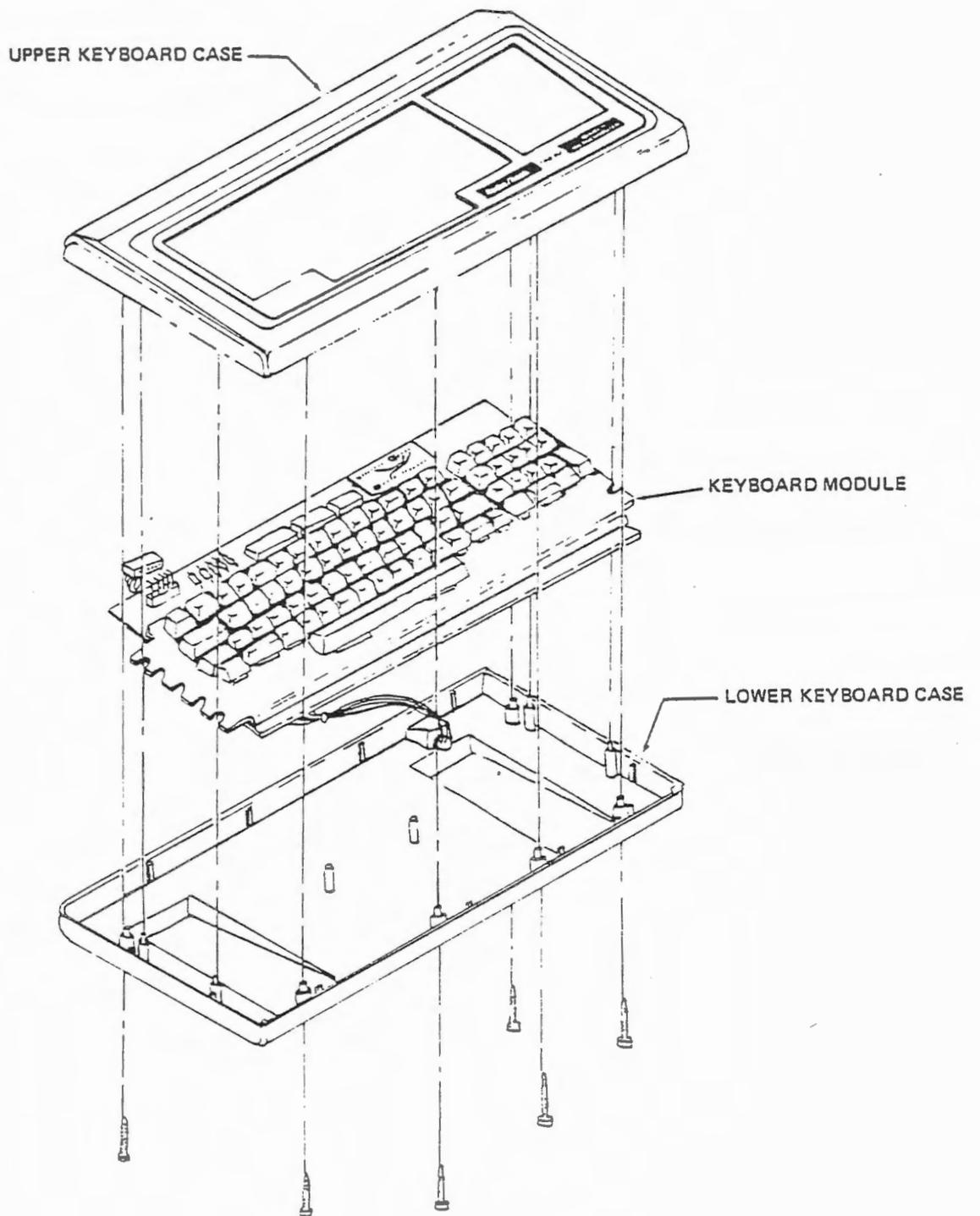


FIGURE 3. KEYBOARD DISASSEMBLY

B. Subassembly Replacement

1. Keyboard

Reassemble the keyboard in reverse order of disassembly.

2. Fan

- a. When installing a new fan, insert the screws into the screw holes before positioning the fan.
- b. Ensure that the fan is oriented so that air will flow in from the bottom and out through the top and so that the power connector is accessible.

CAUTION

Do not put stress on the fan mounting ears.
Tighten the screws and nuts only enough to secure the fan to the chassis.

- c. Position the chassis so that the fan mounting screws are accessible from the bottom of the chassis.
- d. Secure the screw heads while installing the nuts.
- e. Tighten the nuts only enough to ensure that the fan is secure.

3. Disk Drive

- a. Lay the disk drive on its side (PCB up) and position its chassis mounting bracket (wide end forward) to align holes in bracket with the holes in the drive base plate.
- b. Install two screws that secure the drive to the mounting bracket.
- c. Place the drive with mounting bracket into the chassis and align the screw holes in the bracket and in the chassis.
- d. Install four screws loosely so that the drive's position can be properly adjusted. Then tighten the screws that secure the bracket to the chassis.
- e. Install two power connectors and the card edge connector on the drive.

4. Video Display (CRT) and Video Board

- a. Position the CRT and align its mounting holes with its mounting bracket.
- b. Install the upper left and lower right screws and mounting hardware.
- c. Install the lower left and upper right screws and mounting hardware.
- d. Position the CRT matched video board inside of the chassis.
- e. Install the plug on the rear of the CRT neck.
- f. Install the four color coded wires with spade lugs to their associated terminals (as determined by a colored dot on the yoke near each terminal).
- g. The video board will be installed on the power supply mounting bracket, (see the procedures for installation of the power supply).

5. Card Cage

- a. Align the mother board mounting holes with the holes in the left and right PCB mounting brackets. (The left bracket has a left 90° bend at the rear and the right bracket has a right 90° bend at the rear).
- b. Install six screws, nuts and flat washers that secure the mother board to the brackets.
- c. Install the CPU, FDC, video/keyboard and memory cards to the mother board. Be sure of proper orientation in the card cage.
- d. Align the holes in the PCB stabilizer with the holes in the left and right PCB bracket and install two thread forming screws.
- e. Position the card cage inside of the chassis and align the holes in the brackets with the holes in the chassis.
- f. Install four screws that secure the card cage to the chassis.
- g. Connect the DC cables to the connector on the lower right front of the mother board.
- h. Connect the I/O cables to the FDC and CPU cards and connect the control cables to the video/keyboard card.

6. Power Supply

- a. Align the power supply mounting holes with the holes in its bracket mounting plate.
- b. Individually, position five spacers to align with the mounting holes between the power supply board and its mounting plate.
- c. Install five screws, nuts and flat washers that secure the power supply to the bracket.
- d. Position the power supply in the chassis and tilt it toward the outside of the chassis.
- e. Align the video board mounting holes with its mounting holes on the power supply bracket mounting plate.
- f. Position four spacers to align with the mounting holes.
- g. Install four screws, nuts and flat washers that secure the video board to the bracket.
- h. Position the holes in the mounting bracket to the holes in the chassis and install two thread forming screws that secure the bracket to the chassis.

7. Chassis

- a. Position the chassis inside of the bottom case so that two wires can be installed to the terminals on the fuseholder and the AC power input connector can be installed on the connector panel.
- b. Install two wires to the fuseholder.
- c. Install two screws that secure the AC power input connector to the connector panel.
- d. Lift up the chassis (to clear ribs on the case bottom) and position so its mounting holes align with those in the case.
- e. Install five screws, flat washers and lockwashers that secure the chassis to the bottom case.

8. Case

- a. Position the front panel (bezel) to the chassis.
- b. Install one screw that secures the bezel to the video display mounting bracket.

- c. Install one screw that secures the bezel to the top bracket on the disk drive.
- d. Position the top case to the lip of the bottom case and rotate downward (toward the back) until the top case is properly seated.
- e. Install two machine screws that secure the top case to the bottom case.

C. Replacement Parts List (Subassemblies)

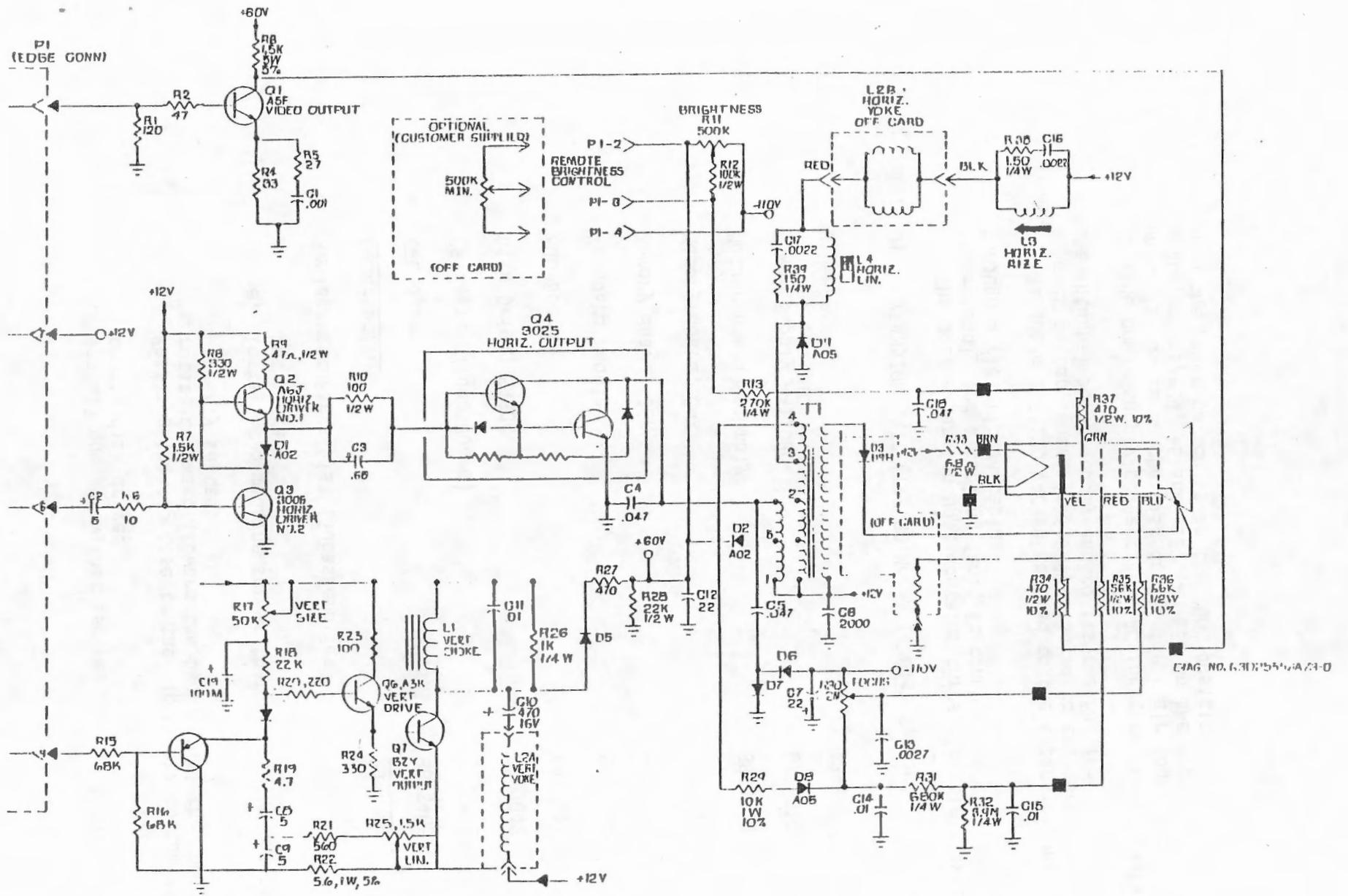
<u>Description</u>	<u>Part No.</u>
CPU Board	8893405
CRT (with Video Board)	8709043
Disk Drive, SA800	8709042
FDC Board	8893425
Keyboard Module	8790504
Memory Board, 32K	8893410
Memory Board, 64K	8893415
Mother Board Assembly	8893430
Power Supply AA11080	8790010
Video Board	8893420

IV. DISK EXPANSION UNIT (TRS-80 Model II Disk System)

The disk expansion unit contains three flexible disk drives, a power supply and a cooling fan. It connects to the TRS-80 Model II through a flat ribbon cable.

Standard 115/120 VAC is applied to the expansion unit (through a power switch) where it is distributed to the three disk drives, the internal power supply and to its cooling fan.

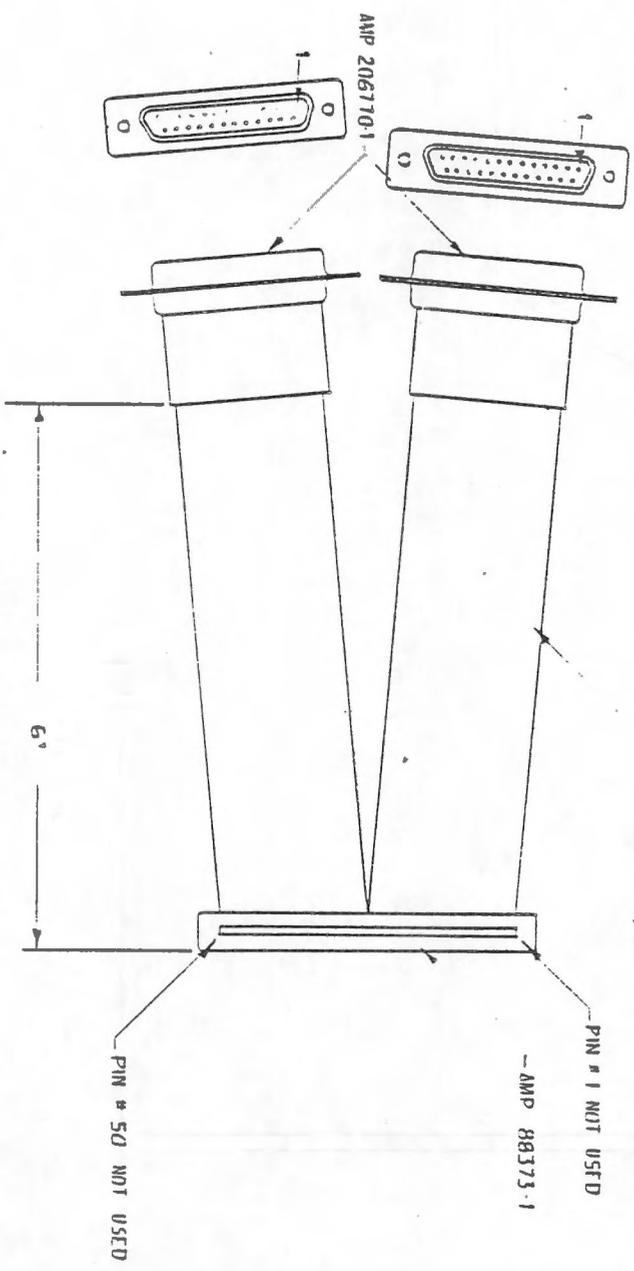
The power supply converts the AC input to three levels of DC which is routed to the disk drives for their logic signals. The DC voltages are +24, +5 and -12. An LED on the front panel "lights up" when the power switch is in the "ON" position.



Schematic
 Video Model II
 1/10/67

4 3 2 1

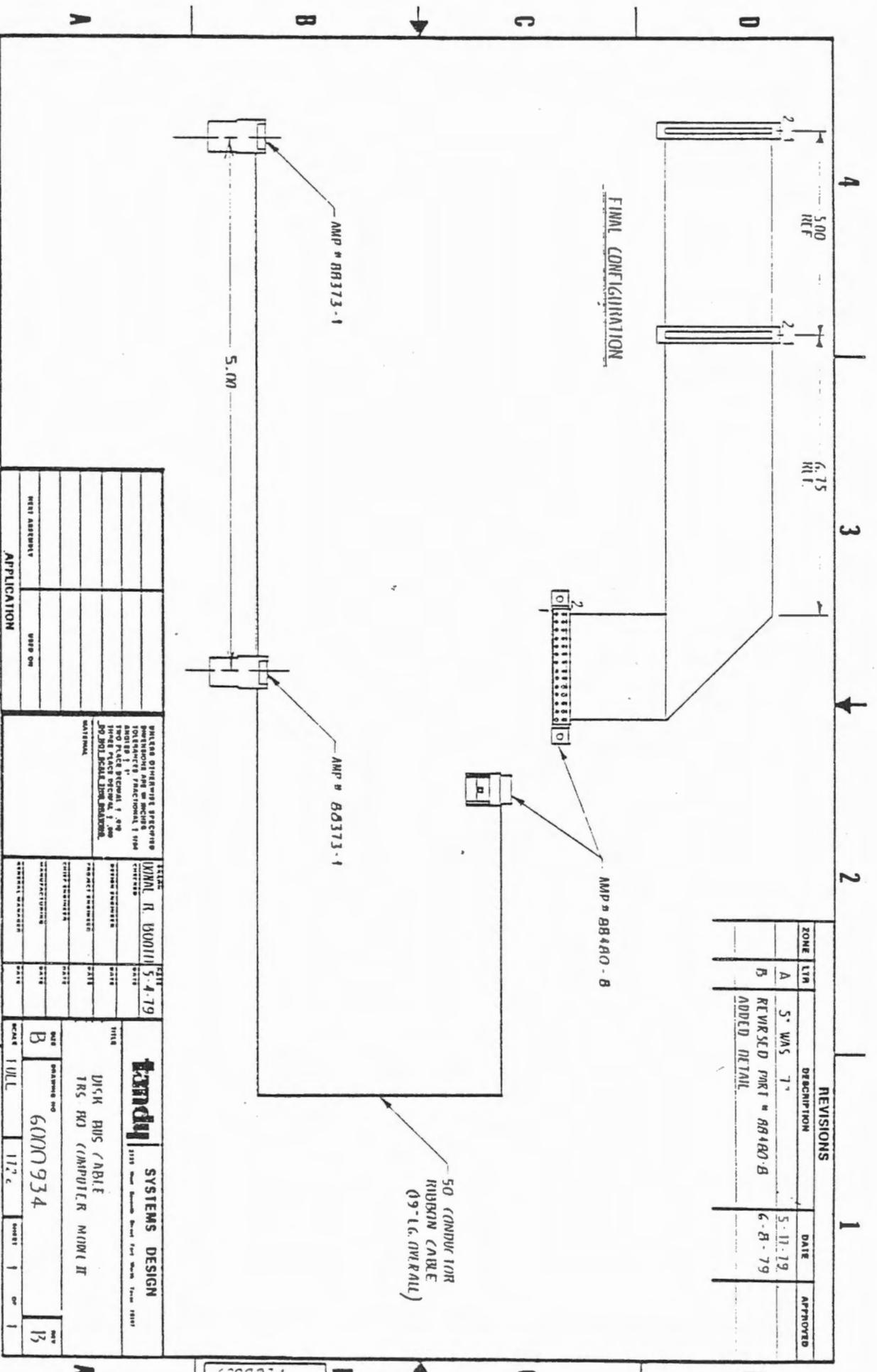
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ZONE	LTN	DESCRIPTION		
A		IMPROVED LENGTH TO 6"	5 17 79	
B		ADDED FRONT VIEW OF CONNECTION NOTED PINS NOT USED	7 9 79	



TAJNDY SYSTEMS DESIGN 1225 West Branch Street Fort Worth, Texas 76102		DATE: 5 4 79 DRAWING NO: 6100933 SHEET: 112 of 112
TITLE: SIGNAL I/O CABLE TRS. 80 MODULE II	PROJECT ENGINEER: [blank] MANUFACTURING: [blank] GENERAL MANAGER: [blank]	DATE: [blank] DATE: [blank] DATE: [blank]
DIMENSIONS SPECIFIED UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMALS - FRACTIONAL 1/16 HOLE PRACTICE DECIMAL 2 9/16 DIMENSIONS TO CENTER UNLESS OTHERWISE SPECIFIED	CHECKED: [blank] DESIGN ENGINEER: [blank] PROJECT ENGINEER: [blank]	DATE: [blank] DATE: [blank] DATE: [blank]
NEXT ASSEMBLY: [blank]	USED ON: [blank]	DATE: [blank]
APPLICATION		

D C B A

D C B A

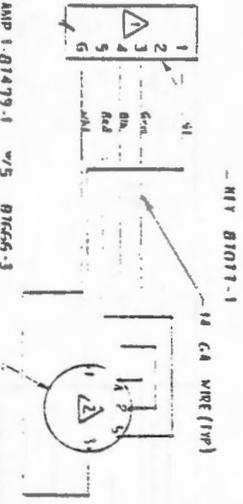


REVISIONS			DATE	APPROVED
1	A	5" WAS 7"	5-11-79	
2	B	REVERSED PART # 88480-B ADDED DETAIL	6-8-79	

TITLE Endy SYSTEMS DESIGN DISK BUS CABLE TRS RD COMPUTER MODEL II		DATE 5-4-79		DRAWING NO 6000934	
DESIGNER CHECKED PROJECT ENGINEER PRODUCT ENGINEER CONSTRUCTION GENERAL MANAGER		DATE DATE DATE DATE DATE		MADE TULL 112c 1 1	
APPLICATION USE ON		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMALS FRACTIONAL 1/16" HOLE PLACE DECIMAL 1/32" HOLE PLACE DECIMAL 1/64" 90° BELL MOUTH ALLOWANCE MATERIAL			

7
1
6
0
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28

REVISIONS		
ZONE	DESCRIPTION	DATE
A	ADDED NOTE TO START	5 14 19
B	AMRD NOTE TO CORRECTION	6 5 19



NOTE: CONTACTS MUST BE INSTALLED ON HARNESS. CONNECTION POINTS WILL BE INSTALLED AT FINAL ASSY.

AMP 1-81479-1 W/S B1666-3 CONTACTS

1. TANDY # 6000921 (INCLUDES CABLE AND CABLE)



NOTE: THIS ASSEMBLY QUANTITY AND WIRE PROGRAM PART OF THE TRASK VZ 711 WIRE ASSY (WIRE)

AMP 1-81479-1

DESIGN	DATE	5 1 79
DESIGNED BY	DATE	
CHECKED	DATE	
DESIGN ENGINEER	DATE	
PROJECT ENGINEER	DATE	
CHIEF ENGINEER	DATE	
MANUFACTURING	DATE	
GENERAL MANAGER	DATE	

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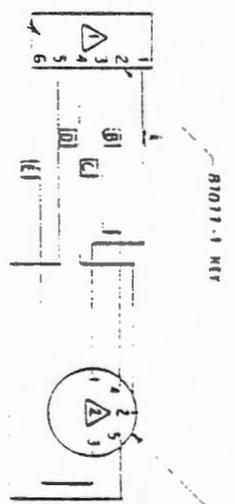
SCALE FULL

KEYBOARD EXTENSION CABLE TRS - BO MODEL II

Tandy SYSTEMS DESIGN 2725 West Seventh Street Fort Worth Texas 76107

6000930

REVISIONS			DATE	APPROVED
FORM	LINE	DESCRIPTION	DATE	
A	1	ADDED COLOR TO SCHEMATIC / SHORTEN CABLE	5 14 79	
B	1	14 GA WIRE WAS 26 GA	5 5 79	
B	2	ADDED NOTE TO CABLE	7 26 79	
D2	C	24 GA WIRE WAS 14 GA.		



DESIGNER	DATE	5 1 79	DESIGNED BY	DATE	5 1 79
CHECKED	DATE		PROJECT ENGINEER	DATE	
DESIGN ENGINEER	DATE		CHIEF ENGINEER	DATE	
MANUFACTURING	DATE		GENERAL MANAGER	DATE	
APPROVED	DATE			DATE	
SCALE	1:1		DRAWING NO.	6000929	
SCALE FILE	112.5		SHEET	C	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
FRACTIONS SHALL BE IN
EIGHTH PARTS DECIMALS. 3/16
SHALL BE PLACED AS 0.1875
DO NOT SCALE THIS DRAWING

KEYBOARD INTERNAL CABLE
185-80 MODEL II

6000929

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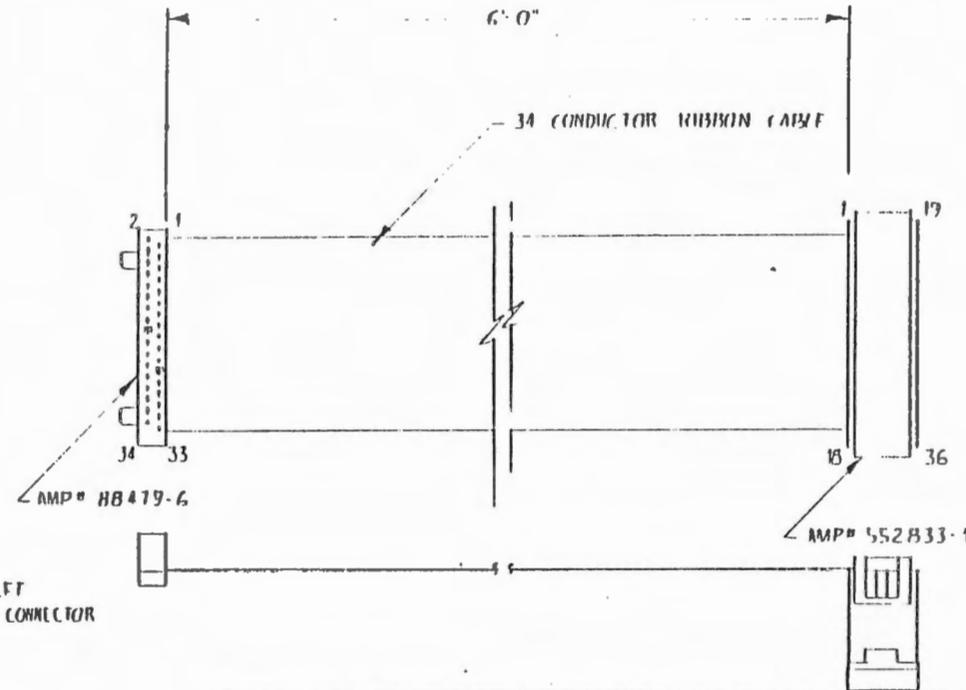
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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
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	B	CORRECTED AMP # 552B33-1, AND POSITION NUMBERS, NOTE 1 - #36 WAS 1B	6-25-79	



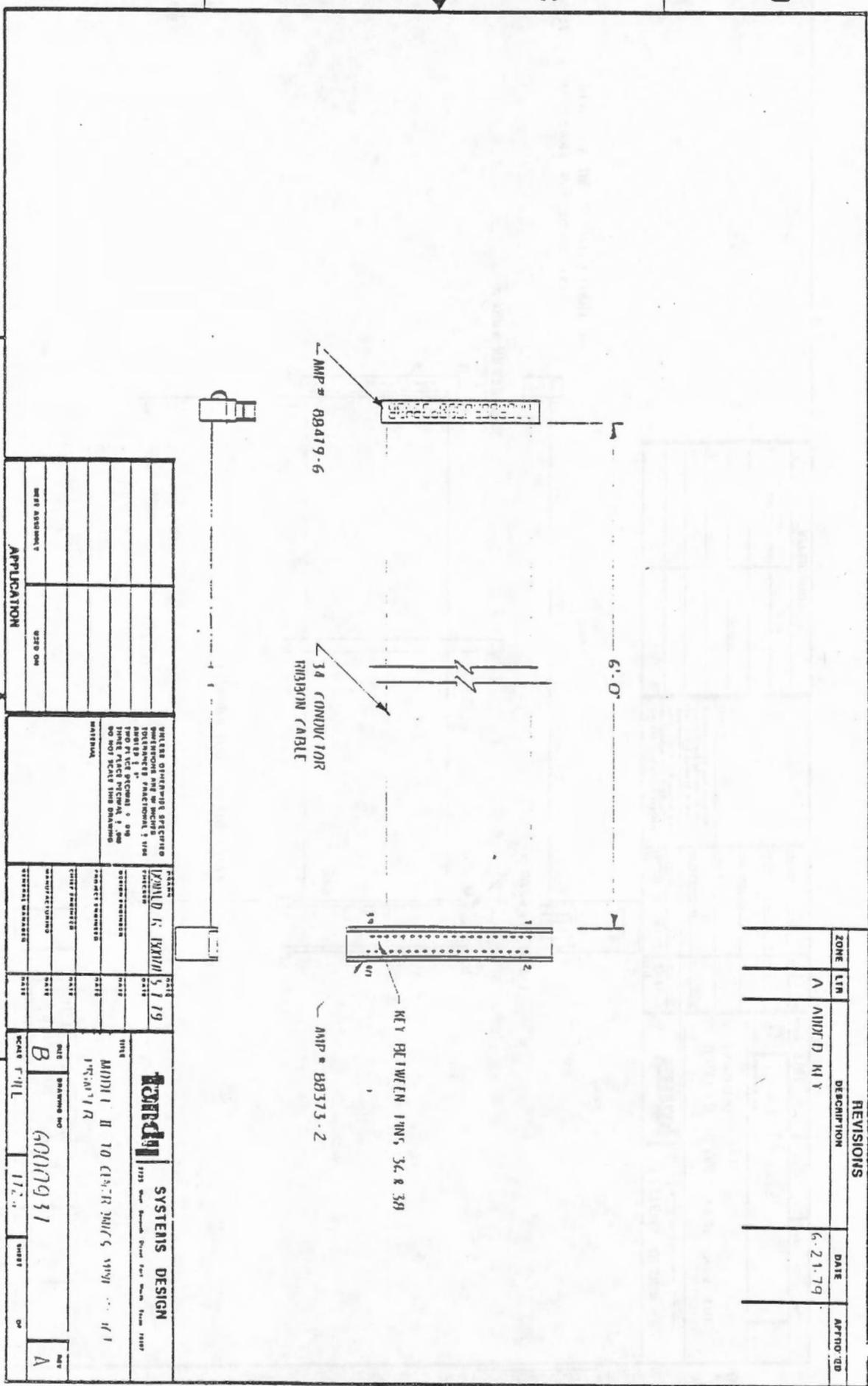
NOTE: 1. POSITIONS 18 & 36 ARE LEFT BLANK ON THE 552B33-1 CONNECTOR

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES FRACTIONAL 1/16 ANGLES 1° TWO PLACE DECIMAL 1.000 THREE PLACE DECIMAL 1.000 DO NOT SCALE THIS DRAWING		CHECKED DESIGN ENGINEER PROJECT ENGINEER CHIEF ENGINEER MANUFACTURING GENERAL MANAGER	DATE 5 1 79	tandy SYSTEMS DESIGN <small>2775 West South Street Fort Worth Texas 76107</small>
TITLE MODEL II 10 LARGE CAPACITORS LINE PRINTER		DATE DATE DATE DATE DATE	DRAWING NO. 6100936	REV B
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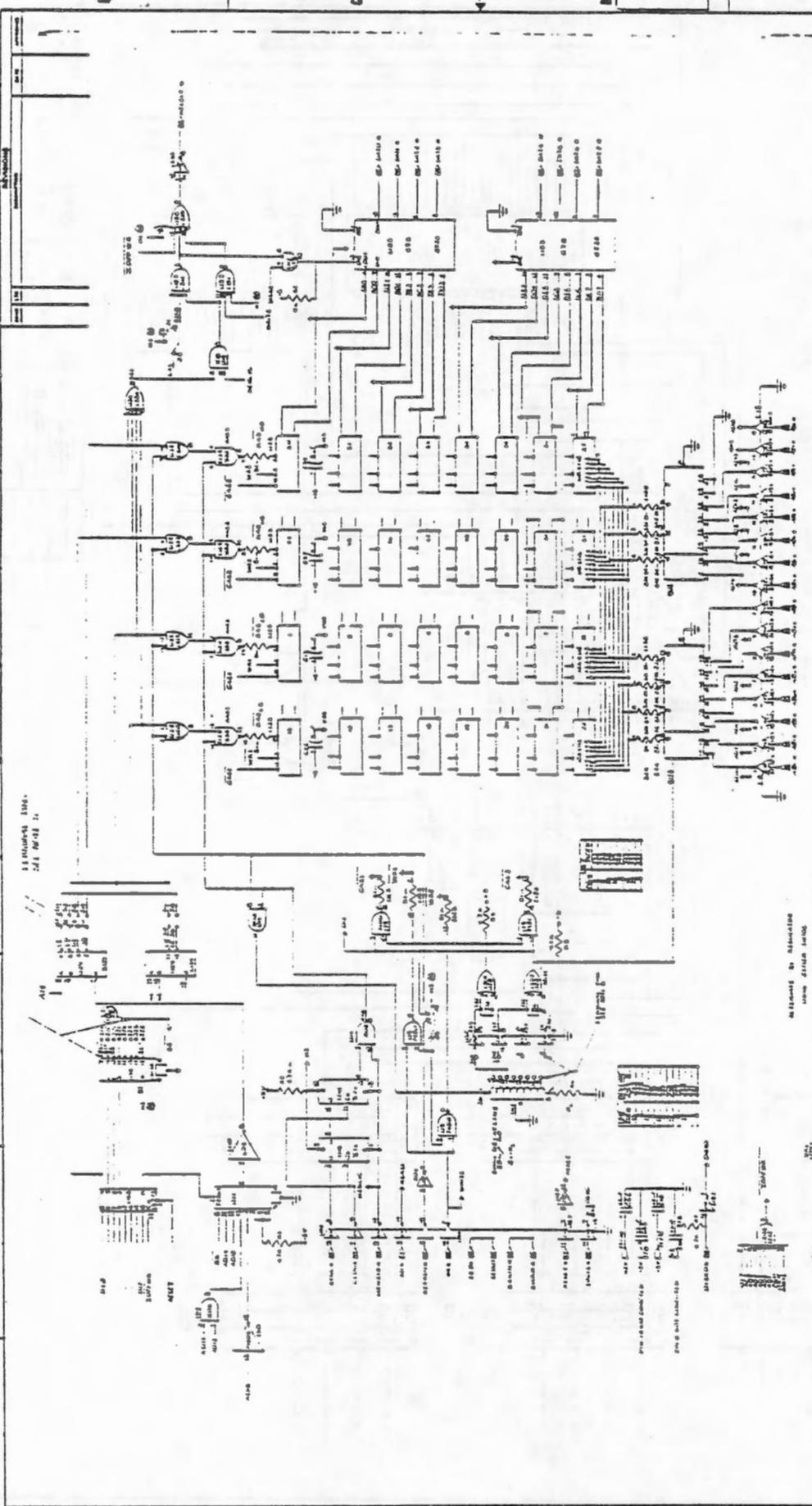
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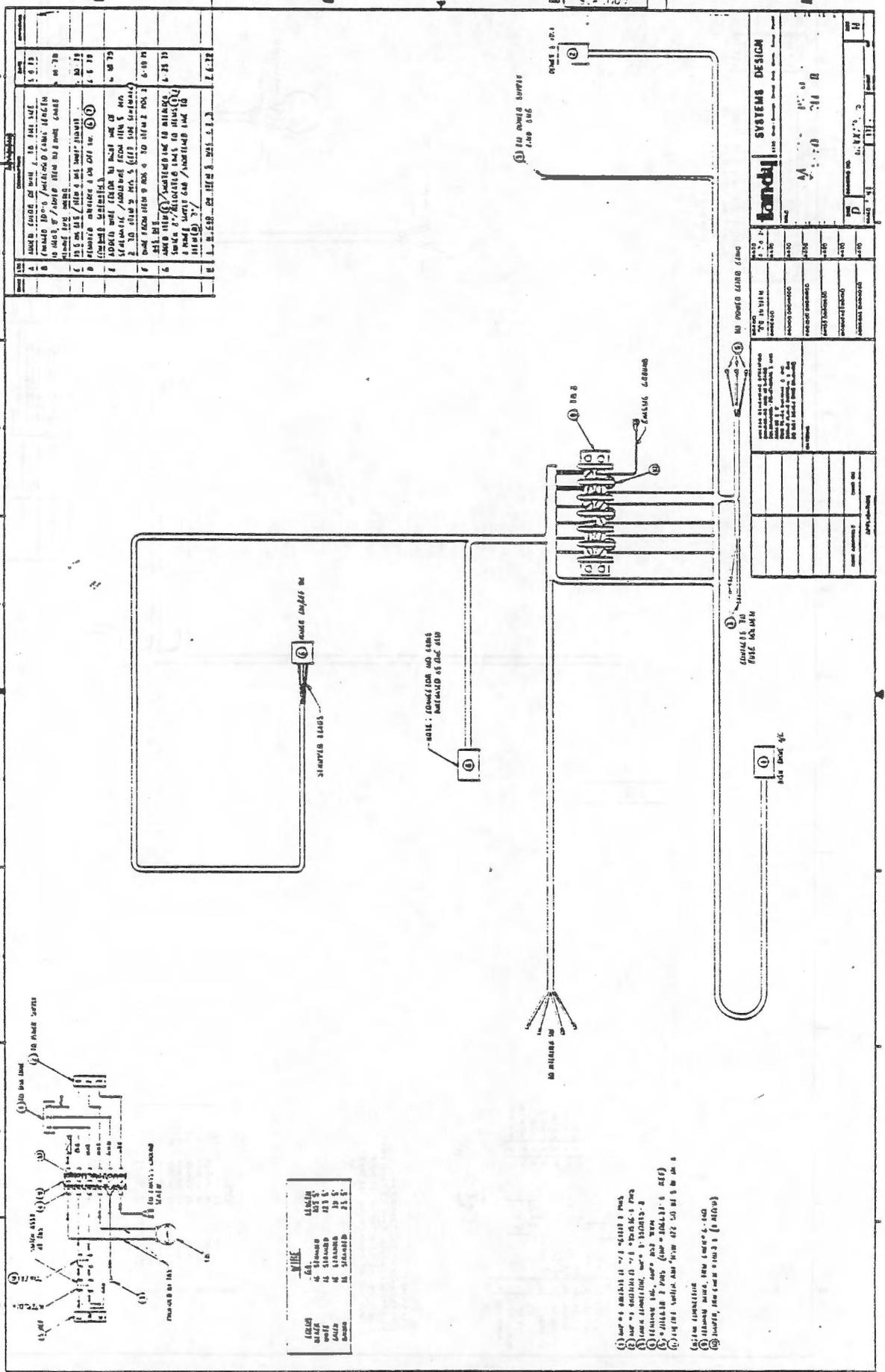


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CHECKED DATE	APPROVED DATE	GENERAL MANAGER DATE	DRAWING NO. 60007931	MODEL II 10 CLUSTER BUILT 5 1979 17201 R	DATE 5/1/79	SCALE FULL	SHEET 172	OF 172



tandij SYSTEMS DESIGN	
SCHENKEL, A. J.	
MODEL II	
DATE	1/10/57
DESIGNED BY	A. J. SCHENKEL
CHECKED BY	
APPROVED BY	
REVISIONS	
NO.	DESCRIPTION
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2	
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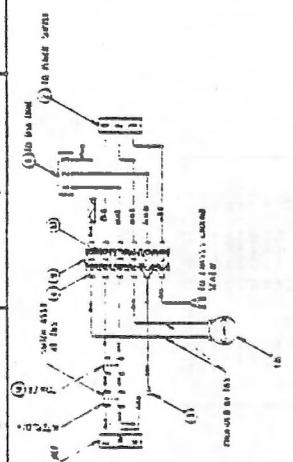




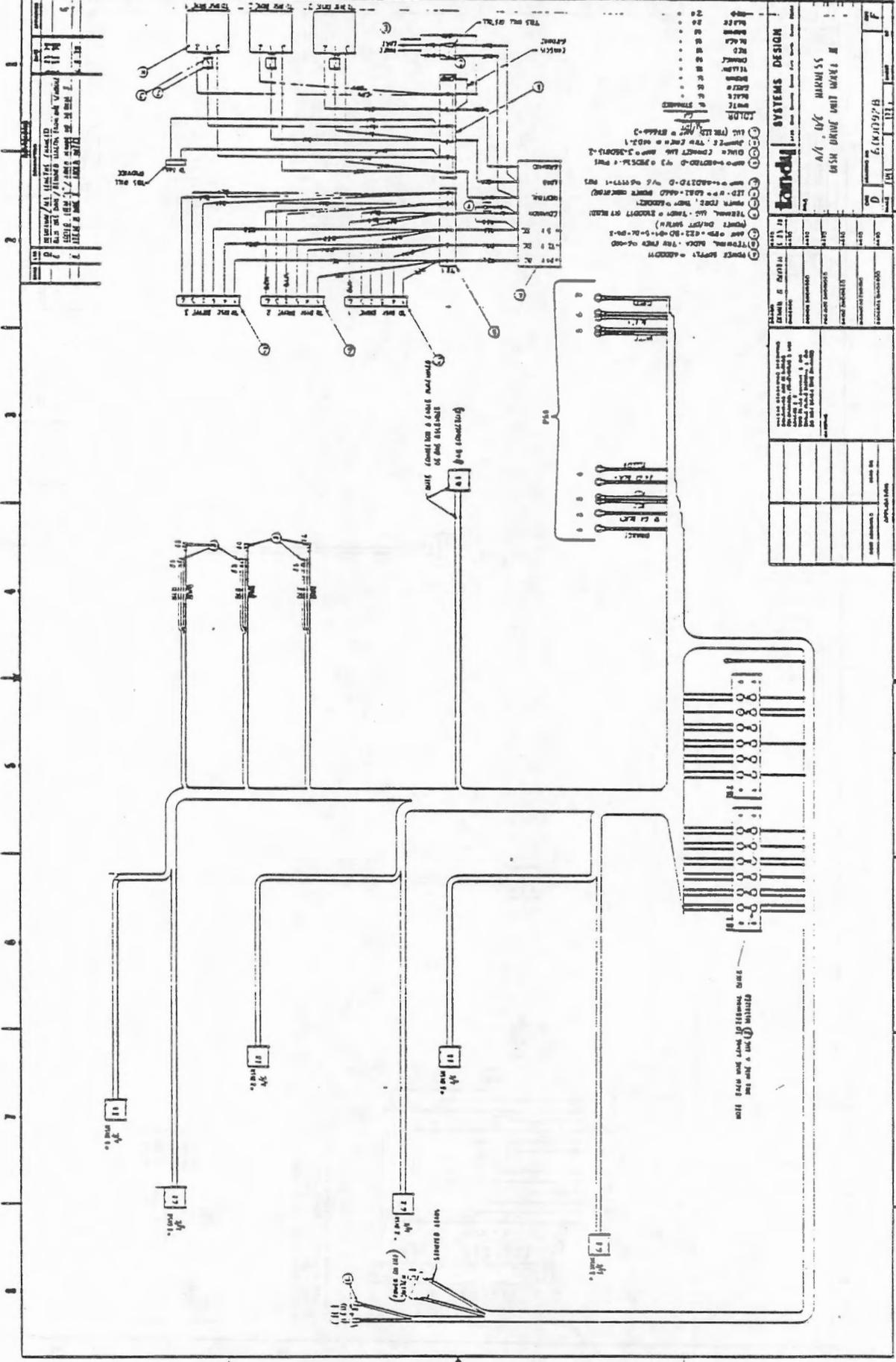
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02	02/10/77	REVISIONS TO MECHANICAL DRAWING
03	03/05/77	REVISIONS TO ELECTRICAL DRAWING
04	04/01/77	REVISIONS TO PIPING DRAWING
05	05/01/77	REVISIONS TO INSTRUMENTATION DRAWING
06	06/01/77	REVISIONS TO CONTROL SYSTEM DRAWING
07	07/01/77	REVISIONS TO SAFETY SYSTEM DRAWING
08	08/01/77	REVISIONS TO ENVIRONMENTAL CONTROL DRAWING
09	09/01/77	REVISIONS TO COMMUNICATIONS DRAWING
10	10/01/77	REVISIONS TO SECURITY SYSTEM DRAWING

SYMBOL	DESCRIPTION
(1)	3/4\"/>

(1) 3/4\"/>



622022



SYSTEMS DESIGN		
DESIGNER	W. J. BROWN	
DATE	11/15/58	
PROJECT NO.	622022	
CLIENT	U.S. AIR FORCE	
LOCATION	WALLINGFORD AIR FORCE BASE	
DESCRIPTION	ELECTRICAL WIRING	
SCALE	AS SHOWN	
REVISIONS		
NO.	DATE	DESCRIPTION
1	11/15/58	INITIAL DESIGN
2	11/20/58	REVISED FOR PERMITS
3	12/01/58	FINAL AS-BUILT

WIRING TO BE DONE BY OTHERS

SA800/801 Diskette Storage Drive

Maintenance Manual

TABLE OF CONTENTS

Section		Page
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2	Diagnostic Techniques	3
3	Preventive Maintenance.	5
4	Removals Adjustments	7
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1.0 MAINTENANCE FEATURES

1.1 Alignment Diskette

The SA120 Alignment Diskette is used for alignment of the SA800/801. The following adjustments can be made using the SA120.

1. R/W Head radial alignment using track 38.
2. R/W Head azimuth alignment using track 76.
3. Index Photo-Detector Adjustment using tracks 01 and 76.
4. Track 00 is recorded with standard IBM 3740 format.
5. TK 75 has $1f + 2f$ signal for load pad adjustment.

Caution should be exercised in using the SA120 Alignment Diskette. Tracks 00, 01, 36, 37, 38, 39, 40, 75, and 76 should not be written on. To do so will destroy pre-recorded tracks.

1.2 SA809 Exerciser

The SA809 Exerciser is built on a PCB whose dimensions are 8" x 8". The Exerciser PCB can be used in a stand alone mode or it can be built into a test station or used in a tester for field service.

The Exerciser is designed to enable the user to make all adjustments and check outs required on the SA800/801 drives, when used with the SA120 alignment diskette.

The exerciser has no intelligent data handling capabilities but can write both $1f$ and $2f$ frequencies. The exerciser can enable read in the drive to allow checking of read back signals.

Refer to Section 6 for illustration.

1.3 Special Tools

The following special tools are available for performing maintenance on the SA800/801.

Description	Part Number
Alignment Diskette	SA120-1
Cartridge Guide Adj. Tool	50377-1
Head Penetration Gauge	50380-0
Load Bail Gauge	50391-0
Exerciser	50619-0
Spanner Wrench	50752-0

2.0 DIAGNOSTIC TECHNIQUES

2.1 Introduction

Incorrect operating procedures, faulty programming, damaged diskettes, and "soft errors" created by airborne contaminants, random electrical noise, and other external causes can produce errors falsely attributed to drive failure or misadjustment.

Unless visual inspection of the drive discloses an obvious misalignment or broken part, attempt to repeat the fault with the original diskette, then attempt to duplicate fault on second diskette.

2.2 "Soft Error" Detection and Correction

Soft errors are usually caused by:

1. Airborne contaminants that pass between the read/write head and the disk. Usually these contaminants can be removed by the cartridge self-cleaning wiper.
2. Random electrical noise that usually lasts for a few μ sec.
3. Small defects in the written data and/or track not detected during the write operation that may cause a soft error during a read.
4. Worn or defective load pad.

The following procedures are recommended to recover from the above mentioned soft errors:

1. Reread the track ten (10) times or until such time as the data is recovered.
2. If data is not recovered after using step 1, access the head to the adjacent track in the same direction previously moved, then return to the desired track.
3. Repeat step 1.
4. If data is not recovered, the error is not recoverable.

2.3 Write Error

If an error occurs during a write operation, it will be detected on the next revolution by doing a read operation, commonly called a "write check." To correct the error, another write and write check operation must be done. If the write operation is not successful after ten (10) attempts have been made, a read operation should be attempted on another track to determine if the media or the drive is failing. If the error still persists the diskette

should be replaced and the above procedure repeated. If the failure still exists, consider the drive defective. If the failure disappears, consider the original diskette defective and discard it.

2.4 Read Error

Most errors that occur will be "soft" errors. In these cases, performing an error recovery procedure will recover the data.

2.5 Seek Error

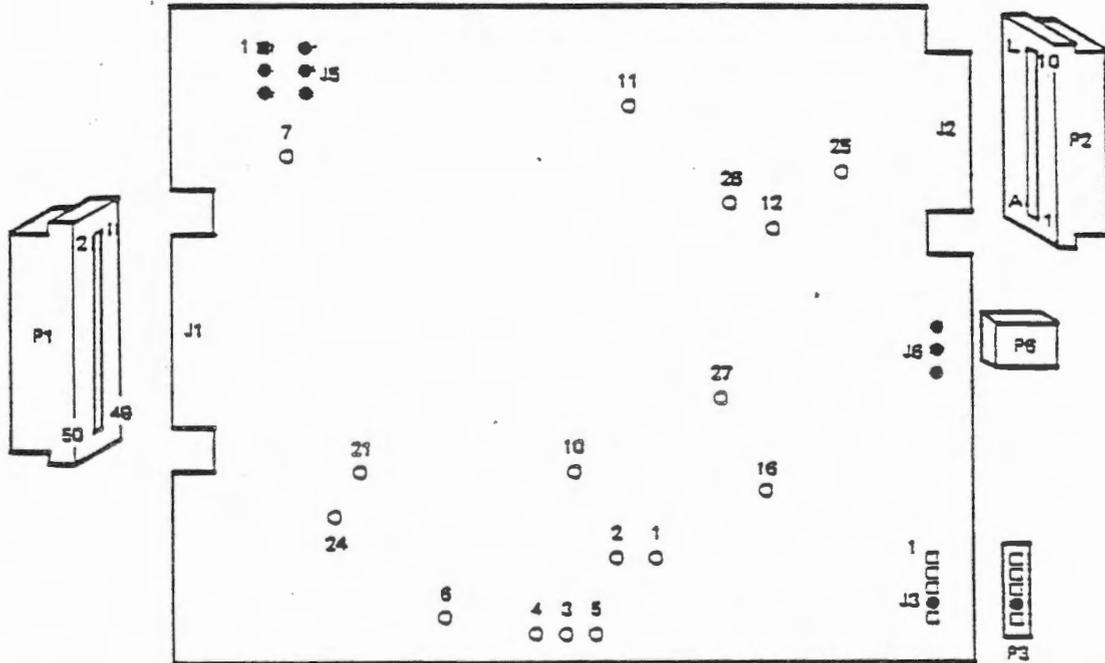
1. Stepper malfunction.
2. Improper carriage torque.

To recover from a seek error recalibrate to track 00 and perform another seek to the original track.

2.6 Test Points—800/801

TP	1	Read Data Signal
	2	Read Data Signal
	3	Read Data (Differentiated)
	4	Read Data (Differentiated)
	5	Signal Ground
	6	Signal Ground
	7	Signal Ground
	10	- Index
	11	+ Head Load
	12	- Index and 801 Sector Pulses
	16	+ Read Data
	21	- Data Separator Time + 1
	24	- Data Separator Time + 2
	25	+ Write Protect
	26	+ Detect Track 00.
	27	+ Gated Step Pulses

2.7 Test Point Locations



3.0 PREVENTIVE MAINTENANCE

3.1 Introduction

The prime objective of any preventive maintenance activity is to provide maximum machine availability to the user. Every preventive maintenance operation should assist in realizing this objective. Unless a preventive maintenance operation cuts machine downtime, it is unnecessary.

Visual inspection is the first step in every scheduled maintenance operation. Always look for corrosion, dirt, wear, binds, and loose connections. Noticing these items during PM may save downtime later.

Remember, do not do more than recommended preventive maintenance on equipment that is operating satisfactorily.

3.2 Preventive Maintenance Procedures

Details of preventive maintenance operations are listed in Figure 1. During normal preventive maintenance, perform only those operations listed on the chart for that preventive maintenance period. Details on adjustments and service checks can be found in the maintenance manual. Observe all safety procedures.

3.3 Cleanliness

Cleanliness cannot be overemphasized in maintaining the SA800/801. Do not lubricate the SA800/801; oil will allow dust and dirt to accumulate. The read/write head should be cleaned only when signs of oxide build up are present.

UNIT	FREQ MONTHS	CLEAN	OBSERVE
Read/Write Head	12	Clean Read/Write Head ONLY IF NECESSARY	Oxide build up
R/W Head Load Button	12*	Replace	
Stepper Motor and Lead Screw	12	Clean off all oil, dust, and dirt	Inspect for nicks and burrs
Belt	12		Frayed or weakened areas
Base	12	Clean base	Inspect for loose screws, connectors, and switches
Read/Write Head	12		Check for proper alignment

*Assumes normal usage

Figure 1 PM Procedures

4.0 REMOVALS, ADJUSTMENTS

For parts location, see Section 5.

4.1 Motor Drive

4.1.1 Drive Motor Assembly: Removal and Installation

- a. Extract 3 contacts to disconnect motor from AC connector.
- b. Loosen two screws holding capacitor clamp to the base. Remove rubber boot and disconnect motor leads from capacitor.
- c. Remove connectors from PCB and remove PCB.
- 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 clamp and base.

4.1.2 Motor Drive Pulley

- a. Loosen set screw and remove pulley.
- b. Reverse procedure for installation.

Note: When installing a new pulley, the drive pulley must be aligned with the spindle pulley so that the belt tracks correctly.

4.2 Side Cover: Removal

- a. Retract screw from upper casting wall sufficiently to allow the side cover to be rocked out.
- b. Lift cover off screw in lower casting wall.

4.3 Cartridge Guide Access

- a. Remove side cover (Section 4.2).
- b. Position head to approximate center of head load bail (to prevent load arm damage).
- c. Loosen 2 screws holding cartridge guide to door latch plate.
- d. Swing cartridge guide out.
- e. When the guide is swung in, it must be adjusted as per Section 4.9.2.

4.4 Sector/Index LED Assembly: Removal and Installation

- a. Remove side cover (Section 4.2).
- b. Disconnect the wires to the LED terminals (solder joints).
- c. Remove the screw holding the LED assembly to the cartridge guide.
- d. Reverse the procedure for installation.
- e. Check index timing and readjust if necessary.

4.5 Write Protect Detector: Removal and Installation

- a. Remove connectors from PCB and remove PCB.
- b. Extract wires from P2 connector, pins L3, L4, R5 (E), and R8 (S).
- c. Remove cable clamps.
- d. Remove side cover (Section 4.2).
- e. Remove screw holding the detector bracket and remove assembly.
- f. Reverse procedure for reinstalling. Connect the wires to P2 by the following: Red to '3' (L3), Grey to '4' (L4), Black to 'E' (R5) and White to 'J' (R8).

4.5.1 Write Protect Detector Adjustment

- a. Insert SA101 diskette into drive. Write protect hole must be open.
- b. Set oscilloscope to AUTO sweep, 2V/div. and monitor TP25.
- c. Loosen screw on detector assembly and adjust until maximum amplitude is achieved. Tighten screw.

4.6 Head Load Actuator

4.6.1 Head Load Actuator: Removal and Installation

- a. Remove side cover (Section 4.2).
- b. Disconnect the wires to the actuator terminals (solder joints).
- c. Swing out the cartridge to guide assembly (Section 4.3).

- d. Remove screw holding the actuator to the cartridge guide.

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

- e. Reverse the procedure for installation.

4.6.2 Head Load Actuator Adjustment

- a. Remove side cover.
- b. Energize Head Load Coil.
- c. Place Head Load Actuator adjustment tool, P/N 50391, on platen.
- d. Adjust down stop so that the top of Head Load Bail is flush with top of tool within $\pm .005''$ at track 76. Reference Figure 3.
- e. Step carriage to track 38.
- f. De-energize Head Load Coil.
- g. Place adjustment tool onto R/W Head and place load button in cup of tool.
- h. Adjust up stop on actuator so that bail just touches Head Load Arm or has $.005''$ clearance or lifts Load Arm $.005''$. Reference Figure 2.
- i. Energize Head Load Coil and step carriage between track 00 and 76. Insure that there is a clearance of a minimum of $.010''$ between Head Load Bail and Head Load Arm.
- j. Replace side cover.

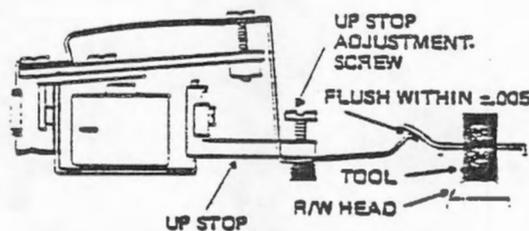


FIGURE 2 HEAD LOAD ACTUATOR UPSTOP ADJUSTMENT

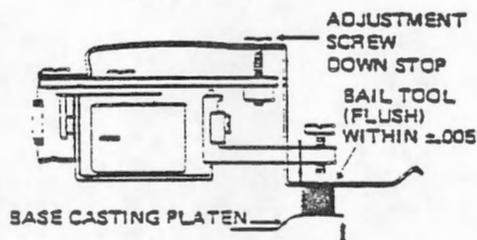


FIGURE 3 HEAD LOAD ACTUATOR DOWN STOP ADJUSTMENT

4.6.3 Head Load Actuator Timing

- a. Insert Alignment Diskette (SA120).
- b. Step carriage to track 00.
- c. Sync oscilloscope on TP11 (+ Head Load). Set time base to 10MSEC/division.
- d. Connect one probe to TP1 and the other to TP2. Ground probes to the PCB. Set the inputs to add and invert one input
- e. Energize the Head Load solenoid and observe the read signal on the oscilloscope. The signal must be at 50% of full amplitude by 35Msec. Reference Figure 4.
- f. If this is not met, continue on with the procedure.
- g. Check adjustments outlined in paragraph 4.6.2.
- h. If item 'g' is ok, adjust down stop screw (Figure 6) clockwise until timing is met.

Note: Not to exceed ¼ turn.

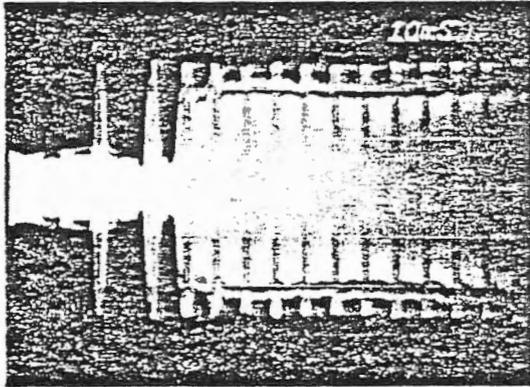


FIGURE 4 HEAD LOAD ACTUATOR TIMING

4.7 Index/Sector Photo Transistor Assembly

4.7.1 Index/Sector Photo Transistor Assembly: Removal and Installation

- a. Disconnect P2 connector from PCB.
- b. Remove wires from Door Closed switch and extract wires from P2 connector pin 9 (L9) Black, H (R7) Brown, 6 (L6) Red and B (R2) Orange.
- c. Remove cable clamp holding wires from detector.

- d. Remove screw holding detector to the base plate and remove assembly.
- e. To install reverse procedure.

4.7.2 Index/Sector Photo Transistor Potentiometer Adjustment

- a. Insert Alignment Diskette (SA120).
- b. Using oscilloscope monitor TP-12 (- Index), sync internal negative, DC coupled, set vertical scale to 2 V/cm.
- c. Adjust the potentiometer on the Sector/Index Phototransistor to obtain a pulse of 1.7 msec. $\pm .5$ msec. duration.
- d. Continue adjustment in Section 4.7.3.

4.7.3 Index/Sector Adjustment

- a. Insert Alignment Diskette (SA120).
- b. Step carriage to track 01.
- c. Sync oscilloscope, external negative, on TP 12 (- Index). Set time base to 50 μ sec/division.
- d. Connect one probe to TP 1 and the other to TP 2. Ground probes to the PCB. Set the inputs to AC, Add and invert one channel. Set vertical deflection to 500 MV/division.
- e. Observe the timing between the start of the sweep and the first data pulse. This should be $200 \pm 100 \mu$ sec. If the timing is not within tolerance, continue on with the adjustment. Reference Figure 5.

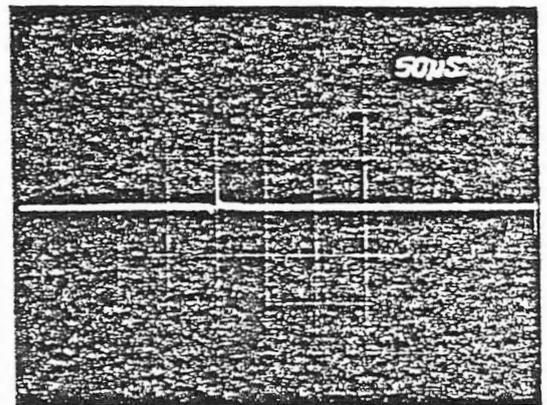


FIGURE 5 INDEX TIMING

- g. Loosen the holding screw in the Index Transducer until the transducer is just able to be moved.
- g. Observing the timing, adjust the transducer until the timing is $200 \pm 100 \mu\text{sec}$. Insure that the transducer assembly is against the registration surface on the base casting.
- h. Tighten the holding screw.
- i. Recheck the timing.
- j. Seek to track 76 and reverify that the timing is $200 \pm 100 \mu\text{sec}$.

4.8 Spindle Assembly

- a. Remove side cover (Section 4.2).
- b. Swing out cartridge guide (Section 4.3).
- c. Remove the nut and washer or 2 spring washers holding the spindle pulley. On late level drives, Spanner Wrench 50752 may be used to hold spindle.

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

- d. Withdraw spindle hub from opposite side of baseplate.
- e. Reverse the procedure for installation.
- f. Tighten nut to 20 in./lbs. If spring washers are used, insure they are compressed. Add a drop of LOCTITE® #290 to threads.

4.8.1 Clamp Hub Removal

- a. Remove hub clamp plate. Reference Figure 6.
- b. Remove clamp hub and spring.
- c. To install, reverse the procedure. No adjustment necessary.

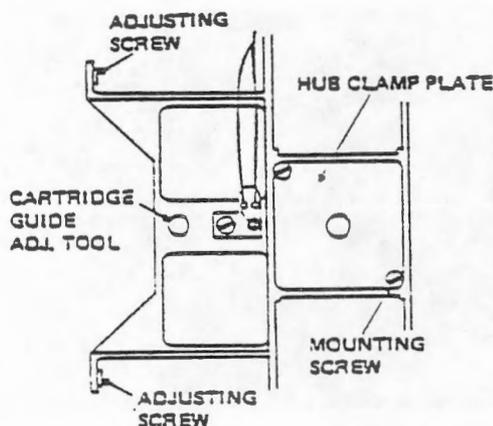


FIGURE 6 CARTRIDGE GUIDE ADJUSTMENT

4.9.1 Cartridge Guide Removal

- a. Perform steps 4.3 through 4.6.1.
- b. Remove C-clip from pivot shaft. Reference Figure 7.
- c. Remove pivot shaft.
- d. Tilt the cartridge guide slightly, and remove it from the upper pivot.
- e. To install the cartridge guide, reverse the procedure.

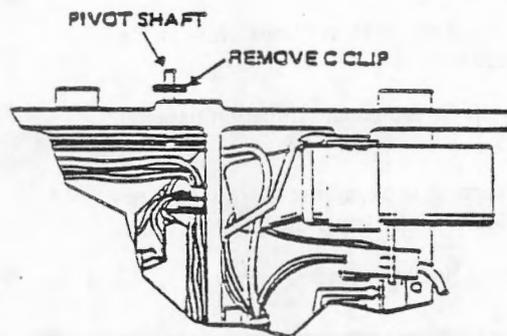


FIGURE 7 CARTRIDGE GUIDE REMOVAL

4.9.2 Cartridge Guide Adjustment

- a. Insert the shoulder screw (tool P/N 50377-1) through the adjustment hole in the cartridge guide and screw completely into the base casting (hand tight). Reference Figure 6.
- b. Move the handle into the latched position and hold it lightly against the latch.
- c. Tighten two screws holding the cartridge guide to the latch plate.
- d. Remove the tool and check to determine the flange on the clamp hub clears the cartridge guide when the spindle is rotating. If the clamp hub rubs on the cartridge guide, repeat the adjustment procedure.
- e. Check index alignment per Section 4.7.3.
- f. Insert diskette, close and open door, then check for proper operation.

4.10 Front Plate Assembly: Removal

- a. Remove side cover (Section 3.4.2).
- b. Swing out the cartridge guide assembly (Section 4.3).

- c. Remove 4 screws holding the front plate assembly to the base casting.
- d. To install, reverse the procedure.
- e. Check Index adjustment Section 4.7.3.

4.11 Head Amplitude Check

These checks are only valid when writing and reading back as described below. If this amplitude is below the minimum specified, the load pad should be replaced and the head should be cleaned if necessary before re-writing and re-checking. Insure the diskette used for this check is not "worn" or otherwise shows evidence of damage on either the load pad or head side.

- a. Install good media.
- b. Select the drive and step to TK 76.
- c. Sync the oscilloscope on TP-12 (- Index) connect one probe on TP-2 and one on TP-1, on the drive PCB. Ground the probes to the PCB add and invert one input. Set volts per division to 50mv and time base to 20 M sec. per division.
- d. Write the entire track with 2F signal (all one's).
- e. The average minimum read back amplitude, peak to peak, should be 110 millivolts.

If the output is below minimum and a new load pad and different media is tried and the output is still low, it will be necessary to install a new head and carriage assembly.

4.11.1 Stepper/Carriage Assembly; Removal and Installation

- a. Remove cable clamp holding R/W head cable on PCB side of drive.
- b. Remove side cover (Section 4.2).
- c. Extract stepper cable contacts from P2 connector. Black 10 (L10), Red 2 (L2), Brown 5 (L5), and Orange 8 (8).

Note: This step is only necessary if the stepper motor is to be replaced.

- d. Loosen (2) screws and swing clamp down to allow withdrawal of motor.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

- e. Remove the grommet on the cable that is inserted into a slot on the Track 00 Detector bracket.
- f. Turn stepper shaft until the carriage runs off the end of the lead screw.
- g. To install stepper/carriage assembly, reverse procedure. Note steps "h" and "i".
- h. If installing a new carriage, set the pre-load nut in the #2 notch. Reference Figure 8.
- i. When threading lead screw into carriage assembly, press the pre-load nut slightly against spring in order to start thread. After threading, insure there is a gap between pre-load nut and rear of carriage.

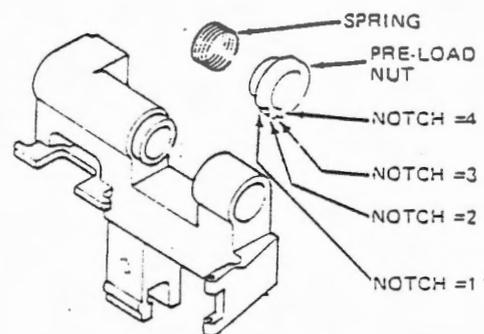


FIGURE 8 CARRIAGE ASSEMBLY

4.11.2 Carriage Assembly Readjustment After Replacement

- a. Loosen Track 00 stop collar and manually move the carriage towards the stepper by rotating the lead screw until the carriage load arm tab is near the edge of the load bail. Tighten the collar set screw.
- b. Position the Track 00 flag approximately in the center of its slot and tighten the screw. Move the carriage towards the spindle by rotating the lead screw until the flag is clear of the detector.
- c. Insert the SA120 alignment diskette and load the head. Set the scope as explained in Section 4.11.3 steps c and d.
- d. Step the carriage towards track 00 until the track 00 signal is detected on the interface pin 42.

- e. Loosen the 2 stepper motor mounting screws slightly and slowly rotate the stepper motor case until a read data signal off of track 00 appears. Continue rotation until maximum amplitude is obtained. This is only a rough adjustment.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL

- f. Step the carriage to TK 38 and proceed with head radial adjustments. Refer to Section 4.11.3.
- g. Adjust Track 00 stop (Section 4.11.7).
- h. Adjust Track 00 flag (Section 4.11.3).
- i. Adjust index (Section 4.7.3).
- j. Adjust Azimuth (Section 4.11.9).

4.11.3 Head Radial Alignment

Note: Head radial alignment should be checked prior to adjusting index/sector, Track 00 flag or carriage stop.

- a. Load alignment diskette (SA120).

Note: Alignment diskette should be at room conditions for at least twenty minutes before alignment.)

- b. Step the carriage to track 38.
- c. Sync the oscilloscope, external negative, on TP 12 (-CE Index). Set the time base to 20 Msec per division. This will display over one revolution.
- d. Connect one probe to TP 1 and the other to TP 2. Ground the probes on the PCB. Set the inputs to AC, Add and invert one channel. Set the vertical deflection to 100 MV/dev.
- e. The two lobes must be within 70% amplitude of each other. If the lobes do not fall within the specification, continue on with the procedure. Reference Figure 9.
- f. Loosen the two mounting screws which hold the motor clamp to the mounting plate.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL

- g. 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 counter-clockwise as viewed from the rear. If the right lobe is less than 70% of the left lobe, turn the stepper motor clockwise as viewed from the rear.

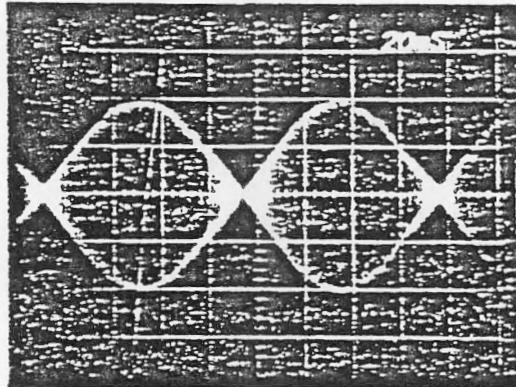


FIGURE 9 HEAD RADIAL ALIGNMENT

- h. When the lobes are of equal amplitude, tighten the motor clamp mounting screws. Reference Figure 9.
- i. Check the adjustment by stepping off track and returning. Check in both directions and readjust as required.
- j. Whenever the Head Radial Alignment has been adjusted, the Track 00 flag adjustment (Section 4.11.8), Track 00 stop (Section 4.11.7) and R/W head azimuth (Section 4.11.9) must be checked.

4.11.3 Read/Write Head Load Button: Removal and Installation

- a. Remove side cover if installed.
- b. To remove the old button, hold the 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 in place. Reference Figure 10.

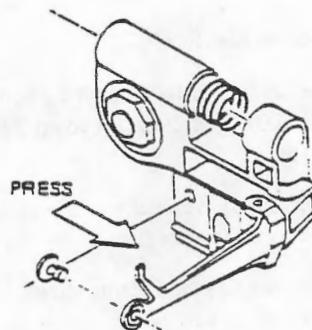


FIGURE 10

d. Adjust according to Section 4.11.4.

Note: The load arm should never be opened over 90° from carriage assembly or while at track 00 to prevent possible damage to the torsion spring.

4.11.4 Read/Write Head Load Button Adjustment

- a. Insert Alignment Diskette (SA120).
- b. Connect oscilloscope to TP 1 and 2, added differentially and sync negative external on TP 12 (- INDEX).
- c. Step carriage to track 75.

d. Observing read signal on oscilloscope, rotate the load button counter-clockwise in small increments (10°) until maximum amplitude is obtained.

4.11.5 Head Penetration Adjustment

Note: This adjustment is not normally done in the field. The only time that this adjustment need be done is when the stepper mounting plate has been loosened or removed.

- a. Place the penetration tool (P/N 50380) on the gauge block and insure that the gauge reads .030 (3 on the small hand) and zero the dial for the large hand. This results in a reading of .030".

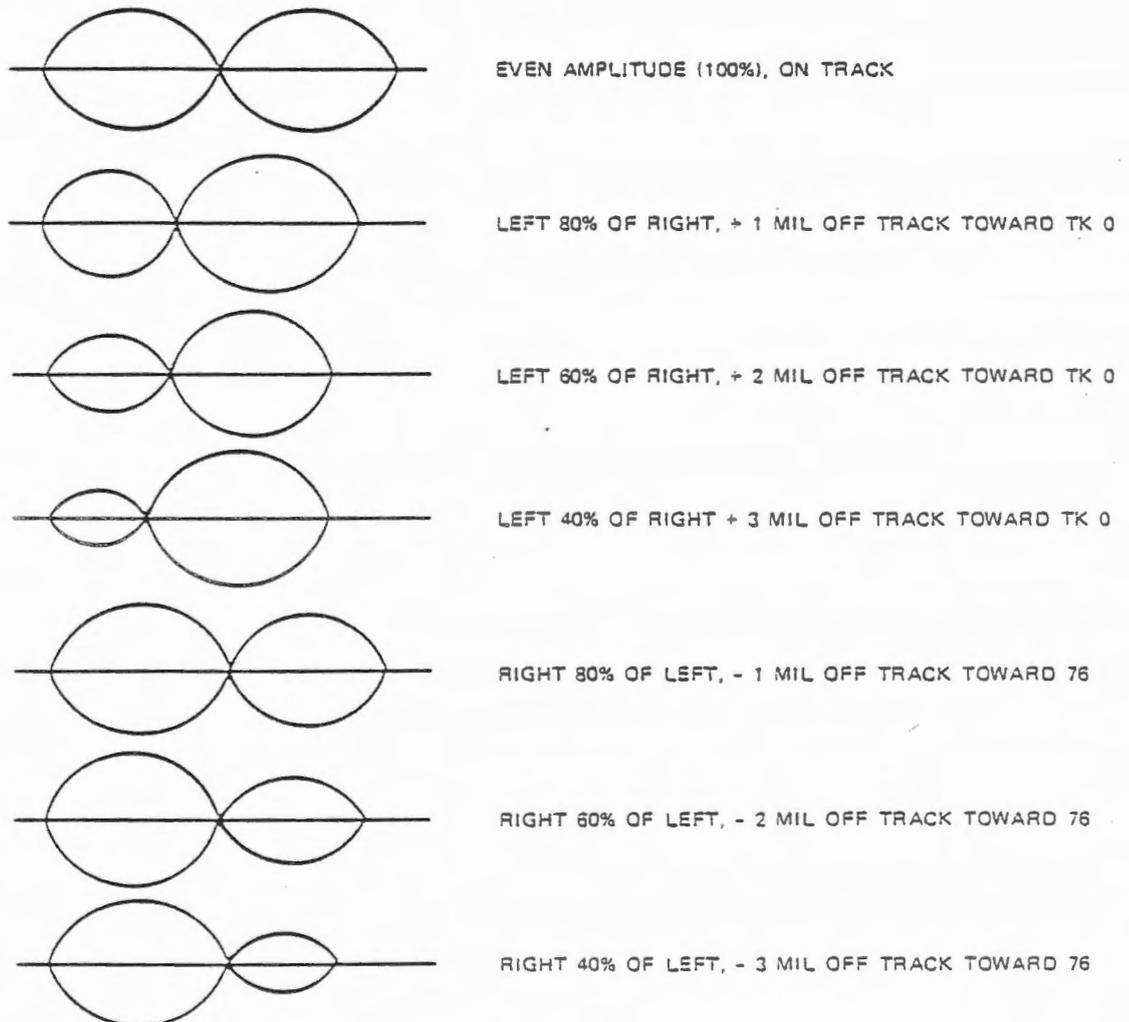


Figure 11 R/W Head Radial Alignment

- b. Swing open the cartridge as per Section 4.3.
- c. Place the penetration tool on the base assembly with the short leg on the platen, the long leg on the carriage guide bar, and the plastic tip in the center of the R/W head.
- d. The head penetration should be $.030'' \pm .003''$ read on the gauge.
- e. If the head does not meet this adjustment, move the stepper plate laterally until the gauge reads $.030''$.
- f. Tighten the screws and recheck the adjustment.
- g. Return cartridge guide and adjust as per Section 4.9.2.
- h. Adjust Azimuth (Section 4.11.9).

4.11.6 Track 00 Detector: Removal and Installation

- a. Remove side cover (Section 4.2).
- b. Swing cartridge guide open (Section 4.3).
- c. Manually rotate stepper shaft and move carriage all the way in.
- d. Remove 2 screws holding bracket to base casting and remove bracket and detector.
- e. Remove PCB connector and remove PCB.
- f. Extract cable from P2 connector; Brown, A (R1); Black, C (R3); Red, F (R6); and Orange K (R9).
- g. Remove cable clamps and remove Detector assembly.
- h. To install, reverse the procedure.
- i. Adjust according to Section 4.11.8.

4.11.7 Track 00 Stop Adjustment

- a. Remove side cover (Section 4.2).
- b. Step carriage to track 00. Verify that carriage is at 00 by checking P1 pin 42 is minus (ground).
- c. Check that stop is $.040'' \pm .020''$ between collar and carriage. Turn DC power OFF, and manually rotate lead screw clockwise until carriage stops. Check that stop is $.020'' \pm .010''$ between collar and carriage.

- d. If clearances are not within tolerance, continue on with adjustment procedure.
- e. Turn DC power ON.
- f. Step carriage to track 02.
- g. Loosen Track 00 stop collar.
- h. Grasp end of lead screw, in back of stepper motor, with a pair of pliers and manually turn lead screw clockwise to the track -01 position. (Next detent position on stepper motor.)
- i. Position the stop collar axially along the lead screw so there is $.020'' \pm .010''$ between collar and carriage. Rotate the collar toward inside until the stop on the collar contacts the carriage stop surface. Tighten screw.
- j. Turn DC Power OFF and back ON. Carriage should move to track 00. Verify that there is data at track 00.
- k. Step carriage between track 00 and 76 and check for any binding or interference between the carriage, lead screw, stop and head cable.

4.11.8 Track 00 Flag Adjustment

- a. Remove side cover (Section 4.2).
- b. Check head radial alignment and adjust if necessary before making this adjustment.
- c. Connect oscilloscope probe to TP 26. Set vertical deflection to 1 v/division and sweep to continuous.
- d. Step carriage to track 01. TP 26 should be high (+5 volts).
- e. If TP 26 is not high, loosen screw holding Track 00 flag and move flag towards stepper until TP 26 just goes high.
- f. Step carriage to track 2. TP 26 should go low. Adjust flag towards spindle if not low.
- g. Check adjustment by stepping carriage between tracks 00 and 02, observing that TP 26 is low at track 02 and high at tracks 01 and 00.
- h. Replace side cover.

4.11.9 R/W Head Azimuth Alignment

This adjustment can only be made on SA800/801's at MLC 3 or higher with a new style stepper plate which has 50112-4 stamped on it. This adjustment is only necessary when the stepper or carriage assembly has been replaced or if the stepper plate has been loosened.

- If stepper plate has been loosened or replaced adjust head penetration, Section 4.11.5.
- Align R/W head, 4.11.3.
- Install C.E. alignment diskette SA 120-1. Select the drive and step to track 76.
- Sync the scope external negative on TP 12, set time base to .5 MSec per DIV.
- Connect one probe to TP 1 and the other to TP 2. Invert one channel and ground the probes to TP 5 & 6. Set the inputs to AC, ADD and 50 MV per division.
- Compare the wave form to Figure 13. If not within the range shown the head Azimuth will require adjustment. If required, proceed to next step.
- Slightly loosen the 2 R.H. stepper plate mounting screws only. Reference Figure 12. Do not loosen the L.H. screw as this will effect the head penetration adjustment.

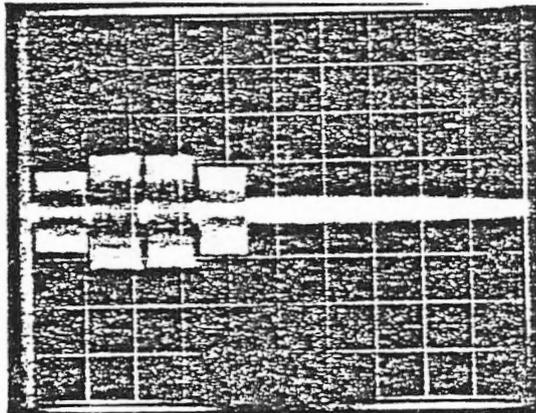


FIGURE 13

- Push the stepper down towards the A.C. drive motor until the 1st sector is larger than the 2nd sector.
- Pry the R.H. side of the stepper plate up with a medium screw driver until the 1st and 4th sectors have equal to or less amplitude than the middle 2 sectors. Reference Figure 13.

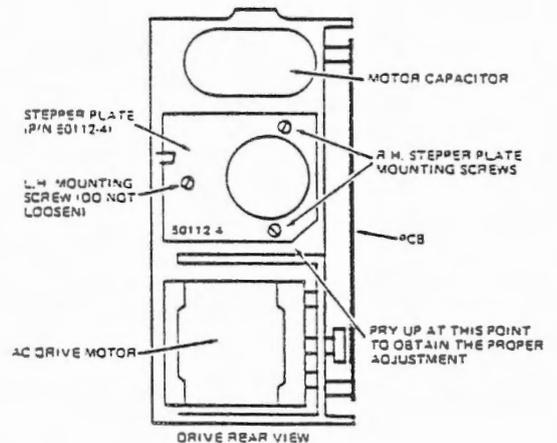


FIGURE 12

- Re-tighten the 2 R.H. screws. If either of the outside 2 sectors increase in amplitude greater than the inside 2 after re-tightening the screws, perform the adjustment again.
- Check and re-adjust the index timing and head radial adjustment if required.

4.11.10 Stepper Plate Removal and Adjustment

- Remove PCB.
- Remove head and carriage assembly from stepper lead screw, section 4.11.1.
- Pull the stepper motor out thru the stepper plate until the lead screw is completely clear of the plate.
- Remove the 3 stepper plate mounting screws.
- Reinstall the stepper plate.

NOTE: If the stepper plate is P/N 50112-4, there must be a nylon bushing in the L.H. hole and all 3 screws must have a flat washer and a black spring washer.

- Reinstall head and carriage and stepper motor assemblies.
- Adjust penetration, Section 4.11.5. If the stepper plate is P/N 50112-4, there will remain a gap between the bottom of the stepper plate and the machined surface on the casting. All other style stepper plates must remain flush with machined surface.
- Readjust carriage assembly. Section 4.11.2.
- Check and adjust Azimuth alignment. Section 4.11.10.

4.12 Activity Light Removal and Installation (Standard)

- a. Remove P6 connector from PCB.
- b. Remove cable clamp holding the cable and remove cable from clamp.
- c. Remove the 2 screws holding the push button.
- d. Remove push button and activity light from the front as an entire assembly.
- e. Install the light and push button assembly by reversing the removal procedure.
- f. No special orientation is required when installing P6 onto the PCB. No adjustments are required to the push button assembly.

- c. Remove front plate (Section 4.10).
- b. Remove two screws holding assembly to front plate.
- c. Remove two allen head screws holding assembly to push button.
- d. Grasp both ends of push button and bow outwards to remove LED.
- e. Reverse procedure to assemble.
- f. Adjustment of the door lock should not be necessary. If it has to be, the gap between the armature tab and the latch should be $.015 \pm .010$. This adjustment can be made by loosening the two screws on the armature.

4.13 Door Lock

- a. Disconnect P6 connector.
- b. Disconnect red wire near IC 2G.

4.14 Activity Light (with Door Lock Option)

- a. Follow procedure for door lock (4.13).

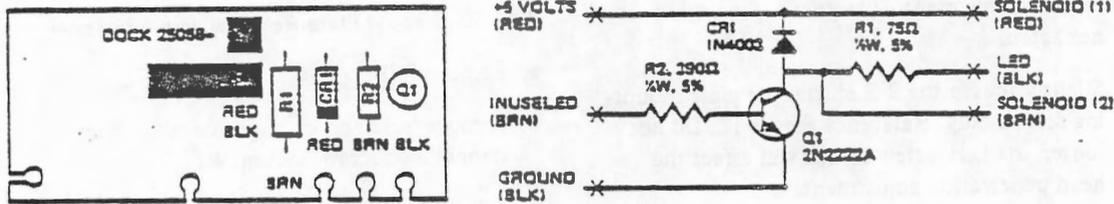
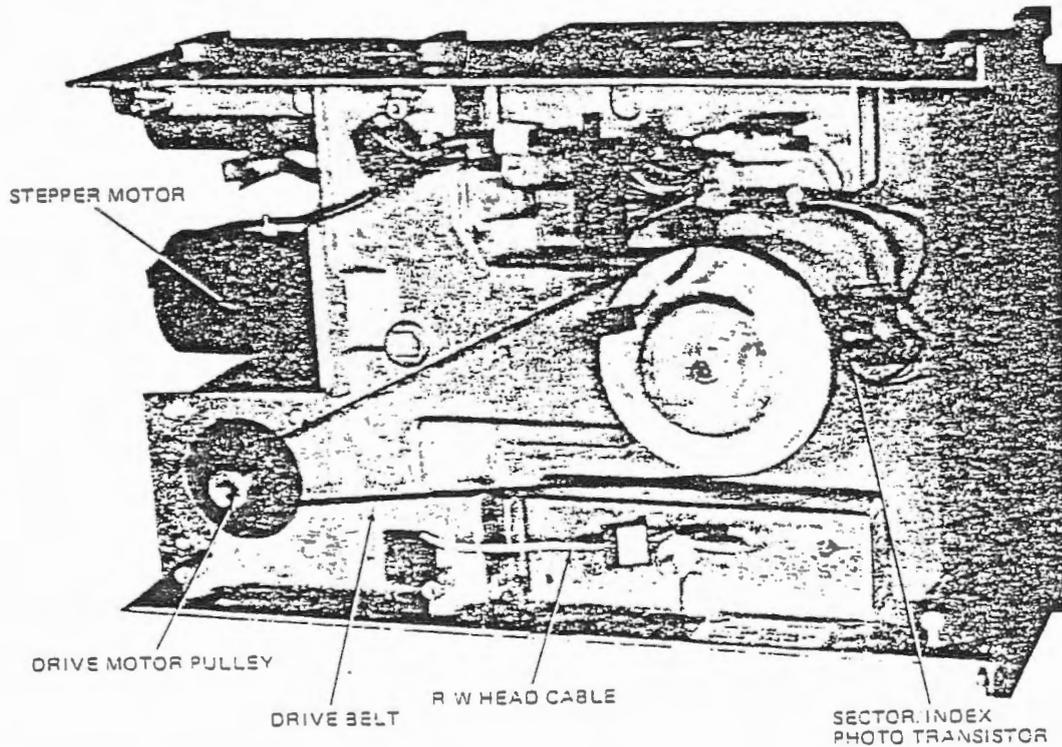
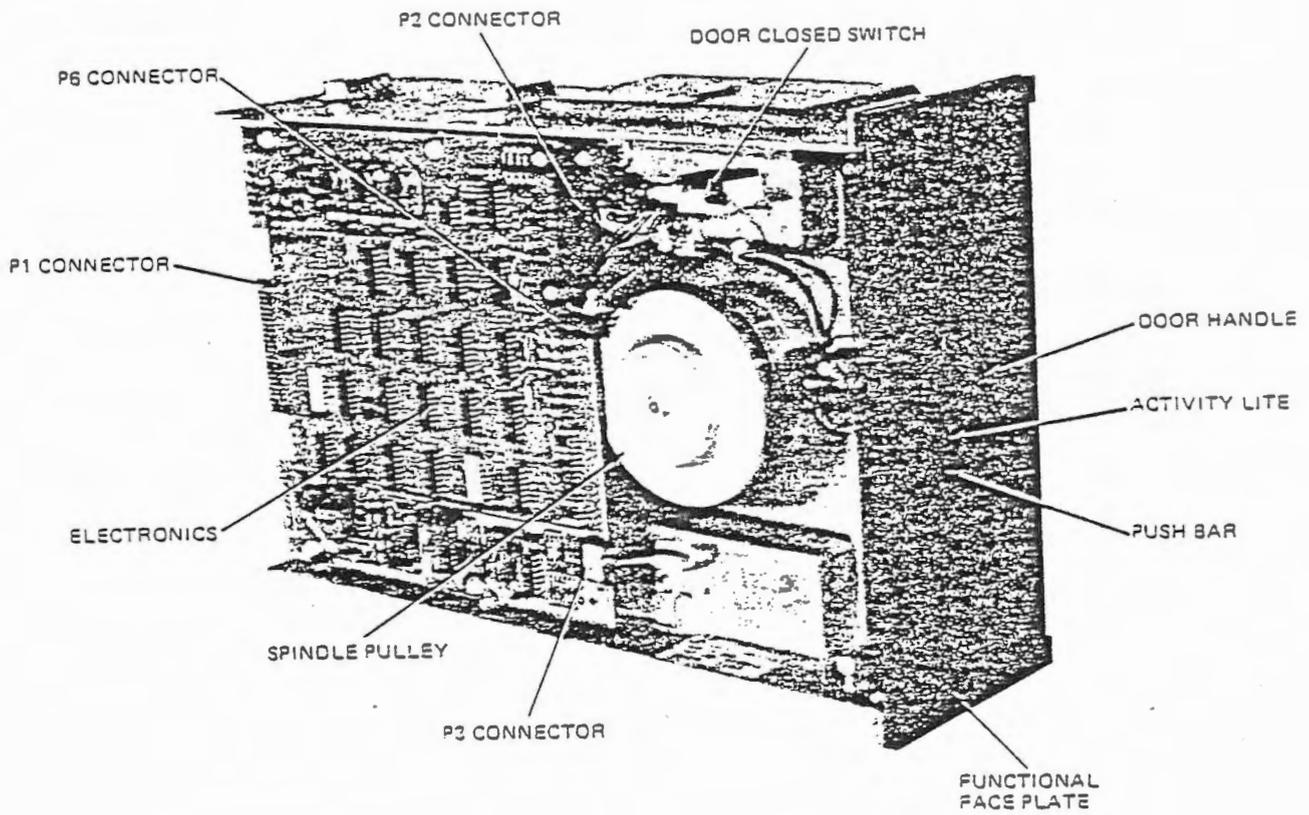
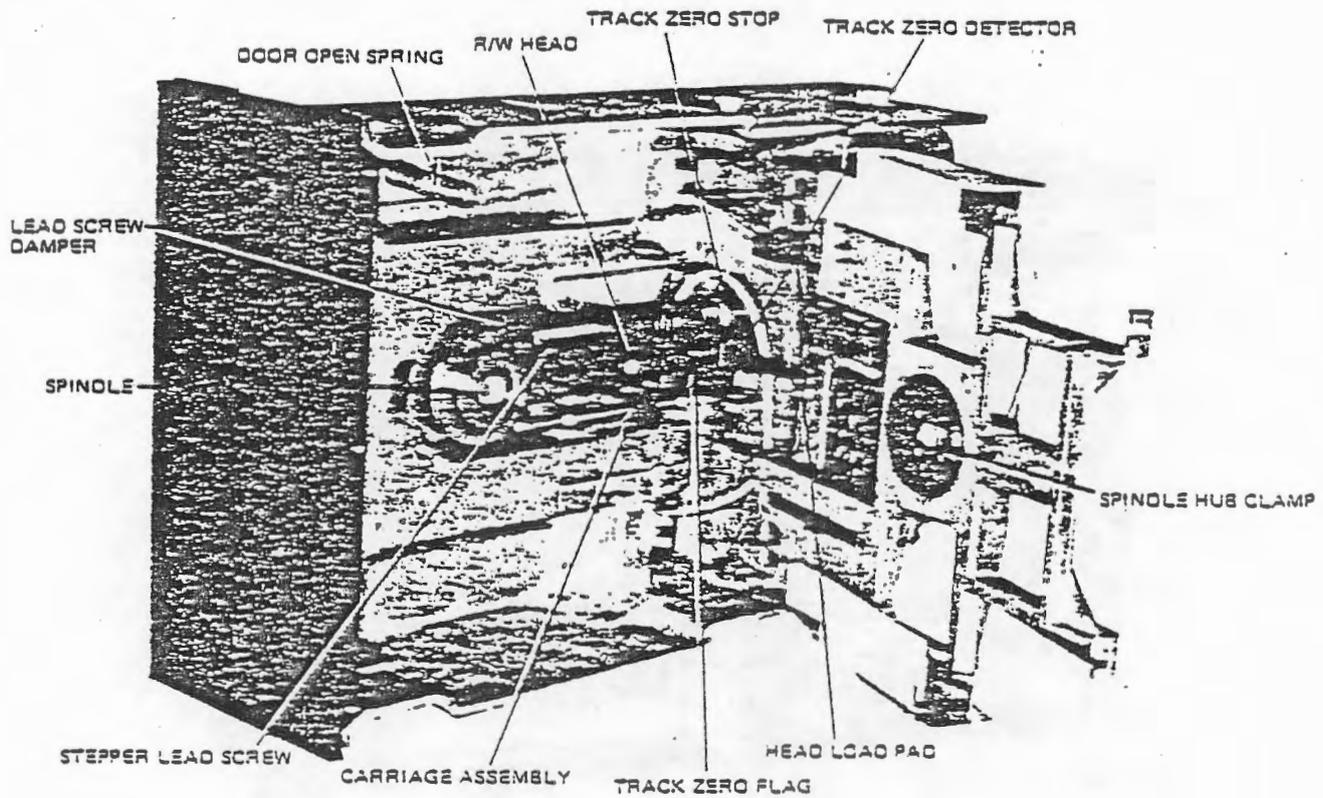
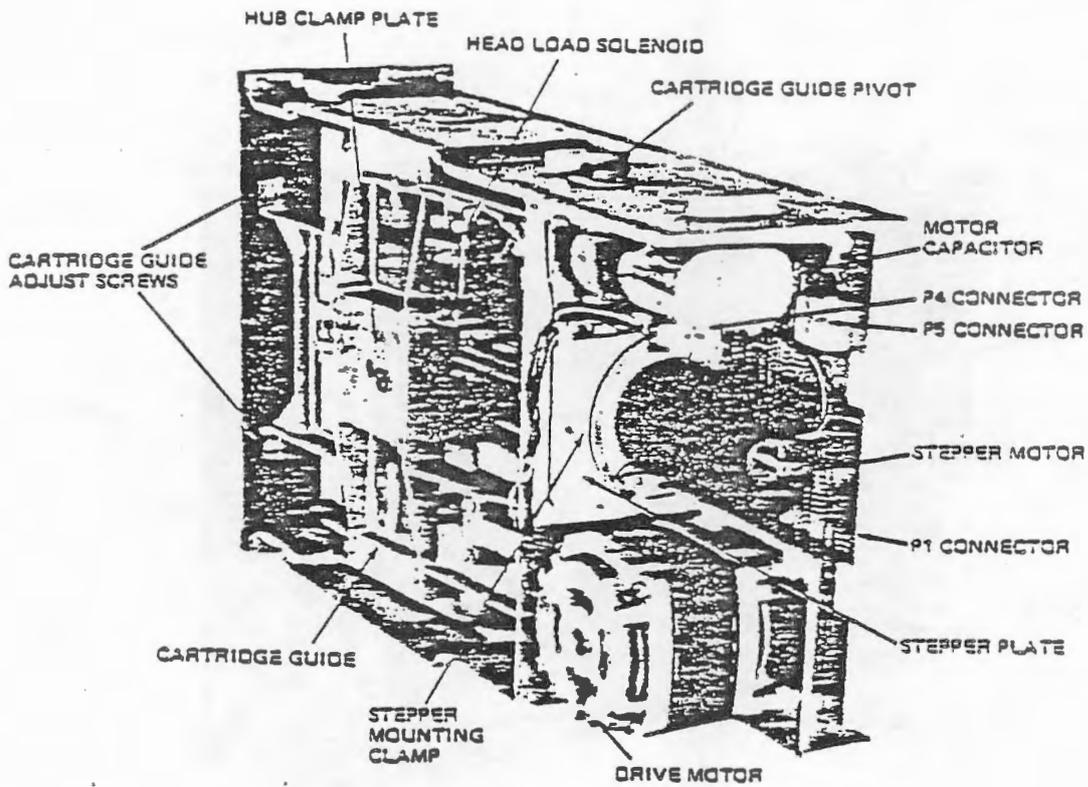
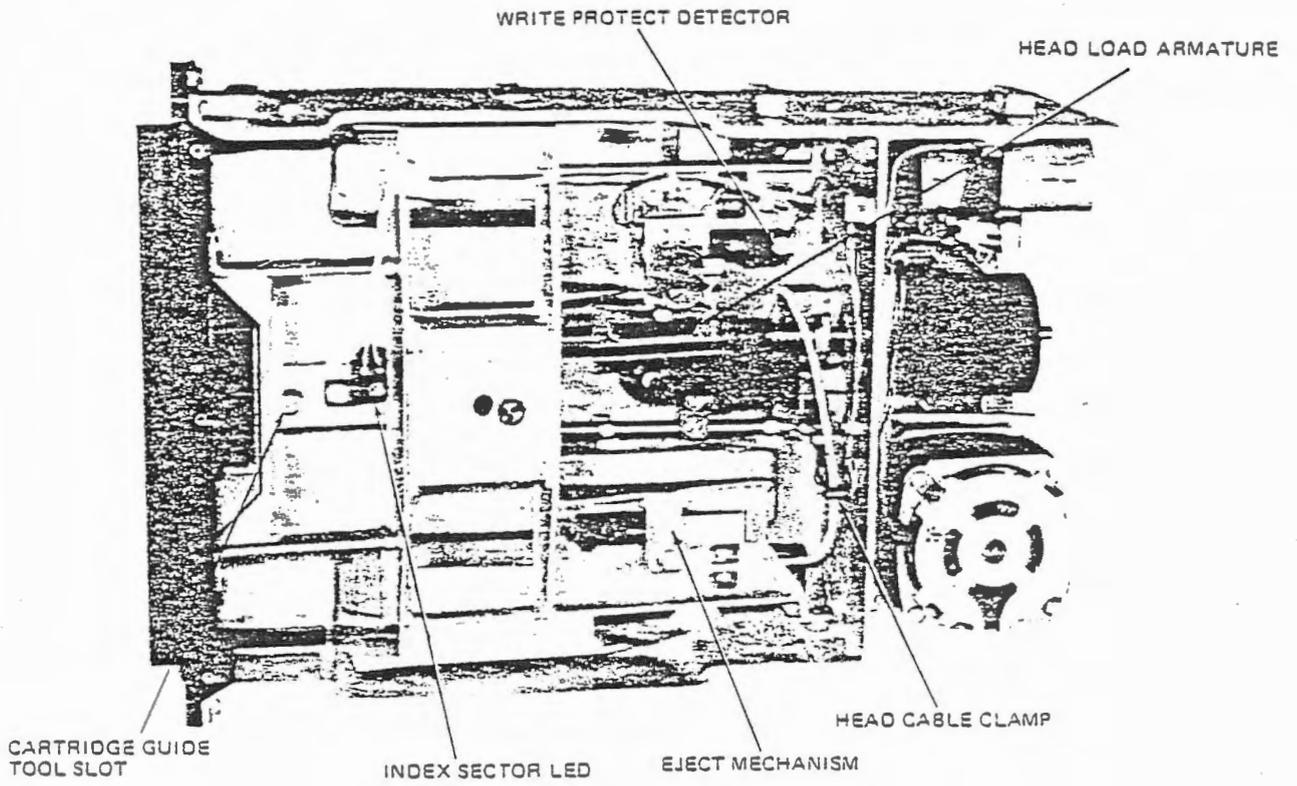


FIGURE 14 DOOR LOCK SCHEMATIC

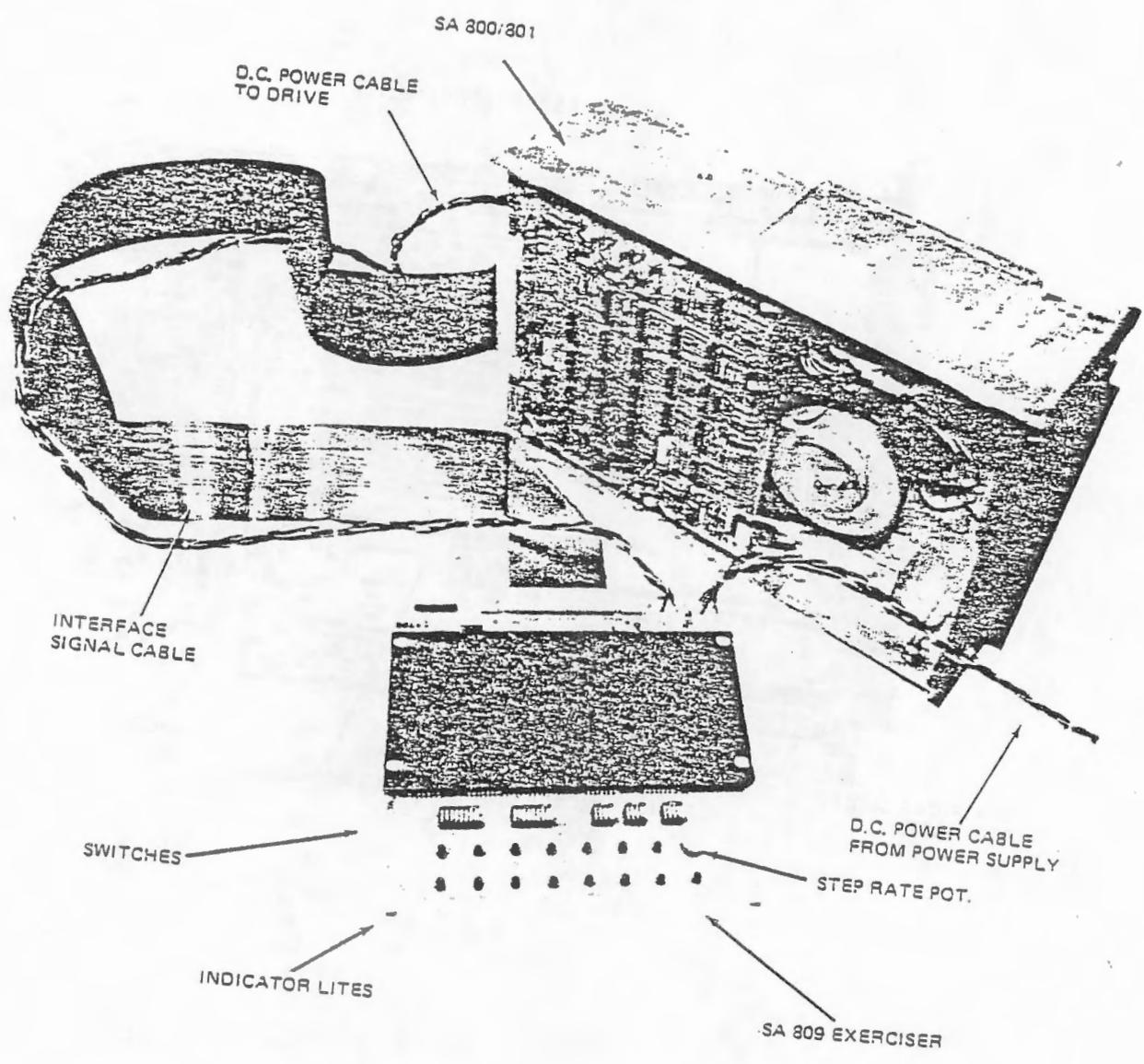
5 PHYSICAL LOCATIONS

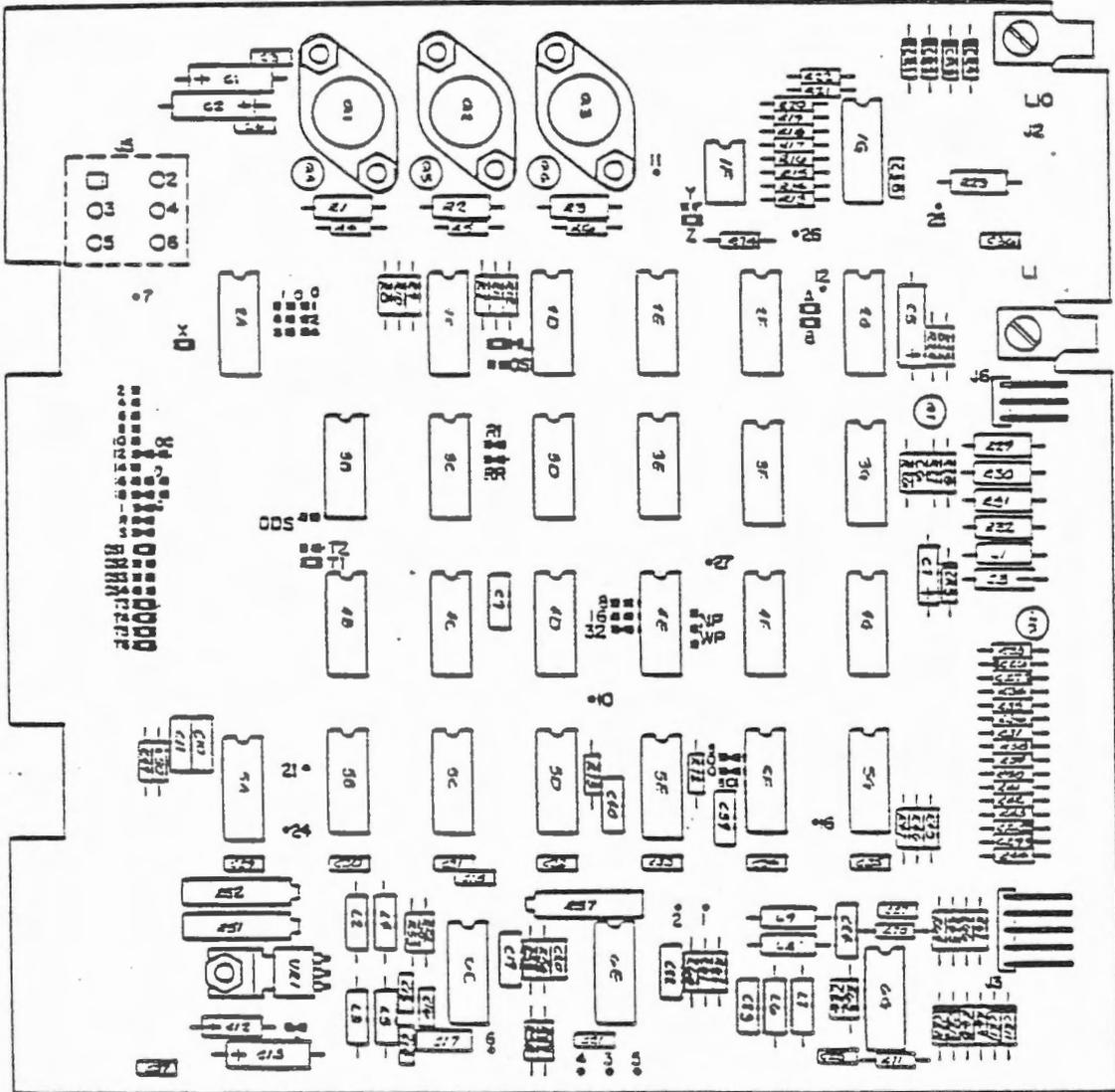






6 SA809 EXERCISER CONNECTION

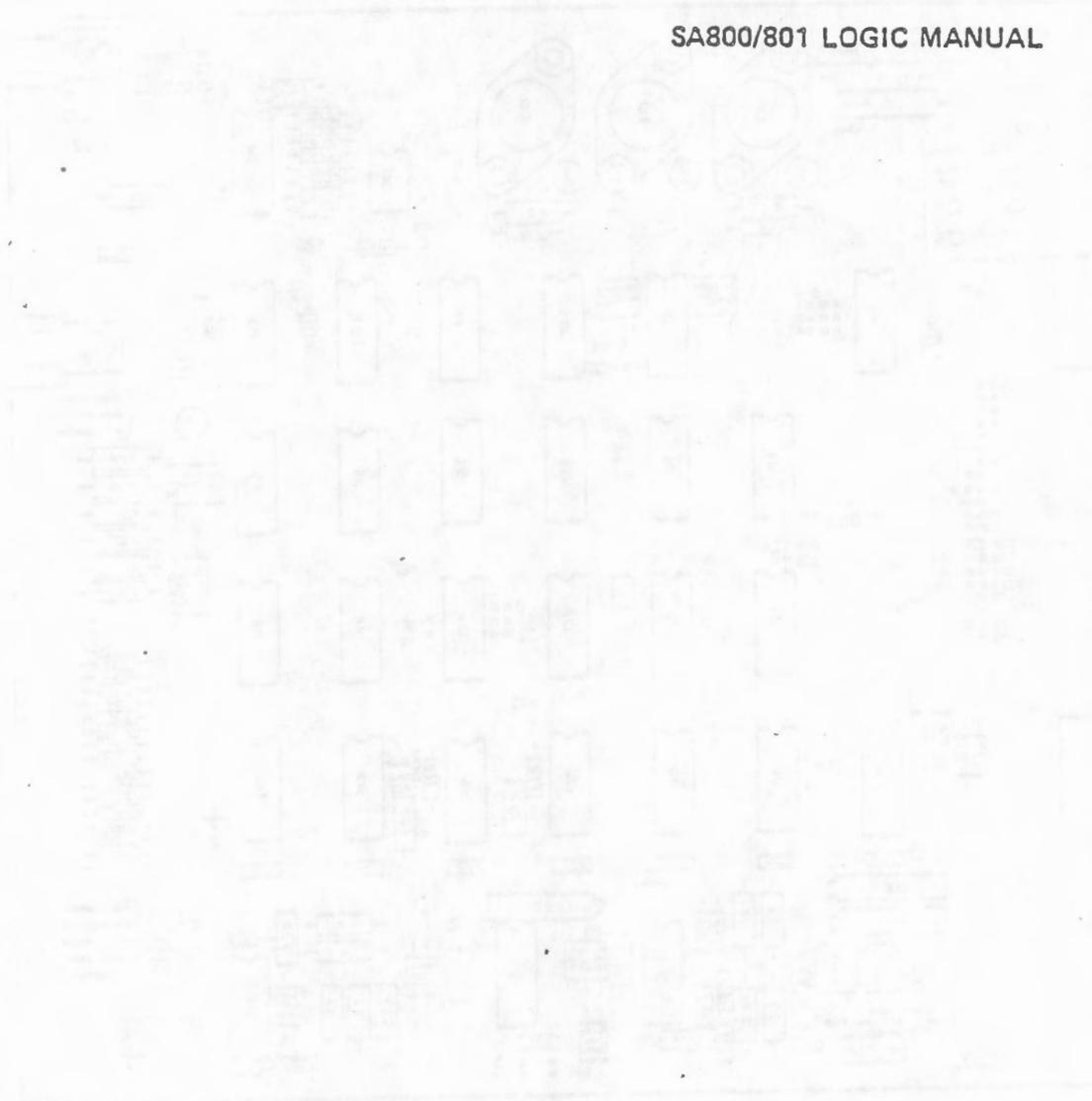




- Jumper Plug Installed as Shipped
- Test Point

SA800/801 PCB Component Location

SA800/801 LOGIC MANUAL



4

3

2

1

LOGIC MANUAL DRIVE SN _____

INDEX

AA001	INDEX
AB010	PCB TRACE AND TEST POINT LOCATIONS
DA010	READ/WRITE/INDEX/SECTOR
DA020	STEPPER CONTROL
DA030	DETECTORS
DA040	MOTORS SOLENOID SWITCH

PART NO
50591-0

TABLE I OPTIONAL FEATURES

PCB ASM NO.	OPTIONAL FEATURES			
	-5V	-7 TO -16V	DATA SEP	SECTOR SEP
25102	X			
25103		X		
25104	X		X	
25105		X	X	
25106	X		X	X
25107		X	X	X

WRITE PROTECT CAN BE ORDERED WITH ANY OF THE ABOVE

TABLE III

CUSTOMER CUT TRACE OPTIONS

DESIGNATOR	DESCRIPTION	SHIPPED FROM FACTORY	
		OPEN	SHORT
T3, T4, T5 & T6	TERMINATIONS FOR MULTIPLEXED INPUTS		(1) X
T2	SPARE TERMINATOR FOR RADIAL HEAD LOAD	X	
T1	TERMINATION FOR DRIVE SELECT		(1) X
DS1	DRIVE SELECT INPUT - ALTERNATE PINS: DS2, DS3, DS4		(1) X
RR	RADIAL READY		X
RI	RADIAL INDEX AND SECTOR		X
R, I, S	READY, INDEX, SECTOR ALTERNATE OUTPUT PROVISION		X
A, B, X	RADIAL HEAD LOAD		(1) X
HL	STEPPER POWER FROM HD LD		(1) X
DS	STEPPER POWER FROM DRIVE SELECT	X	
WP	INHIBIT WRITE WHEN WRITE PROTECTED		X
NP	ALLOW WRITE WHEN WRITE PROTECTED	X	
8, 16, 32	8, 16 OR 32 SECTORS		
D	ALTERNATE INPUT - IN USE	X	
2, 4, 6, 8, 10, 12, 14, 16, 18	NINE ALTERNATE I/O PINS	X	
DI, D2, D4, DDS	CUSTOMER INSTALLABLE DECODE DRIVE SELECT OPTION	X	
C	ALTERNATE INPUT - HEAD LOAD	X	
Z	INUSE LED FROM DRIVE SELECT		(1) X
Y	INUSE LED FROM HD LD	X	
DC	ALTERNATE OUTPUT - DISK CHANGE	X	

LOGIC MANUAL P/N 50590-1

TABLE II

FACTORY CUT TRACE OPTIONS

PCB ASM NO	TRACE "L"	TRACE "801"	TRACE "800"
25102	SHORTED	OPEN	SHORTED
25103	OPEN	↑	↑
25104	SHORTED	↓	↓
25105	OPEN	OPEN	SHORTED
25106	SHORTED	SHORTED	OPEN
25107	OPEN	SHORTED	OPEN

FACTORY CUT TRACE OPTIONS AND HISTORY CHART

I	-5 OR -7 TO -16V	SEE TABLE II
800	INDEX ONLY (800)	SEE TABLE II
801	INDEX AND SECTOR(801)	SEE TABLE II

(1) OPEN TRACE WITH SHORTING PLUG INSTALLED.

AA001

4

3

2

1

MUST CONFORM TO ENGINEERING SPEC ES 30000 0		EC HISTORY		SHUGART ASSOCIATES			
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE INDEX			
		6-75	0398	DETAIL	172	262	RELEASED FOR ASSEMBLY
CASE DEPTH	LINEAR	1-76	0509	DESIGN			50590
HARDNESS	± XXX			APPRO	341	675	SHEET 1 OF 1
SURFACE TREATMENT	ES			SCALE		OD	PART NO 50591-0
	CONFORMS TO MIL SPEC						REV/C 0509
	OUTSIDE MAX						
	INSIDE MAX						

D

D

C

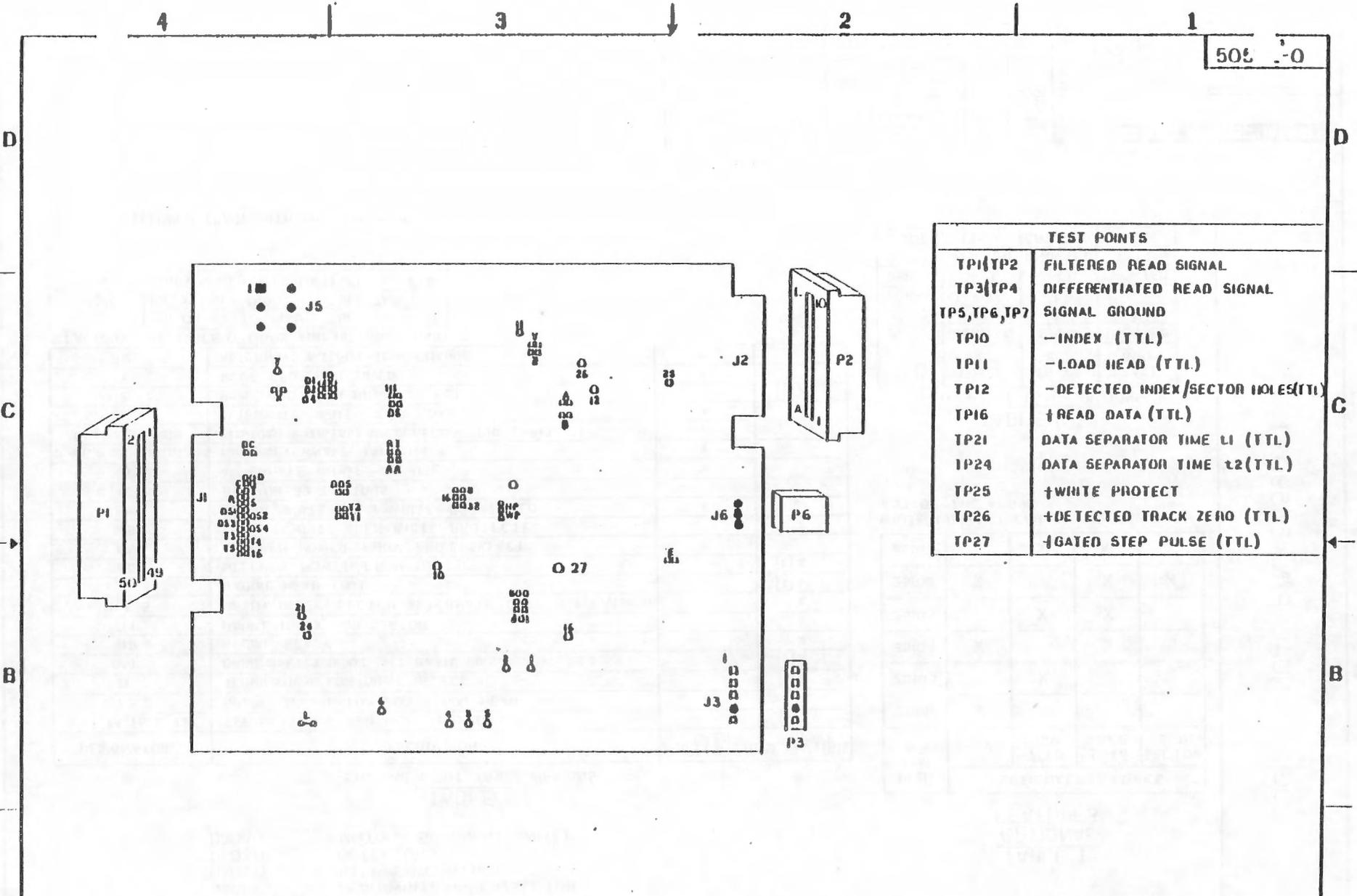
C

B

B

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A

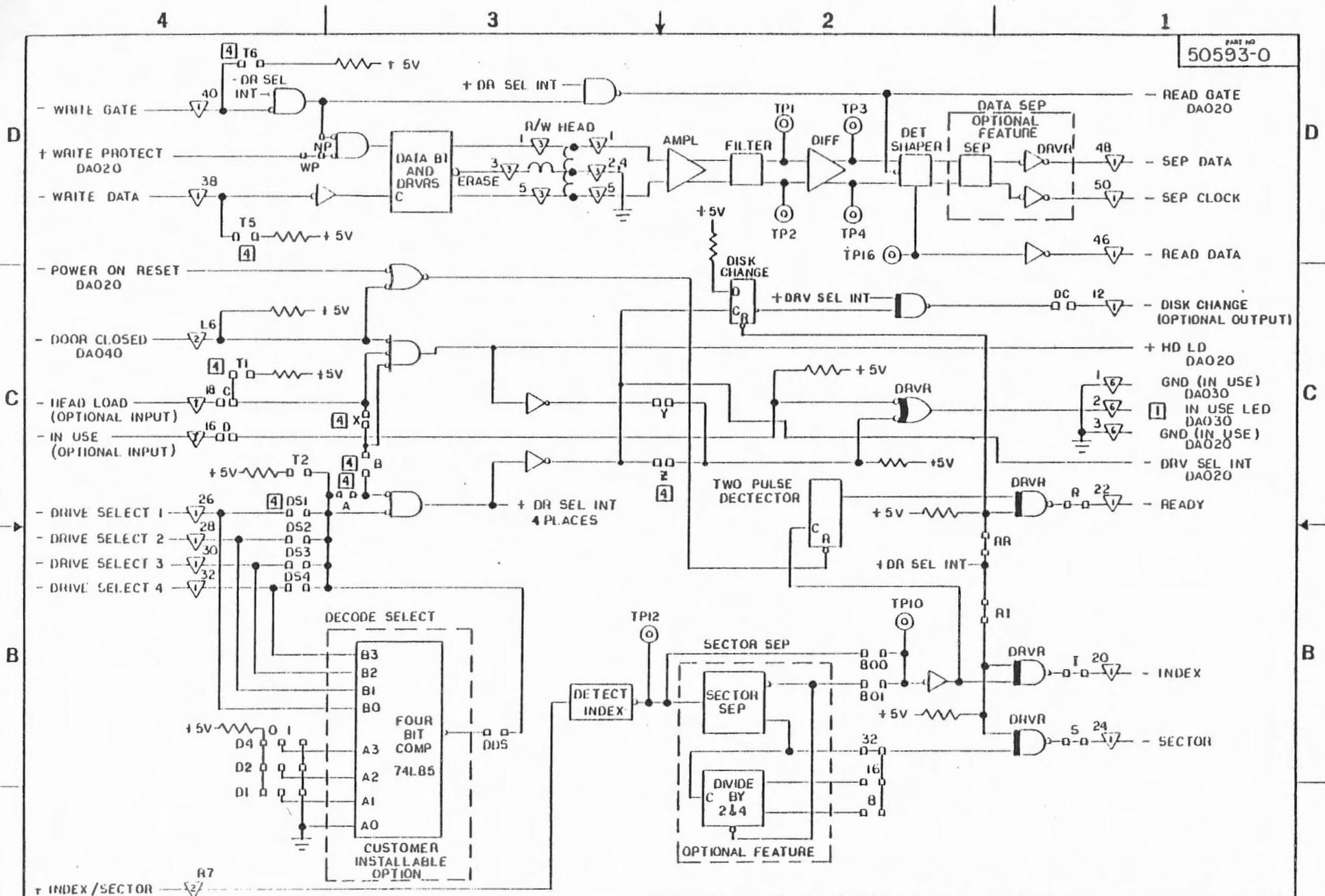


TEST POINTS	
TP1/TP2	FILTERED READ SIGNAL
TP3/TP4	DIFFERENTIATED READ SIGNAL
TP5, TP6, TP7	SIGNAL GROUND
TP10	-INDEX (TTL)
TP11	-LOAD HEAD (TTL)
TP12	-DETECTED INDEX/SECTOR HOLES (TTL)
TP16	↑READ DATA (TTL)
TP21	DATA SEPARATOR TIME L1 (TTL)
TP24	DATA SEPARATOR TIME L2 (TTL)
TP25	↑WHITE PROTECT
TP26	↑DETECTED TRACK ZERO (TTL)
TP27	↓GATED STEP PULSE (TTL)

NOTES:
 1. OO/OO DENOTES CUT TRACE/JUMPER OPTION.
 2. O DENOTES TEST POINTS.

ABOIO

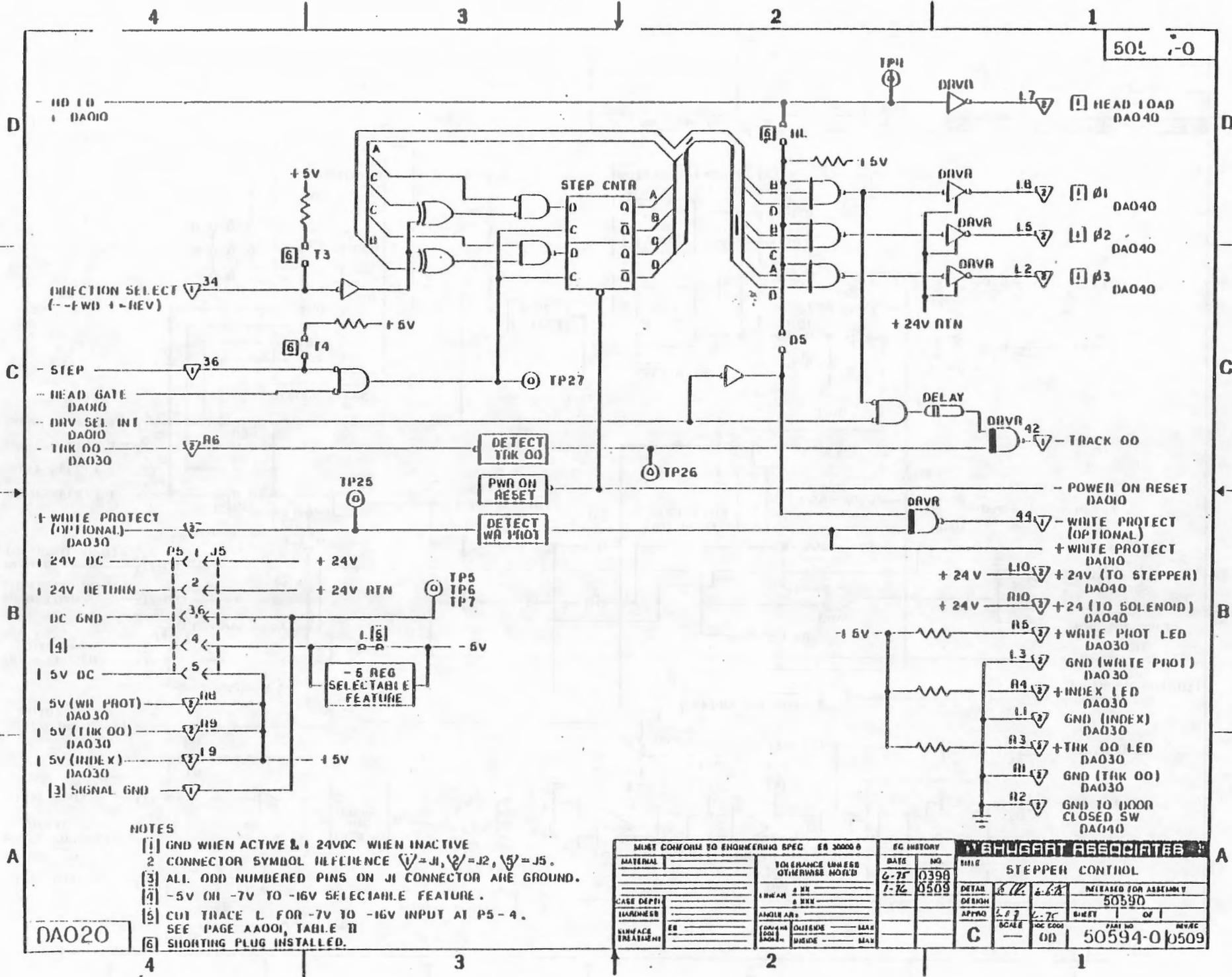
MUST CONFORM TO ENGINEERING SPEC EB 30000 B		EC HISTORY		EMULEART ASSOCIATES			
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE		PCB TRACE AND TEST POINT LOCATION	
		6-75	0398	DETAIL		RELEASED FOR ASSEMBLY	
		1-76	0509	DESIGN		50590	
CASE DEPTH	LINEAR			APPRO		SHEET	
THICKNESS	ANGULAR			C		OF 1	
FINISH/TREATMENT	CONFORM TO SPEC			SCALE		SHEET NO	
	INSIDE			OD		PART NO	
	MAX					50592-0	
	MAX					REV AC	
						0509	



- NOTES:
- [1] GND WHEN INACTIVE AND +1.5VDC WHEN ACTIVE
 - 2. CONNECTOR SYMBOL REFERENCE 1/J1, 2/J2, 3/J3, 6/J6
 - 3. ALL (OH) NUMBERED PINS ON J1 CONNECTOR ARE GROUND.
 - [4] SHORTING PLUG INSTALLED.

MUST CONFORM TO ENGINEERING SPEC. ES 30000 0		EC HISTORY		SHUGART ASSOCIATES	
MATERIAL	DATE	NO	TITLE		
	6-75	0398	HEAD/WRITE/INDEX/SECTOR		
	1-76	0509	DETAR	RELEASED FOR ASSEMBLY	
CASE DEPTH	LINEAR	± .005	DESIGN	50590	
HARDNESS	ANGULAR	± .005	APPRO	SHEET 1 OF 1	
SURFACE TREATMENT	CORROSION RESISTANCE	OUTSIDE --- MAX	SCALE	PART NO	
		INSIDE --- MAX	4-27	50593-0	
			OD	REV/EC	
				0509	

DAO10

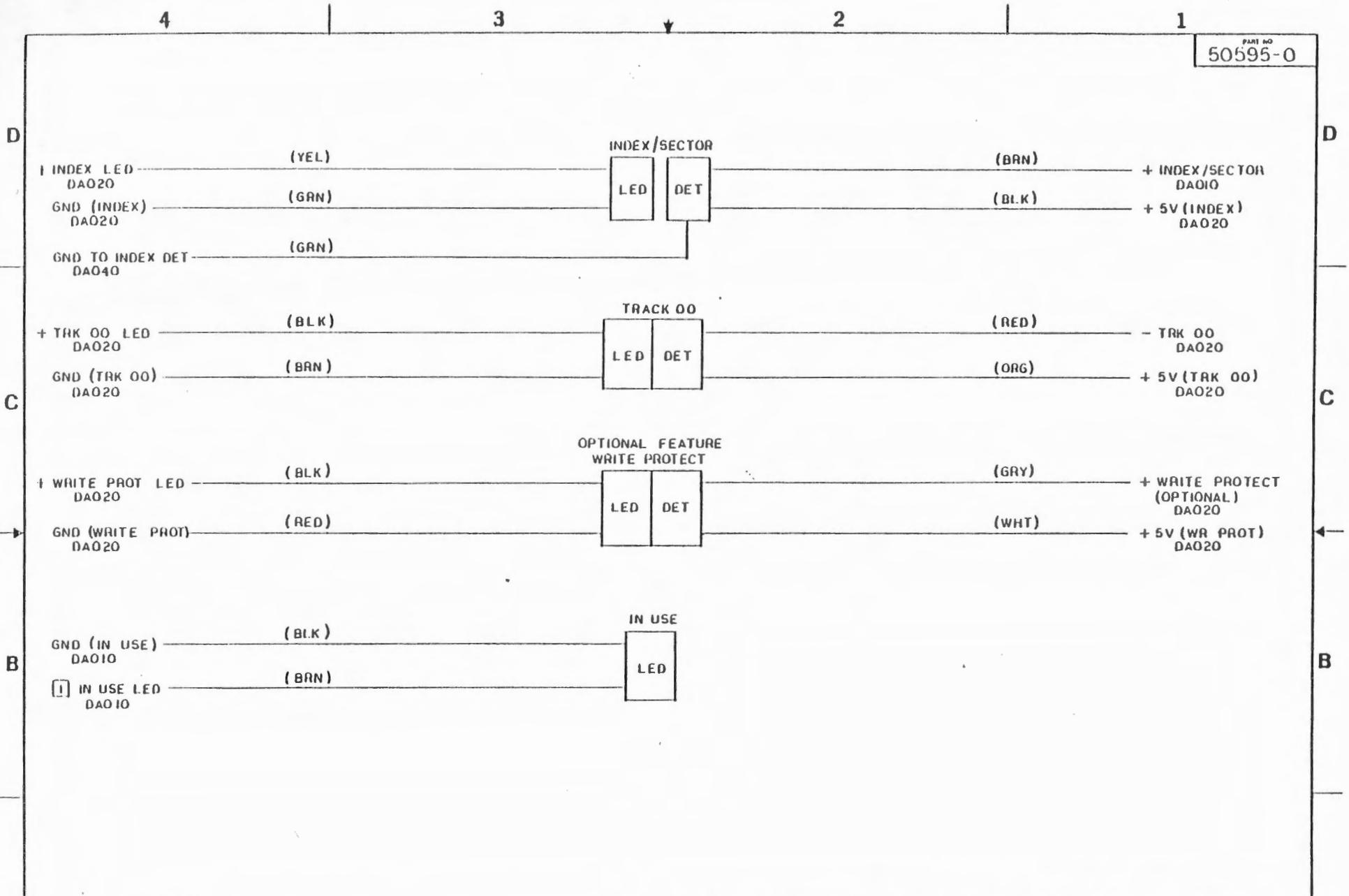


50L -0

- NOTES
- [1] GND WHEN ACTIVE & +24VDC WHEN INACTIVE
 - [2] CONNECTOR SYMBOL DIFFERENCE $\nabla = J1, \nabla = J2, \nabla = J5$.
 - [3] ALL ODD NUMBERED PINS ON J1 CONNECTOR ARE GROUND.
 - [4] -5V ON -7V TO -16V SELECTABLE FEATURE.
 - [5] CUT TRACE L FOR -7V TO -16V INPUT AT P5 - 4. SEE PAGE AA001, TABLE II
 - [6] SHORTING PLUG INSTALLED.

DA020

MILIT CONFORMS TO ENGINEERING SPEC ES 30000 0		EC HISTORY		SHUGART ASSOCIATES	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE	
		6-75	0399	STEPPER CONTROL	
CASE DEPTH	LINEAR 2 MM	7-76	0509	DETAIL	INCREASED FOR ASSEMBLY
FINISHES	2 MM			DESIGN	50590
FINISHES	ANGLE 45°			APPROV	SHEET 1 OF 1
FINISHES	OUTSIDE MAX			SCALE	1
FINISHES	INSIDE MAX			SOC CODE	50594-0
				PART NO	REV AC
					0509

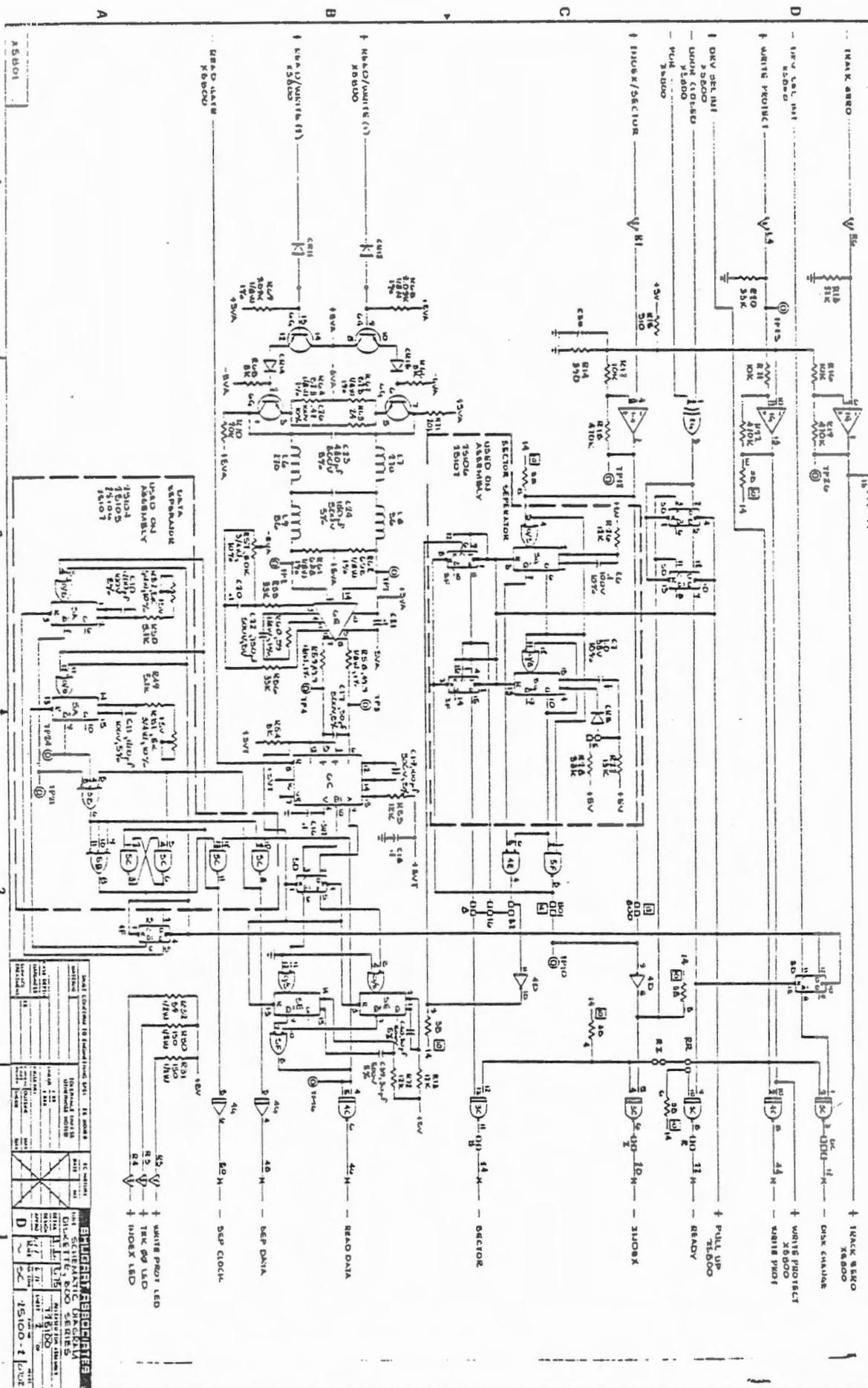


NOTES:
[] GND WHEN INACTIVE AND +1.5VDC WHEN ACTIVE

DAO30

MUST CONFORM TO ENGINEERING SPEC. ES 30000 0		EC HISTORY		BHLGART ASSOCIATES			
MATERIAL	_____	DATE	NO	TITLE			
		6-75	0398	DETECTORS			
CASE DEPTH	_____			DETAIL	672	667	RELEASED FOR ASSEMBLY
HARDNESS	_____			DESIGN	50590		
SURFACE TREATMENT	_____			APPRO	6-75	SHEET	1 OF 1
ES	_____			SCALE	OD	PART NO	REV/C
COMMENTS	_____			SCALE	OD	50595-0	0398
EDGES	_____						
SHOWN	_____						
		OUTSIDE	MAX				
		INSIDE	MAX				

SA800/801 SCHEMATIC DIAGRAMS



45100-1	
1	INDEX LED
2	WRITE PROTECT LED
3	TRK 00 LED
4	INDEX LED
5	DISK CHANNEL
6	WRITE PROTECT
7	WRITE PROTECT
8	WRITE PROTECT
9	WRITE PROTECT
10	WRITE PROTECT
11	WRITE PROTECT
12	WRITE PROTECT
13	WRITE PROTECT
14	WRITE PROTECT
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A. Shugart Associates

435 Oakmead Parkway, Sunnyvale, California 94086

Phone: (408) 733-0100 TWX: 910 339 9355 SHUGART SUVL