SA900/901
Diskette Storage Drive

OEM Manual

TABLE OF CONTENTS

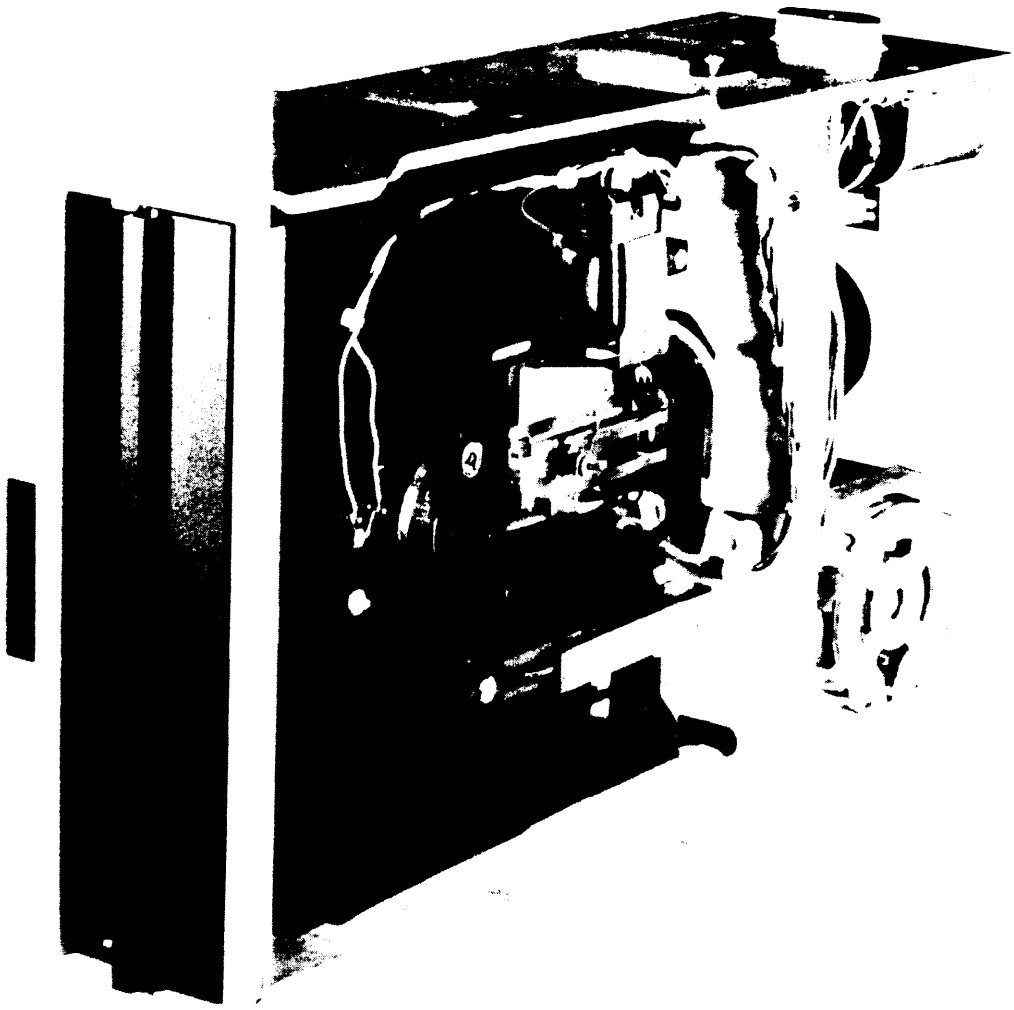
TABLE OF CONTENTS Cont.

TABLE OF CONTENTS Cont.

** This section applies only to PCB's P/N 2500X.

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS Cont.



SA 900
Diskette Storage

1.0 INTRODUCTION

1.0.1 General Description

The SA900/901 are low cost, highly reliable, direct access, removable Diskette Drives, providing storage for 3.1 million bits of data with a data rate of 250,000 bits/sec.

The SA900 Diskette Storage Drive can read and write data for input or output from the IBM 3740 Data Entry System. Any Shugart Associates, IBM, or equivalent diskette can be read or written on an SA900, IBM 3741, 3742, 3747 or 3540 and be subsequently updated on any of these devices.

The SA901 provides additional flexibility to the system designer who has other requirements that preclude IBM compatibility.

SA900/901 Diskette Storage Drives provide the system designer solutions to his applications requirements with greater performance and reliability than cassette or cartridge drives, and lower cost with increased function over card I/O and reel to reel tape drives.

Applications for the SA900/901 Diskette Storage Drive are key entry systems, point of sale recording systems, batch terminal data storage, micro-program load and error logging, minicomputer program and auxiliary data storage, word processing systems and data storage for small business systems.

The SA900/901 is composed of drive mechanism, read/write head, track positioning mechanism and associated electronics.

The SA100 Diskette, IBM Diskette or equivalent, can be read and written interchangeably between any SA900 and IBM 3751/42, 3747 and 3540. The SA101 Diskette can be read or written interchangeably on any SA901.

1.0.2 Specification Summary

1.0.2.1 Performance Specifications

Capacity (Unformatted)	Per Disk	3.1 megabits
	Per Track	41 kilobits
Data Transfer Rate		250 kilobits/second
Access Time	Track to Track	10 ms
	Settling Time	10 ms
Average Access Time		260 ms
Rotational Speed		360 RPM
Average Latency		83 ms
Recording Mode		Frequency Modulation

1.0.2.2 Media Characteristics

Cartridge Required	SA900	SA100 or IBM "Diskette"
	SA901	SA101
Physical Sectors	SA900	0
	SA901	32
Index		1
Tracks		77
Density	Recording	3200 bpi (approx. inside track)
	Track	48 TPI

1.0.2.3 Additional Features for SA900/901

50 Hz – 110 VAC, single phase
60 Hz – 208/230 VAC, single phase
50 Hz – 208/230 VAC, single phase

Write Protect (Optional SA900-Standard SA901)

Activity Light

Chassis Slide

4-5/8" x 10½" Front Plate

5¼" x 11" Front Plate

5¼" x 10" Front Plate

–12 to –15V to replace –5 VDC

User Installed Features:
- Multiplex Interface
- Radial Interrupt
- Radial Rotational Sensing
- Radial Head Load
- Radial DC Power Connector

1.1 FUNCTIONAL CHARACTERISTICS

1.1.1 General Operation

The SA900/901 Diskette Drive consists of read/write and control electronics, drive mechanism, read/write head, track positioning mechanism, and the removable Diskette. These components perform the following functions:

Interpret and generate control signals.
Move read/write head to the selected track.
Read and write data.

The relationship and interface signals for the internal functions of the SA900/901 are shown in Figures 1.1 and 1.2 respectively.

The Head Positioning Actuator positions the read/write head to the desired track on the Diskette. The Head Load Actuator loads the Diskette against the read/write head and data may then be recorded or read from the Diskette.

The electronics are packaged on one PCB. The PCB contains:

1. Index Detector Circuits (Sector/Index for 901).
2. Head Position Actuator Driver
3. Head Load Actuator Driver
4. Read/Write Amplifier and Transition Detector
5. Data/Clock Separation Circuits
6. Safety Sensing Circuits
7. Write Protect
8. Drive Ready Detector Circuit
9. Drive Select Circuits

An electrical stepping motor (Head Position Actuator) and lead screw positions the read/write head. The stepping motor rotates the lead screw clockwise or counterclockwise in 15° increments. A 15° rotation of the lead screw moves the read/write head one track position. The using system increments the stepping motor to the desired track.

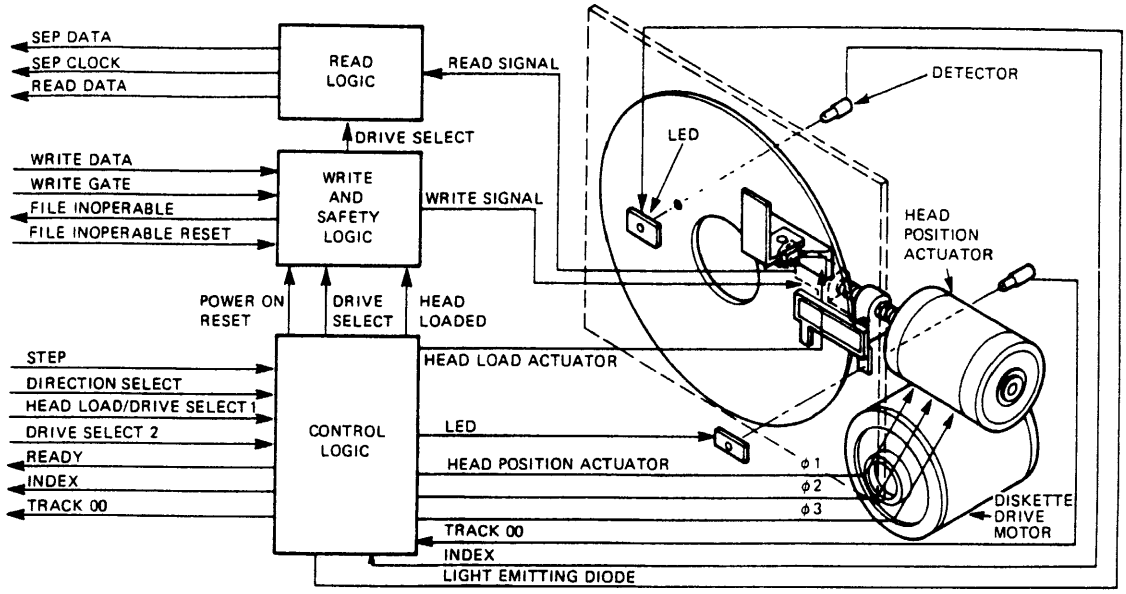


Figure 1.1 SA900 Functional Diagram, One Sector Hole

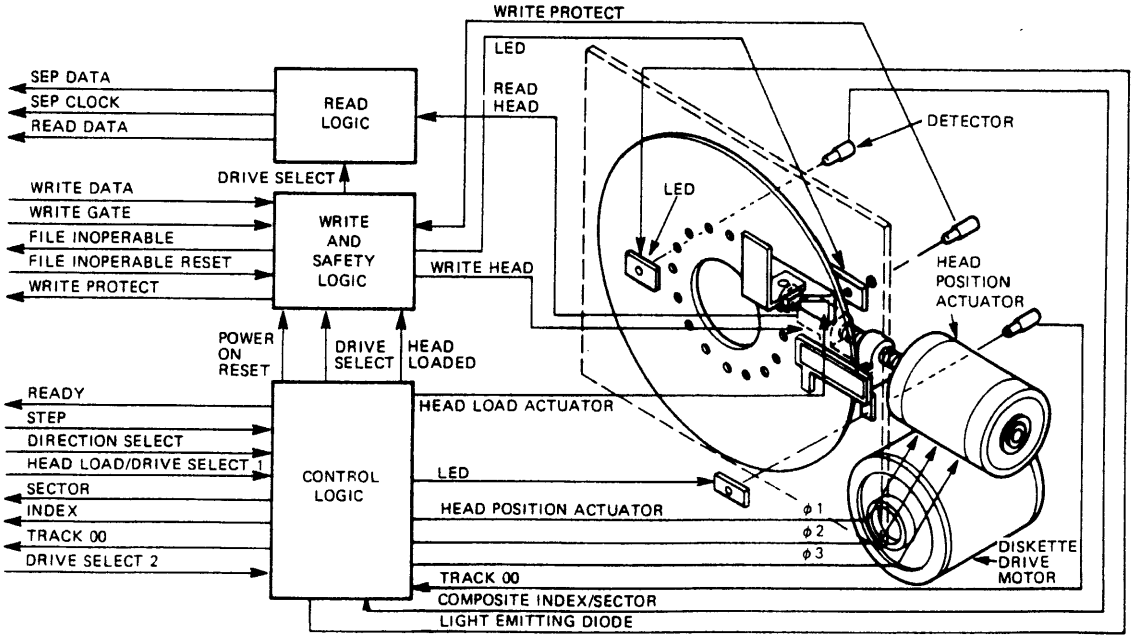


Figure 1.2 SA901 Functional Diagram, 32 Sector Holes

The Diskette drive motor rotates the spindle at 360 rpm through a belt-drive system. 50 or 60 Hz power is accommodated by changing the drive pulley. A registration hub, centered on the face of the spindle, positions the Diskette. A clamp that moves in conjunction with the latch handle fixes the Diskette to the registration hub.

The read/write head is in direct contact with the Diskette. The head surface has been designed to obtain maximum signal transfer to and from the magnetic surface of the Diskette with minimum head/Diskette wear.

The SA900/901 head is a single element read/write head with straddle erase elements to provide erased areas between data tracks. Thus normal tolerance between media and drives will not degrade the signal to noise ratio and insures Diskette interchangeability.

The read/write head is mounted on a carriage which is located on the Head Position Actuator lead screw. (See Figure 1.3.) The Diskette is held in a plane perpendicular to the read/write head by a platen located on the base casting. This precise registration assures perfect compliance with the read/write head. The Diskette is loaded against the head with a load pad actuated by the head load solenoid.

1.1.2 Diskette

The recording media used in the SA900 Diskette Storage Drive is a Mylar* disk enclosed in a plastic envelope. The characteristics of the disk and envelope are:

Disk Diameter	7.875 inches
Envelope Size	8 inches x 8 inches
Rotational Speed	360 RPM
Rotational Period	166.67 ms
Average Latency	83.33 ms
Number of Tracks	77
Bit Density	
Inside Track	3200 bpi approx.

The SA100 Diskette media is IBM compatible and can be used in the SA900 or the IBM 3740 Data Entry System. (See Figure 1.4.)

The SA101 Diskette is used with the SA901 and differs from the SA100 in that there are 32 sector holes. (See Figure 1.5.)

1.1.3 Recording Format

The format of the data recorded on the disk is totally a function of the host system, and can be designed around the users application to best take advantage of the total available bits that can be written on any one track. The data written on the disk is recorded using a frequency modulation technique as shown in Figure 1.6.

For a detailed discussion of IBM 3740 compatibility, the system designer should read Shugart Associates Guide to IBM 3740 Compatibility (Publication number SA 0006-3).

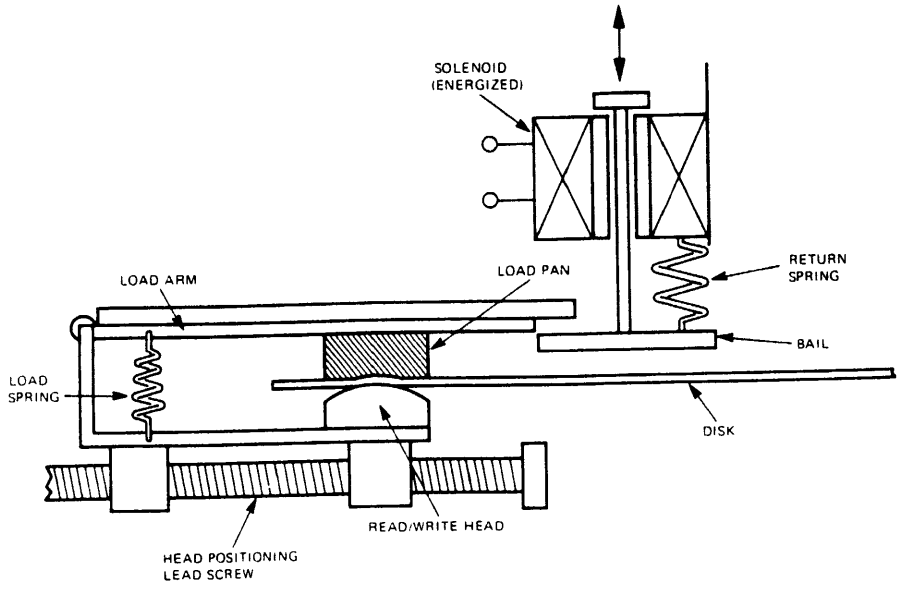


Figure 1.3 Head Load and Carriage Assembly

*Trademark of Dupont Corp.

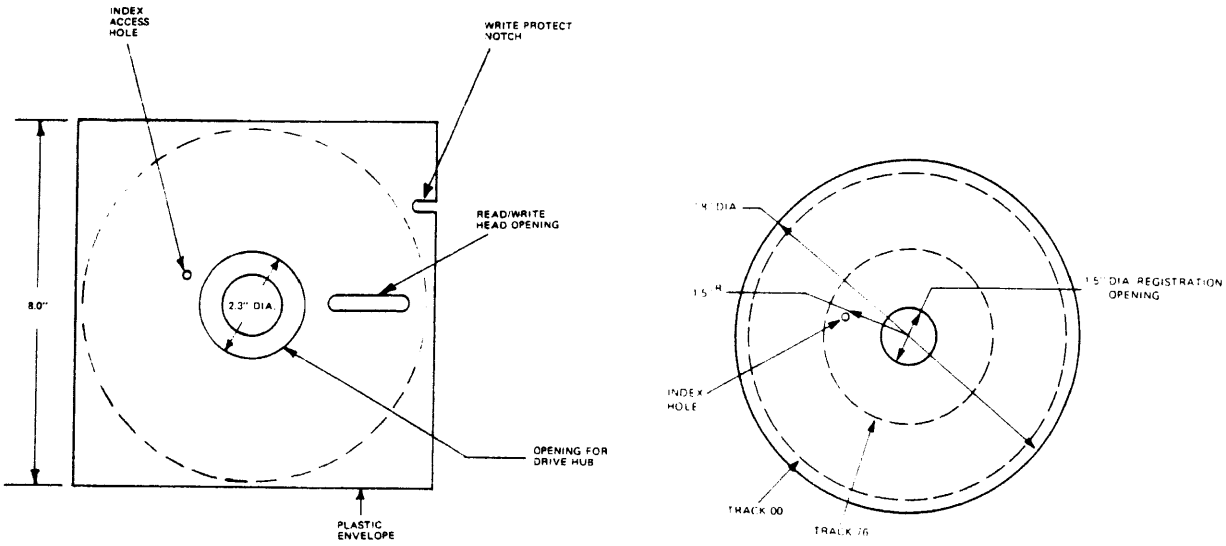


Figure 1.4 SA100 Diskette and Cartidge Layout

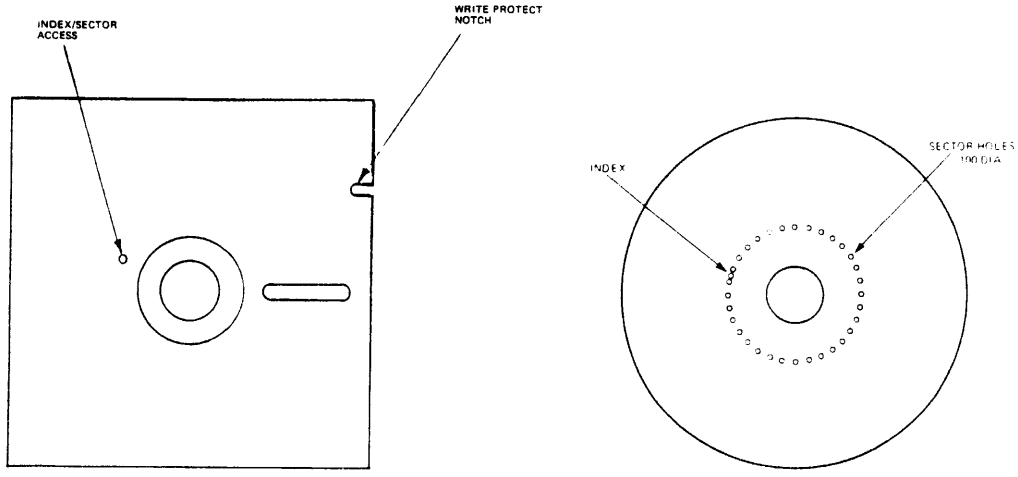


Figure 1.5 SA101 Diskette and Cartridge Layout

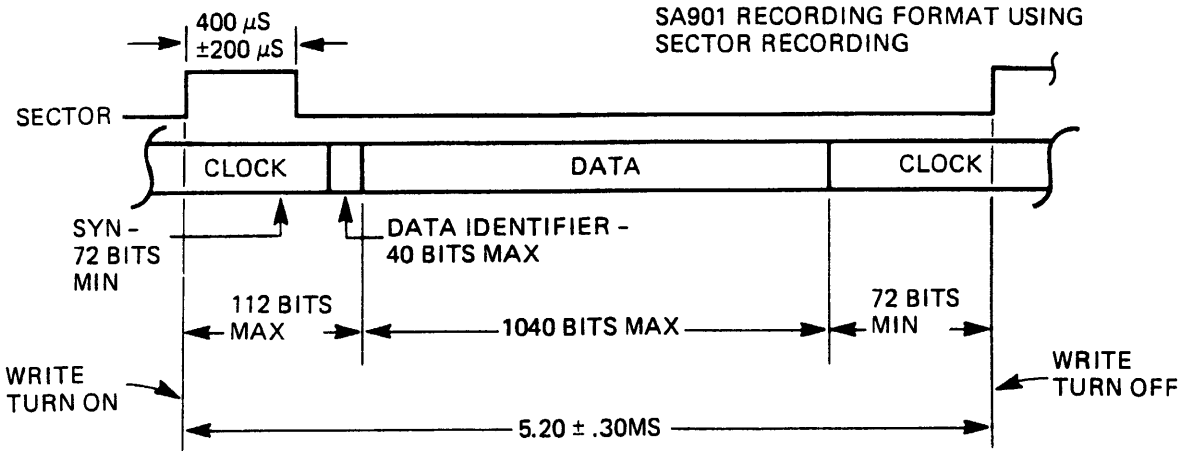


Figure 1.9 Sector Recording Format (SA 901 Only)

1.1.4 Track Accessing

Seeking the R/W head from one track to another is accomplished by selecting the desired direction utilizing the Direction Select interface line and then pulsing the Step line. Multiple track accessing is accomplished by repeated pulsing of the Step line until the desired track has been reached. Each pulse on the Step line will cause the R/W head to move one track either in or out depending on the Direction Select line.

The head load line must be active (logical 0 level) in order to activate the stepper. When not Accessing, Reading or Writing it is not necessary to have power to the stepper; therefore, the head load line controls the 24 volts to the stepper motor which allows it to remain cooler. This function can be crippled by cutting a trace which has been provided on the PCB. This trace has been labeled "R" for easy identification.

1.1.4.1 Step Out

With the Direction Select line at a plus logic level (2.5V to 5.5V) a pulse on the Step line will cause the R/W head to move one track away from the center of the disk. The pulse(s) applied to the Step line and the Direction Select line must have the timing characteristics shown in Figure 1.10.

1.1.4.2 Step In

With the Direction Select line at a minus logic level (0V to .4V), a pulse on the Step line will cause the R/W head to move one track closer to the center of the disk. The pulse(s) applied to the Step line must have the timing characteristics shown in Figure 1.10

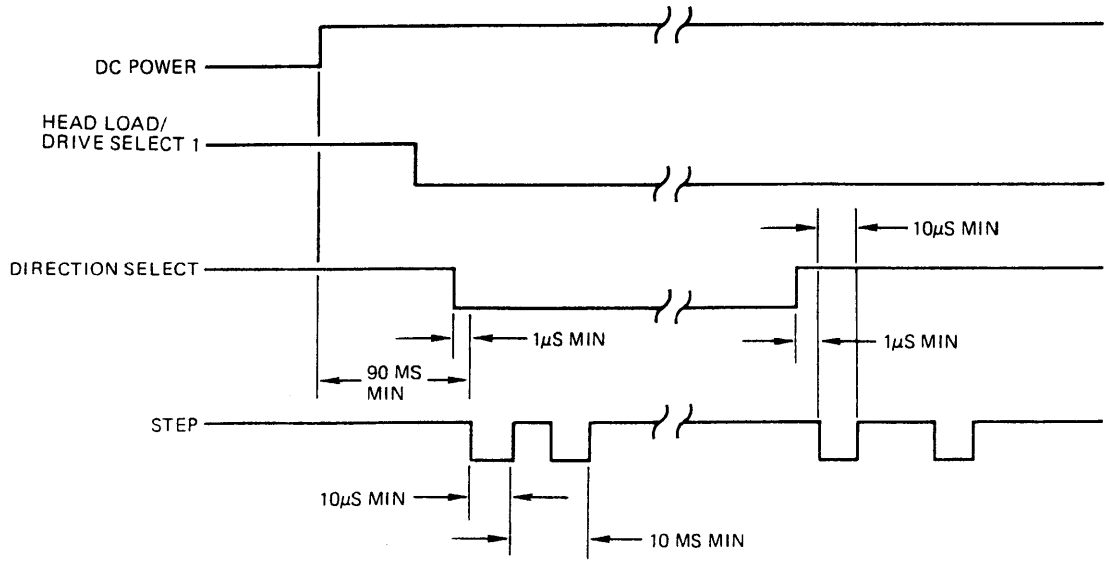
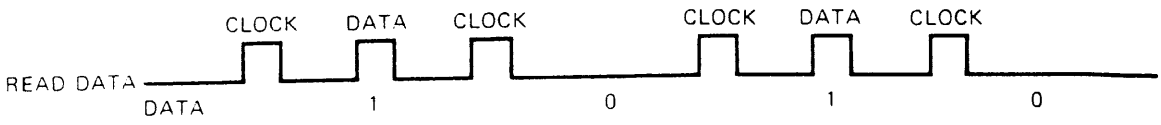


Figure 1.10 Track Access Timing

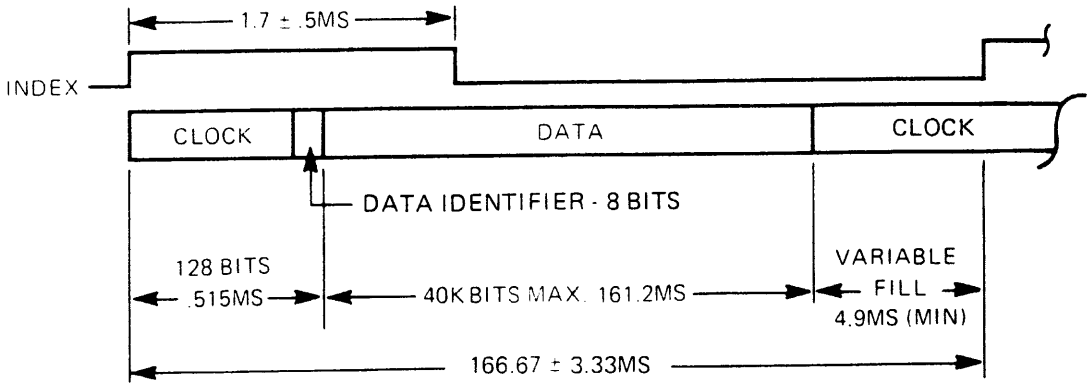


DATA PATTERN ILLUSTRATED = 1010

BASIC TRACK CHARACTREISTICS:

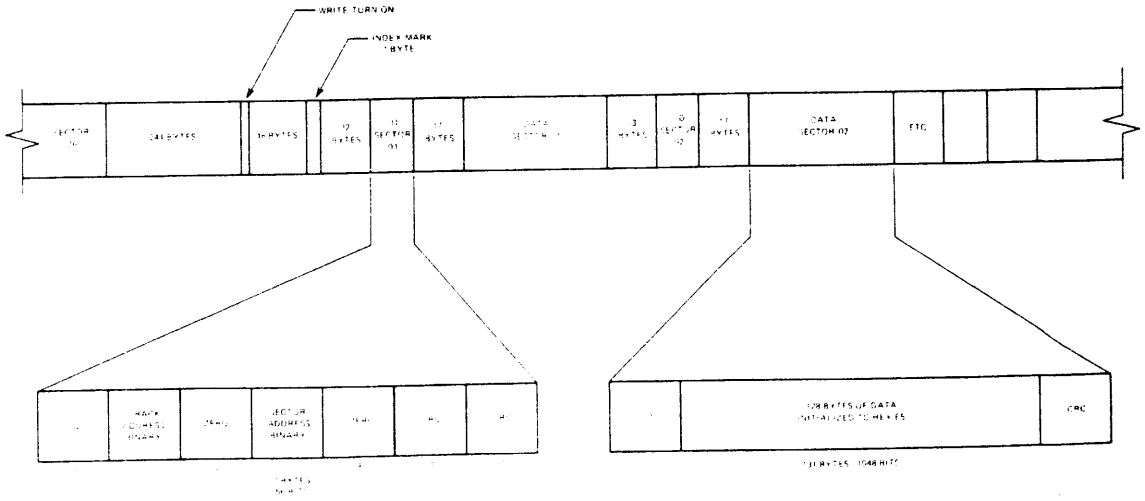
NUMBER OF BITS/TRACK	41,300 BITS
INDEX PULSE WIDTH	1.7 MS
SECTOR PULSE WIDTH (SA901) ONLY	.4 MS

Figure 1.6 Data Format



SA900 RECORDING FORMAT USING INDEX RECORDING

Figure 1.7 Index Recording Format



IBM TRACK FORMAT USED WITH THE SA900

Figure 1.8 IBM Track Format

1.1.5 Read Operation

Reading data from the SA900/901 Diskette Storage drive is accomplished by activating the "Head Load" line and having "Write Gate" inactive. The timing relationships required to initiate a read sequenced are shown in Figure 1.11.

These timing specifications are required in order to guarantee that the R/W head position has stabilized prior to reading.

Once reading has commenced, the two interface lines, Separated Data and Separated Clock provide the read data. The timing of the read signals, Separated Data, and Separated Clock are shown in Figure 1.12.

1.1.6 Write Operation

In order to write data on the SA900/901 Diskette Storage drive, certain timing relationships must be assured. These timing requirements are required to:

1. Avoid destroying data due to a hardware failure or the position of the R/W head has not stabilized.

These timing requirements are defined in Figure 1.13.

In order to ensure that a hardware failure or operator interference does not cause the unintentional loss of data, data safety circuitry is provided. If the data safety circuitry detects an undesirable condition within the drive a latch is set, writing is inhibited, and the signal File Inoperable is sent to the user. File Inoperable is defined by:

$$\begin{aligned}\text{File Inoperable} = &(\text{Write Gate} \cdot \overline{\text{Write I Sense}}) \\ &+ (\overline{\text{Write Gate}} \cdot \text{Write I Sense}) \\ &+ (\text{Write Gate} \cdot \overline{\text{Head Load}}) \\ &+ (\text{Write Gate} \cdot \overline{\text{Door Closed}})\end{aligned}$$

1.1.7 Power Sequencing

Applying AC and DC power to the SA900/901 can be done in any sequence, however, once AC power has been applied, a 2 second delay must be introduced before any Read or Write operation is attempted. This delay is for stabilization of the Diskette rotational speed. Also, initial position of the R/W head with respect to data tracks is indeterminant immediately after application of DC power. In order to assure proper positioning of the R/W head prior to any read/write operation, a Step Out operation should be performed until the Track 00 indicator becomes active.

The Head Load signal can be applied any time after DC power has been applied, however, the signal must be true for a minimum of 50 ms prior to a read or write operation.

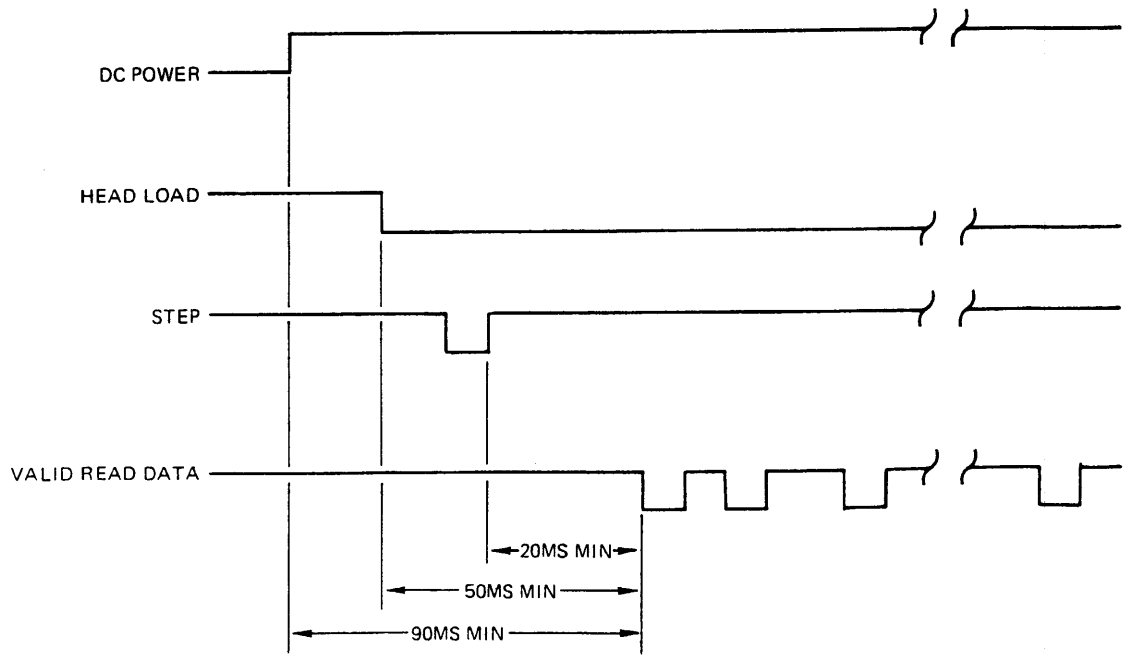


Figure 1.11 Read Initiate Timing

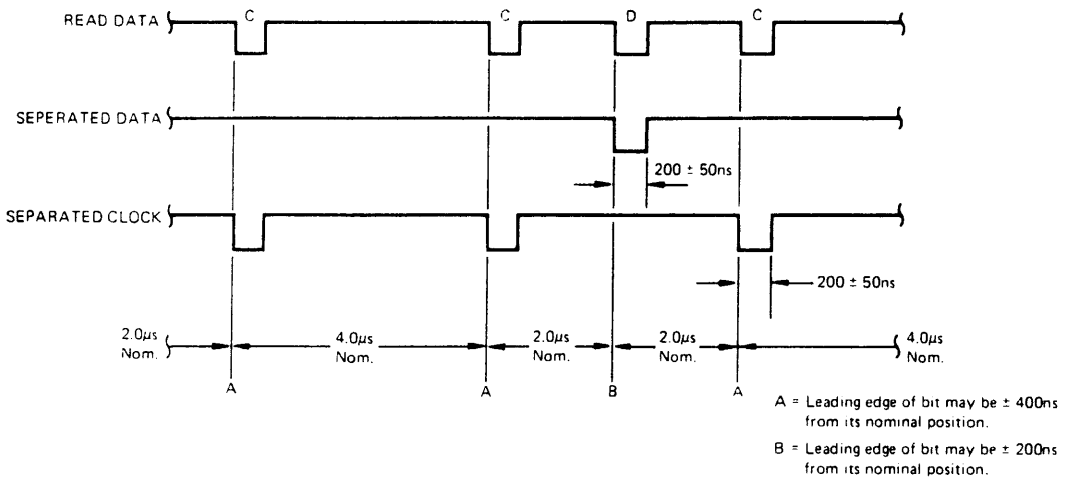
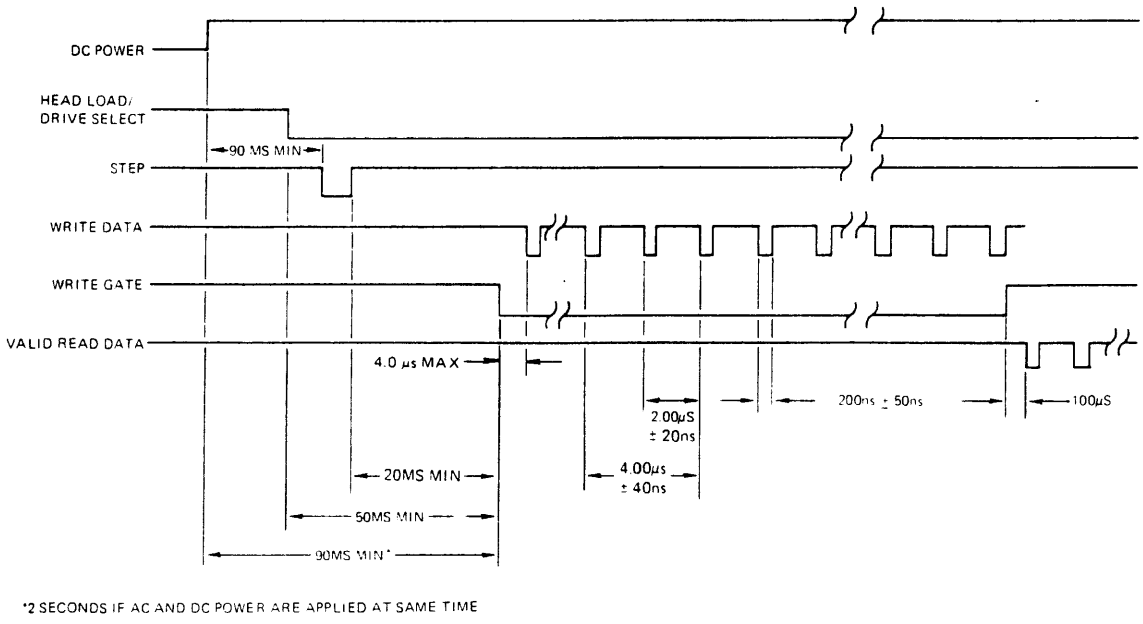


Figure 1.12 Read Signal Timing



*2 SECONDS IF AC AND DC POWER ARE APPLIED AT SAME TIME

Figure 1.13 Write Initiate Timing

1.2 ELECTRICAL INTERFACE

The interface of the SA900/901 Diskette drive can be divided into two categories: Signal and Power. The following sections provide the electrical definition for each line.

1.2.1 Signal Interface

The signal interface consists of the lines required to control the SA900/901 Diskette Storage drive and transfer data to and from the unit. All lines in the signal interface are digital in nature and either provide signals to the drive (input) or provide signals to the user (output).

There are seven (7) input signal lines to the SA900/901 Diskette Storage drive; each line has the following input specifications, except as noted.

V_{in} OV-.4V = logical zero = true = active

V_{in} 2.5V-5.5V = logical one = false = inactive

Input Impedence = 150Ω

There are seven (7) output signal lines from the SA900 Disk Storage Drive, and nine (9) from the SA901. Each line has the following output specifications:

V_{out} = ∪√-.4 logical zero = true = active

Each output line appears as an open circuit (transistor in cut-off) for the logical onelevel. (False = inactive)

Maximum sink current = 55ma., except as noted.

1.2.1.1 Direction Select

This interface signal defines the direction of motion of the R/W head when the Step line is pulsed. An open circuit or logical one level defines the direction as out and if a pulse is applied to the Step line the R/W head will move away from the center of the disk. Conversely, if this input is shorted to ground or a logical zero level is applied the direction of motion is defined as in and if a pulse is applied to the Step line the R/W head will move towards the center of the disk.

1.2.1.2 Step

This interface line is a control signal which causes the R/W head to move with the direction of motion defined by the Direction Select line. The access motion is initiated on each logical zero to logical one transition of this signal. The timing restrictions on this signal are shown in Figure 1.10

1.2.1.3 Head Load/Drive Select 1

This interface line performs two functions. One function is to remove the 24 volts from the stepper motor which will allow the motor to run cooler. This means that in order to step, the Head Load line must be a logical 0 level. This function can be disabled by cutting a trace on the PCB. Then 24 volts will be applied to the stepper at all times. This trace has been labeled "R" for easy identification.

It also is a control signal to an actuator that allows the disk to be moved into contact with the R/W head before a Read/Write operation. An open circuit or logical one deactivates the head load actuator and causes a bail to lift the pressure pad from the disk, which removes the load from the disk and R/W head. A logical zero level on this signal activates the head load actuator and allows the pressure pad to bring the disk into contact with the R/W head with the proper contact pressure. Also, see Multiplex Interface, for Drive Select 1 usage.

1.2.1.4 File Inoperable Reset

This interface line provides a direct reset on the File Inoperable latch. The inactive level for this signal is a logical one. The File Inoperable condition is reset with a logical zero level applied to this line.

NOTE: Under no circumstances should the drive be operated with this signal at a constant logical zero level since all data safety circuitry will be defeated.

1.2.1.5 Write Gate

Write Gate is an interface line which controls the writing of data on the disk. A logical one level on this interface line turns off the current source to the write drivers along with the current sinks for the write current. A logical zero level on this line enables the write current source and current sinks, and disables the stepping circuitry.

1.2.1.6 Write Data

This interface line provides the data to be written on the disk and each transition from the logical one level to logical zero level causes the current through the R/W head to be reversed. Input impedance for Write Data = 150Ω.

1.2.1.7 Drive Select 2

For this line, see Multiplex Interface, paragraph 1.2.3

1.2.1.8 Index

This interface signal is provided by the disk drive once each revolution (166.67 ms) to indicate the beginning of the track. Normally, this signal is a logical one level and makes the transition to the logical zero level for a period of 1.7 ms (.4 ms SA901) once each revolution. The timing of this signal is shown in Figure 1.14

1.2.1.9 Track 00

The Track 00 interface signal indicates when the R/W head is positioned at track zero (the outer most data track) and the access circuitry is driving current through phase one of the stepping motor (Head Load signal true). This signal is at a logical one level when the R/W head is not at track zero and is at a logical zero level when the R/W head is at track zero.

1.2.1.10 File Inoperable

File Inoperable is the output of the data safety circuitry and is at a logical zero level when a condition which jeopardizes data integrity has occured. Logically, the signal is defined as follows:

$$\begin{aligned}\text{File Inoperable} = &(\text{Write Gate} \cdot \overline{\text{Write I Sense}}) \\ &+ (\overline{\text{Write Gate}} \cdot \text{Write I Sense}) \\ &+ (\text{Write Gate} \cdot \overline{\text{Head Load}}) \\ &+ (\text{Write Gate} \cdot \overline{\text{Door Closed}})\end{aligned}$$

1.2.1.11 Sector (SA901 Only)

This interface signal is provided by the disk drive 32 times each revolution. Normally, this signal is a logical one level and makes the transition to the logical zero level for a period of .4 ms 32 times each revolution. The timing of this signal is shown in Figure 1.15.

1.2.1.12 Write Protect

(Standard on 901 – Optional on 900)

This interface signal is provided by the disk drive to allow the user an indication when a write protected diskette is installed. The signal is a logical one level when the diskette is not protected and a logical zero when it is protected.

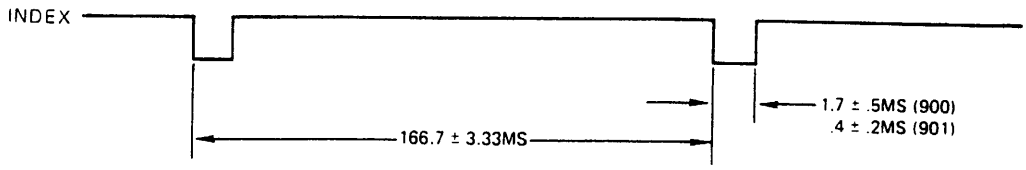


Figure 1.14 Index Timing

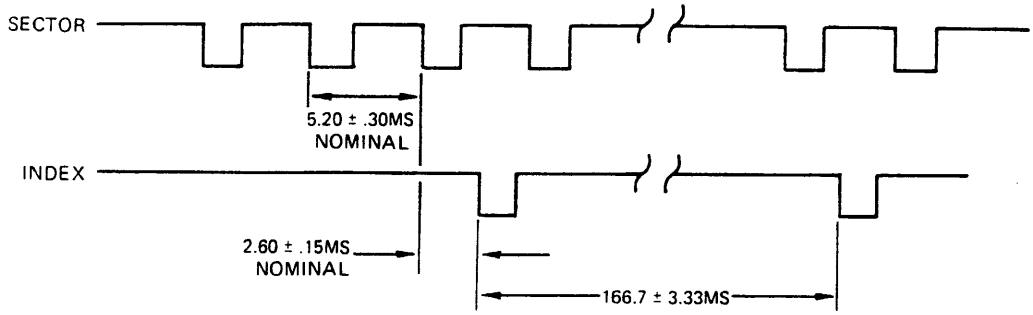


Figure 1.15 Index/Sector Timing

1.2.1.13 Separated Data

Separated Data is the interface line over which read data is sent to the using system. The frequency modulated signal written on the disk is demodulated by the drive electronics and the data pulses are sent to the using system over this interface line. Normally, this signal is a logical one level and each data bit recorded on the disc causes a transition to the logical zero level for 200 ns. The timing for this signal is shown in Figure 1.12. Maximum sink current = 100 ma.

1.2.1.14 Separated Clock

The Separated Clock interface line provides the using system the clock bits recorded on the disk in frequency modulation recording. The levels and timing are identical to the Separated Data line except that a separated clock pulse occurs each 4μs, instead of in multiples of 4μs. Maximum sink current = 100 ma.

1.2.1.15 Read Data

The Unseparated Read Data interface line provides raw data (clock and data bits together) to the using system that requires it. The levels and timing for this signal are shown in Figure 1.12. Maximum sink current = 100 ma.

NOTE: The "Separated Data," Separated Clock and "Unseparated Read Data" signals are not valid for 100μs following turnoff of "Write Gate." See Figure 1.13.

1.2.1.16 Ready

This interface signal is provided to indicate to the user that a diskette is installed properly, the door is closed, and that two index or sector pulses have been detected (diskette is turning). This signal is at a logical one level when not ready and is at a logical zero level when ready.

1.2.2 Power Interface

The SA900/901 Diskette Storage Drive requires both AC and DC power for operation; the AC power is used for the drive motor while the DC power is used for the electronics and stepping motor. The power requirements are defined in the following sections.

1.2.2.1 AC Power

110 ± 10% VAC @ .75A MAX.

50/60 ± .5 Hz single phase

1.2.2.2 DC Power

+5 ± 0.25 VDC @ 1.5A max. 50 mV ripple

-5 ± 0.25 VDC @ .20A max. 50 mV ripple

+24 ± 1.20 VDC @ 2.0A max. 100 mV ripple

1.2.2.3 DC Power Options (-5 VDC Replacement)

-12 to -15 VDC ± 1V @ .20A. max. 50 mV ripple (Cut trace "L").

The PCB has been designed to accept a six circuit amp printed circuit board pin header assembly Amp P/N 1-380999-0 which mates with

socket housing Amp P/N 1-480270-0 and socket P/N 60619-1. This connector will allow the user to bring the DC power to the drive in a cable separate from the signal cable. Both connectors are user installed.

1.2.3 Multiplex Interface

The multiplex interface is a user installed feature of the SA900/901. This feature gives the design engineer the capability of interfacing two or more drives together on one interface cable.

There is a point on the PCB that if jumpered (Jumper "E") converts the Head Load line, pin L18, into Drive Select 1 line. With this jumper installed, only the drive with a low level on pin L18 will respond or output to the Control Unit (Interface lines). This will allow all interface lines to be wire "ORED" on the cable from drive to drive with the exception of Drive Select 1 (Head Load, L18). Each drive should have its own Drive Select 1 line from the Control Unit. Since the inputs to the PCB's are all terminated, traces have been provided that will remove the terminations if cut. The traces are labeled as follows:

Trace "F" Write Data Termination

Trace "G" File Inop Reset Termination

Trace "H" Write Gate Termination

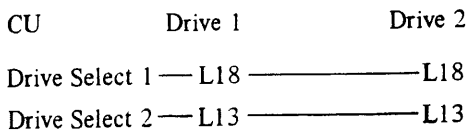
Trace "J" Direction Select Termination

Trace "K" Step Termination

The last drive on the interface must be terminated or the user may elect to terminate the five affected lines externally, thereby maintaining uniformaty in the drive PCB's, i.e. all traces cut the same.

For the user who is using only two drives "Drive Select 2" pin L13 has been provided. There are two ways to use this line.

1. As shipped from the factory it is open and makes no connection. Pin L18 "Head Load" or "Drive Select 1," goes through trace "A" and selects the drive. If trace "A" is cut and jumper "B" is installed pin L13 "Drive Select 2" does the function of drive select. This will allow the user to have a one to one cable from the control unit to drive one to drive two.

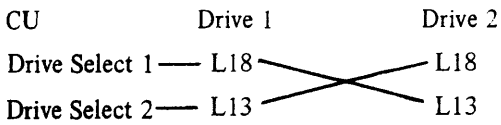


Traces cut or jumpers installed for each drive would be as follows:

	Drive 1	Drive 2
Trace "A"	shorted	cut
Jumper "B"	open	installed
Jumper "E"	installed	installed
Trace "F"	cut	shorted*
Trace "G"	cut	shorted*
Trace "H"	cut	shorted*
Trace "J"	cut	shorted*
Trace "K"	cut	shorted

* If external termination is provided this trace can be cut.

2. If a one to one cable is not required, the drive select lines could rotate as they go from drive to drive.



This would allow both drives to be alike except one is terminated and the other one is not. If the user provided his own termination for the five interface lines, then both drives would be identical.

Traces cut or jumpers installed for each drive would be as follows:

	Drive 1	Drive 2
Trace "A"	shorted	shorted
Jumper "B"	open	open
Jumper "E"	installed	installed
Trace "F"	cut	shorted*
Trace "G"	cut	shorted*
Trace "H"	cut	shorted*
Trace "J"	cut	shorted*
Trace "K"	cut	shorted*

* If external termination is provided this trace can be cut.

A typical multiplexed system is illustrated in Figure 1.16.

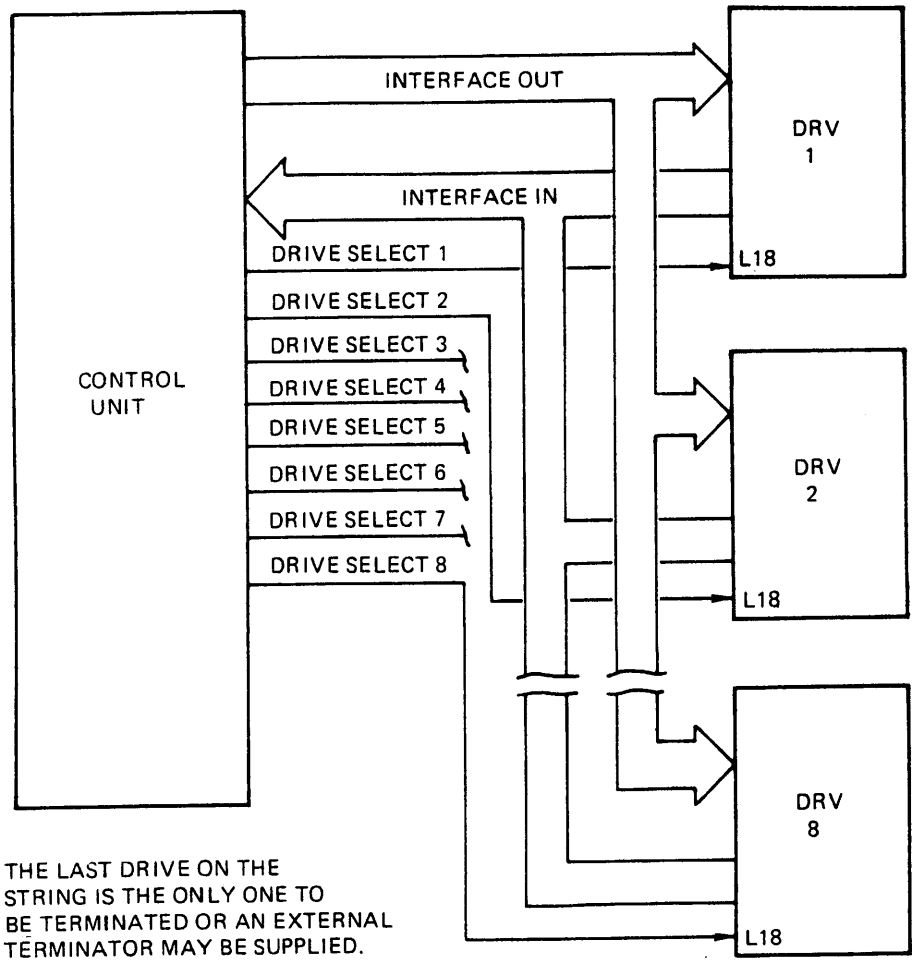


Figure 1.16 Typical Multiplexed System

1.2.3.1 Radial Interrupt Feature

When utilizing the Multiplex Interface feature (Jumper "E" installed), the Radial Interrupt feature will allow the user to monitor the Ready state of each drive on the interface. This can be used to detect when an operator has removed or installed a diskette in any drive. Cutting Trace "M" on the PCB will activate this feature by allowing the Ready line to be present on the interface at all times; i.e. normally, Ready is only presented when the drive is selected. This feature requires a Ready line from each drive to the control unit.

1.2.3.2 Radial Rotational Position Sensing Feature

When the Multiplex feature is active (Jumper "E" installed) on the SA901 the user may find it desirable to monitor sector and index at all times so that he may select the drive just prior to the sector which he wishes to process. To do this, Trace "S" on the PCB must be cut and a line from each drive to the control unit for both sector and index. Used properly, this feature can reduce average latency time to about 55 Msec.

1.2.3.3 Radial Head Load Feature

When the Multiplex feature is active (Jumper "E" installed), the head is loaded when the drive is selected, pin L18 active. The Radial Head Load feature allows the user to load the head without selecting the drive. This is accomplished by connecting Jumper "B", cutting Trace "C" and connecting Jumper "D". The Head Load (L18) and Drive Select (L13) interface lines must come to each drive from the control unit. The drive will only be selected if both Head Load (L18) and Drive Select (L13) are active (low level). Use of this feature will eliminate the 50 Msec head settling delay in disk to disk copy operations.

1.2.3.4 Select Drive Independent of Head Load

When the Multiplex Feature is active (Jumper "E" installed), the head is loaded when the drive is selected. This customer installable option allows the user to select the drive or load the head independent of each other. To install, cut traces "C" and "Y" and jumper traces "B", "D", and "X". To select the drive, activate –Drive Select line, pin L13. To load the R/W head, activate the –Head Load line pin L18. This option is only available on drives with PCB 2500X–6 or above.

1.2.3.5 Enable Stepper Power With Drive Select

When the Multiplex feature is active (Jumper "E" installed), and the user has installed the option of paragraph 1.2.3.4, stepper power is applied when the head is loaded. This customer installable option allows the user to apply stepper power when drive select is active so as to be able to access the R/W head without the head being loaded. To install, cut trace "R" and connect trace "DS". This option is only available on drives with PCB 2500X–6 or above.

1.3 PHYSICAL SPECIFICATIONS

1.3.1 Dimensions

The overall dimensions of the SA900/901 Disk Storage drive are: (See Figure 1.18.)

Height:	10.0 or 11.0 inches
Width:	5¼ inches
Depth:	14¼ inches
Weight:	15 pounds

1.3.2 Environment

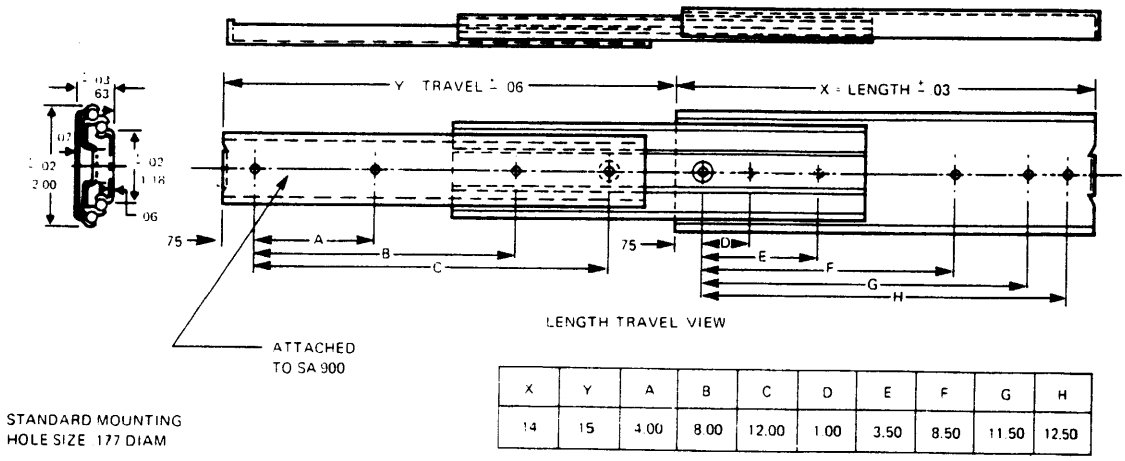
Temperature:	50°F to 100°F
Relative Humidity:	20% to 80% with maximum wet bulb temperature of 78°F
Heat Dissipation:	275 BTU/Hour

1.3.3 Mounting Dimensions

Reference Figure 1.20.

1.3.3.1 Chassis Slide

Reference Figure 1.17 for the mounting dimensions of the chassis slide.



X	Y	A	B	C	D	E	F	G	H
14	15	4.00	8.00	12.00	1.00	3.50	8.50	11.50	12.50

Figure 1.17 Slide Mounting Dimensions

1.3.4 MOUNTING RECOMMENDATIONS

The SA900/901 is capable of being mounted in one of the following positions:

1. Vertical–Door opening to the left or right.
2. Horizontal–Door opening up or down.
3. Upright–Door opening towards the front or rear.

1.3.4.1 Vertical Mounting

The drive, as shipped from the factory, is ready to be mounted in the vertical position, door opening left or right, without any adjustments.

1.3.4.2 Horizontal Mounting

If the drive is to be mounted horizontally with the door opening down (PCB up), the head load actuator return spring must be repositioned to compensate for gravity. Reference Figure 1.18 for the proper spring position on the actuator.

If the door is to open up (PCB down), it must be specified when ordering. This feature provides a heavier door opening spring. In addition, the head load actuator return spring will be repositioned to compensate for gravity. Reference Figure 1.18 for the proper position for the spring on the actuator.

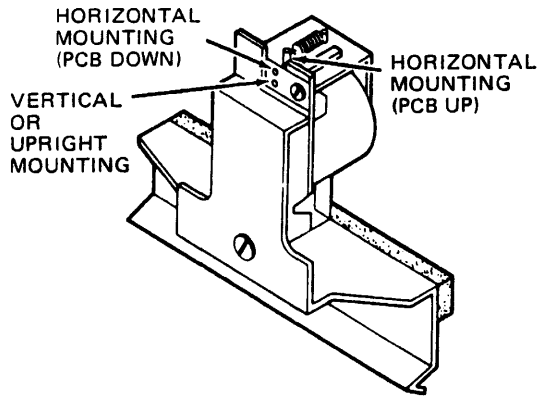


Figure 1.18 Head Load Actuator

1.3.4.3 Upright Mounting

If the drive is to be mounted in the upright position (IBM 3740 fashion), the spring hook attached to the eject mechanism must be removed and the eject spring attached to the place the spring hook was on.

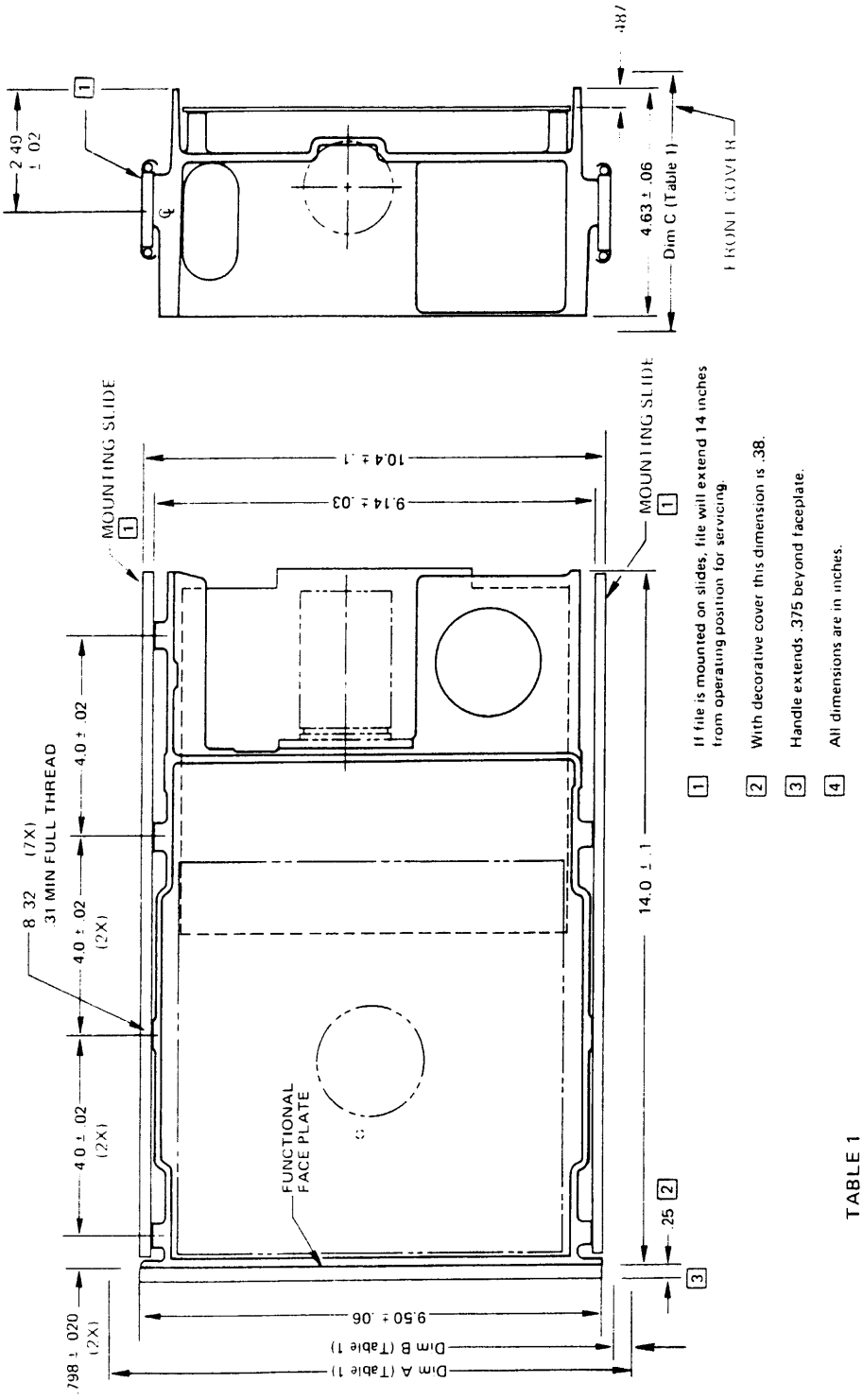


TABLE 1

Decorative Cover Dimensions.			
Cover Size	Dim A	Dim B	Dim C
4-5/8 x 10½	10.50	.240	4.62
5-1/4 x 10	10.00	.240	5.25
5-1/4 x 11	11.00	.740	5.25
Tolerance	±.03	±.030	±.03

Figure 1.20 SA 900/901 Diskette Storage Drive Dimensions

1.4 RELIABILITY SPECIFICATIONS

1.4.1 Read Error Rate

1×10^{9} bits read/soft error (nominal)

1×10^{12} bits read/hard error (nominal)

1.4.2 Seek Error Rate

1 seek error in 10^{6} seeks

1.5 INTERFACE DESCRIPTION

The electrical interface between the SA900/901 and the host system is via two connectors – the first connector (P1) provides for all signals and DC power for the diskette while the second connector (P4) provides for AC power and frame ground.

Connection to P1 is through a PCB edge card connector. The dimensions for this connector are shown in Figure 1.21. The pins are labeled L1 through L22 on one side of the PCB and R1 through R22 on the other side. Pin L1 is located on the component side of the PCB closest to the AC capacitor and is labeled L1. A key slot is provided between pins 6 and 7 to insure proper connector positioning.

The recommended connector for P1 is AMP Twin Leaf Printed Circuit Edge connector P/N583859-3 utilizing AMP contacts P/N 1-583616-1 and intercontact plug P/N583274-1. AC power and frame ground is provided for through a 3-circuit panel mount connector. The pin housing for the connector is mounted in the SA900/901 and is AMP P/N 1-480305-0 with AMP pins P/N 60620-1. The user should use AMP socket P/N 1-480304-0 with AMP pins P/N 60619-1.

Figure 1.22 shows the total interconnection of the SA900/901 with the host system.

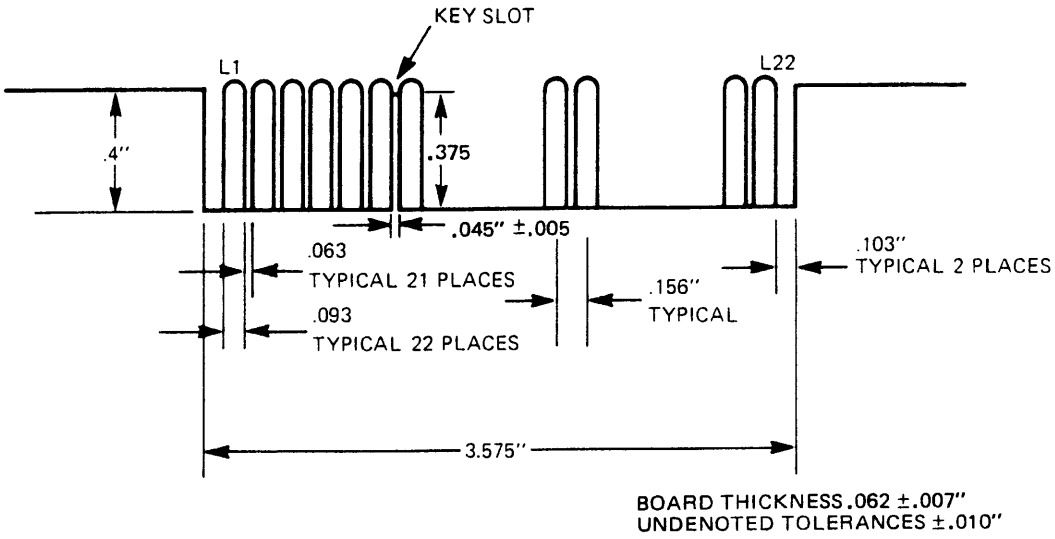


Figure 1.21 Connector Dimensions

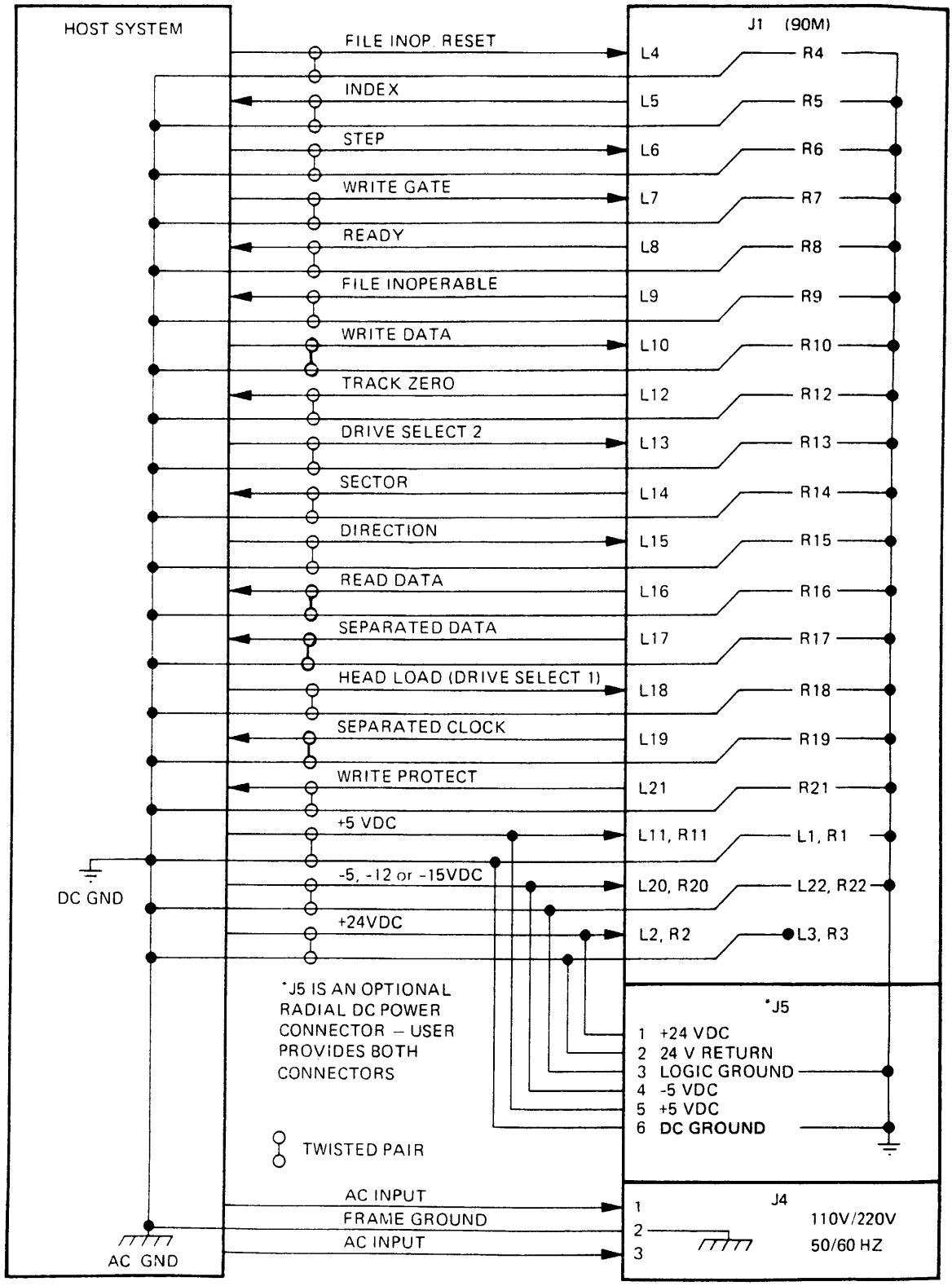


Figure 1.22 Interface Lines

1.6 INTERFACE CIRCUITRY

Shugart Associates provides interface circuitry to connect the SA900/901 with the host system via lines with 150 ohms characteristic impedance. The drivers and receivers are divided into two categories - those lines carrying data and those lines carrying control information.

The following two sections describe the circuitry recommended for interfacing the SA900/901 with the host system.

1.6.1 Data Line Driver

The line drivers for these interface signals must be capable of sinking 55 ma. in the logical true state with the maximum voltage in this state no greater than .3 volts with respect to logic ground. When the line driver is in the logical false state, the driver transistor is in cutoff and the voltage at the output of the driver should be no less than 3.0 volts with respect to logic ground.

1.6.2 Data Line Receiver

The line receiver consists of a standard 7400 family TTL gate with a termination resistor of 150Ω (±5%) to +5 volts.

Figure 1.23 shows the interface circuitry for the Read Data, Separated Data, Separated Clock, and Write Data interface lines.

1.6.3 Control Line Driver

The line driver for these signals consist of TTL 7438 devices. The driver must be able to sink a maximum of 48 ma. in the logical true state with a maximum voltage of .3 volts with respect to logic ground. When the line driver is in the logical false state the driver transistor is in cutoff and the collector cutoff current should be no greater than 10 nanoamperes.

1.6.4 Control Line Receiver

The line receiver consists of a standard 7400 family TTL gate with a termination resistor of 150Ω (±5%) to +5 volts. The input characteristics for

this receiver are:

Maximum logical true state voltage = .8V.
Minimum logical false state voltage = 2.0V.

NOTE: These are measured at the input to the receiver.

Figure 1.24 shows the interface circuitry for the control lines between the SA900/901 and the host system.

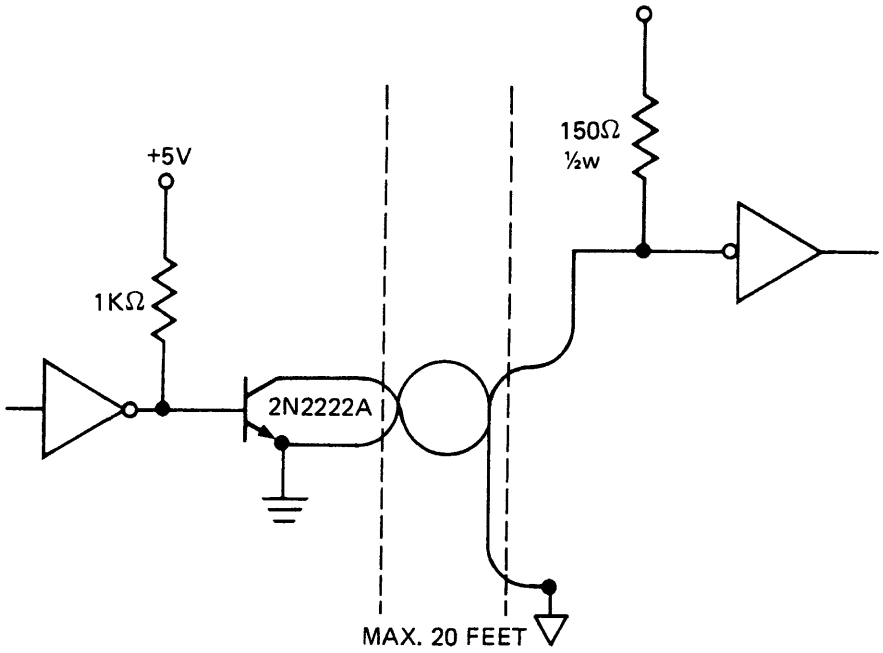


Figure 1.23 Data Line Driver/Receiver Combination

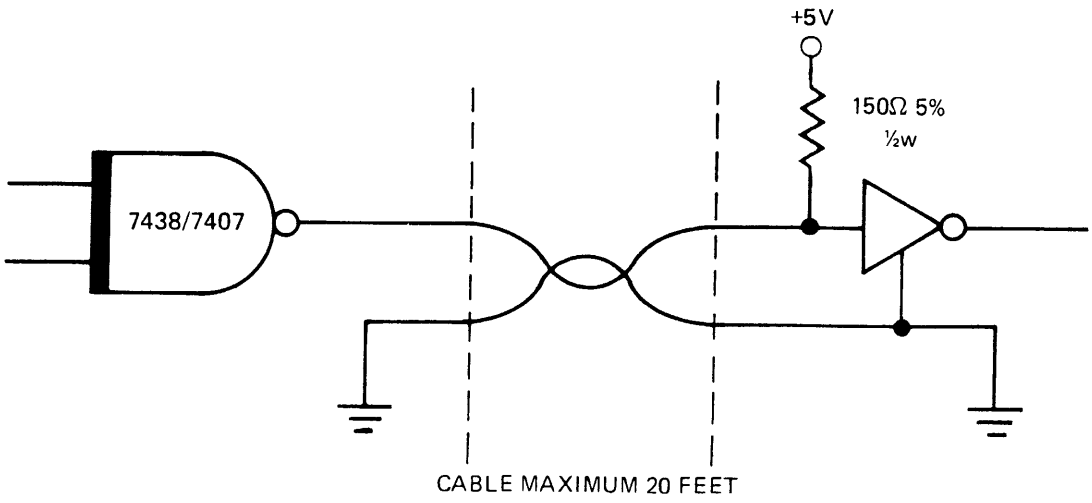


Figure 1.24 Control Signal Driver/Receiver Combination

1.7 OPERATION PROCEDURES

The SA900/901 was designed for ease of operator use to facilitate a wide range of operator oriented applications. The following section is a guide for the handling and error recovery procedures on the diskette and diskette drive.

1.7.1 Diskette Loading and Handling

The diskette is a flexible disk enclosed in a plastic jacket. The interior of the jacket is lined with a wiping material to clean the disk of foreign material. Figure 1.27 shows the proper method of loading a diskette in the SA900/901 Diskette Storage Drive. To load the diskette, depress latch, insert the diskette with the label facing out. (See Figure 1.27.) Move the latch handle to the left to lock diskette on drive spindle. The diskette can be loaded or unloaded with all power on and drive spindle rotating.

When removed from the drive, the diskette is stored in an envelope. To protect the diskette, the same care and handling procedures specified for computer magnetic tape apply. These precautionary procedures are as follows:

1. Return the diskette to its storage envelope whenever it is removed from file.
2. Keep cartridges away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the disk.
3. Replace storage envelopes when they become worn, cracked or distorted. Envelopes are designed to protect the disk.
4. Do not write on the plastic jacket with a lead pencil or ball-point pen. Use a felt tip pen.
5. Heat and contamination from a carelessly dropped ash can damage the disk.
6. Do not expose diskette to heat or sunlight.
7. Do not touch or attempt to clean the disk surface. Abrasions may cause loss of stored data.

1.7.2 SA100/101 Write Protect

The SA100/101 has the capability of being write protected. The write protect feature is selected by the notch in the jacket. When the notch is open it is protected; when covered, writing is allowed. The notch is closed by placing a tab over the front of the notch, and the tab folded over covering the rear of the notch. The Diskette can then be write protected by removing the tab. See Figure 1.25.

1.7.2.1 SA900 Write Protect (Optional)

The IBM Diskettes are not manufactured with a write protect notch punched out as are the SA100 and SA101 Diskettes. To Write-Protect one of these diskettes, a notch must be punched out as specified in Figure 1.26. The operation of the write protect is that which is outlined in paragraph 1.7.2.

1.7.3 Error Detection and Correction

1.7.3.1 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 disk should be considered defective and discarded.

1.7.3.2 Read Error

Most errors that occur will be "soft" errors; that is, by performing an error recovery procedure the data will be recovered.

Soft errors are usually caused by:

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

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.

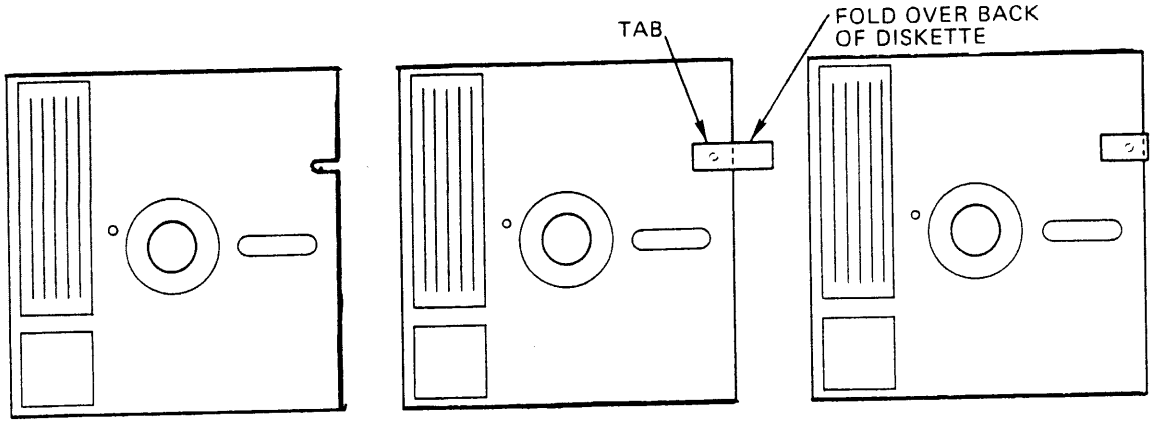


Figure 1.25 Diskette Write Protected

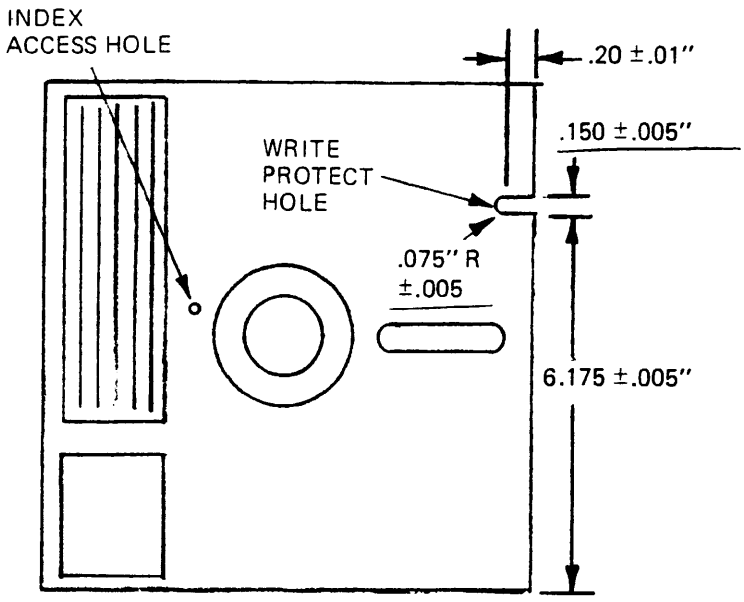


Figure 1.26 Write Protect Notch Specifications

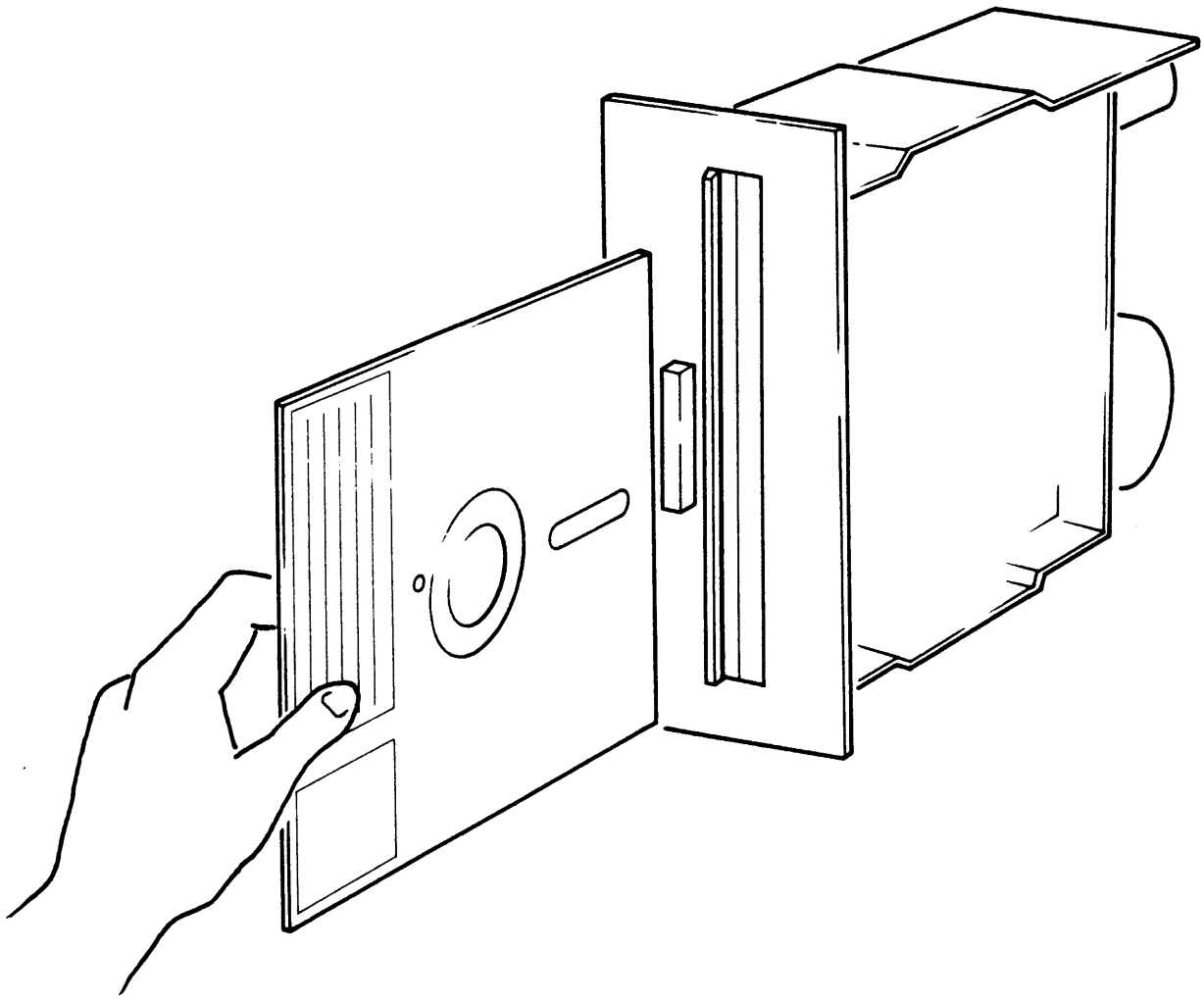


Figure 1.27 Loading SA900/901

SA900/901
Diskette Storage Drive

3.1 MAINTENANCE FEATURES

3.1.1 Alignment Diskette

The SA120 Alignment Diskette is used for alignment of the SA900/901/902. The following adjustments can be made using the SA120.

1. R/W Head radial alignment using track 38.
2. Index Photo-transistor alignment using tracks 01 and 76.
3. Track 00 is recorded with standard IBM 3740 format.

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 tests.

3.1.2 SA809 Exerciser

The SA809 Exerciser was designed as a piece of test equipment for the SA900/901 Diskette Drive. The Exerciser is capable of performing the following functions

1. Seek - Incremental or alternate tracks
2. Read
3. Write - 1F or 2F
4. Load Head
5. Recalibrate to track zero

The exerciser is provided with switches and indicators to perform the listed functions.

3.1.3 Special Tools

The following special tools are available for performing maintenance on the SA900/901/902.

Description	Part Number
Alignment Diskette	SA120
Cartridge Guide Adj. Tool	50377-0
Head Penetration Gauge	50380-0
Head Load Bail Gauge (old)	50383-0
Load Bail Gauge (new)	50391-0
Load Button Pliers	50933-0
Head Cable Extender (902)	50466-0
Drive Cable Extender (902)	50467-0
Extended Belt (902)	50464-0
Exerciser	50620-0
Spanner Wrench	50752-0

TABLE OF CONTENTS

3.2 DIAGNOSTIC TECHNIQUES

3.2.1 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.

3.2.2 "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.

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.

3.2.3 Write Error (Reference Figure 1B)

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 swapped 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.

3.2.4 Read Error (Reference Figure 1A)

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

3.2.5 Seek Error (Reference Figure 1C)

Stepper malfunction.

3.2.6 Index/Sector Error (Not Ready) (Reference Figure 1D)

Initial indiciation is usually a not ready.

3.2.7 Test Points – 900/901

TP 0 + Door Closed
1 Read Data Signal
2 Read Data Signal
3 Read Data (Differentiated)
4 Read Data (Differentiated)
5 Ground
6 Ground
7 + Power On Reset
9 [($\overline{\text{Head Load}}$ + $\overline{\text{Door Closed}}$) • Write Gate]
11 – Load Head
12 – Index and 901 Sector Pulses
13 + File Inop
15 + Write Gate • $\overline{\text{Write Protect}}$
16 + Read Data
21 – Data Window
24 – Data Window
25 + Write Protect
26 + TRK Ø
27 – STEP • $\overline{\text{WRITE GATE}}$
35 – Write Gate • $\overline{\text{File Inop}}$

3.2.8 Test Points – 902

TP 1 Read Data Signal
2 Read Data Signal
3 Read Data (Differentiated)
4 Read Data (Differentiated)
5 Ground
6 Ground
8 Ground
12 – Index
16 + Read Data
21 – Data Window
24 – Data Window
26 + Track Zero Drv 1
27 + Track Zero Drv 2

CAUTION

TURN POWER OFF BEFORE REMOVING DISKETTE DRIVE FROM USING SYSTEM AND/OR WHEN REMOVING PCB

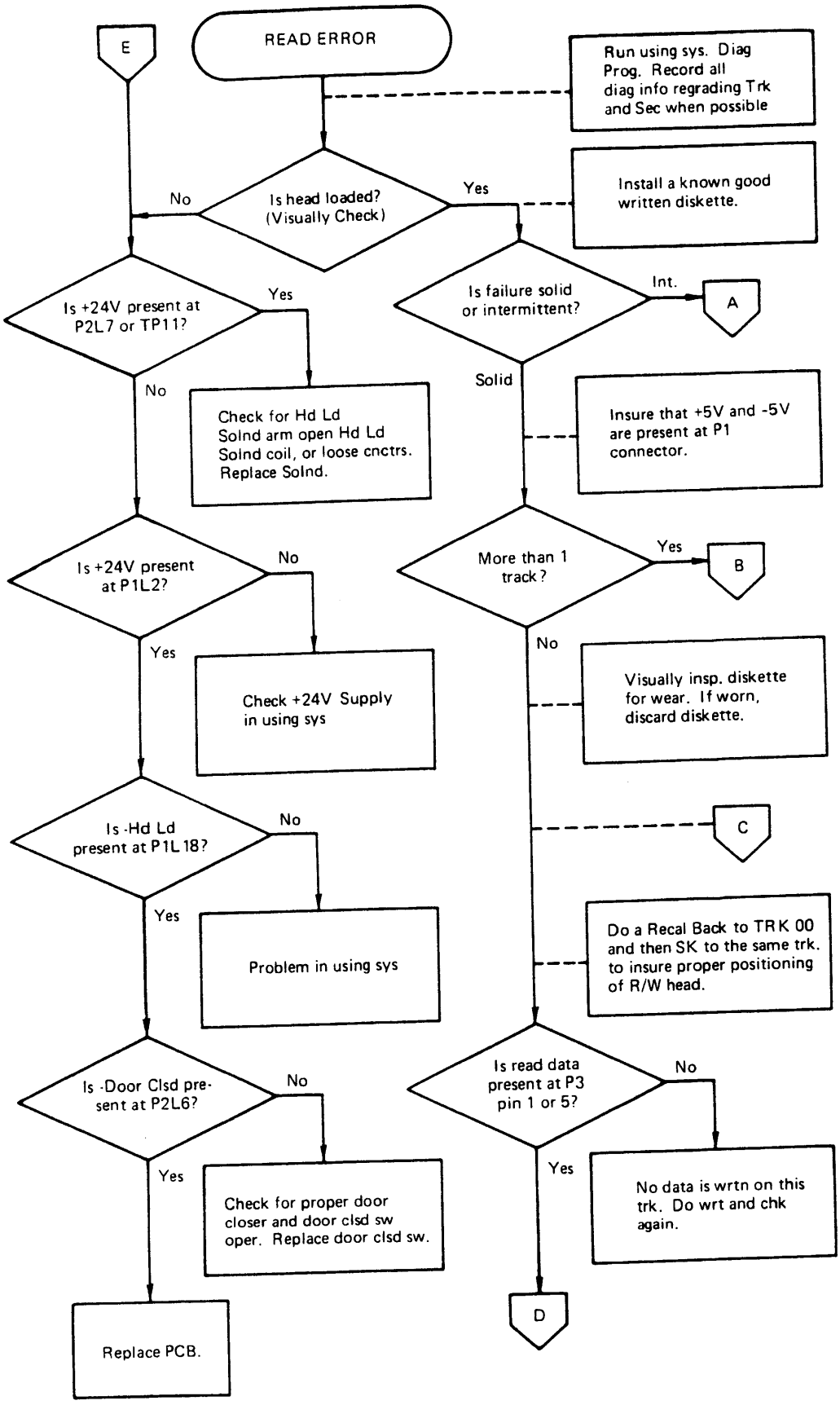

E
READ ERROR
Run using sys. Diag Prog. Record all diag info regrading Trk and Sec when possible
Is head loaded? (Visually Check)
No
Yes
Install a known good written diskette.
Is +24V present at P2L7 or TP11?
Yes
No
Check for Hd Ld Solnd arm open Hd Ld Solnd coil, or loose cnctrs. Replace Solnd.
Is failure solid or intermittent?
Int.
A
Solid
Insure that +5V and -5V are present at P1 connector.
Is +24V present at P1L2?
No
Yes
Check +24V Supply in using sys
More than 1 track?
Yes
B
No
Visually insp. diskette for wear. If worn, discard diskette.
Is -Hd Ld present at P1L18?
No
Yes
Problem in using sys
C
Do a Recal Back to TRK 00 and then SK to the same trk. to insure proper positioning of R/W head.
Is -Door Clsd present at P2L6?
No
Yes
Check for proper door closer and door clsd sw oper. Replace door clsd sw.
Is read data present at P3 pin 1 or 5?
No
Yes
No data is wrtn on this trk. Do wrt and chk again.
D
Replace PCB.

Figure 1A

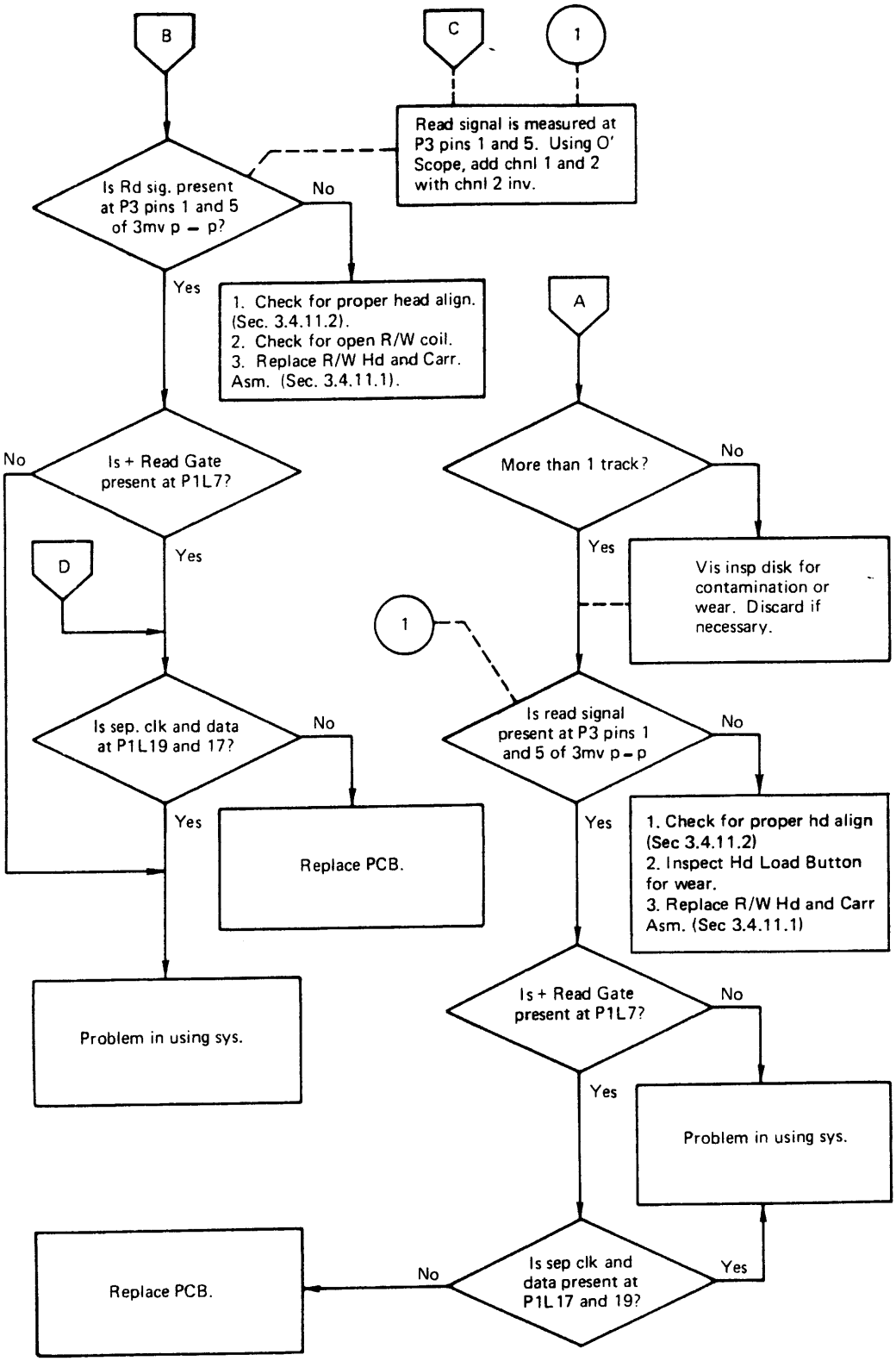


Figure 1A (Continued)

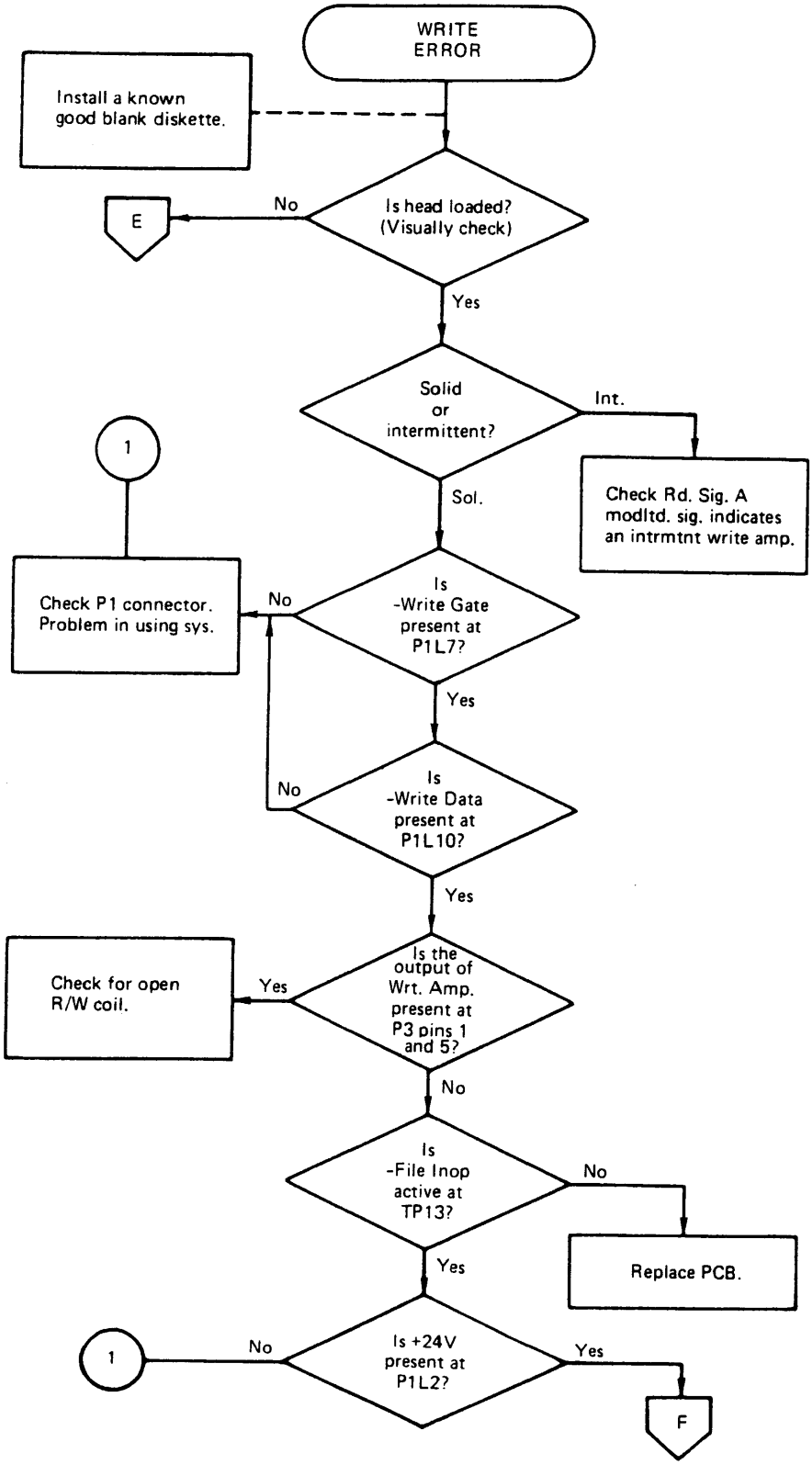

WRITE ERROR
Install a known good blank diskette.
Is head loaded? (Visually check)
No
E
Yes
Solid or intermittent?
Int.
Check Rd. Sig. A modltd. sig. indicates an intrmtnt write amp.
Sol.
1
Check P1 connector. Problem in using sys.
Is -Write Gate present at P1L7?
No
Yes
Is -Write Data present at P1L10?
No
Yes
Check for open R/W coil.
Yes
Is the output of Wrt. Amp. present at P3 pins 1 and 5?
No
Is -File Inop active at TP13?
No
Replace PCB.
Yes
1
No
Is +24V present at P1L2?
Yes
F

Figure 1B

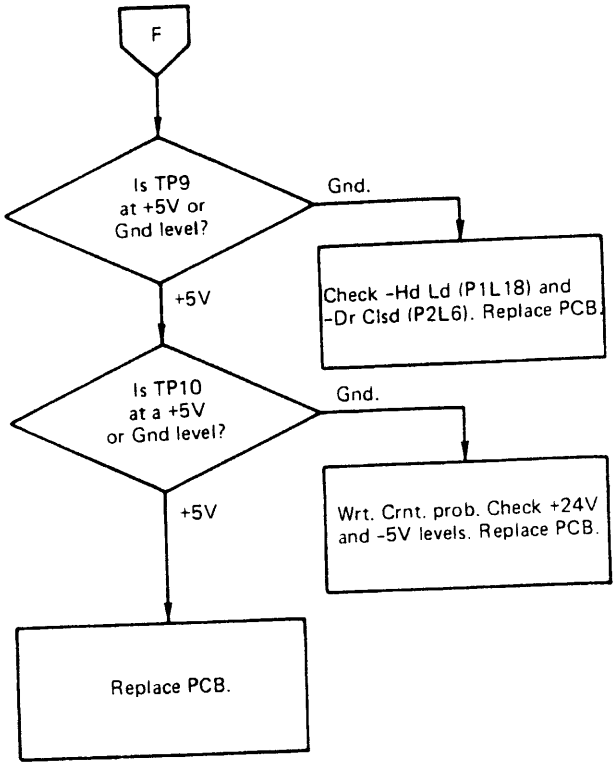


Figure 1B (Continued)

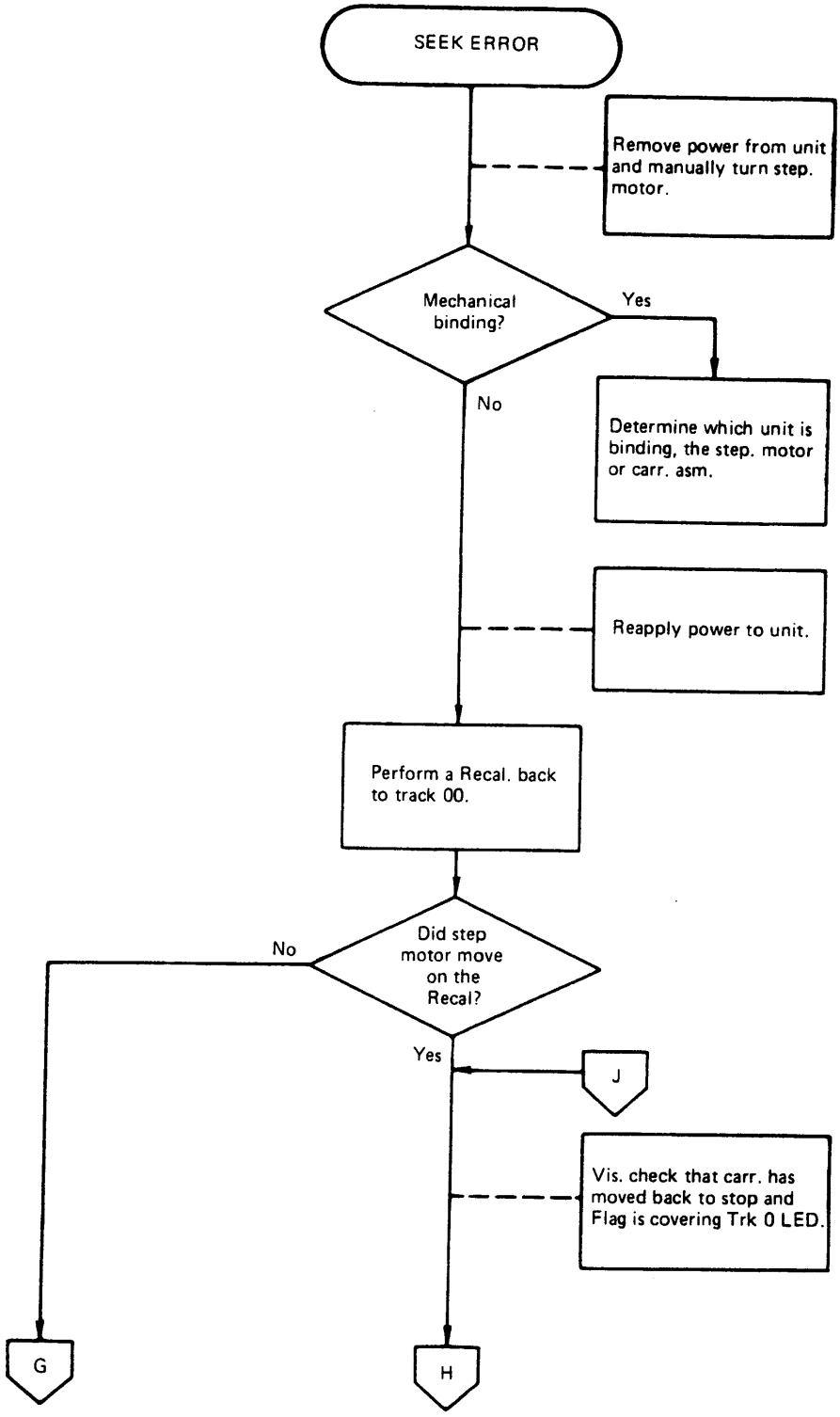

SEEK ERROR
Remove power from unit and manually turn step. motor.
Mechanical binding?
Yes
No
Determine which unit is binding, the step. motor or carr. asm.
Reapply power to unit.
Perform a Recal. back to track 00.
Did step motor move on the Recal?
No
Yes
J
Vis. check that carr. has moved back to stop and Flag is covering Trk 0 LED.
G
H

Figure 1C

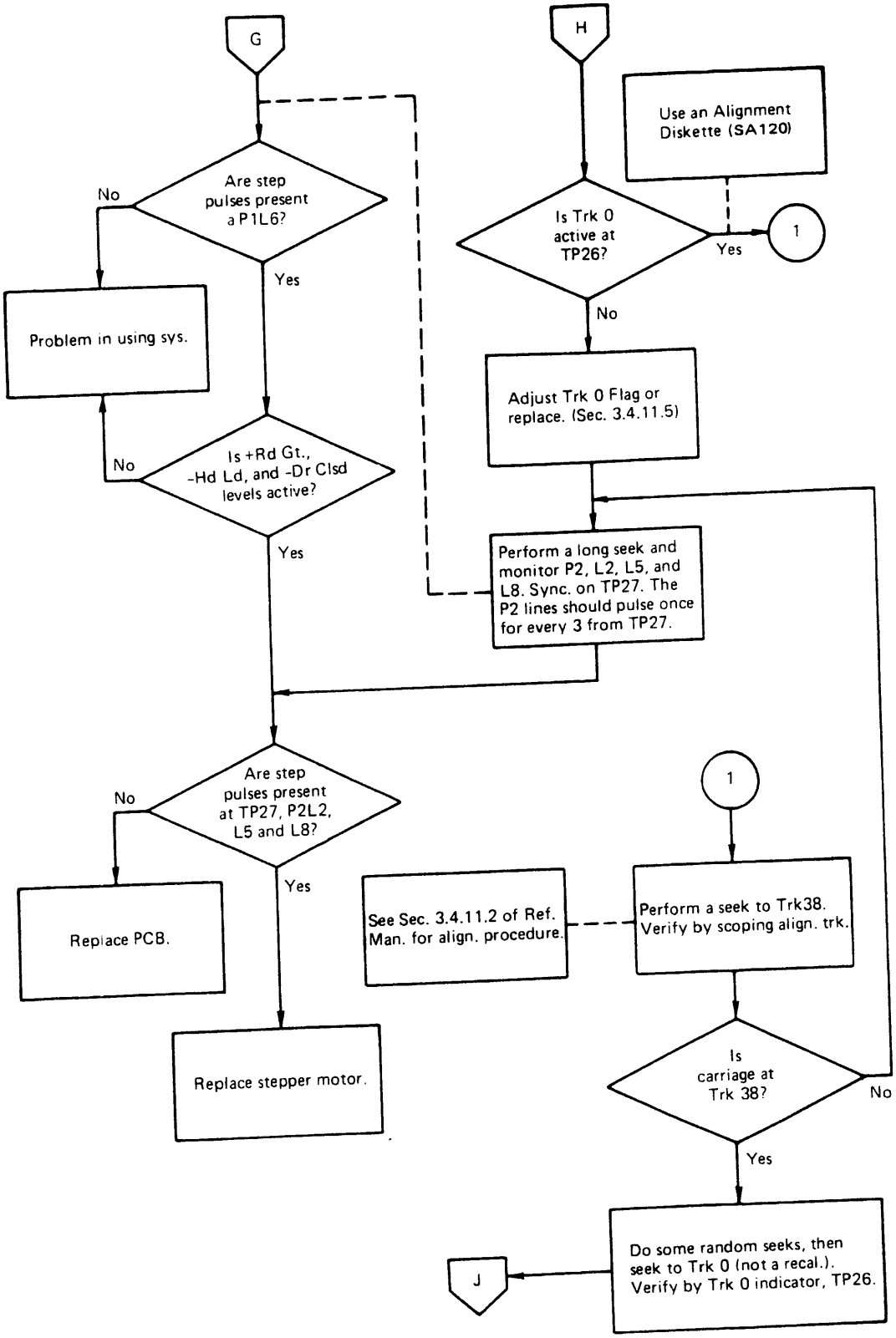


Figure 1C (Continued)

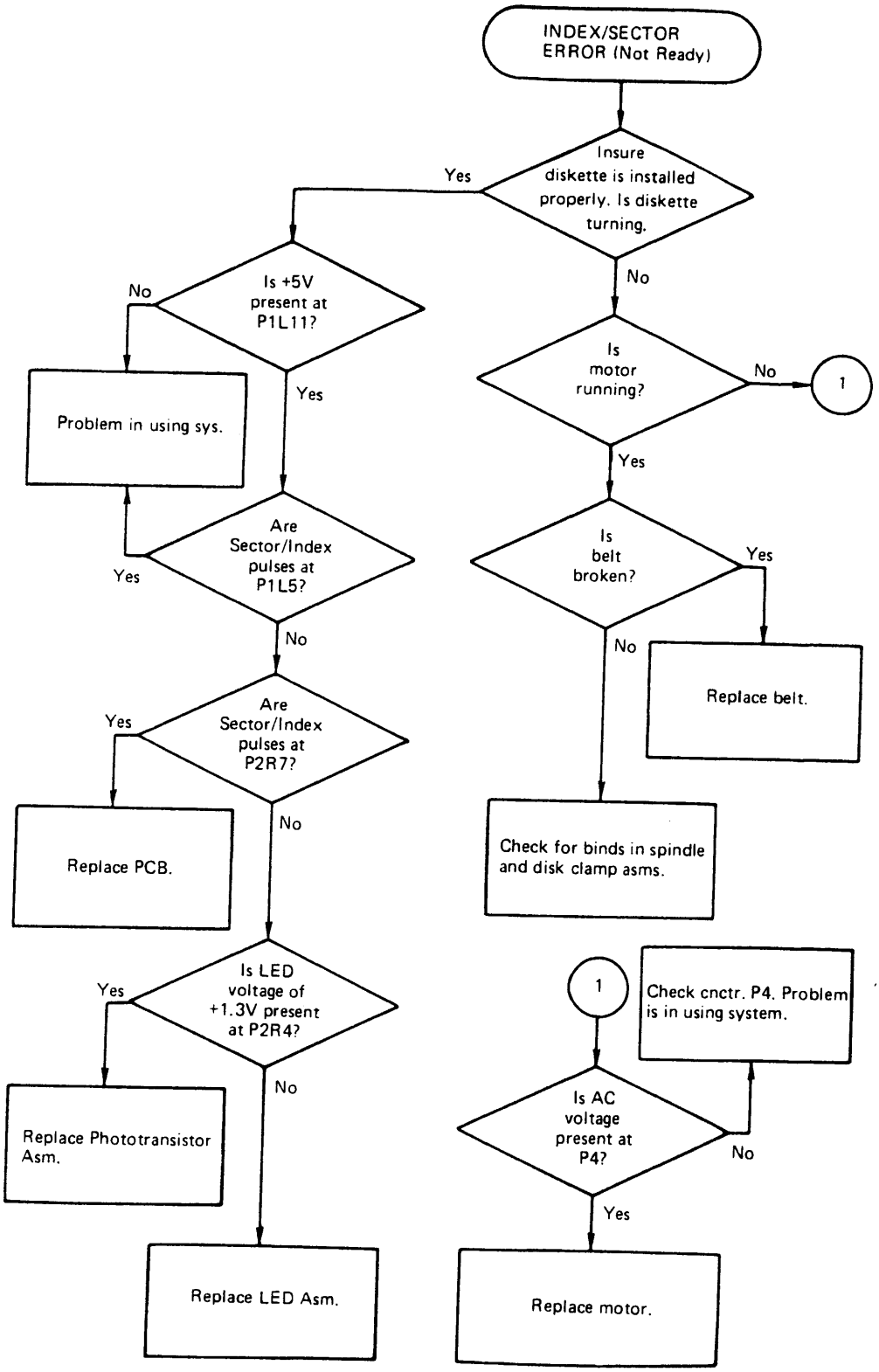

INDEX/SECTOR ERROR (Not Ready)
Insure diskette is installed properly. Is diskette turning.
Yes
No
Is +5V present at P1L11?
No
Yes
Problem in using sys.
Are Sector/Index pulses at P1L5?
Yes
No
Are Sector/Index pulses at P2R7?
Yes
No
Replace PCB.
Is LED voltage of +1.3V present at P2R4?
Yes
No
Replace Phototransistor Asm.
Replace LED Asm.
Is motor running?
No
1
Yes
Is belt broken?
Yes
No
Replace belt.
Check for binds in spindle and disk clamp asms.
1
Check cnctr. P4. Problem is in using system.
Is AC voltage present at P4?
No
Yes
Replace motor.

Figure 1D

3.3 PREVENTIVE MAINTENANCE

3.3.1 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.

3.3.2 Preventive Maintenance Procedures

Details of preventive maintenance operations are listed in Figure 2. During normal preventive maintenance, perform only those operations listed on the chart for that preventive maintenance period. Details on adjustments and service checks are found listed in the chart. Observe all safety procedures.

3.3.3 Cleanliness

Cleanliness cannot be overemphasized in maintaining the SA900/901. Do not lubricate the SA900/901; oil will allow dust and dirt to accumulate. The read/write head should be cleaned but 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 and scratches
R/W Head Load Button		Replace	
Stepper Motor and Lead Screw		Clean off all oil, dust, and dirt	Inspect for nicks and burrs
Belt			Frayed or weakened areas
Base		Clean base	Inspect for loose screws, connectors, and switches
Read/Write Head	Initially 3 Thereafter 12		Check for proper alignment

Fig 2 PM Procedures

3.4 REMOVALS, ADJUSTMENTS

For parts location, see Section 3.6.

3.4.1 Motor Drive

3.4.1.1 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.

3.4.1.2 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.

3.4.2 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.

3.4.3 Cartridge Guide Access

a. Remove side cover (Section 3.4.2).

b. Position head to approximate center of head load bail (to prevent load arm tab from slipping off end of bail).

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 3.4.9.2.

3.4.4 Light Emitting Diode Assembly: Removal and Installation

a. Remove side cover (Section 3.4.2).

b. Disconnect the wires to the LED terminals (solder joints).

c. Swing out the cartridge guide assembly (Section 3.4.3).

d. Remove the screw and nut holding the LED assembly to the cartridge guide.

e. Reverse the procedure for installation.

f. Check index timing and readjust if necessary.

3.4.5 Write Protect Dector: 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 3.4.2).

e. Swing out cartridge guide assembly (Section 3.4.3).

f. Remove screw holding the detector bracket and remove assembly.

g. 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).

3.4.5.1 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 P2L4.

c. Loosen screw on detector assembly and adjust until maximum amplitude is achieved. Tighten screw.

3.4.6 Head Load Actuator

3.4.6.1 Head Load Actuator: Removal and Installation

a. Remove side cover (Section 3.4.2).

b. Disconnect the wires to the actuator terminals (solder joints).

c. Swing out the cartridge to guide assembly (Section 3.4.3).

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.

3.4.6.2 Head Load Actuator Physical Adjustment (old style)

a. Remove side cover.

b. Step carriage to Track 00.

c. Energize coil either using tester or manually grounding pin L18 on connector P1.

d. Loosen bail screw on Head Load Bail.

e. Using Bail Gauge(p/n 50383), adjust bail so that Head Load Arm just touches shim. Tighten screw until just snug. Insure that load arm is over bail when carriage is at Track 00.

f. Step carriage to Track 76 and check that arm still just touches shim. (This will result in Head Load Bail to Head Load Arm clearance of .020"). Insure that load arm is over bail when carriage is at Track 76. Reference figures below.

g. Tighten Head Load Bail screw.

h. Replace side cover.

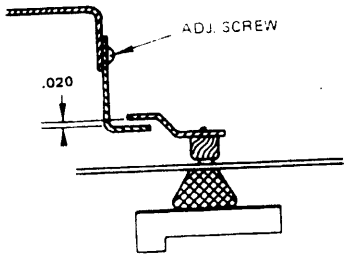


FIGURE 3 HEAD LOAD BAIL TO HEAD LOAD ARM ADJUSTMENT (OLD STYLE)

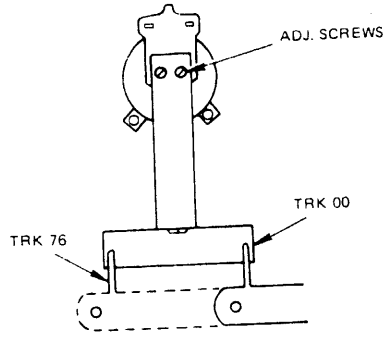


FIGURE 4 HEAD LOAD ACTUATOR LATERAL ALIGNMENT (OLD STYLE)

3.4.6.3 Head Load Actuator Physical Adjustment (new style)

a. Remove side cover.

b. Energize Head Load Coil by grounding TP11.

c. Place Head Load Actuator adjustment tool, P/N 50391, on platen.

d. Adjust down stop so as the top of Head Load Bail is flush with top of tool within ± .005" at track 76. Reference Figure 6.

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 within ±.005". Reference Figure 5.

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.

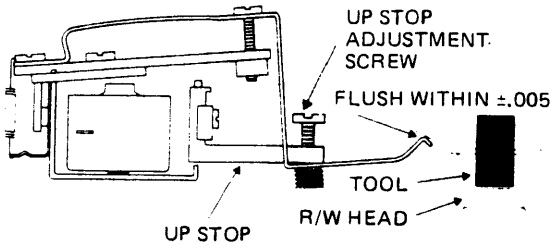


FIGURE 5 HEAD LOAD ACTUATOR UPSTOP ADJUSTMENT

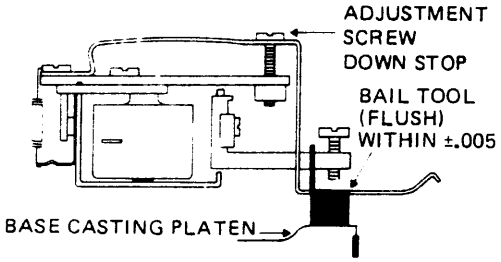


FIGURE 6 HEAD LOAD ACTUATOR DOWN STOP ADJUSTMENT

3.4.6.4 Head Load Actuator Timing

a. Insert Alignment Diskette (SA120)

b. Step carriage to Track 0.

c. Sync oscilloscope on TP11 (- Load Head). 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 solonoid and observe the read signal on the oscilloscope. The signal must be at 50% of full amplitude by 50Msec. Reference Figure 7.

f. If this is not met, continue on with the procedure.

g. Check adjustments outlined in paragraph 3.4.6.2 or 3.4.6.3.

h. If item 'g' is ok, adjust down stop screw (Figure 6) CW until timing is met. Note, not to exceed ¼ turn.

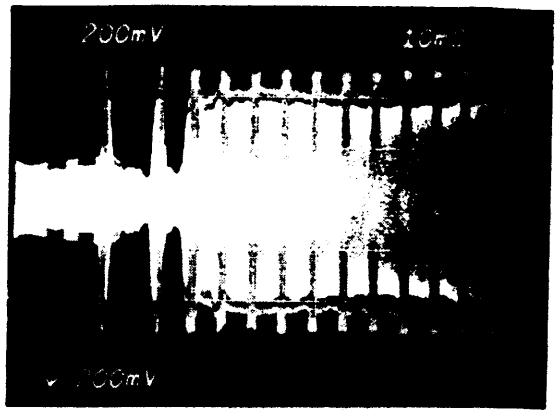


FIGURE 7 HEAD LOAD ACTUATOR TIMING

3.4.7 Index/Sector Photo Transistor Assembly

3.4.7.1 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. If replacing old style phototransistor assembly with new style (potentiometer on assembly), use Field Kit P/N 50928.

3.4.7.2 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. ±.5 msec. duration.

d. Continue adjustment in section 3.4.7.3.

3.4.7.3 Index/Sector Adjustment

a. Insert Alignment Diskette (SA120).

b. Step carriage to Track 1.

c. Sync oscilloscope on TP 12 (- Index). Set time base to 50 μsec/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. Channels 1 and 2 should be added and one of the channels inverted.

f. Observe the timing between the start of the sweep and the first data pulse. This should be 200 ± 100 μsec. If the timing is not within tolerance, continue on with the adjustment. Reference Figure 8.

g. Loosen the holding screw in the Index Transducer until the Transducer is just able to be moved.

h. Observing the timing, adjust the Transducer until the timing is 200 ± 50 μsec. Insure that the Transducer Assembly is against the registration surface on the base casting.

i. Tighten the holding screw.

j. Recheck the timing.

k. Seek to Track 76 and reverify that the timing is 200 ± 100 μsec.

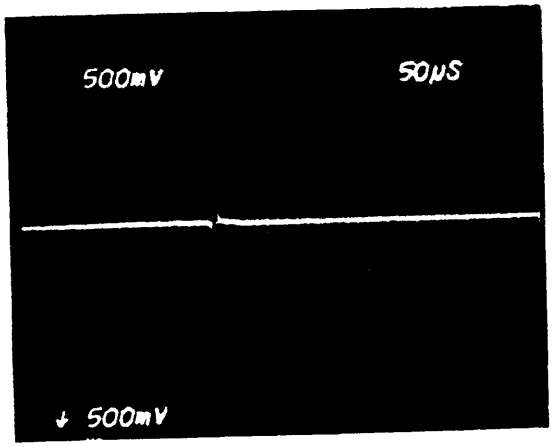


FIGURE 8 INDEX TIMING

3.4.8 Spindle Assembly

a. Remove side cover (Section 3.4.2).

b. Swing out cartridge guide (Section 3.4.3).

c. Remove the nut and washer holding the spindle pulley. Use spanner wrench, P/N 50572, 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.

3.4.9 Cartridge Guide

3.4.9.1 Cartridge Guide Removal

a. Perform steps 3.4.3 through 3.4.6.

b. Pull up on the upper pivot cap screw until the shoulder contacts the base casting. Push up on the cartridge guide until the lower pivot clears the casting.

NOTE: On some units a 'C' clip will have to be removed in place of lifting pivot screw. Figure 9.

c. Tilt the cartridge guide slightly, and remove it from the upper pivot.

d. To install the cartridge guide, reverse the procedure.

NOTE: When swinging cartridge guide in, insert a small screwdriver through the access slot and load the torsion spring. (Force the torsion spring roller toward the rear of the spring.)

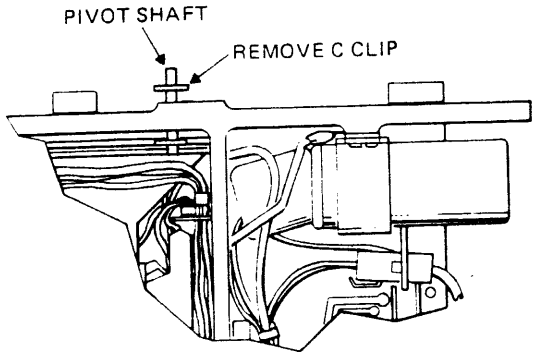


FIGURE 9 CARTRIDGE GUIDE REMOVAL

3.4.9.2 Cartridge Guide Adjustment

a. Insert the shoulder screw (tool p/n 50377) through the adjustment hole in the cartridge guide and screw completely into the base casting (hand tight). Reference Figure 10.

NOTE: Starting with drives manufactured in Dec. '73 the base casting has been machined in the adjustment hole area. This can be easily seen. On the machined castings the long shoulder (#2) should be used. On files where the casting was not machined the short shoulder (#1) should be used.

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.

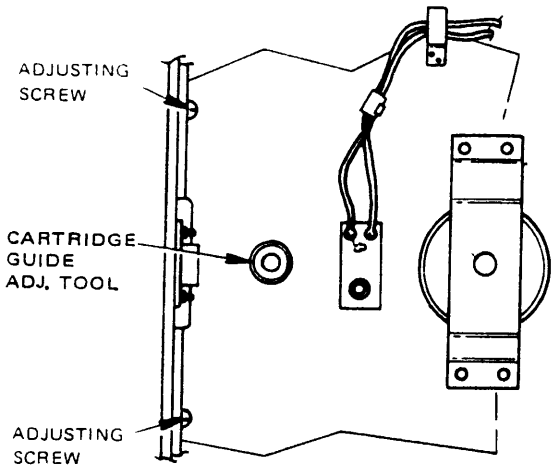


FIGURE 10 CARTRIDGE GUIDE ADJUSTMENT

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 3.4.7.3.

f. Insert diskette, close and open door, then check for proper operation.

3.4.10 Front Plate Assembly: Removal

a. Remove side cover (Section 3.4.2).

b. Swing out the cartridge guide assembly (Section 3.4.3).

c. Remove 4 screws holding the front plate assembly to the base casting.

d. Reverse the procedure for installation.

e. Insert the cartridge guide assembly per Sections 3.4.9.1 and .2.

3.4.11 Stepper/Carriage

3.4.11.1 Stepper/Carriage Assembly: Removal and Installation

a. Disconnect the connectors from PCB and remove PCB.

b. Remove cable clamp holding R/W head cable.

c. Remove side cover (Section 3.4.2).

d. Swing out cartridge guide (Section 3.4.3).

e. 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.

f. Loosen (3) motor clamp screws and rotate clamps to allow withdrawl of motor. On new production units, with redesigned stepper mounting clamp, loosen (2) screws and swing clamp down to allow withdrawl of motor.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

g. Remove cable clamp and spacer holding R/W head cable on cartridge guide side of unit. On new production units a grommet on the cable is inserted into a slot on the Track 0 Detector bracket.

h. To install stepper/carriage assembly reverse procedure. Note steps "i" and "j".

i If installing a new carriage, set the pre-load nut in the #3 notch. Reference figure 11.

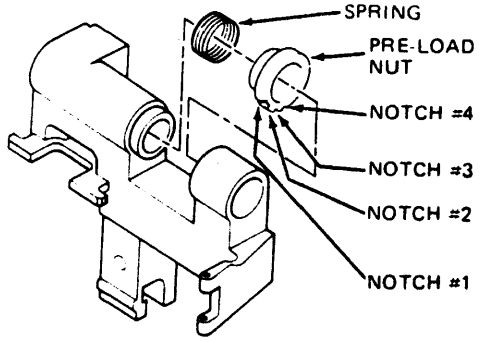
j. When threading lead screw into carriage assembly, press the pre-load nut slightly against spring in order to start thread. After threading, insure there is a gap between pre-load nut and rear of carriage.

k. Adjust index (Section 3.4, 7.3).

l. Adjust radial head alignment (Section 3.4.11.2).

m. Adjust Track 0 stop (Section 3.4.11.7/.8).

n. Adjust Track 0 flag (Section 3.4.11.9).



3.4.11.2 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 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 200 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 12.

f. Loosen the three mounting screws which hold the motor 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 ccw 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.

h. When the lobes are of equal amplitude, tighten the motor mounting screws. Reference Fig. 12.

i. Check the adjustment by stepping off track and returning. Check in both directions.

j. Whenever the Head Radial Alignment has been adjusted, the Track 00 detector adjustment (Section 3.4.11.9) and Track 00 step must be checked (Section 3.4.11.8)

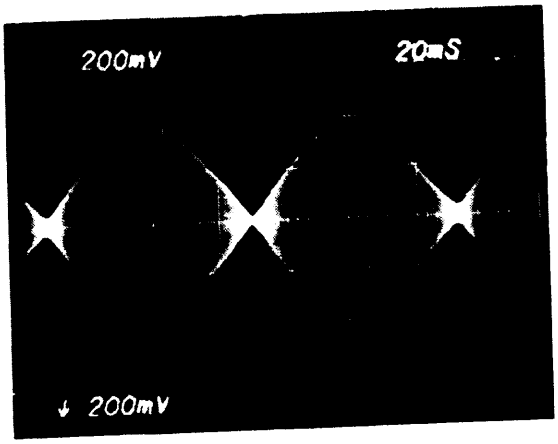


FIGURE 12 HEAD RADIAL ALIGNMENT

3.4.11.3 Read/Write Head Button: Removal and Installation

a. Remove side cover.

b. To remove the old button if glued on metal arm, open the arm, grasp the button with a pair of pliers and rotate the button. This breaks loose the button, and the button can be removed. Remove any glue that may remain by scraping.

c. To remove the old button on metal arm, if attached with a clip and washer, grasp the button with pliers and rock the button back and forth while pulling clip off with your finger.

d. To remove the old button on molded plastic arm, hold the arm out away from head, squeeze the locking tabs together with a pair of needle nose pliers and press forward.

e. To install load button on metal arm, place the new button on the arm. On the back of the arm place the rubber grommet. Holding the button, push the clip over the plastic stud until it is tight against the rubber grommet. Reference Figure 13.

f. To install load button on molded plastic arm, press the button into the arm, from the head side, and it will snap in place.

g. Adjust according to Section 3.4.11.4.

NOTE: The load arm should never be opened over 90° from carriage assembly to prevent possible damage to torsion spring.

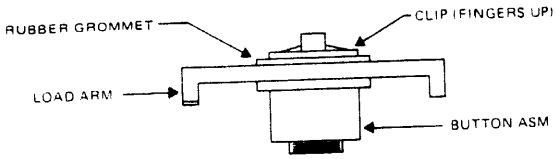


FIGURE 13

3.4.11.4 Read/Write Head Load Button Adjustment 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 CCW in small icrements (10°) until maximum amplitude is obtained.

3.4.11.5 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 penatration tool (P/N 50380) on the gauge block and insure that the gauge reads .03 (3 on the small hand) and zero the dial for the large hand. This results in a reading of .030".

b. Swing open the cartridge as per Section 3.4.3.

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" ± .003" read on the gage.

e. If the head does not meet this adjustment, move the stepper plate laterally until the gage reads .030".

f. Tighten the screws and recheck the adjustment.

g. Return cartridge guide and adjust as per Section 3.4.9.2.

3.4.11.6 Track 0 Detector: Removal and Installation

a. Remove side cover (Section 3.4.2).

b. Swing carriage guide open (Section 3.4.3).

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 3.4.11.9.

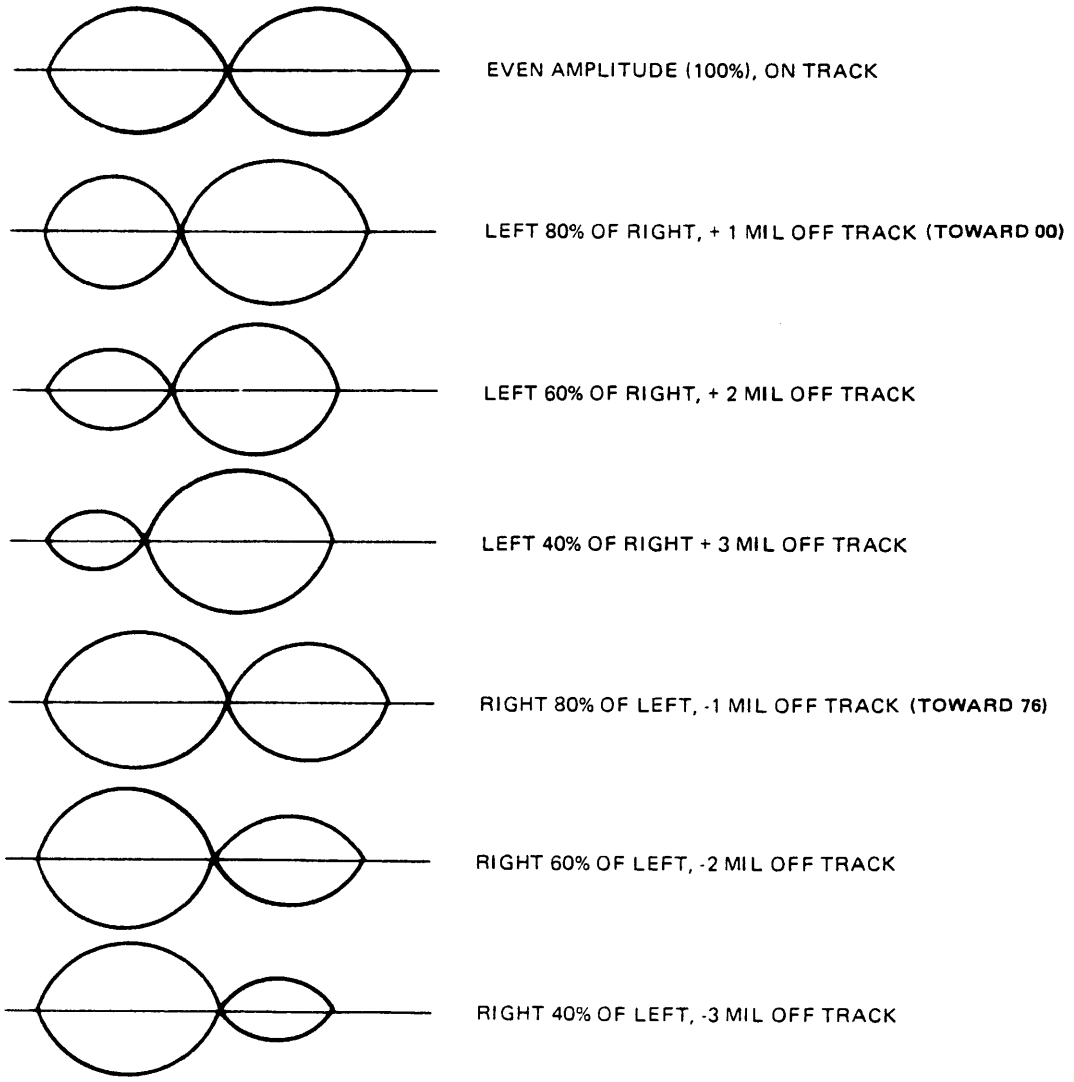


Figure 14 R/W Head Radial Alignment

3.4.11.8 Track 00 Stop Adjustment (Old Style)

a. Remove side cover (Section 3.4.2).

b. Step carriage to Track 00. Verify that carriage is at 00 by checking P1L12 is minus (ground).

c. Check that stop is .005" (+.005" -.000") clearance between the carriage and the stop.

d. If clearance is not within tolerance, continue on with the adjustment procedure.

e. Loosen the screw in the Track 00 stop.

f. Place a .005" feeler gage between the carriage and the stop. Position the stop against the feeler gage. Tighten the stop screw.

g. Turn off AC and DC power.

h. Manually rotate the lead screw clockwise to insure no interference between the carriage and the stop screw.

i. If interference occurs, loosen screw and rotate stop to avoid the interference.

j. Replace side cover.

3.4.11.8 Track 00 Stop Adjustment (new style)

a. Remove side cover (Section 3.4.2)

b. Step carriage to Track 00. Verify that carriage is at 00 by checking P1L12 is minus (ground).

c. Check that stop is .030" ± .020" between collar and carriage. Turn DC power OFF, and manually rotate lead screw CW until carriage stops. Check that stop is .020" ± .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 CW 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" ± .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.

3.4.11.9 Track 00 Flag Adjustment

a. Remove side cover (Section 3.4.2).

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 on Track 0 flag and rotate flag counter clockwise until TP 26 just goes high.

f. Step carriage to Track 2. TP 26 should go low. Adjust flag clockwise if not low.

g. Check adjustment by stepping carriage in and returning Track 00, observing that TP 26 is low at Track 02 and high at Tracks 01 and 00.

h. Replace side cover.

3.5 SA902 MAINTENANCE

Maintenance procedures of the SA902 are the same as those outlined in Section 3.4 of this manual. The only special requirement is that the drives may have to be split apart to gain access to components located between drives. This section of the Maintenance Manual describes the procedure for splitting the units apart.

3.5.1 Special Tools

The following special tools are required for maintenance of the SA902 if the units are to be operated while in the split position.

P/N	Description
50464-0	Extended Maintenance Belt
50466-0	Head Cable Extender
50467-0	Drive Cable Extender

3.5.2 Separating Units

a. Remove plate (loosen 4 screws) from bottom holding units together if present.

b. Remove drive belt from right hand motor pulley and place it on hook provided. Reference Figure 15.

c. Attach Head Extender Cable (P/N 50466-0) to right hand drive R/W head pigtail (P-5). Insure polarity of cables are matched properly. Reference Figure 16.

d. Raise latches (2) at the front of the machine, top and bottom. Screws may have to be loosened. Reference Figure 17.

e. Move right hand drive out and secure into the service position with latch and bracket on top of units. Reference Figure 18. While moving drives apart route right hand R/W head pigtail through left hand drive.

f. Remove P2 from PCB and attach Drive Cable Extender (P/N 50467-0) to it and PCB. Reference Figure 19.

g. Remove drive belt from right drive spindle pulley and hook. Install Extended Maintenance Belt (P/N 50464-0) to right drive and motor pulley.

h. Units are now ready to operate in the split position. Reference Figure 20.

i. To rejoin units reverse procedure. To reinstall right hand drive spindle belt, place belt on spindle pulley and hook provided. Reference Figure 15.

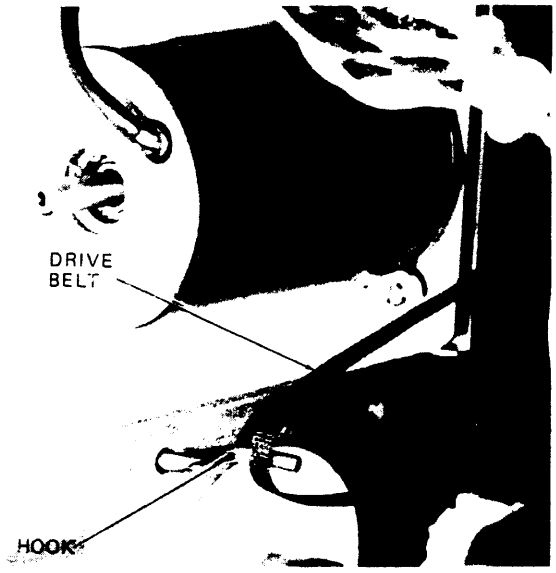


FIGURE 15 RIGHT DRIVE BELT REMOVAL

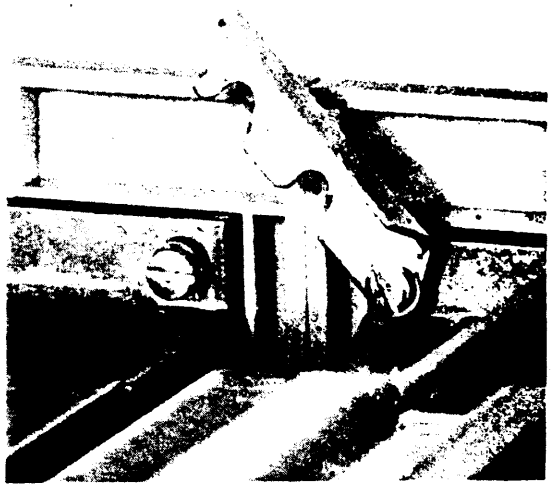


FIGURE 17 LATCH

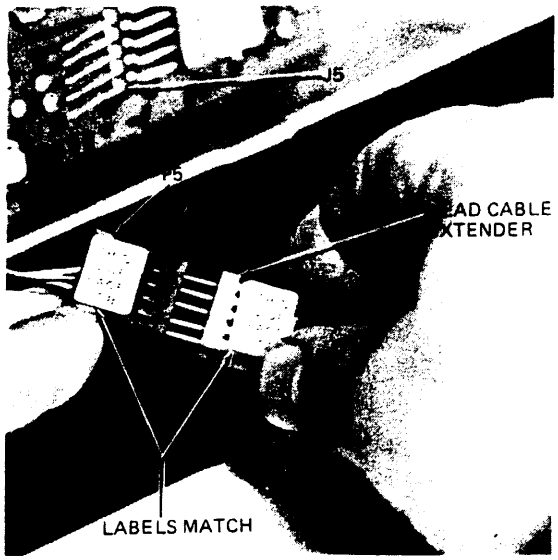


FIGURE 16 HEAD CABLE EXTENDER

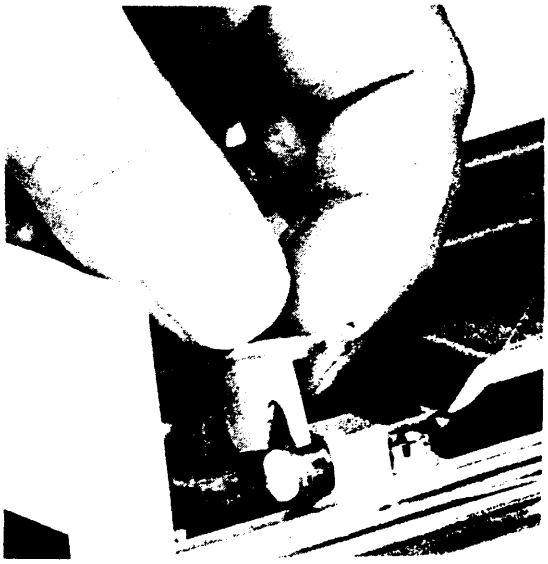


FIGURE 18 LATCHING UNITS TOGETHER

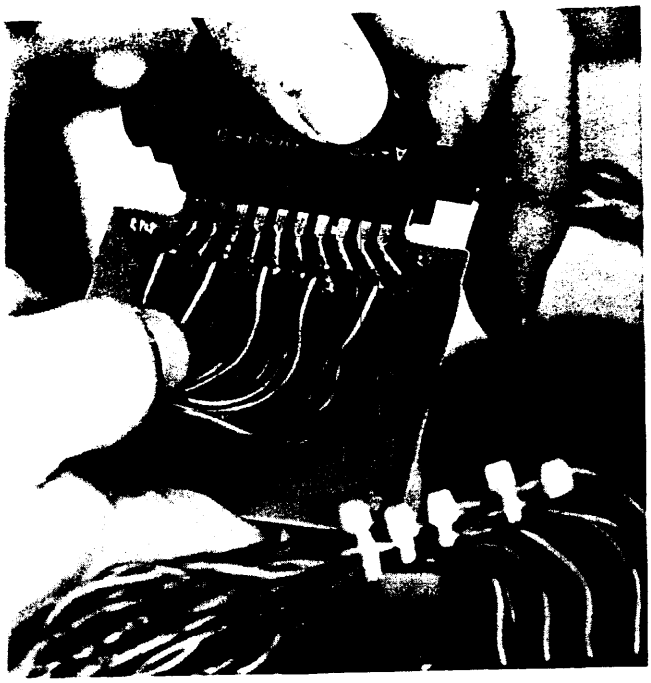


FIGURE 19 DRIVE EXTENDER CABLE ATTACHMENT

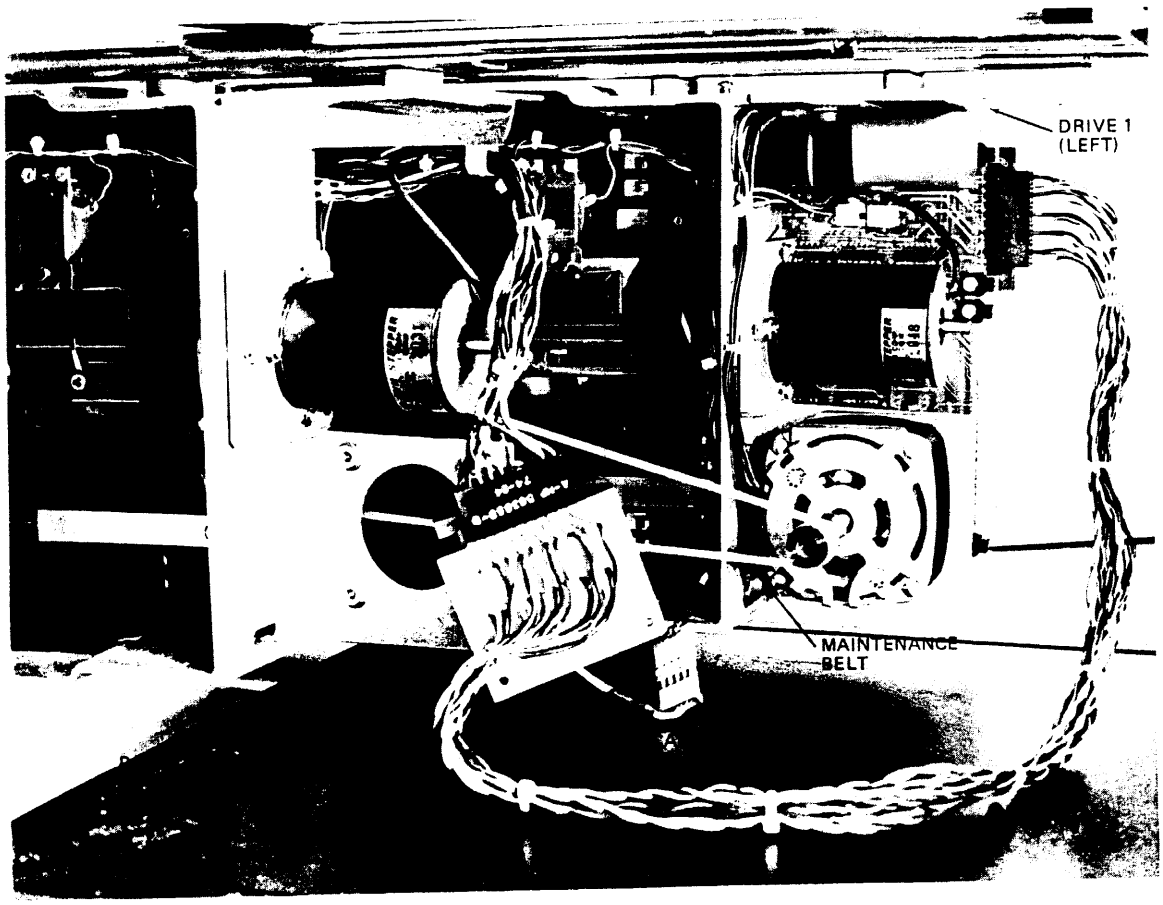
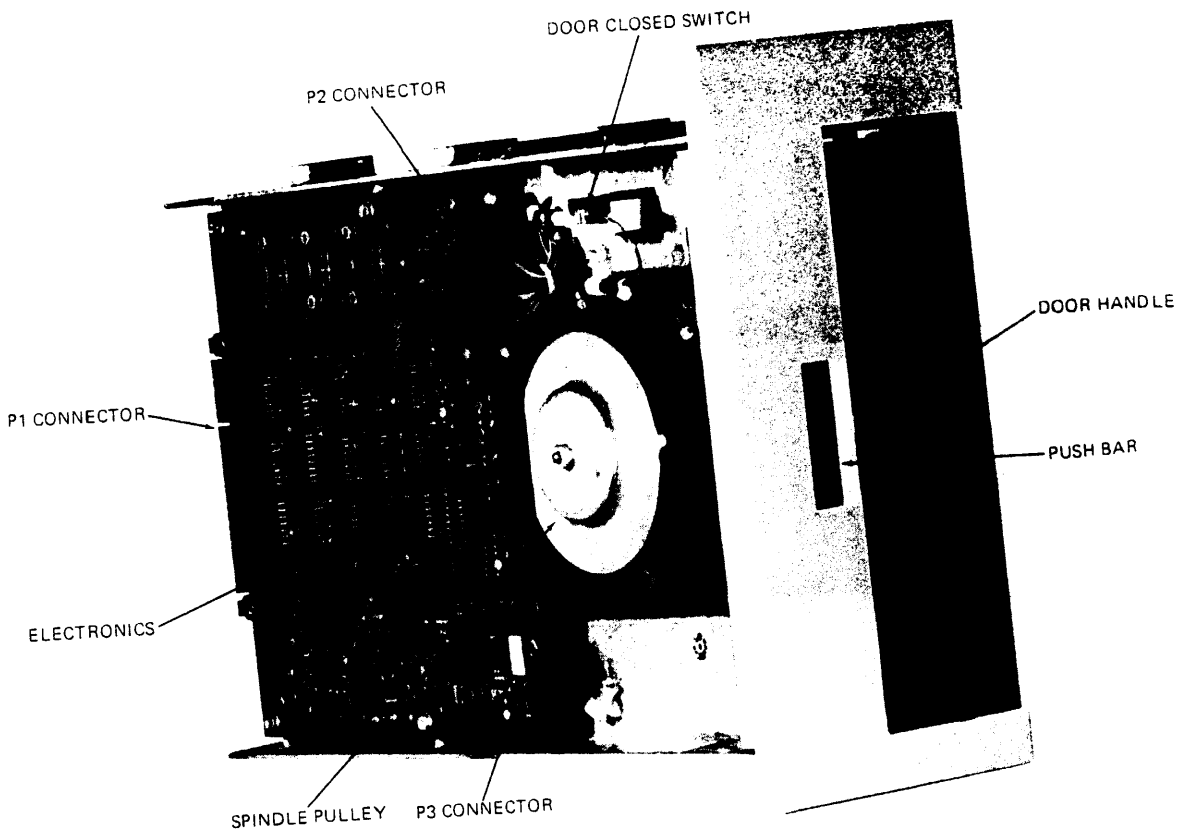
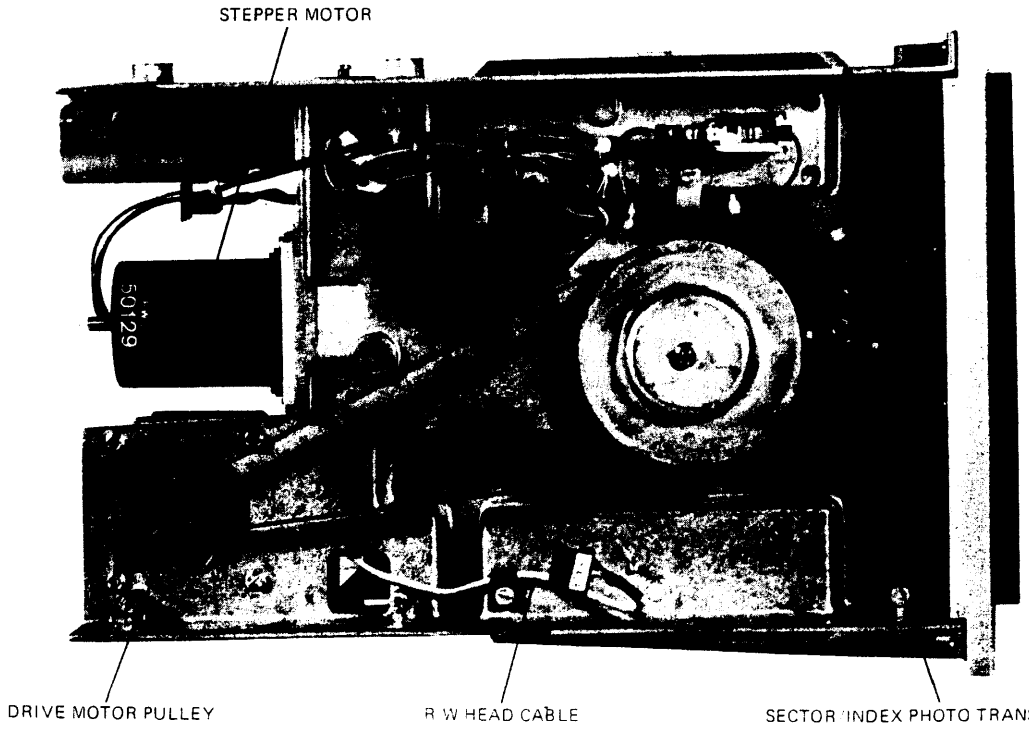
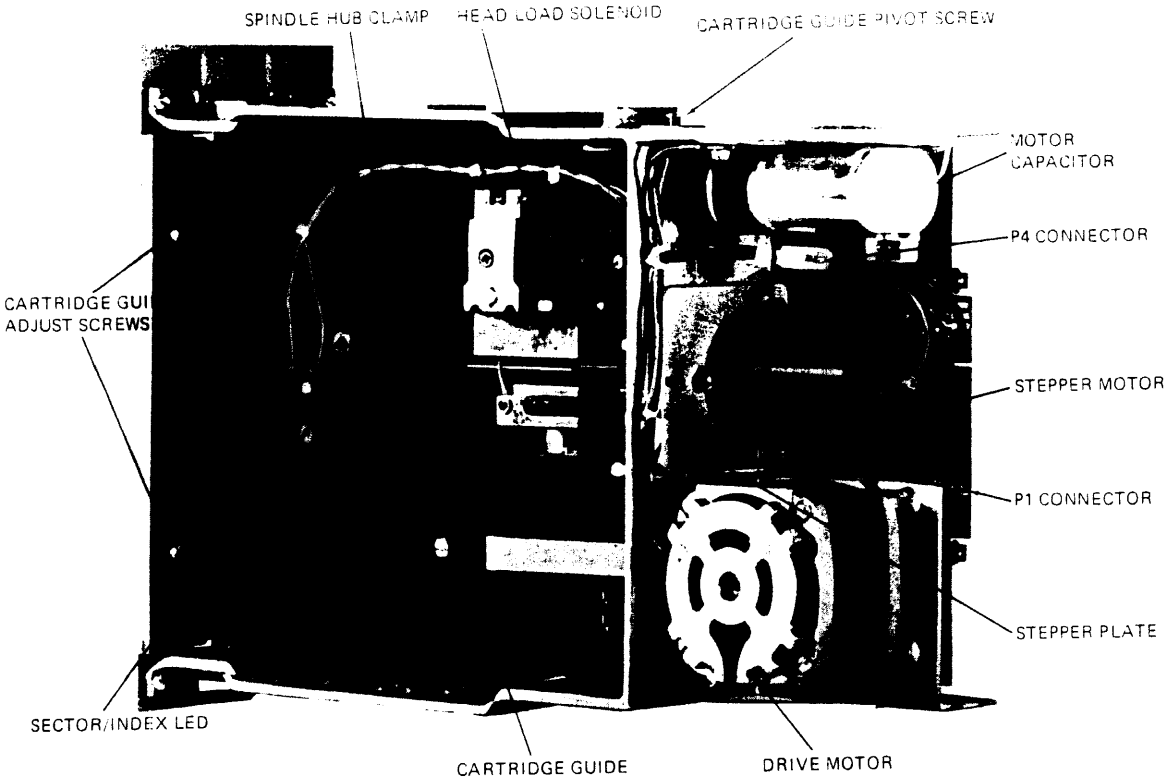


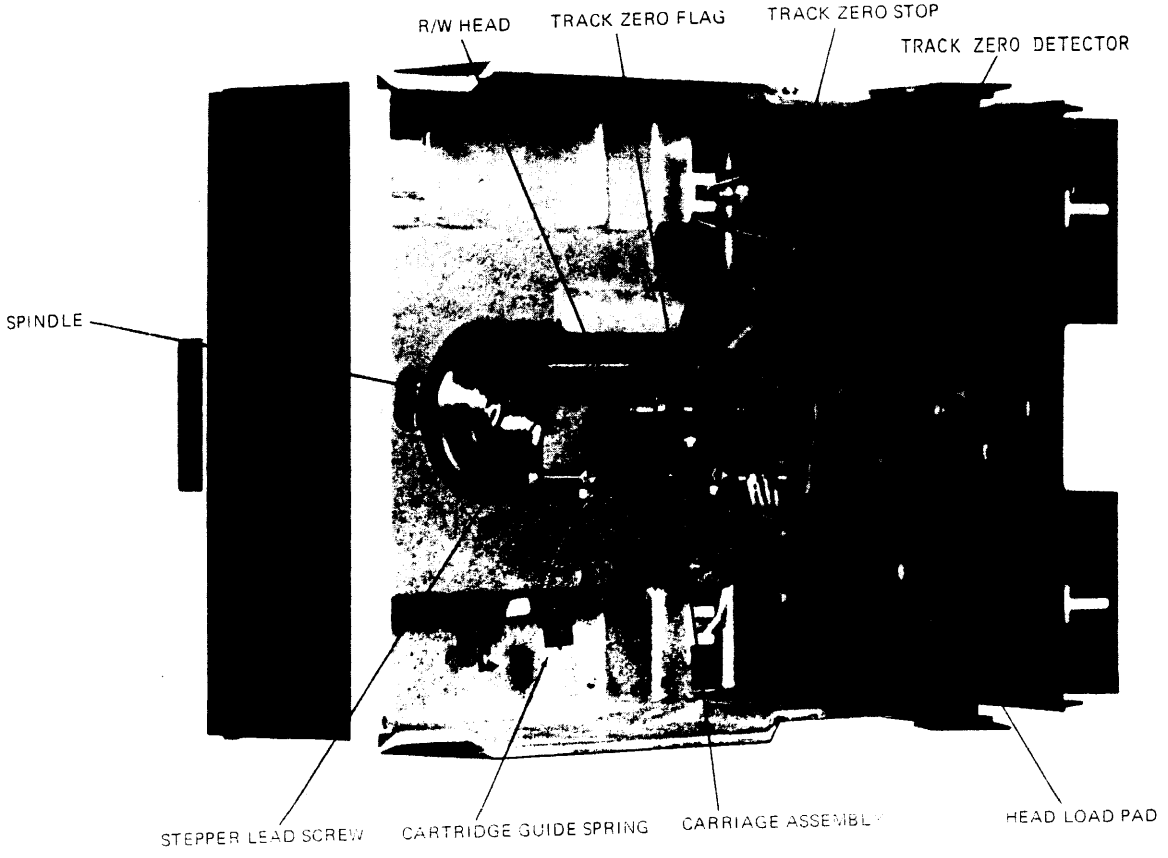
FIGURE 20 OPERATING IN THE MAINTENANCE POSITION

3.6 PHYSICAL LOCATIONS






SPINDLE HUB CLAMP
HEAD LOAD SOLENOID
CARTRIDGE GUIDE PIVOT SCREW
MOTOR CAPACITOR
P4 CONNECTOR
CARTRIDGE GUI
ADJUST SCREWS
STEPPER MOTOR
P1 CONNECTOR
STEPPER PLATE
SECTOR/INDEX LED
CARTRIDGE GUIDE
DRIVE MOTOR


R/W HEAD
TRACK ZERO FLAG
TRACK ZERO STOP
TRACK ZERO DETECTOR
SPINDLE
STEPPER LEAD SCREW
CARTRIDGE GUIDE SPRING
CARRIAGE ASSEMBL
HEAD LOAD PAD

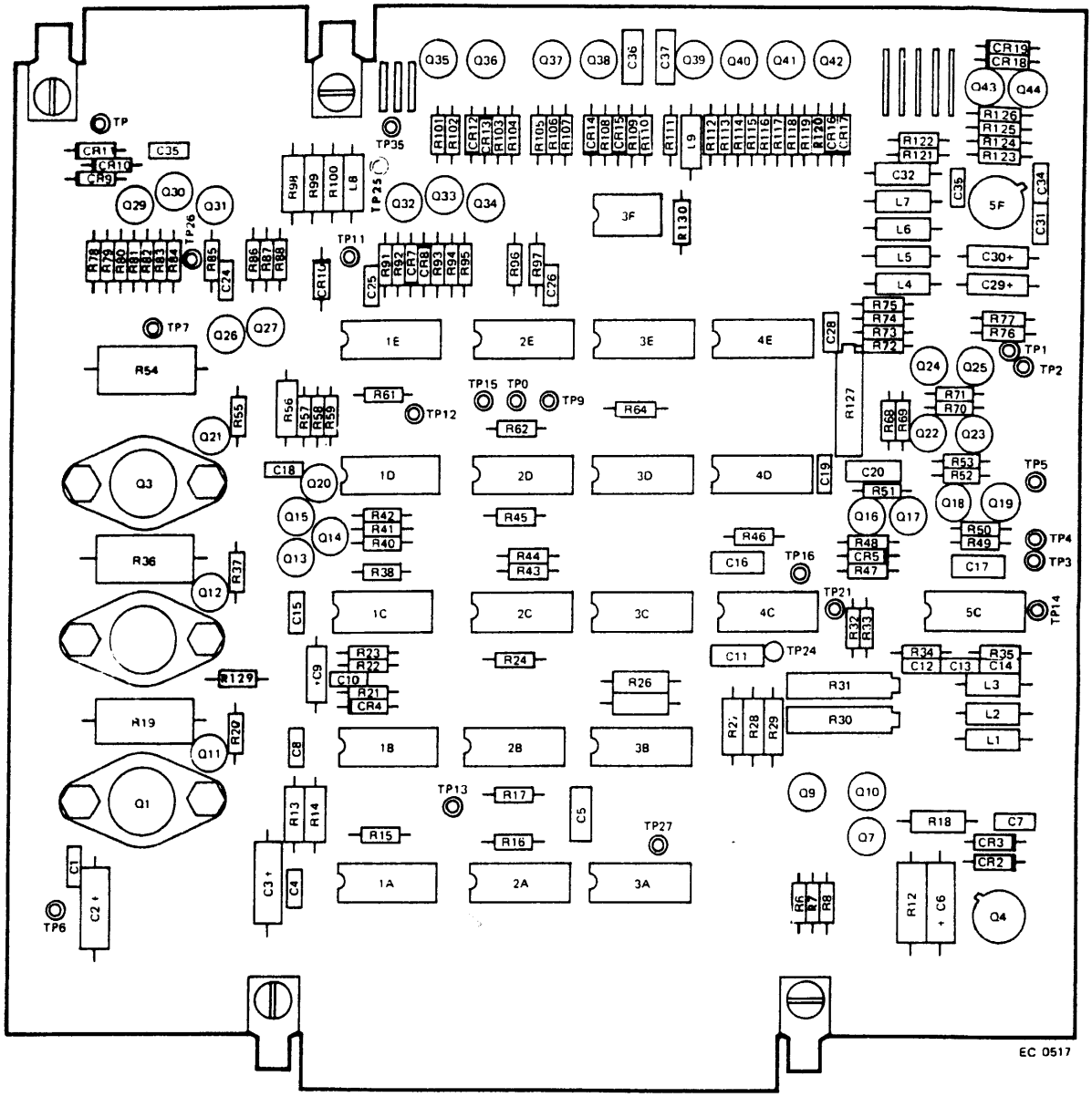


Figure 21 SA900/901 Component Locations

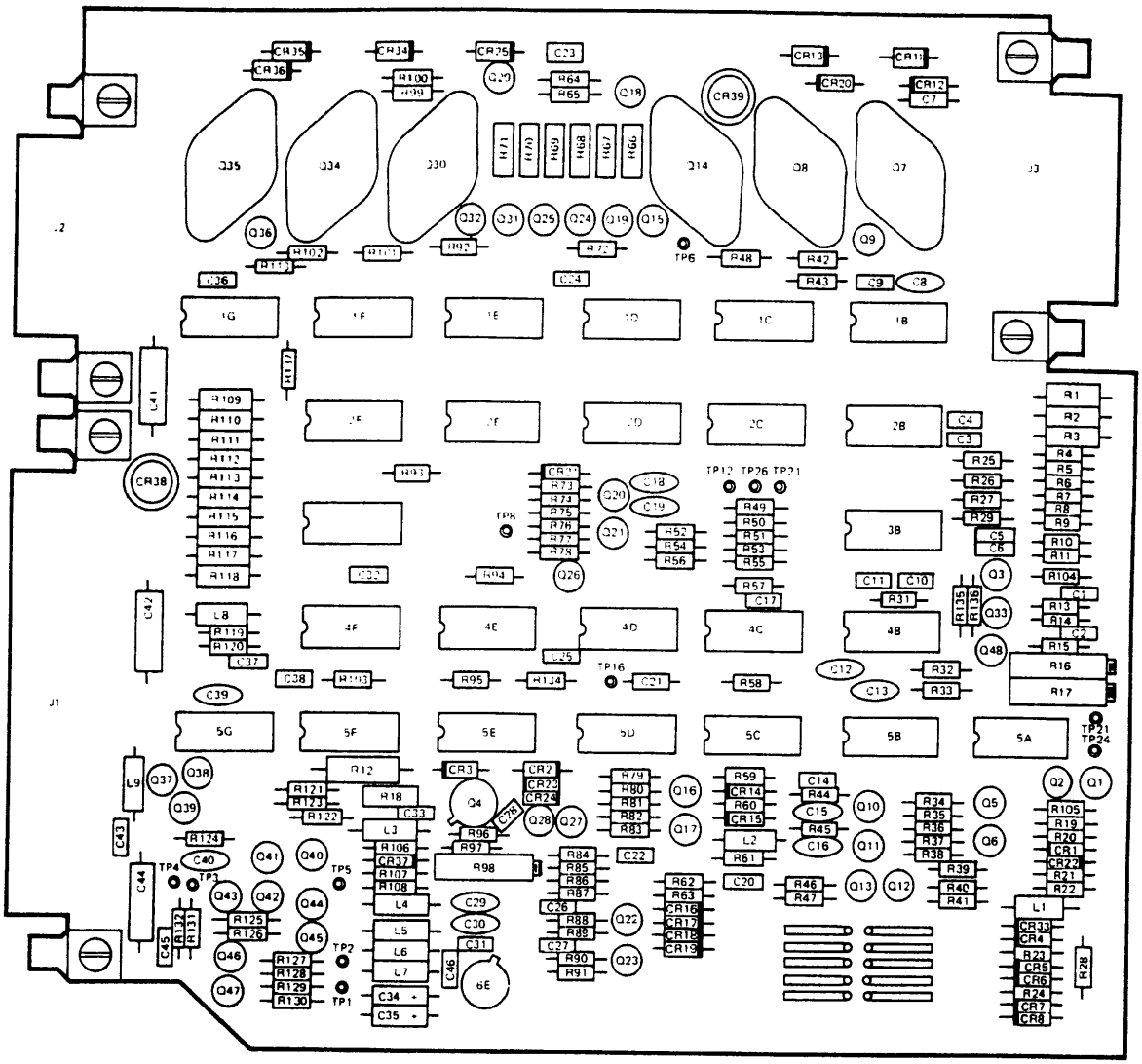


Figure 22 SA 902 Component Locations

PART NO 50501-0

INDEX

TABLE I
OPTIONAL FEATURES

PCB ASM NO.	OPTIONAL FEATURES			
	-5V	-12V TO -15V	DATA SEP	SECTOR SEP
25002	X			
25003		X		
25004	X		X	
25005		X	X	
25006	X		X	X
25007		X	X	X

WRITE PROTECT CAN BE ORDERED WITH ANY OF THE ABOVE.

TABLE III
CUSTOMER CUT TRACE OPTIONS AND HISTORY CHART

JUMPER AND TRACE CUT CAPABILITY			
DESIGNATOR	DESCRIPTION	OPEN	SHORT
A	DRIVE SELECT 1 OR HEAD LOAD		[1]
B	ALTERNATE DRIVE SELECT PATH	[1]	
C	RADIAL HEAD LOAD		[1]
D	DRIVE SELECT TERMINATION WITH RADIAL HEAD LOAD	[1]	
E	MULTIPLEX OR DRIVE SELECT FEATURE	[1]	
F	TERMINATION FOR "WRITE DATA"		[1]
G	TERMINATION FOR "FILE INOP RESET"		[1]
H	TERMINATION FOR "WRITE GATE"		[1]
J	TERMINATION FOR "DIRECTION SELECT"		[1]
K	TERMINATION FOR "STEP"		[1]
M	RADIAL/READY INTERRUPT		[1]
R	STEP WITH HEAD UNLOADED		[1]
S	R.P.S. (RADIAL SECTOR AND INDEX)		[1]
X	DRIVE SELECT INDEPENDENT OF HEAD LOAD	[1]	
Y	DRIVE SELECT INDEPENDENT OF HEAD LOAD		[1]
DS	STEPPER POWER FROM DRIVE SELECT	[1]	

FACTORY CUT TRACE OPTIONS AND HISTORY CHART

L	-5 OR -12 TO -15V	SEE TABLE II
N	INDEX ONLY (900)	SEE TABLE II
P	INDEX AND SECTOR (901)	SEE TABLE II

TABLE II
FACTORY CUT TRACE OPTIONS

PCB ASM NO.	TRACE "L"	TRACE "N"	TRACE "P"
25002	SHORTED	OPEN	SHORTED
25003	OPEN	↕	↕
25004	SHORTED	↕	↕
25005	OPEN	OPEN	SHORTED
25006	SHORTED	SHORTED	OPEN
25007	OPEN	SHORTED	OPEN

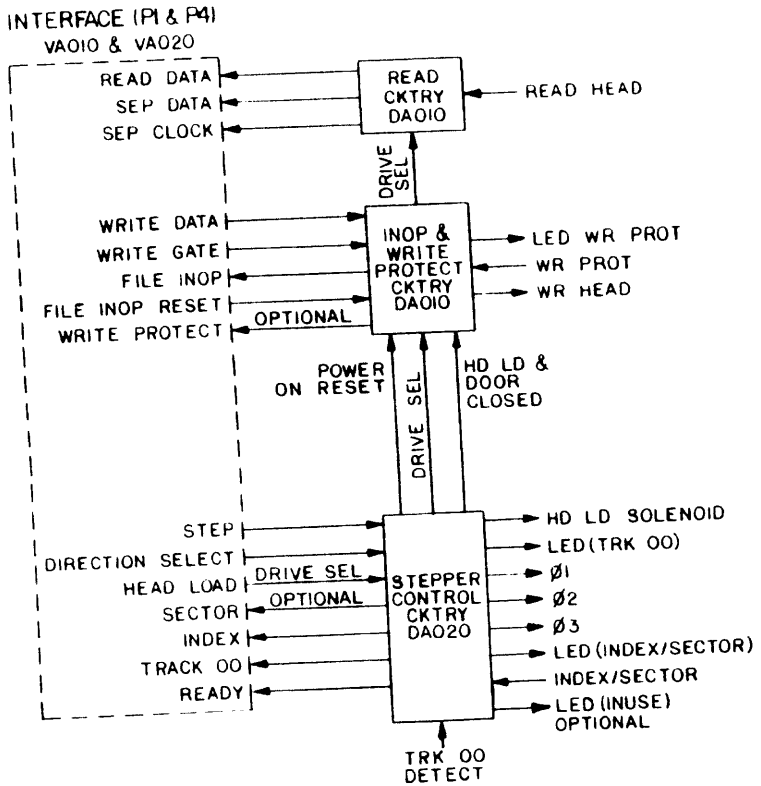
[1] AS SHIPPED FROM FACTORY

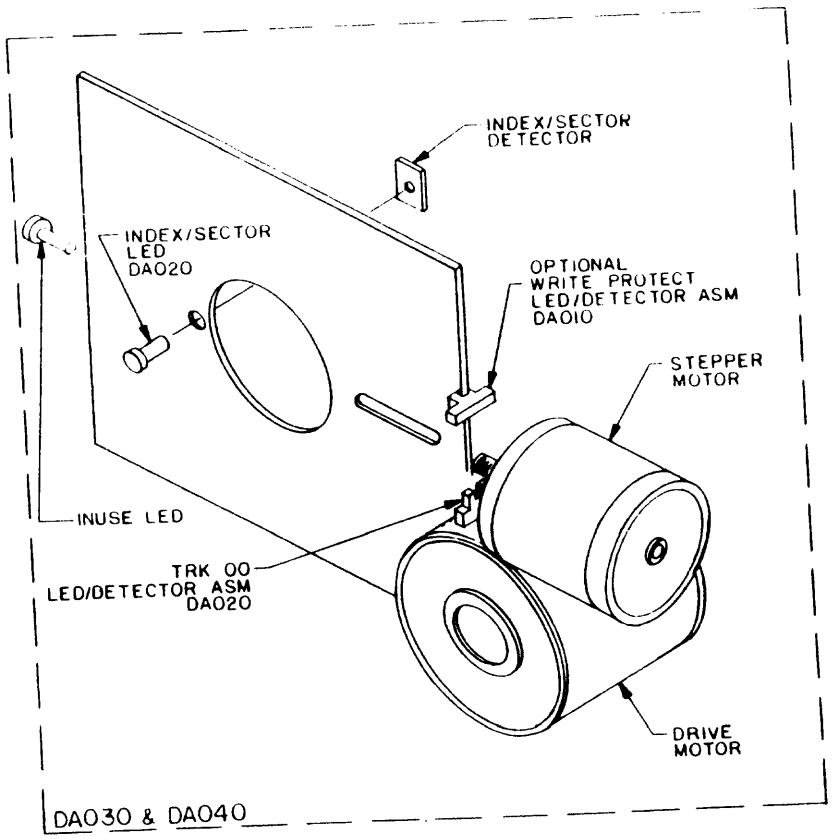
MUST CONFORM TO ENGINEERING SPEC ES 30000

MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	EC HISTORY	DATE	NO	TITLE LOGIC MANUAL INDEX
CASE DEPTH	LINEAR ± XX ± XXX		3-16-4	0114	
HARDNESS	ANGULAR:		4 23 4	0274	DETAIL Jude 3/74 RELEASED FOR ASSEMBLY
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX		JAN 76	0485	DESIGN
					APPRO DW 3/74 50500
					SCALE C DOC CODE OD PART NO 50501-0 REVISE 0485 SHEET 1 OF 1

AA001

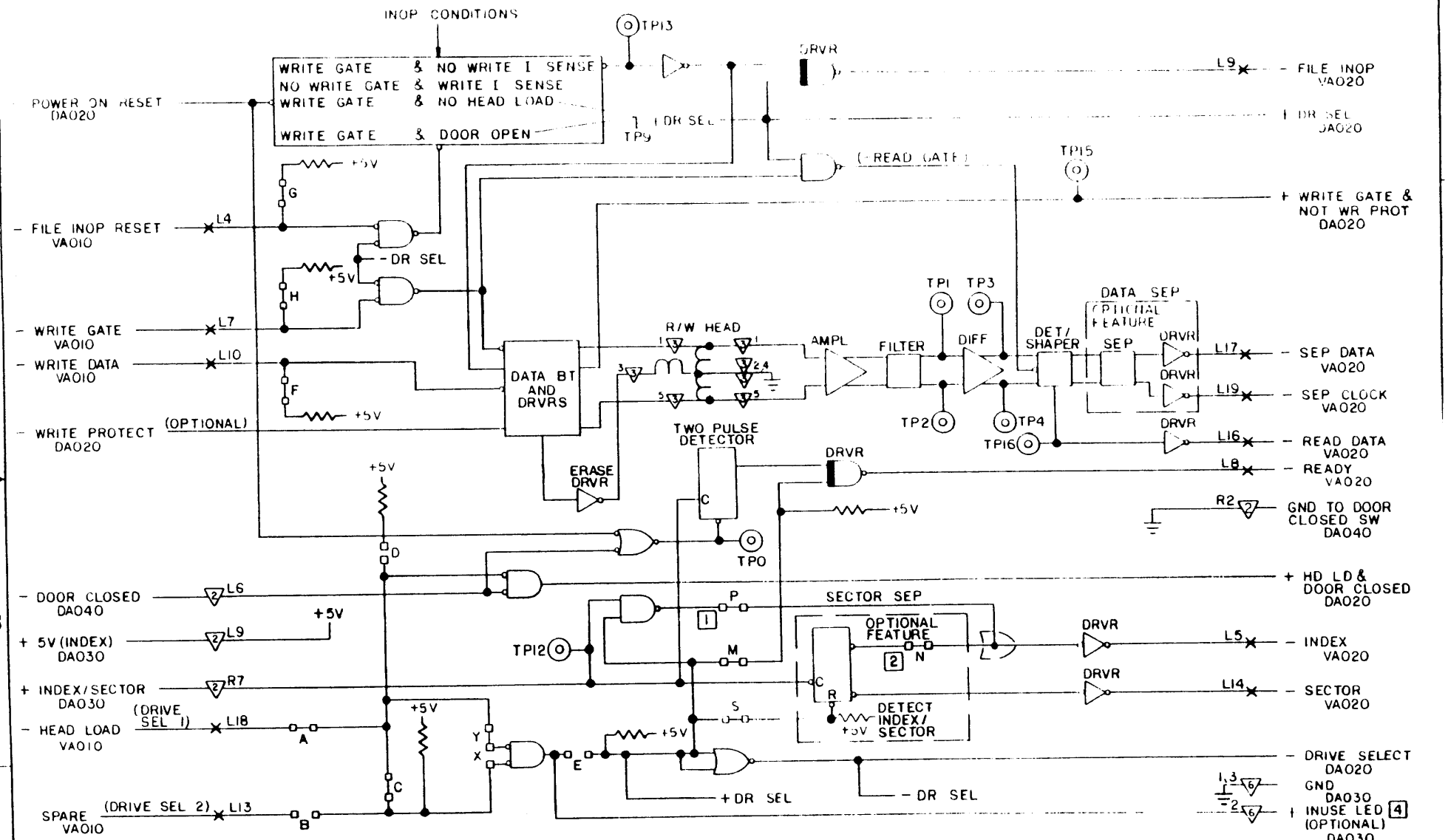
900 LOGIC MANUAL SN ____





MUST CONFORM TO ENGINEERING SPEC ES 30000-0		EC HISTORY		TITLE	LOGIC DIAGRAM FUNCTIONAL DIAGRAM
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO		
	LINEAR ± XX ± XXX	3-16-4	0114		
		JAN 76	0485		
CASE DEPTH	ANGULAR ±			DETAIL	3/74 RELEASED FOR ASSEMBLY
HARDNESS				DESIGN	50500
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX			APPRO	3/14 SHEET 1 OF 1
				C	SCALE — DOC CODE OD PART NO 50502-0 REV/EC 048

ABOIO



NOTES:

[1] CUT TRACE (P) FOR 901. SEE PAGE AA001, TABLE II.

[2] CUT TRACE (N) FOR 900. SEE PAGE AA001, TABLE II.

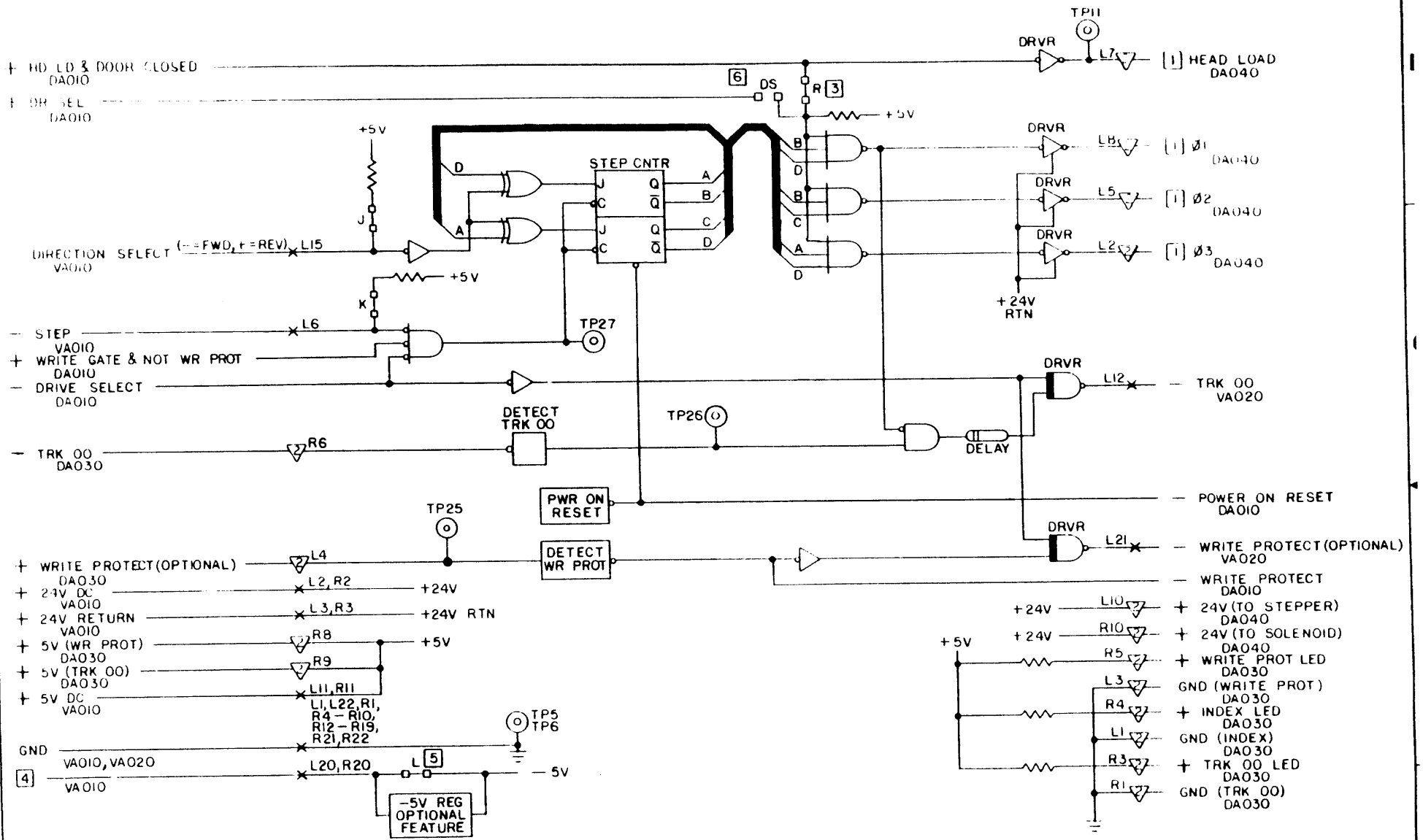
3. CONNECTOR SYMBOL REFERENCE: X=J1, ▽2=J2, ▽3=J3, ▽6=J6.

[4] GROUND WHEN INACTIVE AND 1.5VDC WHEN ACTIVE.

DA010

MUST CONFORM TO ENGINEERING SPEC ES 30000-0		EC HISTORY	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO
		3-16-4	0114
	LINEAR ± XX	1 23 4	C274
CASE DEPTH	± XXX	JAN 76	0485
HARDNESS	ANGULAR ·		
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX / INSIDE MAX		

TITLE	LOGIC DIAGRAM READ/WRITE/INOP CKTRY		
DETAIL	[illegible]	3/74	RELEASED FOR ASSEMBLY
DESIGN			50500
APPRO			SHEET 1 OF 1
SCALE C	DOC CTRL OD	PART NO 50503-0	REV LTR 0485



NOTES:

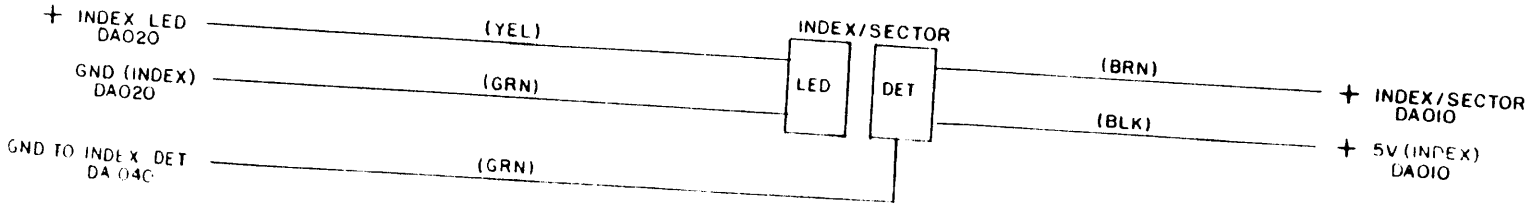
1. GND WHEN ACTIVE & + 24VDC WHEN INACTIVE.
2. CONNECTOR SYMBOL REFERENCE: X = J1, ▽ = J2
3. CUT TRACE (R) TO ALLOW STEPPING WITH HEAD NOT LOADED OR DOOR OPEN.
4. –5V OR –12V TO –15V SELECTABLE FEATURE. SEE PAGE AA001 TABLE II
5. CUT TRACE (L) FOR –12V TO –15V INPUT AT L20, R20. SEE PAGE AA001, TABLE II.
6. CUT TRACE (R) AND SHORT TRACE (DS) FOR STEPPER POWER FROM DRIVE SELECT.

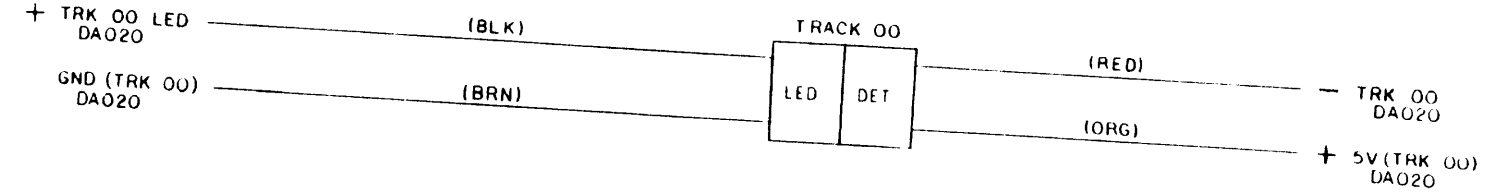
DA020

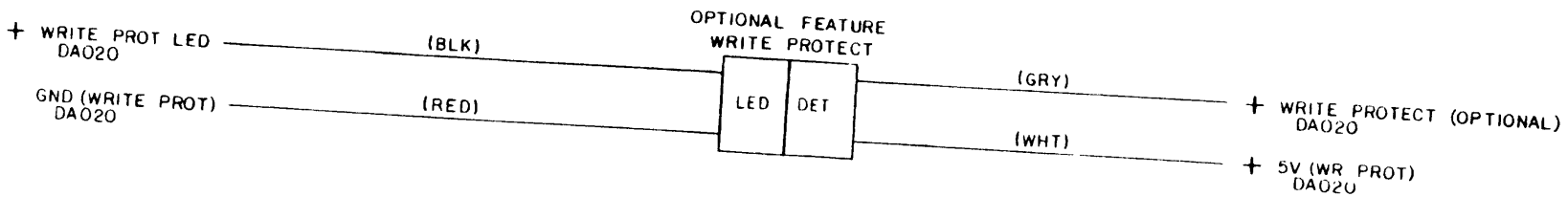
MUST CONFORM TO ENGINEERING SPEC ES 30000		E HISTORY		SHUGART ASSOCIATES	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE	LOGIC DIAGRAM STEPPER CONTROL
		4 16 74	0114		
	LINEAR .XX ± .XXX	JAN 76	0485		
EDGE DEPTH				DETAIL	3/74 RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR ±			DESIGN	50500
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX			APPRO	7/74 SHEET 1 OF 1
				C	SCALE OD 50504-0 0485

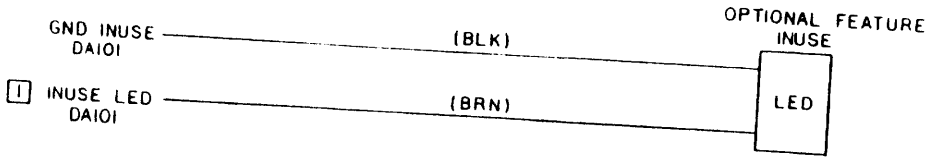
4 3 2 1

PART NO 50505-







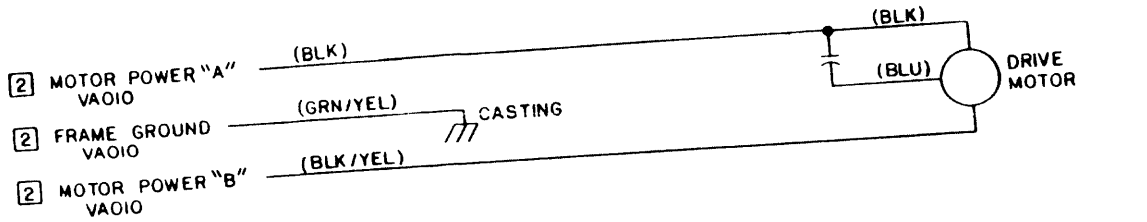


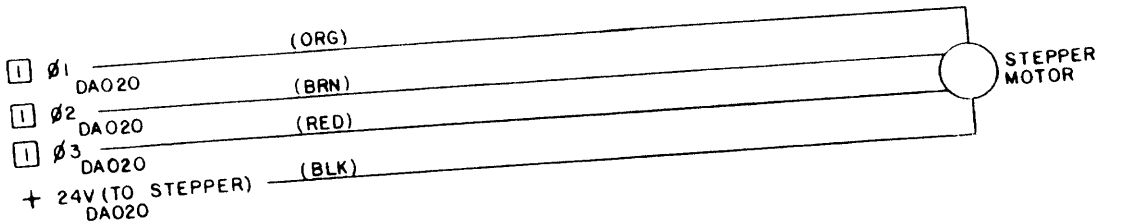
NOTES:

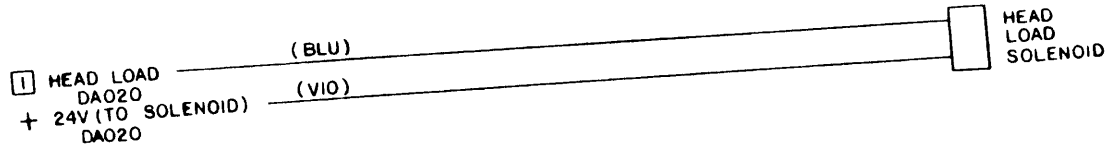
[1] GND WHEN INACTIVE AND 1.5VDC WHEN ACTIVE.

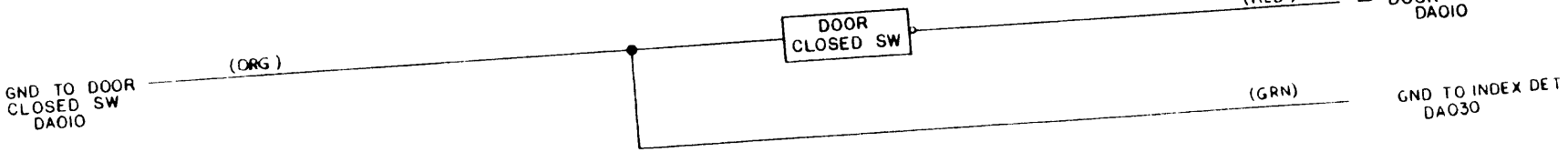
DA030

MUST CONFORM TO ENGINEERING SPEC ES 30000-0		EC HISTORY		TITLE	LOGIC DIAGRAM DETECTORS
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO		
	LINEAR .XX ±.XXX	3/6/4	0114	DETAIL	J. de 3/74 RELEASED FOR ASSEMBLY
CASE DEPTH	ANGULAR:	7/23/4	0274	DESIGN	
HARDNESS		JAN 76	0485	APPRO	W 7/74 SHEET 50500
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX			SCALE C	DOC CODE 00 PART NO 50505-0 REV/EC 0485









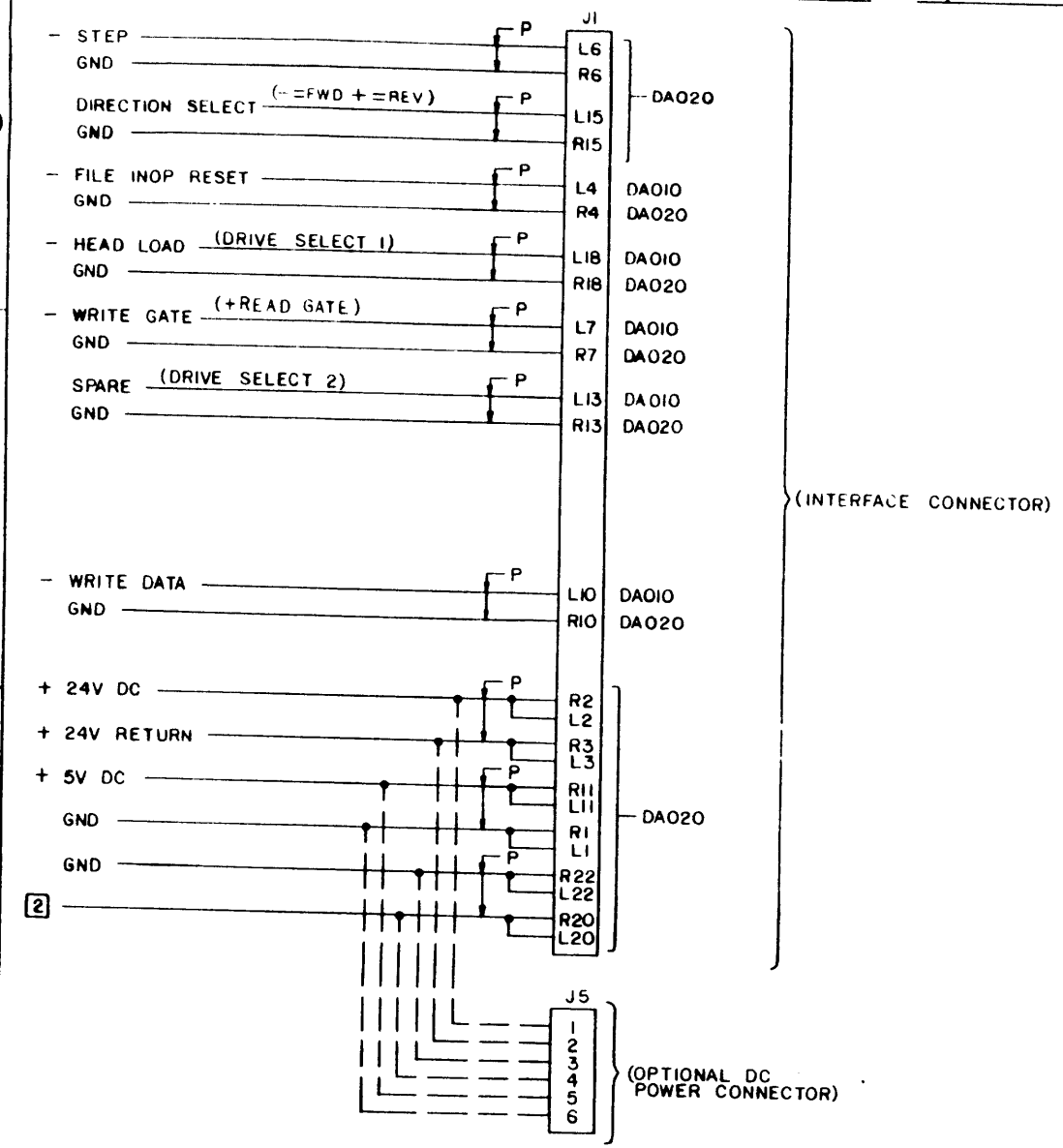
NOTES:

[1] GND WHEN ACTIVE & +24V WHEN INACTIVE.

[2] SEE PAGE VA01O (NOTE 1) FOR AC VOLTAGES.

MUST CONFORM TO ENGINEERING SPEC ES 30000-0	TOLERANCE UNLESS OTHERWISE NOTED	EC HISTORY DATE	NO	TITLE LOGIC DIAGRAM MOTORS/SOLENOID/SWITCH
MATERIAL	LINEAR ± XX, ± XXX	3-16-4	0114	DETAIL 3/74 RELEASED FOR ASSEMBLY
CASE DEPTH	ANGULAR ±	9-23-4	0274	50500
HARDNESS	CORNERS EDGES BROKEN: OUTSIDE MAX, INSIDE MAX	JAN 76	0485	DESIGN
SURFACE TREATMENT ES				APPRO 3/74 SHEET OF
				SIZE C SCALE DOC CODE OD PART NO 50506-0

DA040



NOTES: 1

CONN P4	60 HZ		50 HZ	
	110V	208/230	110V	220V
1	110V	208/230	110V	220V
2	FRAME GND	FRAME GND	FRAME GND	FRAME GND
3	110V RETURN	208/230	110V RETURN	220V

2 -5V OR -12V TO -15V SELECTABLE FEATURE. SEE PAGE AA001, TABLE II.

PART NO 50507-0

VA010

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0

MATERIAL

TOLERANCE UNLESS OTHERWISE NOTED
LINEAR ± XX ± XXX
ANGULAR:

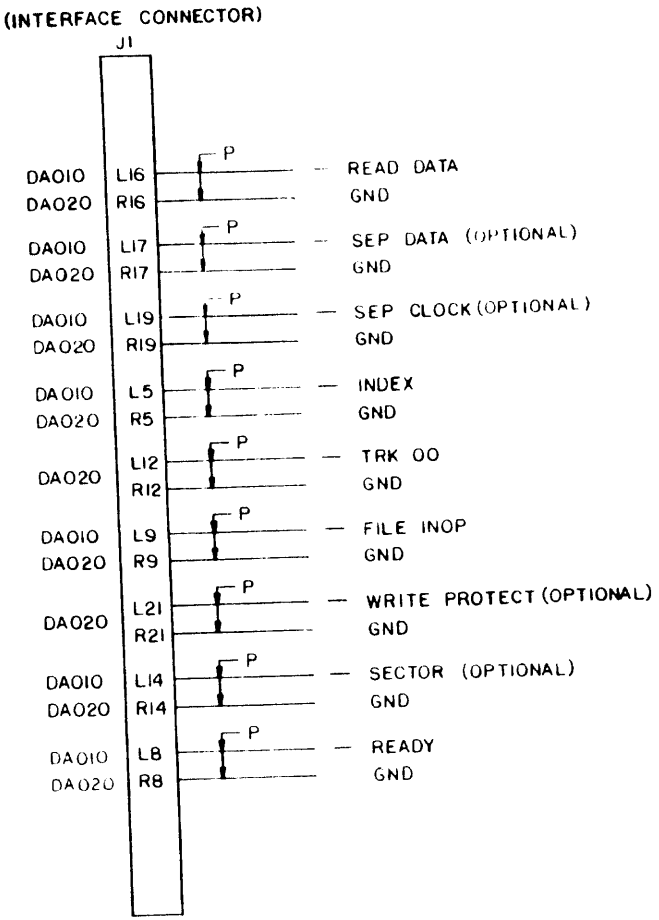
CASE DEPTH
HARDNESS
SURFACE TREATMENT ES
CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX

EC HISTORY

DATE	NO
3-14	0114
JAN 76	0485

TITLE LOGIC DIAGRAM INTERFACE INPUTS (J1, J4 AND J6)

DETAIL 3 774 RELEASED FOR ASSEMBLY
DESIGN 50500
APPRO SHEET 1 OF 1
SCALE C DOC CODE 00 PART NO 50507-0 REVISE 0485



MUST CONFORM TO ENGINEERING SPEC ES 30000 0		EC HISTORY		SHUGART	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE	LOGIC DIAGRAM INTERFACE OUTPUTS (J1)
	LINEAR ± XX ± XXX	3 16	0114	DETAIL	3/14 RELEASED FOR ASSEMBLY
CASE DEPTH		1 23	0274	DESIGN	50500
HARDNESS	ANGULAR ±	JAN 76	0485	APPRO	3/14 SHEET 1 OF 1
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX			C	SCALE DOC CODE PART NO 50508-0 REV/EC 0485

VA020

PART NO 50290-0

LOGIC MANUAL DRIVE SN_____

INDEX

TABLE I

PCB ASM NO.	OPTIONAL FEATURES			
	-5V	-12 TO -15V	DATA SEP	
25037	X			
25038		X		
25039	X		X	
25040		X	X	

TABLE III

JUMPER AND CUT TRACE CAPABILITY			
TRACE	DESCRIPTION	OPEN	SHORT
A	MAINTAIN DRIVE 1 STEPPER POWER INDEPENDENT OF SELECT		[1]
B	MAINTAIN DRIVE 2 STEPPER POWER INDEPENDENT OF SELECT		[1]
C	RADIAL/READY INTERRUPT NOTE [2]		[1]
D	RADIAL/READY INTERRUPT NOTE [2]		[1]
E	RADIAL/READY INTERRUPT NOTE [2]		[1]
F	TERMINATION FOR WRITE DATA		[1]
G	TERMINATION FOR FILE INOP RESET		[1]
H	TERMINATION FOR WRITE GATE		[1]
J	TERMINATION FOR DIRECTION SELECT		[1]
K	TERMINATION FOR STEP		[1]
M	RADIAL HEAD LOAD NOTE [3]		[1]
N	RADIAL HEAD LOAD NOTE [3]	[1]	
P	RADIAL HEAD LOAD NOTE [3]		[1]
R	RADIAL/READY INTERRUPT NOTE [2]	[1]	

TABLE II

FACTORY CUT TRACE OPTION		
PCB ASM NO.	TRACE L	
25037	SHORT	
25038	OPEN	
25039	SHORT	
25040	OPEN	

NOTES:

[1] AS SHIPPED FROM FACTORY.

[2] FOR RADIAL READY INTERRUPT OPEN TRACES C, D, E, AND SHORT TRACE R. READY 1 OUTPUT IS NOW ON PIN J1-L8 AND READY 2 IS NOW ON PIN J1-L14.

[3] WHEN READY IS NOT RADIAL, PIN J1-L14 CAN BE USED TO LOAD BOTH HEADS TOGETHER INDEPENDENT OF DRIVE SELECT. OPEN TRACES M, P, R, AND SHORT TRACES E, N. ADD JUMPER FROM N TO PIN J1-L14.

AA001

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

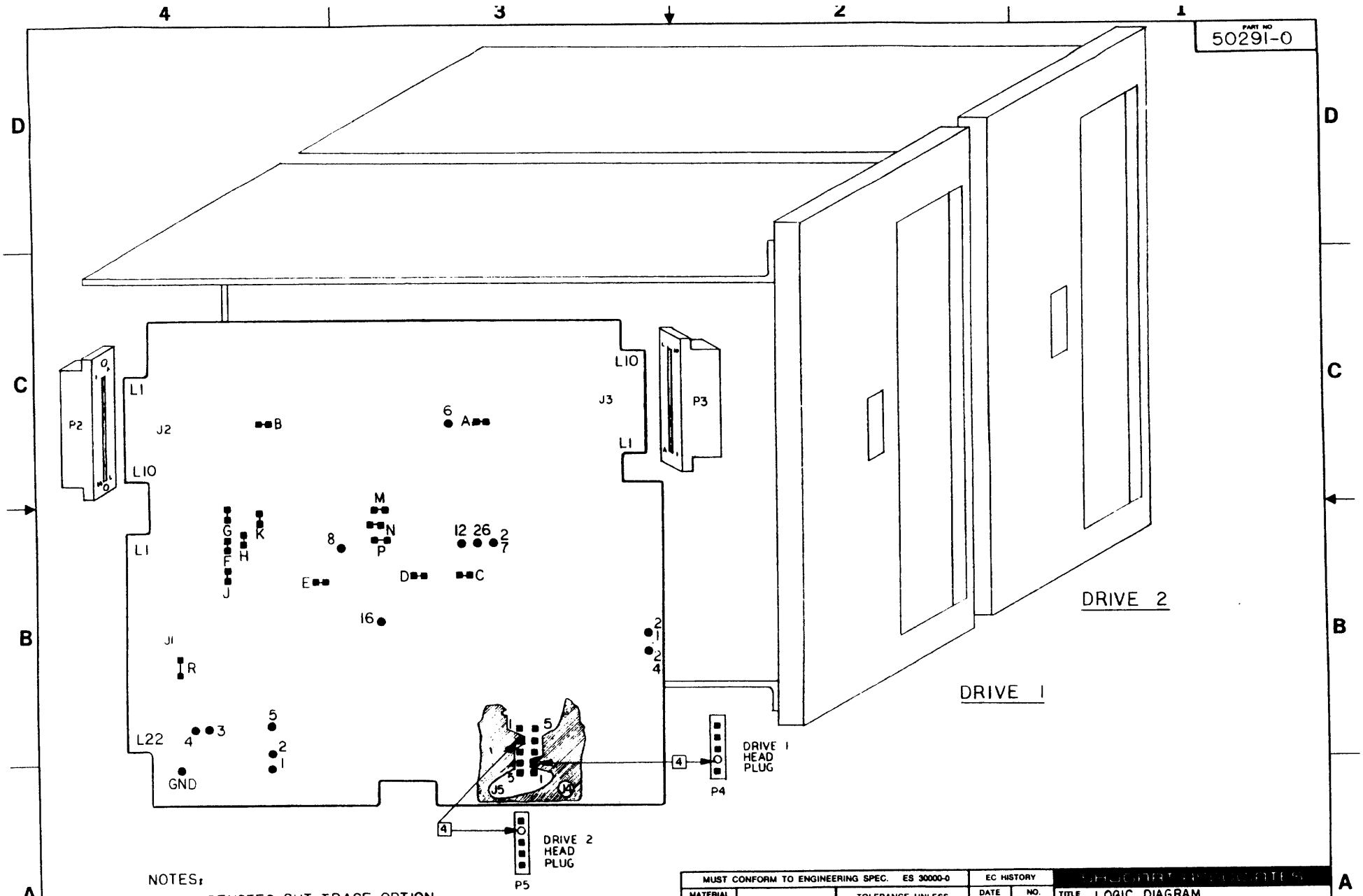
EC HISTORY		
	DATE	NO.
	12-74	0317

TITLE LOGIC DIAGRAM INDEX

DETAIL	BF	10-74	RELEASED FOR ASSEMBLY
DESIGN	DD	10-74	50268
APPRO	BF	11-74	SHEET 1 OF 1

SCALE C | DOC CODE OD | PART NO 50290-0 | REV/EC 0317

LOGIC MANUAL PN 50268-0



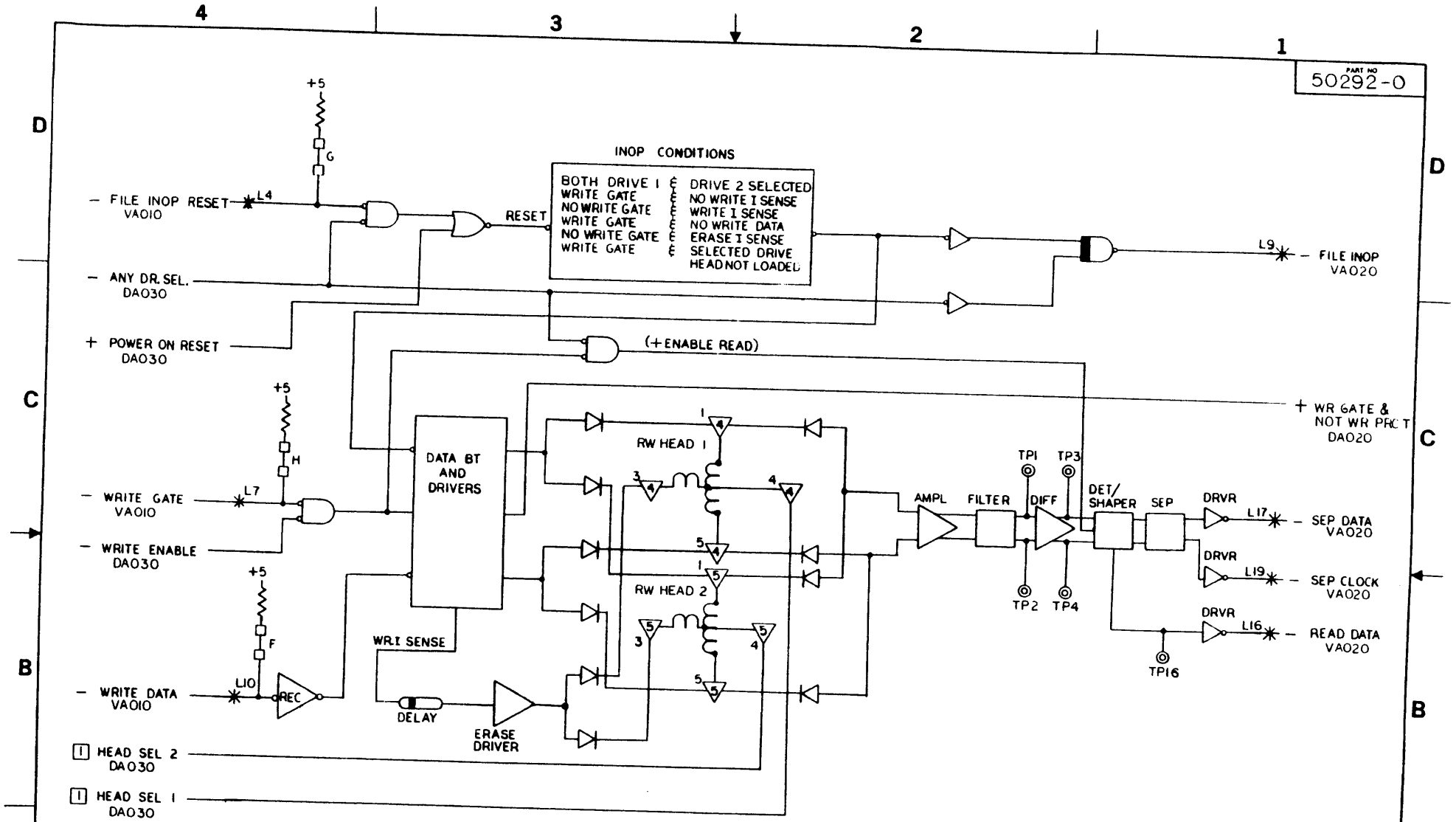
NOTES:

1. ■-■ DENOTES CUT TRACE OPTION.
2. ● DENOTES TEST POINT.
3. CONNECTOR SYMBOL REFERENCE:
   ✳ = J1 ▽2 = J2 ▽3 = J3 ▽4 = J4 ▽5 = J5
4. THE ROUND PLUG PIN PLUGS INTO PIN 2.

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.
		12-74	0317
CASE DEPTH	LINEAR ± XX / ± XXX		
HARDNESS	ANGULAR ±		
SURFACE TREATMENT ES	CORNERS EDGES BROKEN — OUTSIDE MAX / INSIDE MAX		

TITLE	LOGIC DIAGRAM BASIC DRIVE		
DETAIL	CHUCK	10-74	RELEASED FOR ASSEMBLY
DESIGN	DD	10-74	50268
APPRO	BF	11-74	SHEET 1 OF 1
C	SCALE	DOC CODE OD	PART NO 50291-0 REV/EC 0317

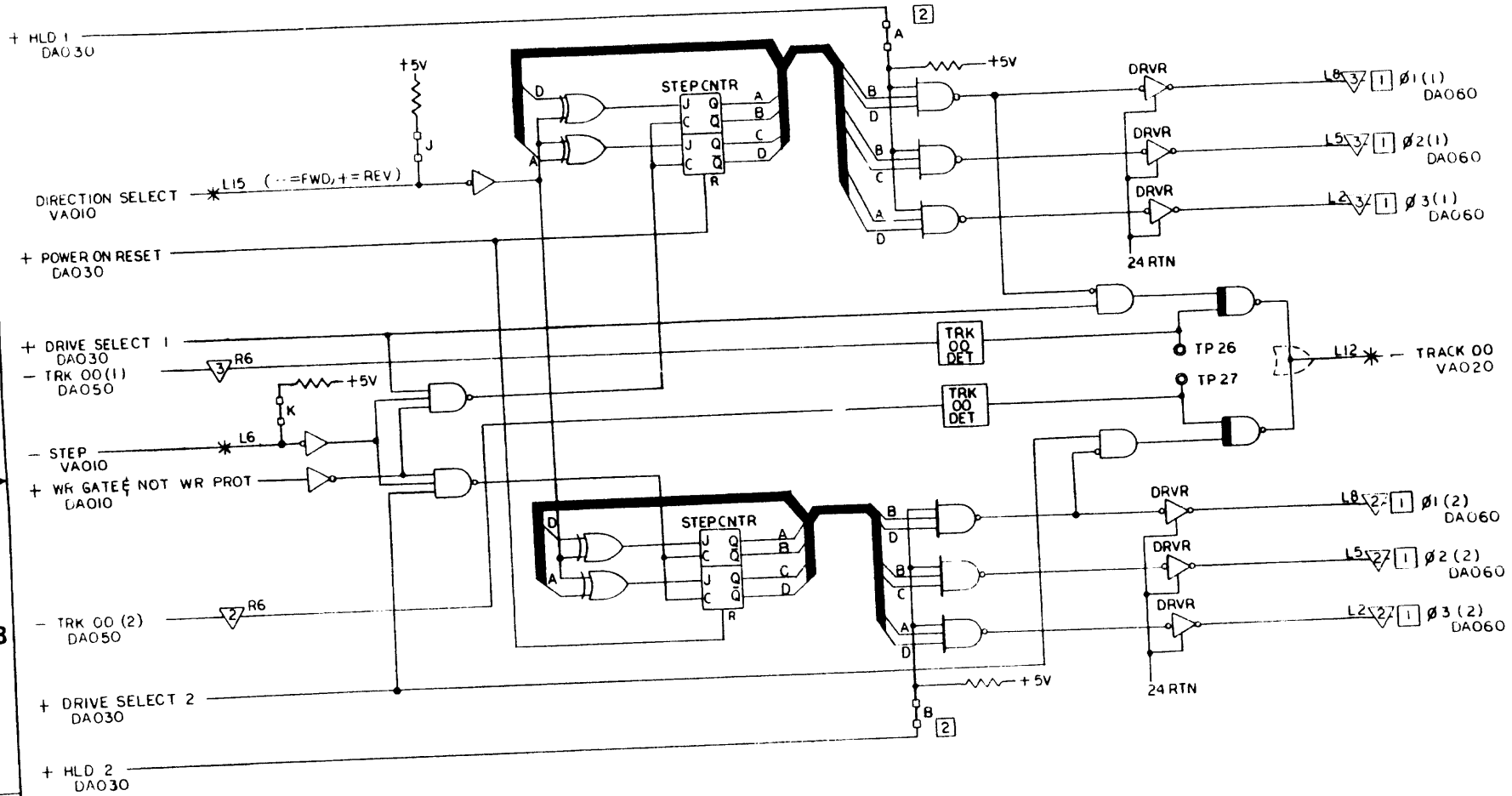
ABOIO



NOTES:
[1] GND WHEN ACTIVE, +24V WHEN INACTIVE

DA010

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		TITLE LOGIC DIAGRAM READ/WRITE/INOP CKTRY	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.		
		12-74	0317		
CASE DEPTH	LINEAR ± XX, ± XXX			DETAIL CHUCK 10-74	RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR ±			DESIGN D D 10-74	5026E
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX, INSIDE MAX			APPRO B F 11-74	SHEET 1 OF 1
				C SCALE	DOC CODE OD PART NO 50292-0 REV/EC 0317



NOTES:
1. GND WHEN ACTIVE, +24V WHEN INACTIVE
2. CUT TRACE (A)&(B) TO ALLOW STEPPING WITH HEAD NOT LOADED OR DOOR OPEN.

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.
	LINEAR ± .XX / ± .XXX	12-74	0317
CASE DEPTH	ANGULAR ±		
HARDNESS	CORNERS EDGES BROKEN OUTSIDE MAX		
SURFACE TREATMENT ES	CORNERS EDGES BROKEN INSIDE MAX		

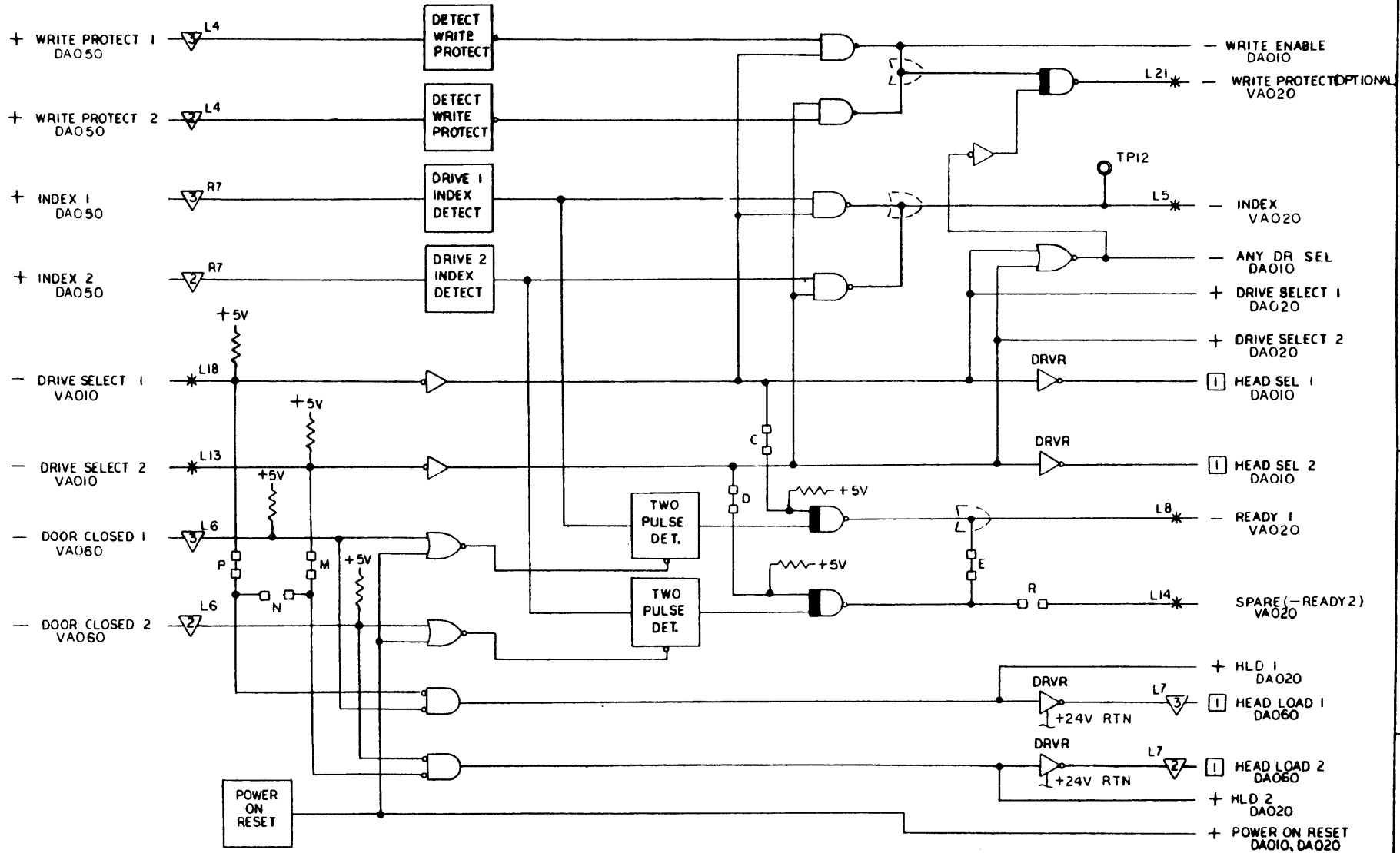
SHUGART ASSOCIATES

TITLE: LOGIC DIAGRAM STEPPER CONTROL/WRITE PROTECT

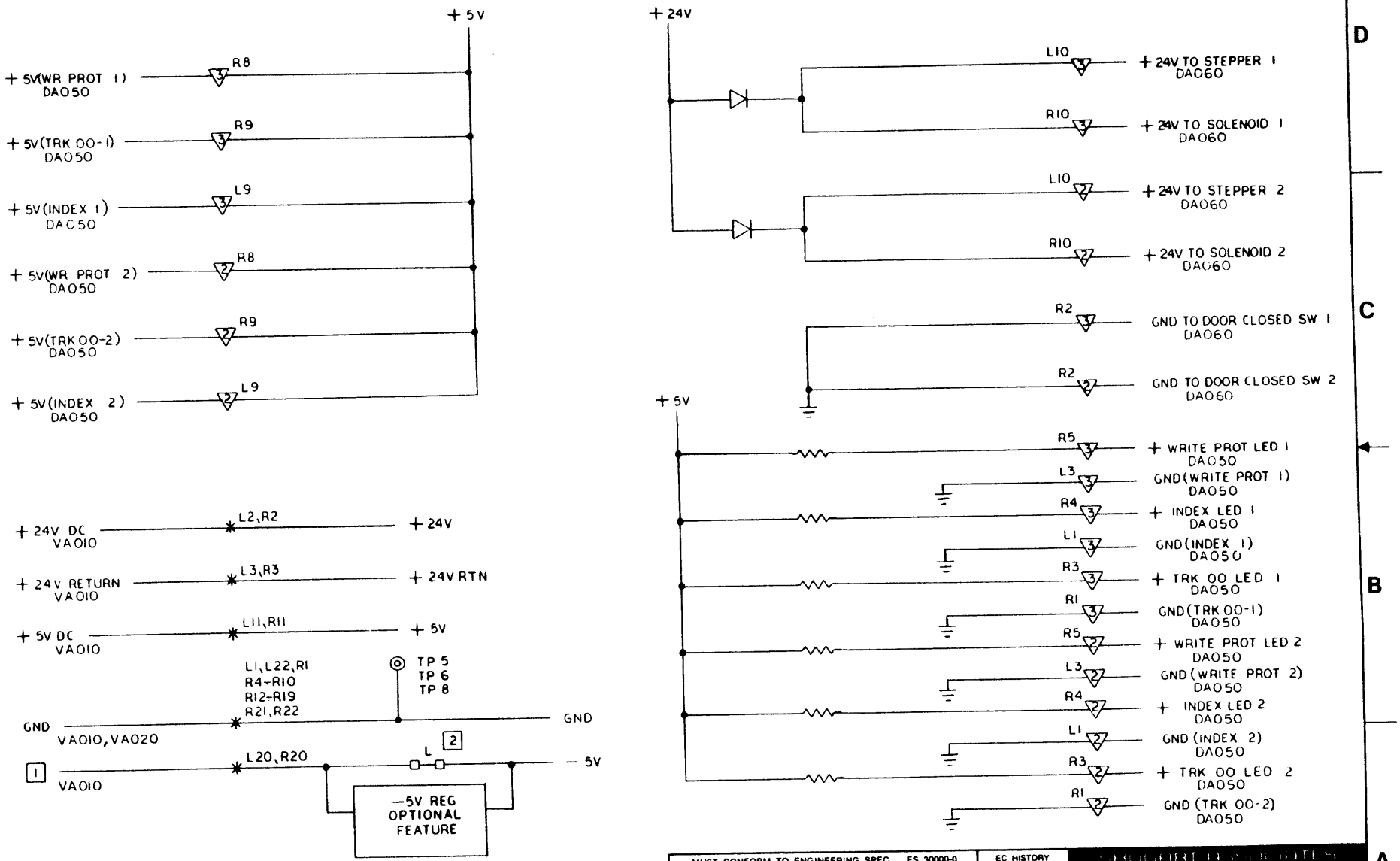
DETAIL	CHUCK	10-74	RELEASED FOR ASSEMBLY
DESIGN	DD	10-74	50268
APPRO	BF	11-74	SHEET 1 OF 1

SCALE: C | DOC CODE: OD | PART NO: 50293-0 | REV/EC: 0317

DA020


PART NO 50294-0
+ WRITE PROTECT 1 DA050
+ WRITE PROTECT 2 DA050
+ INDEX 1 DA050
+ INDEX 2 DA050
DETECT WRITE PROTECT
DETECT WRITE PROTECT
DRIVE 1 INDEX DETECT
DRIVE 2 INDEX DETECT
+5V
— DRIVE SELECT 1 VA010
— DRIVE SELECT 2 VA010
— DOOR CLOSED 1 VA060
— DOOR CLOSED 2 VA060
TWO PULSE DET.
TWO PULSE DET.
POWER ON RESET
— WRITE ENABLE DA010
— WRITE PROTECT (OPTIONAL) VA020
TP12
— INDEX VA020
— ANY DR SEL DA010
+ DRIVE SELECT 1 DA020
+ DRIVE SELECT 2 DA020
DRVR
[1] HEAD SEL 1 DA010
[1] HEAD SEL 2 DA010
— READY 1 VA020
SPARE (—READY2) VA020
+ HLD 1 DA020
[1] HEAD LOAD 1 DA060
+24V RTN
[1] HEAD LOAD 2 DA060
+ HLD 2 DA020
+ POWER ON RESET DA010, DA020
NOTES:
[1] GND WHEN ACTIVE, 24V WHEN INACTIVE
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 12-74 NO. 0317
TITLE LOGIC DIAGRAM INDEX / READY / SELECT
DETAIL CHUCK 10-74 RELEASED FOR ASSEMBLY
DESIGN D D 10-74 50268
APPRO B F 10-74 SHEET 1 OF 1
SCALE C
DOC CODE OD PART NO 50294-0 REV/EC 0317
DA030

PART NO 50295-0



NOTES:

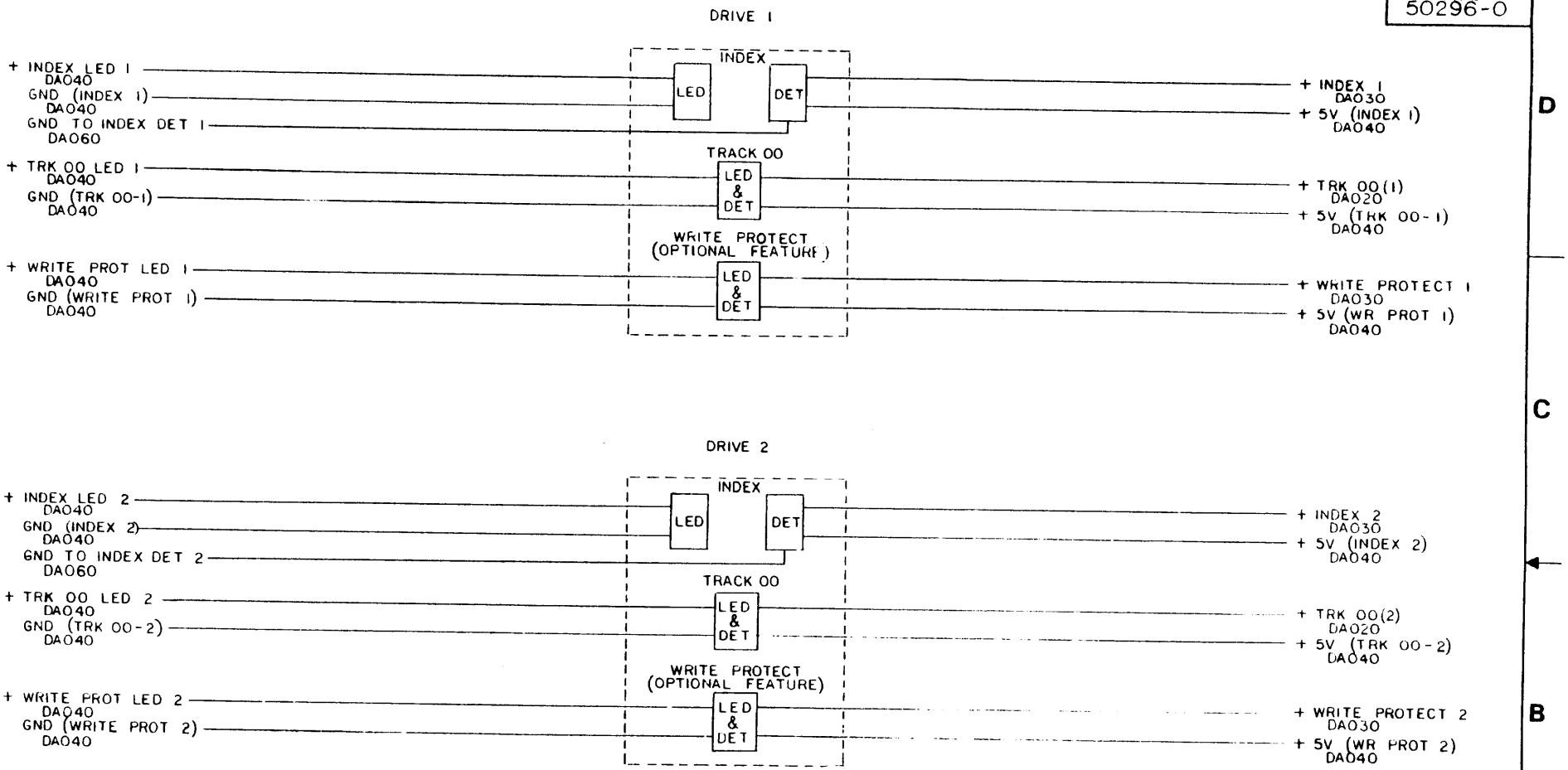
1. -5V OR -12 TO -15 SELECTABLE FEATURE.
2. CUT TRACE(L) FOR 12 TO 15 INPUT AT L20, R20. SEE PAGE AA001, TABLE II.

DA040

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0			EC HISTORY		
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	
			12-74	0317	
		LINEAR ± XX ± XXX			
CASE DEPTH					
HARDNESS		ANGULAR ±			
SURFACE TREATMENT	ES	CORNERS EDGES BROKEN OUTSIDE MAX			
		INSIDE MAX			

TITLE	LOGIC DIAGRAM VOLTAGE INTERFACE			
DETAIL	CHUCK	10-74	RELEASED FOR ASSEMBLY	
DESIGN	DD	10-74	50268	
APPRO	BF	11-74	SHEET 1 OF 1	
C	SCALE	DOC CODE OD	PART NO 50295-0	REV/EC 0317

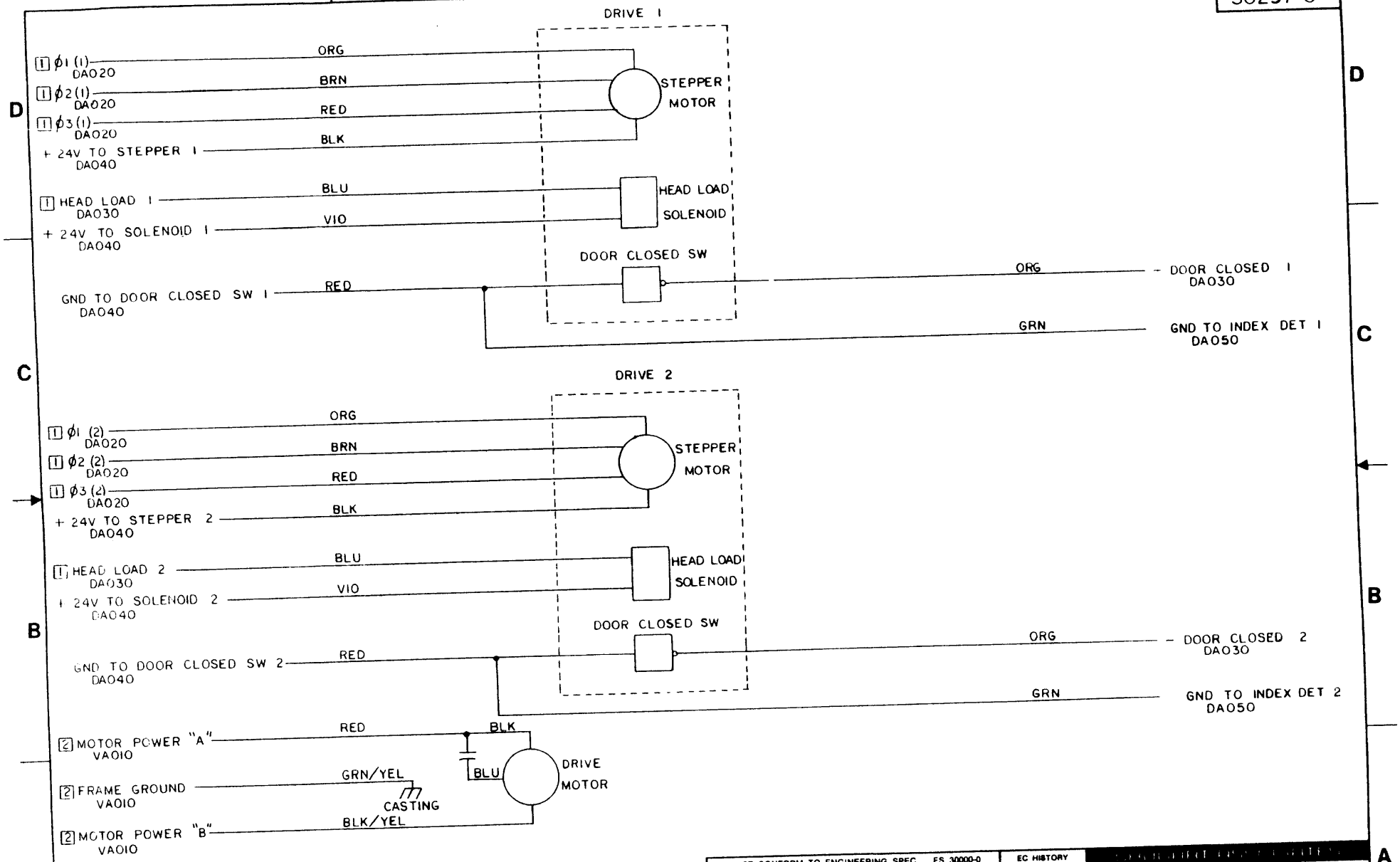
PART NO 50296-0



MUST CONFORM TO ENGINEERING SPEC ES 30000-0			EC HISTORY		TITLE	LOGIC DIAGRAM DETECTORS	
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.			
			12-74	0317			
CASE DEPTH		LINEAR ± XX / ± XXX			DETAIL	BF	10-74	RELEASED FOR ASSEMBLY
HARDNESS		ANGULAR ±			DESIGN	DD	10-74	50268
SURFACE TREATMENT	ES	CORNERS EDGES BROKEN: OUTSIDE MAX / INSIDE MAX			APPRO	BF	10-74	SHEET 1 OF 1
					SCALE	DOC CODE	PART NO	REV/EC
					C	OD	50296-0	0317

DA050

PART NO 50297-0



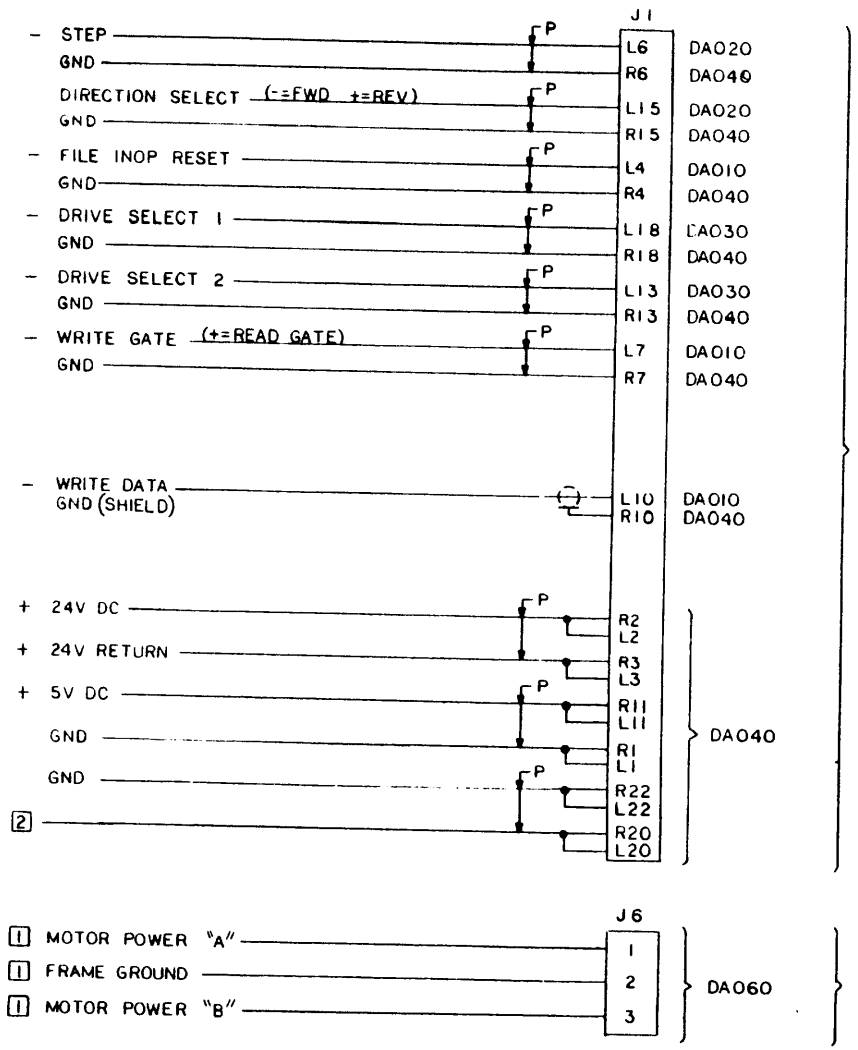
NOTES:
[1] GND WHEN ACTIVE, +24 WHEN INACTIVE.
[2] SEE PAGE VA010 FOR AC VOLTAGES.

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTORY	
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO.
		LINEAR ± XX		12-74	0317
CASE DEPTH		± XXX			
HARDNESS		ANGULAR ±			
SURFACE TREATMENT	ES	CORNERS EDGES BROKEN	OUTSIDE MAX		
			INSIDE MAX		

TITLE	LOGIC DIAGRAM MOTORS-SOLENOIDS-SWITCHES		
DETAIL	BF	10-74	RELEASED FOR ASSEMBLY
DESIGN	DD	10-74	50268
APPRO	BF	11-74	SHEET 1 OF 1
SCALE C	DOC CODE OD	PART NO 50297-0	REV/EC 0317

DA060

PART NO 50298-0



NOTES: [1]

CONN P6	60 HZ		50 HZ	
	110 V	208/230 V	110 V	220 V
1	110	208/230	110	220
2	FRAME GND	FRAME GND	FRAME GND	FRAME GND
3	110 RET	208/230	110 RET	220

[2] -5 V OR -12V TO -15V SELECTABLE FEATURE. SEE PAGE AA001 TABLE II.

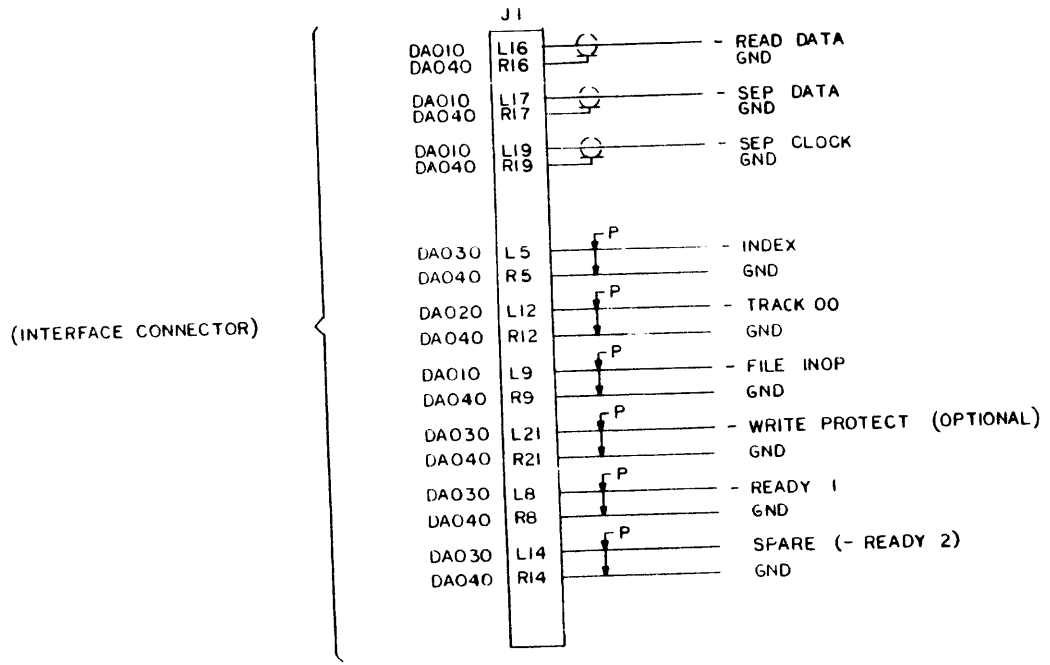
VA010

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY DATE	NO
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	12-74	0317
CASE DEPTH	LINEAR ± XX, ± XXX		
HARDNESS	ANGULAR ±		
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX, INSIDE MAX		

TITLE: LOGIC DIAGRAM INTERFACE INPUT

DETAIL	B F	10-74	RELEASED FOR ASSEMBLY
DESIGN	D D	10-74	50268
APPRO	B F	11-74	SHEET 1 OF 1
SCALE		DOC CODE OD	PART NO 50298-0 REV EC 0317

C

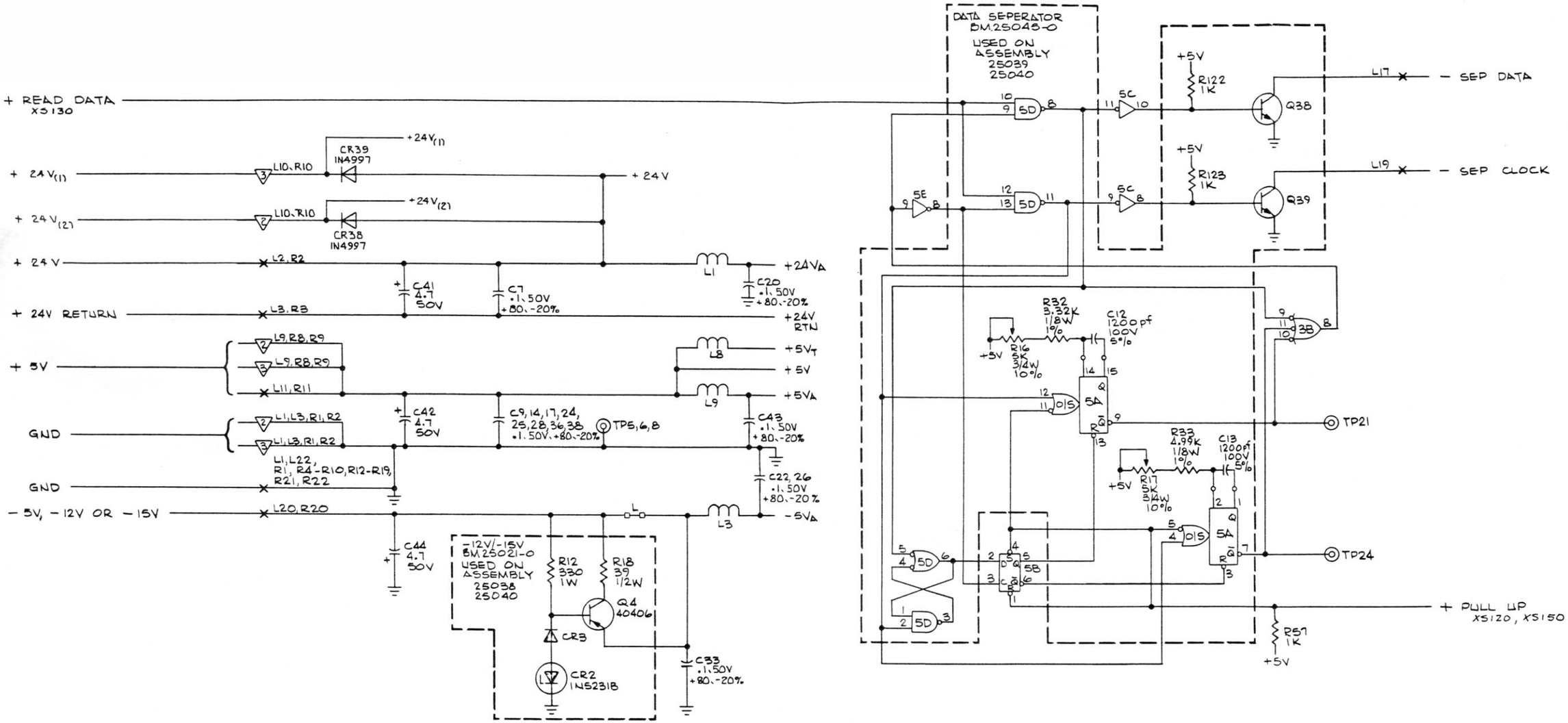


MUST CONFORM TO ENGINEERING SPEC. ES 30000-0			EC HISTORY		SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO.	TITLE LOGIC DIAGRAM INTERFACE CUTOUT
	LINEAR ± XX / ± XXX		12-74	0317	DETAIL B F 10-74 RELEASED FOR ASSEMBLY
CASE DEPTH	ANGULAR ±				DESIGN C L 10-74 50268
HARDNESS	CORNERS EDGES BROKEN OUTSIDE MAX				APPRO F F 11-74 SHEET 1 OF 1
SURFACE TREATMENT ES	INSIDE MAX				SCALE C DOC CODE OD PART NO 50299-0 REV/EC 0317

VA020

3.10 900/901 SCHEMATIC DIAGRAMS

PART NO
25036-0
USED ON ASSEMBLY
25037-4
25038 4
25039-4
25040-4



NOTES: UNLESS OTHERWISE SPECIFIED;

1. ALL CAPACITORS ARE IN MICROFARADS, 100V.
2. ALL CHOKES ARE 100μH, 10%.
3. ALL DIODES ARE IN4148.
4. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
5. ALL TRANSISTORS ARE 2N2222A.
6. CONNECTOR SYMBOL REFERENCES: (X-J1), (2-J2), (3-J3), (4-J4), (5-J5).
7. SYMBOL: -O-O- = CUT TRACE CAPABILITY. :O O: = ADD JUMPER WIRE CAPABILITY.

TYPE	POSITION	UNUSED ELEMENTS	VCC (PIN)	GND (PIN)
7400	5D		14	7
7402	2D, 2E, 5F		14	7
7404	1B, 5E, 2F	1B5	14	7
7406	5C		14	7
7410	3B, 1D, 1E		14	7
7488	4B, 2C, 4E, 3F, 4F		14	7
7474	5B, 4C, 4D		14	7
7476	1C, 1F		5	13
7486	1G		14	7
9602	5A		16	8
uA733	6E		—	—

TYPE	POSITION	UNUSED ELEMENTS	VCC (PIN)	GND (PIN)
8T20	5G		—	8
LM339	2B		3	12

REFERENCE DESIGNATION	
LAST USED	NOT USED
C48	C-11
CR39	CR9,10,26,27,28,29,30,31,32
L9	-
R139	R30
Q48	-
TP27	TP7,9,10,11,13,14,15,17,18,19, 20, 22, 23, 25 (RESERVED)
J5	

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0			EC HISTORY		SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO.	TITLE SCHEMATIC DIAGRAM DISKET, 902 (-1) (-2)
			10-74	0199	
	LINEAR ±.XX		10-74	0286	DETAIL Wdt 6/28/74 RELEASED FOR ASSEMBLY
CASE DEPTH	±.XXX		3-75	0360	DESIGN TA25036
HARDNESS	ANGULAR±		5-75	0397	APPRO AK 10/3/74 SHEET 1 OF 5
SURFACE TREATMENT ES	CORNERS EDGES BROKEN	OUTSIDE MAX	12-75	0492	D SCALE — DOC CODE SC PART NO 25036-0 REV/EC 0707
		INSIDE MAX	1-77	0707	

XS110

PART NO 25036-0

+ PULL UP XS110

− WRITE DATA

− WRITE GATE
− WRITE ENABLE
XS130

− FILE INOP RESET

− SENSE ERASE
XS130

XS130
+ HLD (1)
+ HLD (2)
+ DRIVE SELECT (1)
+ DRIVE SELECT (2)

− ANY DRV SEL
XS130

+5V
R115 100 1/2W
R74 4.7K
R76 430
R75 560
R73 620
Q26 2N2907A
CR21
Q20 2N2907A
R78 1K
R77 240
Q21
R114 150 1/2W
R134 1K
R96 1K
CR23
CR24
Q28
R103 3K
R112 150 1/2W
R59 1K
CR14
C15 100pf 500V, 5%
R44 2K
R60 1K
CR15
C16 100pf 500V
R58 6.8K
C8 1200pf 5%
R43 510
C21 .015 50V
+24VA
R81 100
R82 3K
Q27 2N4013
Q17 2N2907A
R83 22K
Q16
R79 2K
R80 1K
C10 .015 50V
R31 6.8K
R34 422 1/8W 1%
R37 3.32K 1/8W 1%
R36 422 1/8W 1%
R38 3.32K 1/8W 1%
R35 422 1/8W 1%
Q10
Q11
L2
R61 3.32K 1/8W 1%
R39 1.1K 1/8W 1%
-5VA
R21 20K
R22 20K
Q5 2N2907A
Q6 2N2907A
CR7
CR33
CR8
CR4
+ RW HEAD 1 XS130
+ RW HEAD 2 XS130
− RW HEAD 2 XS130
− RW HEAD 1 XS130
− ERASE ENABLE XS130
R93 1K
R94 10K
C32 .015 50V
R137 4.7K
L9
− FILE INOP
+ GATE STEP XS140
+ ANY DRV SEL XS130
− EN READ CHL XS130
+ POWER ON RST XS150
− POWER ON RST XS140
R99 470K
R100 1K
R65 1K
Q29 2N2907A
Q18
C23 .1 50V
R64 4.7K

XS120

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE / NO.	TITLE SCHEMATIC DIAGRAM DISKET, 902 (-1)(-2)
CASE DEPTH / HARDNESS / SURFACE TREATMENT ES	LINEAR ±.XX ±.XXX; ANGULAR ±; CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX		DETAIL Judi 6/28/78 RELEASED FOR ASSEMBLY; DESIGN TA25036; APPRO 10/3/78 SHEET 2 OF 5
			SCALE — DOC CODE SC PART NO 25036-0 REV/EC 0707

PART NO 25036-0

+ RW HEAD 1 XS120
+ RW HEAD 2 XS120
− RW HEAD 1 XS120
− RW HEAD 2 XS120
− EN READ CHL XS120
+ WRITE PROT (1)
+ ANY DRV SEL XS120
+ WRITE PROT (2)
− DRIVE SELECT (1)
− DRIVE SELECT (2)
− DOOR CLOSED (2)
− DOOR CLOSED (1)
− ERASE ENABLE XS120

+ READ DATA XS110
− READ DATA
− WRITE PROTECT
− WRITE ENABLE XS120
− DRIVE SELECT (1) XS150
− DRIVE SELECT (2) XS150
− ANY DRV SEL XS120
+ HLD (2) XS120, XS140
− DOOR CLOSED (2) XS150
+ HLD (1) XS120, XS140
− DOOR CLOSED (1) XS150
+ DRIVE SELECT (1) XS120, XS140, XS150
− HEAD SEL (1)
GND (PLANE)
+ DRIVE SELECT (2) XS120, XS140, XS150
− HEAD SELECT (2)
SHIELD GND (2)
− SENSE ERASE XS120
ERASE I (1)
ERASE I (2)

XS130

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE / NO.	TITLE SCHEMATIC DIAGRAM DISKET, 902 (-1) (-2)
CASE DEPTH	LINEAR ± XX, ± XXX		DETAIL Judy 6/28/74 RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR ±		DESIGN
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX		APPRO 14/2/74 SHEET 3 OF 5
			D SCALE 1 DOC CODE SC PART NO. 25036-0 REV/EC 0707

PART NO 25036-0

+ HLD (1) XS130
+ DIRECTION SELECT
- POWER ON RST XS120
+ DRIVE SELECT (1) XS130
- STEP
+ DRIVE SELECT (2) XS130
+ GATE STEP XS120
+ HLD (2) XS130

R118 150 1/2W
R113 150 1/2W
R133 1K
R48 1K
R101 1K
R42 510
R102 510
R68 68 1/2W
R67 68 1/2W
R66 68 1/2W
R69 68 1/2W
R72 1K
R138 1K
R139 1K
R92 1K
R71 68 1/2W
R70 68 1/2W

CR12 1N4003
CR20 1N4003
CR13 1N4003
CR11 1N4003
CR36 1N4003
CR35 1N4003
CR34 1N4003
CR25 1N4003

Q9 Q14 2N4231 Q24
Q8 2N4231 Q19
Q7 2N4231 Q15
Q35 2N4231 Q32
Q34 2N4231 Q31
Q30 2N4231 Q25

- LOAD HEAD (1)
- φ1 (1)
- DETECT φ1 (1) XS150
- φ2 (1)
- φ3 (1)
- LOAD HEAD (2)
- φ1 (2)
- DETECT φ1 (2) XS150
- φ2 (2)
- φ3 (2)

XS140

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE NO.	TITLE SCHEMATIC DIAGRAM DISKET, 902 (-1) (-2)
CASE DEPTH	LINEAR ±.XX ±.XXX		DETAIL Jude 6/28/74 RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR±		DESIGN TA25036
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX		APPRO 10/3/74 SHEET 4 OF 5
			SCALE D DOC CODE SC PART NO 25036-0 REV/EC 0707

PART NO. 25036-0

- TRACK ZERO (1)
- DETECT Φ1 (1) XS140
- DRIVE SELECT (1) XS130
- TRACK ZERO (2)
- DRIVE SELECT (2) XS130
- DETECT Φ1 (2) XS140
+ DRIVE SELECT (1) XS130
+ DRIVE SELECT (2) XS130
+ INDEX (1)
+ INDEX (2)
+ PULL UP XS110
- DOOR CLOSED (1) XS130
+ POWER ON RST XS120
- DOOR CLOSED (2) XS130

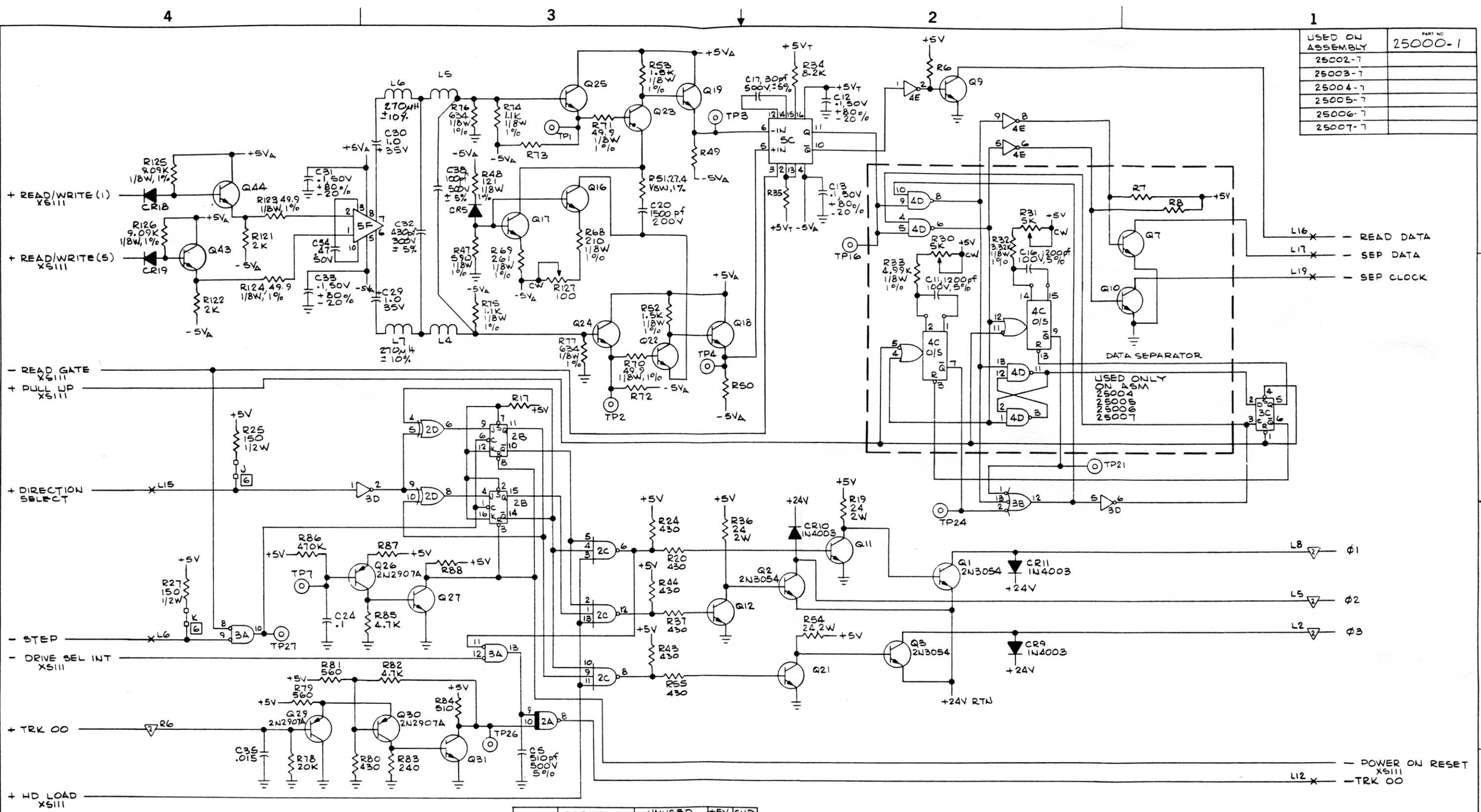
+ TRACK ZERO LED (1)
+ TRACK ZERO LED (2)
+ INDEX LED (1)
+ INDEX LED (2)
+ WRITE PROT LED (1)
+ WRITE PROT LED (2)
- TRACK ZERO
- INDEX
- READY (1)
- READY (2)

XS150

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY	SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE / NO.	TITLE SCHEMATIC DIAGRAM DISKET 902 (-1)(-2)
	LINEAR ±.XX ±.XXX		DETAIL Jude 6/28/74 RELEASED FOR ASSEMBLY
CASE DEPTH	ANGULAR±		DESIGN TA25036
HARDNESS	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX		APPRO 10/3/74 SHEET 5 OF 5
SURFACE TREATMENT ES			SCALE 1 / DOC. CODE SC / PART NO. 25036-0 / REV. C 0707

3.11 902 SCHEMATIC DIAGRAMS

USED ON ASSEMBLY	PART NO 25000-1
25002-7	
25003-7	
25004-7	
25005-7	
25006-7	
25007-7	



NOTES: UNLESS OTHERWISE SPECIFIED;

1. ALL RESISTORS ARE 1K, 1/4W, 5%.
2. ALL CAPACITORS ARE IN MICROFARADS, 100V, 10%.
3. ALL CHOKES ARE 100UH, 10%.
4. ALL DIODES ARE IN4148.
5. ALL TRANSISTORS ARE 2N2222A.
6. SYMBOL: O—O = TRACE CUT CAPABILITY.
7. SYMBOL: O O = JUMPER CAPABILITY.
8. CONNECTOR SYMBOL REFERENCES: (X) = J1 (2) = J2 (3) = J3 (5) = J5

TYPE	POSITION	UNUSED ELEMENTS	+5V (PIN)	GND (PIN)
7400	1D, 4D, 2E	1D1	14	7
7402	1A, 3A	1A1	↓	↓
7404	3D, 3E	3E3, 3D2		
7406	4E	4E2		
7410	3B, 2C			
7438	2A, 1B	1B4	↓	↓
7474	1E, 3C		14	7
7476	2B		5	13
7486	2D		14	7
UA733	5F		—	—
8T20	5C		—	8
9602	1C, 4C		16	8
75452P	3F		8	4

REF DESIGNATION LAST USED	REF DESIGNATION NOT USED
C38	C21, 22, 23, 27
CR19	CR1
L9	
Q44	Q5, 6, 8, 28
R130	R1-5, 9-11, 39, 60, 63, 65-67, 89, 90
TP35	TP10, 17, 18, 19, 22, 23, 20 28, 29, 30, 31, 32, 33, 34

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE SCHEMATIC DIAG, DISKET
		3-75	0358	
	LINEAR ±.XX	5-75	0396	DETAIL 3/4/74 RELEASED FOR ASSEMBLY
CASE DEPTH	±.XXX	8-75	0436	DESIGN SEE ABOVE
HARDNESS	ANGULAR±	1-76	0485	APPRO 3/7- SHEET 1 OF 2
SURFACE TREATMENT ES	CORNERS EDGES BROKEN OUTSIDE MAX	3-76	0517	D SCALE — DOC CODE SC PART NO 25000-1 REV/EC 0596
	INSIDE MAX	10-76	0596	

XS110

PART NO 25000-1

- WRITE DATA
- POWER ON RESET XS110
- FILE INOP RESET
- DRIVE SEL INT XS110 (OUTPUT TO XS110)
- DRIVE SELECT
- HEAD LOAD
- DOOR CLOSED
- WRITE GATE
+ WRITE PROTECT
+ INDEX/SECTOR
+24V
+24V RETURN
+5V
GROUND
-5V, OR -12 TO -15V

+24V
+24V$_A$
+24V RTN
+5V$_T$
+5V
+5V$_A$
GND
-5V$_A$

+ IN USE LED
+ PULL UP XS110
XS110
+ READ/WRITE (1)
XS110
+ READ/WRITE (5)
- READ GATE XS110
- ERASE DRV (3)
+ WRITE PROT LED
+ TRK 00 LED
+ INDEX LED
- FILE INOP
- LOAD HEAD
+ HD LD XS110
- READY
- WRITE PROTECT
- INDEX
- SECTOR

-5 V REG FOR -12 TO -15 INPUT

CUT TRACE "L" ON ASM 25003 25005 25007

SECTOR SEPARATOR USED ONLY ON ASM 25006 25007

XS111

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE	SCHEMATIC DIAG., DISKET
	LINEAR ±.XX ±.XXX			DETAIL Judd 3/6/74	RELEASED FOR ASSEMBLY
CASE DEPTH	ANGULAR ±			DESIGN	SEE ABOVE
HARDNESS	CORNERS EDGES BROKEN OUTSIDE MAX			APPRO PW 3/74	SHEET 2 OF 2
SURFACE TREATMENT ES	INSIDE MAX			SCALE D —	DOC CODE SC / PART NO 25000-1 / REV/EC 0596