

P R E F A C E

The contents of this technical instruction comprise all necessary instructions for the service of the Floppy Disk Drive

DS 3413 / SA 800

The Floppy Disk Drive is used for the following Units:

DS 2000

DS 2100

SAT 808

BITSY dds 2

The electrical interface between the SA 800 drive and the host system is made via three connectors. The control mode of the resp. Controller is explained in a separate brochure.

If any changes might be necessary you will be informed by our technical reports.

January 1981

TRIUMPH-ADLER Aktiengesellschaft
für Büro- und Informationstechnik
Service Department dds

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TECHNICAL SPECIFICATION

CAPACITY

Unformatted:

per Disk	3,2 megabits
per Track	41,7 kilobits

IBM Format:

per Disk	2,0 megabits
per Track	26,6 kilobits
per sector	128,0 byte

<u>Rotation Speed:</u>	360,0 rpm
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<u>Tracks:</u>	77,0
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<u>Track Density:</u>	48,0 tpi
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<u>Encoding Method:</u>	FM
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<u>Track to Track Access Time:</u>	10,0 ms
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<u>Power Requirements:</u>	Operating voltage 220 V \pm 10% AC
	Frequenzy 50 Hz
	Operating current 0,5 A
	360 BTU/0,11 Kw

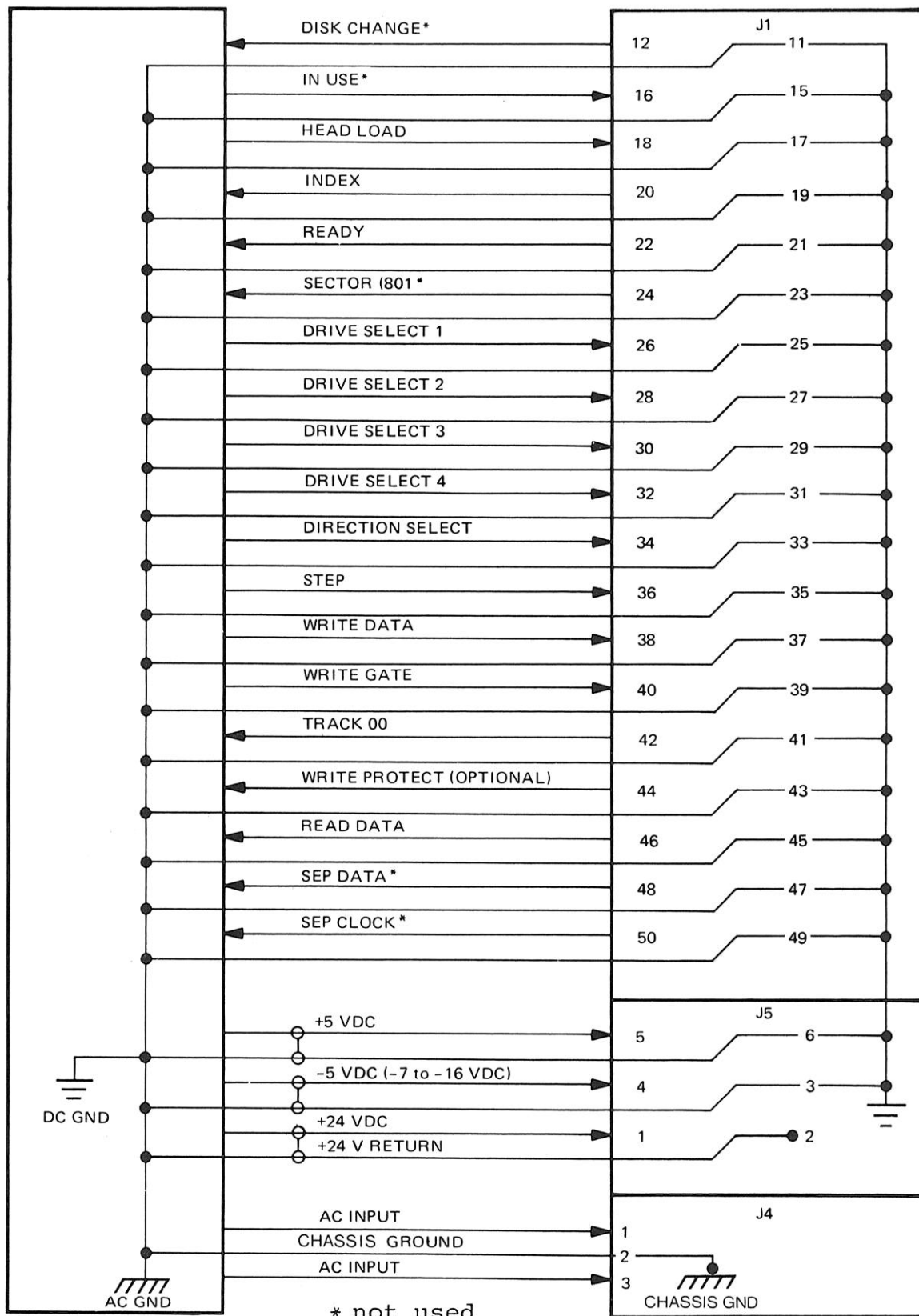
<u>Environmental Limits:</u>	Temperature 15° C - 32° C
	Temperature change is not to
	exceed 6,6° C per hour
	Humidity 20° - 80° C
	(non condensating)

INTERFACE CONNECTIONS

Host System

Flat Ribbon max. 10 Feet

SA 800 (Disk Drive)



1.0 General Operations

The SA800/801 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 desired track.
- Read and write data.

The relationship and interface signals for the internal functions of the SA800/801 are shown in Figure 1.

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 801.
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 (SA801 only)

1.1 Head Positioning

An electrical stepping motor (Head Position Actuator) and lead screw positions the read/write head. The stepping motor rotates the lead screw clockwise or counter-clockwise 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.

1.2 Diskette Drive Spindle

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.

1.3 Read/Write Head

The read/write head is a ceramic head and 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 SA800/801 ceramic 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 Acuator lead screw. The Diskette is held in a place perpendicular to the read/write head by one platen located on the base casting. The Diskette is loaded against the head with a load pad actuated by the head load solenoid.

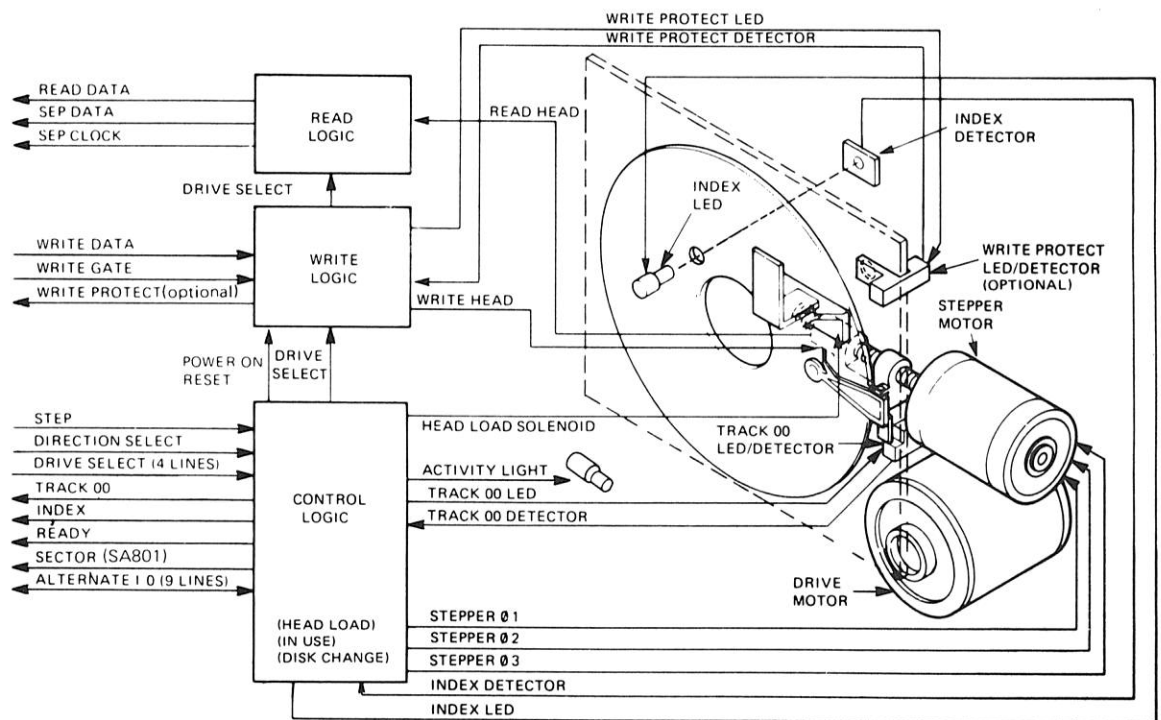


Figure 1 SA800/801 Functional Diagram

2.0 Recording Format (Single Density)

2.1 The format of the data recorded on the Diskette is totally a function of the host system. Data is recorded on the diskette using frequency modulation as the recording mode, i.e., each data bit recorded on the diskette has an associated clock bit recorded with it, this is referred to as FM. Data written on and read back from the diskette takes the form as shown in Figure 2. The binary data pattern shown represents a 101.

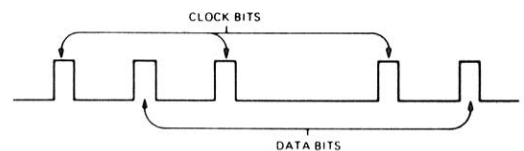


Figure 2 Data Pattern

2.2 Bit Cell

As shown in Figure 3, the clock bits and data bits (if present) are interleaved. By definition, a Bit Cell is the period between the leading edge of one clock bit and the leading edge of the next clock bit.

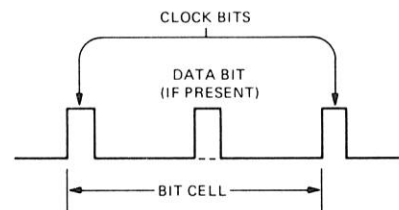


Figure 3 Bit Cell

2.3 Byte

A Byte, when referring to serial data (being written onto or read from the disc drive), is defined as eight (8) consecutive bit cells. The most significant bit cell is defined as bit cell 0 and the least significant bit cell is defined as bit cell 7. When reference is made to a specific data bit (i.e., data bit 3), it is with respect to the corresponding bit cell (bit cell 3).

During a write operation, bit cell 0 of each byte is transferred to the disc drive first with bit cell 7 being transferred last. Correspondingly, the most significant byte of data is transferred to the disc first and the least significant byte is transferred last.

When data is being read back from the drive, bit cell 0 of each byte will be transferred first with bit cell 7 last. As with reading, the most significant byte will be transferred first from the drive to the user.

Figure 4 illustrates the relationship of the bits within a byte and Figure 5 illustrates the relationship of the bytes for read and write data.

2.4 Recording Format (Double Density)

Double capacity can be obtained by use of M²FM (modified, modified frequency modulation) rather than FM (frequency modulation) which is the standard method of encoding data on the diskette.

The differences between FM and M²FM encoding are shown in Figure 6. Note that M²FM results in a 1 to 1 relationship between the "flux changes per inch" and the bits per inch recorded on the diskette. This also results in a doubling of the data transfer rate, from 250 to 500 KBS, when compared to FM.

Data error rate performance equal to standard capacity diskettes using FM encoding can be achieved by using:

- The SA800/801 diskette drive with its proprietary ceramic/ferrite read/write head.

- Phase locked loop (VFO) data separator with asymmetrical (60/40) data and clock windows.
- Write precompensation.

Provision of the phase locked loop data separator and write precompensation circuitry is the responsibility of the user of the SA800/801 diskette drive.

Shugart Associates will provide design information, as required, to SA800/801 users who desire to incorporate double capacity diskette drives in their end products.

The bit cell for M²FM encoded data is one half the duration of the bit cell for FM encoded data. Also, unlike FM, the M²FM bit cell does not always contain a clock bit at its leading edge. This lack of a clock bit makes data separation more complex. Also, the window size is half the FM window size, which results in less tolerance to bit shift. The only reliable method to separate M²FM encoded data is

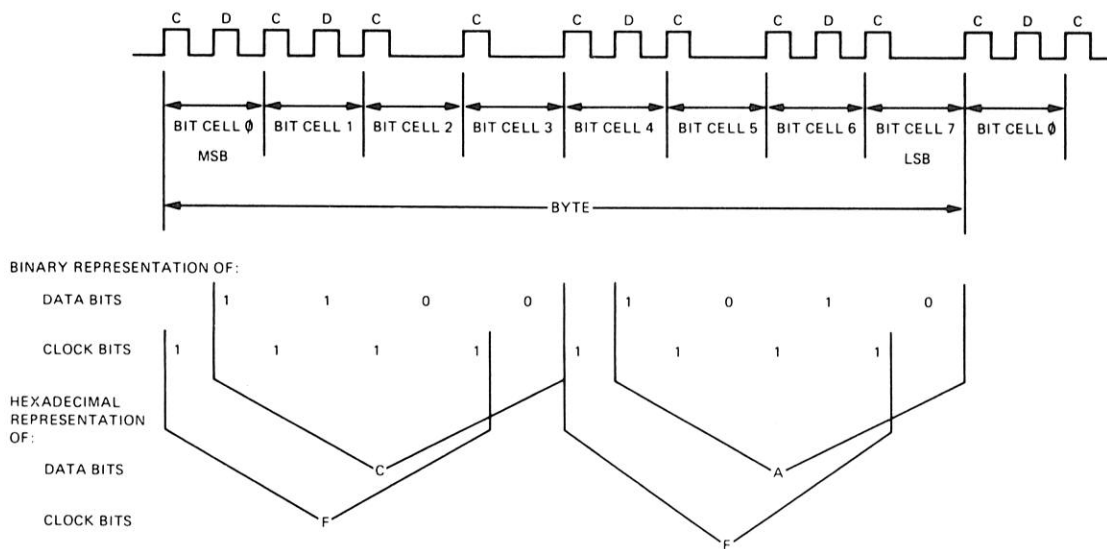


Figure 4 Byte

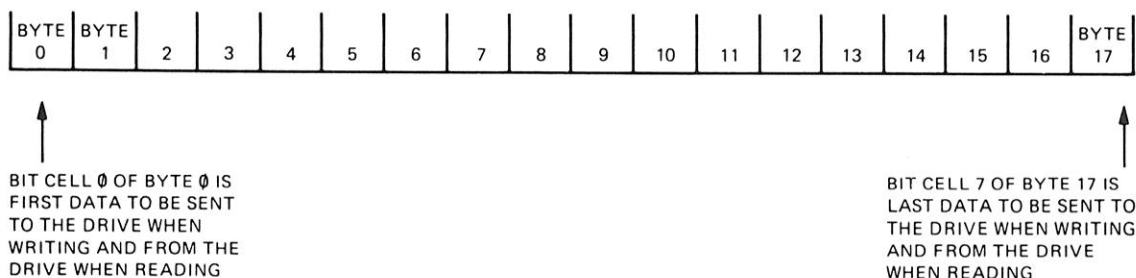


Figure 5 Data Bytes

through use of a phase locked loop (VFO) type of data separator. The VFO, once synchronized, tracks the data and generates clock and data windows, improving the bit shift tolerance over the conventional "hard" data separators commonly used in FM recording, which use windows of fixed timing.

2.5 Tracks

The SA800/801 drive is capable of recording up to 77 tracks of data. The tracks are numbered 0-76. Each track is made available to the read/write head by accessing the head with a stepper motor and carriage assembly. Track accessing will be covered in Section 3.

Basic Track Characteristics:

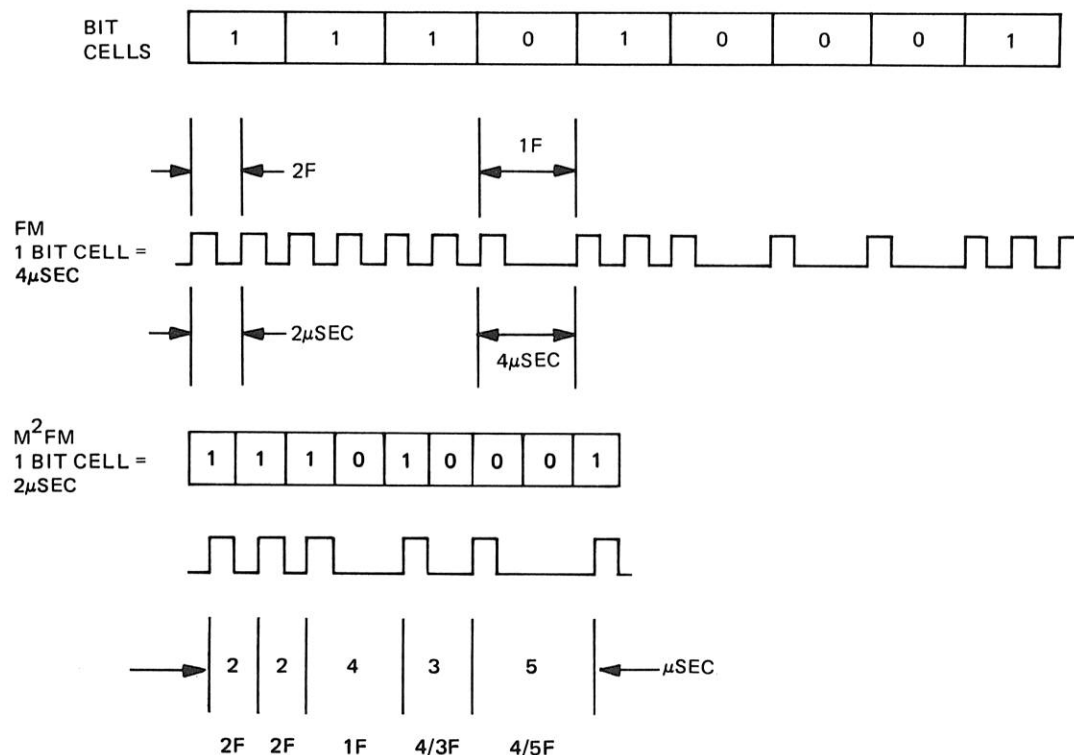
No. bits/track Single Density	41,300 bits
No. bits/track Double Density	82,600 bits
Index Pulse Width	$1.7 \pm .5$ ms
Index/Sector Pulse Width	$.4 \pm .2$ ms
(SA 801 only)	

2.6 Track Format

Tracks may be formatted in numerous ways and is dependent on the using system. The SA800/801 use index and sector recording formats respectively.

2.6.1 Sector Recording Format

In this Format, the using system may record up to 32 sectors (records) per track. Each track is started



FM Encoding:

- Write data bits at the center of the bit cell
- Write clock bits at the leading edge of the bit cell

M²FM Encoding:

- Write data bits at the center of the bit cell
- Write clock bits at the leading edge of the bit cell if:
 - 1) There is no data bit or clock bit written in the previous bit cell, and
 - 2) There will be no data bit written in the present bit cell.

NOTE: In M²FM, the write oscillator frequency is doubled, while maintaining the same flux changes per inch as FM. Thus, the bit cell in M²FM is ½ that in FM. Data transfer rate is also doubled, since a 1 to 1 relationship exists between flux changes per inch and bits per inch (2 to 1 in FM).

Figure 6 FM and M²FM Encoding

by a physical index pulse and each sector is started by a physical sector pulse. This type of recording is called hard sectoring. Figure 7 shows a typical Sector Recording Format.

2.6.2 Soft Sector Recording Format

In this Format, the using system may record one long record or several smaller records. Each track is started by a physical index pulse and then each record is preceded by a unique recorded identifier. This type of recording is called soft sectoring. Figure 8 shows a soft sector format. (IBM compatible)

2.7 Typical Track Index Format

Figure 8 shows a track Format, which is IBM compatible, using Index Recording Format with soft sectoring.

2.7.1 Gaps (Ref. Fig. 8)

Each field on a track is separated from adjacent fields by a number of bytes containing no data bits. These areas are referred to as gaps and are provided to allow the updating of one field without affecting adjacent fields. As can be seen from Figure 8, there are four different types of gaps on each track.

Gap 1 Post-Index Gap

This gap is defined as the 32 bytes between Index Address Mark and the ID Address Mark for Sector one (excluding the address mark bytes). This gap is always 32 bytes in length and is not affected by any updating process.

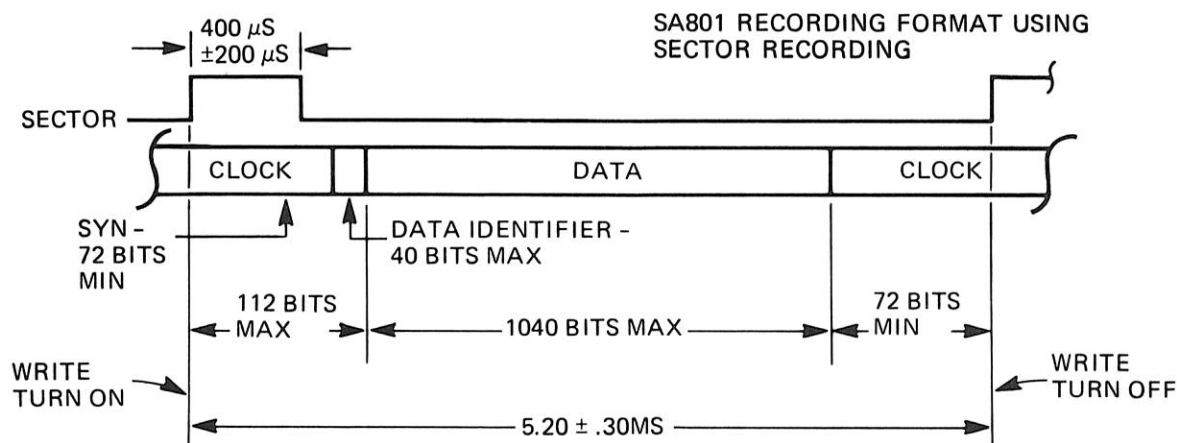
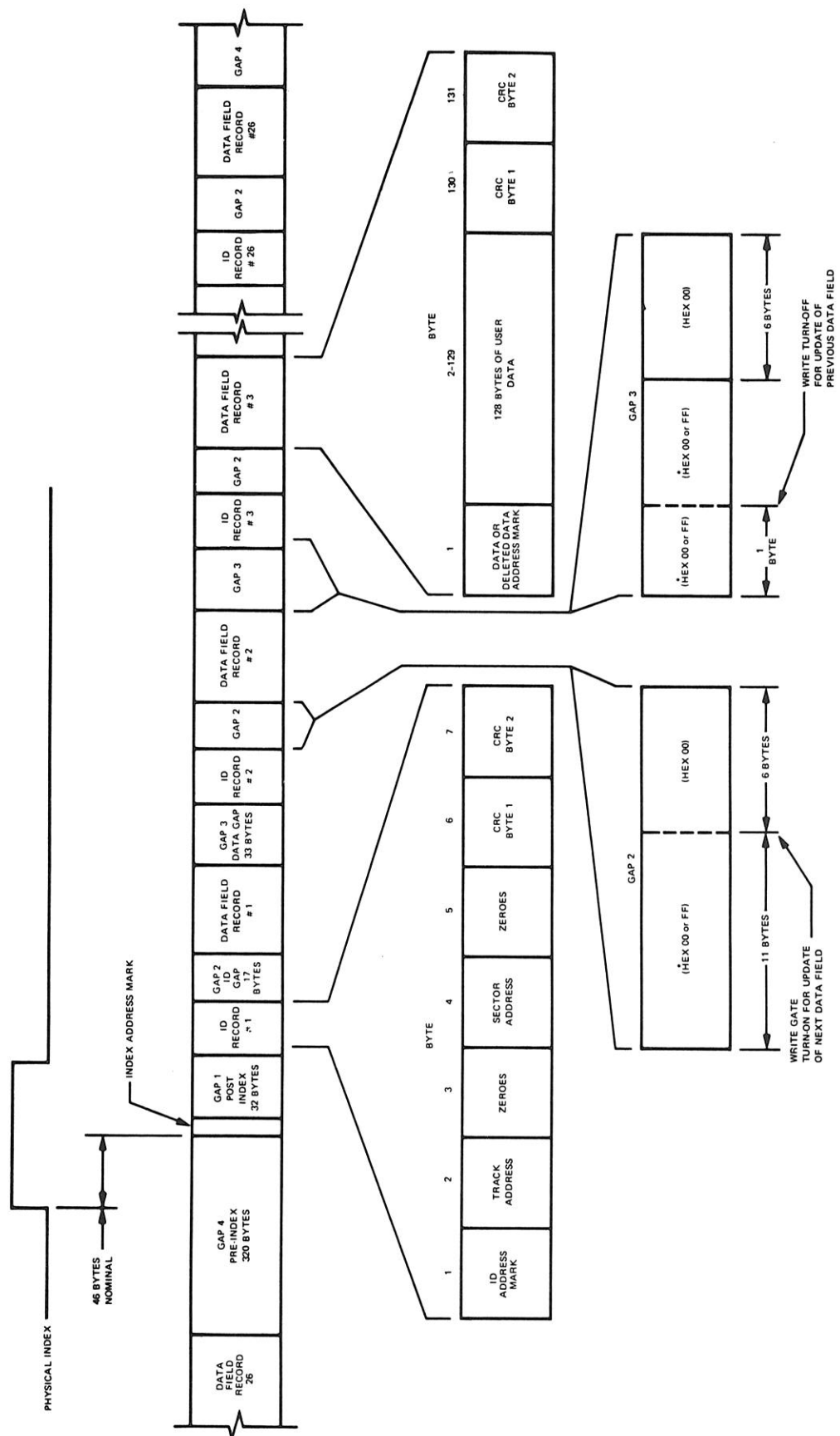


Figure 7 Sector Recording Format



*Where Hex 00 or FF is optional, FF is recommended.

Figure 8 Track Format

Gap 2 ID Gap

The seventeen bytes between the ID Field and the Data Field is defined as Gap 2 (ID Gap). This gap may vary in size slightly after the Data Field has been updated.

Gap 3 Data Gap

The thirty-three bytes between the Data Field and the next ID Field is defined as Gap 3 (Data Gap). As with the ID Gap, the Data Gap may vary slightly in length after the adjacent Data Field has been updated.

Gap 4 Pre-Index Gap

The three hundred and twenty bytes between the last Data Field on a track and the Index Address Mark is defined as Gap 4 (Pre-Index Gap). Initially, this gap is nominally 320 bytes in length; however,

due to write frequency tolerances and disc speed tolerances this gap may vary slightly in length. Also, after the data field of record 26 has been updated, this gap may again change slightly in length.

2.7.2 Address Marks

Address Marks are unique bit patterns one byte in length which are used in this typical recording format to identify the beginning of ID and Data Fields and to synchronize the deserializing circuitry with the first byte of each field. Address Mark bytes are unique from all other data bytes in that certain bit cells do not contain a clock bit (all other data bytes have clock bits in every bit cell). There are four different types of Address Marks used. Each of these are used to identify different types of fields.

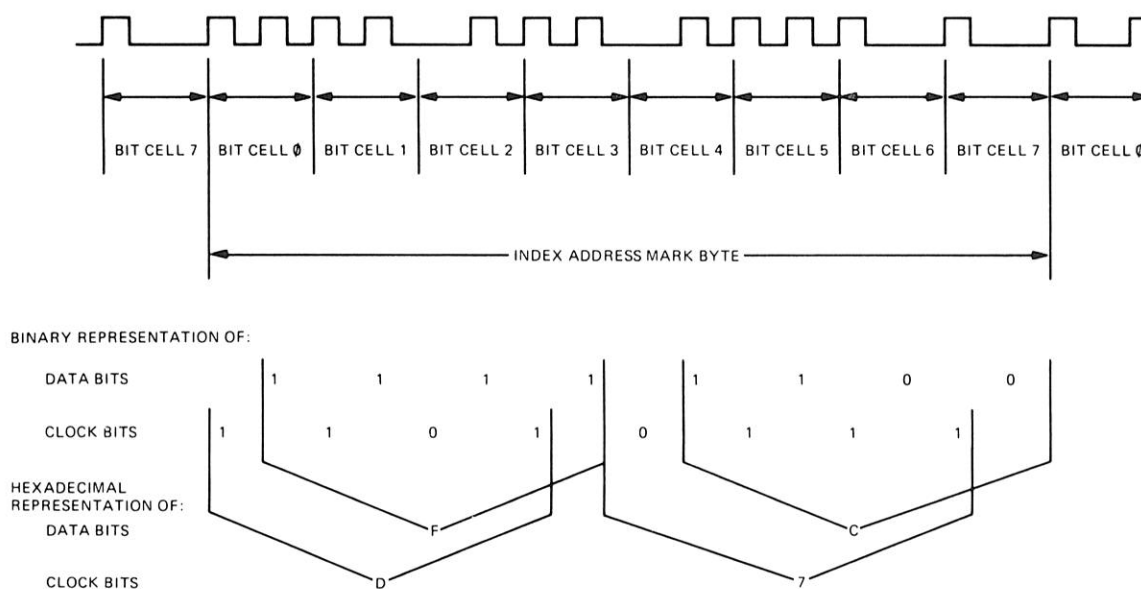


Figure 9 Index Address Mark

Index Address Mark

The Index Address Mark is located at the beginning of each track and is a fixed number of bytes in front of the first record. The bit configuration for the Index Address Mark is shown in Figure 9.

ID Address Mark

The ID Address Mark byte is located at the beginning of each ID Field on the diskette. The bit configuration for this Address Mark is shown in Figure 10.

Data Address Mark

The Data Address Mark byte is located at the beginning of each nondeleted Data Field on the diskette. The bit configuration for this Address Mark is shown in Figure 11.

Deleted Data Address Mark

The Deleted Data Address Mark byte is located at the beginning of each deleted Data Field on the diskette. The bit configuration for this Address Mark is shown in Figure 12.

2.7.3 CRC

Each field written on the diskette is appended with two Cyclic Redundancy Check (CRC) bytes. These two CRC bytes are generated from a cyclic permutation of the data bits starting with bit zero of the address mark and ending with bit seven of the last byte within a field (excluding the CRC bytes).

When a field is read back from a diskette, the data bits (from bit zero of the address mark to bit seven of the second CRC byte) are divided by the same generator polynomial. A non-zero remainder indicates an error within the data read back from the drive while a remainder of zero indicates the data has been read back correctly from the disk.

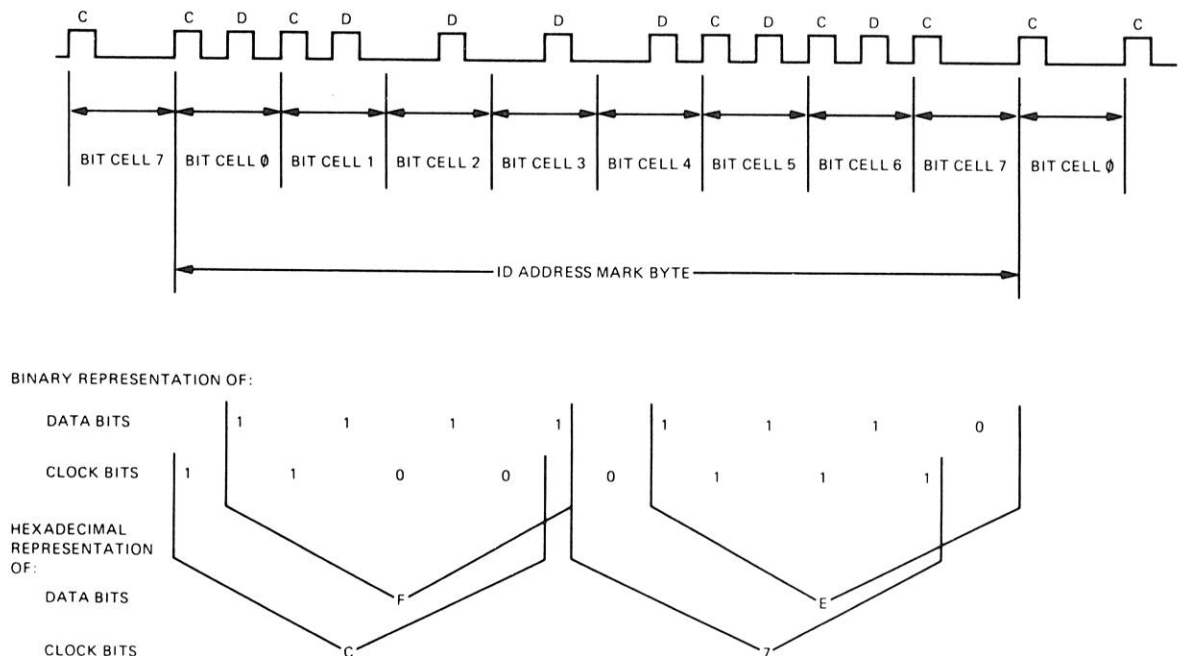
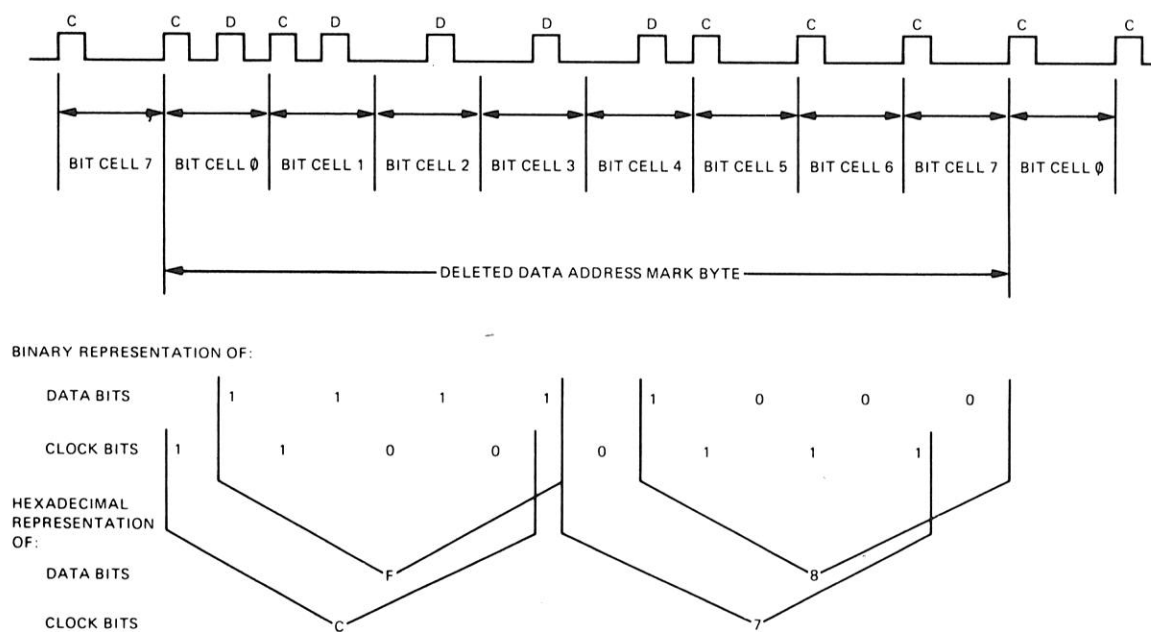
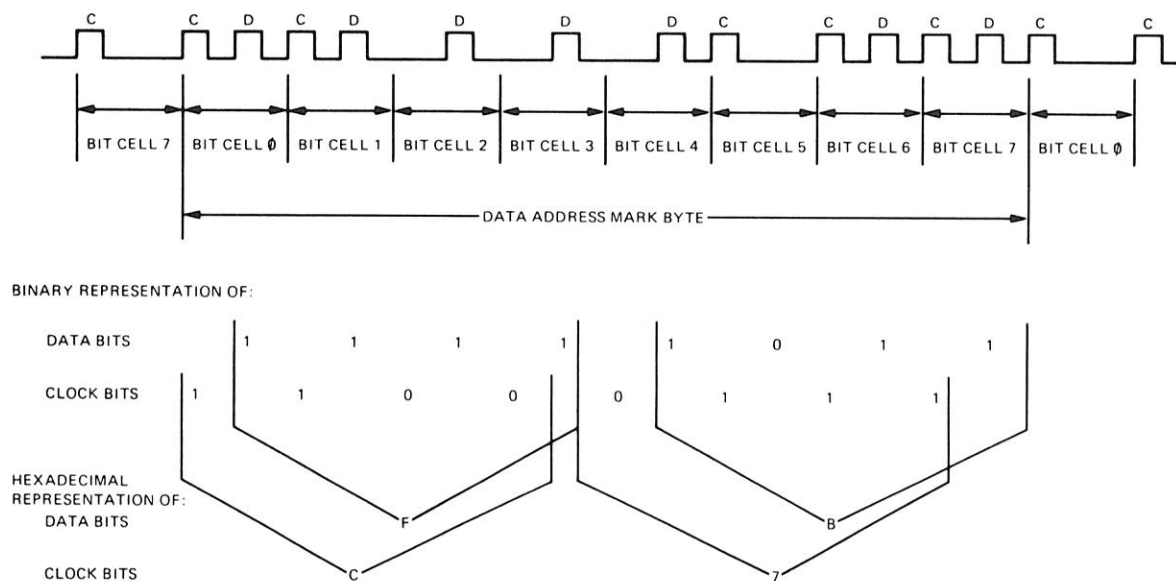


Figure 10 ID Address Mark



3.0 PREVENTIVE MAINTENANCE

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.

Preventive Maintenance Procedures

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

Cleanliness

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

MAINTENANCE FEATURES

Alignment Diskette

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

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

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

Special Tools

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

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

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

Figure 1

4.0 REMOVALS, ADJUSTMENTS

For parts location, see Section 5.

4.1 Motor Drive

4.1.1 Drive Motor Assembly: Removal and Installation

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

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

4.1.2 Motor Drive Pulley

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

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

4.2 Side Cover: Removal

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

4.3 Cartridge Guide Access

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

4.4 Sector/Index LED Assembly: Removal and Installation

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

4.5 Write Protect Detector: Removal and Installation

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

4.5.1 Write Protect Detector Adjustment

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

4.6 Head Load Actuator

4.6.1 Head Load Actuator: Removal and Installation

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

- Remove screw holding the actuator to the cartridge guide.

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

- Reverse the procedure for installation.

4.6.2 Head Load Actuator Adjustment

- Remove side cover.
- Energize Head Load Coil.
- Place Head Load Actuator adjustment tool, P/N 50391, on platen.
- Adjust down stop so that the top of Head Load Bail is flush with top of tool within $\pm .005$ " at track 76. Reference Figure 3.
- Step carriage to track 38.
- De-energize Head Load Coil.
- Place adjustment tool onto R/W Head and place load button in cup of tool.
- Adjust up stop on actuator so that bail just touches Head Load Arm or has $.005$ " clearance or lifts Load Arm $.005$ ". Reference Figure 2.
- 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.
- Replace side cover.

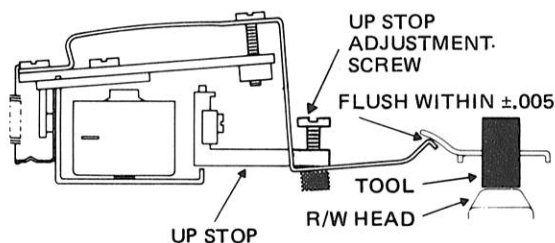


FIGURE 2 HEAD LOAD ACTUATOR UPSTOP ADJUSTMENT

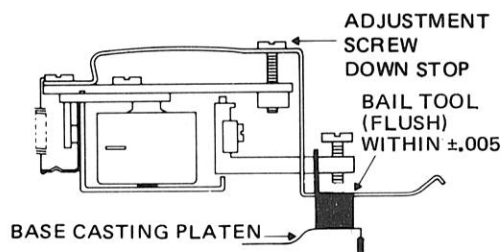


FIGURE 3 HEAD LOAD ACTUATOR DOWN STOP ADJUSTMENT

4.6.3 Head Load Actuator Timing

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

Note: Not to exceed $\frac{1}{4}$ turn.

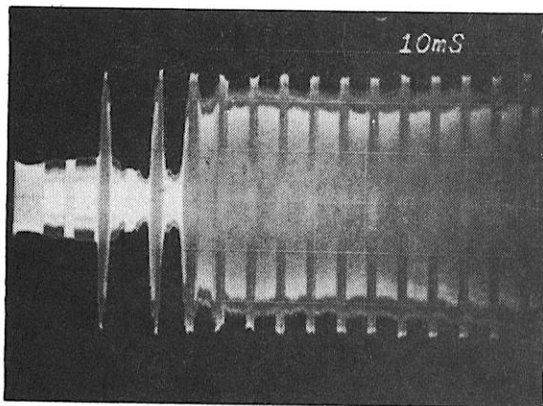


FIGURE 4 HEAD LOAD ACTUATOR TIMING

4.7 Index/Sector Photo Transistor Assembly

4.7.1 Index/Sector Photo Transistor Assembly: Removal and Installation

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

d. Remove screw holding detector to the base plate and remove assembly.

e. To install reverse procedure.

4.7.2 Index/Sector Photo Transistor Potentiometer Adjustment

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

4.7.3 Index/Sector Adjustment

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

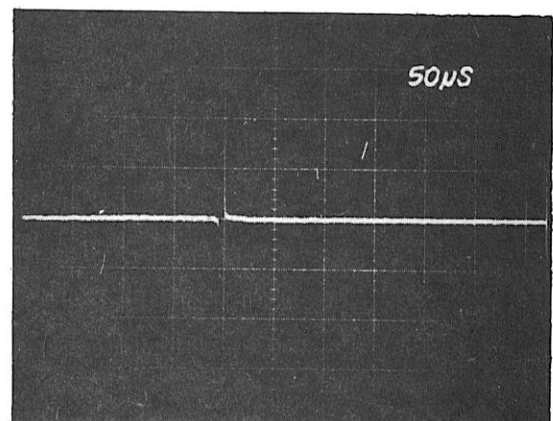


FIGURE 5 INDEX TIMING

- f. Loosen the holding screw in the Index Transducer until the transducer is just able to be moved.
- g. Observing the timing, adjust the transducer until the timing is $200 \pm 50 \mu\text{sec}$. Insure that the transducer assembly is against the registration surface on the base casting.
- h. Tighten the holding screw.
- i. Recheck the timing.
- j. Seek to track 76 and reverify that the timing is $200 \pm 50 \mu\text{sec}$.

4.8 Spindle Assembly

- a. Remove side cover (Section 4.2).
- b. Swing out cartridge guide (Section 4.3).
- c. Remove the nut and washer or 2 spring washers holding the spindle pulley.

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

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

4.8.1 Clamp Hub Removal

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

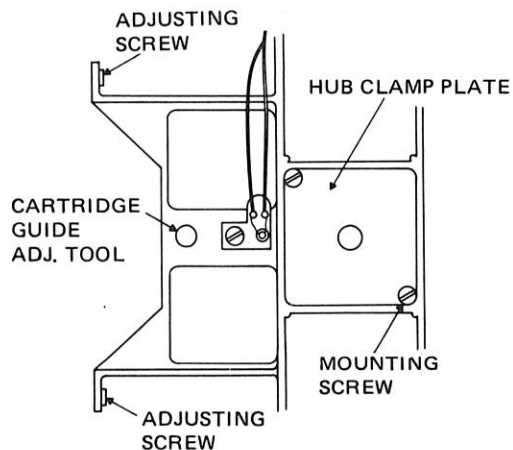


FIGURE 6 CARTRIDGE GUIDE ADJUSTMENT

4.9.1 Cartridge Guide Removal

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

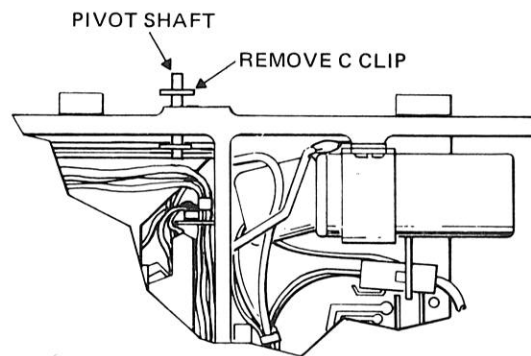


FIGURE 7 CARTRIDGE GUIDE REMOVAL

4.9.2 Cartridge Guide Adjustment

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

4.10 Front Plate Assembly: Removal

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

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

4.11 Head Amplitude Check

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

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

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

4.11.1 Stepper/Carriage Assembly; Removal and Installation

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

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

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

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

- e. Remove the grommet on the cable that is inserted into a slot on the Track 00 Detector bracket.
- f. Turn stepper shaft until the carriage runs off the end of the lead screw.
- g. To install stepper/carriage assembly, reverse procedure. Note steps "h" and "i".
- h. If installing a new carriage, set the pre-load nut in the # 3 notch. Reference Figure 8.
- i. When threading lead screw into carriage assembly, press the pre-load nut slightly against spring in order to start thread. After threading, insure there is a gap between pre-load nut and rear of carriage.

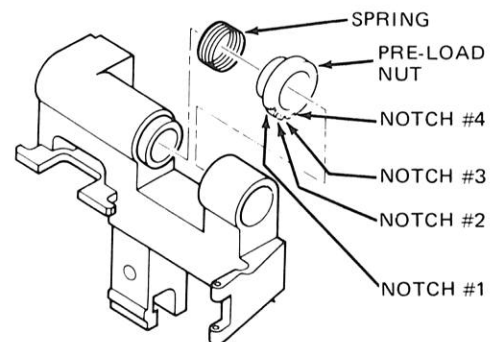


FIGURE 8 CARRIAGE ASSEMBLY

4.11.2 Carriage Assembly Readjustment After Replacement

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

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

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

- f. Step the carriage to TK 38 and proceed with head radial adjustments. Refer to Section 4.11.3.
- g. Adjust Track 00 stop (Section 4.11.7).
- h. Adjust Track 00 flag (Section 4.11.8).
- i. Adjust index (Section 4.7.3).
- j. Adjust Azimuth (Section 4.11.9).

4.11.3 Head Radial Alignment

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

- a. Load alignment diskette (SA120).

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

- b. Step the carriage to track 38.
- c. Sync the oscilloscope, external negative, on TP 12 (- CE Index). Set the time base to 20 Msec per division. This will display over one revolution.
- d. Connect one probe to TP 1 and the other to TP 2. Ground the probes on the PCB. Set the inputs to AC, Add and invert one channel. Set the vertical deflection to 100 MV/dev.
- e. The two lobes must be within 80% amplitude of each other. If the lobes do not fall within the specification, continue on with the procedure. Reference Figure 9.
- f. Loosen the two mounting screws which hold the motor clamp to the mounting plate.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

- g. Rotate the stepper motor to radially move the head in or out. If the left lobe is less than 80% of the right, turn the stepper motor counter-clockwise as viewed from the rear. If the right lobe is less than 80% of the left lobe, turn the stepper motor clockwise as viewed from the rear.

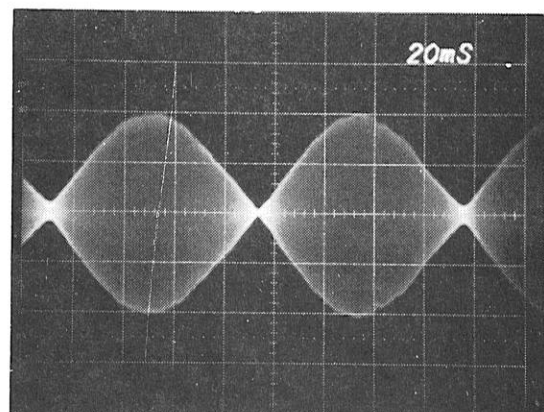


FIGURE 9 HEAD RADIAL ALIGNMENT

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

4.11.3 Read/Write Head Load Button: Removal and Installation

- a. Remove side cover if installed.
- b. To remove the old button, hold the arm out away from head, squeeze the locking tabs together with a pair of needle nose pliers and press forward.
- c. To install load button, press the button into the arm, from the head side, and it will snap in place. Reference Figure 10.

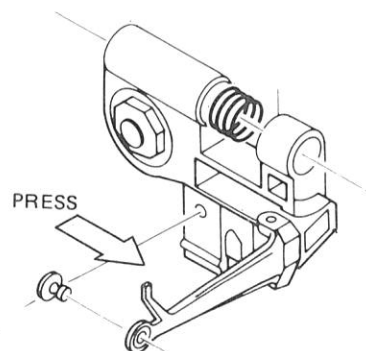


FIGURE 10

- d. Adjust according to Section 4.11.4.

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

4.11.4 Read/Write Head Load Button Adjustment

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

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

4.11.5 Head Penetration Adjustment

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

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

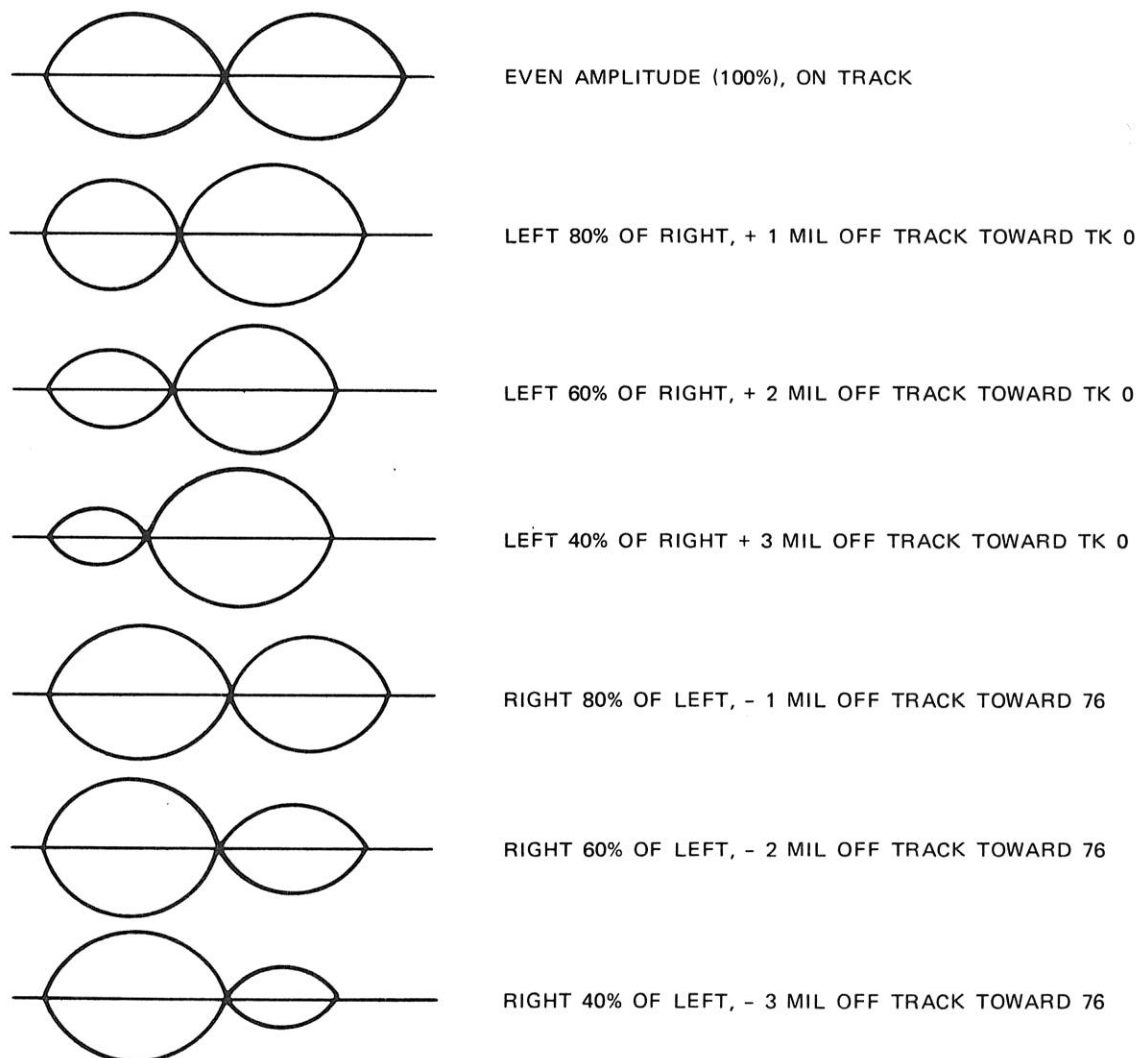


Figure 11 R/W Head Radial Alignment

- b. Swing open the cartridge as per Section 4.3.
- c. Place the penetration tool on the base assembly with the short leg on the platen, the long leg on the carriage guide bar, and the plastic tip in the center of the R/W head.
- d. The head penetration should be $.030'' \pm .003''$ read on the gauge.
- e. If the head does not meet this adjustment, move the stepper plate laterally until the gauge reads $.030''$.
- f. Tighten the screws and recheck the adjustment.
- g. Return cartridge guide and adjust as per Section 4.9.2.
- h. Adjust Azimuth (Section 4.11. 9).

4.11.6 Track 00 Detector: Removal and Installation

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

4.11.7 Track 00 Stop Adjustment

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

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

4.11.8 Track 00 Flag Adjustment

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

4.11.9 R/W Head Azimuth Alignment

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

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

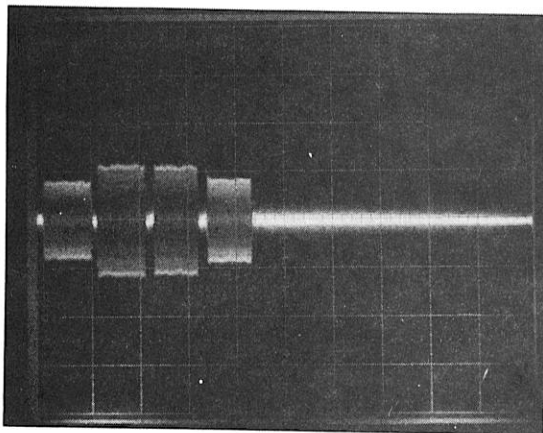


FIGURE 13

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

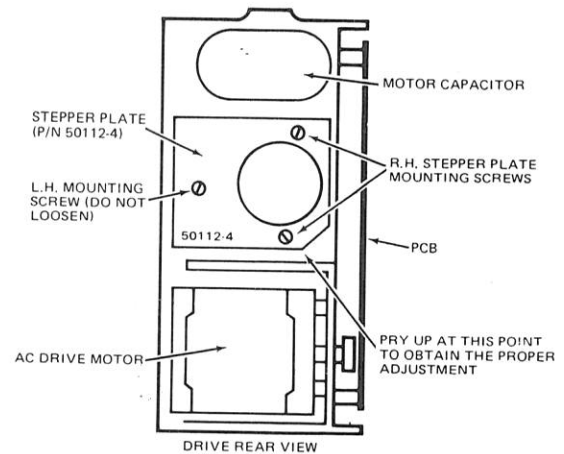


FIGURE 12

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

4.11.10 Stepper Plate Removal and Adjustment

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

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

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

4.12 Activity Light Removal and Installation (Standard)

- a. Remove P6 connector from PCB.
 - b. Remove cable clamp holding the cable and remove cable from clamp.
 - c. Remove the 2 screws holding the push button.
 - d. Remove push button and activity light from the front as an entire assembly.
 - e. Install the light and push button assembly by reversing the removal procedure.
 - f. No special orientation is required when installing P6 onto the PCB. No adjustments are required to the push button assembly.
- c. Remove front plate (Section 4.10).
 - b. Remove two screws holding assembly to front plate.
 - c. Remove two allen head screws holding assembly to push button.
 - d. Grasp both ends of push button and bow outwards to remove LED.
 - e. Reverse procedure to assemble.
 - f. Adjustment of the door lock should not be necessary. If it has to be, the gap between the armature tab and the latch should be $.015 \pm .010$. This adjustment can be made by loosening the two screws on the armature.

4.13 Door Lock

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

4.14 Activity Light (with Door Lock Option)

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

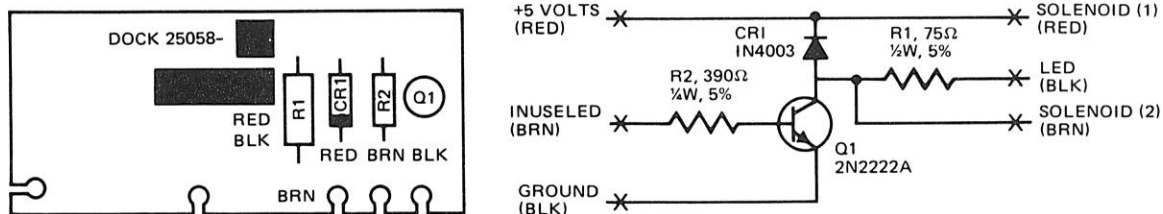
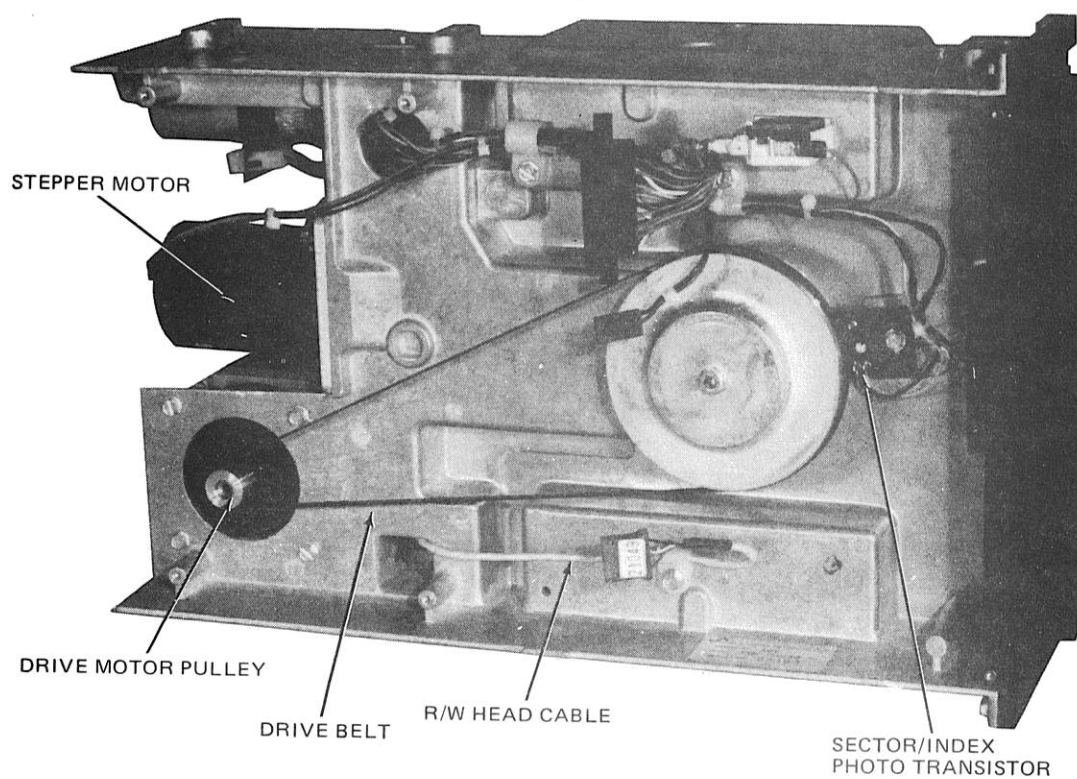
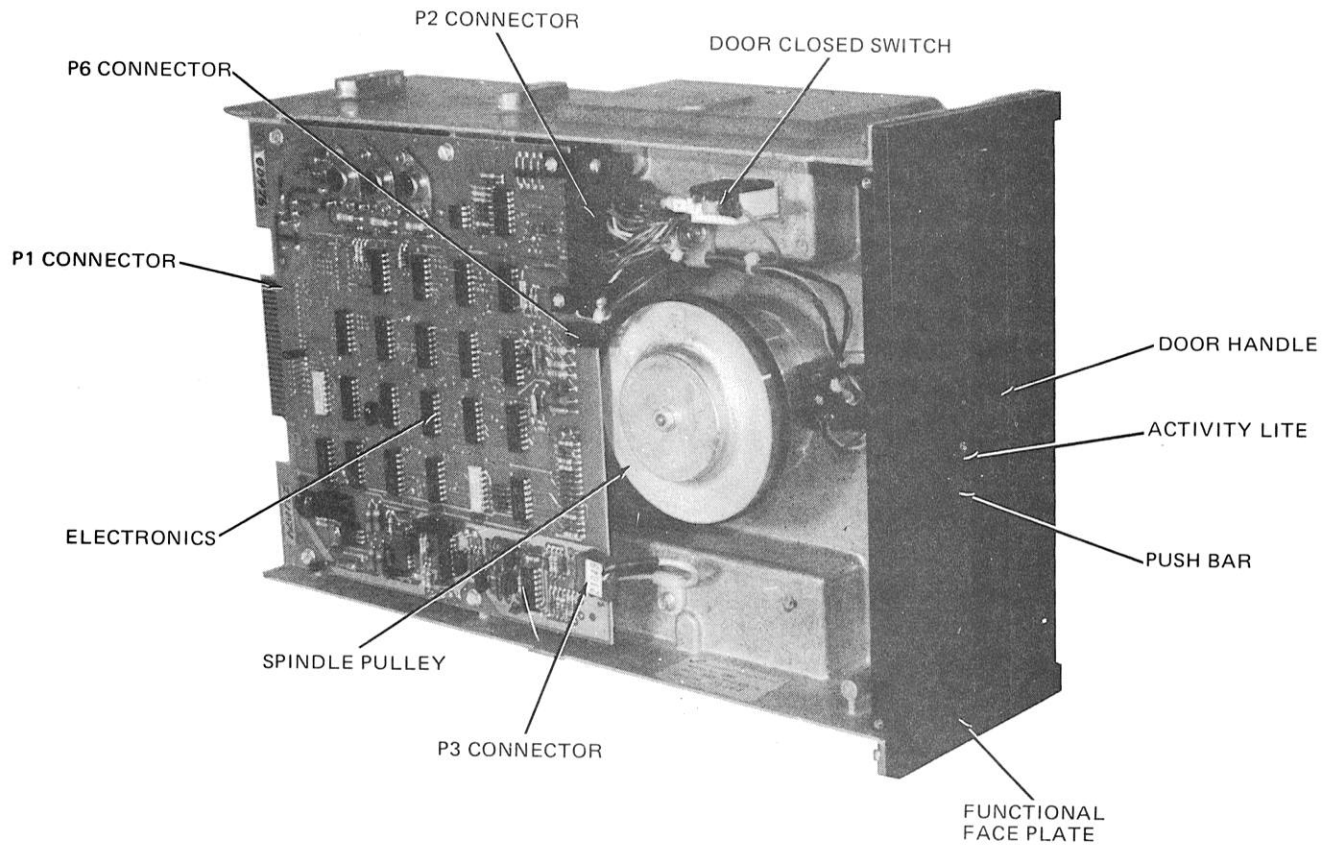
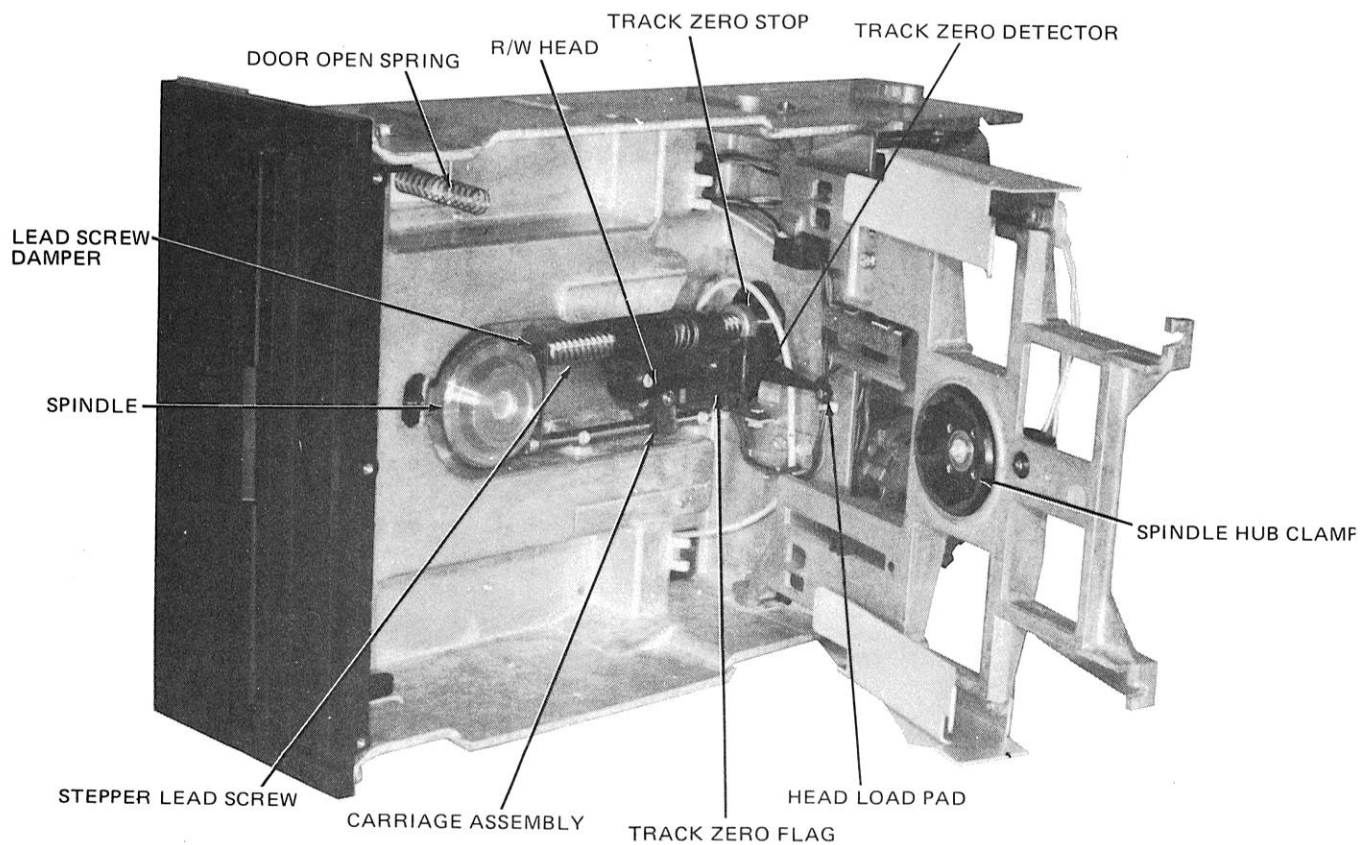
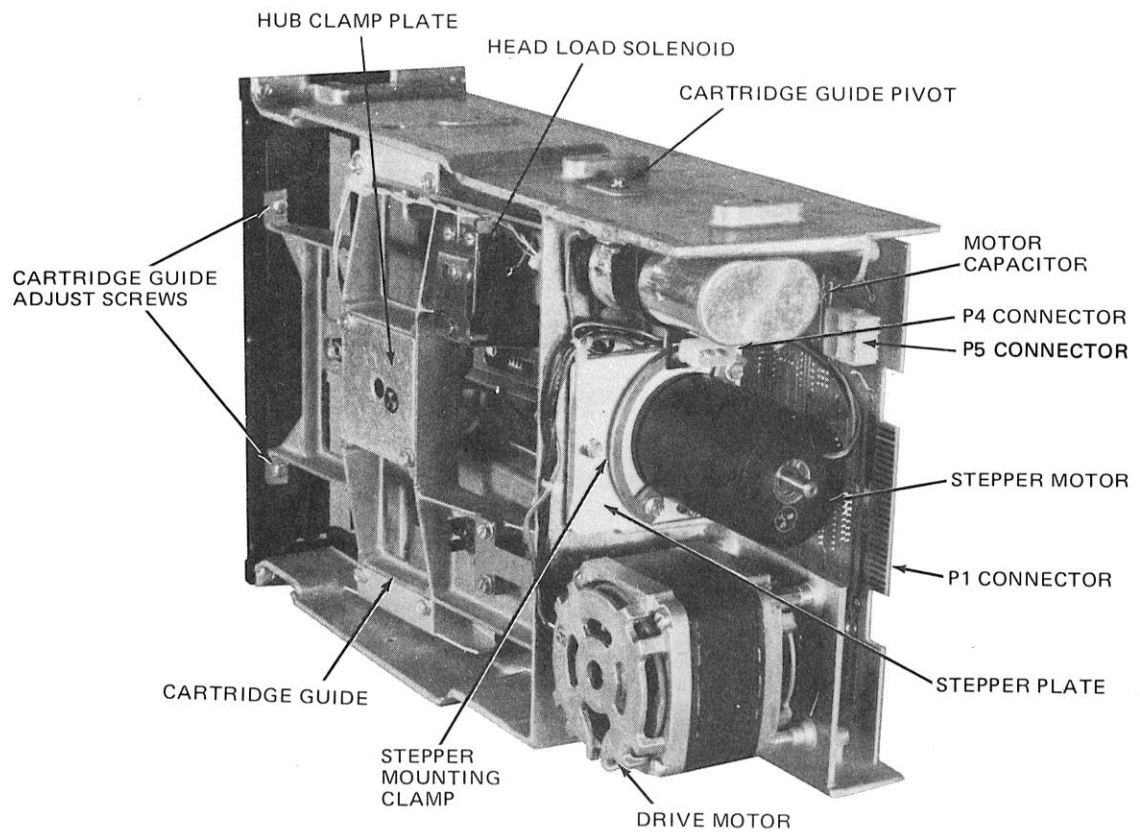
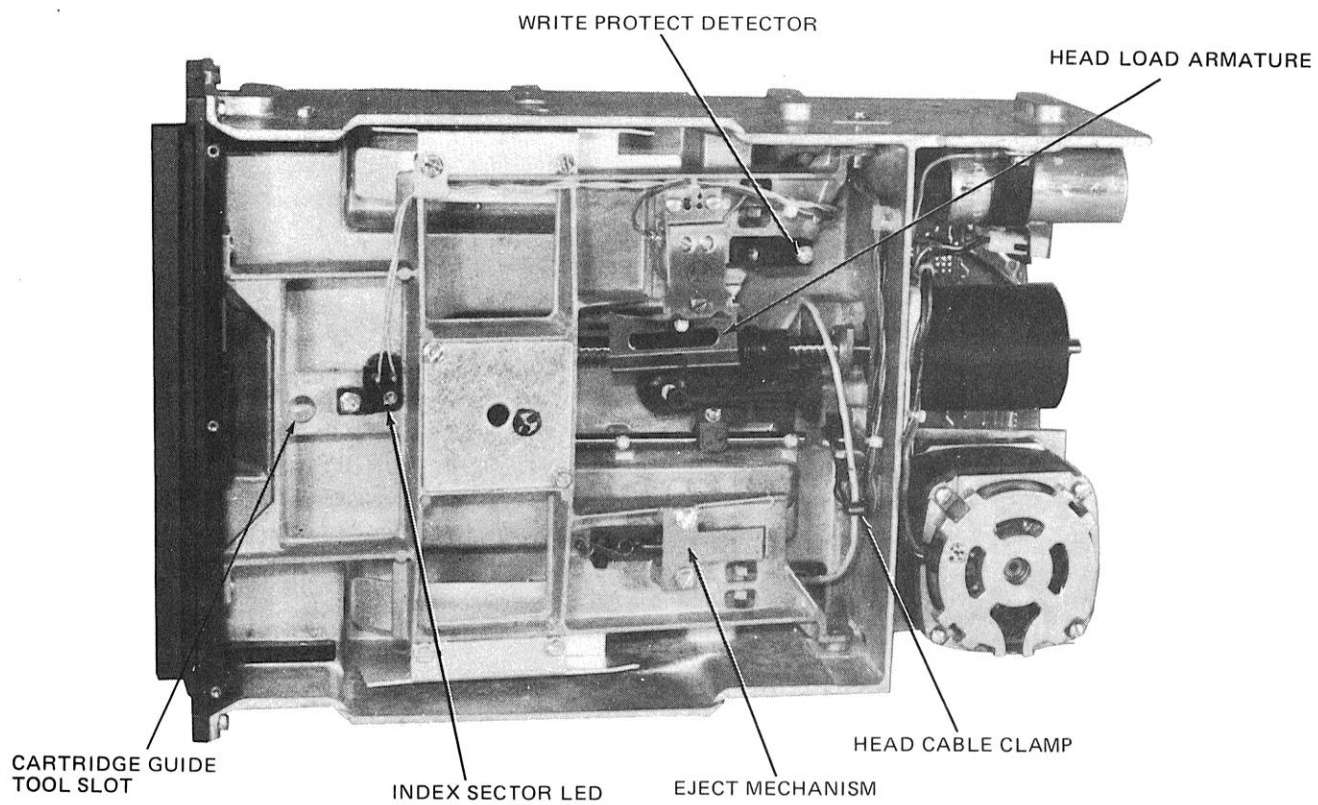


FIGURE 14 DOOR LOCK SCHEMATIC

5 PHYSICAL LOCATIONS







DIAGNOSTIC TECHNIQUES

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.

"Soft Error" Detection and Correction

Soft errors are usually caused by:

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

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

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

Write Error

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

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

Read Error

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

Seek Error

1. Stepper malfunction.
2. Improper carriage torque.

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

Test Points—800/801

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

SAT 808 JUMPER LOCATION

Jumper	Unit0	Unit1	Function
DS1			Drive Select
DS2			
DS3			
DS4			
T1			Terminator for the last Disk Drive
T2			
T3			
T4			
T5			
T6			
DC			Disk Change
C			Head Load - Input
D			Door Control - LED of Drive Select
Y			
Z			
X			Head Load only with Drive Select
A			
B			
HL			Apply current to stepper Motor at the whole time
DS			

Wiring bridge	Unit0 + 1
RI	
RR	
DDS	
8	
16	
32	
NP	
WP	
800	
801	
L	
E	

DS 2000/DS 2100 JUMPER LOCATION

Jumper	Unit1	Unit2	Function
DS1			Drive Select
DS2			
DS3			
DS4			
T1			Terminator for the last Disk Drive
T2			
T3			
T4			
T5			
T6			
DC			Disk Change
C			Head Load - Input
D			Door control - LED von Drive Select
Y			
Z			
X			Head Load only with Drive Select
A			
B			
HL			Apply current to stepper Motor with HEAD LOAD
DS			

Wiring bridge	Unit0 + 1
RI	
RR	
DDS	
8	
16	
32	
NP	
WP	
800	
801	
L	
E	

WIRING DIAGRAM

