NEXT ASSY	USED ON	REV.	DESCRIPTION	DATE	APPROVED
	CM6000	A	ERN-11-M	8-21-84	

DWG. NO. | SH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±	REMOVE BURRS AND SHARP EDGES. ALL DIAMETERS ON COMMON CENTERS TO BE CONCENTRIC WITHIN .005.	COMPUTER MEMORIES,INC.
MATERIAL	APPROVALS / DATE	DRIVE DEBUG PROCEDURE
	DRAWN W. Martin 8-20-84	
FINISH	CHECKED W. Burg 8-20-84	SIZE A / FSCM NO. / DWG. NO. 600005 / REV. A
	ISSUED	
DO NOT SCALE DRAWING		SCALE / SHEET 1 of 12

Upon power-up, the drive enters an initilization procedure, where various system parameters such as disc speed, servo velocity, power supply voltage and track zero are checked. After verifying these parameters, the microprocessor issues a Drive Ready signal to the controller, indicating the drive is ready to perform read/write operations. The controller in this case being the AMT tester.

Positioning of the read/write heads to various tracks is achieved by setting the direction line, (logic 0 for seek in, logic 1 for seek out) and clocking the -step line. After locating the desired track, the drive issues a seek complete signal to the controller.

There are many conditions which must be met in order for the drive to properly read and write data on the disc surface.

The serial Data Bit Rate of the drive is a direct function of the disc speed, hence proper disc speed must be maintained in order for the controller to properly decode the data it receives from the drive. The CM6000 operates on a rate of 5 megabits per second. This corresponds to a spindle motor speed of 3600 RPM.

Each time the spindle motor rotates 360 degrees, an index pulse from the spindle motor encoder is issued to the microprocessor. The microprocessor continuously monitors these index pulses and issues a correction signal labeled "motor" when the elapsed time between index pulses is greater than or less than 16.8ms. This variable duty cycle signal is filtered via R5 on the main board and C4 on the motor control board and is used to control the spindle motor speed.

When writing data on the disc surface, proper write current should be maintained. Excessive write current may result adjacent track data being disturbed due to increased flux lines generated by the readwrite heads. Excessive write current also increases "Bit Shift" and may result in reduced window margins.

Insufficent write current is troublesome for a number of reasons. Remember that in order to write new data on the disc surface, the old data must first be erased. Insufficent write current may result in new data being written over partially erased old data. A common symptom of this condition is random soft errors during a read operation. Figure 1 is an example of data that was written without a sufficent amount of current.

Note the peak to peak amplitude variations and the absense of a blank horizontal line at the zero crossing point. Figure 2 should clarify the reason for this. Notice that the center of each data bit cell drops down and actually touches the zero crossing point. This may result in the drive sending a logic 0 instead of a logic 1 and vice versa. The CM6000 incorporates the use of a "Desnake" circuit, consisting of Z41, Z23 and Z32, to help overcome this problem. However sufficient write current should be maintained for reliable operation.

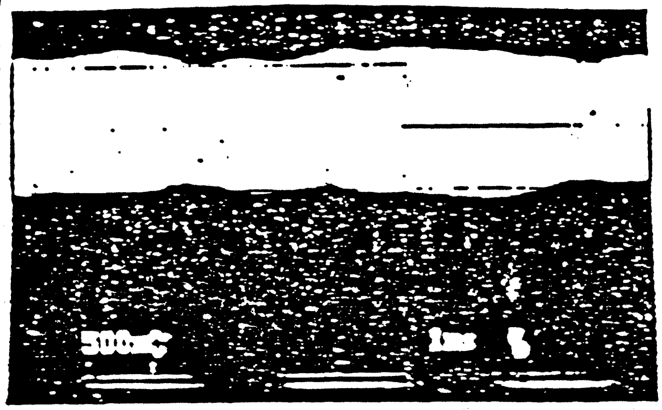


FIG 1

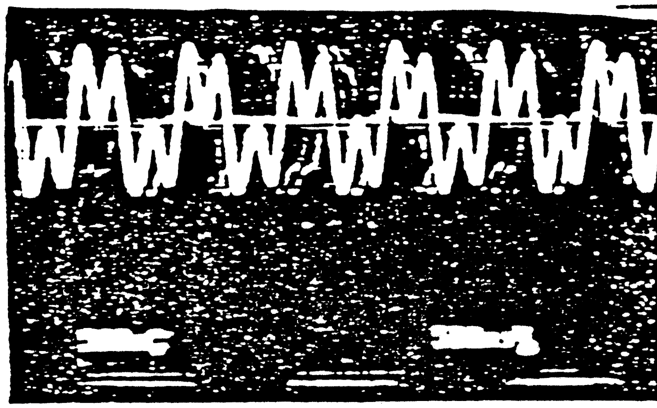


FIG 2 DATA = AA

Figures 3 and 4 are examples of data written with the correct amount of write current. Note in Figure 4 the center of each bit cell never comes in contact with the zero crossing point. Of course different data patterns will result in different waveforms and may vary slightly from head to head and from drive to drive.

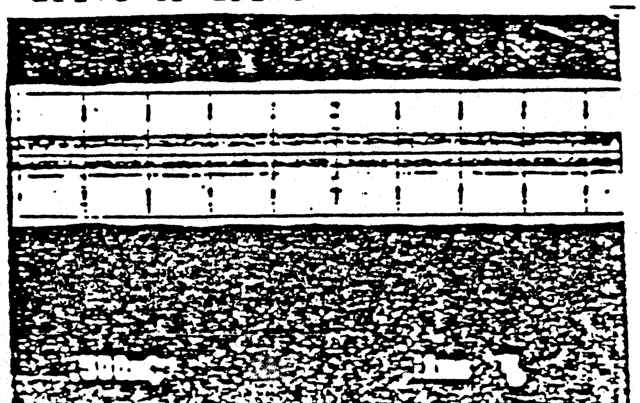


FIG 3

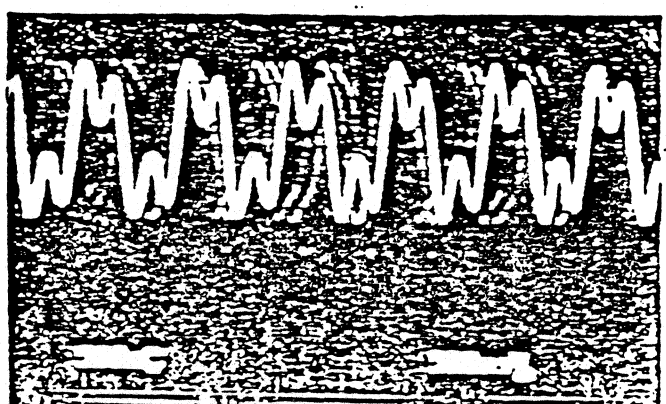


FIG 4

In order for the drive heads to serve any useful function, they must first be able to locate a track, and stay on that track for the entire 360 degrees of rotation during a read or write opeation. Not an easy task when you consider that three tracks are about as wide as the thickness of this piece of paper!

The CM6000 incorporates the use of a closed loop, servo wedge positioning system, as outlined in Figure 5.

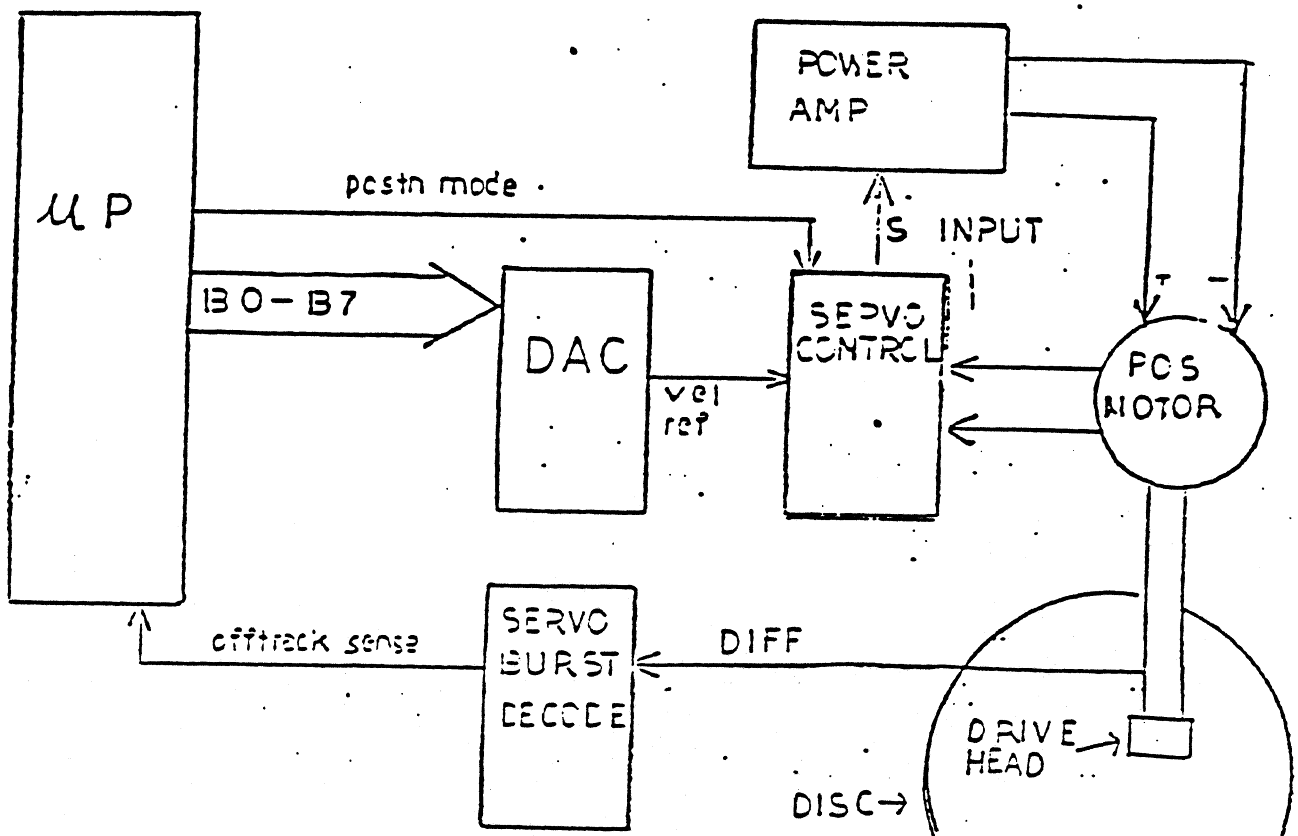
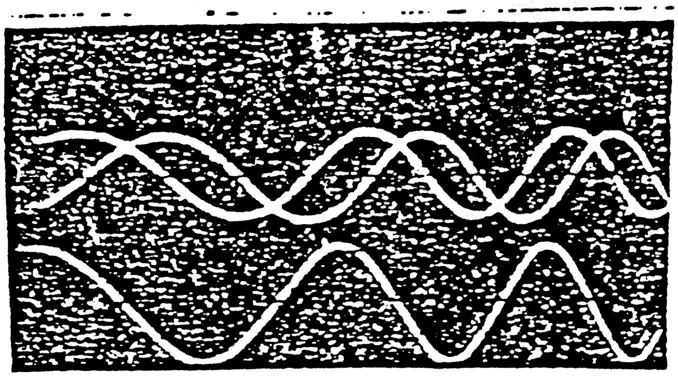


FIG. 5

output signlas, channel A and channel B. Figure 6b is the difference signal of channel A and B. This signal may be observed at T.P. 10. Each half cycle represents one track on the disc surface, with the zero crossing of each half cycle denoting the center of the track. Figure 7 may help the reader visualize this relationship.



← FIG 6A

← FIG 6B

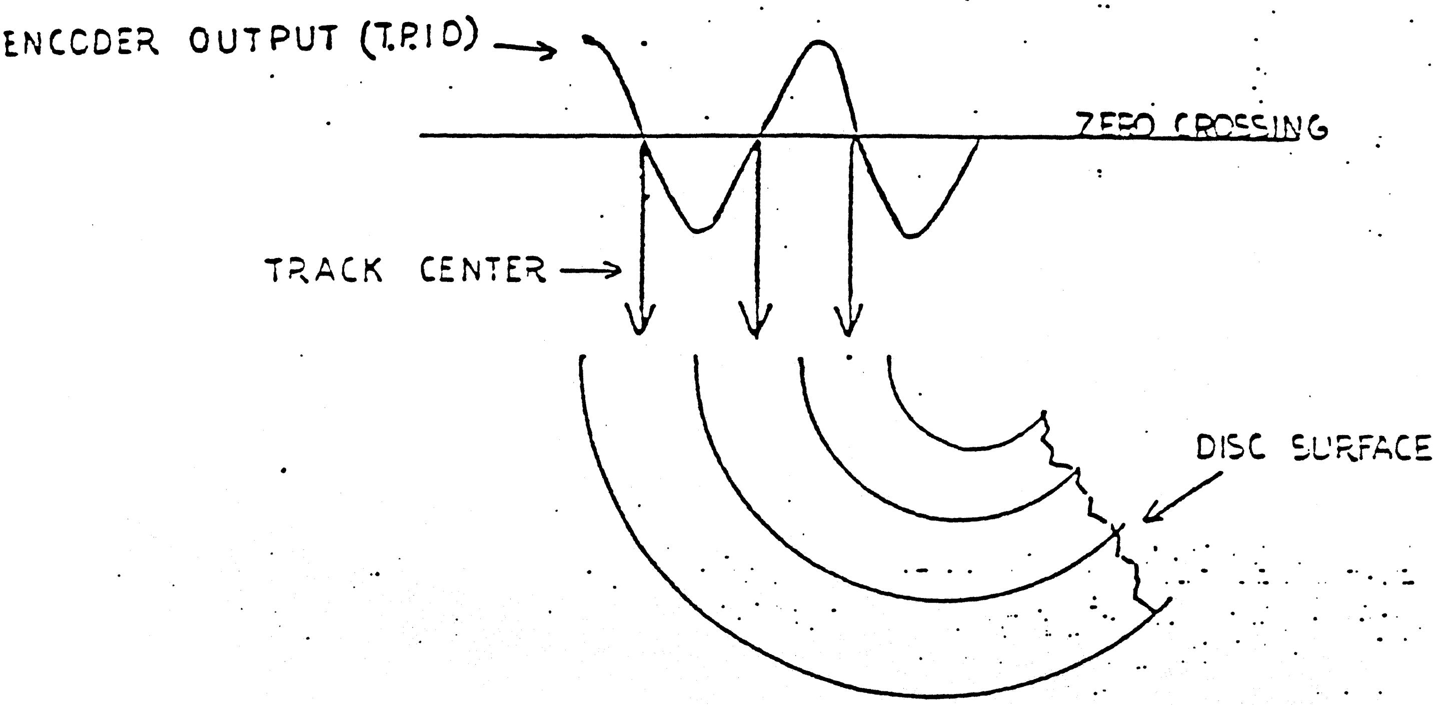


FIG. 7

first understand the need for such a system. As you know, material tends to expand when heated, and contract when cooled. This fact can cause many problems in the disc drive if it is not compensated for. Suspose a drive is powered up from a cold start condition, and formatted with data as shown in Figure 8a. Naturally we want to write and read data on the center of the track, so the drive heads are positioned on the track center, based on the zero crossing of the encoder output as seen from T.P. 10.

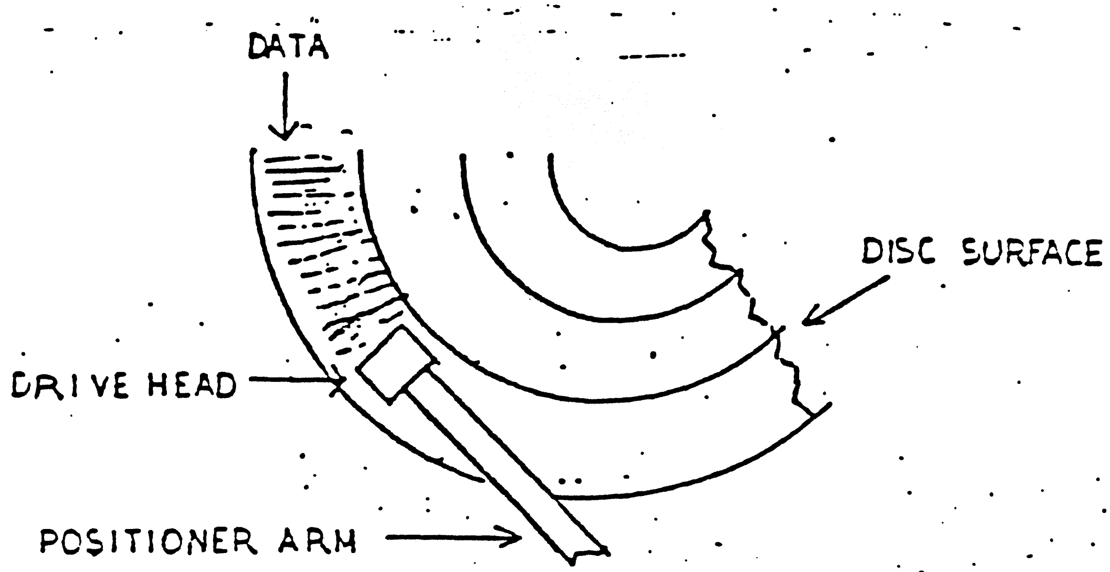


FIG. 8A

Sometime later after the drive has warmed up, mechancial components such as the postioner arm expand. Since the drive heads are mechanically connected to the postioner arm they too will move, and now the heads are no longer positioned on the center of the track. Refer to Figure 8b. This condition cannot be tolerated, and many read/write problems will occur if the drive heads are not properly centered on track. At this point, we may now describe how the servo wedge maintains proper head positioning, regardless of temperature changes in the drive itself.

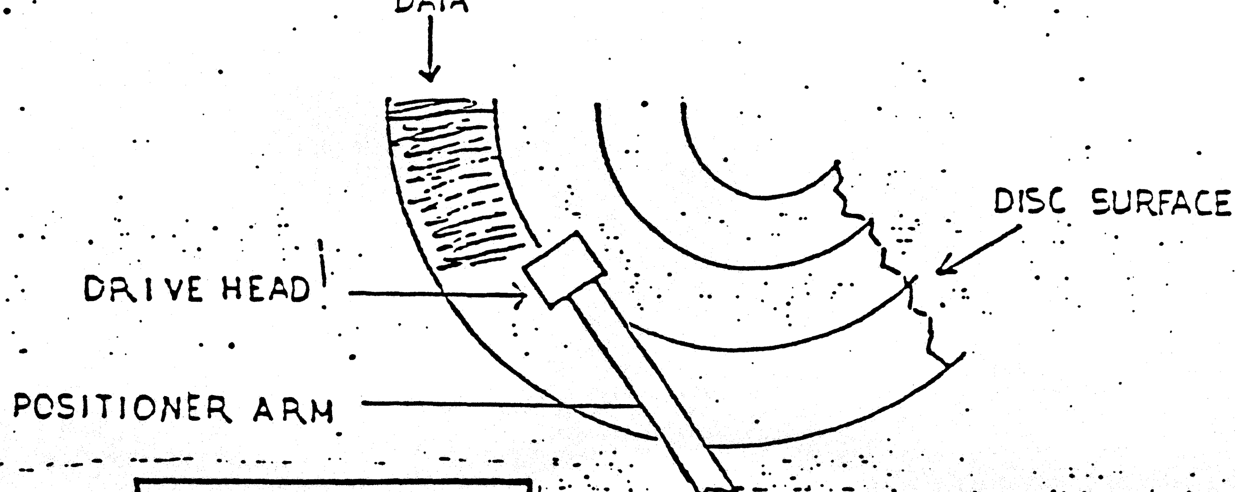


FIG 8B

COMPUTER MEMORIES	SIZE A	FSCM NO.	DWG. NO. 600005	REV. A
DRAWN				
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The servo wedge or servo burst, as it is sometimes referred to, is written on the first two sectors of each track, on surface zero and surface one. In terms of time, this relates to the first 128 us of the track following the index, or start of the track. Refer to Figure 9.

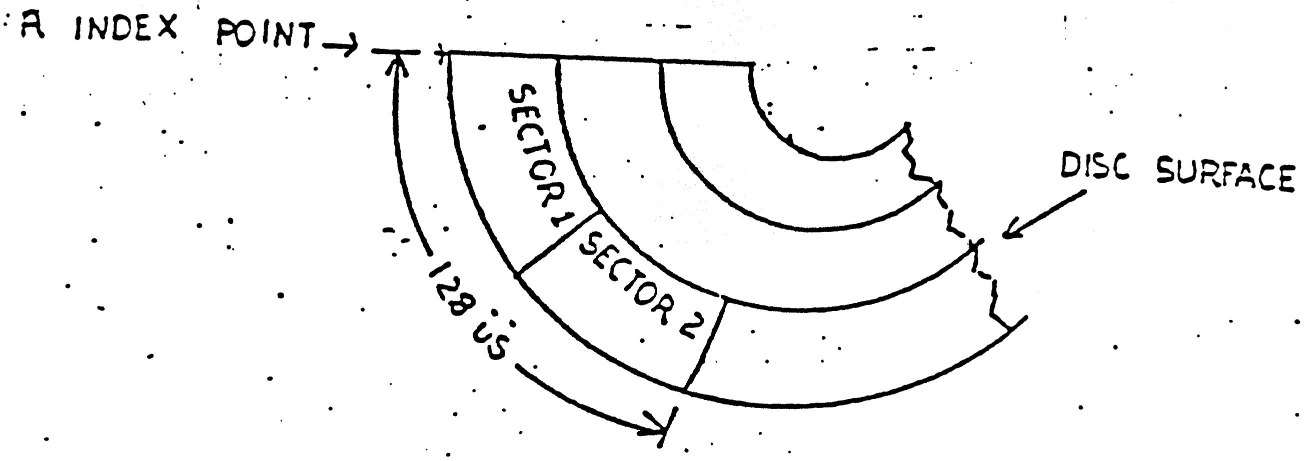


FIG. 9

Before the drive is "servo written" it must first be temperature stabilized. This is accomplished by allowing the drive to warm up for approximately two hours prior to servo writting. This allows for mechanical components, such as the positioner arm mentioned earlier, to expand to the dimensions they will normally be at, after the drive is warmed up.

Prior to writing the servo burst, the disc heads must be positioned away from the center of the track. First in one direction for the first sector, and in the opposite direction for the second sector. See Figure 10.

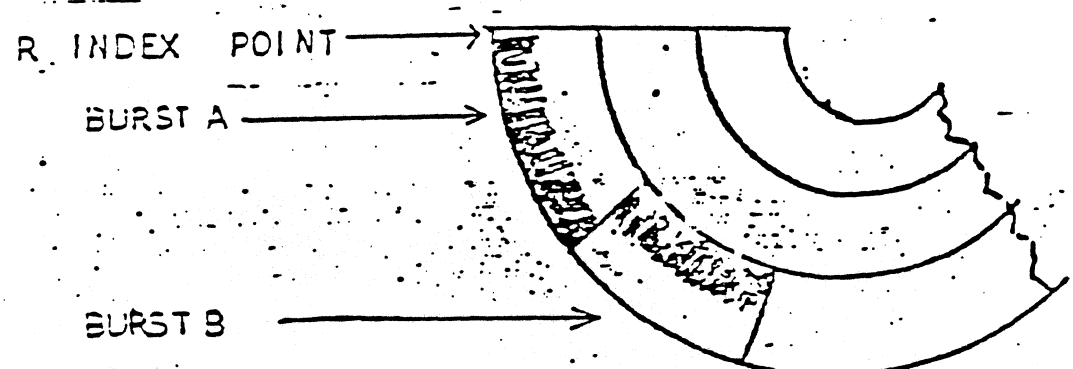


FIG. 10

centered on track, the reader may now be wondering why the servo burst is purposely written off the center of the track! However, in order to properly decode the servo burst, it must be written away from the center of the track. The reason for this is as follows: Suppose the disc has been servo written and the drive head is centered on track as shown in Figure 11. As the disc rotates, the head reads the first servo burst, in this example burst A. Immediately following Burst A, the drive head reads Burst B written in the opposite direction. These signals are sent to a servo burst decode circuit, as shown in Figure 5. If the drive head is centered on track, the amplitude of Burst A, as seen by the head, will be equal to the amplitude of Burst B, and the drive heads will be considered "On Track". If the heads are not on track, the amplitude of the two bursts will not be equal and the servo burst decode circuit will issue an offtrack sense signal to the microprocessor. The microprocessor in turn, issues an offset value to the D.A.C. which in turn torques the positioner motor until the servo burst decode circuit receives equal amounts of Burst A and Burst B. The microprocessor constantly monitors the offtrack sense signal, and in doing so keeps the drive heads properly centered on track.

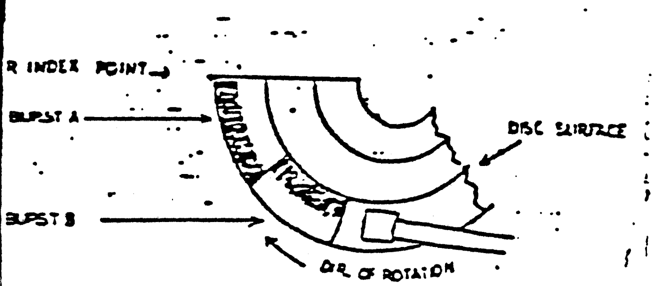


FIG. 11

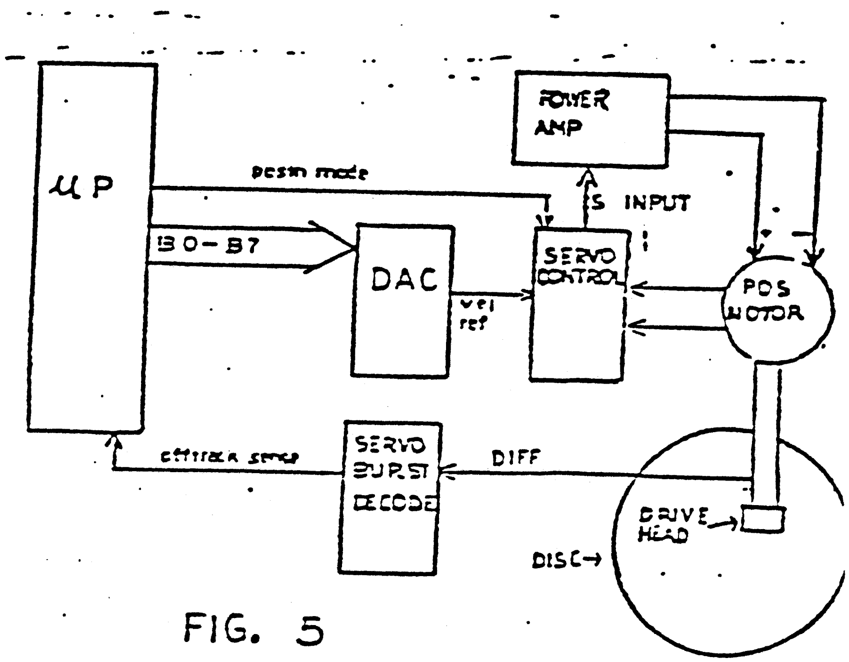


FIG. 5

measured at T.P. 10, denotes the center of each track. However, in actual practice this is seldom the case, encoder tolerance and other parameters affect this, such that typical values for offset may range from 0 to 1.5 volts after the drive has been servo written. Temperature changes within the drive will also correspond to a change in the offset or correction level.

For example, suppose a drive that has been servo written is powered up from a cold start condition, and the offset at T.P. 10 is monitored. As the drive warms up, the offset value will decrease until the drive reaches its normal operating temperature. As a general rule, this valve should not exceed 2 volts after the drive has been temperature stabilized.

The following flowcharts are intended to help the reader isolate a faulty drive to the subassembly level. At this point it may be helpful to review some of the various functions of the A.M.T. tester, and how they may be used to aid in troubleshooting.

One method for checking the servo burst is as follows: Trigger scope on spindle index (T.P.6) monitor head output on T.P. 14 (V/div=1V sweep time 20us. Enter function 7, mode 1 on the A.M.T. from track 0 to max track (614 for Snow White) size 1. The fast and slow buttons may pressed for the desired dwell time between seeks. As the heads are positioned on each track, the servo burst may be observed during the first 128us of the signal, this corresponds to approx. 6.5 divisions on the scope. See Fig.12.

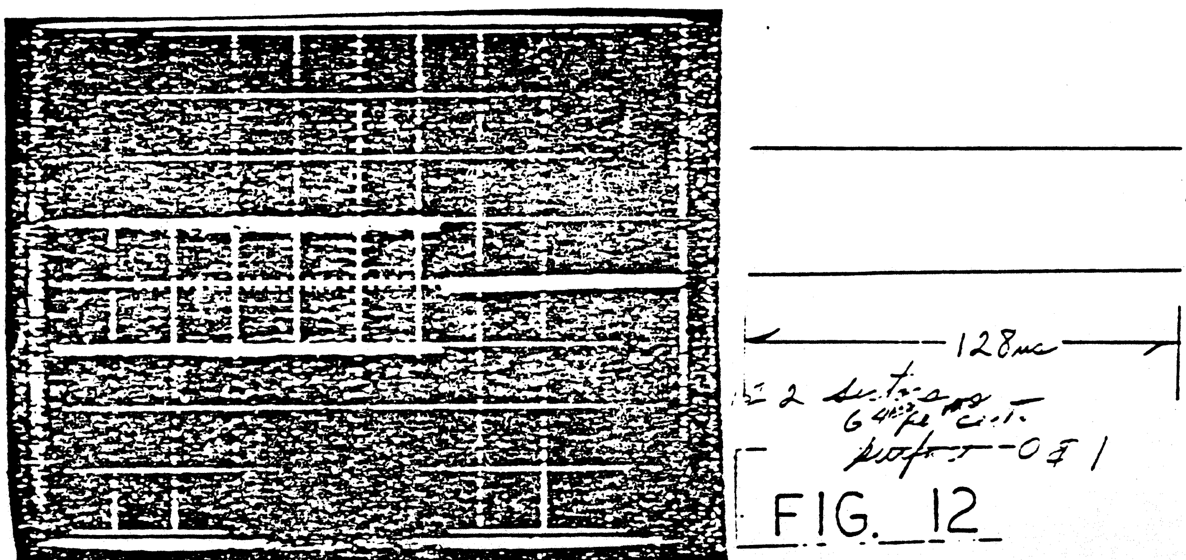
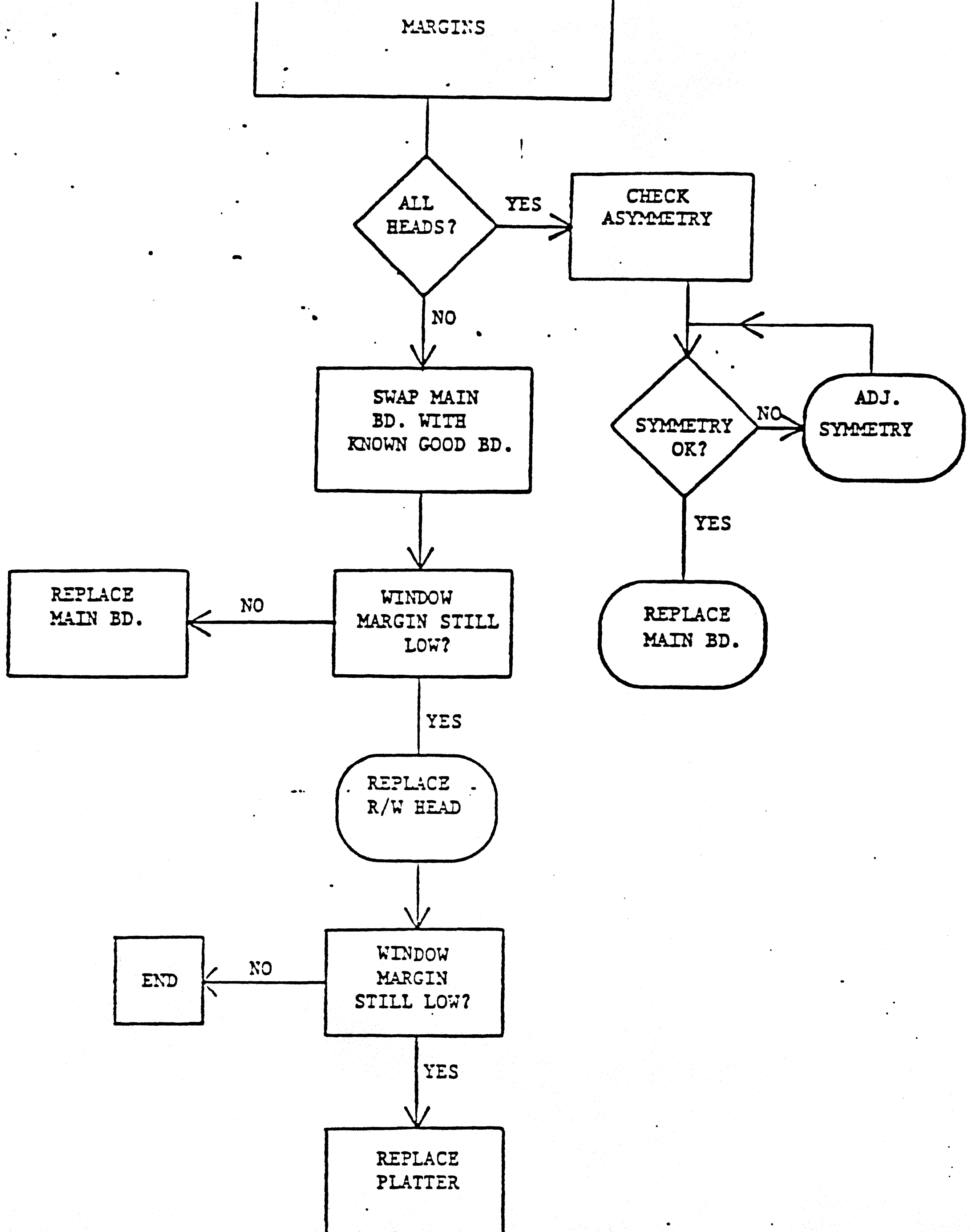
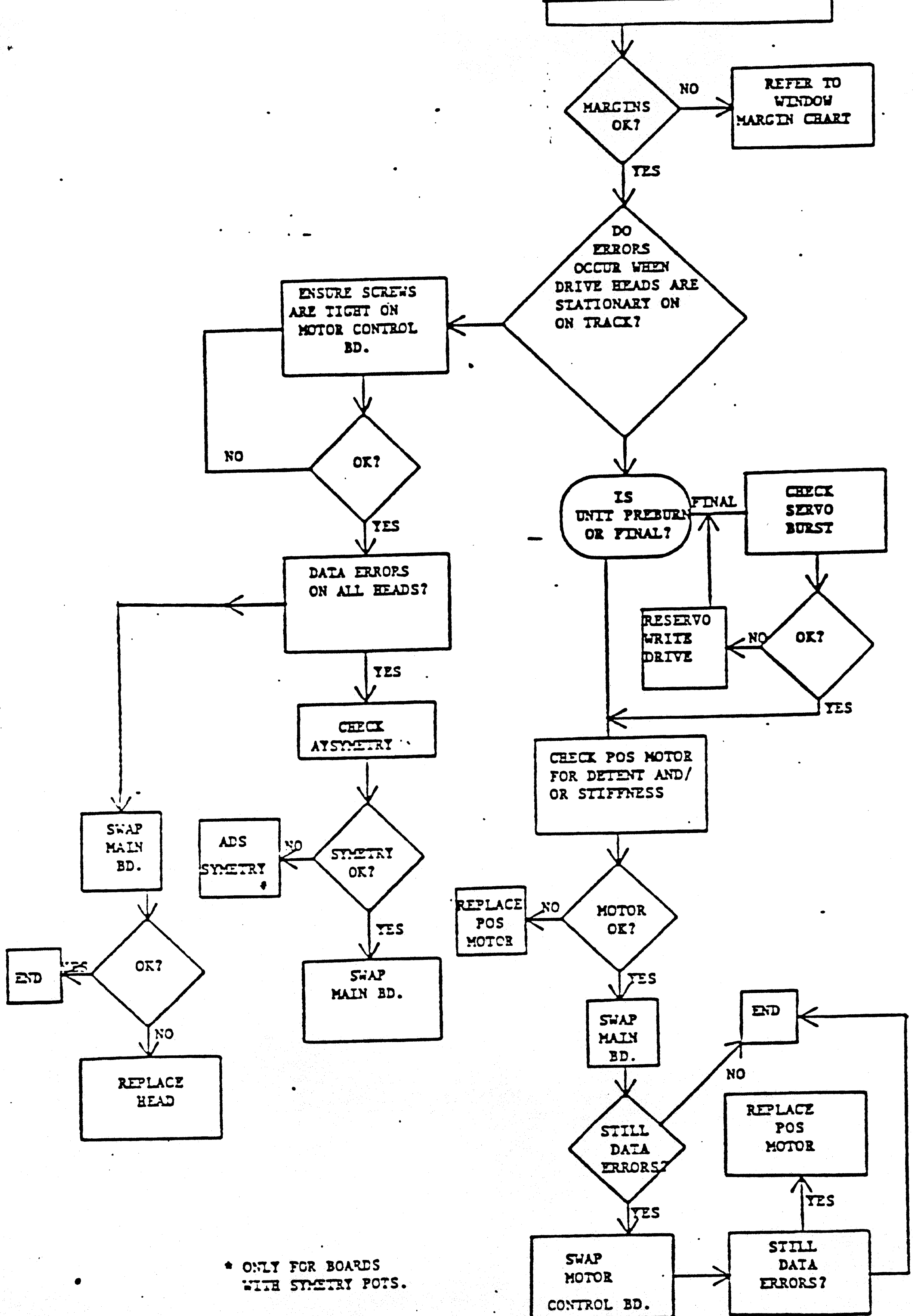


FIG. 12

One method for checking write current is to write an "AA" data pattern on 0 track and then verify the signal at T.P. 14. This may be accomplished by entering function D, mode 6. The A.M.T. will display "Data Pattern". Type AA on the keyboard and press the "enter" button twice. To write the data pattern on the disc., enter function 9, mode 0. Function 9 is a Read/Write mode on the A.M.T. that ignores the track header. Mode 0 is for writing while mode 1 is for Reading.



COMPUTER MEMORIES			
DRAWN	SIZE A	FSCM NO.	DWG. NO. 600005
ISSUED	SCALE		SHEET 10 of 12



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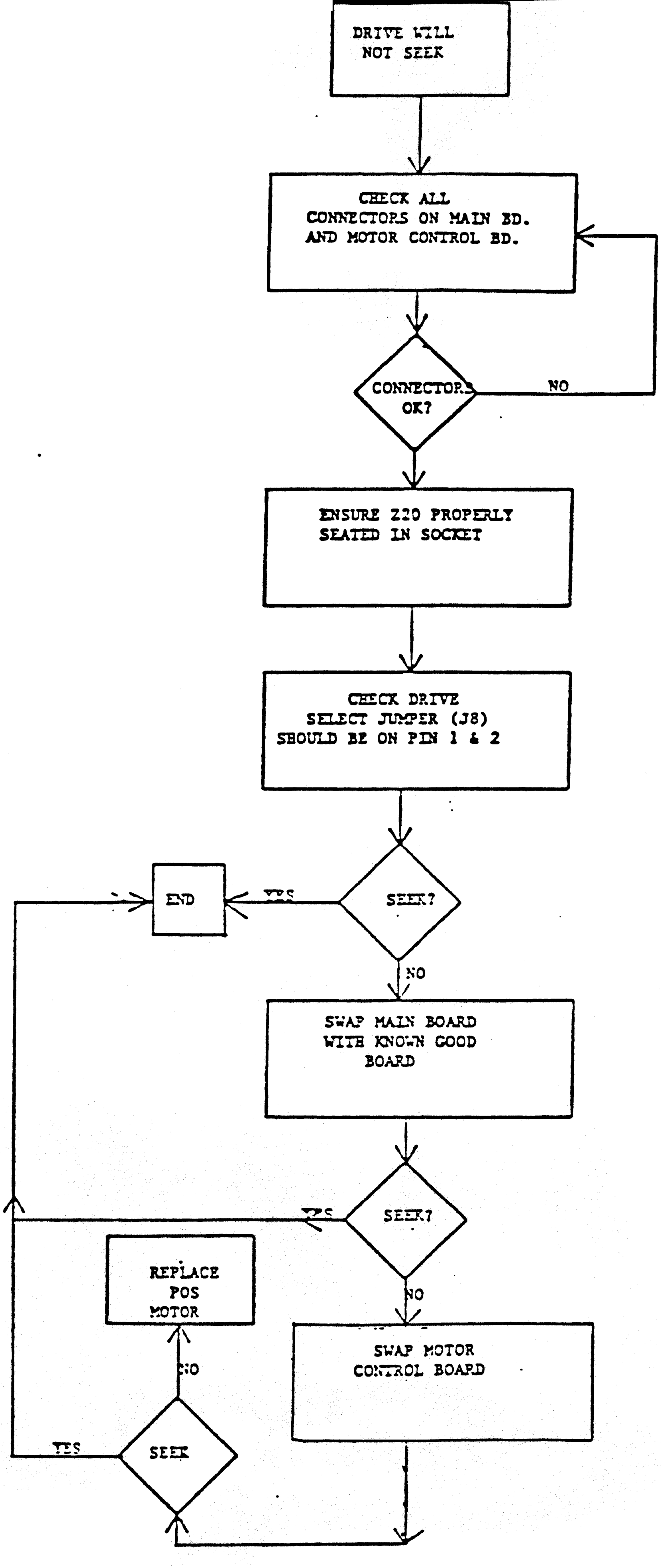
DWG. NO.

COMPUTER MEMORIES	SIZE	FSCM NO.	DWG. NO.	REV.
DRAWN	A		600005	
ISSUED	SCALE		SHEET 11 of 12	


DRIVE WILL NOT SEEK
CHECK ALL CONNECTORS ON MAIN BD. AND MOTOR CONTROL BD.
CONNECTORS OK?
NO
ENSURE Z20 PROPERLY SEATED IN SOCKET
CHECK DRIVE SELECT JUMPER (J8) SHOULD BE ON PIN 1 & 2
SEEK?
YES
END
NO
SWAP MAIN BOARD WITH KNOWN GOOD BOARD
SEEK?
YES
NO
SWAP MOTOR CONTROL BOARD
REPLACE POS MOTOR
NO
SEEK
YES