

WANG

LABORATORIES, INC.

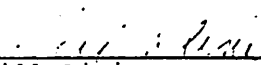
M-E-M-O-R-A-N-D-U-M

TO: Northeast Area ATS's & DTS's
FROM: Bill Dini
DATE: April 24, 1981
SUBJECT: Series 24 TB216A FTU

Attached is the procedure of the series 24 FTU. There are presently 3 models of the TB216A used in the field today. The series number of the FTU is located on the inside top left corner of the display panel. This is an extra which is done after the 5754 code is entered and allows writing on all cylinders except 256. This procedure applies only to the series 24 and is not needed on the 19 and 23 series.

If you have any questions, please call Bill Dini at 1-800-225-3304.

Regards,



Bill Dini
Area Technical Specialist

Attch.

BD:LCM:0756A

NOTE

Perform step 16 to write on C.E. (innermost, highest number) cylinder only. Perform steps 16 and 17 to write all tracks except 256, (track 256 is locked out when drive is controlled by FTU).

16. Allow writing only on CE (innermost highest number) cylinder by proceeding as follows:
 - a. Rotate DATA ENTRY switch to position B.
 - b. Enter 5754 via keyboard.
 - c. Press LOAD key.
17. Allow writing on all cylinders (except 256) by proceeding as follows:
 - a. Rotate DATA ENTRY switch to position E.
 - b. Press DISP key.
 - c. Press BIT key.
 - d. Press 1 key.
 - e. Press LOAD key.
18. Press GO key. FTU is now commanding drive to perform desired write operation.

Write/Read or Write/Read Format Operation

The following procedure describes how to prepare the FTU to command the drive to first write information and then to read the same information back. During a write/read format operation, the FTU writes then reads the entire record including the address field (see figure 2-7). During a write/read, the entire record is read but only the data field portion of a record is written. In both cases, the operator can control only what is written in the data field portion of the record, the address field is automatically calculated and supplied by the FTU.

1. Perform Power Up Initialization procedure.
2. Perform Drive Selection procedure.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#11027

III.A.7

PERIPHERALS-DISK DRIVES-CDC PHOENIX 9448 CMD.

TOPIC: TB216 CDC DISK TESTERS

With new TB216 CDC Series Code 23 and above there is a new set up that has to be done to be able to write and read on all tracks.

The FTU with the old set up will only allow you to write and read on the "CE Cylinder", number 822.

To know if you have a new tester, after you select the drive, rotate the "Data Entry" switch to "F", if it displays a Hex code 336 you have a new tester. No code is an old tester.

If you do have a new tester you will now have to set up in the following way:

1. Turn "Data Entry" switch to "Device Type" and enter the drive code. Then depress "Load".
2. Turn "Data Entry" switch to "B" and enter 5754 then depress "Load".
3. With "Write Protect" switch up depress "SEL DRV". Then switch "Write Protect" down.
4. Turn "Data Entry" Switch to "E" then depress the following buttons in the following order:
 - a. DISP
 - b. BIT
 - c. 1
 - d. LOAD

The above steps will allow you to write and read on all cylinders except 256. The FTU will prevent the use of cylinder 256.

We will be updating all TB216's shortly and this procedure will be followed on all testers.

PHOENIX ALIGNMENT

1. PURGE UNIT and ALIGNMENT PACK (up to speed, servo disconnected)
2. CABLING (Disk and FTU off)
 - A. Install alignment extender brd in drive, slot 4, and alignment board into extender
 - B. Install 2 wire cable from Servo Fine (white to front) to R/W Preamp (white on top)
 - C. Install 8 wire cable from Servo Fine (Arrow points up and towards wire) to Alignment Extender Brd (Arrow points to rear of drive away from wire)
 - D. Install 3 ribbon cables between FTU and Drive.
Small cable from J1 of Brd 2 in FTU (red wire to right) to I/O Brd (red wire on top) bottom of A connector via adapter cable.
Medium cable from J3 of Brd 2 in FTU (red wire to right) to CONTROL/MUX Brd, B connector (red wire on top)
Large cable from J2 of Brd 2 in FTU (red wire to right) to I/O Brd (red wire on top) top of A connector via adapter cable.
3. SWITCH SETTINGS (Setting up for removable servo alignment)
 - A. Alignment extender board: S1 to FXD (Load off fixed servo)
 - B. Alignment Board: S1 to N (negative polarity of alignment voltage)
S2 to RW (always RW with Phoenix)
S3 to X1 (Attenuation factor of alignment voltage)
 - C. Servo Fine: S1 to S (looking at servo head)
 - D. FTU: Data Entry to Device Type; R/W Select to Alignment; Access Select To Direct Seek

HEAD and RECORD to manual, START and RUN off
STEP-down; SINGLE/CONT.-cont; -+ to center; LATE/EARLY-center
WRITE FLAG-off; WRITE PROTECT-on; AM/SECTOR-sector; EOT STOP-off
ERROR OVERRIDES-off; SHIFT PATT/DATA PATT-data patt; SEQ PWR-off

4. INITIAL POWER ON

- A. Power on FTU
- B. Pull out card cage, loosen removable heads to 4 lb/(if fixed servo has been loosened, it should be centered and tightened to 12 lb/)
- C. Power on drive to LOAD (Alignment pack previously installed and purged)
- D. FTU-START and RUN switches to ON(3rd row down, 7 right most lites come on)
- E. FTU-key in 8905 (90 Meg), 8903 (60 Meg), 8901 (30 Meg)
Key LOAD then SEL DRIVE (Busy light will flash till drive ready) set DATA Entry switch to destination
- F. Bring Drive to READY (Busy light stops blinking on FTU)

5. SCOPE and METER SET UP

- A. Scope: Ch 1- 50 mV/div to READ SIGNAL on Alignment Board
Ground to chassis
Sync on Ch 1, 1 microsec/div
- B. Volt Meter: 500 milV scale
Positive lead to + TP. of Align Brd., Neg lead to - TP of Align Brd.

"CAUTION: WHEN TIGHTENING OR LOOSENING HEADS IT'S A GOOD IDEA TO HAVE HEADS UNLOADED"

6. ALIGNMENT of REMOVABLE SERVO to FIXED SERVO

- A. Key RTZ on FTU (heads should move slightly)
- B. Move R Servo Head to the outer guard band and back to track 0 using scope (first balanced dibit pattern) heads previously loosened to 4 lb/ (See diagram on next page)
- C. Key in CLR, 0404, LOAD, GO
- D. Rough Adj-Adjust head till dibit pattern on scope is balanced.
- E. Fine Adj-fine adjust head for meter reading as close to 0 Mil V as possible.
- F. Calculate offset-record meter reading, switch S1 of Align Brd. to P. Record reading, subtract readings, should be less than 50 MilV (if off, loosen, Fine Adj again)
EXAMPLE:
P reading (+25 milV)-N reading (+5 milV)=20 milV offset
P reading (+25 milV)-N reading (-10 milV)=35 milV offset
P reading (-5 milV)-N reading (-10 mil V)= 5 milV offset
- G. Tighten down head to 12 lb/ making sure meter reading is less than +/- 50 milV while guiding carriage with other hand and then recheck offset.
- H. Seek track 0 (key CLR, RTZ) and check for dibit pattern (not in outer guard band)
- I. Seek track 822 (key 0822, LOAD,GO) and check for bal. dibit pattern (if either step H. or I does not show bal. dibit pattern you are off a track, restart at A)
- J. Recheck track 404 (key RTZ, CLR, .0404, LOAD,GO, CALCULATE OFFSET, LESS THAN 50 MILV, if not loosen head, fine adj. again)
- K. Check offset at track 8 for less than 350 milV (key CLR,008, LOAD,GO)
- L. Check offset at track 800 for less than 350 milV (key CLR,0800, LOAD, GO)(if step L or M off, fine adj.)

7. ALIGNMENT of REMOVABLE DATA to REMOVABLE SERVO

- A. Sl of servo fine to D (looking at data head), Sl of align ext brd to normal (seeking off removable servo), seek track 0 (key RTZ) (data head previously loosened to 4 lb/)
- B. Seek track 404 (key CLR,0404,LOAD,GO)
- C. Rough adjust-adjust head till dibit pattern on scope is balanced
- D. Fine adjust-adjust head for meter reading as close to 0milV as possible
- E. Calculate offset-(as in step 6.f.) should be less than 50 milV
- F. Tighten down head to 12 lb/ guiding carriage making sure meter reading is less than +/- 50 milV and recheck offset (if off redo fine adjust)
- G. Key RTZ then recheck offset at 404 (key CLR,0404,LOAD,GO)
- H. Check offset at track 8 for less than 350 milV (key CLR,0008,LOAD,GO)
- I. Check offset at track 800 for less than 350 milV(key CLR,0800,LOAD,GO)(if step H or I is off, fine adjust again.)

OUTER GUARD BAND

OSCILLOSCOPE SETTINGS

LOGIC GROUND TO SCOPE GROUND

VOLTS/DIV

CH 1 - 0.5 V
CH 2 - NOT USED

TIME/DIV

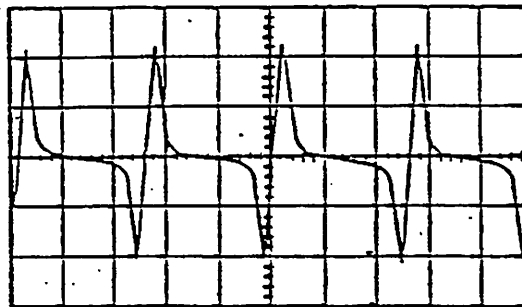
A - 0.5 μ s
B - NOT USED

TRIGGERING

A - INTERNAL POSITIVE
B - NOT USED

PROBE CONNECTIONS (USE X10 PROBE)

CH 1 TO FTU DIBITS JACK
CH 2 NOT USED



BALANCED DIBIT PATTERN (ON TRACK)

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS/DIV

CH 1 - 0.2 V
CH 2 - NOT USED

TIME/DIV

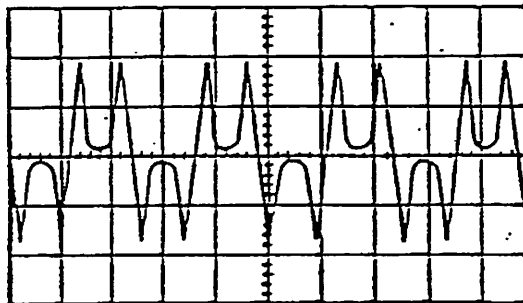
A - 0.5 μ s
B - NOT USED

TRIGGERING

A - INTERNAL POSITIVE
B - NOT USED

PROBE CONNECTIONS (USE X10 PROBE)

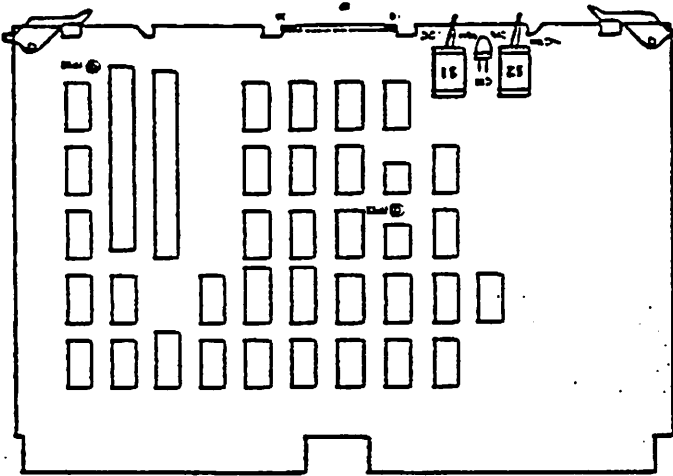
CH 1 TO FTU DIBITS JACK
CH 2 - NOT USED



MASTER

PHOENIX DRIVE

MINI MANUAL



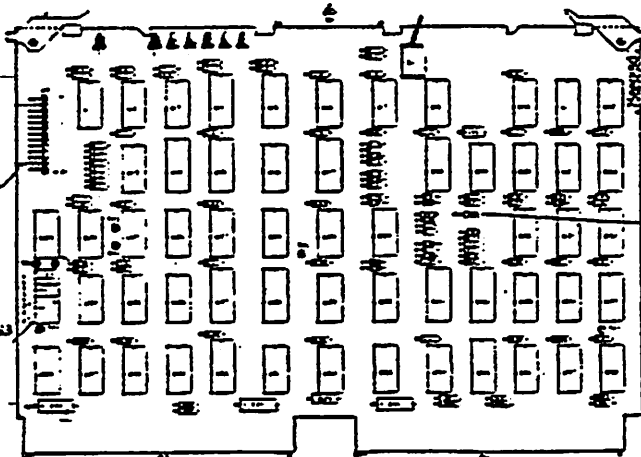
EM1 I/O Bd.

1. Main interface between drive and controller .
2. performs the following functions:
 - a. Receipt and ttl conversion of signal from controller.
 - b. Decoding of tag lines and bus bits.
 - c. Driving of signals to controller.
3. Contains
 - a. Local/remote switch: for selection of power sequences.(local)
 - b. Norm/Disable switch: inhibits I/O to the drive (norm).
 - c. Connectors for "A" cable and terminator.

	ON	OFF
1	X	
2		X
3		X
4		X

S3

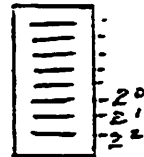
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EM2 Control/Mux Bd.

1. Works closely with the I/O bd. in managing controller drive interface signals.
2. Performs the following functions:
 - a. Fault detection/reset
 - b. Unit selection.
 - c. Head selection.
 - d. Reception, shaping and transmission of servo and data signals to/from controller.
3. Contains
 - a. Connection for "B" cable.
 - b. Fault lights CR1 through CR7.
 - c. Fault readout toggle switch.

U33



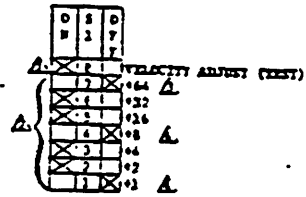
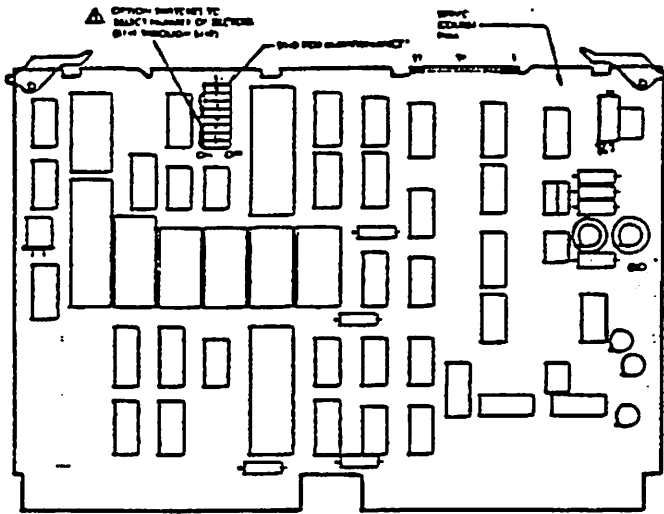
OPEN

2280-1 20
 2280-2 20-21
 2280-3 20-22

	ON	OFF
1		X
2	X	
3	X	

S2

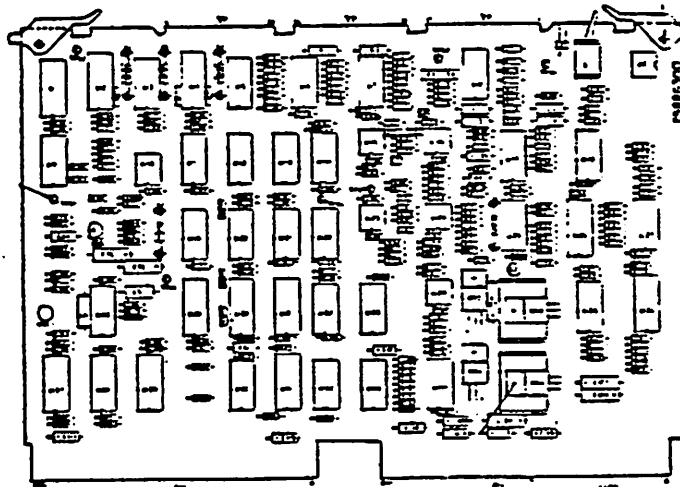
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- NOTES: Δ S1 MUST BE ON (DOWN) FOR NORMAL I/O OPERATING.
 Δ NO. OF SECTORS ARE SET BY SELECTING COMPONENT, I.E., FOR 64 SECTORS SET S1-7 UP AND S1-1 THRU S1-6 DN.
 Δ FOR 2200 64 SECTORS \rightarrow UP
 Δ FOR 2200V5 9 SECTORS

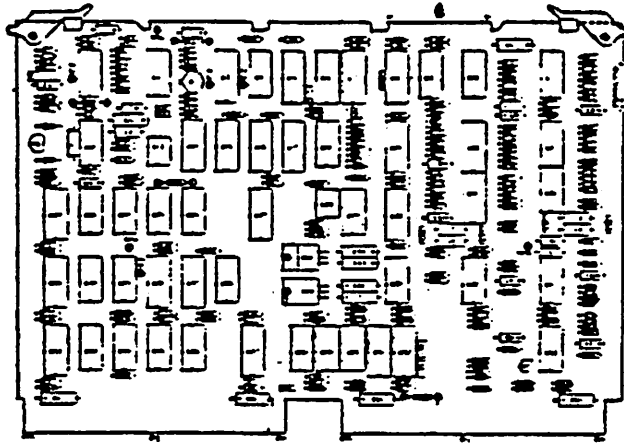
EM3 Servo Course Bd.

1. General control over drive functions
2. Performs following functions:
 - a. System drive status monitoring.
 - b. Cylinder addressing.
 - c. Servo positioning velocity/control.
 - d. Spindle speed monitoring.
 - e. EOT detection circuitry.
 - f. Interrupt processing.
 - g. Sector detection and pulse generation.
 - h. Track center detection.
3. contains
 - a. 8080 microprocessor.
 - b. Velocity gain adjustment pot.



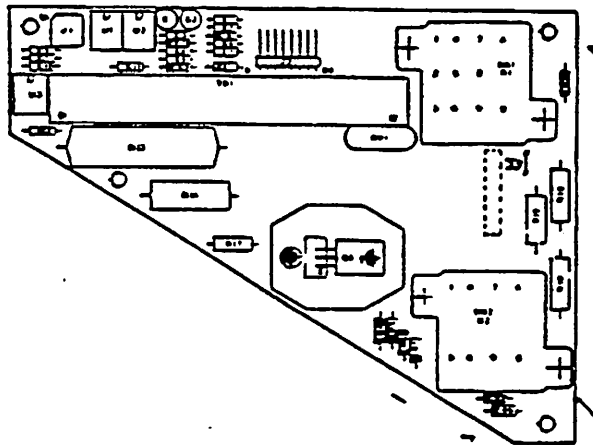
EM6 Servo Fine Bd.

1. Basically interrupts servo platter surface.
2. Responsible for:
 - a. Servo positioning error signals. (AGC, PLO)
 - b. Volume switching.
 - c. Generates various clocks (403khz, 806khz, 9.6mhz, 19.34mhz).
 - d. Index detection and sector sync.
3. Contains servo/data switch used during alignment.



EM7 R/W Bd.

1. Handles the timing and processing of read data and write data signals.
2. NRZ-MFM (write) encoding.
3. MFM-NRZ (read) encoding.
4. Compensates the MFM data by peak shifting the data depending on the frequency of the flux reversals.



Relay Control Circuit Bb.

1. Contains:
 - a. K1 (spindle motor relay)
 - b. K2 (voice coil relay)
 note. Solid state relay SSR1 energizes first then K1
 SSR1 not on relay board.

R/W Preamp.

1. Link between R/W heads and electronics module.
2. Amplifies read signals.
3. Develops write current for the selected head.
 - a. 7 different magnitudes (zones) of write current depending on the cylinder address.

Servo Preamp.

1. Link between the servo heads and the electronics module.
2. Amplifies digit signals from the servo platter surface.

Power Amp Bd.

- 1 Drives the voice coil/head assy. and controls emergency retract
 - a. Velocity command signal(P com).
 - b. Retract signal(P retract).

Operator Control Bd.

- 1 Supports start/stop switch, fault reset and indicator, and protect switches
 - a) address plug (0 for VS and WP, 1 for 2200 first drive)

Power Supply

- 1 +5 volts (digital logic - TTL)
- 2 -5 volts (digital logic - TTL)
- 3 +20 volts (used to develop +12, +15, +6)
- 4 +32 volts (voice coil/positioner, +32 for pack unlock sol.)
- 5 35 volts AC (for drive motor braking)

FAULT DIAGNOSIS

DISPLAY MODE 1 - Non-Microprocessor Detected Faults

Display mode 1 faults are displayed immediately when faults are detected.

Faults can be cleared by front panel if fault conditions are gone.

- NO FLT.*
- CR1 (NH) - NO HEAD SELECT FLT. Indicates that the I/O selected an existing head address.
- CR2 (MP) - Lights only when M.P. is active. (Display modes 2 through 5)
- CR3 (WF) - WRITE FAULT. Indicates that a loss of AC or DC write current has occurred.
- CR4 (W-R) - WRITE OR READ OFF CYLINDER. Indicates that an attempt was made to write or read during a seek, RTZ, or volume change.
- CR5 (W+R) - WRITE AND READ FAULT. Indicates an attempt to write and read simultaneously.
- CR6 (VF) - VOLTAGE FAULT. Indicates a below normal voltage.
- CR7 (HS) - HEAD SELECT FAULT. Indicates a multiple head select (2 or more heads selected).

***** NOTE *****

Display mode 4 may follow display mode 1 if no cylinder address stored. A cylinder address is stored only after a seek command has been completed.

DISPLAY MODE 2 - Present Cylinder Address

Displays present cylinder address. Resets display mode 1

(S1)*

- 1 (CR6-CR7) Highest order bits of cylinder address...CR3 only if zero.
 - 2 (CR4-CR7) Next highest order bits of address.....CR3 only if zero..
 - 3 (CR4-CR7) Lowest order bits of cylinder address....CR3 only if zero.
-

DISPLAY MODE 3 - Separator

(S1)*

- 4 (CR2 only) Display Mode 3 is a separator between Mode 2 and Mode 4
If display Mode 3 does not occur it should be recognized
that the first three actuations of S1 displayed M P faults.
-

DISPLAY MODE 4 - Microprocessor faults

(S1)*

- 5 or 1 (CR3-CR7) Display mode 4 displays faults detected by the M.P.
6 or 2 The phases in which the errors occurred are displayed
7 or 3 first, then the type of fault is displayed.
etc These faults can be decoded by the use of the table
found on the next page.
(CR3-CR7) all on indicate Fault registers are clear.

* (S1) indicates actuations of S1 on the Control/Mux PWA.

Microprocessor Fault Codes and Meanings

Codes 01 through 0C represent the 12 phases of operation that are checked by the microprocessor. Codes 0F through 1E represent the fault types that could have occurred in one of the phases. In display mode 4 the phase codes are read out in order first and then the fault codes in order. Code hex 1F is read after the last fault code is read out.

<u>HEX CODE</u>	<u>BINARY CODE*</u>	<u>PHASE OF OPERATION</u>
01	00001	RETURN TO TRACK CENTER
02	00010	WAIT FOR COARSE SEEK COMPLETION
03	00011	AFTER SEEK SETTLING
04	00100	IDLE LOOP
05	00101	RETURN TO ZERO MOTION
06	00110	END OF VELOCITY TABLE
07	00111	HEAD LOAD
08	01000	AWAIT AGC DURING HEAD LOAD
09	01001	AWAIT TRACK CENTER-LOAD OR RTZ
0A	01010	SETTLING-LOAD OR RTZ
0B	01011	OFFSET ACTIVE
0C	01100	CLEAR OFFSET SETTLING
		<u>FAULT TYPE</u>
0F	01111	SPINDLE DID NOT START/STOP IN 2 MINUTES AFTER ERSLO/ERSTP WAS NOTED (10000/10100)
10	10000	SPINDLE START GT 60 SEC
11	10001	NO SPINDLE MOVEMENT OR NOT UP TO SPEED IN 2 MIN
12	10010	MOTOR OVERHEATED
13	10011	SOLID STATE RELAY FAILURE
14	10100	STOP TIMEOUT
15	10101	EMERGENCY RETRACT FAILURE
16	10110	NORMAL RETRACT FAILURE
17	10111	CYLINDER ADDRESS GT 822
18	11000	OFF TRACK GT 1200 USEC
19	11001	UNEXPECTED AGC IN HEAD LOAD
1A	11010	LOST AGC
1B	11011	SPEED TOO LOW
1C	11100	LOST SPEED PULSES
1D	11101	ALLOWED TIME EXPIRED
1E	11110	NO TRACK LOCK IN SETTLING
1F	11111	MICROPROCESSOR FAULT CODE SUMMARY READOUT IS COMPLETE

*CR3-CR7. "1" means light on. "0" means light OFF.

VELOCITY GAIN

There is only one adjustment that is required by field service personnel; this is the Velocity Gain Adjustment. Misadjustment of this control may cause difficulties that appear to be malfunctions of the hardware. If any servo pcb is replaced velocity gain should be checked.

VELOCITY GAIN ADJUSTMENT

1. Position switch S1-8 on the Servo Coarse PWA to the OFF (open contact) position (right side down).
2. Actuate the momentary switch on the Control/Mux PWA(S1) and observe the fault indicators.
3. When (S1) on the Control/Mux PWA is actuated, the carriage seeks to and stops at track 822.
4. One of the fault indicators #3 through #7 will light to indicate the status of the Velocity gain.
5. Adjust R7 on the Servo Course PWA actuate S1 after each R7 adjustment until only fault indicator #5 is on, then continue to turn R7 an additional 1/2 turn in the same direction.
6. Return S1-8 on the Servo Course PWA to its normal (ON) position.

VELOCITY GAIN ADJUSTMENT TABLE

INDICATOR#	INTERPRETATION	SERVO COURSE R7 ADJUSTMENT
CR 3	Velocity gain very low	Turn clock-wise coarse
CR 4	Velocity gain low	Fine tune clock-wise
CR 5	Velocity gain all right	No adjustment necessary
CR 6	Velocity gain high	Fine tune counter clock-wise
CR 7	Velocity very high	Turn counter clock-wise coarse

ALIGNMENT PROCEDURE

FTU Connection

1. Install cables as shown on next pages.

2. Set rotary switches on the FTU as follows:

DATA ENTRY	DEVICE TYPE
RD/WRT SELECT	ALIGNMENT
ACCESS SELECT	DIRECT SEEK

3. Set toggle switches on the FTU as follows:

TOP ROW	UP	CTR	UP	UP	DOWN	
CTR ROW	DOWN	CTR	CTR	DOWN	UP	DOWN
BTM ROW			ALL	DOWN		

4. Toggle START and RUN back to the up position.

5. On the FTU keyboard enter CLR, 8905, LOAD.

6. Switch the DATA ENTRY rotary switch on the FTU to UNIT NUMBER.

7. enter SEL. DRIVE on the FTU keyboard. The ready light on the FTU should be on.

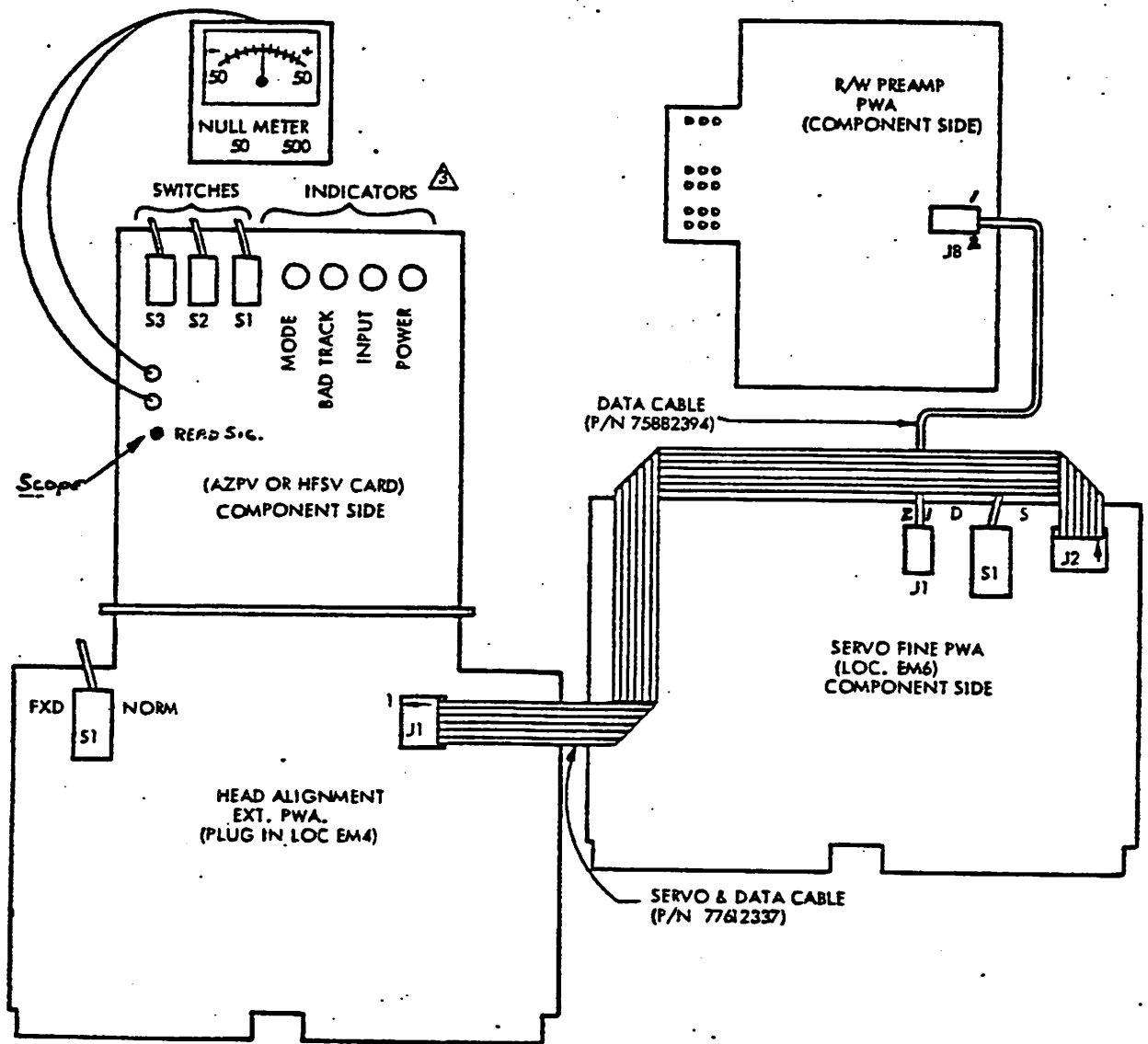
8. Set the DATA ENTRY rotary switch on the FTU to DESTINATION.

9. Enter RTZ on the FTU keyboard, the drive should do a restore.

10. Allow C.E. alignment pack to temperature stabilize for 30 minutes

A) To command a seek key RTZ ,CLEAR, CYLINDER ADDRESS, LOAD, GO.

B). To use the FTU display to calculate offset voltage key BIT GO after entering cylinder address



⚠ AZPV PWA HAS NO INDICATORS.

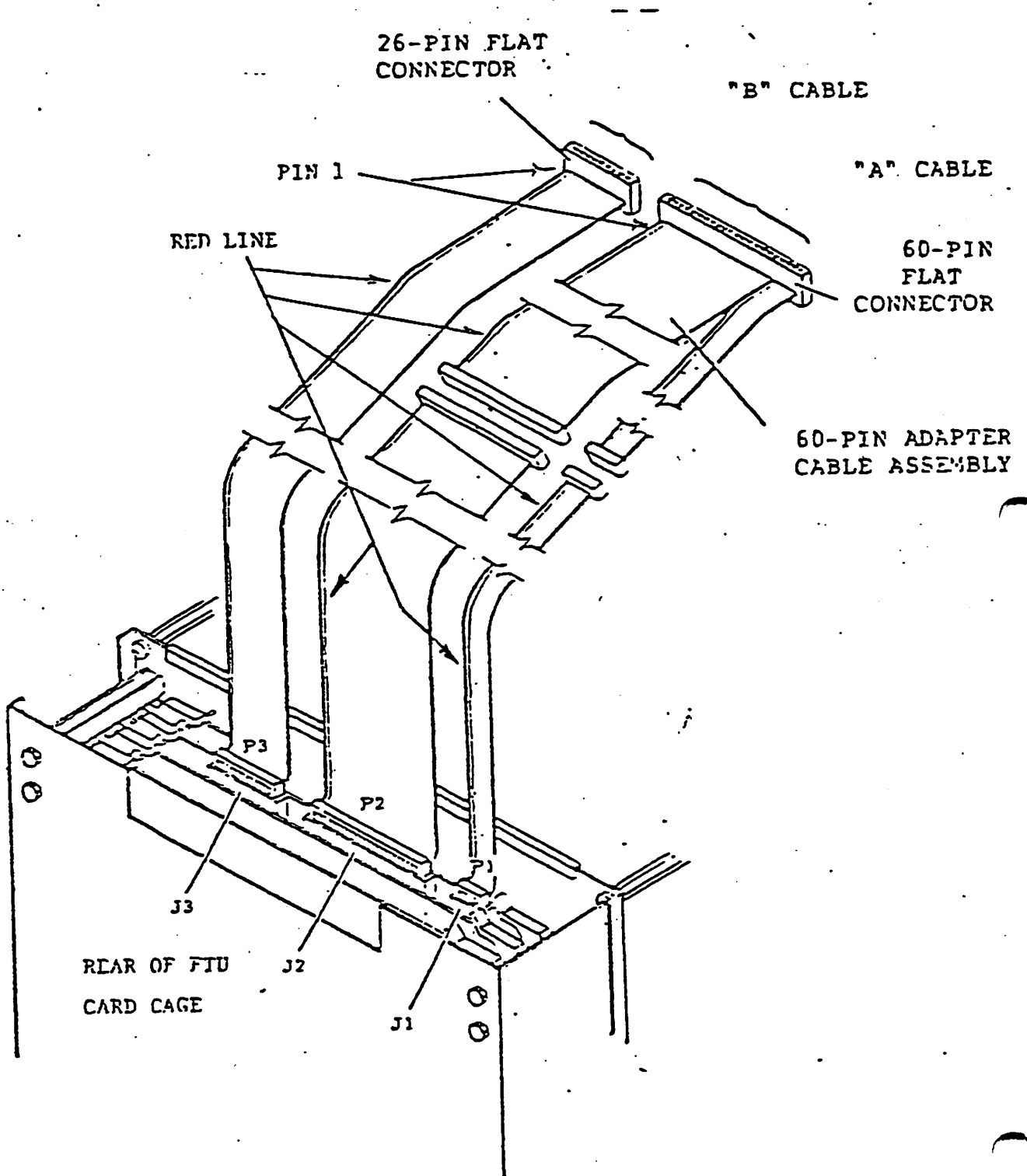
Refer to parts listing in Appendix A for Data Cables.

HEAD ALIGNMENT BLOCK DIAGRAM

HEAD ALIGNMENT

Set up.

Assemble and plug the "A" and "B" cables into the FTU (RED LINE ON CABLES GO TO PIN 1).



CARTRIDGE HEAD ALIGNMENTS

Outer Guard Band Detection

1. Set switches as follows:

- | | |
|-----------------------|----------------|
| a) (AZPV) Align. Card | S1 N position |
| | S2 RW position |
| | S3 X1 position |
| b) Ext Card | FXD position, |
| c) Servo Fine Card | S position |

2. Issue a RTZ command to the fixed disk.

3. Move the cartridge servo head to the rear of the drive until the outer guard band is reached. (see top fig. 9-3)

4. Once the guard band has been located move the cartridge servo head forward until cylinder zero is reached.(see bottom fig. 9-3).

5. Perform a seek to track 822 to ensure that the carriage servo head is on track (the guard band should not be present). This will assure that both servo heads are aligned over the same servo track.

**** CAUTION****

WHENEVER THE HEADS ARE ADJUSTED OR THE CLAMPING SCREWS TURNED WHILE THE HEADS ARE FLYING, EXTREME CARE SHOULD BE TAKEN SO AS NOT TO MOVE THE CARRIAGE ASSEMBLY IN A LATERAL DIRECTION. THIS CAN RESULT IN A HEAD CRASH. COUNTER FORCE SHOULD BE APPLIED ON THE OPPOSITE SIDE OF THE CARRIAGE.

OSCILLOSCOPE SETTINGS

LOGIC GROUND TO SCOPE GROUND

VOLTS/DIV

CH 1 - 0.5 V
CH 2 - NOT USED

TIME/DIV

A - 0.5 μ s
B - NOT USED

TRIGGERING

A - INTERNAL POSITIVE
B - NOT USED

PROBE CONNECTIONS (USE X10 PROBE)

CH 1 TO FTU DIBITS JACK
CH 2 NOT USED

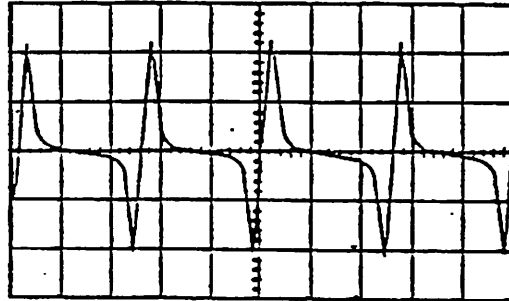


FIGURE 9-3 GUARD-BAND WAVEFORM PATTERN

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS/DIV

CH 1 - 0.2 V
CH 2 - NOT USED

TIME/DIV

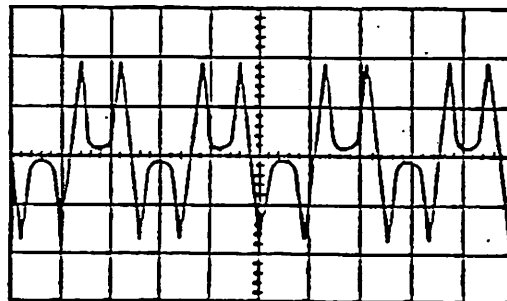
A - 0.5 μ s
B - NOT USED

TRIGGERING

A - INTERNAL POSITIVE
B - NOT USED

PROBE CONNECTIONS (USE X10 PROBE)

CH 1 TO FTU DIBITS JACK
CH 2 - NOT USED



CARRIAGE SERVO HEAD ALIGNMENT

1. Perform a seek to track 404
2. Align the carriage servo for an offset less than 50 mV.
3. Torque head to between 8 and 10 in-lbs. Readjust offset if necessary. Torque heads to 12 in-lbs.
4. Perform a seek to cylinder 8 and 800. The calculated offset should be less than 350 mV. Minor adjustments can be made if either offset is greater than 350 mV. However the final offset at cylinder 404 should not be greater than 75 mV.

CARRIAGE R/W HEAD ALIGNMENT

1. Set switches as follows:

a) (AZPV) Align. Card	S1 N position
	S2 R/W position
	S3 X1 position
b) Ext Card	NORM position
c) Servo Fine Card	D position
2. Repeat steps for carriage servo head except that offset tolerances are different.

Cylinder 404	offset less than 40 mV.
Cylinder 8	offset less than 75 mV.
cylinder 800	offset less than 75 mV.

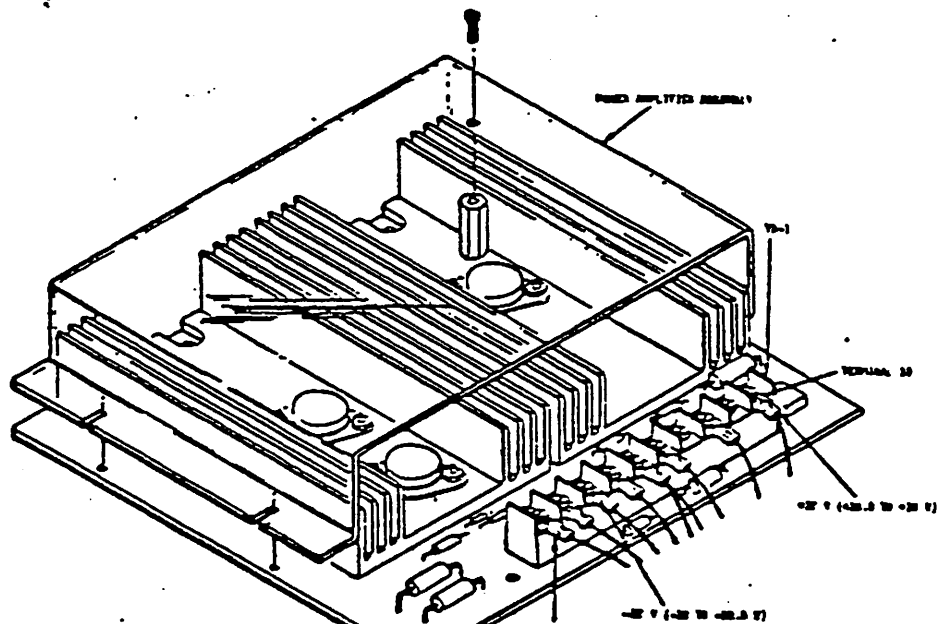
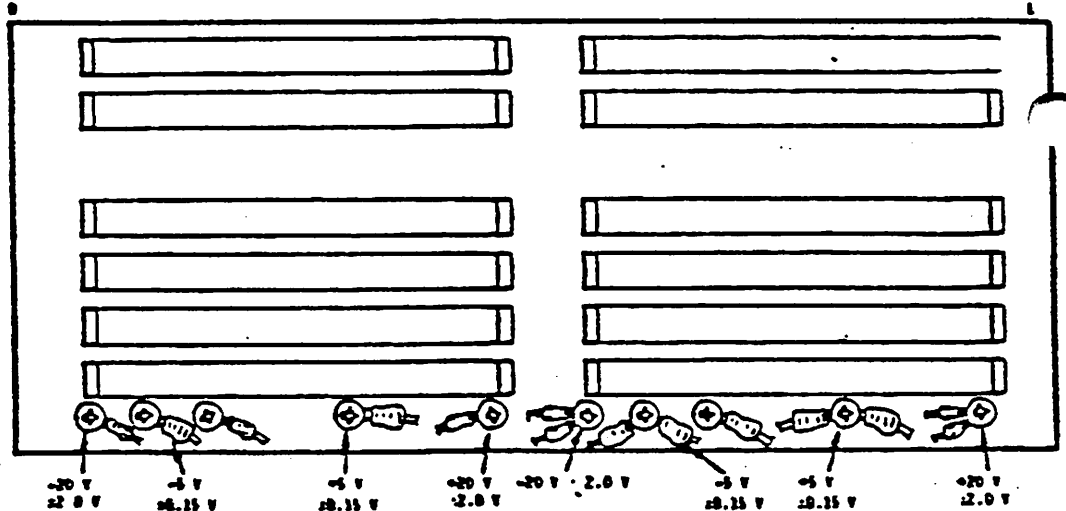
Voltage Check Points

To check true voltage levels for $\pm 20V$ and $\pm 5V$ will require the Customer Engineer to perform the procedure in Section 2.5 of this manual. This will permit the Electronic Module to be hinged out 90° for access to the voltage terminals on the bottom of the motherboard shown in illustration. The voltage readings indicated, proceed forward from the bottom rear of the terminal screws on the Electronic Module. Checking voltages on connector pins is discouraged.

MOTHERBOARD TEST POINTS.

FOR VOLTAGE CHECKS

Using the DC ground terminal at the rear of the base pan as a reference point, check the DC voltages at points shown



FIXED MODULE REPLACEMENT/RUNOUT CHECK

The new fixed module is secured to the shipping container in a different manner from the old style. To remove the bottom of the shipping container loosen the two center screws on the locating fixture. These screws are numbered "B" in the CDC manual page 6-16. The plastic screws are not used on the newer modules.

RUNOUT CHECK

The new procedure to check electrical runout is to connect scope to test point 10 on the servo course PCB. Volt/div. - 1 volt, time base is 10 milliseconds. Ground test point 9 on the servo course PCB. Select the removable or a fixed R/W head, which ever is to be tested. Observe the wave form at TP10. Peak to peak should be less than 2 volts. If the signal is larger than 2 volts the module is considered to be bad and replaced.

PHOENIX DISK DRIVE
PRINTED CIRCUIT BOARDS

<u>WLI</u>	<u>CDC #</u>	<u>DESCRIPTION</u>
5778	77616790	PCB I/O EMI
5779	77616600	PCB CNTL/Mux EM2
5780	75885600	PCB Servo/Course EM3
5782	75886300	PCB Servo/Fine EM6
5783	75886350	PCB Servo/Write EM7
5784	75885750	PCB Servo/Fine Pre Amp
5785	75885950	PCB Pwr Amp
5786	75898850	PCB Relay CNTL
5787	75895150	PCB Oper CNTL Pnl.
5788	75895250	PCB Component Bd.
5789	75832900	PCB Regulator
5790	75886100	PCB Terminator
5792	75885800	PCB Servo Pre Amp

* ALL 726-XXXX

PHOENIX DISK DRIVE
DISCRETE COMPONENTS

<u>WLI</u>	<u>CDC #</u>	<u>DESCRIPTION</u>
726-5816	—	DRY AIR
726-5548	75010102	Head Arm Assy, Lower
726-5549	75010103	Head Arm Assy, Upper
726-5550	75010105	Head Arm Assy, Servo
726-5559	92314113	Belt 60 HZ (80)
726-5629	50223603	Xistor Pwr Amp
726-5630	50223703	Power Amp Assy
726-5747	95575000	Rectifier
726-5748	93418334	Fuse 6A 250V
726-5757	75880045	Speed Sensor
726-5758	75885996	Filter Fine
726-5759	75881911	Filter Course & Gasket
726-5760	77610050	A/C Relay
726-5761	75887871	Static Spring
726-5762	95583504	CR2 Rectifier Blk.
726-5763	50242201	CR1 Rectifier Brdg
726-5764	95588200	Rectifier Sil.
726-5765	75887484	Rectifier MR 500 P.A.
726-5766	95587107	CKT BKR
726-5767	77610140	Switch PK-on, DK-DN, Car-R.T.N
726-5770	22940807	Relay 10A
726-5771	22940808	Relay 15A
726-5773	75894102	Velocity Xducer Assy
726-5774	75886281	Spindle Assy
726-5775	75891689	Drive MTR 60 HZ
726-5776	75889886	Blower MTR
726-5777	77610705	Power Supply Assy.
726-5778	77616790	PCB I/O EM1
726-5779	77616600	PCB Cntl/Mux EM2
726-5780	75885600	PCB Servo/Coarse EM3
726-5782	75886300	PCB Servo/Fine EM6
726-5783	75886350	PCB Read/Write EM7
726-5784	75885750	PCB Read/Write Pre-Amp
726-5785	75885950	PCB Power Amp

726-5786	75898850	PCB Relay Cont'l
726-5787	75895150	PCB Optr Cont'l Panel
726-5788	75895250	PCB Component Board
726-5789	75832900	PCB Regulator
726-5790	75886100	PCB Terminator
726-5792	75885800	PCB Servo Pre-Amp
726-5793	93418324	Fuse 1.25A 250V
726-5794	93418239	Fuse 10A 125V
726-5797	77610706	Power Supply 50Hz
726-5898	75891690	Drive Motor Assy 50Hz
726-5899	92314127	Belt 50Hz
726-5800	75778718	Power Card 50Hz
726-5801	75889887	Blower Motor 50Hz
726-5813	75317102	Transducer Assy
726-5821	94394004	Switch Start
726-5822	94394001	Switch, Fault
726-5823	94394002	Switch, Protect
726-5824	94394108	Switch Device Encoding
726-5831	51853015	Head Cable Clamps
726-5832	75888775	Resistor Wire Wound
726-5833	75888776	Resistor Wire Wound
726-5834	95645628	Capacitor 40V
726-5835	75882865	Door Assy
726-5836	75883056	Solenoid Door-Lock
726-5837	75883465	Cable Door-Lock
726-6506	76204650	Fixed Disk Module
726-8018	95033502	Media Cleaning Solution
726-9675	75882520	Extender Board
726-9677	75882565	Guide
726-9678	75886000	PWA Hd. Alignment Ext.
726-9679	77612622	Jumper Ext.
726-9680	77612337	Head Align. CBL 1
726-9681	75882394	Head Align. CBL 2
726-9682	75891573	Carr. Link Tool
726-9683	76204400	CE Cartridge 1204-51
726-9698	82338800	TB216 (FTU) Disk Exercisor
726-9696	D22628	Torque Tip Short
726-9699	75893963	Head Alignment Tool
726-5611	77440500	Min Alignment Kit

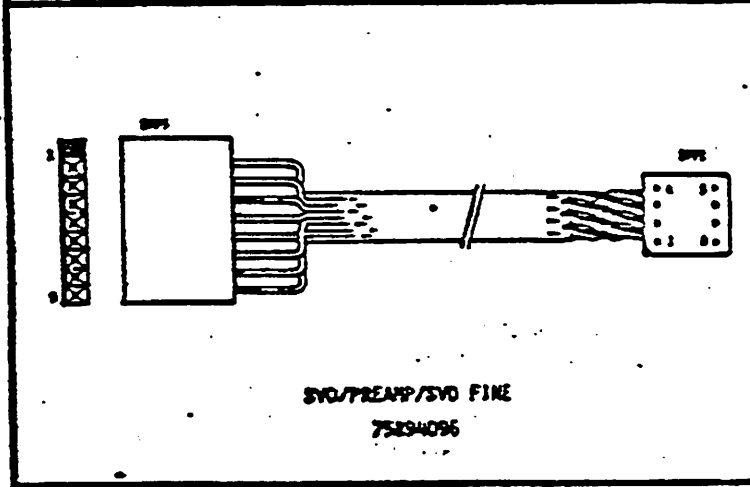
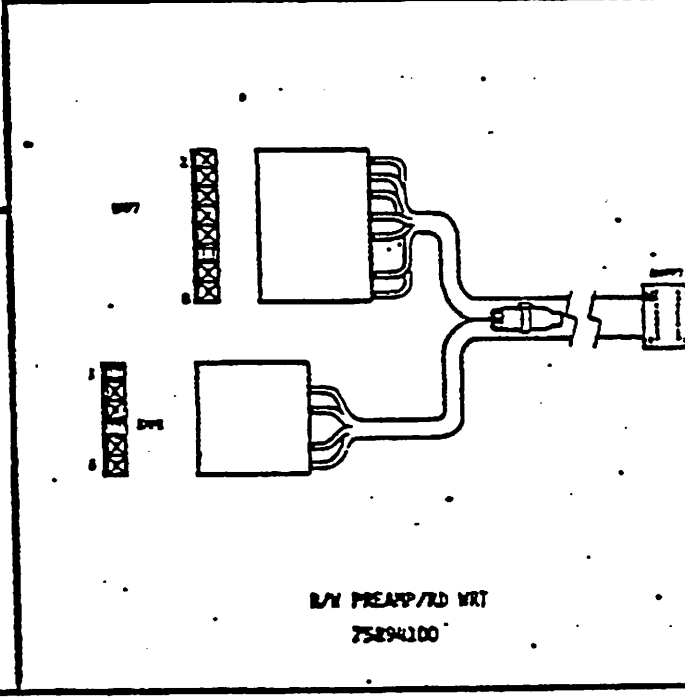
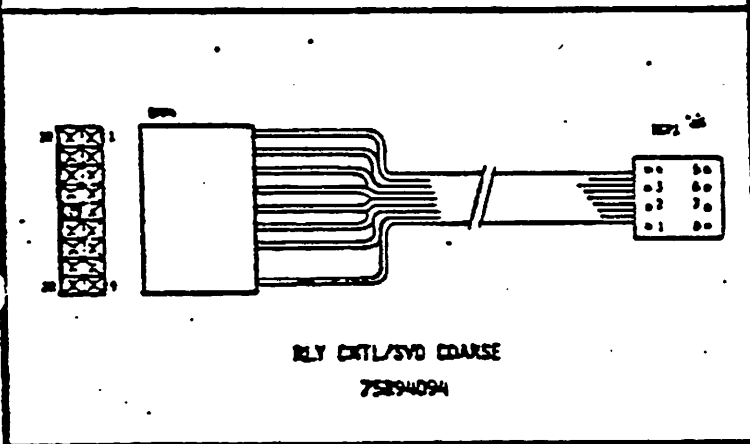
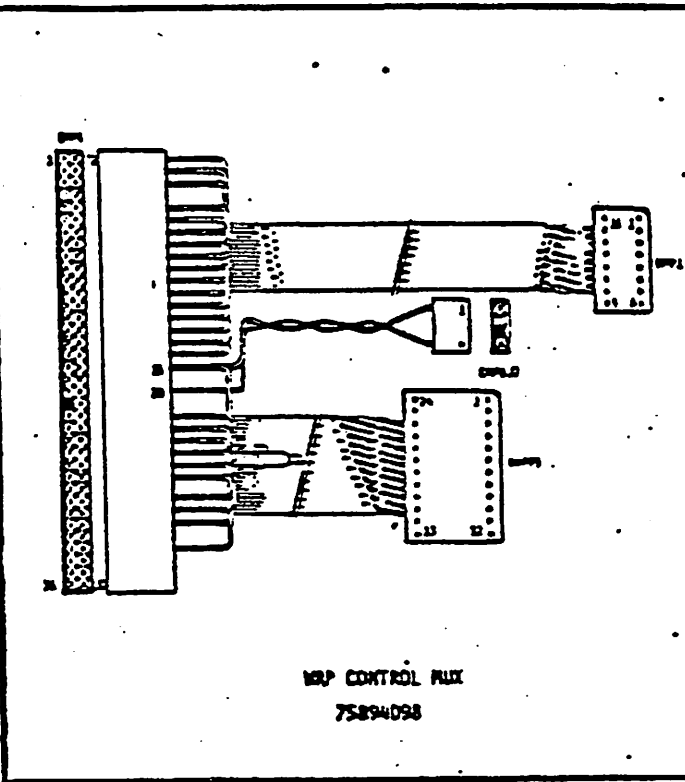
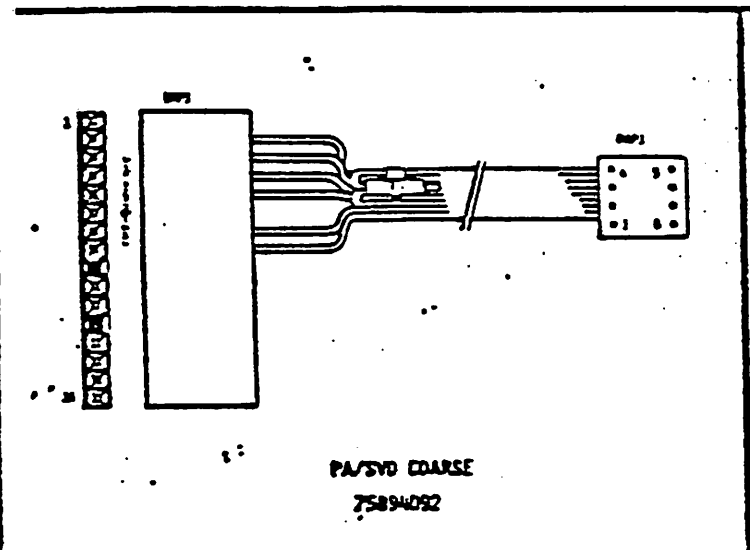
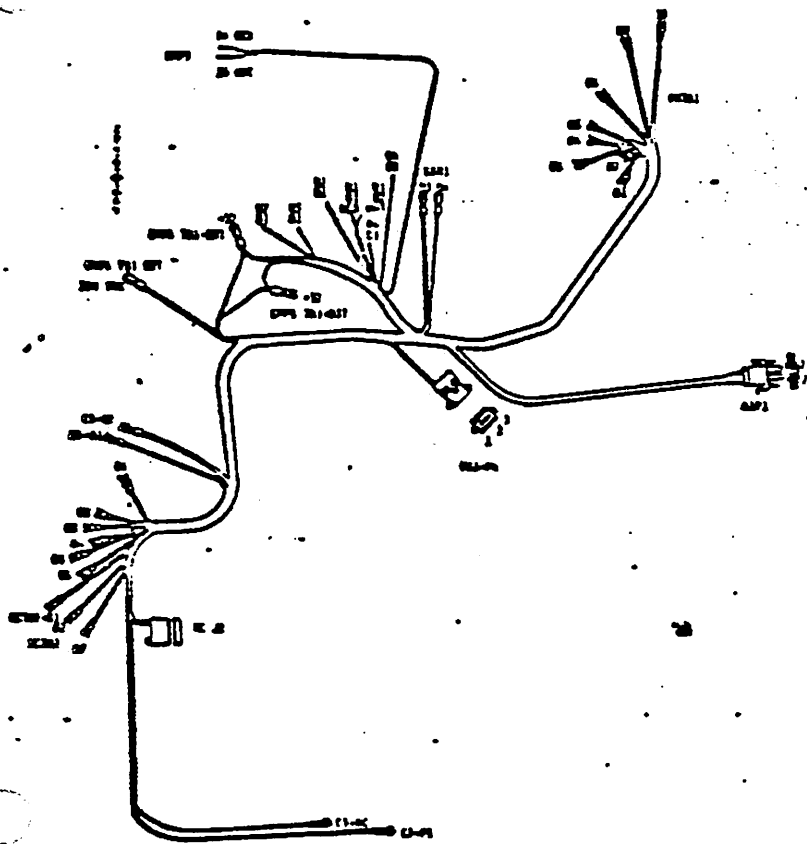
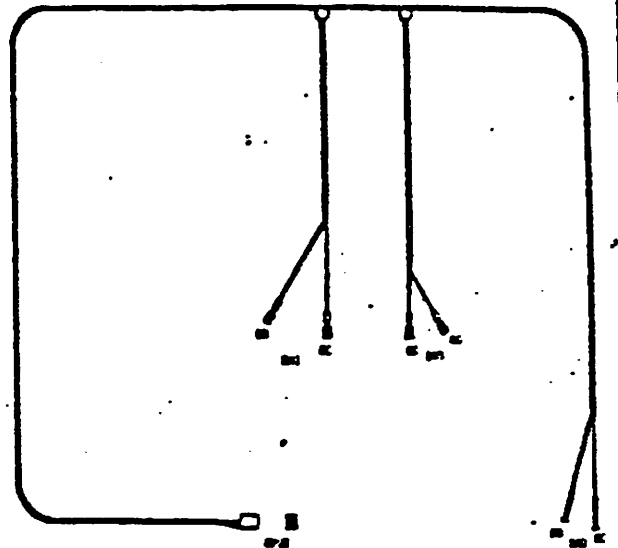


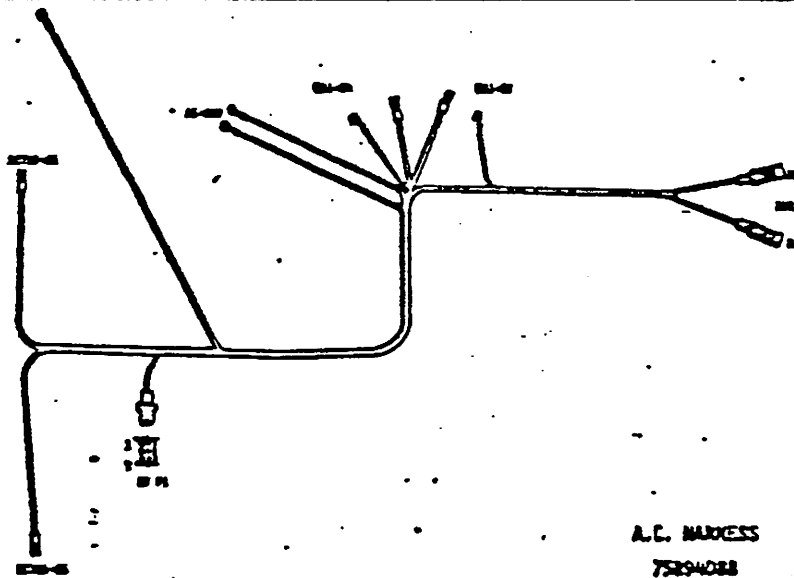
FIGURE 7-19. CMD HARNESSSES (SHEET 1 OF 2)



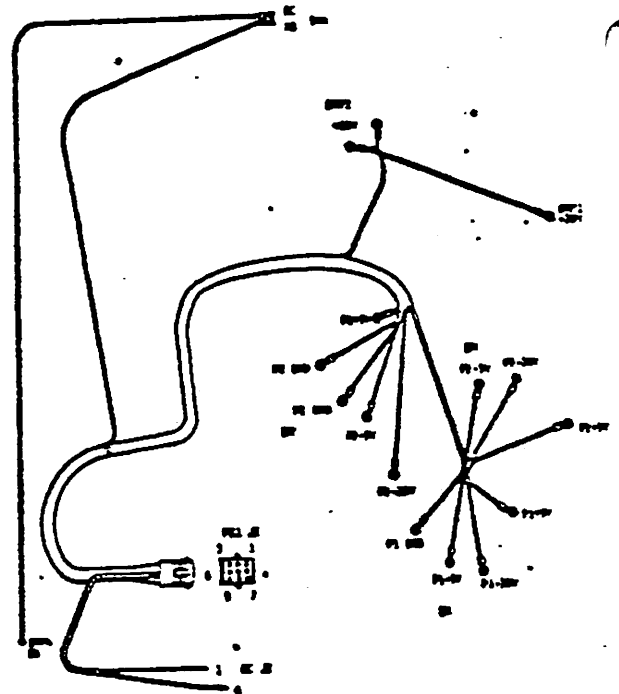
SIGNAL HARNESS
75894086



INTERLOCK HARNESS
75892747



A.C. HARNESS
75894088



D.C. HARNESS
75894090

TECH TIP

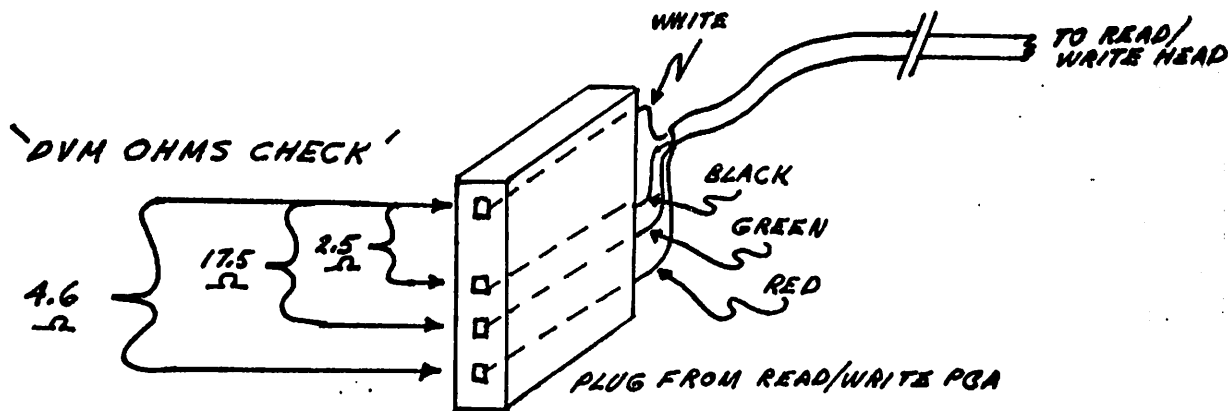
Quick Test Method: For 'Soft' / Hard Disk / Head Crash.

Advantage: No pack or head exposure for visual inspection, required. Absolute detection of soft crash damage (momentary touchdown) to head.

Procedure and Equipment Required:

1. Equipment:
 - a. Screwdriver, Phillips #1
 - b. DVM - Fluke Model 8000 series.
Note: Readings are based on particular DVM model. Other types of DVM's may supply different constant current levels when in low ohm ranges and will affect values of DCR obtained.

2. Procedure:
 - a. Obtain access to read/write plugs from heads at entrance to logic card cage assembly.
 - b. Set up DVM to OHMS Mode, 200 OHM RANGE.
 - c. Perform continuity checks per illustration.
Note: It may be necessary to fashion test probes from paper clip wire in order to gain access to plug connections.
 - d. A variation of greater than 2 OHM or open / shorted condition, indicates defective head coil assembly requiring replacement and a further inspection of disk pack.



PHOENIX SWITCH SETTINGS - 2200

(normal operation)

X- denotes position

EM1 - I/O PWA

S1 REMOTE
X LOCAL

S2 DISABLE
X NORMAL

	ON	OFF
S3 -1	X	
-2		X
-3		X
-4		X

300 Meg - 2265V-2 Local - Normal
75 Meg - 2265V-1 Local - Normal

EM2 - CONTROL/MUX PWA

CR1 NH CR2 MP CR3 WF CR4 WTR CR5 WR CR6 VF CR7 NS

NH- No Head Select
MP- lites for microprocessor faults
WF- Loss of AC or DC write current
WTR- Write or Read off cylinder
WR- Write + Read simultaneously
VF- Voltage Fault
NS- Multiple Head Select.

S1 - Clears Faults - see ERROR CODE; for more description

U33 - determines number of platters
X- denotes jumper cut

U33	2 ²	2 ¹	2 ⁰
2280-1	IN	IN	X
2280-2	IN	X	X
2280-3	X	IN	X

	ON	OFF
S2 -1		X
-2	X	
STANDARD VOL. -3	X	
INVERTED VOL.		

EM3 - SERVO COARSE PWA

	ON	OFF	
S1 -8	X		
-7		X	64
-6	X		32
-5	X		16 OFF
-4	X		8 ACTIVE
-3	X		4
-2	X		2
-1	X		1

sl-1 through sl-7

determines sectors/track

3,2200 uses

64 sectors/track

VS- uses 9 sectors/track

EM6 - SERVO FINE PWA

S1 DATA SERVO

Doesn't matter. Used for head alignment only.

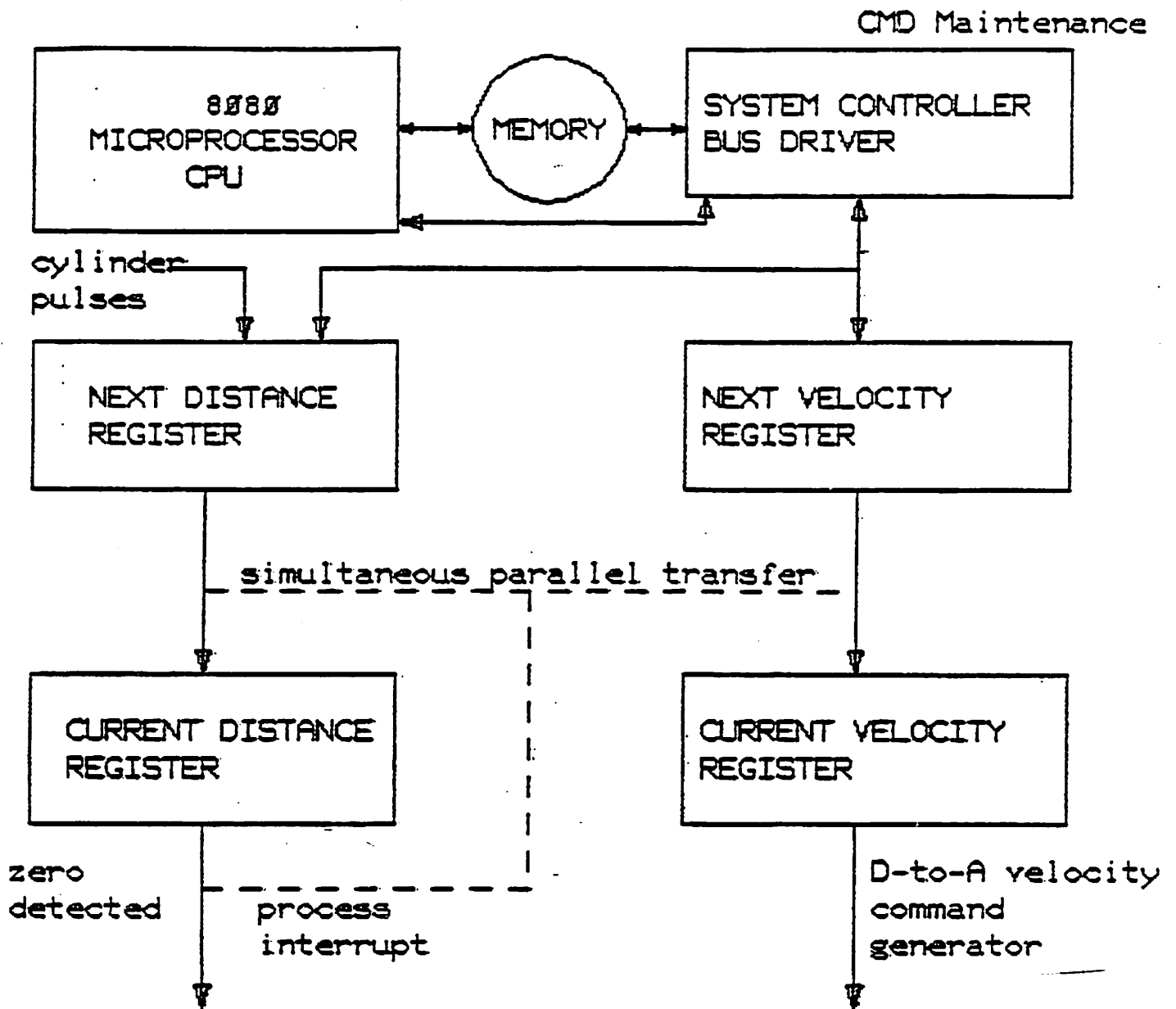


Figure 7-1. Block Diagram

SEEK VELOCITY PROFILE

SEEK DISTANCE	SEGMENT #	NUMBER OF CYL	VELOCITY (IPS)
822 - 626	16	197	74.8
625 - 429	15	197	74.8
428 - 232	14	197	74.8
231 - 165	13	67	63.3
164 - 116	12	49	51.9
115 - 74	11	42	41.2
73 - 48	10	26	31.6
47 - 33	9	15	23.9
32 - 18	8	15	17.3
17 - 12	7	6	11.9
11 - 8	6	4	8.95
7 - 6	5	2	6.92
5 - 4	4	2	4.55
3	3	1	3.46
2	2	1	2.63
1	1	1	2.11

TABLE 7-1, Velocity Profile

<u>PHASE INDICATORS</u>		<u>PHASE INDICATORS</u>	
<u>CODE (HEX)</u>	<u>PHASE</u>	<u>CODE (HEX)</u>	<u>PHASE</u>
01	Return to Track Center	07	Head Load
02	Wait for Coarse Seek Comp.	08	Await AGC during
03	After Seek Settling		Head Load
04	Idle Loop	09	Await Track Center-
05	Return to Zero Motion		Load or RTZ
06	End of Velocity Table	0A	Settling- Load or RTZ
		0B	OFFSET Active
		0C	Clear OFFSET Settling
<u>FAULT INDICATORS</u>			
<u>CODE (HEX)</u>	<u>FAULT TYPE</u>		
0F	Spindle did not Start/Stop in 2 minutes 10 or 14 was noted		
10	Spindle Start GT 70 SEC max		
11	No spindle movement or not up to speed in 2 MIN		
12	Motor Overheated		
13	Solid State Relay Failure		
14	Stop Timeout		
15	Emergency Retract Failure		
16	Normal Retract Failure		
17	Cylinder Address GT 822		
18	OFF Track GT 1200 USEC		
19	Unexpected AGC in Head Load		
1A	Lost AGC		
1B	Speed Too Low		
1C	Lost Speed Pulses		
1D	Allowed Time Expired		
1E	No Track Lock in Settling		

Table 7-3 Microprocessor Phase/Fault Codes

MAGNETIC PERIPHERALS INC.

1 W. Reno Avenue
Fax Address: P.O. Box 12313
Oklahoma City, Oklahoma 73112
405-946-5421

January 12, 1979

Mr. Charlie Torrieli
Wang Labs
836 North Street
Tewksbury, Massachusetts 01876

Charlie:

This is the new head alignment procedure we promised. The changes are as follows:

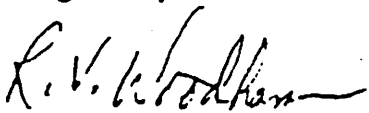
1. The offset limits at cylinder 8 and 800 for servo head to servo head alignment have been changed from 200 mV to 350 mV.
2. The offset limits at cylinder 8 and 800 for servo head to data head alignment (cartridge) have been deleted.

The alignment limits at cylinder 404 remain the same.

The 8 and 800 checks were in the procedure to detect an out-of-tolerance mechanical assembly, particularly a "bowed" or non-parallel carriage guide rod. The 8 and 800 check during servo head to servo head alignment will do this, and it is not necessary to repeat this check for servo to data alignment.

Please call me at 405/946-5421, extension 4137 if you have any questions.

Regards,



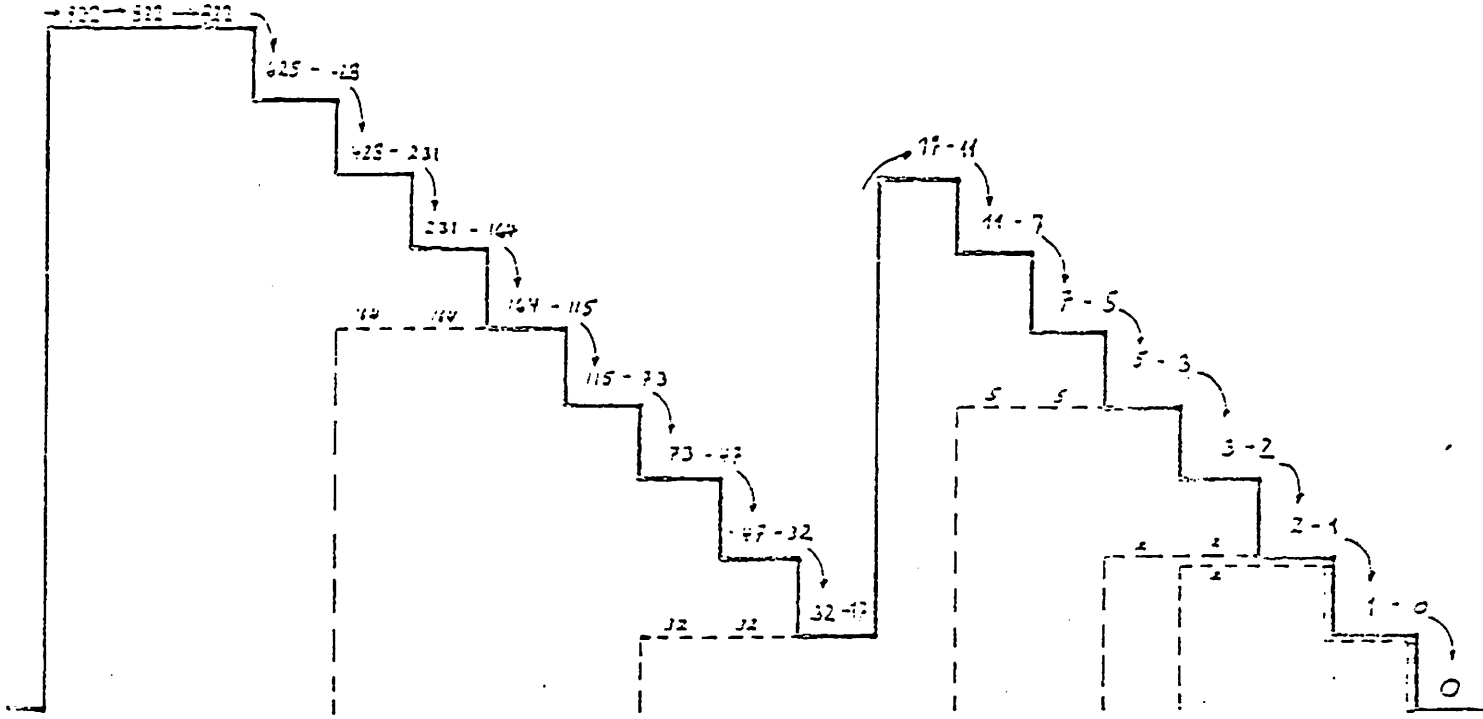
R. V. Woodham
Product Engineering

RVW:sjp

encl.

RTZ - VELOCITY - DISTANCE TABLE

AND M.P. - VELOCITY - DISTANCE TABLE



ALSO
USED FOR
↓

FOR LOAD AND RTZ →

FOR LOAD ON DDD AFTER
REST DETECTION →

FOR POS. OR NEG. OFFSET →

VELOCITY COMMAND	FOR DISTANCE ≥	SEGMENT LENGTH
7 4,0	8 2 2	1 9 7
6 3,3	5 2 5	1 9 7
5 1,9	4 2 8	1 9 7
4 2,1	2 3 1	5 7
3 1,5	1 5 4	4 9
2 3,9	1 1 5	4 2
1 7,3	7 3	2 5
1 1,9	4 7	1 5
8,9 5	3 2	1 5
6,9 2	1 7	5
4,5 5	1 1	4
3,4 6	7	2
2,6 3	5	2
2,1 1	3	1
1,7 8	2	1
0,7 7	1	1
0 0 0	0	

CURRENT TABLE ENTRY LEVEL FOUND BY A BINARY SEARCH ROUTINE.

PHOENIX POWER SUPPLY AND AMPLIFIER PROBLEM ISOLATION PROCEDURE

1. The voltages produced by the CMD power supply are effectively interlocked to protect the drive electronics. In nearly all cases where it appears that the power supply has failed, the 32 volt load (power amplifier circuitry) is actually the culprit. Figs. A & B are basic and less basic drawings of the power circuitry.
2. If the Power Amplifier of the CMD fails, it usually manifests itself as one or more of the darlington pairs being shorted. In many cases, the heads home switch is defective and the microprocessor doesn't know that a move was complete. As a result, the drive commands for the voice coil don't shut off at the proper time and the Power Amplifier burns up. When a darlington shorts out, this causes the power supply to effectively fold back into itself and generate little or no voltages at all. The proper procedure is to insure that the heads home switch is working properly, replace any shorted components and then look for the power supply to come up again. It is recommended that you disconnect the voice coil plug (A1P1) until you are sure that the heads home switch is operating correctly.
3. To isolate the entire 32 volt network from the power supply, it can be easily accomplished by disconnecting the plug leaving the power supply which goes into the 32 volt filter at the filter end of the harness. (J1/P1 of the filter, Fig. B) The filter is located in the center of the base pan where the blower and other large components are mounted. When the 32 volt load is taken off the power supply at that point, it is removed from the power amp, relay control board and the logic rack. (see figure A on the following page) If the power supply does come up with the plug removed, you should see a fault light on the operators panel and CR6 should be lit on the control mux pcb. This indicates the power supply is probably OK. If the power doesn't come up, the problem is in one of the other supply circuits or the power supply itself. It will be necessary to check the fuses on the power supply and/or replace the regulator on the supply or the supply itself.

C A U T I O N

4. At this point you will not know if the 32 volt output of the power supply is actually present because it is disconnected from the voltage sense circuits on EM2. If the power supply came up, check to make sure that there is actually plus and minus 32 volts at the end of the plug coming from the power supply. The reason for doing this is to insure you don't blow up another power amp later. The power amp has to have both plus and minus 32 volts at the right terminals for the correct bias on the darlington or they will short out as soon as power is applied and the power supply will be dead again.

5. Now, you can shut down the power, disconnect terminals 1,3,8 & 10 from the power amp; reconnect the input to the 32 volt filter, then bring up the power again. This will reconnect all 32 volt circuitry except the power amplifier. If the power amp was the only problem left to be repaired, the front door lock will open (click) and the ready lite will flash once, the fault light will be off and CR6 will not be lit. If this is the case, replace the power amp or replace the determined defective transistors which are bad using the power amp representative schematic and resistance chart, (Figs. C&D), included with this blurb as a guide.

For information, the darlington amplifiers have WLI numbers.
They are as follows:

Q1	726-5769
Q2	726-5629
Q3	726-5630

HHSW (heads home switch)
726-5767

AC/DC BASIC BLOCK

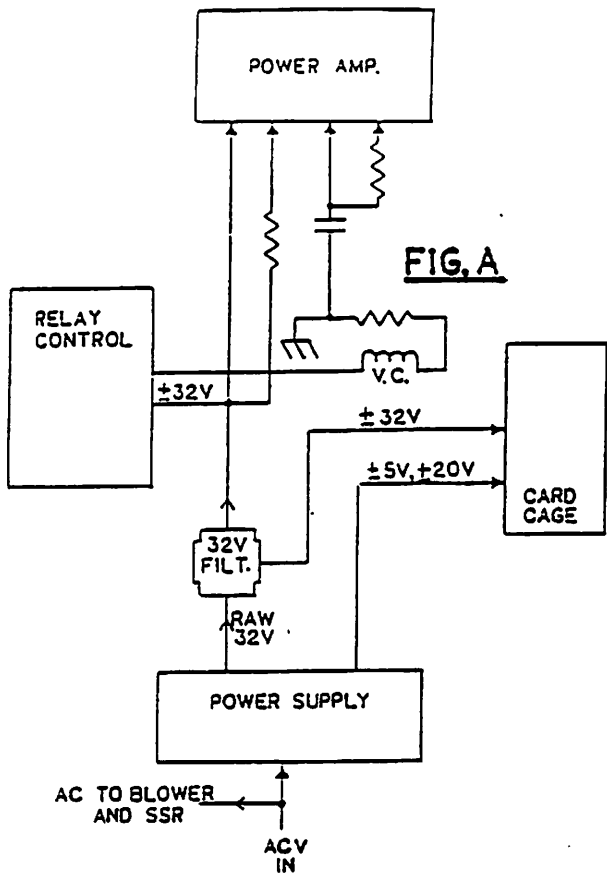


FIG. A

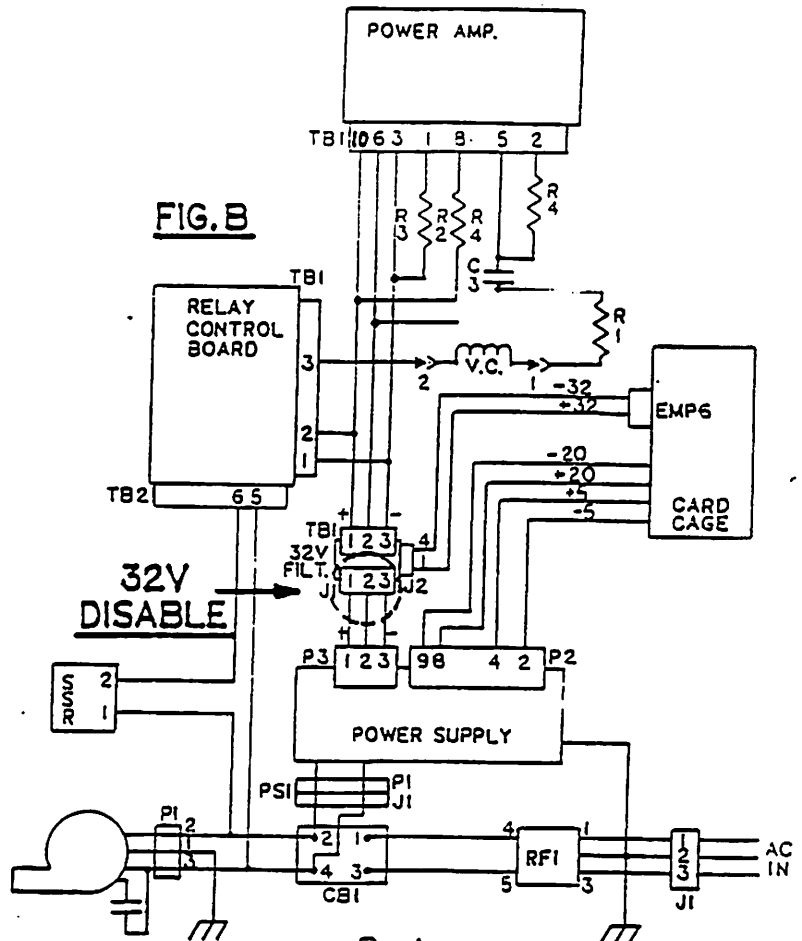


FIG. B

POWER AMP. REP. CIRCUIT ONLY

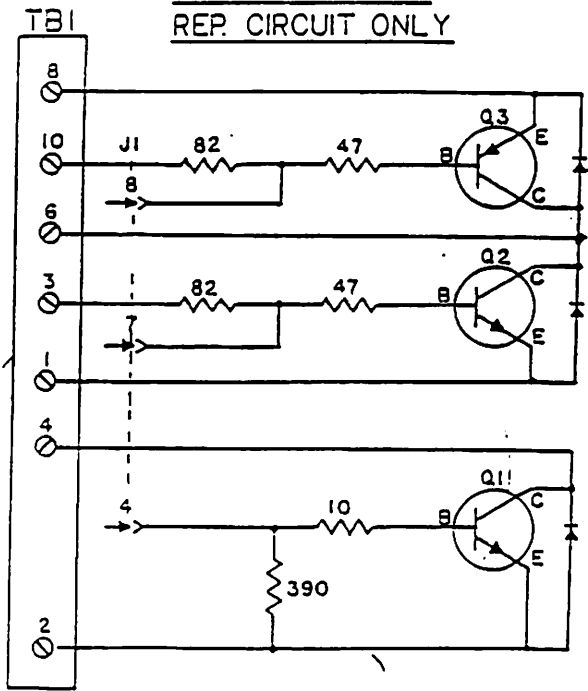


FIG. C

P. A. RES. CHK. CHART

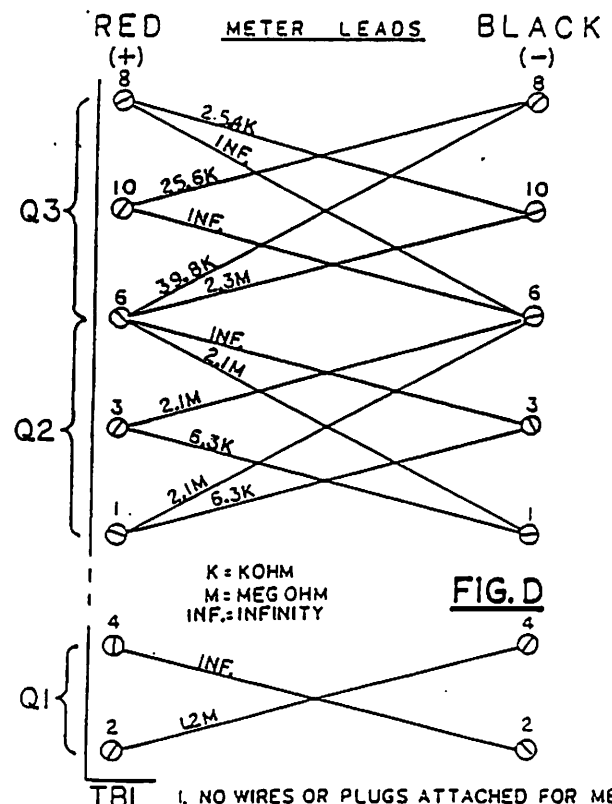
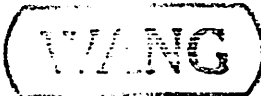


FIG. D

- NOTES:
1. NO WIRES OR PLUGS ATTACHED FOR MEAS.
 2. MEASUREMENTS TAKEN WITH FLUKE DVOM
 3. VALUES WILL VARY ON SOME PA'S DUE TO DIFF. COMPONENTS



LABORATORIES, INC.

ORIGINAL

DATE: 8-18-81 ADMINISTRATIVE _____ TECHNICAL X NUMBER 174

ORIGINATOR: Earle Keizer REVIEWED BY: Merrill Johns

DISTRIBUTION: ATS X DTS X DM _____ ATCM X

ALL OFFICES X HOME OFFICE _____ EACH EMPLOYEE _____

SUBJECT: Phoenix Filters PAGE 1 OF 1

New Phoenix air filters have a duct (opening) to facilitate air flow measurements with an air flow meter (726-9710). Remove the red cap, insert necessary tubing and check for at least .75 inches when doing a PM. If less, replace the filter.

IMPORTANT

This measurement must be done with heads loaded at cylinder 0 and the deck lowered to the normal position.

This means that you will have to route the hoses from the filter properly in order to insure proper and complete air flow when the deck is lowered from the maintenance position back to the normal position.

Make sure you replace the red cap after measuring airflow before returning machine to normal operation, or else HEAD CRASH WILL occur.

III.A.7.

REF TABLES
6-6 8 6-7

Phase	Fault Code	Error Description	Corrective Action	
			Immediate	Extended
	1D & 15	Emergency retract failure after head retract timeout (44 Oms) (Fault 1D, Fault 15).	<ol style="list-style-type: none"> 1. Replace power amplifier. 2. Replace servo coarse board. 	
01	1D	Timeout (8 Oms) during return to track center after a seek (seek error phase 01 Fault code 1D).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace servo fine board. 3. Replace power amplifier. 	
02	1A	Lost automatic gain control (AGC) during wait coarse complete for a seek (seek error phase 02 Fault code 1A).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace servo fine board. 3. Replace power amp. 4. Replace cartridge. 	Possible bad servo head.
02	1D	Timeout (8 Oms) during wait coarse complete for a seek (seek error phase 02 Fault code 1D).	Reference error code A16.	
			<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace servo fine board. 3. Replace power amp. 	Check for mechanical problems: a. Bearing plate b. Carriage bearings. c. Cudde rod.

R
6-16-7

Phase	Fault Code	Error Description	Corrective Action	
			Immediate	Extended
03	1A	Lost AGC during after seek settling (seek error phase 03 Fault code 1A).	Reference error code A16.	
03	1E	No track lock in settling during after seek settling (seek error phase 03 Fault code 1E).	Reference error code A21.	
03	1D	Timeout (8 Oms) during after seek settling (seek error phase 03 Fault code 1D).	Reference Error Code A16.	
03	1D & 1E	Timeout (8 Oms) and no track lock in settling during after seek settling (seek error phase 03 Fault code 1D and 1E).	Reference Error Code A21.	
04	1B	Off track GT 1200 US during idle loop (seek error phase 04 Fault code 1B).	Reference error code A21.	
04	1B	Off track GT 1200 US during idle loop (seek error phase 04 Fault code 1B).	Reference error code A21.	

2-6 TABLAS
6-7

ATTACHMENT 4

Phase	Fault Code	Error Description	Corrective Action	
			Immediate	Extended
04	1A	Lost AGC during idle loop (seek error phase 04 fault code 1A).	<ol style="list-style-type: none"> 1. Replace servo fine board. 2. Replace servo coarse board. 3. Replace servo preamp. 4. Replace power amp. 	<ol style="list-style-type: none"> 1. Check servo head and cables. 2. Check cable between servo preamp and servo fine board.
04	1B & 1E	Off track GT 1200 US and no track lock in settling during idle loop (seek error phase 04 fault codes 1B and 1E).	Reference error code A21.	
05	1D	Timeout (50 Oms) during RTZ motion (seek error phase 05 fault code 1D).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace power amp. 3. Check voice coil cables. 	
06	1D	Timeout (8 Oms) during end of velocity table (seek error phase 06 fault code 1D).	Reference error code A44.	
06	1A	Lost AGC during end of velocity table (seek error phase 06 fault code 1A).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace servo fine board. 3. Replace servo preamp. 	

IF PHOLES
L-616-7

Phase	Fault Code	Error Description	Corrective Action	
			Immediate	Extended
08	1D	Timeout (30 Oms) during await AGC during head load (seek error phase 08 fault code 1D).	<ol style="list-style-type: none"> 1. Replace servo fine board. 2. Replace servo preamp. 	Check servo head and cable.
09	1D	Timeout (30 Oms) during await track center during head load/RTZ (seek error phase 09 fault code 1D).	Reference error code A56.	
0A	1A	Lost AGC during settling head load/RTZ (seek error phase 0A fault code 1A).	<ol style="list-style-type: none"> 1. Replace servo fine board. 2. Replace servo coarse board. 3. Replace servo preamp. 	Check servo head and cable.
0B	1A	Lost AGC during offset active (seek error phase 0B fault code 1A).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace servo fine board. 3. Replace power amp. 	<ol style="list-style-type: none"> 1. Check voice coil and associated cabling. 2. Check servo head and cables.
0C	1A	Lost AGC during clear offset settling (seek error phase 0C fault code 1A).	Reference error code A72.	

REC. TABLES
6-516-7

Phase	Fault Code	Error Description	Corrective Action	
			Immediate	Extended
	10	Spindle start GT 60 Sec. (Fault Code-10)	Reference Error Code A97	
	10 & OF	Spindle start GT 60 Sec & spindle did not start stop in 2 minutes after ERSLO/ERSTP was noted (Fault Codes 10 & OF).	<ol style="list-style-type: none"> 1. Check drive belt. 2. Replace motor starter capacitor. 3. Replace solid state relay. 	Check relay control and cabling.
	11	No spindle movement or no up to speed in 2 min. (Fault Code 11).	<ol style="list-style-type: none"> 1. Replace solid state relay. 2. Check drive belt. 	Check relay control and cabling. Verify speed sensor.
	12	Solid state relay not activated (Fault code 12).	1. Replace servo coarse board.	Check relay control and cabling.
	13	Solid state relay failure (Fault 13).	<ol style="list-style-type: none"> 1. Replace solid state relay. 2. Replace servo coarse board. 3. Replace relay control. 	
	14	Stop Timeout (2 min.) (Fault code 14).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Check drive belt. 	Check relay control and cabling.
	14 & OF	Stop timeout (2 min.) & spindle did not start/stop in 2 minutes after ERSLO/ ERSTP was noted (Fault codes 14 & OF).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Check drive belt. 3. Replace solid state relay. 	Check relay and control cabling.

Phase	Fault Code	Error Description	Immediate	Corrective Action	Extended
	16	Normal retract circuitry failure (Fault 16).	<ol style="list-style-type: none"> 1. Replace power amplifier. 2. Replace servo coarse board. 		
	17	Cylinder address GT 822 (Seek error Fault code 17).	<ol style="list-style-type: none"> 1. Replace I/O board. 2. Replace servo coarse board. 	Check host controller/software.	
	1B	RPM fault (Fault code 1B)	<ol style="list-style-type: none"> 1. Verify speed sensor operation. 2. Check: <ol style="list-style-type: none"> a. Motor b. Pulleys c. Belt 3. Replace solid state relay. 4. Replace servo coarse board. 		
	1C	Lost speed pulses (1C)	<ol style="list-style-type: none"> 1. Replace RPM sensor; 2. Replace servo coarse board. 3. Check cables from sensor. 		
	1D	Timeout (44 Oms) awaiting head retract (Fault 1D).	<ol style="list-style-type: none"> 1. Replace servo coarse board. 2. Replace power amplifier. 		

PHOENIX

POTENTIAL FIXED MODULE PROBLEM

CDC Has introduced a fixed module with a chrome plated hub. If this hub is over torqued it could cause some of the chrome to flake off possibly causing a head crash. Please use the specs called for when tightening down the hub, tightening them in the given sequence to 4 lb/inch, then 7 lb/inch, and finally to 10 lb/inch as shown in the removal/replacement of the fixed module in the Phoenix manual, part number 729-0198A. If this problem is found please mark repair tag "Flaking Hub".

The drive should be purged 30 minutes after replacing the fixed module, up to speed, heads unloaded.

NEW SERVO COARSE BOARD

There is a new Servo Coarse Board in the field completely compatible with all other boards and under the same part number, 726-5780.

This new board, however, does have a head load delay jumper located near the right board extractor lever.

Jumper to left	90 second delay before head load
Jumper to right	120 second delay before head load

The 120 second delay is recommended to increase purge time, therefore hopefully decreasing head crashes.



DISTRICT NEWSLETTER
JULY 1981
#3

PHOENIX

Switch Settings

There are new style I/O boards and Control/Mux boards in the field which have switch banks on them. The settings for these switch banks are as follows:

- | <u>I/O Board</u> | <u>Control/Mux Board</u> |
|--|--|
| 1. ON (Off inhibits sector count) | 1. OFF Spare |
| 2. OFF (Pseudo seek, not used by WANG) | 2. ON (Off inhibits sector) |
| 3. OFF Spare | 3. ON (Allows selection of fixed and removable, OFF-only select fixed) |
| 4. OFF Spare | |

Thanks to Joe McDermott for his assistance with this information.

PHOENIX

CHECKING FILTER

Phoenix filters are now being shipped with a hole on the side for checking air pressure to determine if the filter is allowing enough air to pass through. The hole on those seen so far has an orange plug in it.

To check the filter, power down drive, remove covers, remove plug which should be accessible from left side. Using the Dwyer 460 Air meter, (part number 726-9710), connect the supplied rubber tubing to the outer connector of the meter and the metal angle connector to the other end of the rubber tube. Place the other end of the angle connector in the hole in the filter, and block the other connector hole of the meter with your finger. Power the drive to the load state and check for a reading on the In of Water Draft or Pressure-High Range Scale. A reading of below .75 in. calls for replacement of the filter. A new filter in a drive in the shop gave a reading of .95 in.

Make sure pre-filter is clean.

Please date your filters so that it can be plainly seen how often they need to be changed at particular sites. Sites requiring a filter change more frequently than what is called for may be billable.

10_MEG_DISK

10_MEG_CATSEYE_ALIGNMENT_DISK

When using the new Catseye Alignment Disk to check for radial head alignment, the following scope settings can be used:

CH. 1-.2V/Div AC TP1
1 or 2 milsec/div.
Sync.-CH 1 AC or EXT UPPER INDEX

A sample of the radial head signal was sent out in District Newsletter 9. The other adjustments should be the same as the GDC tribit pack.

**Some catseye alignment disks have been found to have no index signal on track 402. If you find this to be the case with the alignment disk you are using, please tag the disk as such and send it back to Lawrence. The azimuth cannot be checked without an index signal on track 402 and compatibility problems could arise. If you have any questions please contact us at the District.

VS

PHOENIX

Upgrading Phoenix Drive

When upgrading a Phoenix drive from a 30 or 60 MEG drive to a 90 MEG drive under REL 5.XX it is sometimes necessary to write over the fixed platter using the FTU to destroy the VTOC prior to initializing the fixed platter.

PHOENIX

NEW RELAY BOARDS FOR BLOCK POINT 4 DRIVES

Phoenix Block Point 4 drives are now being delivered with a new relay control board.

The CDC P/N is 77713900. This board is not compatible with 726-6724 (CDC # 77680650), the first Relay Board with pluggable connectors.

The part number for the new Relay Board is 726-6724A.

726-5786	Original Relay Board (screw type connector)
726-6724	CDC P/N 77680850 First BP 4 Drives (pluggable connector)
726-6724A	CDC P/N 77713900 Latest BP 4 Drives (pluggable connectors)

P.S.N. III-A-7-4. Phoenix Terminator Modification

The following is a concern from Bob Peebles of the New England District. If anyone has had this situation please call the Area so that we may check into it.

This PSN is to correct the termination of OPEN CABLE DETECT signal line. It calls for the cutting of the etch from pins 14 and 44 on the terminator and adding a resistor to U3-5, and U3-6. The result of this will be to Float the OPEN CABLE DETECT signals and add a 470 Ohm resistor between ground and a 5.6 Ohm terminator according to the CDC C.M.D. manual. The correct point for connecting the added resistors should be to pins 14 and 44 thus terminating them with 470 Ohm resistors instead of 5.6 Ohm resistors.

"A" & "B" Cable Total Distances (VS)

The maximum length of "A" cable which can be used off of one I.O.P. connecting up to 4 drives is 100 feet. The maximum "B" cable length to any one drive is 50 feet.

TECHNICAL SERVICE BULLETIN
SECTION: HardWare Technical

NUMBER: HWT 7149 REPLACES: _____ DATE: 08/04/87 PAGE 1 OF 1

MATRIX ID. 3105 PRODUCT/RELEASE# CDC PHOENIX DISK DRIVE

TITLE: PHOENIX CARRIAGE BUMPER PROBLEM

PURPOSE:

To inform the field of a possible problem with the rubber Carriage Stop Bumper on the Phoenix 2280, 2280V, and 6580V disk drives.

EXPLANATION:

The Carriage Stop Bumper is mounted on a metal bracket attached to the cam towers of the Phoenix drive. Its only purpose is to prevent the carriage from crashing into the actuator housing during an uncontrolled seek to spindle. Heat can cause the glue to melt and the bumper to slip down into the path of the carriage. This can prevent the carriage from positioning the heads to the inner cylinders of the drive. The problem can show up as intermittent seek errors.

The bumper is identified as reference numbers 389 and 403 of figure 7-9 (DECK ASSEMBLY) in the Phoenix Product Maintenance Manual, WLI# 741-1063A.

CORRECTIVE ACTION:

The bumper can easily be removed and glued back in place.

GROUP: Desktop Systems/Peripherals

MAIL STOP: 001-140

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

WANG

TECHNICAL SERVICE BULLETIN
SECTION: HardWare Technical

NUMBER: HWT 5049 REPLACES: N/A DATE: 03/05/85 PAGE 1 OF 01
MATRIX ID. 3105 PRODUCT/RELEASE# Phoenix Disk
TITLE: Absolute Filter Causing Airlflow Problems

Wang has been delivering an improved Phoenix absolute filter for approximately nine months. This filter is distinguished by new packaging and an orange gasket around the exhaust outlet. Another distinguishing feature is the stabilizing "toes" at the underside of the exhaust outlet. It has been reported that the air hose from the no-air plenum will sometimes get caught under one of the stabilizers. The air pressure will then be cut off and the drive disabled. Care should be exercised when installing a new filter to prevent the air hose from being cut off.

GROUP: Peripheral Hardware Support Group MAIL STOP: 0125

COMPANY CONFIDENTIAL

WANG Laboratories, Inc.

TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#00729

III.A.7

PERIPHERALS-DISK DRIVES-CDC PHOENIX 9448 CMD.

TOPIC: ...IMPROPERLY INSTALLED CAPACITORS

On the PCB CNTL/MUX, WLI 726-5779, capacitor C44, a 4.7uF 20V cap, may be installed backwards. After approximately 4 hours of operation the cap will short +5V causing emergency retract and constant reverse drive. If power is left on the servo power amp will short out. Please check on all new installations for this problem. Should this problem arise, please contact the Technical Assistance Center. Please have the CDC SN of drive when you call in.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#10217

III.A.7

PERIPHERALS-DISK DRIVES-CDC PHOENIX 9448 CMD.

TOPIC: POTENTIAL PROBLEM ON PHOENIX

With Phoenix drives CDC S/N's 1500 and below, a problem has been found in two carriage assemblies with Barden bearings. If the carriage is making a lot of noise, such as in a dry bearing, replacement may be necessary. Most of the drives with this problem have been found, however, there may be a small number in the field.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#10512

III.A.7

PERIPHERALS-DISK DRIVES-CDC PHOENIX 9448 CMD.

TOPIC: PHOENIX FIXED MODULE REPLACEMENT

The new fixed module is secured to the shipping container in a different manner from the old style. To remove the bottom of the shipping container, loosen the two center screws on the locating fixture. These screws are numbered "B" in the CDC manual # 75888415 in the maintenance section, page 6-16. The plastic screws are not used on newer modules.

There is also a new procedure to check electrical runout on the fixed module. After purging for a reasonable time period, load the heads. Connect a scope to test point 10 on the servo-coarse PCB. Volt/Div. - 1 volt, time base 10 milliseconds. Ground test point 9 of the servo-coarse PCB and select a head greater than 1 and observe the wave form of TP 10. Peak to peak should be less than 2 volts. If the signal is larger than 2 volts, the module is to be considered bad and replaced.

A PSN on this procedure will be issued shortly. The new Phoenix OEM manuals are in print and will also be available shortly. We will issue the part number for the manual as soon as we can do so.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#11107

III.A.7

PERIPHERALS-DISK DRIVES-CDC PHOENIX 9448 CMD.

TOPIC: CARRIAGE CENTER RAIL TORQUE

Torquing the center rail:

- 1) Inspect the rail screw hole for contamination.
- 2) Using lock tight, torque the screw to 1.25 inch lbs.
plus/minus 0.25.

Note: This torque specification is critical and
should be rigidly adhered to.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#20330

VI.B.1

VS SYSTEMS-INTERFACE-DISK I/O PROCESSORS.

TOPIC: VS-100 DISK CABLES -- INPUT FOR NEWSLETTER

Below is the list of part numbers for "A" and "B" cables for the VS-100.

"A" Cable -- CPU to Disk

- 1) CPU to Phoenix
15' 220-3041-7
25' 220-3041-20
50' 220-3041-21
- 2) CPU to 80 MEG SMD
15' 220-3041-9
25' 220-3041-16
50' 220-3041-19
- 3) CPU to 300 MEG SMD
15' 220-3041-8
25' 220-3041-18
50' 220-3041-19

"A" Cable -- Daisy Chain

- Phoenix to Phoenix
220-3031-1
- 300 Meg to 300 MEG
220-3031-2
- 80 MEG to 80 MEG
220-3031-3
- 80 to 300 MEG
220-3031-4

"B" Cable -- CPU to Disk

- 1) CPU to Phoenix
15' 220-3033-21
25' 220-3033-22
50' 220-3033-33
- 2) CPU to 80 MEG SMD
15' 220-3033-25
25' 220-3033-22
50' 220-3033-35
- 3) CPU to 300 MEG SMD
15' 220-3033-23
25' 220-3033-24
50' 220-3033-34

Phoenix to 300 MEG

- 220-3031-5
- 80 MEG to Phoenix
220-3031-6

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#21102

VI.B.1

VS SYSTEMS-INTERFACE-DISK I/O PROCESSORS.

TOPIC: INITIAL INTERFACE CABLE ORDERING

As of August 1, 1982 standard length disk cables will not be shipped automatically when a drive is ordered. The salesperson ordering the drive is required to order the proper length cabling. This is to assure the cable length is adequate for the customer's system layout and configurations. At the time of order, the salesperson may require the assistance of a Customer Engineer to assure proper cable lengths for disk drives.

If a disk drive is delivered for install without cabling or with improper length cabling, refer to section 3.4 of the Customer Engineering Policies and Procedures Manual for the escalation and process for resolution of the problem.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#21130

VI.C.1

VS SYSTEMS-SOFTWARE-OPERATING SYSTEMS.

TOPIC: VS OPERATING SYSTEM 5.02.XX WITH SINGLE PHOENIX DRIVE.

When an IPL is performed from the removable volume of a Phoenix drive, the System Paging Files are placed on the wrong volume by the Operating System (version 5.02.XX). Instead of going to the removable volume where they belong, they are placed on the fixed volume. Subsequent IPL attempts fail because the Operating System tries to place new paging files on the fixed volume without having scratched the old ones.

One way to circumvent this problem is to maintain a copy of Operating System version 5.01.XX on a removable volume. IPL from this volume and scratch the @SYSPACE library from the fixed volume. This procedure is to be performed right after having IPL'd from Operating System version 5.02.XX on a removable volume.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#30222

III.A.8 (3106)

PERIPHERALS-DISK DRIVES-CDC 75MB SMD BK/4XX-5XX.

TOPIC: NEW STYLE TERMINATORS FOR DUAL CHANNEL DISKS

The problems of making dual channel drives the last drive in a string is that two terminators cannot be mounted on the unit. A new terminator WLI# 210-8177 has been made for this application. This new terminator will have low profile resistor sips WLI# 333-0849 in place of the old style.

We expect the new style to be available by the end of February. The low profile sips can be used to upgrade an existing terminator if the situation warrents.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#30510

3107

PERIPHERALS-DISK DRIVES-2200 DISK FUNCTION PROCESSORS.

4202

- 2200 SYSTEMS-INTERFACE-DISK MULTIPLEXER.

TOPIC: 2280 ALTERNATE SECTOR PROBLEM

Problem Symptoms:

1. D82 errors.
2. D88 errors.
3. Disk hangs.

The above problems could be due to an alternate sector on the first sector of a track. We are addressing the alternate sector problem with this procedure.

Trouble Shooting Procedure:

1. On platters where an error occurs; run 'VERIFY T(0,52608)'. If there is an error on sector 52608, you do not have an alternate sector on the first sector of a track. An error on sector 52608 is expected. There is another problem with your system and you should troubleshoot it accordingly.
2. If there is no error on sector 52608 but errors exist on other parts of the disk, you have an alternate sector problem.

Solution:

1. Backup platter where problem occurs.
2. Reformat bad platter using 'SFORMAT DISK T/Daa' command. (aa = disk platter number.)
3. Run 'VERIFY T(0,52608)'. If there is no error on sector 52608 but errors exist on other parts of disk, you still have an alternate sector problem. Go to step 6.
4. If there is an error on sector 52608, you have recovered from the alternate sector problem.
5. Restore your data from the backup to the reformatted platter.
Go to step 11.
6. At this point you have two choices. First is replacing the fixed module. To do this go to step 10. The second is that you must find the bad sector.

Verify the disk. Write down the sectors which verify bad. Add one to each sector and divide by sixteen. The sector address that divides evenly by sixteen is your bad sector.

If the sector is not within a file, go to step 7.

If the sector lies within a program file, go to step 8.

If the sector lies within a data file which is accessed by 'DATALOAD DC' or 'DATASAVE DC', go to step 9.

7. Make sure that the sector is not within a data file which is accessed by the 'DATALOAD DA or BA' or accessed by the 'DATASAVE DA or BA' commands. If it is, go to step 10. If it isn't, recommend that the customer avoid that sector. Go to step 11.

8. Follow the steps below to avoid the bad sector in a program file.

A. Key in 'SELECT DISK aaa' and 'CR'. (aaa = address of platter where bad sector is.)

B. Key in 'CLEAR' and 'CR'.

D. Key in 'MOVE T "ffffffff" TO T/bbb,' and 'CR'.
(ffffffff = file where bad sector exists.)
(bbb = address of unused scratch platter.)

E. Key in 'SCRATCH T "ffffffff"' and 'CR'.

F. Key in 'CLEAR' and 'CR'.

G. Key in 'SAVE DC T("ffffffff")"BADSEC"' and 'CR'.

H. Key in 'MOVE T/bbb, "ffffffff" TO T' and 'CR'.

I. Go to step 11.

9. Follow the steps below to avoid the bad sector in a program file which can be accessed by 'DATASAVE DC' and 'DATALOAD DC' commands.

A. Key in 'SELECT DISK aaa' and 'CR'. (aaa = address of platter where bad sector is.)

B. Key in 'CLEAR' and 'CR'.

D. Key in 'MOVE T "ffffffff" TO T/bbb,' and 'CR'.
(ffffffff = file where bad sector exists.)
(bbb = address of unused scratch platter.)

E. Key in 'SCRATCH T "ffffffff"' and 'CR'.

F. Key in 'CLEAR' and 'CR'.

G. Key in 'DATASAVE DC OPEN T("ffffffff")"BADSEC"' and 'CR'.

H. Key in 'MOVE T/bbb, "ffffffff" TO T' and 'CR'.

I. Go to step 11.

10. This is the second choice. If the above steps fail to alleviate the problem, follow the steps below.

A. Backup all the fixed platters.

B. Remove and replace the fixed module.

C. Format all the fixed platters.

D. Restore all the backups to their appropriate platter.

11. Bring system back up and return to customer operation.

This fix is only temporary. The final fix will be a microcode update. No time frame has been given by R&D.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#30524

3105

PERIPHERALS-DISK DRIVES-CDC PHOENIX 9448 CMD.

TOPIC: COMPATIBILITY BETWEEN DISKS (PHOENIX)

When suspected compatibility problems occur between disk drives, checking head alignment may not locate the problem. You should also check the index to burst as you check head alignment.

Procedure is on page 6-57 of Phoenix manual 729-0198A, Item 39A.

1. Set up the drive as you would to do head alignment except you don't need the DVM attached to the alignment PCB.
2. Set the scope for negative trigger and sync on "index" test point 52 on the I/O PCB. This test point is below the left hand card extractor next to the "A" cable plug J1.
3. Seek to cylinder 15 and probe test point "Y" of the alignment PCB. The index to burst (I-TQ-B) should be 4 micro-seconds plus or minus 2.9 micro-seconds.
4. Seek to cylinder 793 and repeat.
5. If the I-TQ-B is out, try replacing the head.
6. There is no adjustment other than the replacement of the head or the carriage assembly. You should check the center rail torque for 1.5 inch lbs.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#40124

3106

PERIPHERALS-DISK DRIVES-CDC 75/288/675 MB

TOPIC: FCO 1072, 2265V-2, 6565 CDC 288 MB SMD

FCO 1072, released on January 11, 1984, documents ECO # 29993. The I/O cable clamp on the drive is replaced with a new clamp. This change reduces static problems in the unit by properly grounding the I/O cables at the base of the cabinet and insures compliance with FCC regulations. The change is required on units shipped from Wang between June 1 and October 1, 1983. To obtain the FCO Kit, order WLI # 728-0088.

CUSTOMER ENGINEERING
TECHNICAL ASSISTANCE CENTER
NEWSLETTER

#40306

3105

PERIPHERALS-DISK DRIVES-CDC PHOENIX

TOPIC: PHOENIX SERVO COURSE PCB'S

There is a new Servo Course PCB that is being shipped with new units. It is completely compatible with other Servo Course PCB's (726-5780).

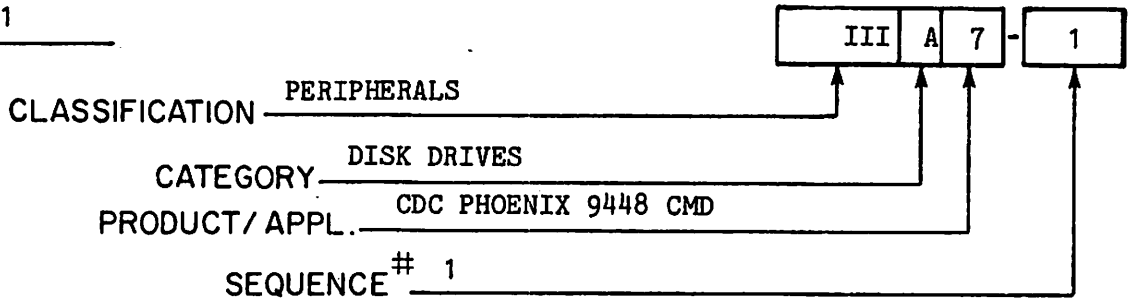
This new Servo Course board has a jumper located near the right hand PCB extractor lever. This jumper is for the head load delay. With the jumper to the left side, there is a 90 second delay; with the jumper on the right side, there is a 120 second delay before head load. This delay was incorporated to allow extra purge and stabilization time for the cartridge. The lower particle count can reduce head crashes. Normal setting is 120 seconds.

XX YY
I I I

XX= 90 seconds, YY= 120 seconds

PRODUCT SERVICE NOTICE

DATE : 05/11/81



TITLE:

Phoenix Silencing Procedure

This PSN applies to the CDC Model 9448 CMD "Phoenix" Disk Drive used in Wang Model 2280, 2280V, 6580 and the OIS-140.

The following procedure is used for the purpose of reducing the noise output from the Phoenix Disk Drive. It is to be performed only on customer request.

The procedure involves the installation of 12 pre-cut pieces of foam within the equipment cabinet. These items may be ordered from stock and include the following:

QUANTITY PART NO.

- 1 660-0692
- 1 660-0693*
- 2 660-0690
- 2 660-0688
- 1 660-0686
- 1 660-0689
- 1 660-0685
- 1 660-0683
- 2 660-0684

* This piece does not have any adhesive backing. It just wedges in place.



LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL. (617) 459-5000, TWX 710 343-6769, TELEX 94-7421

PRINTED IN U.S.A.
REORDER NO.
729-0889

III.A.7-1

The procedure consists of positioning the 12 pieces as shown in Figures and 2. Each piece except one has an adhesive coating on one side which is covered with a protective backing. The adhesive used is rather fast acting. Therefore, after removing the protective backing care should be taken to position the pieces correctly before allowing the adhesive to contact the cabinet.

The side pieces (Nos. 660-0688 and 660-0690) should be inserted first since the large top pieces (No. 660-0686) are cut to butt against them. The remaining pieces may be inserted in any order.

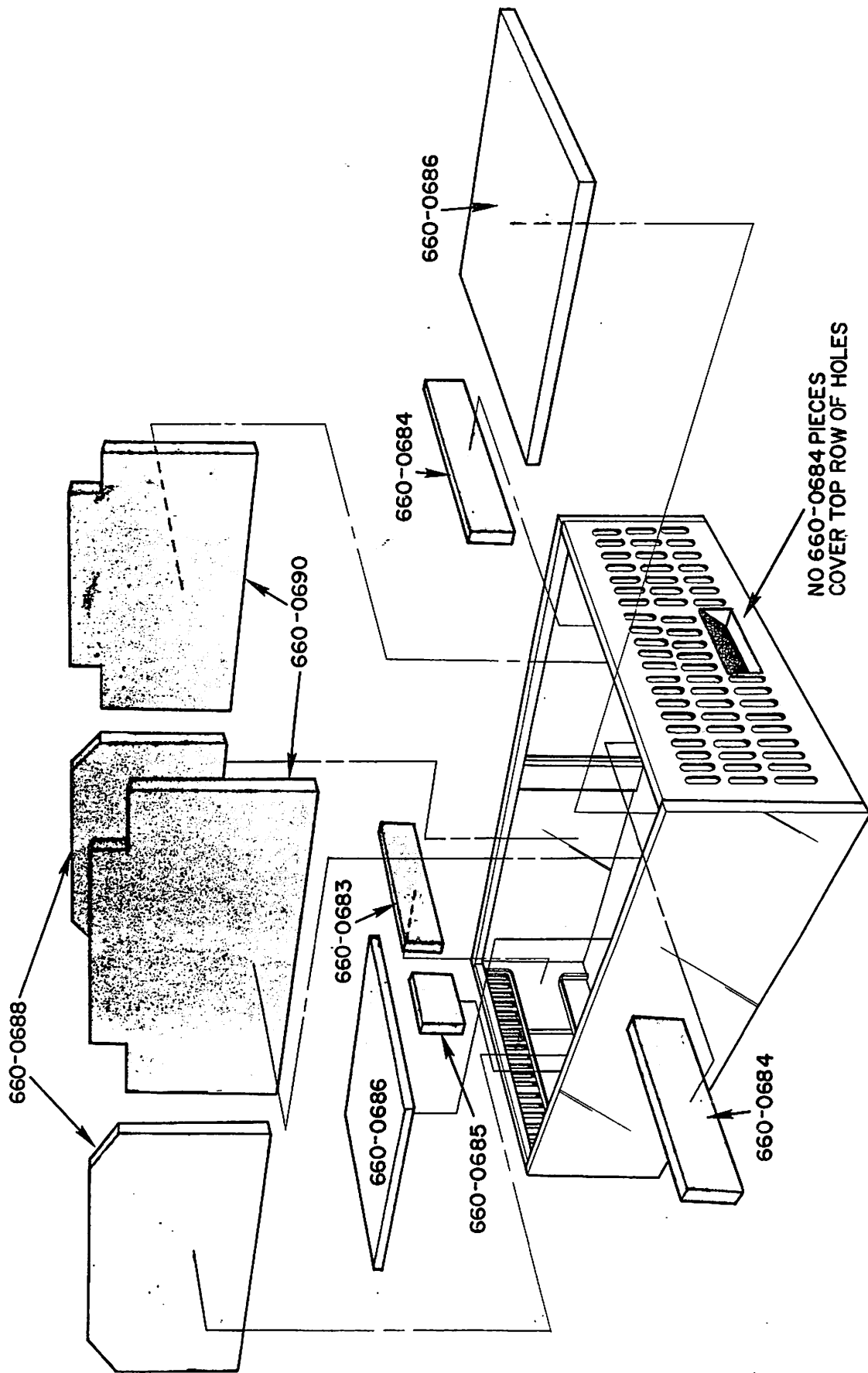


FIGURE 1 FOAM PAD INSTALLATION

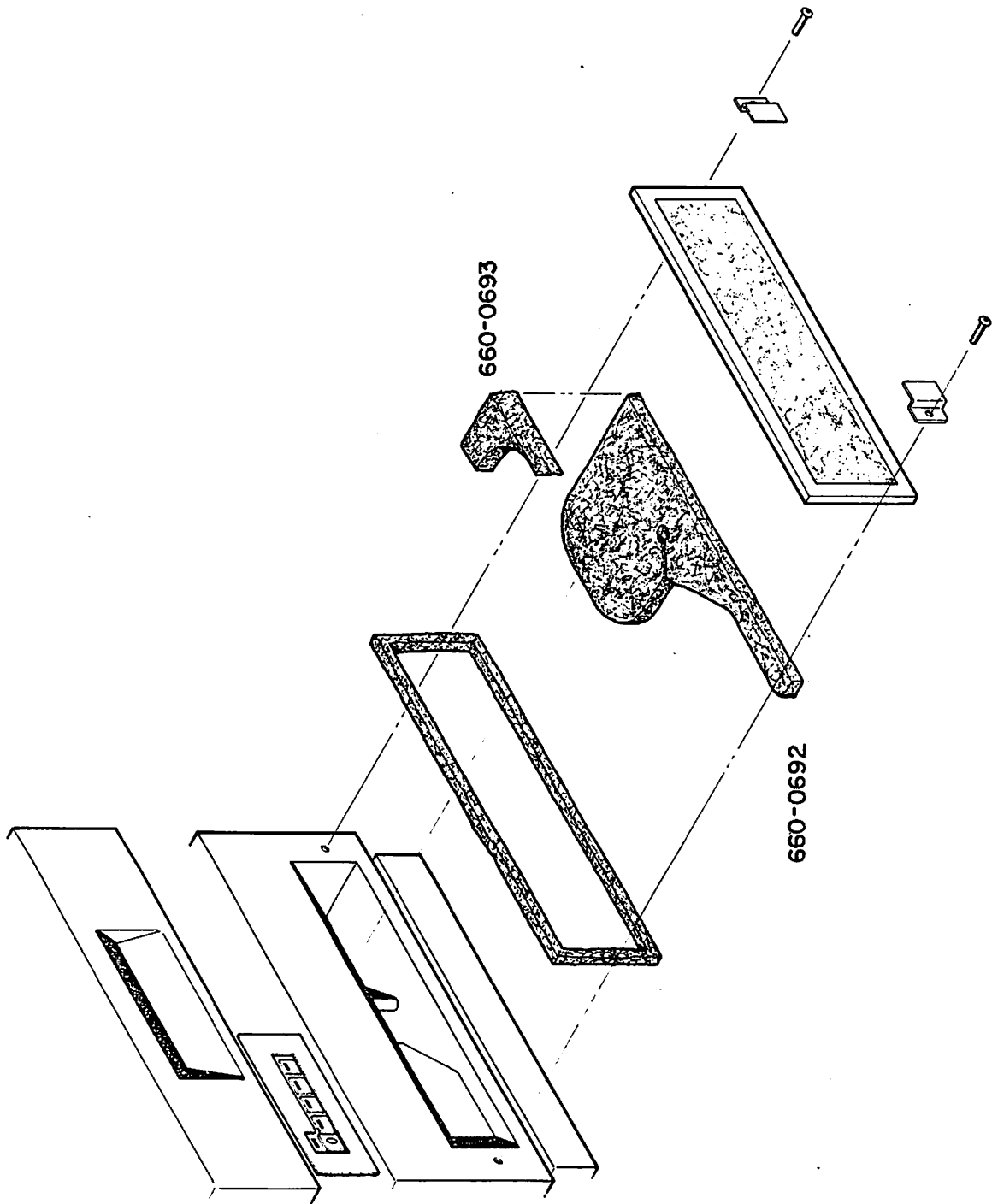
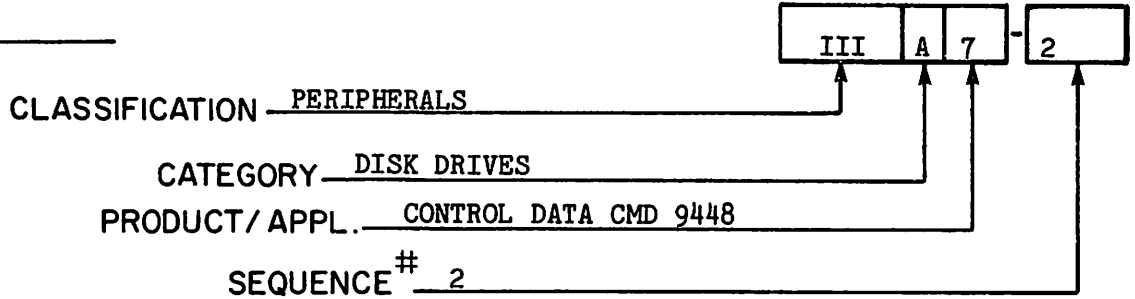


FIGURE 2 FOAM PAD AND WEDGE FOR BLOWER HOUSING

PRODUCT SERVICE NOTICE

DATE : 5/81



TITLE:

CARTRIDGE MODULE DRIVE 9448, REPLACING FAILED
POWER SUPPLY WITH NEW TYPE SUPPLY

EQUIPMENT AFFECTED

This Product Service Notice (PSN) applies to Control Data Corporation (CDC) Phoenix Cartridge Module Drive (CMD) 9448 Units, Series Code (Block Point) - 1 Serial Numbers 101 through 300, where the 60-Hz power supply has failed and requires replacement. CMD 9448 Units are given the following Wang Laboratories, Incorporated designations: 2280, 2280V, and 6580.

AFFECTED MANUAL

The change affects the Control Data Corporation Cartridge Module Drive Hardware Maintenance Manual, P/N 75888415. The Wang Laboratories, Inc. (WLI) P/N for the manual is 729-0198. This publication is an Outside Equipment Manufacturer (OEM) document.

DESCRIPTION OF CHANGE

The original 60-Hz power supply (CDC P/N 75830535) installed in these CMD units is block point one equipment. When this power supply fails and an identical replacement is ordered, a power supply (CDC P/N 77610705, WLI P/N 726-5777) associated with block point two CMD units is furnished. Block point two CMD units have serial numbers of 301 or higher. Block point one CMD units must be modified to accommodate block point two power supplies.

PURPOSE OF PSN

This PSN contains procedures required to update the affected manual to provide for:

1. Modifying the CMD unit to accommodate the new type power supply.
2. Installing the new type power supply in the modified CMD unit.

MODIFYING CMD UNIT

1. Remove failed power supply according to procedure in paragraph 6.7.15.3 of affected manual (WLI P/N 729-0198).
2. Refer to figure 1 and proceed as follows:
 - a. Identify orange wire connected between relay control (RC) printed wiring assembly (PWA) TB2-1 and pin 2 of power supply connector PS1P1.
 - b. Cut red plastic cable ties holding orange wire to base pan signal harness.
 - c. Disconnect orange wire from terminal RCTB2-1 and from pin 2 of power supply connector PS1P1.
 - d. Remove orange wire from base pan signal harness.
 - e. Using Amp Pin Extractor Tool No. 458994-1 or small screwdrivers, remove pin 2 from power supply connector PS1P1.
 - f. Identify wire in base pan signal harness with three-pin connector marked PS1-P4 on one end. Other end is bent back and covered with heat shrinkable tubing.
 - g. Remove heat shrinkable tubing from wire identified in last step, and solder end marked RCTB2-1 to terminal RCTB2-1 in place of orange wire disconnected in step 2c.
3. Refer to figure 2 and proceed as follows:
 - a. Remove jumper from W3 position on component side of PWA.

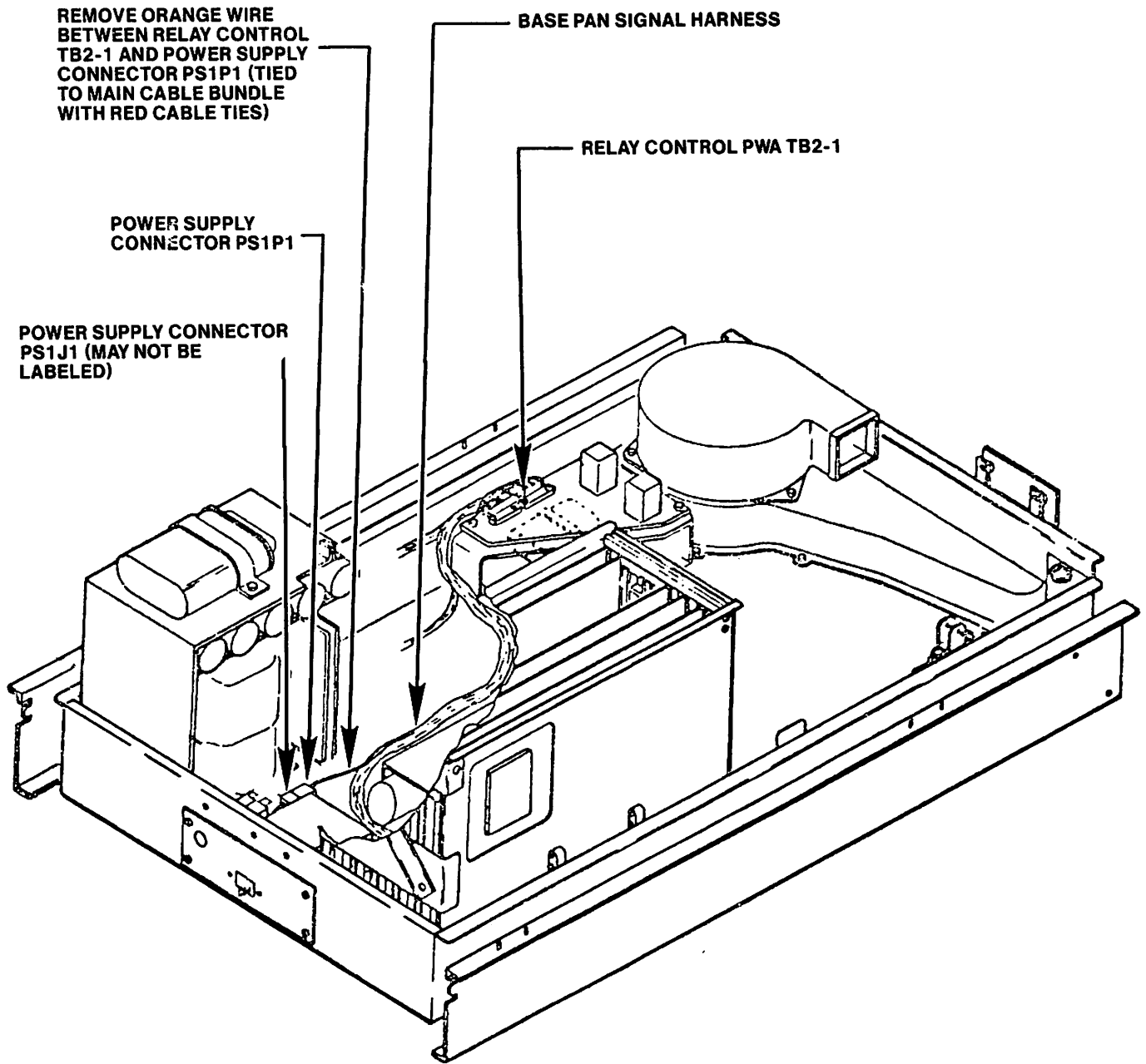


Figure 1. Base Pan Cutaway Showing Base Pan Signal Harness and Power Supply Connector PS1P1

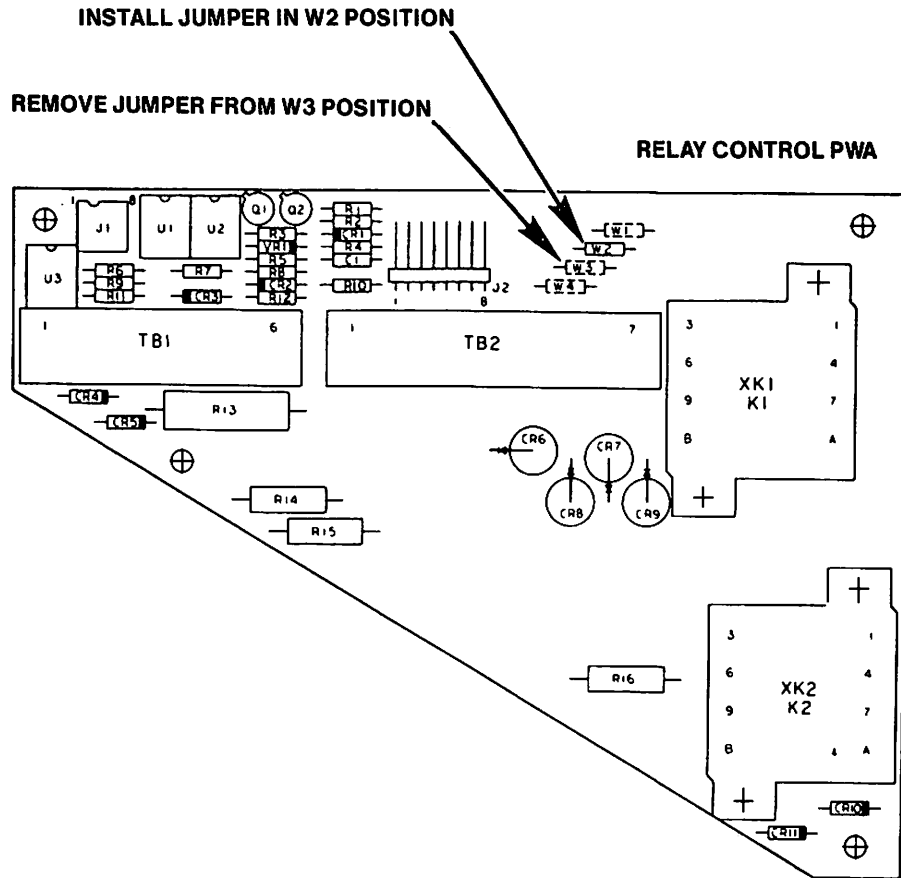


Figure 2. Relay Control PWA Layout Showing Location of Jumpers to Be Changed

- b. Locate jumper removed in step 3a and install it in W2 position on component side of PWA.
- c. Solder both ends of W2 jumper.
- d. Change marking of relay control printed wiring assembly (PWA) to part number 75898850 (WLI P/N 726-5786).

INSTALLING NEW POWER SUPPLY

1. Position new power supply in CMD unit in approximate position shown in figure 1.
2. Refer to figure 6-17 in affected manual (WLI P/N 729-0198) and plug power supply connectors PS1P1 ①, PS1P2 ②, and PS1P3 ③, into their mating connectors.

3. Refer to figure 3 and insert connector PS1-P4 into power supply connector PS1P4.
4. Use procedure in paragraph 6.7.2 of affected manual (WLI P/N 729-0198) to:
 - a. Lower deck assembly from maintenance position into normal position.
 - b. Restore electronics module to its normal position.

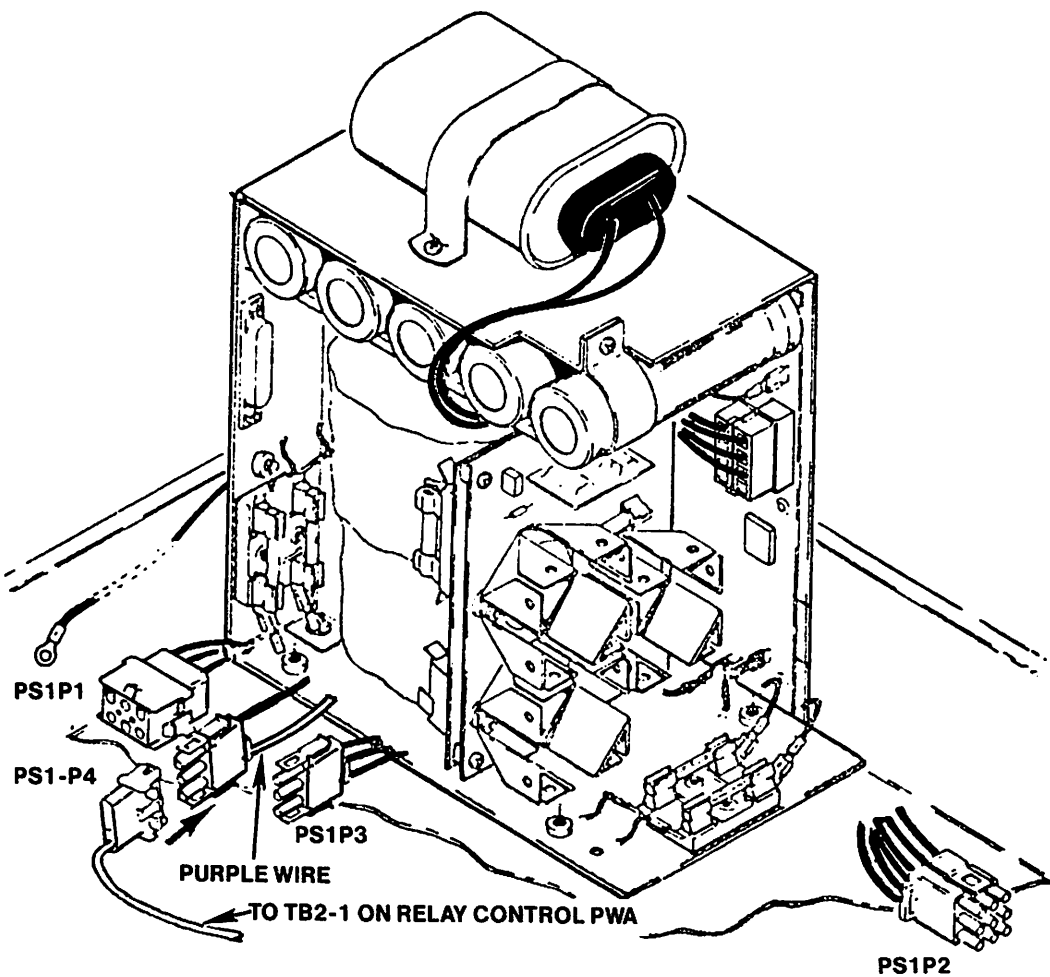
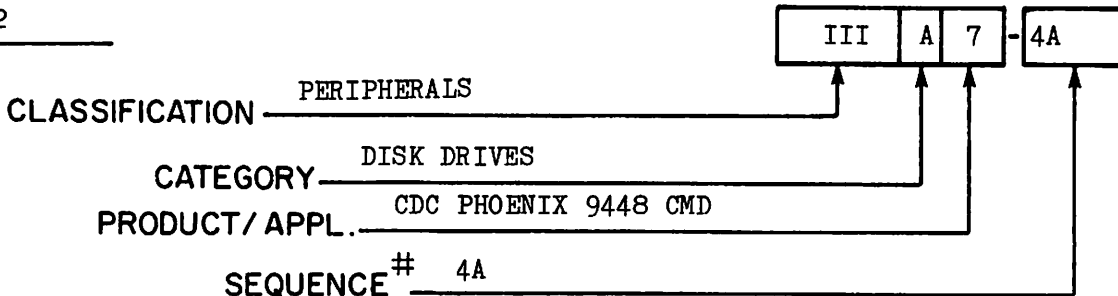


Figure 3. Power Supply Showing Connection for New Connector PS1P4

5. Refer to figure 6-17 in affected manual (WLI P/N 729-0198), then:
 - a. Connect frame ground wire (14) at power supply end.
 - b. Align holes in base plate of power supply with four mounting holes in CMD base pan.
 - c. Working from under side of CMD base pan, attach power supply to CMD base pan using four screws (4).
6. Use procedure in paragraph 2.3.1 of affected manual (WLI P/N 729-0198) to power up CMD unit.

PRODUCT SERVICE NOTICE

DATE : 04/08/82



TITLE:

VS SYSTEM SMD AND CMD DISK DRIVE "A" CABLE TERMINATOR
INCOMPATIBILITY MODIFICATION

NOTE

This PSN supercedes PSN III.A.7-4 (729-0993) to correct its instructions as noted by vertical black bars to the right of the corrected text and the error in figure 2.

1. SCOPE

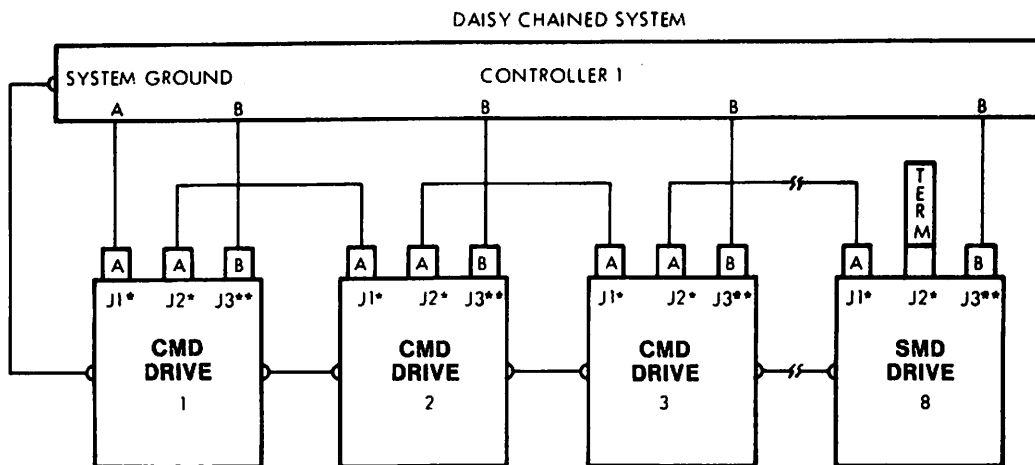
This PSN provides instructions for determining compatibility of the VS System 2280V Cartridge and Service Module Disk Drive (CMD and SMD) combinations with the 'A' Cable Terminator. The terminator incompatibility problem arises when using the standard 726-5790 (WANG) or 75886100 (CDC) terminators with daisy chained SMD and CMD units when the CMD unit is connected last in the daisy chain. In this configuration, the terminator must be modified as described in paragraph 3 to provide correct termination for the Open Cable Detect signal line.

2. COMPATIBILITY CHECK

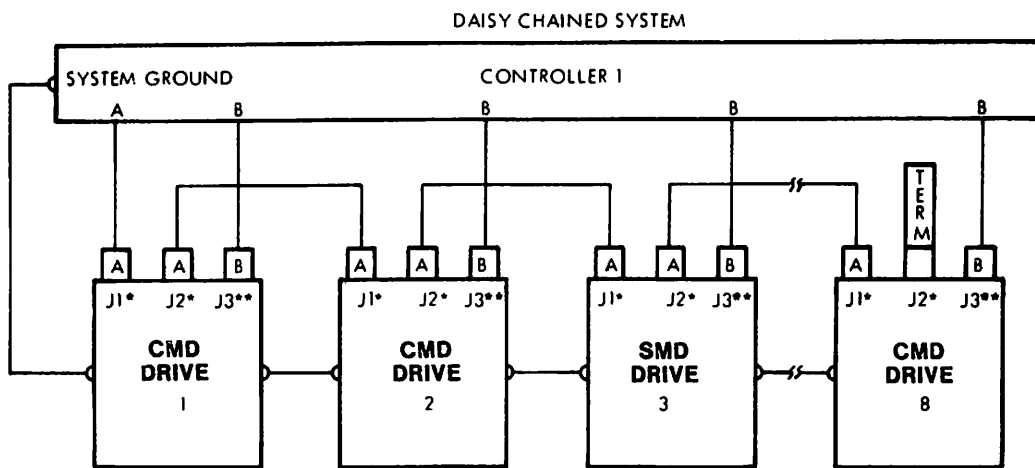
All daisy chained VS systems (60/80/100) in the field that have a combination of SMD/CMD or all CMD drives must be checked for terminator compatibility as follows.

- a. If the SMD unit is the last unit of the daisy chain in a mixed SMD/CMD VS System (see figure 1A) there is no terminator compatibility problem.

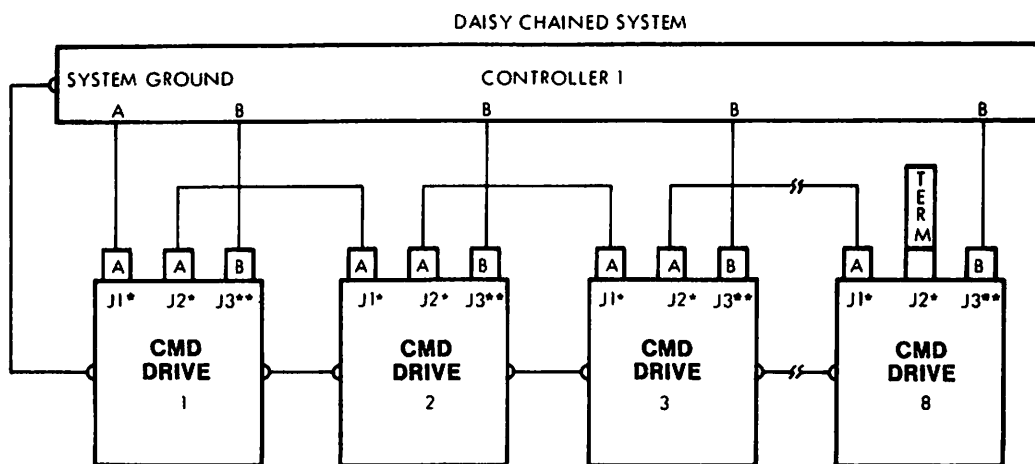




A



B



C

*I/O PWA
 **CNTL/MUX PWA

FIGURE 1. THREE POSSIBLE CONFIGURATIONS OF DAISY CHAINED MIXED SMD/CMD AND ALL CMD DISK DRIVE SYSTEMS

- b. If the CMD unit is the last unit of the daisy chain in a mixed SMD/CMD VS System (see figure 1B) the following three corrective options are available:
 1. Rearrange the SMD/CMD units so that an SMD unit is the last unit in the daisy chain
 2. Replace incompatible terminator (726-5790 or 75886100) with compatible terminator (WANG P/N 210-7177 or 210-7477)
 3. Modify terminator 726-5790 or 75886100 as described in paragraph 3 and shown in figure 2
- c. If the VS System has only CMD units in the daisy chain (see figure 1C), the terminator must be either replaced with a compatible terminator or the existing terminator modified to be made compatible as described in paragraph 3 and shown in figure 2.

3. MODIFICATION OF INCOMPATIBLE TERMINATORS

The following parts and tools are required to complete this modification:

pin vise, WPN 726-9488
 #60 DRILL, WPN 726-9490
 two 470 Ohm, 1/4 Watt resistors, WPN 330-2048
 insulator, WPN 605-0124
 solder

- a. Using the pin vise and #60 drill, drill two holes from the etch side (one on each side of the ground cable) through the ground plane on the opposite side of the PWA as shown in figure 2.
- b. Cut the etches leading from pins 14 and 44 of connector J1 at pins 5 and 6 respectively of resistor pack U3 as shown in figure 2.
- c. Slide insulators on the both leads of the two 470 ohm resistors and solder one end of one resistor to the etch leading from pin 14 and one end of the other resistor to to the etch leading from pin 44 of connector J1 as shown in figure 2.
- d. Insert the remaining end lead of each of the two resistors through the two holes drilled through the PWA and ground plane and then solder as shown in figure 2.

NOTE

Using a VOM on RX1 scale, check for zero (0) ohms resistance between resistor leads at ground plane connection and ground cable to ensure continuity. A cold solder connection will cause input/output problems.

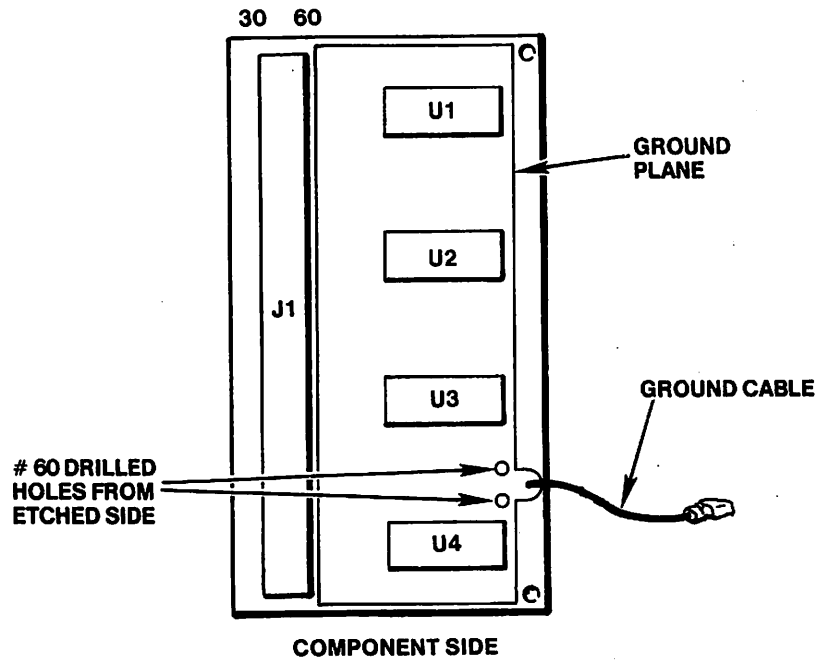
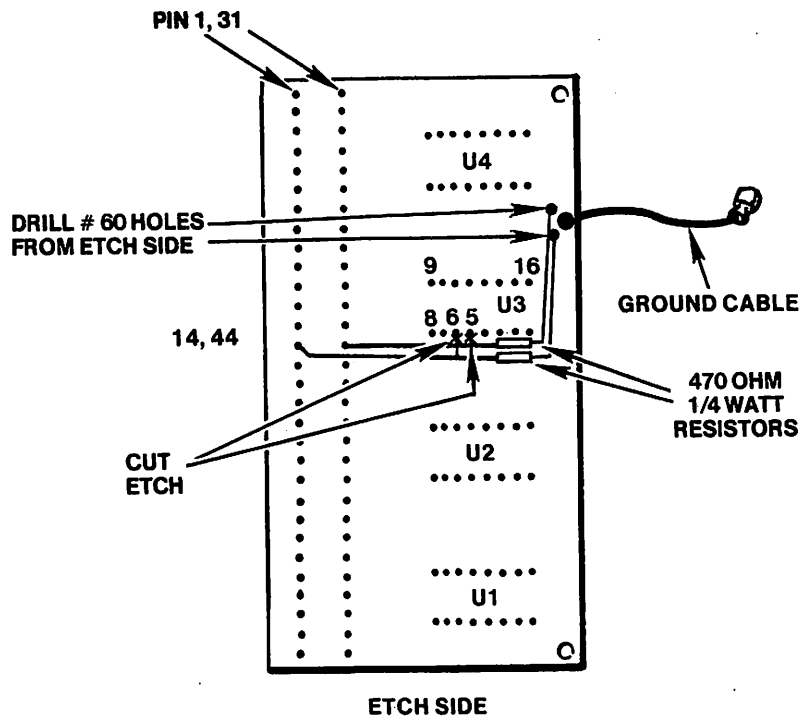


FIGURE 2 MODIFICATION OF INCOMPATIBLE TERMINATORS 726-5790 AND 75886100.

Dubé, Bell, A. J., M. B. F. J. K. C.

WANG

FIELD CHANGE ORDER

FCO NO.
1064A

Equipment Affected 2280, 2280V, 6580 (CDC Phoenix 9448 CMD)

Class Problem Only * FCO Kit # 728-0081A Page 1 of 4

Org. Code 3105 (III.A.7M) * FCO Doc. # 729-1382A Approval Date:

Est. Install. Time 2.5 hours Ref. ECO # CDC FCO 33945 **DEC 28 1983**

* THIS SUPERCEDES FCO 1064

220V ONLY

1. REASON FOR CHANGE

- A. To enable use of low air option.
- B. To increase shroud pressure.
- C. To increase device cooling.

2. DESCRIPTION OF CHANGE

The CDC ID# 75889887 50/60 Hz. high voltage blower is replaced by the CDC ID# 75889889 50 Hz. high voltage blower.

3. DOCUMENTATION AFFECTED

"Customer Engineering Reprint CDC Cartridge Module Drive," 729-0198A. (Henceforth, referred to as the "manual").

4. PREREQUISITE (S)

This FCO should be installed only in 220, 230 and 240 volt 50 Hz. units having a CDC serial number below 89,209. New blowers were cut in starting with S/N 89,210.

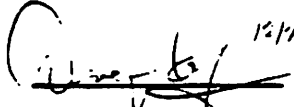
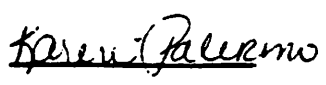
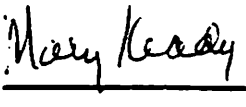
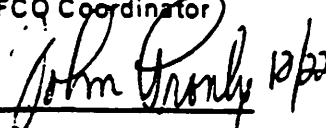
5. INSTALLATION PROCEDURE

Before proceeding with any rework, note the following caution.

ESD CAUTION

The circuit assemblies contained in this equipment can be degraded or destroyed by ELECTROSTATIC DISCHARGE (ESD).

Static electrical charges can accumulate quickly on personnel, clothing, and synthetic materials. When brought in close proximity to, or in contact with delicate components, ELECTROSTATIC DISCHARGE OR FIELDS can cause damage to these parts. This damage may result in degraded reliability or immediate failure of the affected component or assembly.

Tech Ops 	Logistics 12-28-83 	Originator 	FCQ Coordinator 
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To insure optimum/reliable equipment operation, it is required that technical support personnel discharge themselves by periodically touching the chassis ground prior to and during the handling of ESD susceptible assemblies. This procedure is very important when handling printed circuit boards.

- A. Operate the START/STOP switch to the STOP position (out position), and wait for the spindle to stop rotating (READY lamp extinguished).
- B. Set circuit breaker (by input power connector on back of base pan) to OFF position.
- C. Remove A.C. power cord from power source.
- D. Remove top cover per section 6.7.1. of manual.
- E. Raise base deck per section 6.7.2. of manual.
- F. Remove blower per steps 6-8 of Section 6.7.13 of manual.
- G. Remove the power supply and card cage air hoses. Wash the interior of the air hoses with water. Dry the air hoses with vacuum. Reinstall air hoses in the unit.
- H. Vacuum the plenum.
- I. Install the replacement blower per steps 9-11 of Section 6.7.13 of the manual.
- J. Perform Check-Out Procedure described in Section 6 below.
- K. Document installation of FCO by completing a Call Report or Activity Report

6. CHECK-OUT PROCEDURE

- A. Reconnect A.C. power cord to power source.
- B. Turn on A.C. circuit breaker. Check to see that the blower is operating. Allow unit to purge 5 minutes.
- C. Turn off circuit breaker. Lower the base deck per section 6.7.2 of manual.

- D. Disconnect AlPl (the voice coil lead).
- E. Turn on circuit breaker. Operate START/STOP switch to the START position and allow unit to spindle up and purge for 30 minutes.
- F. Operate START/STOP switch to STOP position and wait for spindle to stop rotating.
- G. Turn off circuit breaker.
- H. Log the FCO number on unit FCO log on the side of the electronics module.
- I. Reconnect AlPl.
- J. Replace top cover per section 6.7.1. of manual.
- K. Return disk to normal operations.
- L. Run the appropriate diagnostic listed below:

<u>Disk Drive</u>	<u>System</u>	<u>Part #</u>	<u>Description</u>
2280	VP/MVP	702-0146	2200 Multi Disk Exerciser
		702-0128A	2200 General Disk Exerciser
	LVP/SVP	732-0002B	System Exerciser
2280V	VS 25/45	732-0019	FTU 25 VS 25 Stand Alone FTU (Rev 2 BP only) Rev 6111
		732-0036	FTU 25/45 Stand Alone FTU (Rev 3 BP only) Rev 6111
	VS 80/90/100	702-0099A	FTU On-line OIS 5.0 or later, Rev 61C4
6580	OIS 140	702-0057E	Master Resident Diagnostic Package Rev 2284

- M. Run 727-0116 Stand Alone TB 216.

7. FCO KIT PARTS LISTING

* KIT #728-0081A

<u>Item</u>	<u>Qty</u>	<u>Item Description</u>
* 729-1382A	1	FCO document 1064A
726-6883	1	CDC Kit# 77715534 which contains one CDC ID# 75889889 Blower Assembly

* 8. FCO KIT AVAILABILITY DATE

FCO Kit# 728-0081-A will be available January 9, 1984. To obtain it, place a routine order through the Logistics Order Processing System.

* 9. REMOVED PARTS DISPOSITION

The removed 50/60 Hz high voltage blower should be returned to Wang.

From Latin America, send blowers to:

Wang Latin America Headquarters
95 Merrick Way
Suite 620
Coral Gables, Florida 33134

Attention: Eric Garthe

From Western Europe, send blowers to:

Wang Europe S.A./N.V.
Keerstraat 10
9412 Erpe-Mere, Belgium

Attention: Chuck Chorman

10. MISCELLANEOUS

N/A

JUL 5 REC'D

WANG

FIELD CHANGE ORDER

FCO NO.

1024A

Equipment Affected 2280, 2280V, 6580 (CDC Phoenix 9448 CMD)Class Problem Only FCO Kit # 728-0047 Page 1 of 3Org. Code III.A.7 (3105) FCO Doc. # *729-1298A Approval Date:Est. Install. Time 10 Minutes Ref. ECO # 27287 JUN 28 1983

*THIS FCO SUPERSEDES FCO 1024

1. REASON FOR CHANGE

- A. To assure compatibility of the CDC Phoenix 9448 CMD (Wang model used in 2280V, 2280, and 6580) with the A-Cable Terminator.
- B. To correct intermittent device selection errors.

2. DESCRIPTION OF CHANGE

- * Remove CDC CMD PCB #75886100 (WLI 726-5790) and replace with 210-8017 PCB.

3. DOCUMENTATION AFFECTED

- A. Wang "Customer Engineering Reprint, CDC Cartridge Module Drive", 729-0198A.
- B. Wang "Cartridge Module Disk Drive, CDC Model 9448 CMD (Phoenix Drive)", 729-0199.

4. PREREQUISITE (S)

N/A

5. INSTALLATION PROCEDURE

- A. Operate the START switch to the stop position.
- B. Turn AC power off using AC circuit breaker shown in Figure 1.
- C. Lift furniture cover with built in handle at rear of drive. See section 2.7 of Wang "Cartridge Module Disk Drive, CDC Model 9448 CMD (Phoenix Drive)", 729-0199.
- D. Remove and retain the two slotted screws on the left and right side of the dust cover at the rear of the drive. Remove the dust cover. See Section 2.7 referenced above in C.

Tech Ops

Logistics

Originator

FCO Coordinator

*Chal Hagarty**John DeBart 6/28/83**Mary Keady 6/23/83**John P. Pinsky 6/28/83*

- * E. Refer to Figure 1. Remove the A-Cable Terminator, CDC CMD PCB #75886100 (WLI 726-5790), from the I/O J2 slot of the I/O PWA in the electronics module.
- F. Install the new A-Cable Terminator 210-8017 PCB in the I/O J2 slot of the I/O PWA in the electronics module. Insure that cable is properly attached.
- G. Run Check-Out Procedure described in Section 6 below.
- H. Replace dust cover and install screws.
- I. Replace furniture cover.
- J. Document installation of FCO by completing a Call Report or Activity Report.

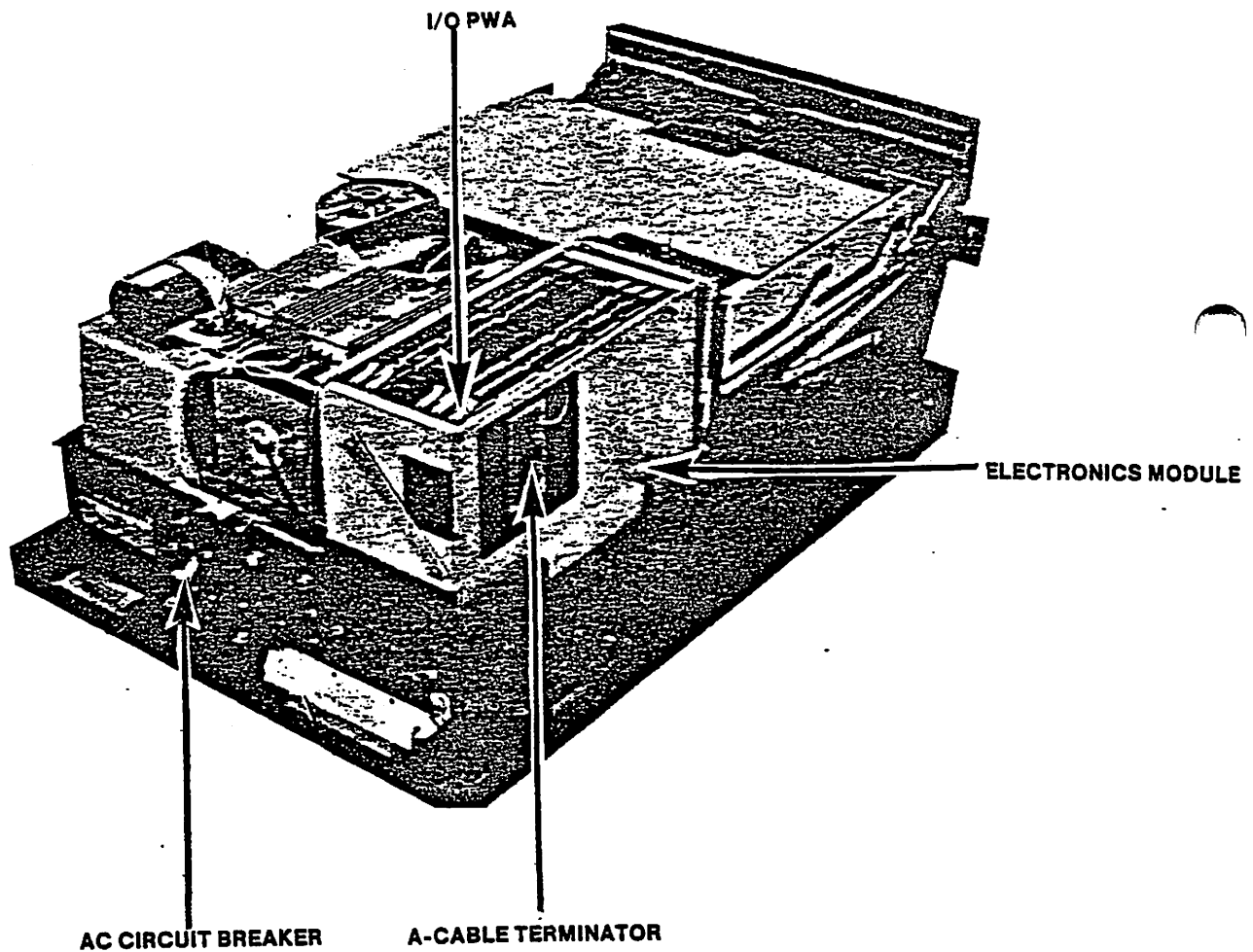


FIGURE 1 ELECTRONICS MODULE/A-CABLE TERMINATOR LOCATIONS

6. CHECK-OUT PROCEDURE

Run the appropriate diagnostic listed below:

<u>Disk Drive</u>	<u>System</u>	<u>Part #</u>	<u>Description</u>
2280	VP/MVP	702-0146	2200 Multi Disk Exerciser
		702-0128A	2200 General Disk Exerciser
	LVP/SVP	732-0002B	System Exerciser
2280V	VS 25/45	732-0019	FTU 25 VS 25 Stand Alone FTU (Rev 2 BP only) Rev 6111
		732-0036	FTU 25/45 Stand Alone FTU (Rev 3 BP only) Rev 6111
	VS 80/90/100	702-0099A	FTU Online OIS 5.0 or later, Rev 61C4
6580	OIS 140	702-0057E	Master Resident Diagnostic Package Rev 2284

7. FCO KIT PARTS LISTING

KIT #728-0047

<u>Item</u>	<u>Qty</u>	<u>Item Description</u>
*729-1298A	1	*FCO #1024A Document
210-8017	1	CMD-A-Cable Terminator

8. FCO KIT AVAILABILITY DATE

FCO Kit #728-0047 will be available June 13, 1983. It can be obtained by placing a routine order through Logistics Order Processing System.

* 9. REMOVED PARTS DISPOSITION

Return CDC CMD PCB #75886100 (WLI 726-5790) to Home Office FSC, RDB 3933.

10. MISCELLANEOUS

This FCO formally resolves the A-Cable Terminator incompatibility problem described in PSN III.A.7.4A.

WANG

FIELD CHANGE ORDER

FCO NO.
1024

Equipment Affected 2280, 2280V, 6580 (CDC Phoenix 9448 CMD)
 Class Problem Only FCO Kit# 728-0047 Page 1 of 3
 Org. Code III.A.7 (3105) FCO Doc. # 729-1298 Approval Date:
 Est. Install. Time 10 Minutes Ref. ECO # 27287 **JUN 1 1983**

1. REASON FOR CHANGE

- A. To assure compatibility of the CDC Phoenix 9448 CMD (Wang model used in 2280V, 2280, and 6580) with the A-Cable Terminator.
- B. To correct intermittent device selection errors.

2. DESCRIPTION OF CHANGE

Remove CDC CMD PCB #75886100 and replace with 210-8017 PCB.

3. DOCUMENTATION AFFECTED

- A. Wang "Customer Engineering Reprint, CDC Cartridge Module Drive", 729-0198A.
- B. Wang "Cartridge Module Disk Drive, CDC Model 9448 CMD (Phoenix Drive)", 729-0199.

4. PREREQUISITE (S)

N/A

5. INSTALLATION PROCEDURE

- A. Operate the START switch to the stop position.
- B. Turn AC power off using AC circuit breaker shown in Figure 1.
- C. Lift furniture cover with built in handle at rear of drive. See section 2.7 of Wang "Cartridge Module Disk Drive, CDC Model 9448 CMD (Phoenix Drive)", 729-0199.
- D. Remove and retain the two slotted screws on the left and right side of the dust cover at the rear of the drive. Remove the dust cover. See Section 2.7 referenced above in C.

Tech Ops <i>Charles Haggarty</i>	Logistics 5/31/83 <i>Kevin Sanders</i>	Originator <i>Mary Keady</i> 5/27/83	FCO Coordinator <i>Tom Brown</i> 5/31/83
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- E. Refer to Figure 1. Remove the A-Cable Terminator, CDC CMD PCB #75886100, from the I/O J2 slot of the I/O PWA in the electronics module.
- F. Install the new A-Cable Terminator 210-8017 PCB in the I/O J2 slot of the I/O PWA in the electronics module. Insure that cable is properly attached.
- G. Run Check-Out Procedure described in Section 6 below.
- H. Replace dust cover and install screws.
- I. Replace furniture cover.
- J. Document installation of FCO by completing a Call Report or Activity Report.

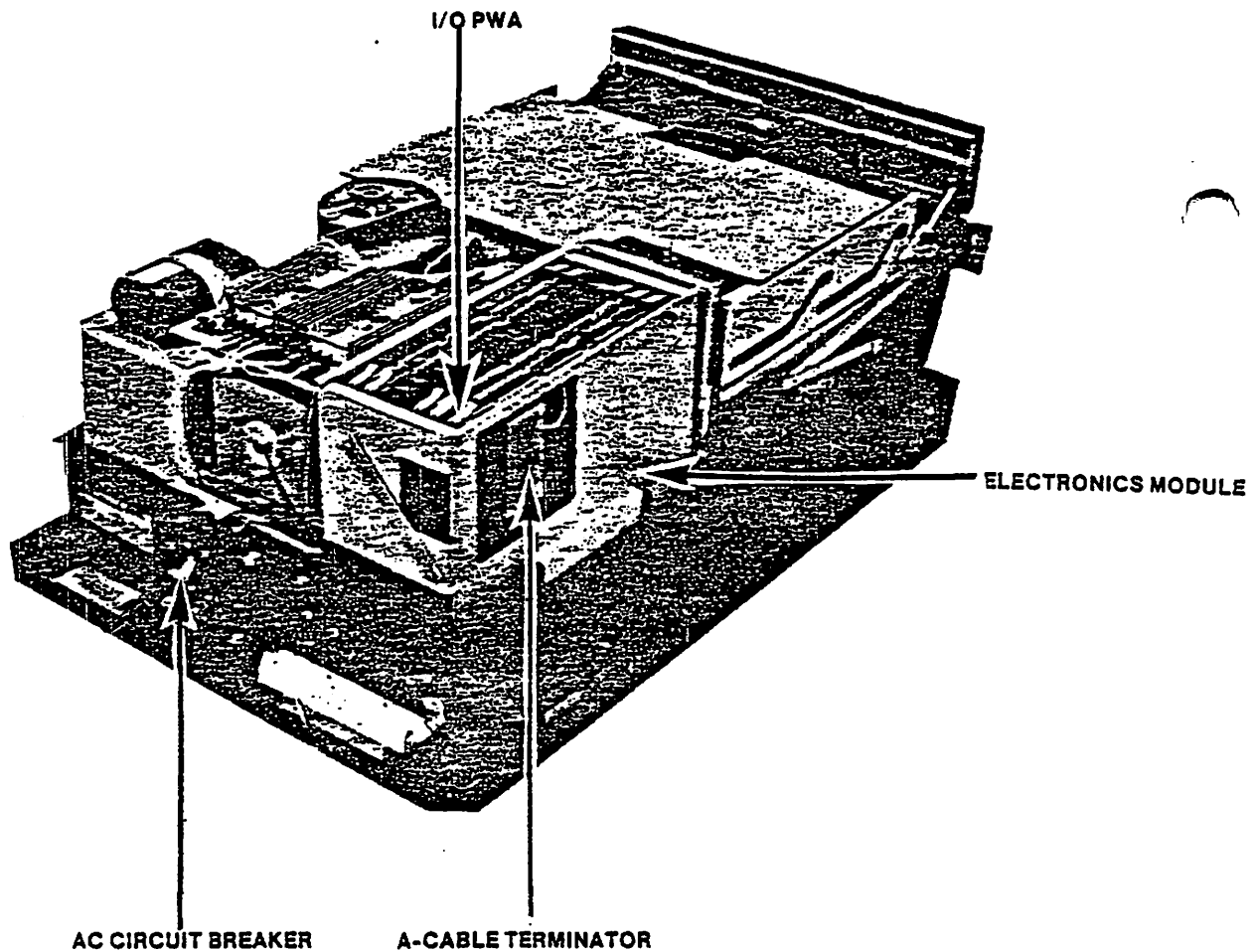


FIGURE 1 ELECTRONICS MODULE/A-CABLE TERMINATOR LOCATIONS

6. CHECK-OUT PROCEDURE

Run the appropriate diagnostic listed below:

<u>Disk Drive</u>	<u>System</u>	<u>Part #</u>	<u>Description</u>
2280	VP/MVP	702-0146	2200 Multi Disk Exerciser
		702-0128A	2200 General Disk Exerciser
	LVP/SVP	732-0002B	System Exerciser
2280V	VS 25/45	732-0019	FTU 25 VS 25 Stand Alone FTU (Rev 2 BP only) Rev 6111
		732-0036	FTU 25/45 Stand Alone FTU (Rev 3 BP only) Rev 6111
	VS 80/90/100	702-0099A	FTU Online OIS 5.0 or later, Rev 61C4
6580	OIS 140	702-0057E	Master Resident Diagnostic Package Rev 2284

7. FCO KIT PARTS LISTING

KIT #728-0047

<u>Item</u>	<u>Qty</u>	<u>Item Description</u>
729-1298	1	FCO #1024 Document
210-8017	1	CMD-A-Cable Terminator

8. FCO KIT AVAILABILITY DATE

FCO Kit #728-0047 will be available June 13, 1983. It can be obtained by placing a routine order through Logistics Order Processing System.

9. REMOVED PARTS DISPOSITION

N/A

10. MISCELLANEOUS

This FCO formally resolves the A-Cable Terminator incompatibility problem described in PSN III.A.7.4A.

Bill A
Frank B FYI Paul

WANG FIELD CHANGE ORDER

FCO NO.
1086

Equipment Affected 2280 DPU

Class All UNITS FCO Kit # 728-0104 Page 1 of 5

Org. Code 3107 (III A.10 M-2) FCO Doc. # 729-1482 Approval Date: **APR 25 1984**

Est. Install. Time 45 MINUTES Ref. ECO # 31181

1. REASON FOR CHANGE

- A. To prevent read cache from being lost when a reset is issued from one of the terminals on the system.
- B. To allow the DPU to reselect the destination drive when dumping the multi-sector write cache to one of the drives.

4. DESCRIPTION OF CHANGE

Four PROM's on the 210-7423-A PCA are changed.

3. DOCUMENTATION AFFECTED

N/A

4. PREREQUISITE (S)

Refer to Step 10 for a list of serial numbers of units requiring this change.

5. INSTALLATION PROCEDURE

- A. Power off. Remove AC plug at wall.
- B. Refer to "Customer Engineering Maintenance Manual" (729-0971) p.4.3, sections 4.5 through 4.5.1 for top cover removal/replacement procedures.
- C. Refer to Figure 1. Remove the 210-7423-A PCA from the Disk Processing Unit (DPU).
- D. Refer to Figure 2. Change PROM's on the 210-7423-A PCA as follows:
 - 1. Component Side:
 - a. Change L13 to 378-4083-R8.
 - b. Change L14 to 378-4084-R8.

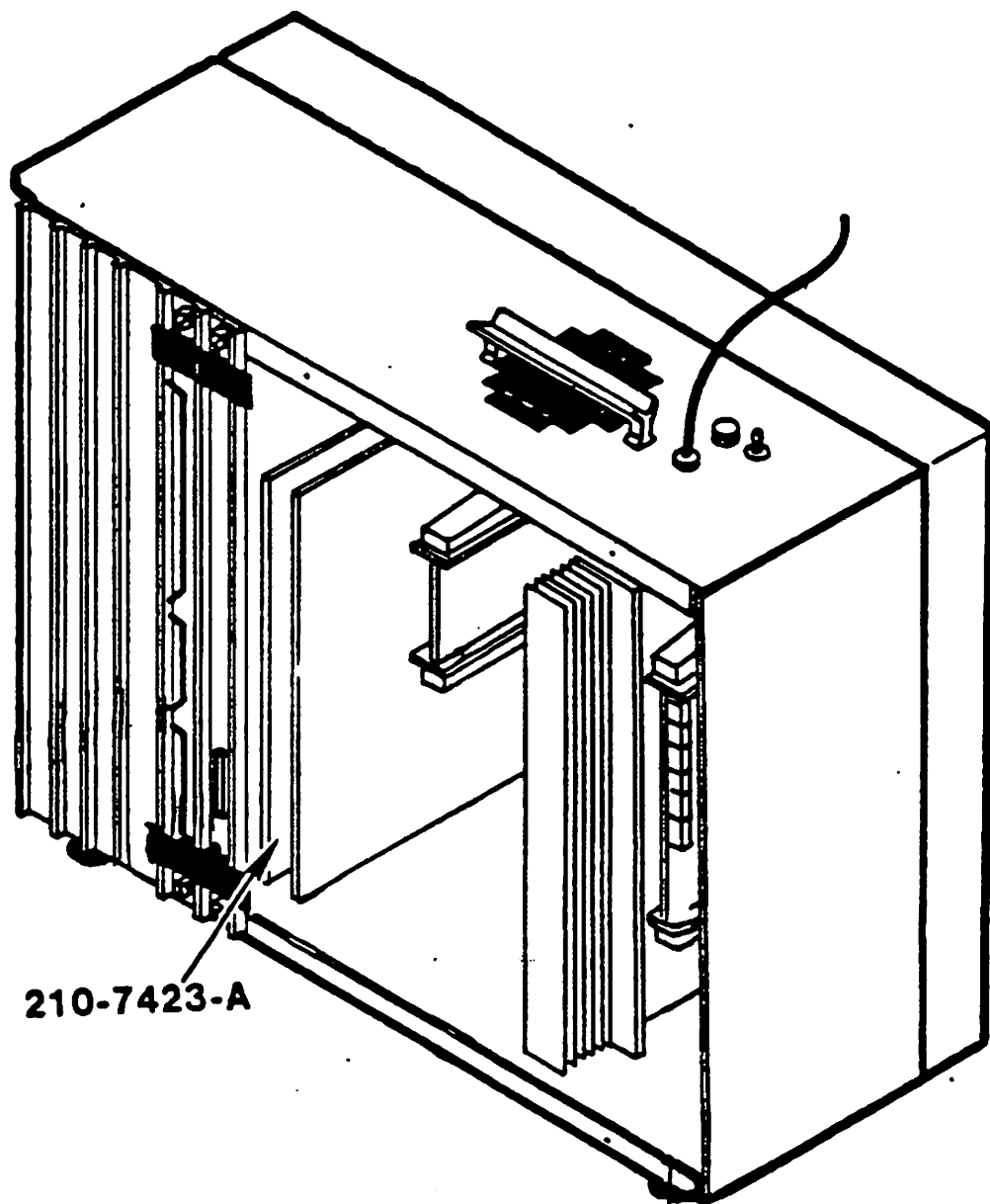
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Tech Ops 4/19/84
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Logistics 4-18-84
[Signature]

Originator 4/18/84
[Signature]

FCO Coordinator
[Signature]

- c. Change L15 to 378-4085-R8.
- d. Change L16 to 378-4086-R8.
- E. Reassemble the unit by reversing the procedures in Steps A through C.
- F. Perform check-out procedure described in Section 6 below.
- G. Document installation of this FCO by completing a Call Report or Activity Report.



210-7423-A

FIGURE 1

CIRCUIT BOARD LOADING

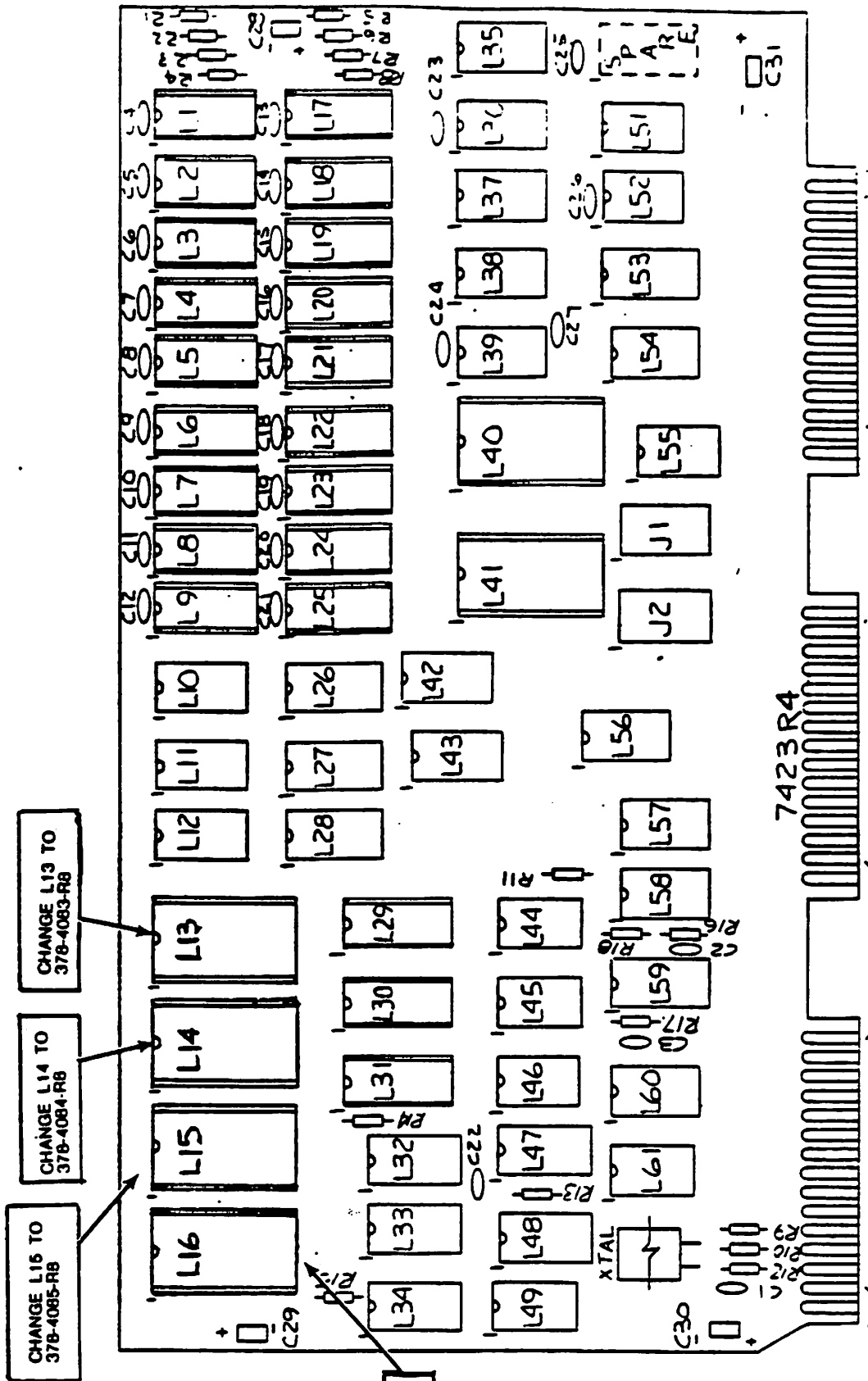


FIGURE 2
210-7423 IC LOCATIONS

6. CHECK-OUT PROCEDURE

Run 2280 Disk Diagnostics from 2200 Diagnostics Package #195-2956-0.

7. FCO KIT PARTS LISTING

KIT #728-0104

<u>Item</u>	<u>Qty</u>	<u>Item Description</u>
729-1482	1	FCO Document 1086
378-4083-R8	1	PROM
378-4084-R8	1	PROM
378-4085-R8	1	PROM
378-4086-R8	1	PROM

8. FCO KIT AVAILABILITY DATE

FCO Kit# 728-0104 will be available May 7, 1984. It can be obtained by placing a routine order through the Logistics Order Processing System.

9. REMOVED PARTS DISPOSITION

Recycle removed PROM's through your FSC.

10. MISCELLANEOUS

This FCO applies to units that fall within the following serial number ranges.

026513	IC5325 through IC5328
135033 through 135984	IG5042
687297	IN1002 through IN3138
941797	IN7407
DL5772	KH1380
EB1277	KR6959
EB1339 through EB1341	KV1701
EB2626 through EB2632	KV3474
FY1038	KV4680 through KV4813
GN1706	KV5354 through KV5608
GU1341	KY1002 through KY6572
HN2809	KY7250 through KY7822
HU1505	KY8056 through KY8454
HU2465	KY9330 through KY9654
HU3775	LI2427
HU5714	LS1747
HU8365	LY2317
HV1955	NS17464 through NS17468
	NY1619

CUSTOMER ENGINEERING DIVISION



PRODUCT: PHOENIX DISK DRIVE

NO: 7

MODEL NO: 2280, 2280V, 6580

DATE: 4/25/79

I. DESCRIPTION

The Phoenix Disk Drive is designed to be a high performance, random access, mass storage device. It is an available option for the Wang 2200 VP, 2200 MVP, 2200 VS, and Office Information System 140. The Phoenix is available to the 2200 VP and MVP as a Model 2280-1, -2, or -3; to the 2200 VS as a Model 2280V-1, -2, or -3; and to the OIS 140 as a Model 6580-1, -2, or -3.

The 2200 VS is interfaced to the Phoenix Drive by an IOP device at the CPU (see VS Interface RSL). The 2200VP and MVP are interfaced to the Phoenix by an I/O Controller at the CPU and a micro-processor attached to the Phoenix Drive (see Microprocessor RSL). The OIS interface will be outlined in a later NPN.

Storage capacity for the 2280 and 6580 models is as follows:

<u>MODEL</u>	<u>CAPACITY (In Bytes)</u>
-1	26,836,992 (27 Mbytes)
-2	53,673,894 (54 Mbytes)
-3	80,510,976 (80.5 Mbytes)

NOTICE:

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LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 851-4111, TWX 710 343-6769, TELEX 94-7421

The 2280V has a greater storage capacity than either the 2280 or 6580 Models because of a difference in formatting. The storage capacity of the 2280V is as follows:

<u>MODEL</u>	<u>CAPACITY (In Bytes)</u>
-1	30,265,344 (30 Mbytes)
-2	60,530,688 (60 Mbytes)
-3	90,796,032 (90 Mbytes)

In all models (2280, 2280V, 6580) 13.5 Mbytes are removable, the remainder is stored on from 1 to 5 fixed surfaces depending on the model number.

Specifications:

Height	10.5 Inches (264 mm)
Width	19.0 Inches (483mm)
Length	31.75 Inches (806mm)
Weight	170 lbs. (77.1kg)

***Power Requirements:**

120VAC $\pm 10\%$ / 230VAC $\pm 10\%$
60Hz $\pm 1\text{Hz}$ / 50Hz $\pm 1\text{Hz}$
8.2A (15A at start up) / 4A (7.5A at start up)
.950KWH

*The Disk Drive should have a separate dedicated power line.

II. MAINTENANCE

Maintenance requirements are similar to those of the 80/300 Meg Drive. An FTU (Field Test Unit) is necessary to simulate the control unit allowing the drive unit to be repaired off-line. See RSL for necessary alignment cables, alignment extender, head adjustment tool, spare boards, etc. A maintenance manual is currently being written and will be available in early May.

Following is the distribution strategy for the various test equipment used with the Phoenix Disk Drive:

TB-216 (Field Test Unit)

Distribution: One per Subsidiary
Two per Area
One per District
Six to Home Office Repair
Six to Home Office Training

Alignment Tool

Distribution: One per each domestic city
Two per each Subsidiary
Two per Area
Four to Home Office Repair
Six to Home Office Training
Sixty for Rep coverage

Alignment Pack

Distribution: One per each domestic city
Two per each Subsidiary
Two per Area
Four to Home Office Repair
Six to Home Office Training
Sixty for Rep coverage

III. LOGISTICS

A. Equipment Allocations:

There will be no automatic allocations of spares or serialized equipment. See section D for ordering procedures.

B. Recommended Spares List:

See attached RSL

C. Dispositon Of Bad Parts:

Defective subassemblies will be returned to either Area or Home Office for exchange, as per RSL. Individual defective parts will be scrapped locally and replacements ordered.

D. Ordering Procedure:

Spares or serialized equipment must be ordered as follows:

Telex to: (TELEX #947-151)

LOGIC

ATTN: SUSAN HOMOLISKI

WANG MODEL NO.: _____

WANG PART NO.: (If Serialized Equipment)

REQUESTING PERSON: _____

RDB #: _____

SHIP TO ADDRESS: _____

SHIP TO PERSON: _____

SALES ORDER NUMBER: _____

ADDITIONAL REQUIREMENTS: _____

COMMENTS: _____

This request may be submitted when sales order is placed or at scheduling of installation.

Logistics will screen shipments from Distribution to help ensure that required spares and serialized equipment have been ordered by the installing RDB. If no order has been placed, Logistics will enter one and notify the installing RDB.

IV. DELIVERY

Limited delivery of both the 2280 and 2280V Drives has already begun with full scale delivery scheduled for late May, 1979. Delivery of the 6580 is not scheduled until June, 1979.

V. TRAINING

The first training class for the Phoenix Disk Drive is scheduled to be given May 14-18. A second class is scheduled for June 25-29. An audio-visual course on the Phoenix is also available. It is recommended that Area Offices have WPS personnel trained on the Phoenix to ensure support for it when it appears on the OIS 140.

RECOMMENDED SPARES LIST

Model Name: PHOENIX DISK DRIVE

Part No.: 725-0076, 726-0076-1 (50HZ)

Model No.: 2280, 2280V, 6580

OEM Vendor(s) CDC

DATE: 3/30/79

NO: 2211 - REV 1

PLANNER 22

WANG PART NUMBER	OEM PART NUMBER	NAME and DESCRIPTION			REPLACEABLE		REPAIR SOURCE			RECOMMENDED QTY. - INITIAL SPARES			COMMENTS
		1	2	3	BRANCH	REPAIR DEPOT	AREA	H.O.	AREA	DIST.	BRANCH	REPAIR DEPOT	
726-5548	75010102			HEAD ARM ASSY	X			X			3		
726-5549	75010103			HEAD ARM ASSY	X			X			2		
726-5550	75010105			HEAD ARM ASSY	X			X			1		
726-5559	92314113			BELT 60 HZ	X						5		DOMESTIC USE ONLY
726-5611	74440500			MIN ALIGN KIT	X			X			1		
726-5757	75880045			SPEED SENSOR	X						2		
726-5758	75885996			FILTER FINE	X						1		
726-5759	75881911			FILTER COURSE	X						1		
726-5761	75887871			STATIC SPRING	X						1		
726-5773	95874102			VELOCITY XDCER ASSY	X					4			
726-5774	75886281			SPINDLE ASSY		X				4			
726-5775	75892689			DRIVE MOTOR 60HZ	X			X	2				DOMESTIC USE ONLY
726-5776	75889886			BLOWER MOTOR 60HZ	X			X	2				DOMESTIC USE ONLY
726-5777	77610705			POWER SUPPLY ASSY 60HZ	X			X	2				DOMESTIC USE ONLY
726-5778	77616790			PCB I/O EM1	X			X			1		
726-5779	77616600			PCB CONT'L MUX EM2	X			X			1		
726-5780	75885600			PCB SERVO/COURSE EM3	X			X			1		
726-5782	75886300			PCB SERVO COURSE EM6	X			X			1		
726-5783	75886350			PCB READ/WRITE EM7	X			X			1		
726-5784	75885750			PCB READ/WRITE PN ASSY	X			X			1		
726-5785	75885950			PCB POWER AMP	X			X			1		
726-5786	75898850			PCB RELAY CONTROL	X			X			1		
726-5787	75895150			PCB OPER CNT'L PANEL	X			X			1		
726-5788	75895250			PCB COMPONENT BD	X			X			1		

RECOMMENDED SPARES LIST

Model Name: PHOENIX DISK DRIVE
 Part No.: 725-0076, 726-0076-1 (50HZ)
 Model No.: 2280, 2280V, 6580
 OEM Vendor(s) CDC

DATE: 3/30/79
 NO: 2211 - REV 1
 PLANNER 22

WANG PART NUMBER	OEM PART NUMBER	NAME and DESCRIPTION			REPLACEABLE		REPAIR SOURCE		RECOMMENDED QTY. -		COMMENTS
		1	2	3	BRANCH, REPAIR DEPOT	AREA	H.O.	AREA	DIST.	BRANCH	
726-5629	50223603			TRANSISTOR POWER AMP	X		X			1	
726-5630	50223703			TRANSISTOR POWER AMP	X		X			1	
726-5747	95575000			RECTIFIER	X	X				20	
726-5748	93418334			FUSE 6A 250V	X					20	
726-5760	77610050			A/C RELAY	X			4			
726-5762	95583504			CR2 RECTIFIER BLK	X					5	
726-5763	50242201			CR1 RECTIFIER BRDG	X					2	
726-5764	95588200			RECTIFIER SIL	X					20	
726-5765	75887484			RECTIFIER MP500	X	X		5			
726-5766	95587107			CRKT. BKR.	X			2			
726-5767	77610140			SWITCH PACK-ON	X					2	
726-5770	22940807			RELAY 10A	X					1	
726-5771	22940808			RELAY 15A	X					1	
726-5792	75885800			PCB SERVO PRE-AMP	X		X			1	
726-5793	93418324			FUSE 1.25A 250V	X					20	
726-5821	94394004			START SWITCH	X					4	
726-5822	94394001			FAULT SWITCH	X					4	
726-5823	94394002			PROTECT SWITCH	X					4	
726-5832	75888775			RESISTOR WIREWOUND	X			100			
726-5833	75888776			RESISTOR WIREWOUND	X			100			
726-5834	95645628			CAPACITOR 40V	X			100			
726-9675	75882560			EXTENDER BOARD	X		X			1	
726-9678	75886000			PWA HEAD ALIGN EXT. BOARD	X		X			1	

RECOMMENDED SPARES LIST

Model Name: PHOENIX DISK DRIVE
 Part No.: 725-0076, 726-0076-1 (50HZ)
 Model No.: 2280, 2280V, 6580
 OEM Vendor(s): CDC

DATE: 3/30/79
 NO: 2211 - REV 1
 PLANNER 22

1	2	3	NAME and DESCRIPTION	1	2	3	REPAIR SOURCE	RECOMMENDED QTY.	- INITIAL SPARES!	COMMENTS	
WANG PART NUMBER	OEM PART NUMBER			BRANCH	REPAIR DEPOT	AREA	H.O.	AREA	DIST.	BRANCH!	REPAIR DEPOT!
726-5789	75832900		PCB REGULATOR	X			X			1	
726-5790	75886100		PCB TERMINATOR	X						1	
726-5797	77610706		POWER SUPPLY 50HZ	X		2	X				
726-5798	75891690		DR. MOTOR ASSY 50HZ	X		2	X				
726-5799	92314127		BELT 50HZ	X						5	
726-5800	75778718		POWER CORD 50HZ	X		1					
726-5801	75889887		BLOWER MOTOR 50HZ	X		2	X				
726-5824	94394108		SW DEVICE ENCODING	X						6	
726-5831	51853015		HEAD CABLE CLAMP	X						6	
726-5835	75882865		DOOR ASSY	X		2	X				
726-5836	75883056		DOOR SOLENOID	X			X			1	
726-5837	75883465		CABLE DOOR LOCK	X		4					
726-8018	95033502		HEAD CLEANING SOLUTION	X						1	
726-9677	75882565		GUIDE	X		4					
726-9679	77612622		JUMPER EXT	X						1	
726-9683	72204400		CE CARTRIDGE	X		2	X			1	
726-9693	82338800		TB 216 DISK EXER.	X		2	X			1	
726-9699			HEAD ALIGN TOOL	X		2				2	
726-5816			COMPRESSED AIR	X						1	
360-1100			FUSE 10A 125V	X						1	
726-9696			TORQUE TIP	X						1	

RECOMMENDED SPARES LIST

Model Name: VS INTERFACE
 Part No.: 177-22VS-93
 Model No.: 2280V
 OEM Vendor(s) _____

DATE: 3/30/79
 NO: 2203 - REV 1
 PLANNER 22

HWANG PART NUMBER	OEM PART NUMBER	1 2 3 NAME and DESCRIPTION			REPLACEABLE		REPAIR SOURCE		RECOMMENDED QTY. - INITIAL SPARES			COMMENTS
		BRANCH	REPAIR DEPOT	AREA	BRANCH	REPAIR DEPOT	AREA	DIST.	BRANCH	REPAIR DEPOT	INITIAL SPARES	
177-0071				WORK PACK	X						1	
212-3003				IOP VS	X			X			1	
220-3003-4				CABLE ASSY	X						1	
220-3041				CABLE	X						1	

WANG PART NUMBER	OEM PART NUMBER	1	2	3	NAME and DESCRIPTION	REPLACEABLE BRANCH	REPAIR DEPOT	REPAIR AREA	REPAIR SOURCE H.O.	RECOMMENDED AREA	QTY.	INITIAL SPARES	COMMENTS
						BRANCH	DEPOT	AREA		DIST.		BRANCH!	REPAIR DEPOT!
210-7415					VOLT SENSE BOARD	X			X		1		
210-7421A					PCB-ALU/MUX INTERFACE	X			X		1		
210-7422					PCB-ECC/DEVICE INTERFACE	X			X		1		
210-7423A					PCB-RAM/PROM CONT.	X			X		1		
210-7424					I/O CONTROLLER PCB	X			X		1		
220-3033-4					CABLE ASSY	X					1		
220-3041					CABLE	X					1		
360-1067					FUSE 6A	X					5		
360-1100					FUSE 10A	X					5		
220-0105-3					INTERFACE CABLE	X					1		

Service Newsletter

NO. 176

November 28, 1979

MASS STORAGE DEVICES #38

PRECAUTIONARY GUIDELINES FOR MODEL 2280-SERIES DISK DRIVES

NOTE:

The 2280-series (Phoenix CMD) disk drives, the newest members of the 2200 systems disk family, are extremely delicate. Although the operating theory for the 2280-series disks drives combines elements of theory common to the earlier Hawk and SMD drives, the 2280-series equipment has been refined to such a critical point that existing "rules of thumb" used with the earlier drives are not adequate for the 2280-series units. The 2280-series drives have their own set of guidelines, particularly with respect to preventing head crashes, and these guidelines must be followed to ensure problem-free operation. This SNL provides both specific information that is applicable only to CE/service representatives and more-general usage guidelines that are also applicable to customer personnel using the equipment. Each Customer Engineer should see to it that all applicable customer personnel know of and adhere to the applicable usage guidelines, discussed in paragraph C.

A. INSTALLATION GUIDELINES

The following guidelines pertain to handling of the 2280-series equipment during system installation:

1. Inspect the carriage assembly and read/write heads very carefully for any signs of shipping damage.
2. Check that all pieces of packing material are removed, and ensure that the disk drive unit is clean inside.
3. If the interior of the disk drive unit must be cleaned, use only lint-free cloth.

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WANG

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13-266

4. Never move the unit any significant distance without first putting the carriage locking pin in place to prevent the heads from moving onto the disks surfaces, which could damage the heads and/or disks.
5. Do not position the carriage manually. Such action could move the read/write heads onto the disks, causing the heads and/or disks to become damaged.
6. Do not leave the deck assembly in its raised position except while absolutely necessary for maintenance activities. (Contamination falling into the absolute filter exit while the deck is raised could be blown into the disk area when normal operation is resumed.)
7. Do not attempt to override any interlocks in the system. They are included for good reasons and should not be defeated at any time.
8. Purge all newly installed disk drives for at least 10 minutes. To purge, disconnect voice-coil power at A1P1 and then start the unit. Under these conditions, the spindle turns but the heads will not load.
9. Do not load the heads manually during the purge operation.

B. MAINTENANCE GUIDELINES

The following guidelines pertain to handling of the 2280-series disk drives during maintenance activities:

1. Change (clean) the disk drive's air filters at least every six months. In a very dusty environment, change them more often.
2. Since the 2280-series drives do not have an upper guard rail, take extreme care to not move the carriage assembly in a lateral direction (right angles to the normal direction of head movement) when turning the clamping screws to adjust the heads while the heads are flying. The resultant force from such motion could rotate the carriage assembly and cause severe damage to the heads and disks. To prevent this motion, carefully apply sufficient counter force on the opposite side of the carriage assembly while turning the screws.

C. SERVICE-RELATED AND CUSTOMER-RELATED GUIDELINES

The following guidelines pertain to handling of the 2280-series disk drives during normal operation. These guidelines must be followed both by service representatives and by customer-user personnel in order to ensure troublefree operation.

1. Disk cartridges can be stored either flat or on edge. If stored flat, the cartridges must be stored right-side-up. Although several cartridges can be stacked on top of one another, avoid stacking them more than five high, which could cause excessive pressure.
2. Keep a disk cartridge in the disk drive at all times, whether operating or not, so as to guarantee proper sealing of the shroud area from environmental contaminants.
3. Keep the disk-cartridge dust cover on the disk cartridge while that cartridge is outside of the disk receiver. The cover ensures a positive dust seal and immobilizes the contained disk.
4. While a cartridge is in the drive, with its bottom dust cover removed, store that dust cover upside down to prevent dust from collecting inside the cover.
5. Unless the pack access door must be opened for maintenance, keep that door closed to prevent dust from entering the pack area.
6. Whenever possible, leave disk drive ac power on at all times to ensure positive pressure in the pack area and to keep dust out.
7. If disk drive power must be turned off, do not open the circuit breaker switch until the disk has stopped rotating. (Blower power must be on whenever the disk is rotating, in order to prevent the disk drive unit from sucking in unfiltered air.)

12-14
2mm

FORMATDISKT/D_ _

D11 - 310
D10 - 810
VERIFY T/D_ _ , (0,52607)
LISTS DCT/D_ _

2280 SERVICE BULLETIN

GENERAL DESCRIPTION

A new disk drive, the Model 2280, has been added to the line of Mass Storage Devices that is available for use with the 2200 VP/MVP computer systems. Unlike other large capacity disk systems where the storage media is only available as either an entirely fixed volume or an entirely removable cartridge, the 2280 provides a single 13.4 megabyte removable cartridge and from 13.4 to 67 megabytes of fixed volume storage all within the same drive unit. The 2280 is available in three models; 2280-1, 2280-2 and 2280-3, with the smallest model (-1) providing approximately 27 megabytes of storage and the largest model (-3) providing approximately 80.5 megabytes. The 2280 disk controller and microprocessor allow two disk drives to be daisy-chained, providing up to 161 megabytes of on-line storage.

PHYSICAL CHARACTERISTICS

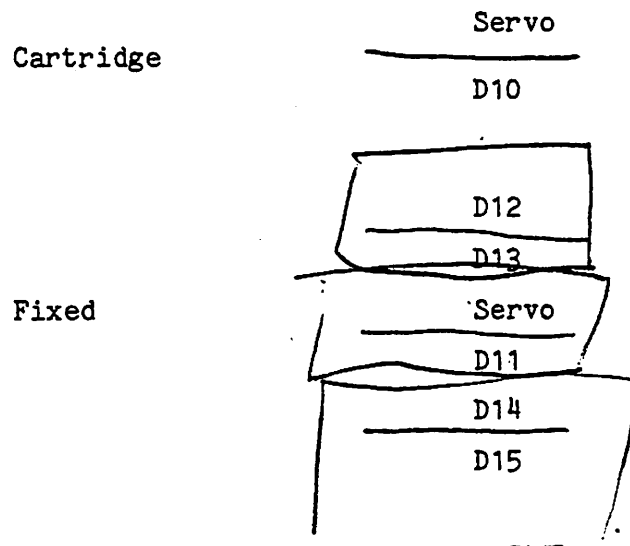
The Model 2280 is composed of a CDC Phoenix disk drive and a Wang manufactured microprocessor. Both the drive and microprocessor are contained in a single free-standing unit. The unit features a hinged front door for easy loading and removal of the one removable cartridge that the drive accomodates. The disk drive also contains a three platter fixed volume with the capacity of the volume being specified by way of a selected jumper configuration that is located in the disk drive. The jumper configuration is dependent on the model designation.

STORAGE CAPACITY

As stated previously, the 2280 physically contains four disk platters; one removable and three fixed. The number of fixed platters that are actually used depends on the model. The 2280-1 uses one fixed platter, the 2280-2 uses two and the 2280-3 uses three. One surface of the removable platter contains servo information which is

used by the disk drive and is not available to the user. The remaining surface of the removable platter is accessible by the user. The three fixed platters are normally referred to as the fixed volume. Regardless of the model, only one surface in the fixed volume is a servo surface and is not accessible by the user. The remaining fixed surfaces (1 for a 2280-1, 3 for a 2280-2 and 5 for a 2280-3) are available to the user. Each usable surface, fixed and removable, has a unique device address in the 2200 system. The addresses are D10 (D20,D30), D11 (D21,D31), D12 (D22,D32), D13 (D23,D33), D14 (D24,D34) and D15 (D25,D35). The relationship between the usable surfaces along with their addresses, and the physical disk platters is shown in Table 1.

TABLE 1



Each usable surface is divided into a number of concentric recording tracks. Each surface has 824 tracks and every track is, in turn, sub-divided into 64 sectors. A sector is the smallest addressable unit on the disk platter and can store 256 bytes of information. The sectors on each surface are sequentially numbered and individual sectors can be directly addressed.

822 TRACKS
64 SECTOR/

In addition there are 64 sectors (1 track) reserved on each usable surface for alternate sector addressing.

The exact storage capacities of the three models are shown below.

Disk Unit	2280-1	2280-2	2280-3
Sectors/Surface	52,608	52,608	52,608
Total Sectors	105,216	210,432	315,648
Bytes Removable	13,467,648	13,467,648	13,467,648
Bytes Fixed	13,467,648	40,402,944	67,338,240
Total Bytes	26,935,296	53,870,592	80,805,888

OPERATING SYSTEM REQUIREMENTS

The following are the minimum VP/MVP System requirements for the installation and operation of a 2280.

- | | | | |
|-----|----------|----------|----------------|
| 1a. | 2200 VP | O.S. 2.0 | WL #701-2118 J |
| 1b. | 2200 MVP | O.S. 1.7 | WL #701-2294 H |

2. The VP/MVP Bootstrap proms must be R1 version. 6789
3. A single disk controller modified for MVP use must be used (210-6541-2), on both VP and MVP systems.
4. A dual printer/disk controller may be used (210-7042-2).

* NOTE: The 2280 is not supported on 2200 B, C, S, or T CPU's or workstations.

FORMAT UTILITY

Before either the fixed or removable volumes can be used to store programs or data, they each must be formatted. Wang provides a utility program, @ FORMAT, that will reside on the VP/MVP operating system disk of each 2280 disk drive which can be used to format the disk surfaces. This utility requests that the operator identify the surface which is to be formatted with its logical address, and then automatically issues the appropriate instruction sequence to certify, format and verify the designated surface. Formatting should be necessary only once for each surface unless the surface begins to produce frequent read/write errors; in this case, reformatting may correct the problem. Reformatting, however, destroys all information previously recorded on the surface.

During the process of formatting, the disk controller writes control information (including sector address and error checking information) onto each disk sector and then fills the 256 byte user data area of the sector with zeros on the last pass. The disk controller also automatically performs a verification check to insure that the media is suitable for system use. The formatting processes are performed automatically under software control and if any sectors are found bad, the disk controller reassigns the bad sector to another sector in the spare track (823). Sector zero of track 823 contains a map of sectors that have been alternately assigned. When all sectors on the surface are formatted, the surface is ready to store programs and data. An I93 error that occurs during formatting indicates the surface is unacceptable for use because either sector zero of track 823 is bad or more than 2 sectors are bad in track 823.

INSTALLATION PROCEDURE

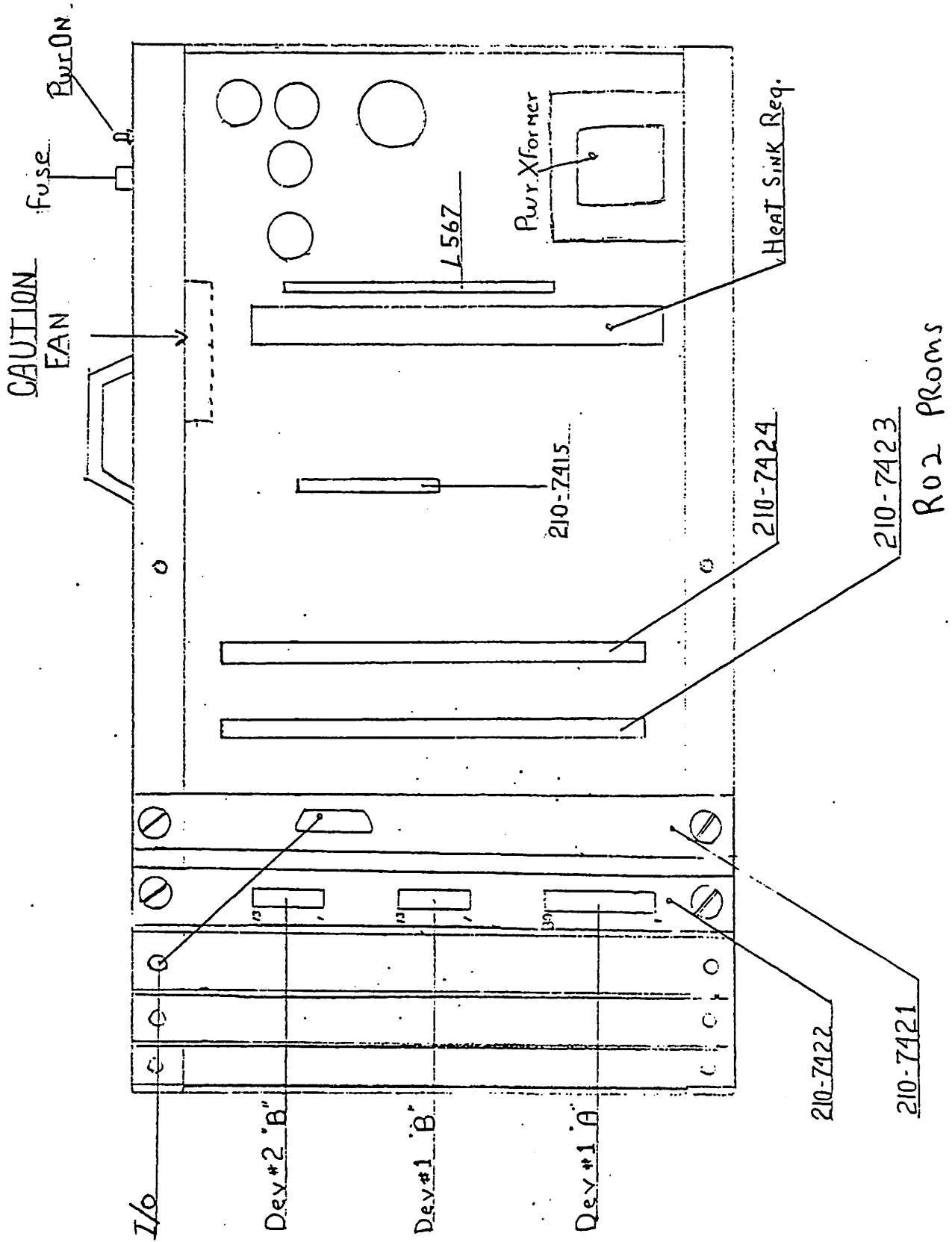
CONTROLLER - VOLTAGE ADJUSTMENT PROCEDURE

1. Remove top cover of controller.
2. Place L567 circuit board on an extender.
3. Turn Supply power ON.
4. Using a Digital Voltmeter check voltages for specified value(s) between the point indicated and +0V, as listed in Table 2. Adjust L567 pc trimpots to obtain correct voltage levels only where necessary. Never allow the -15VR power supply to exceed -17 vdc, otherwise permanent damage to the controller will result.
5. With an oscilloscope and X1 probe, measure the ripple at the points indicated in Table 2. AC ripple should not exceed the limits specified. If any voltage or ripple measurement is out of specification, troubleshoot the power supply.

TABLE 2

LOCATION	VOLTAGE	LIMITS	ADJ	RIPPLE
7. L567 Pin 1 ₁	+5VRM	+4.90 vdc to +5.10 vdc	R17 ²	15 mvp-p
L567 Pin 2 ₁	+5VRL	+4.90 vdc to +5.10 vdc	R2 ¹	15 mvp-p
2. L567 Pin 12 ₁	+8VR	+8.50 vdc to +8.80 vdc	R13 ³	20 mvp-p
L567 Pin 15 ₁	+12VR	+11.80 vdc to +12.20 vdc	R30 ⁴	15 mvp-p
L567 Pin 5 ₂	-12VR	-11.80 vdc to -12.20 vdc	R34 ⁶	15 mvp-p
L567 Pin 6 ₂	-15VR	-14.80 vdc to -15.20 vdc	R40 ⁵	25 mvp-p

2280 Microprocessor
Lay-out



CABLE CONNECTIONS

<u>From</u>	<u>To</u>	<u>Cable #</u>
Single Drive		
6541-2(7042-2)	210-7421	220-0138
7422 BOTTOM	Drive 1 I/O BRD	220-3041 "A" Cable
7422 MID	Drive 1 CNTRL/MUX	220-3033-1 "B" Cable
Daisy Chain (Same as above plus the following)		
Drive 1	Drive 2	220-3031 "A" Cable
7422	Drive 2	220-3033-4 "B" Cable

BOARD LAYOUT

<u>Board</u>	<u>Description</u>
210-7421	ALU/MUX
210-7422	Ecc/Disk Interface
210-7423	PROM/RAM
210-7424	Disk I/O Control

DRIVE SETUP

1. Before applying power, check the Control Mux board in the Phoenix drive to make sure the drive capacity selected matches the drive capacity listed on the work order by using Table 3.

TABLE 3

<u>Drive Type</u>	<u>!</u>	<u>Setting of U3 on Control MUX Board</u>
2280-1	!	Cut between pins 6-11
2280-2	!	Cut between pin 6-11 and 7-10
2280-3	!	Cut between pins 6-11 and 8-9

2. It is also necessary to ensure the system is set up for 64 sector operation. Do this by setting switch 7 of the switch bank on the Servo Coarse board to the ON position and all others to the OFF position.

3. Install the drive select plug in the front panel of the drive. The only valid drive numbers are one and two. The number one plug should be installed in the Master drive; the number two plug should be installed in the Slave Drive.

4. Install a ground strap (WLI #220-1198) at least 18 Awg. from the terminal at the rear of the drive marked DC grd to the 2280 controller ground.

OPERATING INSTRUCTIONS

After performing the installation procedure, apply power to the CPU, microprocessor, and disk drive. When the door lock solenoid picks, open the cartridge door and insert a CDC 1204 cartridge; close the door and press start. The ready light should blink while the drive comes up to speed. The ready light will stay lit when the drive is ready for operation.

DIAGNOSTICS

A new diagnostic will be available for testing the 2280 disk under diskette WL #XXX-XXXX. An additional feature on this diskette is a 2280 head alignment utility which when used with a mini-alignment kit (WLI # 726-5611) eliminates the need for a CDC field test unit to perform head alignment. The following is a description of the diagnostic and its operation.

To operate the diagnostics enter the following:

SELECT DISK (ADDRESS OF DISK WHICH CONTAINS DIAGNOSTICS) (EXEC)

LOAD DCT "START" (EXEC)

RUN (EXEC)

The following should appear on the screen:

SF '0 --- DISK ACCESS TEST
SF '1 --- RANDOM VERIFY TEST
SF '2 --- MULTI-SECTOR TEST
SF '3 --- COPY TEST
SF '4 --- READ AND WRITE ON ONE SECTOR
SF '5 --- READ ONE SECTOR
SF '6 --- RANDOM READ AFTER WRITE (ALL SURFACES)
SF '7 --- RANDOM READ/WRITE TEST (ONE SURFACE)
SF '8 --- PHOENIX HEAD ALIGNMENT

: ___ STOP

The following prompts pertain to all the tests except 4,5,8. These tests will be explained later. Depress the appropriate special function key to select the desired test. The following will then appear:

***** DISK UNIT DIAGNOSTIC SET UP *****

WHICH DISK IS TO BE TESTED? 14

- | | |
|--------------------------|--------------------------|
| 1. 2270-1 | 2. 2270A-1 |
| 3. 2270-2 | 4. 2270A-2 |
| 5. 2270-3 | 6. 2270A-3 |
| 7. 2230-1 | 8. 2230-2 or 2260B/C-1/4 |
| 9. 2230-3 or 2260B/C-1/2 | 10. 2260 B/C |
| 11. 2260 B/C-2 | 12. 2280-1 |
| 13. 2280-2 | 14. 2280-2 |
| 15. Twin 2280-3 | 16. 2nd 2280-3 |

Select the type of drive to be tested by entering one of the numbers (1 thru 16) and keying (EXEC).

The following will appear:

DISK MODEL: (TYPE OF DISK SELECTED)

HAVE ALL SURFACES BEEN FORMATTED (Y or N)? Y

SURFACE NO.	PLATTER ADDRESS	START SECTOR	END SECTOR
1.	(ADDRESS)	0	52607
2.	(SELECTED)	0	52607
3.		0	52607
4.		0	52607
5.		0	52607
6.		0	52607

Enter Y or N then (EXEC). The following will appear:

DISK MODEL: (TYPE OF DISK SELECTED)

WHICH SURFACE IS TO BE CHANGED (CR IF NONE)?

At this time if any surface is not to be tested, the surface number (1 thru 6) should be entered, then (EXEC). If all surfaces are to be tested then only (EXEC) should be entered. To eliminate one or more than one surface from being tested, perform the following.

Enter the first surface number not to be tested, then key (EXEC).
The following will appear:

DISK MODEL: (TYPE OF DRIVE SELECTED)

IS THIS SURFACE TO BE TESTED (Y or N)? Y

Enter N then (EXEC). The start and end sector numbers should not appear on the screen for the surface(s) not to be tested. Continue this procedure until all surfaces not to be tested have been entered.

Tests 4,5,8 differ slightly from the format of the other tests. Following is a brief explanation of each:

SF 4: Test 4 performs continuous reads and write of a selected sector. If test 4 is selected the following appears on the screw.

STOP DATA ON DISK WILL BE CLOBBED! CONTINUE?

Key CONTINUE, (EXEC) and the following will appear:

DISK ADDRESS / 3 2 0

Enter the address of the desired surface and the following appears.

SECTOR ADDRESS

Key in the desired sector address then (EXEC). The test should begin. The data pattern used is displayed on the left side of the screen and the number of accesses on the right. Key HALT to stop test.

SF 5: This test allows you to read one sector and display the data on the screen. This test can also be used to read the alternate sector map which is not normally available to the user. To run this test, select the disk and sector addresses as described in SF 4. After the data read from the sector is displayed, there are five options available.

SF 0: This SF key allows you to select another surface.

SF 1: This SF key allows you to select another sector on the same surface.

SF 2: This SF key will read the next sequential sector of the selected surface.

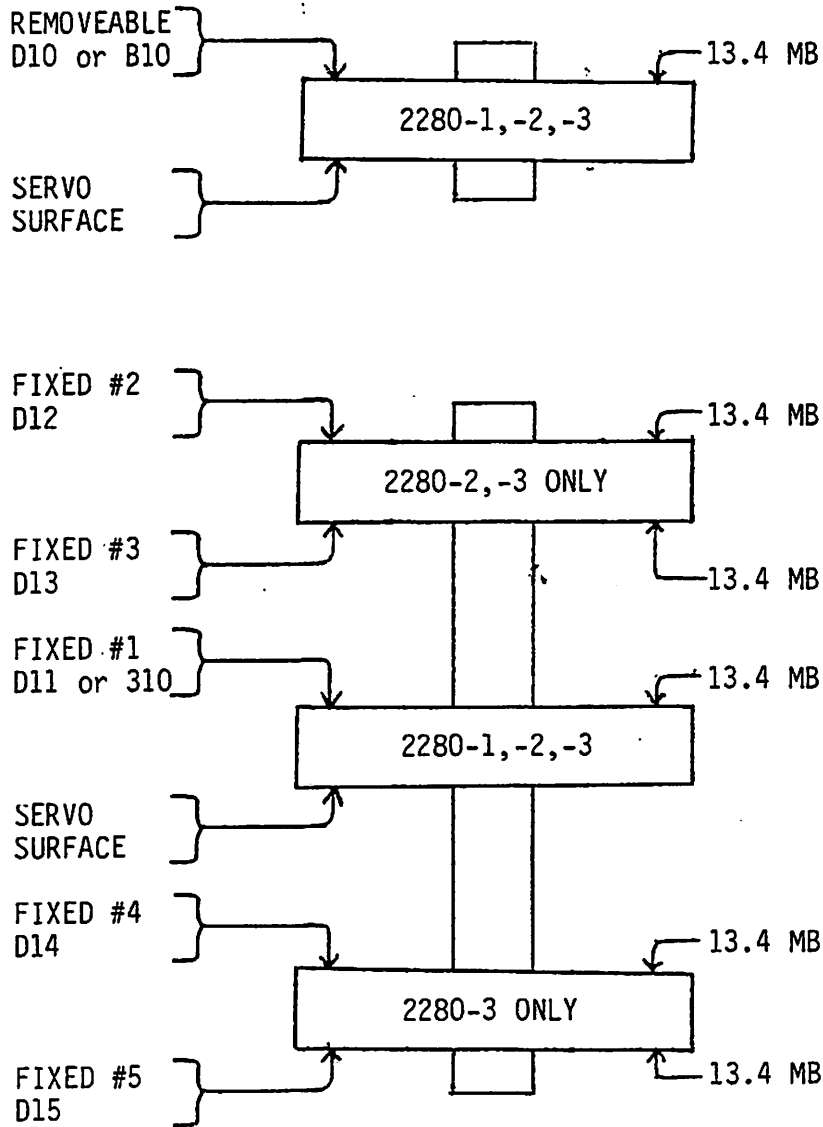
SF 3: This SF key converts the data read from sector 52608 (alternate sector map) to indicate which sectors have been alternately assigned during formatting.

SF 19 After the data is read from a sector, the data can be changed and written back onto a sector thru use of this key.

TEST DESCRIPTION

- SF 0: This test performs 20 passes of random seeks then performs sequential writes and reads. After this, random read/writes are performed. This test runs continuously and will destroy data on the surfaces selected for testing.
- SF 1: This test performs random verifies and runs continuously. This test does not destroy data.
- SF 2: This test performs multi-sector writes with a pattern determined by the diagnostic. This test will destroy data and runs continuously.
- SF 3: This test copies the data found in randomly selected sectors to other randomly selected sectors. This test will destroy data and runs continuously.
- SF 4: This test writes and reads on one sector continuously and will destroy data.
- SF 5: This test will read one sector and display the data read. This test can be used to determine alternate sector assignments. This can be done by reading sector 52608 and then depressing SF '3. This test does not destroy data.
- SF 6: This test performs random writes/reads on selected surfaces. This test destroys data and runs continuously.
- SF 7: This test uses only one surface. It starts out with a verify of the selected surface, then performs 100 maximum seeks. After this, the test performs random writes/reads of single sectors.
- SF 8: This kit is used in conjunction with the mini alignment kit to replace the CDC field test unit by positioning the R/W heads over the alignment tracks.

2280-1/-2/-3 DISK DRIVE



Due to the unavailability at the present time of alignment packs from CDC we have been forced to vary slightly from our recommended installation policies for Phoenix Drives.

The pack contained in this box is a master data pack which is not to be used to perform alignments, but only to check that head alignment has not changed during shipment. Because a high percentage of drives arrive with the heads still in alignment, this master data pack determines whether or not a head alignment is required. This allows us to provide an alignment pack only where it is really necessary. There are two versions of these data packs available. One is for VS and one for VP/MVP. The label on the pack indicates which version the pack is. The following is the procedure to determine if the drive is in alignment.

A. VP/MVP SYSTEMS

1. After the drive has been installed at the customer's location, install the master data pack and allow the drive to purge for 5 minutes (start button depressed, voice coil plug disconnected) then continue with step 2.

2. Enter the following on the VP/MVP console;

```
VERIFY T/DXX, (0, 52607) (EXEC)  
XX = DRIVE ADDRESS (10, 20, 30)
```

3. Visually check the head carriage to verify that no errors (hard or soft) occur. Hard errors are displayed on the screen, while soft errors are indicated by the head carriage performing a restore and a re-seek.
4. If no errors (hard or soft) occur, then the drive does not require a head alignment.

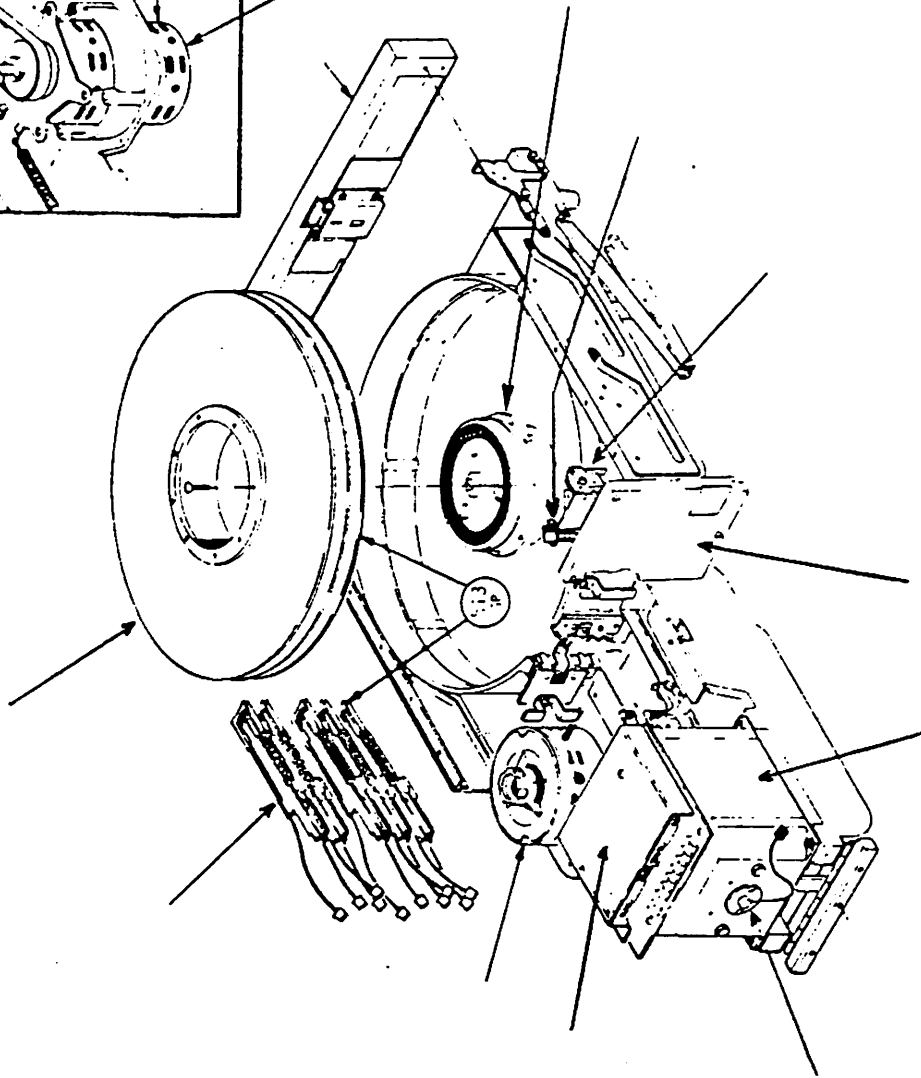
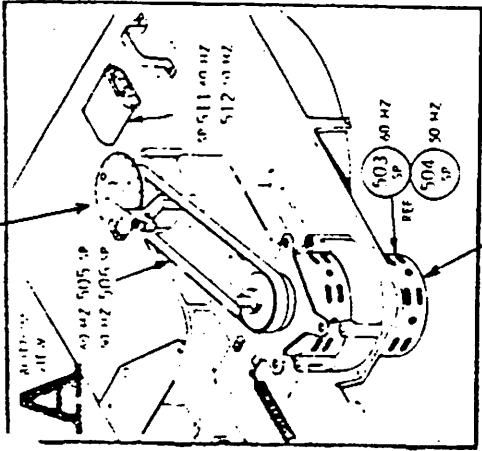
5. If any verify errors occur, remove the master data pack and install a scratch pack.
6. Format the scratch pack (Head 0) using the format utility on the system platform.
7. Perform steps 2 and 3 again.
8. If no errors occur, request an alignment pack. If errors occur, a hardware problem exists. Correct the hardware problems and return to step 1.

B. VS SYSTEM

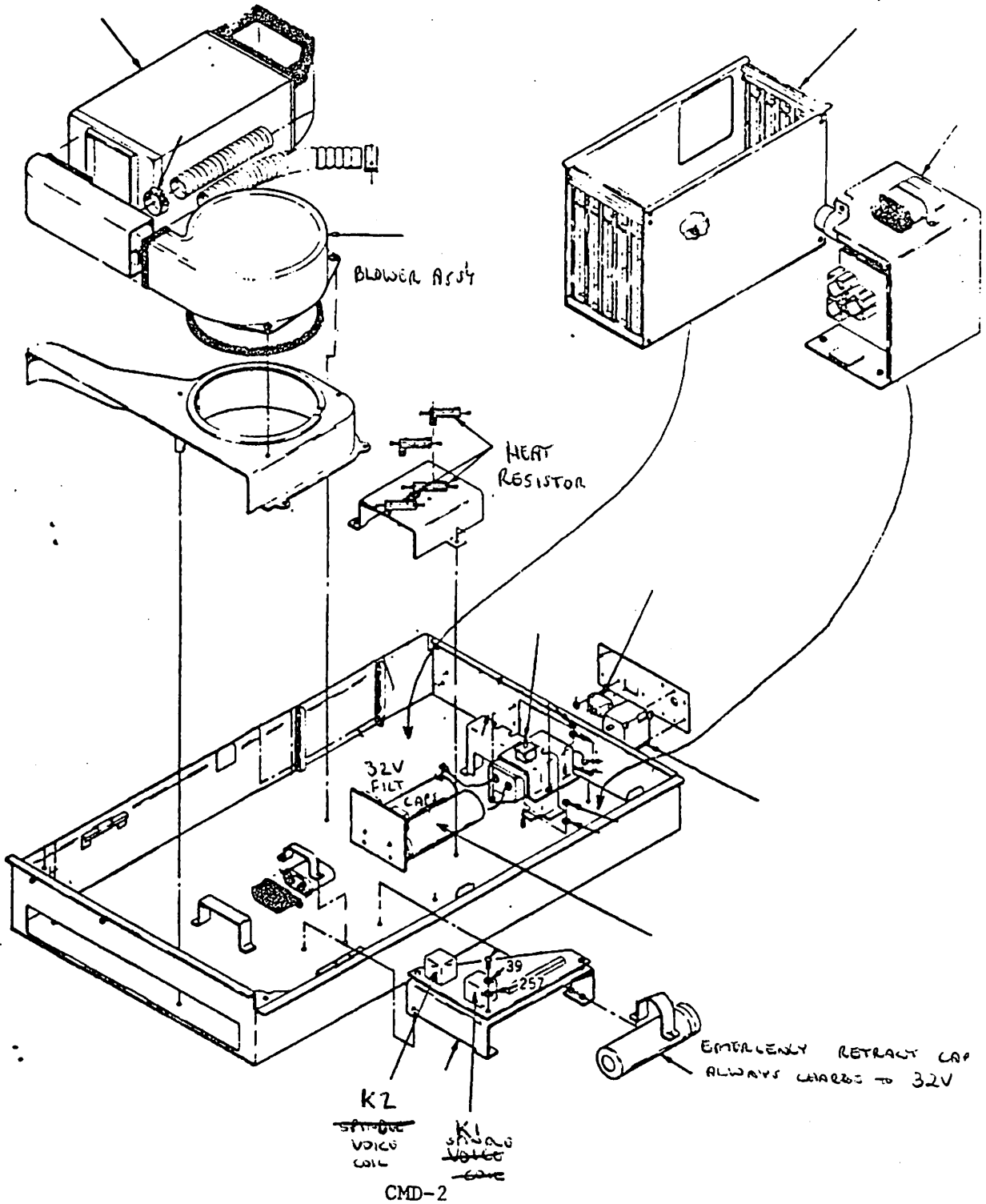
1. Perform step 1 of VP/AVP System.
2. Load FTU program.
3. Enter appropriate device and volume (volume name is MASTER).
4. Select VERIFY DISK option.
5. At the end of the verify, if no errors (hard or soft) occur, no alignment is required.
6. If any errors occur, remove the master data pack and install a scratch pack.
7. Load DISKINIT, select INITIALIZE.
8. Perform VERIFY again. If no errors occur, request an alignment pack.
9. If errors occur, hardware problem exists. Correct the hardware problem and proceed to step 1.

WANG MODEL 2280
CARTRIDGE MODULE DRIVE
(CME)

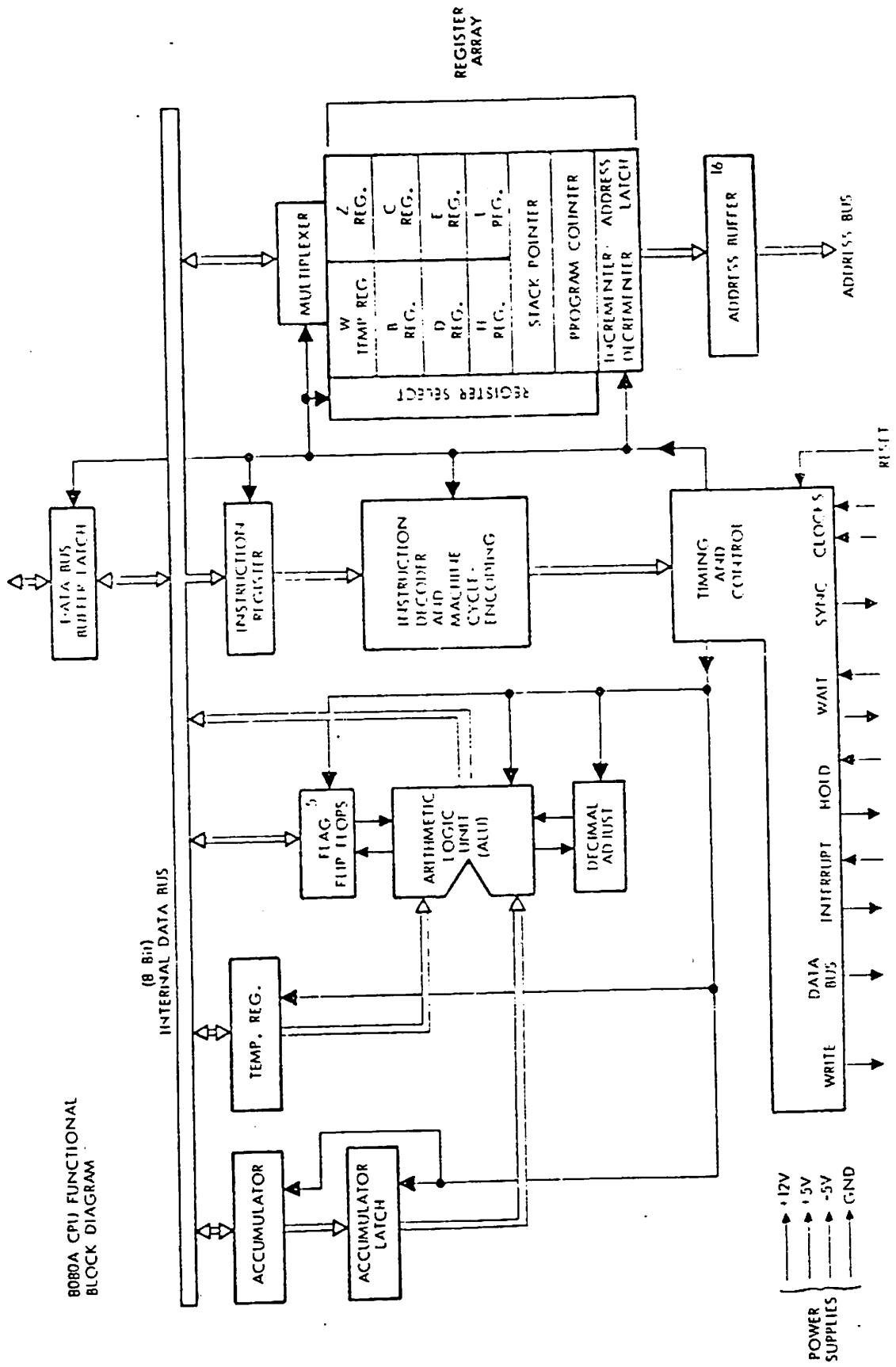
STUDENT
INFORMATION
SHEETS



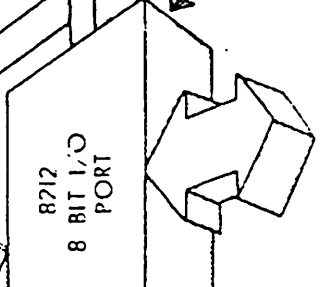
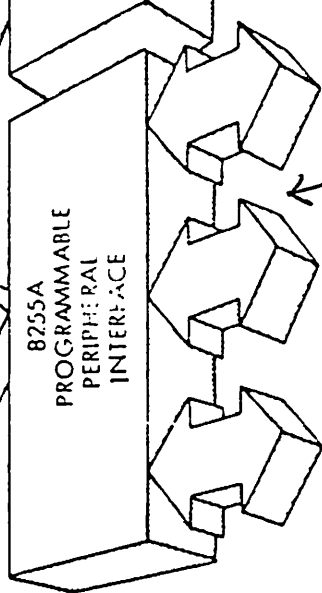
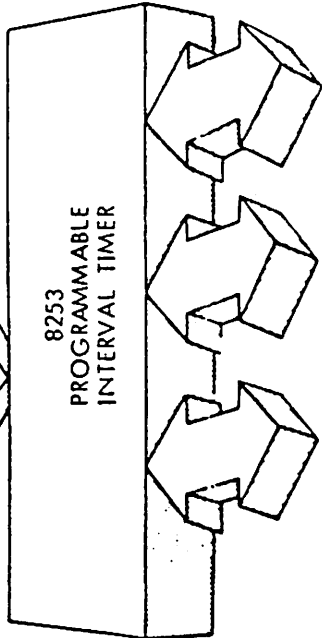
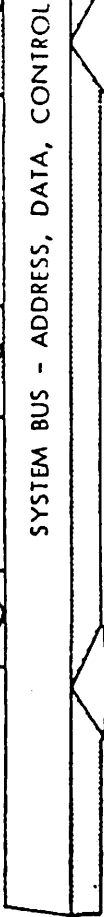
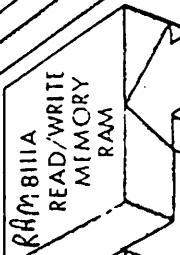
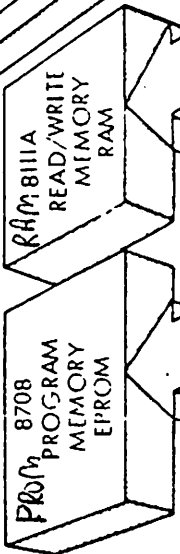
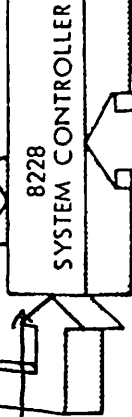
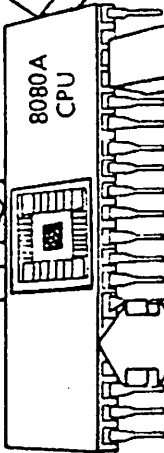
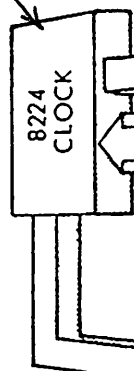
CMD-1



8080A CPU FUNCTIONAL BLOCK DIAGRAM



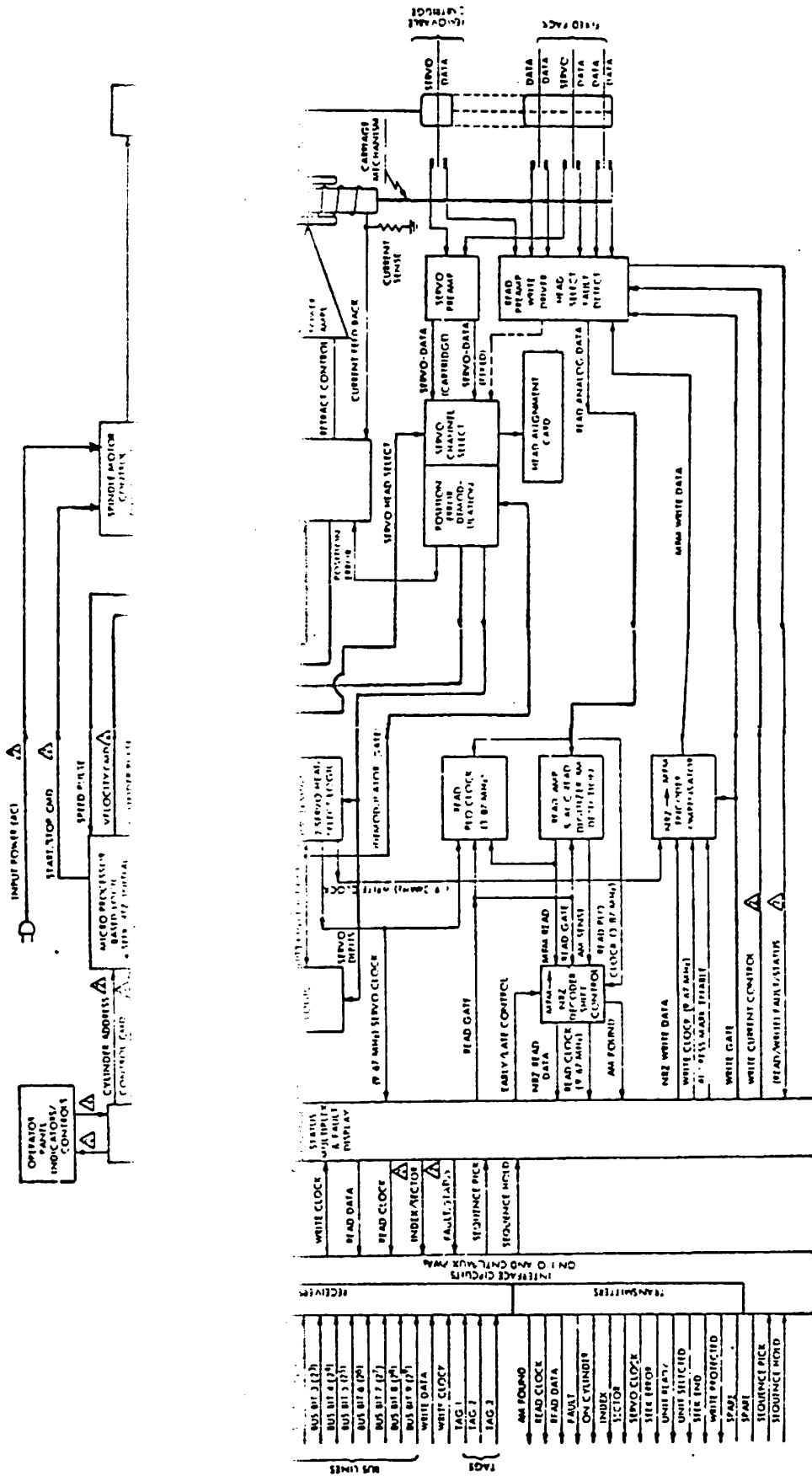
PHASE 1 & 2 TIMING



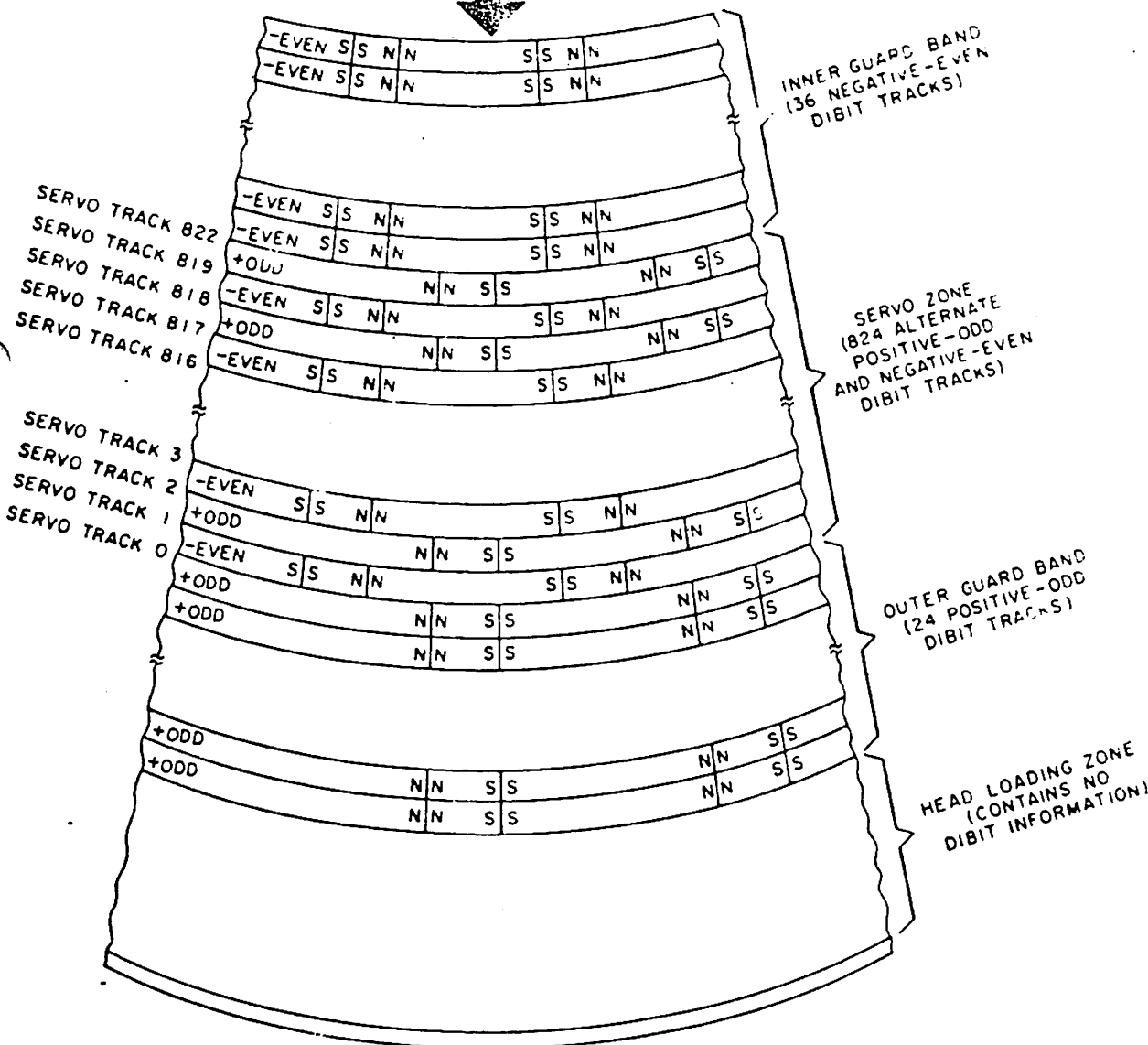
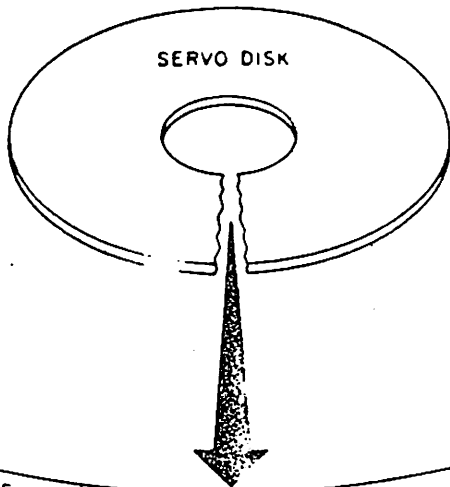
INTERLUPT
SPINDLE SPEED
SECTOR PULSE
SEGMENT END

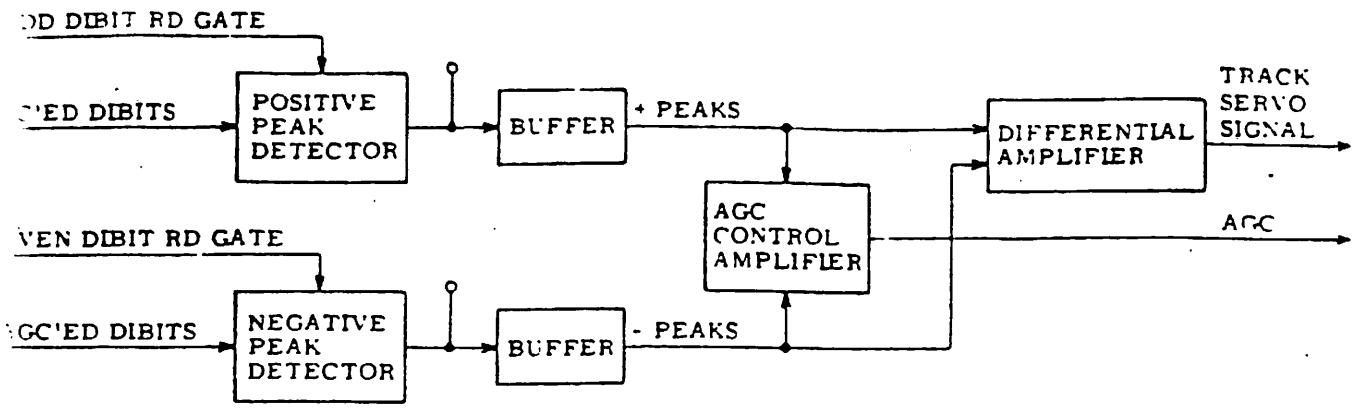
TRANSFER OF DATA/CONTROL
STATUS COMMAND

INTERRUPT SIGNALS



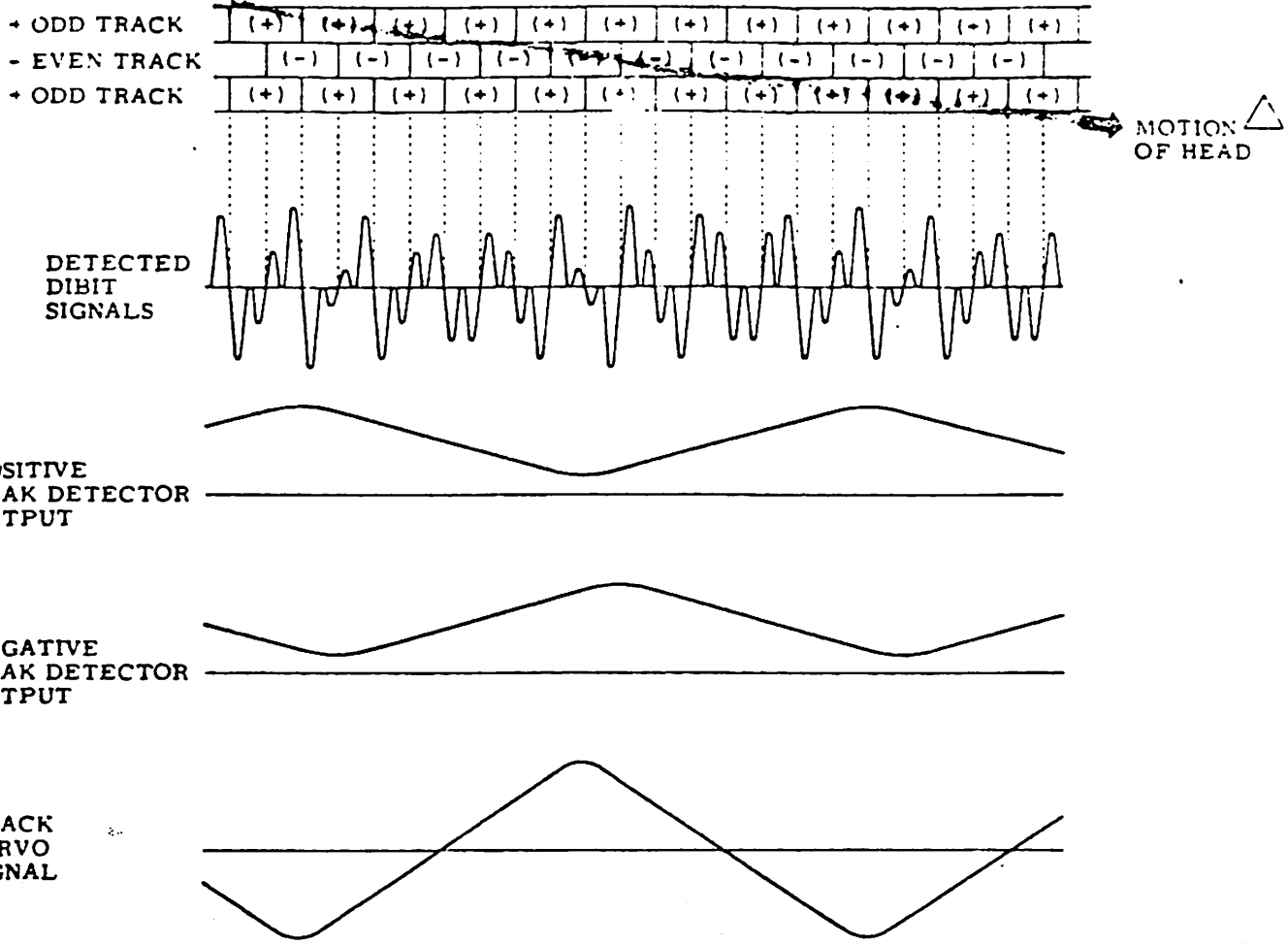
△ DENOTES MULTIPLE LINES





PATH OF SERVO HEAD ACROSS DIBIT TRACKS

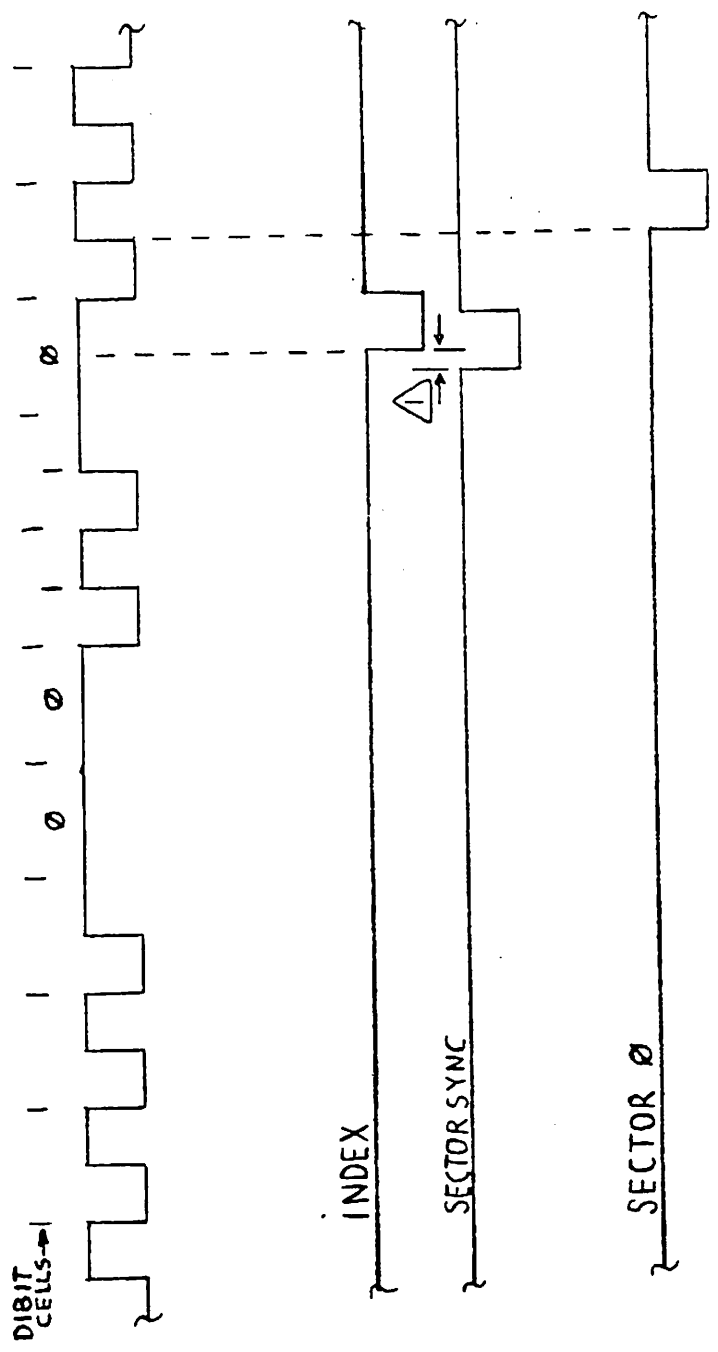
← MOTION OF DISK



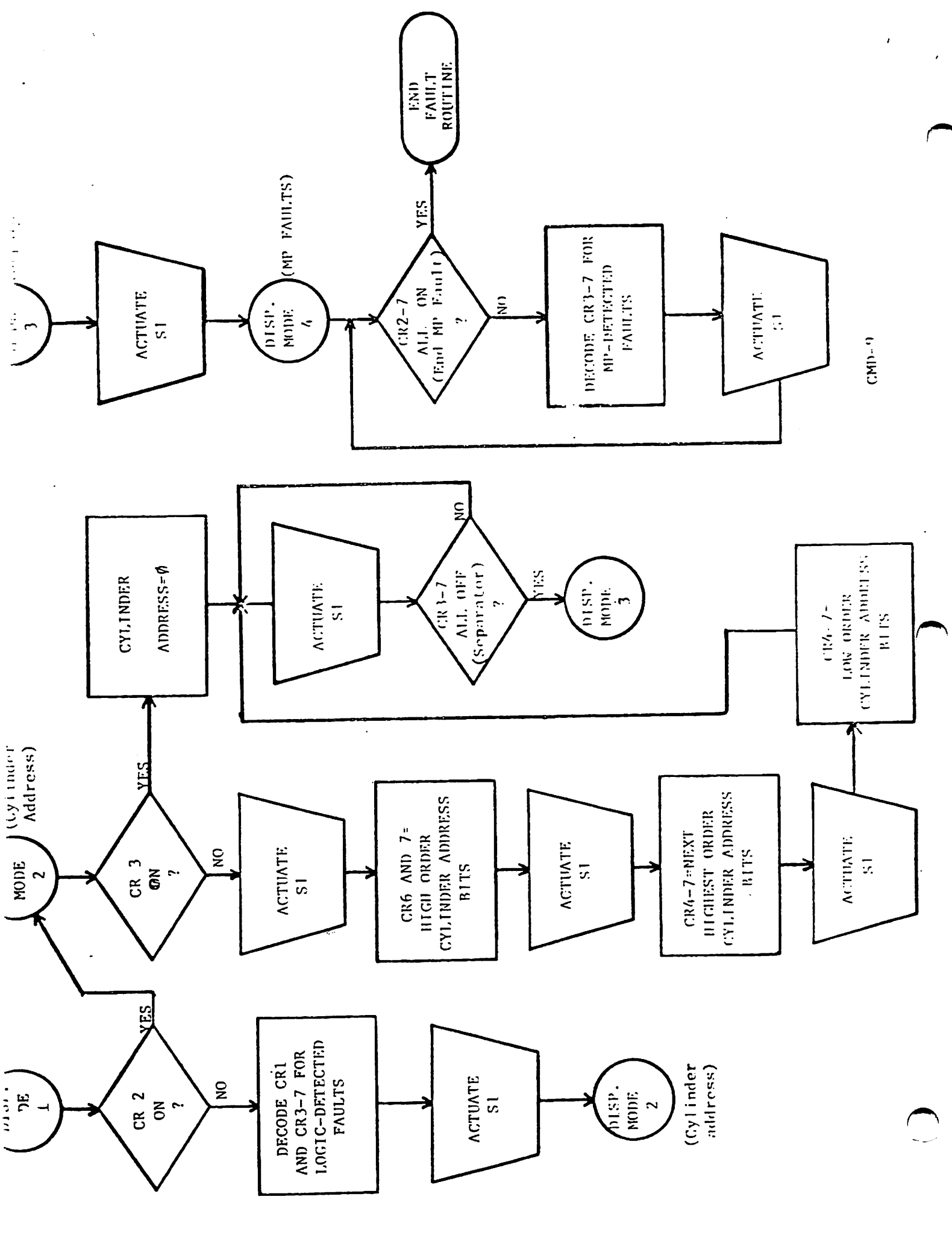
NOTES:

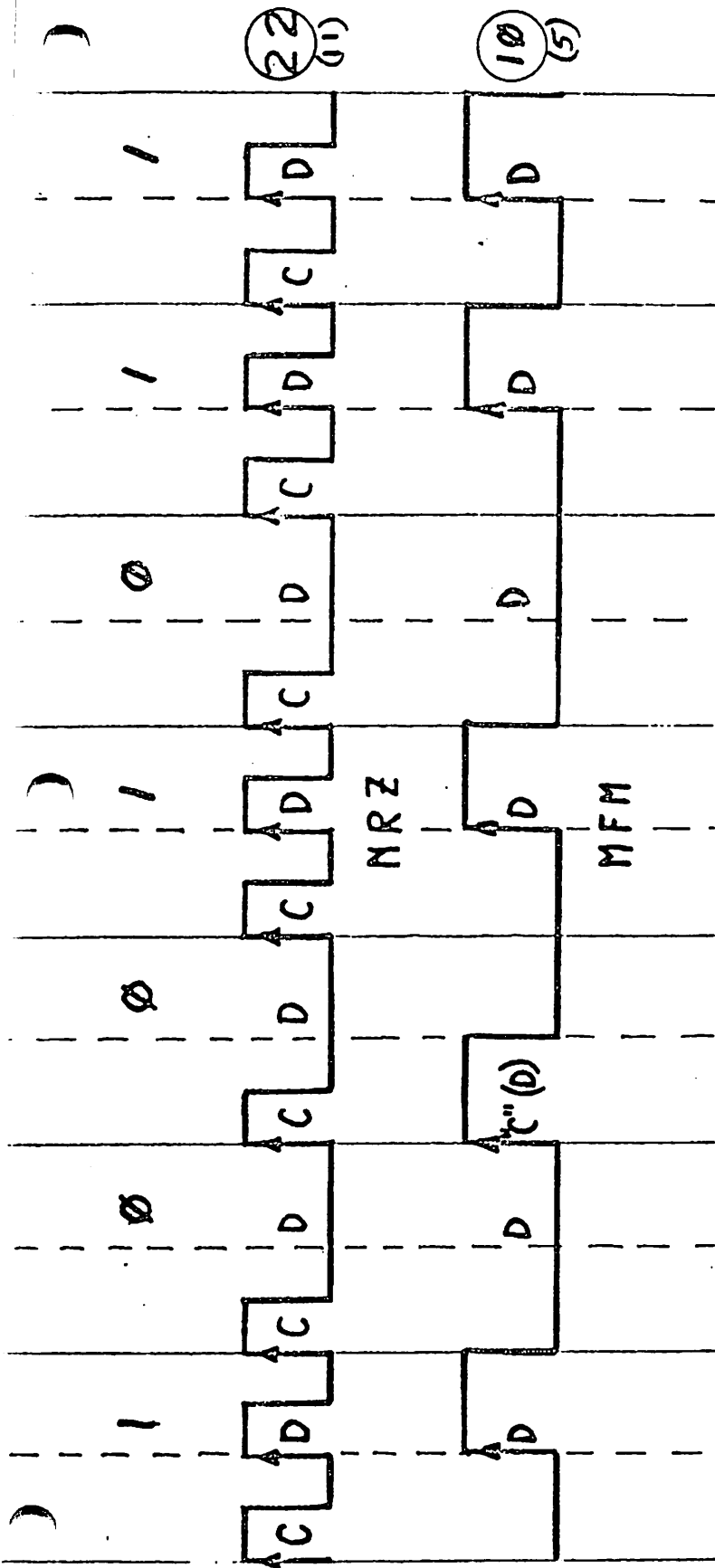
- 1. MOTION OF HEAD EXAGGERATED.
- 2. ALL WAVEFORMS IDEALLIZED FOR PURPOSES OF ILLUSTRATION.

13,440 Dibits found remainder of track



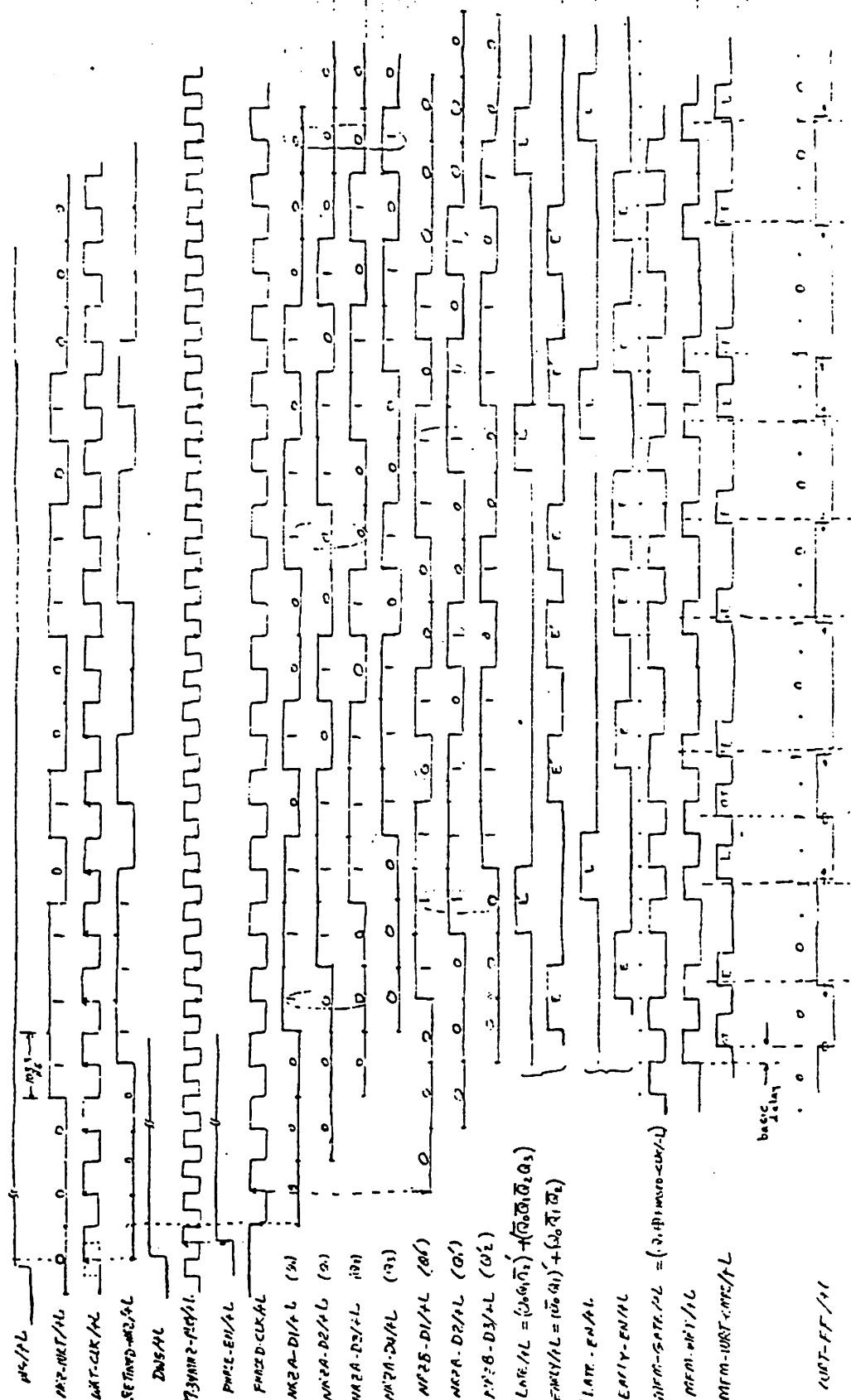
△ Propagation delay between U40/pin 8 and U40/pin 6 (Servo-Fine Board)





GENERAL Rules of NRZ vs. MFDM Recording

FUNCTION	NRZ	MFDM
Clock	Pulse at beginning of EACH Bit Cell time.	Pulse at beginning of Bit Cell time ONLY for a "0" which follows a previous "0".
"1" Bit	Clock pulse + data pulse at half-cell time.	Pulse at half-cell time.
"0" Bit	Clock pulse and absence of pulse at half-cell time.	A. If previous bit was a "1" - Absence of pulse at half-cell time. B. If previous bit was a "0" - Clock pulse at beginning of cell time.
Flux Transitions	A. At half-cell for every "1" bit (data) B. Between EACH AND EVERY pair of bits (clock).	A. At half-cell for every "1" bit (data) B. Between PAIRS of "0" bits only (clock) - not between "10" or "01" combination.



P3/M2-WRT
 M2M-SATE
 M2M-WRT-M2

INPUT/OUTPUT (I/O) CKT BRD
EM SLOT #1

1 ○
○
3 ○
○
5 ○
○
7 ○
○
9 ○
○
11 ○
○
13 ○
○
15 ○
○
17 ○
○
19 ○
○
21 ○
○
23 ○ Tag 3 (+)
○ Tag 2 (+)
25 ○ Unit Select Tag (+)
○ Tag 1 (+)
27 ○
○
29 ○
○
31 ○
○
33 ○
○
35 ○
○
37 ○
○
39 ○
○
41 ○
○
43 ○
○
45 ○
○
47 ○
○
49 ○
○
51 ○

CNTL/MUX CKT BRD
EM SLOT #2

- 1 ○
-
- 3 ○
-
- 5 ○
-
- 7 ○
-
- 9 ○
-
- 11 ○
-
- 13 ○
-
- 15 ○
-
- 17 ○
-
-
- 19 ○ Voltage Fault, -5v (-)
- Voltage Fault, +5v (-)
- Fixed Head Selected (+)
- 21 ○ Write Gate (+)
- Write Inhibit (+)
- 23 ○ NHSF - Non-existent head select fault (+)
- Voltage Fault, +20 or +32v (-)
- 25 ○ Read Gate (+)
- Voltage Fault, +20 or +32v (-)
- 27 ○ Write Protect (+)
- Unit Selected (+)
- 29 ○
-
- 31 ○ Unit Select/Logic Plug Address Compare (+)
-
- 33 ○
-
- 35 ○
-
- 37 ○
-
- 39 ○
-
- 41 ○
-
- 43 ○
-
- 45 ○
-
- 47 ○
-
- 49 ○
-
- 51 ○

SERVO COARSE CKT BRD
EM SLOT #3

- 1 o
- o
- 3 o Velocity
 - o Summing Amp (U30) output
- 5 o Emergency Retract Velocity Control
 - o Notch Amp (U10) output
- 7 o Velocity Current (DAC output)
 - o
- 9 o Enable Track Centering (+)
 - o 60 Hz Runout Compensator (Approx. 2v p-p)
- 11 o Offset Change Pulse (-)
 - o
- 13 o Track Center
 - o Unload Capacitor Voltage
- 15 o Cylinder Pulse (Raw) (-)
 - o Spindle Speed Sensor Pulse (600 us) (+)
- 17 o Cylinder Pulse (Shrunk - approx. 1.5 us) (+)
 - o
- 19 o
- o
- 21 o
- o
- 23 o
- o
- 25 o
- o
- 27 o
- o
- 29 o
- o
- 31 o
- o
- 33 o
- o
- 35 o
- o
- 37 o
- o
- 39 o
- o
- 41 o
- o
- 43 o
- o
- 45 o
- o
- 47 o
- o
- 49 o
- o
- 51 o

SERVO FINE CKT BRD
EM SLOT #6

1 o
o
3 o
o
5 o
o
7 o
o
9 o
o
11 o
o
13 o Positive Dibits, AGC'D
o Negative Dibits, AGC'D
15 o
o
17 o
o
19 o
o
21 o
o
23 o
o
25 o SPE (Servo Position Error)
o I-SPE (Servo Position Error-Inverse)
27 o
o
29 o
o
31 o
o
33 o
o
35 o
o
37 o
o
39 o
o
41 o
o
43 o
o
45 o
o
47 o 806 KHz Feedback
o
49 o
o
51 o PLO Test Input

READ/WRITE CKT BRD
EM SLOT #7

- 1 ○
-
- 3 ○
-
- 5 ○
-
- 7 ○
-
- 9 ○ Read Data (MFM)
- Read Data (MFM)
- 11 ○
-
- 13 ○
-
- 15 ○
-
- 17 ○
-
- 19 ○
-
- 21 ○
-
- 23 ○
-
- 25 ○
-
- 27 ○
-
- 29 ○
-
- 31 ○
-
- 33 ○
-
- 35 ○
-
- 37 ○
-
- 39 ○
-
- 41 ○
-
- 43 ○
-
- 45 ○
-
- 47 ○
-
- 49 ○
-
- 51 ○

+5VL - 2.5V
+5VM - 8.9V
+8.5 - 9.65V

WANG

LABORATORIES, INC.

MEMO TO: ALL FIELD ANALYSTS

FROM: TOM CAMP

SUBJECT: RELEASE 2.0 - VP O.S.
RELEASE 1.7 - MVP O.S.

DATE: APRIL 18, 1979

Enclosed you will find copies of latest operating system software for the 2200VP and 2200MVP. These operating systems are required for any system using a 2280 disk.

These operating systems will be shipped with all 2280 disk drives, however, a mass distribution to our existing customer base is not planned. A return reply card will be sent to all existing users, and those who desire the new release may obtain it through software distribution. It is strongly recommended that all users be upgraded to the latest release of these operating systems. A return reply card will be distributed from the Home Office announcing their availability.

A separate Marketing Release is planned to announce this to our sales force.

Please inform your users and vendors about the availability of these revised operating systems.

Tom
Tom Camp

TC:pn

Attachment

TECHNICAL NOTE #2605

Author: 2200 Development Group
Date: March 26, 1979
Subject: 2280 Disk Drives

Several things make the 2280 different than previous 2200 disks.

- (1) More than 32768 sectors.
- (2) More than 2 platters per drive.
- (3) Device type D.
- (4) Incompatibility with B, C, T series CPU.

These points are interrelated, but it is important that they be understood.

I. The CPU and the Disk Controller.

The 2280 disk drive will work with the 2200VP Release 1.9 or later, and with the 2200MVP Release 1.7 or later. It will not work properly with earlier releases, nor with a 2200 B, C, S, or T CPU.

In addition, the system bootstrap (which loads the operating system from disk) must be at least version R1 (ECN 9772) in order to be able to load from the 2280. One easy way to tell if an older machine has this bootstrap is to watch the screen while loading a system file. The older bootstrap displays the function key number on the top line, while the newer bootstrap displays the file name and device address. The system bootstrap can only load the operating system from the removable or 1st fixed platter of a 2280.

The drive needs to be cabled to the CPU via a 22C11 dual printer/disk or a 22C03 single disk controller. The present triple controller (22C31) should not be used, and the 2230 MXA is not supported at the present time. If an older 22C03 is used, a check should be made that it has the ECN 8051 made for the MVP, even if the 2280 will be used with a VP.

II. The Platter Size.

Floppy and hard disk platters that were created on a B, C, S, or T may not in general be COPYed to the 2280 and used. The MOVE statement or its software equivalent should always be used for the initial transfer. The same precautions may apply when transferrring data from a platter on which the index was created or modified by DATASAVE BA statements.

The potential problem occurs because on all previous drives, the '8000' bit of all sector addresses in the index was ignored. This gave a 15 bit sector address which sufficed until the 2280, larger which has a platter size. When a platter is MOVEd from another disk to the 2280, the operating system will reconstruct the high order bit to conform to the 16 bit structure of the 2280.

In addition to platter transfer, two similar or other potential problems can arise from software that uses DATASAVE BA and DATALOAD BA. On the 2280, for the first time, the high order bit of the two byte alpha sector address actually is used as part of the 16 bit sector address. It is conceivable, but not likely, that some software may assume otherwise. A more likely problem is existing utilities (including Wang's ISS) that deal directly with index sectors will deliberately strip off the highest order bit of each sector address before using it. These utilities must be changed before being used on the 2280. ISS Release 5.0 is 2280 compatible.

III. Device Type D

The 2280 is our first drive with more than 2 platters at a single address. (The triple floppy was accommodated by treating the 3rd platter as a single platter of a secondary drive). For this reason the concept of 3XX, BXX to address the two surfaces had to be extended. Device type D has been defined, and will normally be used for all 2280 operations. For all disk statements, if type D is specified, then a new meaning is assigned to the other two digits. The controller for the 2280 should be set at either 10, 20 or 30 and D10, D20 or D30 is the address to use to specify the removable platter of the drive. If the low order digit of a type D device address is non zero, it does not refer to the hardware (switch selectable) address, but to a specific platter. Thus the six platters of a 2280 at address 10 are referred to as D10, D11, D12, D13, D14, and D15. Note that a separate device (normally a printer) may be at 215 with no conflict at all since, for example, /D15 enables device 10 not 15. If two drives are daisy chained together the second may be address by D50, D51, D52, D53, D54, and D55. Note also that the F and R parameters may not be used when type D is selected; T must be used. For a more complete description of 2280 platter addressing refer to the "Model 2280 Disk Drive User Manual".

For disk controllers set to address 10, 20, or 30 the following device addresses are equivalent:

/310 ↔ /D11	/320 ↔ /D21	/330 ↔ /D31
/B10 ↔ /D10	/B20 ↔ /D20	/B30 ↔ /D30

for any 2200 disk on a 2200VP or MVP.

The biggest impact this has on existing software is that the choice of possible platter addresses has been greatly expanded. It is primarily for this reason that a new variation of the SELECT statement has been introduced:

```
SELECT #n < A$ >
```

which allows the device address to be specified as the value of an alpha variable.

For details see the release memo for VP Release 1.9 or MVP Release 1.7 or the new reference manual.

If \$GIO is used with an external address of type D, the same interpretation is made. Thus SELECT TAPE/D12:\$GIO (...) and SELECT #3/D14:\$GIO #3 (...) and \$GIO/D11 (...) will all enable the disk controller at address 10. The \$GIO address commands 7lxx and 73x0, when used with the 2280, must use the physical addresses 10, 20, 30, 50, 60 or 70 since there is no device type available to indicate that the low 4-bits specify a platter. The effects of any previously tried sequences can not be guaranteed at this time. Wang does not support any \$GIO sequences to the 2280 except \$GIO hog and unhog, and that should be replaced by a \$OPEN whenever possible. If and when it becomes advisable to support other sequences, they will be published as specific to the 2280.

MVP BASIC-2 RELEASE 1.7
(Platter 701-2294H)

Release 1.7 of 2200MVP BASIC-2 replaces all previous MVP BASIC-2 releases. Release 1.7 is required for any MVP with 2280 disk drives. This release also provides all MVP systems with several new features and corrects all known system anomalies. Listed below are the system changes since Release 1.6. The following files on the system platter differ from Release 1.6:

"@" - MVP OS & BASIC-2 interpreter.
"@MOVE" - Move system file utility.
"@FORMAT" - Format disk utility.

A. System Enhancements

The following enhancements are also available with VP BASIC-2 Release 1.9.

1. 2280 Disk Drives

Release 1.7 supports the 2280 disk drives; previous releases should not be used. For details concerning 2280 operations, see the "2280 Disk Drive User Manual".

2. Disk Platter Formatting

A format disk platter utility, "@FORMAT", for formatting 2260C, 2260BC, and 2280 disk platters resides on the system diskette. To format a disk platter, LOAD RUN "@FORMAT" and respond to the prompts as requested. The format utility makes use of the new \$FORMAT DISK statement to format the specified disk platter (see following description of \$FORMAT DISK).

3. Variable Device Address Specification

Device addresses used in SELECT statements can now be specified by the value of an alpha variable as well as explicitly by 3 hexdigits. Device addresses in SELECT statements have the following format:

$$\text{device address} = \left\{ \begin{array}{l} \text{hexdigit hexdigit hexdigit} \\ \langle \text{alpha-variable} \rangle \end{array} \right\}$$

where the value of the alpha variable must be 3 ASCII hexdigits representing the device type and address.

Examples:

A\$ = "320": SELECT #3<A\$> selects #3 to disk 320

A\$ = "215": SELECT PRINT<A\$>(132) selects print to device 215
with a line width of 132
characters.

\$FORMAT DISK

! General Form:

```
! $FORMAT DISK platter [ file # ] !  
! [ disk-address ] !  
!
```

Purpose:

The \$FORMAT DISK statement issues a command to the disk processing unit to format the specified disk platter. This statement can only be used with disks that support formatting under software control (e.g., 2260C, 2260BC, 2280). Formatting on certain 2200 disks (e.g., 2270) is initiated by pressing the format button located on the disk unit.

Before a platter can be used for the storage and retrieval of data by the user, the platter must be formatted. Formatting involves recording a unique address for each sector on the disk platter, along with other control information used by the disk processing unit when accessing a sector. All data within the sector is zeroed.

!Caution: Formatting a disk platter overwrites all!
!data that may previously have been stored on the !
!platter. It is recommended that the Wang supplied!
!format utility be used, to prevent the accidental !
!formatting of the wrong disk platter. !

Examples of valid syntax:

```
10 $FORMAT DISK T/310  
20 $FORMAT DISK T/D11  
30 $FORMAT DISK R#2
```

VP BASIC-2 RELEASE 2.0
(Diskette Platter 701-2118J)
(Minifloppy Platters 701-8127 BASIC-2 and 701-8128 Diagnostics)

Release 2.0 of BASIC-2 replaces all previous VP BASIC-2 releases. This release fixes one problem introduced in Release 1.9. Since Release 1.9 was not widely distributed, the documentation for Release 1.9 is included here. All description of Release 1.9 applies also to Release 2.0.

The following files on the system platter(s) differ from Release 1.9:

"@" - VP OS & BASIC-2 interpreter
"@MOVE" - Move system file utility.

A. Corrected Anomaly

1. LIST T did not work in Release 1.9. This has been corrected in Release 2.0.

VP BASIC-2 RELEASE 1.9
(Platter 701-2118H)

Release 1.9 of 2200VP BASIC-2 replaces all previous VP BASIC-2 releases. Release 1.9 is required for any VP with 2280 disk drives. This release also provides all VP systems with several new features and corrects all known system anomalies. Listed below are the system changes since Release 1.8. The following files on the system platter differ from Release 1.8:

"@"	-	VP OS & BASIC-2 interpreter.
"@MOVE"	-	Move system file utility.
"@FORMAT"	-	Format disk utility.
"@A","@B","@C"	-	System diagnostics

A. System Enhancements

The following enhancements are also available with MVP BASIC-2 Release 1.7.

1. 2280 Disk Drives

Release 1.9 supports the 2280 disk drives; previous releases should not be used. For details concerning 2280 operations, see the "2280 Disk Drive User Manual".

2. Disk Platter Formatting

A format disk platter utility, "@FORMAT", for formatting 2260C, 2260BC, and 2280 disk platters resides on the system diskette. To format a disk platter, LOAD RUN "@FORMAT" and respond to the prompts as requested. The format utility makes use of the new \$FORMAT DISK statement to format the specified disk platter (see following description of \$FORMAT DISK).

3. Variable Device Address Specification

Device addresses used in SELECT statements can now be specified by the value of an alpha variable as well as explicitly by 3 hexdigits. Device addresses in SELECT statements have the following format:

$$\text{device address} = \left\{ \begin{array}{l} \text{hexdigit hexdigit hexdigit} \\ \langle \text{alpha-variable} \rangle \end{array} \right\}$$

where the value of the alpha variable must be 3 ASCII hexdigits representing the device type and address.

Examples:

A\$ = "320": SELECT #3 <A\$> selects #3 to disk 320

A\$ = "215": SELECT PRINT <A\$> (132) selects print to device 215
with a line width of 132
characters.

4. System Diagnostics

The system diagnostics, accessible immediately after power on, have been rewritten to support the larger memory configurations and to provide better memory diagnosing with more consistent error messages and improved displays.

5. MOVE/COPY

The MOVE and COPY disk operations now make more efficient use of memory for buffering; these operations are now up to 15% faster.

6. \$RELEASE PART

The syntax for the MVP \$RELEASE PART statement is supported; however, the statement is ignored if executed.

7. Reloading System Software

Executing \$INIT "SYSTEM" in immediate mode, allows the system to be reloaded with BASIC-2 or a system diagnostic without powering the system off and then back on. When \$INIT "SYSTEM" is executed, control is passed to the system bootstrap. The bootstrap message

```
MOUNT SYSTEM PLATTER  
PRESS RESET
```

is displayed and the system can be loaded, as if the system had just been turned on. Note that the program and data in memory are cleared when \$INIT "SYSTEM" is executed.

B. Corrected Anomalies

1. If the ERROR statement was used to recover from an error within a subroutine called from a special function key, the system lost the subroutine return information. This would result in ERR P41 when RETURN was executed.
2. The system did not always detect the illegal occurrence of alpha array elements where numeric variables were expected.
3. If variables were used to specify array dimensions (e.g., DIM X(R,C)) during program overlaying, erroneous memory overflow errors (ERR A02) might be reported by the system. This could only happen if the program text being overlaid was larger than that of the overlay loaded, more variables were defined in the overlay than existed in the original program, and most of memory was used.

4. A PACK statement with an exponential image could modify the values of the variables containing the data to be packed. If an exponential image in a PACK statement did not have exactly 1 integer digit specified and the data to be packed was specified by a numeric array designator (e.g., N()), the result of the pack would be correct but the exponents of the values in the numeric array would be changed.
5. MVP global variables (e.g., @X\$) were listed by LIST V as local variables (e.g., X).
6. SELECT P timing was approximately 10% fast.
7. \$CLOSE disk did not release (unhog) the specified disk unit. \$CLOSE /xyy should have been equivalent to \$GIO /xyy (4400) disk unhog.

\$FORMAT DISK

```
! General Form:
!
!   $FORMAT DISK platter [file #
!                       [disk-address]
!
```

Purpose:

The \$FORMAT DISK statement issues a command to the disk processing unit to format the specified disk platter. This statement can only be used with disks that support formatting under software control (e.g., 2260C, 2260BC, 2280). Formatting on certain 2200 disks (e.g., 2270) is initiated by pressing the format button located on the disk unit.

Before a platter can be used for the storage and retrieval of data by the user, the platter must be formatted. Formatting involves recording a unique address for each sector on the disk platter, along with other control information used by the disk processing unit when accessing a sector. All data within the sector is zeroed.

```
!Caution: Formatting a disk platter overwrites all!
!data that may previously have been stored on the !
!platter. It is recommended that the Wang supplied!
!format utility be used, to prevent the accidental !
!formatting of the wrong disk platter. !
```

Examples of valid syntax:

```
10 $FORMAT DISK T/310
20 $FORMAT DISK T/D11
30 $FORMAT DISK R#2
```

PHOENIX

16 MEGABYTE/SURFACE	30 ms	DATA XFER RATE
64 SECTORS/ TRACK	822 TRACKS/SURF.	(400) TPI
		3600 RPM $\pm 2.5\% - 3.5\%$
1 -1	CDC 32 MEG	2280
-2	60	27 MEG
-3	90	56
		80.5
		1 F + 1 R HEAD
		3 F + 1 R HEAD
		5 F + 1 R HEAD

3 FIXED SURFACE & 1 REMOVABLE PLATTERS 6 WRITING SURF. 2 SERVO SURF.
 SEEK TIME (0-822) 55 msec | TRK - 6 MILS Avg. - 30 MILS. 74 IPS MAX - 11 IPS MIN
 OUTER TRACK 0 4038 BPI 136 MPH
 INNER 822 6038 BPI 98 MPH
 POWER 120V $\pm 8-18$ 60 Hz $\pm 6-1$

MAJOR ASSEMBLIES

- ELEC. MODULE ① I/O BRD ② CNTRL/MUX ③ SERVO COARSE ④ ALIGN. EXT.
 ⑤ NOT USED ⑥ SERVO FINE ⑦ R/W
 A/W & SERVO PREAMP
 RECEIVER ASSY. ① CARTRIDGE IN PLACE INTERLOCK ② RECEIVER IN PLACE INTERLOCK
 ③ DECK DOWN INTERLOCK
 DECK ASSY. ① ACTUATOR ASSY. ② SPINDLE & MOTOR ③ THERMAL OVERLOAD SW. (2 MIN. DELAY DOWN STAGE)
 ④ FIXED DISK MODULE
 USB PIN 14 TO U39 PIN 2 IF CUT ETCH, DRIVE SELECTED AS #1
 POWER ON INSTALL - REMOVES 2 BOLTS DISCONNECT AIPI (Purge Unit) 5 or 10 MIN
 ① AC APPLIED (CB) ALL INTERLOCKS CLOSED NO FAULTS

SERIAL # A876700 - ANY PART WITH # BELOW THIS DON'T USE

SPINDLE SPEED CHECKED EVERY 20 MIL SEC. SENSED BY LIGHT EMITTING DIODE & SENSING XISTOR

POWER SUPPLY

- ① FERRORESONANT X FORMER ② IEMATTING FOLD BACK DEVICE $\pm 32V$
 $\pm 5V \pm 20$ INTERNALLY REGULATED $\pm 20 \Rightarrow \pm 15 \pm 12 \pm 6V$ ANALOG CIRC. SERVO %
 ① 12 MICROPROCESSOR + MEM. CIRC.
 ± 5 LOGIC ± 32 VOLTS COIL + EMERG. RETRACK

VELOCITY GAIN ADJ. WAIT FOR READY THEN BUT SW. 8 ON
 ON ~~CNTRL MUX~~ SERVO COARSE (RED UP ON)
 THEN USING CR3 - CR7 TURN POT ON SERVO COARSE BRD FLIPPING
 SW ON CNTRL MUX UNTIL CR5 STAYS ON, ADJ. TO MID POINT

SERVO COARSE

- ① POSITION VELOCITY & OFFSET COMMAND GENERATOR
 - ② ACTUATOR DRIVE CIRC.
 - ③ SERVO SYS. VELOCITY FEEDBACK
 - ④ " " ACCELERATION
 - ⑤ ACTUATOR RETRACT (UNLOAD OF HEADS)
 - ⑥ COMPENSATION CIRC.
 - ⑦ TRACK CTR. DETECTION CIRC.
 - ⑧ CYC. PULSE GENERATOR
 - ⑨ END OF TRAVEL DETECTION
 - ⑩ SPINDLE SPEED PULSES
- SERVO FINE

- ① VARIOUS CLOCKS GEN. BY PHASE LOCK LOOP CIRC.
- ② SERVO POSITIONING ERROR SIGNAL
- ③ AGC ACTIVE + NOT ACTIVE (ACTIVE WHEN CARL MOVING)
- ④ INDEX PULSE, SECTOR SYNC & INHIBIT LOGIC SIGNALS
- ⑤ VOLUME SELECT
- ⑥ HEAD SIGNALS (ALIGNMENT)

R/W

- ① R/W OPERATIONS
- ② NRZ TO MFM ENCODER
- ③ WRITE PROTECT

MICROPROCESSOR FUNCTIONS (SERVO COARSE BRD)

- ① SPINDLE START/STOP & SPEED MONITORING (20 MILS)
- ② SERVO COARSE POSITIONING
- ③ SERVO HEAD CHANGE
- ④ SELF DIAG. OF MICROPROCESSOR
- ⑤ CONTROLS FAULTS w/ LEDs

40 PIN CHIP

16 BIT MEM. ADDR. (64K OR RAM OR ROM)

8 BIT DATA BUS

I/O PORT ADDRESSING CAPABILITY 256 IN & OUT

TTL COMPATIBLE

I/O BOARD "A" CABLE

- ① I/O LATE & EARLY STROBE
- ② SELECT LINE
- ③ CLEAR FAULT STATUS
- ④ CYC. ADDRESSES
- ⑤ SEEK
- ⑥ RTZ

CNTRL MUX "B" CABLE

- ① B CABLE SIGNALS
- ② READY, FAULT LED - LED ACTIVE
- ③ HEAD SELECT

ECL LOGIC

SUPPLY VOLTAGE 5.2V_{EE}
LOGIC 0 -1.7V
LOGIC 1 .6V

1. OUTPUTS MUST NOT BE TIED HI OR LOW
2. SUSCEPTIBLE TO STATIC
3. ECL TENDS TO HEAT UP IN IDLE MODE

~~8080 MICROPROCESSOR~~ ERR CORRECTION 12 BITS/SECTOR
LOADS OFF OF REMOVABLE SERVO
ALIGNMENT

CHANGE TO FIXED SERVO

ADJ. R SERVO TO 1ST M PATTERN TIGHTENED TO 6 lb/INCH
GO TO TRACK 404, ADJ. TO < 50 milV
800, < 350 milV
8, < 350 milV TIGHTEN TO 12 lb/INCH

- R_{DATA}
1. S_i OF SERVO FINE IS S
 2. S_i OF ALIGN EXT. IN FXD
 3. HO ALIGN. BRG. SWA-N SWB-R/W SW3-X1
 4. LOOSEN R HEADS TO 6 lbs/IN.
 5. ALIGN. R SERVO HEAD TO TRACK 0
 6. SEEK TO 404 - ADJ. TO < 50 milV
 7. TIGHTEN SERVO HEAD TO 12 lb/IN & RECHECK 404 AFTER RTZ
 8. CHECK TRACKS 8 & 800 < 350 milV
 9. S_i OF SERVO FINE IN D
 10. S_i OF ALIGN. EXT IN NORMAL
 11. HO. ALIGN BRG. SAME AS STEP 3.

LOOK AT
READ SIGNAL
ON ALIGN BRD.

MICROPROCESSOR

L567, T HEATSINK, 210-7415 R0, 210-7424 R1, 210-7423 R1 (R2 PROMS)
210-7421 (I/O BOARD TO CPU) PRINTER CABLE
210-7422 TO DRIVE (COLOR CABLE BLK BOTTOM, ON DRIVE BLACK TOP)
DEVICE 1 RIBBON CABLE MIDDLE SLOT, BLK DOWN, ON DRIVE BLACK UP)

EXTENDER BOARD

F/N

F - TRACK OFF FIXED

N - TRACK OFF REMOVABLE

ALIGNMENT BOARD

S/RW

S - LOOKING AT SERVO HEAD W/ SCOPE TRACKING ON

RW - LOOK AT REM. DATA OR SERVO ACCORDING TO SERVO FINE

SERVO FINE

D/S

D - LOOKING AT DATA HEAD

S - LOOKING AT SERVO HEAD

ADVANCED DISK

TUES - INTRO / CDC CIRCUITRY / 300 POWER SUPPLY
WED - 1ST SEEK / DIRECT SEEK / SERVO SURFACE / FTU
THUR - FINISH SERVO / I/O / CLK
FRI - R/W
MON - 75 MAJOR DIFFERENCES
TUES - "
WED - Px - MICROPROCESSOR
THUR - TROUBLESHOOTING

COIL - 3-4 Ω s

75 MEG ALIGNMENT DISK - ONLY 330 SERVO TRACKS THEN GUARD BAND

75 MEG - VOICE COIL BEARINGS SHOULD BE CHECKED WHEN REMOVED OR REPLACED

ADJ. - 2 DIV CHANGE FROM CENTER TO EITHER END

75/300 - \leq 200 GRAMS TO MOVE CARRIAGE

75 MEG - BEARING ADJ. TOOL - \leq 2 DIV MOVEMENT FOR CTR TO EITHER END

RAIL ADJ. TOOL

SPINDLE ADJ. TOOL - FOR 75 & 300

TPA + Z ALWAYS GROUND - B6/7

BOARD TYPE CKFV ^{REV LEVEL}

SEEK ERRORS - 4 CAUSES MUST RTZ TO CLEAR

1. MAX ADDRESS FAULT

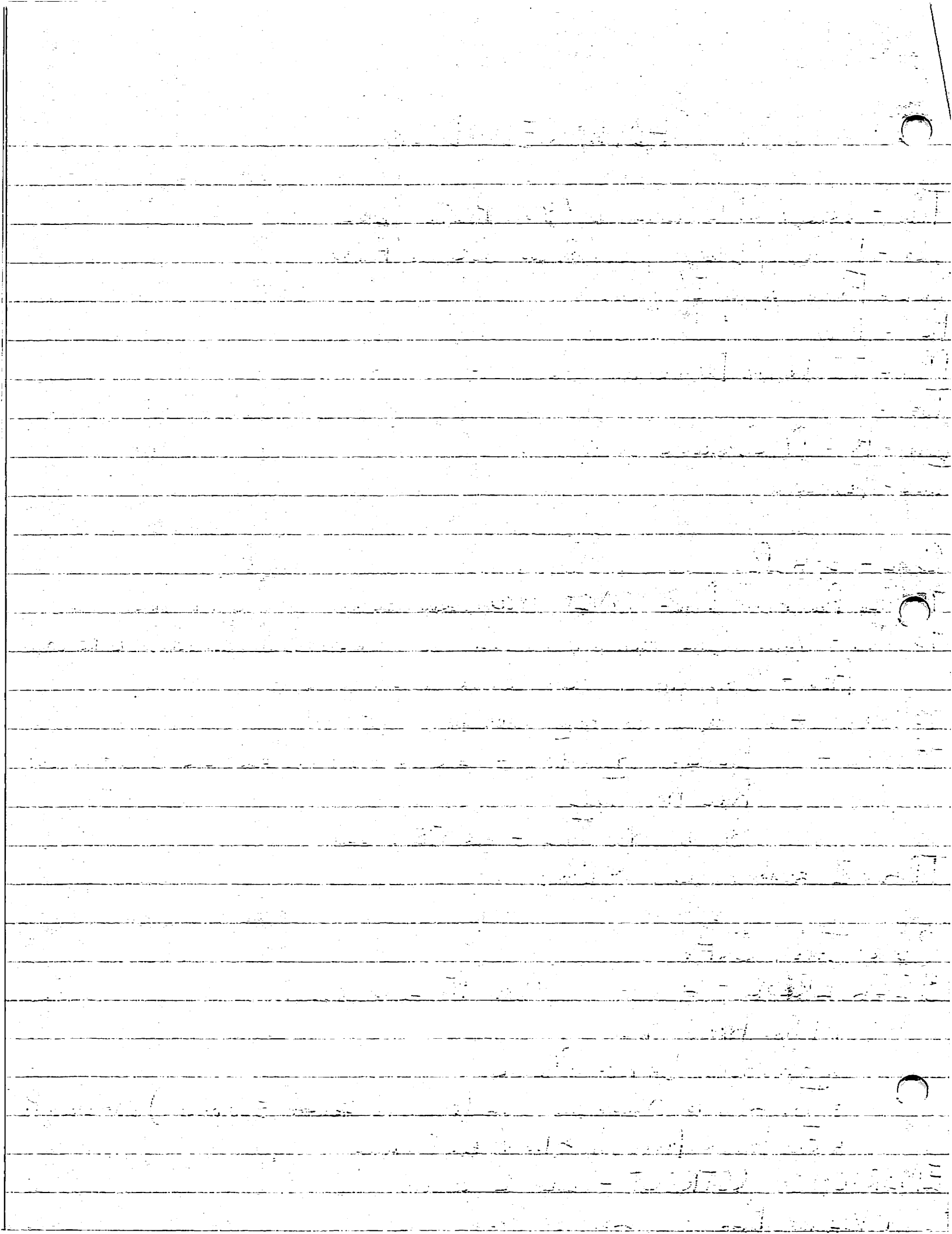
2. HIT GUARD BAND BY MISTAKE

3. TOO LONG TO ACCOMPLISH SEEK (MUST BE ~~AT LEAST~~ WITHIN 500 MILLISEC) 80 MILLISEC ON Px

4. FIND POSITION ANALOG V. $>$ 1.61V FOR 800 MUSEC.

EMERGENCY RETRACT - ONLY 2 REASONS:

1. VOLTAGE FAULT 2. LOSS OF SPEED

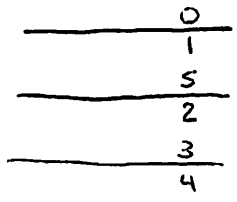


MPI - MAGNETIC PERIPHERAL INC. (70% CDC 16% HONEYWELL 14% UNIVAC)

P₁ - NIX (80)
 9448 BP3/BP4
 FIXED HEADS LABELED - 0-4
 REM. HEAD - 0

75 MEG (65V-1)
 9760/62
 BK4xxx - 40 MB (DIFFERENT DATA HEAD, 4 TRACKS NOT USED BY WANG)
 BK5xxx - 80 MB
 BK4/S - EQUIP. ID
 xxx - TYPE ID (CDC OPTIONS)
 BJ - MUX INTELLIGENT INTERFACE (NOT USED BY W)
 5 PLATTERS TOP & BOT. PROTECTION PLATTERS

300 MEG (65V-2)
 9764/66
 BK6xxx - 150 MB (NOT USED BY WANG)
 BK7xxx - 300 MB
 12 PLATTERS. TOP/BOT PROTECT PLAT.
 0|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18
 SPINDLE SPEED / V FAULT - EMERG RETRY



208V - 60 Hz 300 MB
 60 PIN "A" CABLE
 SINGLE CH. (NO PACK LOCK)
 SECTOR / INDEX - B CABLE

xxx - C2A
 120V / 60 Hz
 80 MB SINGLE CHANNEL
 60 PIN A CABLE
 INDEX & SECTOR MARKS
 VS - 9 ~~SECTOR~~ INDEX MARK IS ALSO SECTOR MARK

SPEC. 59°-90° F (60-80) HUMIDITY 20%-80% (40-60) ^{BK4/6 411} 823 CYL. ¹⁹² 384 TRK/IN.

TRK SPACING = .0026" CTR - CTR TRK WIDTH = .002"

OUTER TRK - CYL 0 4038 BPI INNER TRK = CYL 822 6038 BPI

DATA RATE - DRIVE ↔ CONTROL 967 MEG Hz 1,209,600 BYTES/SEC.

VOICE COIL / SERVO - (CLOSED LOOP) MAX SEEK 0-822 55 MIL SEC

MIN SEEK 1 TRK 6 MIL SEC AVG SEEK 30 MIL SEC

AVG LATENCY TIME - 8.33 MIL SEC (TIME FROM ON TRK TO DATA UNDER HEAD)

3600 RPM 16 DRIVES / CONTROLLER

FMD - SHOULD BE LEFT IN COMPUTER ENVIRON. 2 DAYS BEFORE INSTALL. PURGE 2-3 HOURS.

HEAD CRASH - HDI (HEAD DISK INTERFERENCE)

AREA - PACK INSPECTOR - CHECKS BALANCE AND SURFACES

75 + Px HEADS - SAME 300 HAS CABLE COMING OFF OTHER SIDE - OTHERWISE SAME

BRUM K₀ HEAD - \$60 COMPARED TO \$125 STIFFER HEAD LOAD SPRING

WHITE HEAD PAD - INDENTED SURFACES

CLEANING HEADS

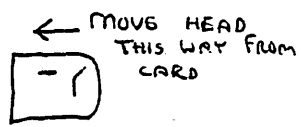
1. BLOW OFF HEAD W/ AIR DUSTER.

2. MOISTEN SPOT ON IBM CARD.

ZIG-ZAG FROM SPOT WITH HEAD.

MOVE AGAINST ANGLE ON HEAD

3. DUST HEAD



BLOWER MOTOR - COOLING, POSITIVE AIR PRESSURE SHOULD BE ON WHEN

CHANGING PLATTERS AS BLOWS DUST UP & OUT SHOULD BE ON 24 HR

DOES NOT AFFECT HEADS FLYING.

75 MEG - ONLY 330 SERVO TRACKS THEN GUARD BAND

FTU - TB216

DEVICE CODES Px - 8905 BK5 - 0905 BK7 - ~~0919~~

LAST TWO NUMBERS REPRESENT # OF HEADS - Px & BK5 - 5 HEADS

FIRST 2 NUMBERS - 8 - CMD

- 8 - INDEX & SECTOR PULSES ON B CABLE

- 1 - 823 CYLINDERS.

WRITE ENABLE FTU

① DATA ENTRY - B KEY 5754

② DATA ENTRY - E (TOP ROW 5TH FROM LEFT ON ONLY)

KEY DISPLAY, BIT, 1, LOAD

③ WRITE PROTECT - OFF

④ DATA PATTERN - E36C

SEEKERS ① LOAD/UNLOAD/RTZ ② DIRECT SEEK ③ FINE SEEK LAST 1/2 TRACK OF SEEK SEEK FINISH

> 128 CYLINDERS - MAX SPEED UNTIL 128 CYL. OR LESS AWAY.

DECELERATES FOR EACH CYL. PAST AFTER ~~128~~ WITHIN 128 CYL. OF DESTINATION

SERVO SURFACE

PURPOSES

1. CYLINDER CROSSING
2. FINE POSITIONING
3. KEEP ON CYLINDER
4. REOT, FEOT DETECTION
5. GENERATES CLOCKS 806 KHZ (13440 DIBITS AT 3600 RPM)

DIBITS

POSITIVE - ODD \downarrow TRACK HAS 6720 ALL POSITIVE DIBITS AT INTERVALS
 NEGATIVE - EVEN \uparrow TRACK HAS 6720 ALL NEGATIVE DIBITS AT INTERVALS
 ODD EVEN ALONG TRACK

SERVO TRACK - CENTER BETWEEN POS + NEG DIBIT TRACKS

OUTER GUARD BAND - 24 POS. ^{ODD} DIBIT TRACKS

INNER GUARD BAND - 36 NEG EVEN DIBITS

ON INITIAL LOAD 350 MILLISEC TO START SEEING DIBITS WHEN HEADS START TO ^{TRAVEL}

I/O

BUS - 10 LINES

0-9

3 TAG LINES

TAG 1 - CYL. ADDRESS ON BUS TAG 2 - HEAD ADDR. ON BUS TAG 3 - CONTROL

MFM - "0" - NO FLUX REVERSAL MIDDLE OF CELL

"1" - FLUX REVERSAL MIDDLE OF CELL BIT

CLOCK - BETWEEN 2 "0" CELL BITS

TITLE: 80/300 MB DISK DRIVE

SMD QUIZ #1

REV. 2

DO NOT WRITE IN THIS HANDOUT

1. A Series Code 18 SMD can be replaced by a Series Code 10 SMD.

- A. True
- B. FALSE

2. The Speed Transducer on the 80 MB disk produces approximately?

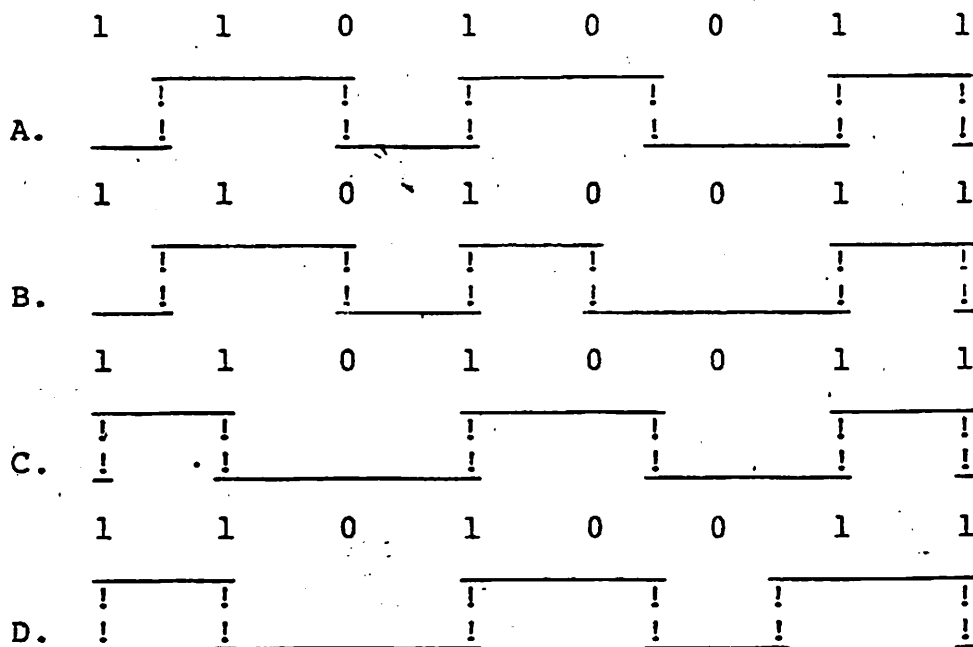
- A. 3600 Pulses/min.
- B. 3600 Pulses/hour
- C. 7200 Pulses/hour
- D. 7200 Pulses/min.

3. Given the following Rules, which pattern is correct for the following Data Bits? 1 1 0 1 0 0 1 1

RULES: There is a flux transition for each "1" bit at the time of the "1".

There is a flux transition between each pair of "0" bits.

There is no flux transition between the bits of a "10" or "01" combination.



4. What three (3) functions are accomplished in proper order during the Power-On sequence in the 80 MB disk?
- A. Brake power is disabled, AC to the drive motor, heads are loaded.
 - B. AC to the drive motor, heads are loaded, brake power is disabled.
 - C. Heads are loaded, AC to the drive motor, brake power is disabled.
 - D. Brake power is disabled, heads are loaded, AC to the drive motor.
5. What Condition has happened if Bus Bits 0, 2, 6 and 9 are TRUE and TAG 1 is received?
- A. Cylinder 581 octal has been selected
 - B. Head 5 has been selected
 - C. Cylinder 581 decimal has been selected
 - D. Illegal combination of tag and bits.
6. What is TAG 2 used for?
- A. Head select
 - B. Cylinder select
 - C. Control select
 - D. Unit select
7. In the 80 MB Disk, what is the name of the signal on A2B06-02B?
- A. Nn signal present
 - B. -CH 1 Control select
 - C. +DIFF Bit 7
 - D. + T = 256
8. The position on a pin that a wire is wrapped is referred to as the _____ ?
- A. Level 1
 - B. Level 2
 - C. Z Level
 - D. V Level

9. In what Cable is the Index Pulse located?

- A. "A" cable
- B. "B" cable
- C. "C" cable
- D. "Ground" cable

10. What two (2) conditions will retract the heads with Emergency Power?

- A. Low speed, write fault
- B. Low speed, no head select
- C. Low speed, voltage fault
- D. Low speed, no dibits

11. The recordable surface beneath one head is called?

- A. Track
- B. Cylinder
- C. Sector
- D. Index

12. How many Filters does the SMD have?

- A. 1
- B. 2
- C. 3
- D. None

13. If Dibits are not detected within 350 Msec after Head Load, what would be the result?

- A. Disk drive would power down
- B. Heads would load
- C. Heads would unload
- D. Nothing

14. What controls the velocity of the carriage during an Emergency Retract?

- A. Emergency Retract relay ALK2
- B. Transistor Q9
- C. Transistor Q10
- D. Velocity transducer

15. On Initial Spindle Motor Start of the 80 MB disk, AC is applied to the Start Winding only.

- A. True
- B. False

16. What bus bit is, Servo Offset Positive?

- A. Bit 9
- B. Bit 3
- C. Bit 2
- D. None of the above

17. How many types of Dibits are there?

- A. 1
- B. 2
- C. 3
- D. 823

18. Convert the Hex term 9CF3 to Octal.

- A. 113636
- B. 116363
- C. 937842
- D. 116364

19. By what means in Index detected?

- A. By missing Dibits
- B. By the Index Transducer
- C. By Cylinder Pulses
- D. By software means

20. When data is read from the recording surface, it is destroyed on the surface.

- A. True
- B. False

21. What Write Current Zone would the unit be in if at Cylinder 383?

- A. F
- B. D
- C. C
- D. A

22. Cylinder Pulses are used to:

- A. Switch from Course to Fine control
- B. Decrement Cylinder Address Register
- C. Decrement Difference Counter
- D. All of the above.

23: The temperature of the 80 MB Disk Drive Motor is monitored by?

- A. External thermal switch
- B. Speed transducer switch
- C. Internal circuit breaker
- D. Internal thermal switch

24. How many Servo surfaces does the SMD disk pack have?

- A. 1 on the 80 MB
- B. 2 on the 300 MB
- C. Both A and B
- D. One for each platter

25. Of the 10 surfaces on the 80 MB Disk Pack, how many are used for data?

- A. 4
- B. 5
- C. 6
- D. 10

DO NOT WRITE ON THIS HANDOUT

Questions 1 thru 18 pertain to the TB 304.

1. How many access modes does the TB304 have?
 - A. 5
 - B. 3
 - C. 9
 - D. 4

- X. The Disk Format that the FTU writes is compatible with the WANG System Format.
 - A. True
 - B. False

- X. During head alignment, in what position should the SEQ/MAN switch on the FTU be placed?
 - A. OFF
 - B. ON
 - C. SEQ
 - D. MAN

4. The Heads Switch on the FTU should be in what position when aligning heads on the SMD Disk Drive?
 - A. LO for BK7XX
 - B. HI for BK5XX
 - C. To correspond to the number of tracks of the drive under test.
 - D. To correspond to the number of heads of the drive under test.

5. Read data is displayed in what bits on the FTU?
 - A. 0-4
 - B. 1-16
 - C. 1-7
 - D. 0-7

6. What is the "OFF" position of the Wrt-Rd Select Switch used for?

- A. Formatting
- B. Read
- C. Head alignment
- D. Write

~~7~~. The FTU will operate on 120 or 240 VAC without any modifications.

- A. True
- B. False

8. Pin 1 of P3 corresponds to Pin 16 of A02.

- A. True
- B. False

9. The character-count display provides an indication of how far from Index the error occurred.

- A. True
- B. False

~~10~~. What is a segment of a track called?

- A. Sector
- B. Dibit
- C. Index
- D. Format

11. There are sector switches that need to be set on the FTU.

- A. True
- B. False

12. The I/O Bypass Cable can be used on the CMD Disk Drive.

- A. True
- B. False

~~13~~. In what slot is the Head Alignment Card installed when aligning the Heads of a 288 MB Disk Drive?

- A. A02
- B. A16
- C. B16
- D. B02

~~X~~. What conditions must be met in order to sequence the Disk Drive up from the FTU?

- A. The drive must be in the Remote mode
- B. the drives Start switch must be ON
- C. Power must be available to the drive
- D. All of the above

~~X~~. Write Protect is enabled when the Head Alignment Card is installed in the disk drive.

- A. Write protect must be turned on at the operators panel
- B. Only if the "MODE" light is "ON"
- C. True
- D. False

16. Sequential Reverse access mode requires that a address be put in the FTU cylinder address switches.

- A. True
- B. False

17. What is the name of the indicator that tells the HSFV that its input signal is to low to operate?

- A. Power
- B. Input
- C. Mode
- D. Bad Track

18. What is the setting of the FTU sector switches for 64 sectors?

- A. Sector switch 64 ON
- B. Sector switch 64 OFF
- C. Sector switch 1,2,4,8,16,32 OFF; 64 ON
- D. Sector switch 1,2,4,8,16,32 ON; 64 OFF

Questions 19 thru 25 pertain to the TB 216.

~~X~~. The Device Type Code for the 288 MB drive is _____.

- A. 0905
- B. 0919
- C. 2265
- D. None of the above.

20. To observe the cylinder address being sequenced, you would place the DATA ENTRY switch in the STATUS BYTES position and then press key _____.
- A. A
 - B. B
 - C. 1
 - D. 2
21. With ERROR OVERRIDE switches down and a WRT/RD FORMAT or WRT/RD test in progress, the tester will stop exercising the drive in the event of a data or address error.
- A. True
 - B. False
22. The LOAD button;
- A. Translates lower lights to Octal.
 - B. Translates upper lights to Hex.
 - C. Transfers contents of lower lights to upper lights.
 - D. Transfers contents of upper lights to lower lights.
23. In order to run the LAMP TEST, which button is pressed?
- A. START
 - B. LOAD
 - C. GO
 - D. RESET
24. Which is not true about the TB 216 FTU.
- A. It is heavier than the TB 304.
 - B. It is more expensive than the TB 304.
 - C. It does more than the TB 304.
 - D. None of the above.
25. The FIXED VOLUME position of the ACCESS SELECT switch applies to CMD's only.
- A. True
 - B. False

DO NOT WRITE IN THIS HANDOUT

1. What Component is at location A3L2 in the 80 MB disk?

- A. Heads load switch
- B. Hysteresis brake
- C. Servo capacitor
- D. Velocity transducer

2. On the 80MB disk drive +5 VDC must be adjusted to?

- A. $\pm 5.1 \pm 0.05$ Vdc
- B. $+5.1 \pm 0.05$ Vdc
- C. $+5.1 \mp 0.05$ Vdc
- D. $\pm 5.0 - 0.05$ Vdc

3. What is TAG 3 used for?

- A. Cylinder select
- B. Control select
- C. Head select
- D. Unit select

4. The 300 MB Disk Drive Head Alignment track is _____ ?

- A. 555g
- B. 753g
- C. 640g
- D. 4911g

5. In what Cable is the Seek Error signal located?

- A. "A" Cable
- B. "B" Cable
- C. "C" Cable
- D. "GROUND" Cable

6. If the 80 MB Disk Drive was unable to complete a seek within 500 Msec., what kind of error will be indicated?

- A. Seek error
- B. Seek end
- C. Track error
- D. Sector error

7. The Outer Guard Band contains _____ ?

- A. 24 Positive even dibit tracks
- B. 36 Negative even dibit tracks
- C. 24 Positive odd dibit tracks
- D. 36 Negative odd dibit tracks

8. What is the Maximum Count that the Sector Counter will go to before generating a Sector Pulse?

- A. 4095
- B. 13,440
- C. 4096
- D. 3886

9. What condition would the FTU show if you tried to seek to Cylinder 512g on a 80 MB CE pack?

- A. Seek error
- B. Servo Fault
- C. Normal
- D. Normal if cylinder bypass is selected.

10. How is the Servo Head selected to see the Dibits when doing a Head Alignment?

- A. By the FTU
- B. By control mode
- C. By the HFSV card
- D. It cannot be selected

11. What is the Full Length Seek Time on a 300 MB disk Drive?

- A. 52 TO 54 Msec
- B. 50 TO 54 Msec
- C. 60 TO 65 Msec
- D. 50 TO 54 Usec

12. The total amount of recording surface available without moving the heads is called a _____ ?

- A. Track
- B. Cylinder
- C. Disk
- D. Sector

13. In what order are the 300 MB Servo System Adjustments done?

- A. Integrator, Fine Velocity, Coarse Position
- B. Fine Velocity, Integrator, Coarse Position
- C. Coarse Position, Fine Velocity, Integrator
- D. None of the above

14. The Plus and Minus 5 Volt Regulator card of the 300 MB Disk Drive is in location A20.

- A. True
- B. False

15. On the 300 MB Disk Drive, the Head Alignment Card would be plugged into A16.

- A. True
- B. False

16. During "Write Format" with the FTU, Data Errors will not be indicated.

- A. True
- B. False

17. On the 80 MB Disk Drive, what is the Signal at A2B09-07A called?

- A. +Desired velocity
- B. -On cylinder
- C. -Head alignment
- D. -Forward seek

18. The Disk Motor and Disk Pack on the 80 MB are stopped by _____ ?
- A. Disk Pads
 - B. Two Permanent Magnets
 - C. Magnetic Field
 - D. Concentric Permesable Bodies
19. How many access modes does the TB304 have?
- A. 5
 - B. 3
 - C. 9
 - D. 4
20. Which of the following Error conditions will NOT turn the FAULT light ON?
- A. Write while Reading
 - B. Seek Error
 - C. Low Voltage
 - D. Select two heads
21. The mode of data transfer from the controller to the disk drive is _____ ?
- A. Byte Parallel
 - B. Bit Parallel
 - C. Byte Serial
 - D. Bit Serial
22. What condition would the FTU show if you tried to seek to Cylinder 513g on a 300 MB CE pack?
- A. Seek Error
 - B. Servo Fault
 - C. Normal
 - D. Normal if cylinder bypass is selected

23. Where did the signal that is on pin B02-16A originate?

- A. B0104A
- B. B0216A
- C. JA82-08B
- D. JA82-08A

24. Write Protect is enabled when the Head Alignment Card is installed in location A2A02 on the 80 MB drive.

- A. True
- B. False

25. A 300 MB CE Disk Pack can be used to adjust Velocity Gain.

- A. True
- B. False