6101

WANG

Wang Computer Systems 60 & 80
Volume 2 System Installation

Customer Engineering
Product Maintenance Manual

741-0715

PREFACE

This document is the installation manual for the VS-60/80 Computer Systems The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to install the VS-60/80 Computer Systems. It will be updated on a regular schedule.

Third Edition (September 1984)

This edition of the VS-60/80 Computer Systems Installation Manual obsoletes document(s) no. 729-0715-A/A1/A2. The material in this document may only be used for the purpose stated in the Preface. Updates and/or changes to this document will be published as Publications Update Bulletins (PUB's) or subsequent editions.

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SECTION 1

INSTALLATION PREREQUISITES

1.0 GENERAL

Prior to each WCS 60/80 installation, thorough system planning procedures must be completed. These procedures are detailed in three publications:

A. 2200VS Presale Guidelines & Use of the Physical Planning Guide. (A Customer Engineering publication)

B. 2200VS Configuration Guide (WL# 800-2100)

C. 2200VS Physical Planning Guide (WL# 800-1106PG)

If all pre-installation requirements have been satisfied, actual installation of the system may begin.

Make sure that the customer understands that 'delivery date' only <u>starts</u> the installation, and that the system will not be usable until Customer Engineering installation work is complete (Ref: Section 9, 'Turnover Procedure').

Appropriate tools should be <u>on site</u> to facilitate an orderly installation. The tools required are:

1) Basic C.E. tool kit.*
   (* Ref: Customer Engineering manual #03-0064.)
2) Oscilloscope.
3) Digital Voltmeter.
4) System Generate diskette set (Ref: Section 5).
5) Line analyzer.
6) Complete set of diagnostics on Diskette (Ref: Section 7).
7) Special test equipment and tools for peripherals. (Note that these items, as needed, are specified in Section 4.)

When <u>all</u> prerequisites have been satisfied, proceed with Section 2.

SECTION
2
EQUIPMENT POSITIONING

SECTION 2

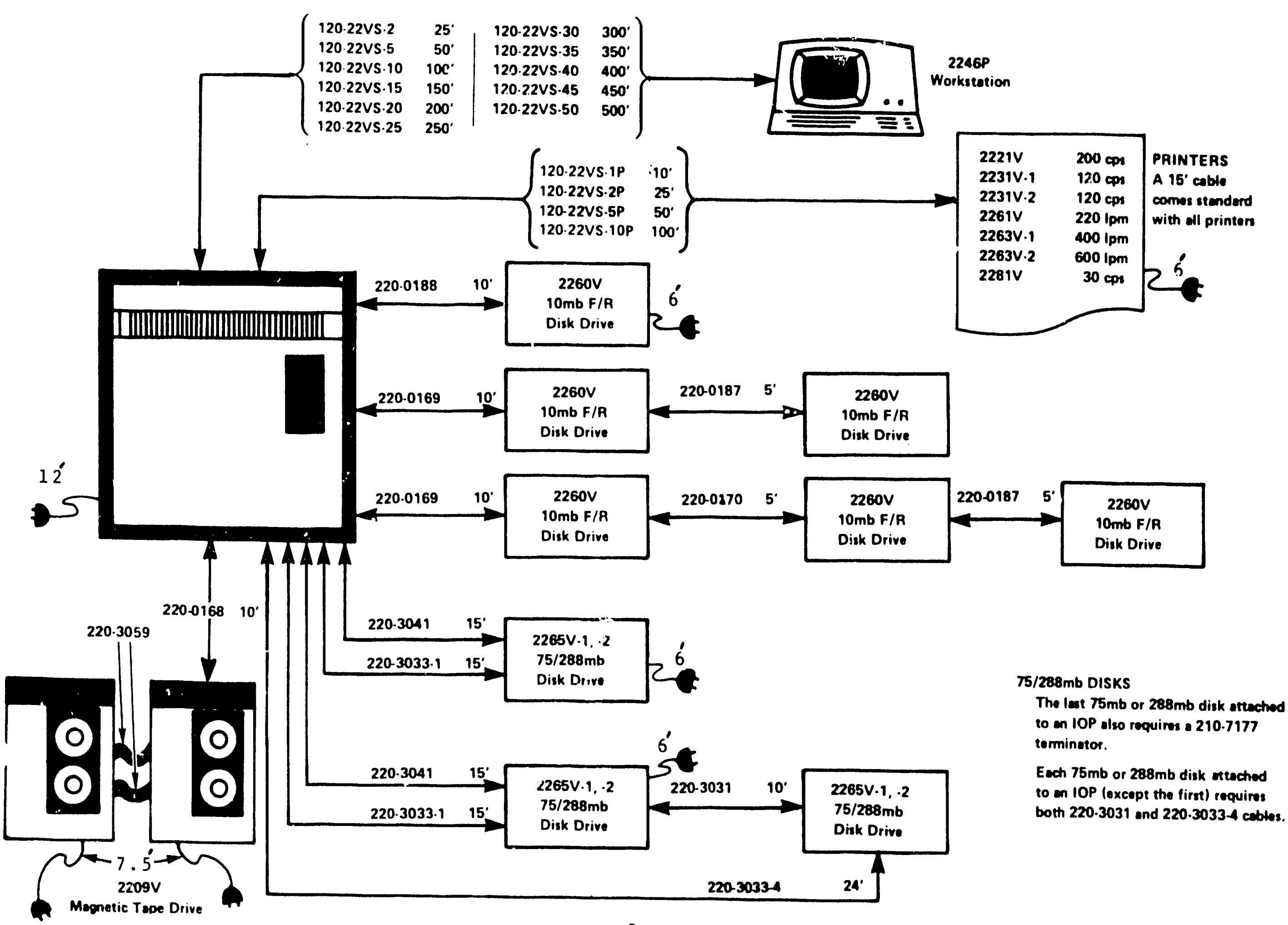
EQUIPMENT POSITIONING

2.0 GENERAL

After all packing material has been removed, move each unit to its predetermined location. If, due to an error in preinstallation planning or setup, these locations are found to be infeasible, minor adjustments to assigned equipment positions can be made.

The physical placement of peripherals with respect to the location of the 2200VS Processor Mainframe is limited primarily by the length of the data interface cables between the Processor Mainframe and the peripheral equipment (Ref: Figure 2-1). For the sake of appearance, and to prevent traffic over the data cables, it is recommended that peripheral equipment be positioned as close as possible to the Processor Mainframe (with the exception of workstations and printers).

FIGURE 2-1



SECTION
3
2200VS PROCESSOR MAINFRAME INSTALLATION

SECTION 3

2200VS PROCESSOR MAINFRAME INSTALLATION

3.1 INSPECTION

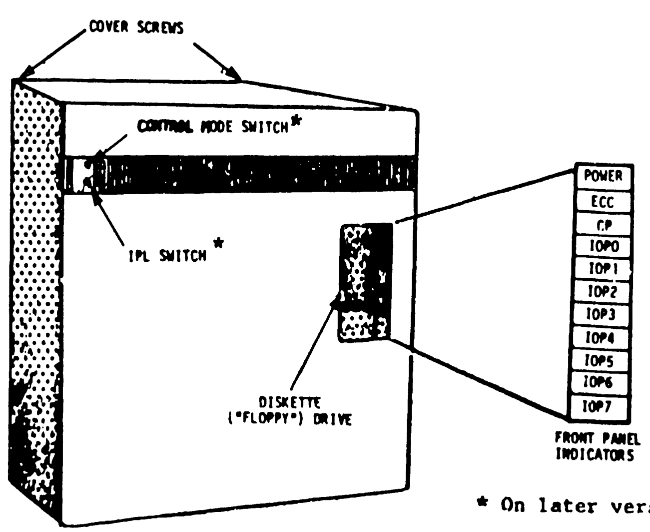
1. Remove the two cover screws (Ref: Figure 3-1) at the rear of the VS Mainframe. The rear panel must be removed next, so that it will not fall over. To remove the rear panel, tilt it back, remove all grounding straps that are attached to panels, and lift it upwards. Slide the top cover forward and remove it. .

2. Remove the two bolts securing the front panel. Lift the front panel upwards and remove it. (On some earlier production models, NYLATCH fasteners were used instead of bolts.)

3. Visually inspect inside the VS Mainframe for damage, such as broken connectors.

4. Since the 2200VS motherboard is horizontally mounted, it is very susceptible to fallen debris during shipping. A careful and complete inspection of the motherboard is required in order to prevent etch shorts during power-up.

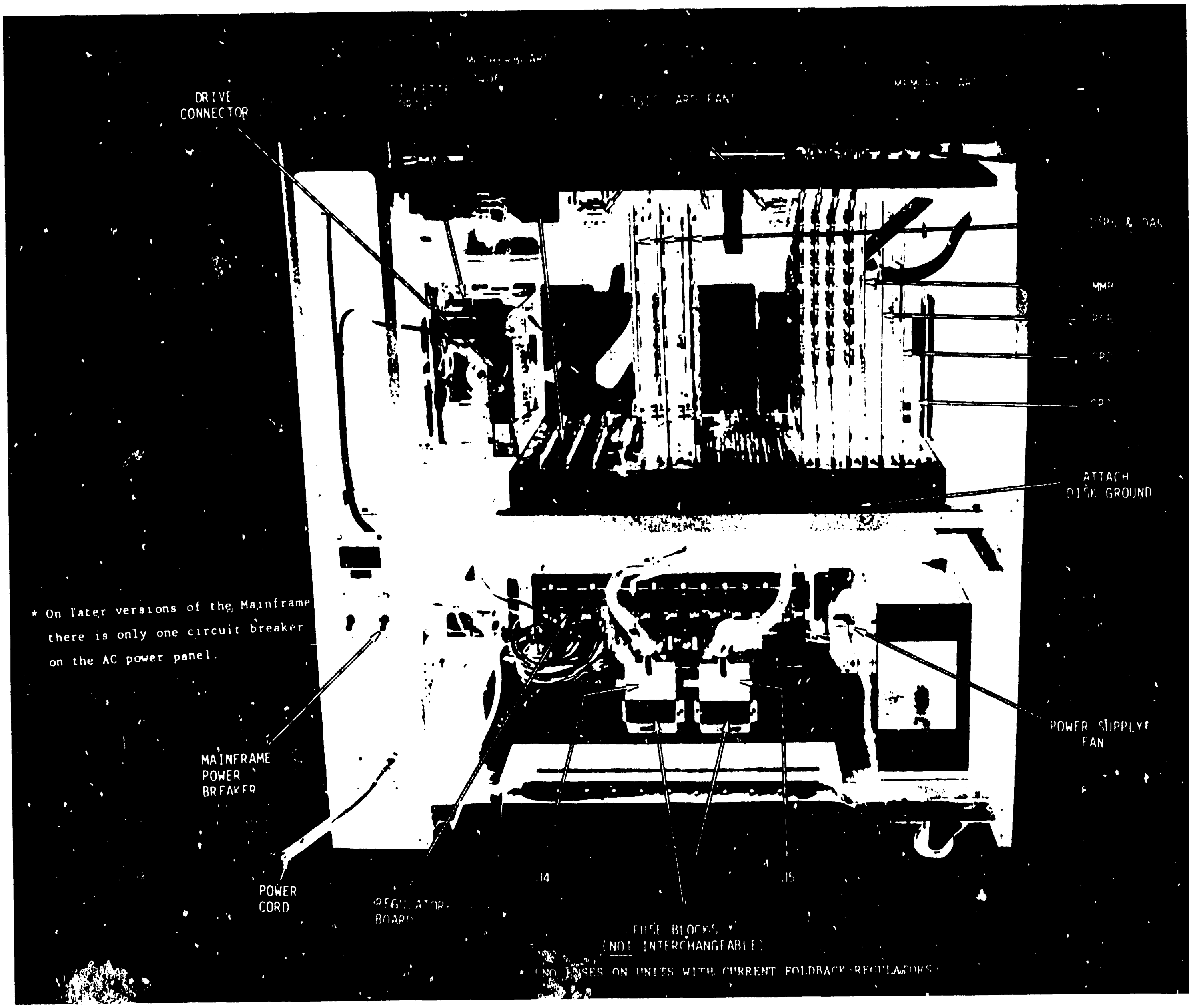
5. Ensure that power cables J4 and J5 from the motherboard to the power supply are correctly seated in their corresponding receptacles.



* On later versions of the Mainframe, the Control Mode switch and the IPL switch are located on the right side of the front panel.

FIGURE 3-1

FIGURE 3-2



2200VS MAINFRAME LAYOUT

CAUTION:

Cables J4 and J5 should descend directly from the VS Mainframe Motherboard to the Mainframe power supply. These cables must not cross.

Remove the card support bars located on top of the 2200VS Processor Mainframe.

3.2 MOTHERBOARD LOADING

Whether a Mainframe has logic cards already installed or not, the following checklist may be used.

1) If logic cards are already in the Mainframe, check for proper loading, per Figures 3-2 and 3-3. Check all switch settings on the MMB, Disk Device Adaptor, and IOPs for proper settings (described in subsequent text). Also, check for solder splashes on the motherboard, power supply, and floppy drive. If necessary, vacuum clean the unit with all logic cards removed, then return each logic card to its correct location.

2) If a system Mainframe does not have logic cards already installed when it arrives for installation, first check all switch settings on the MMB, Disk Device Adaptor, and IOPs for proper settings (described in subsequent text). Next, check for solder splashes on the motherboard, power supply, and floppy drive. If necessary, vacuum clean the unit; then, install all logic cards in the motherboard according t Figures 3-2 and 3-3 .

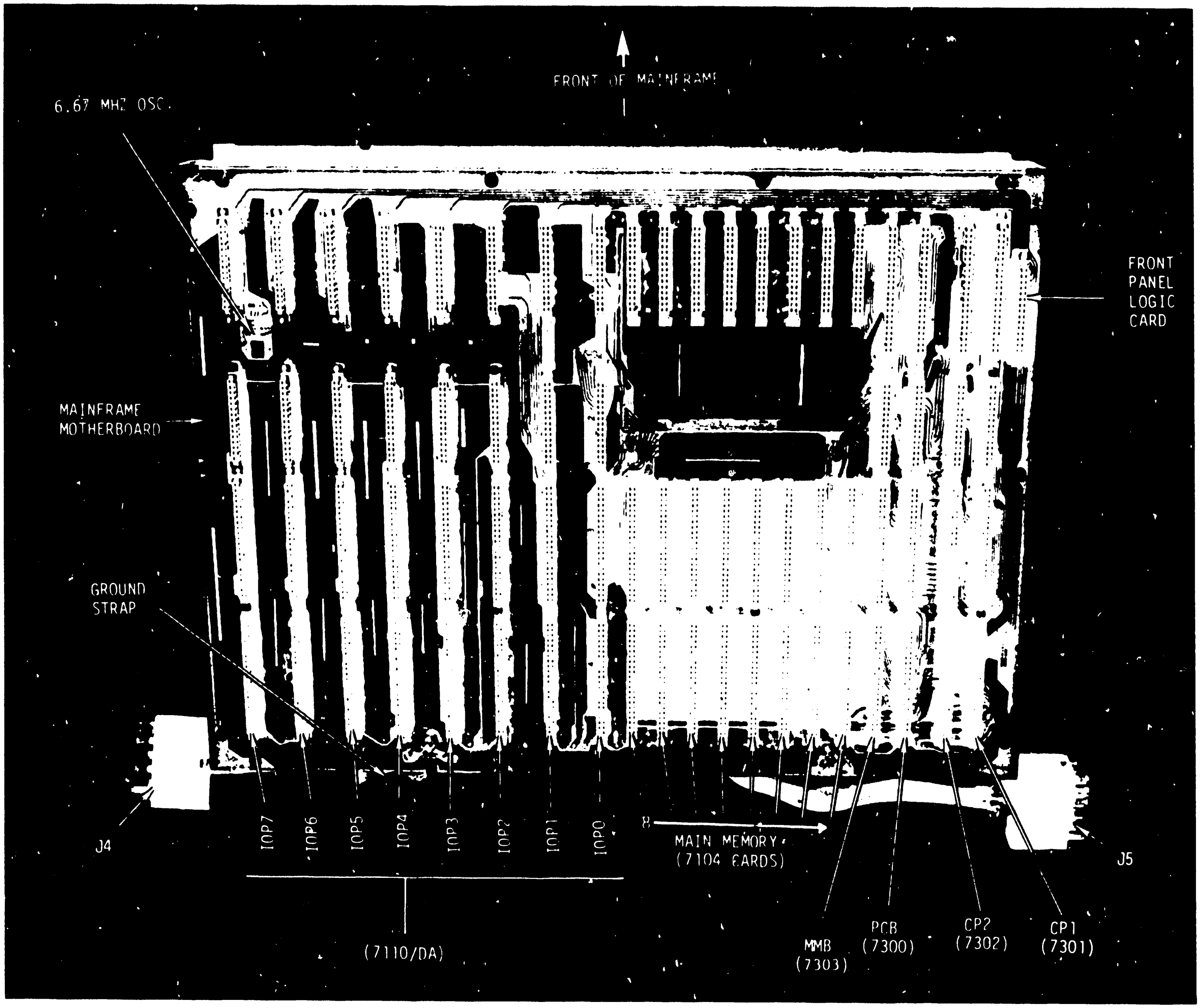
4) Check for proper seating of all logic cards.

NOTE:

Due to the flex characteristics of these cards, it is possible to miss or break a motherboard receptacle when installing one.

FIGURE 3-3

2200VS MOTHERBOARD LAYOUT

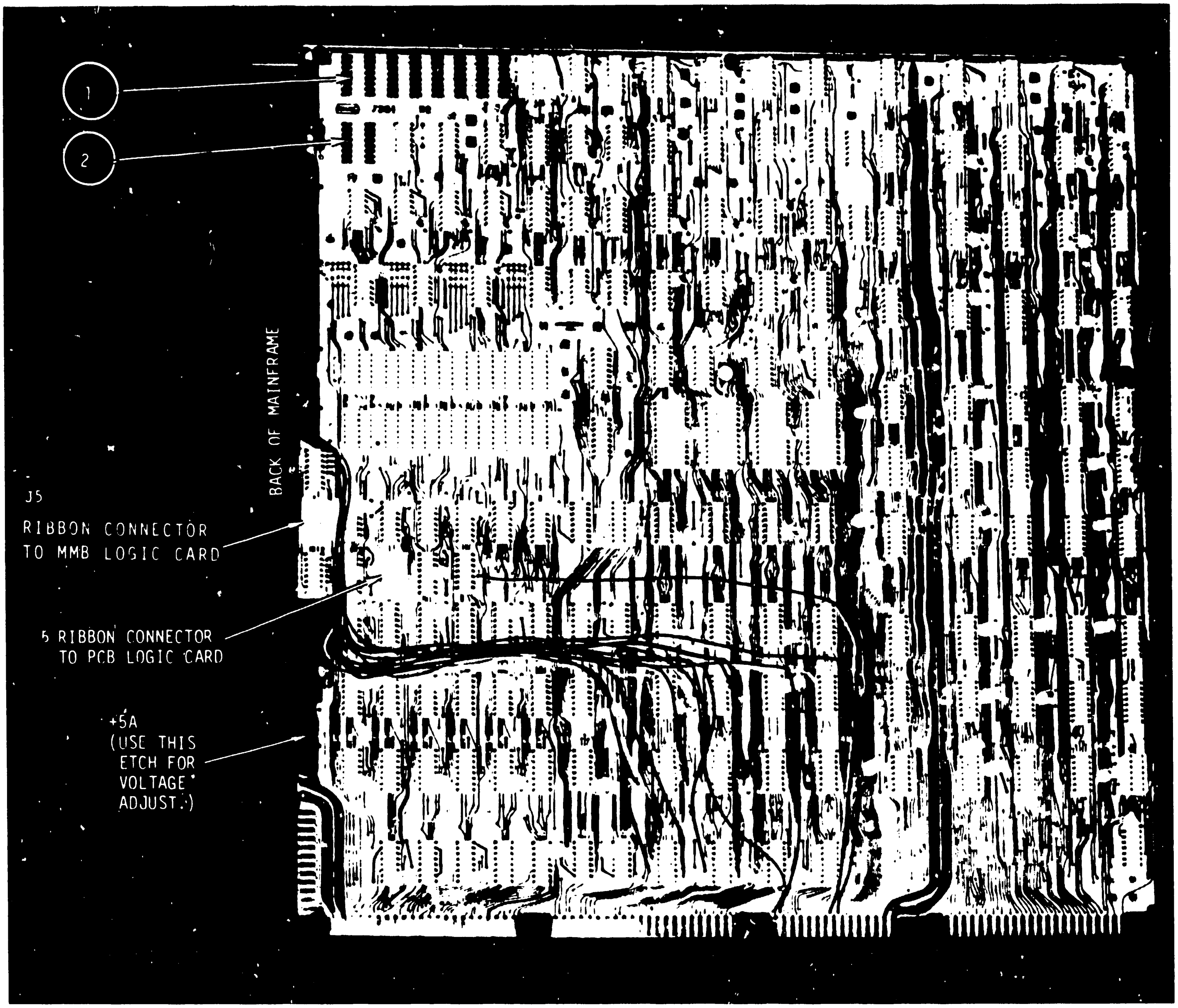


5) Ensure that all internal Mainframe cables are properly installed, according to text descriptions that follow.

CP1 (210-7301)

1. Attach two ribbon cables to connectors indicated in Figure 3-4. Note that on early production models these connectors are located at positions indicated by (1) and (2) in that same figure.

FIGURE 3-4



CP1 (210-7301)

Callout (1) is the ribbon cable connector to the PCB card (7300).

Callout (2) is the ribbon cable connector to the MMB card (7103).

2. Install the CP1 card into the appropriate motherboard slot (Ref: Figures 3-2 and 3-3), and be sure that the component side faces the right side of the mainframe, as viewed in Figure 3-2.

CP2 & PROM DAUGHTERBOARD Combination (WL# 212-3000)

1. Check the 7107 PROM board (Figure 3-5) for proper seating of PROM chips. Plug the 7302 into the CP 2 card (Figures 3-6 and 3-7). Note that the PROM board should presently contain 20 PROM chips at locations L6-L9, L15-L18, L23-L26, L31-L34, and L40-L43, resulting in 4K of PROM.

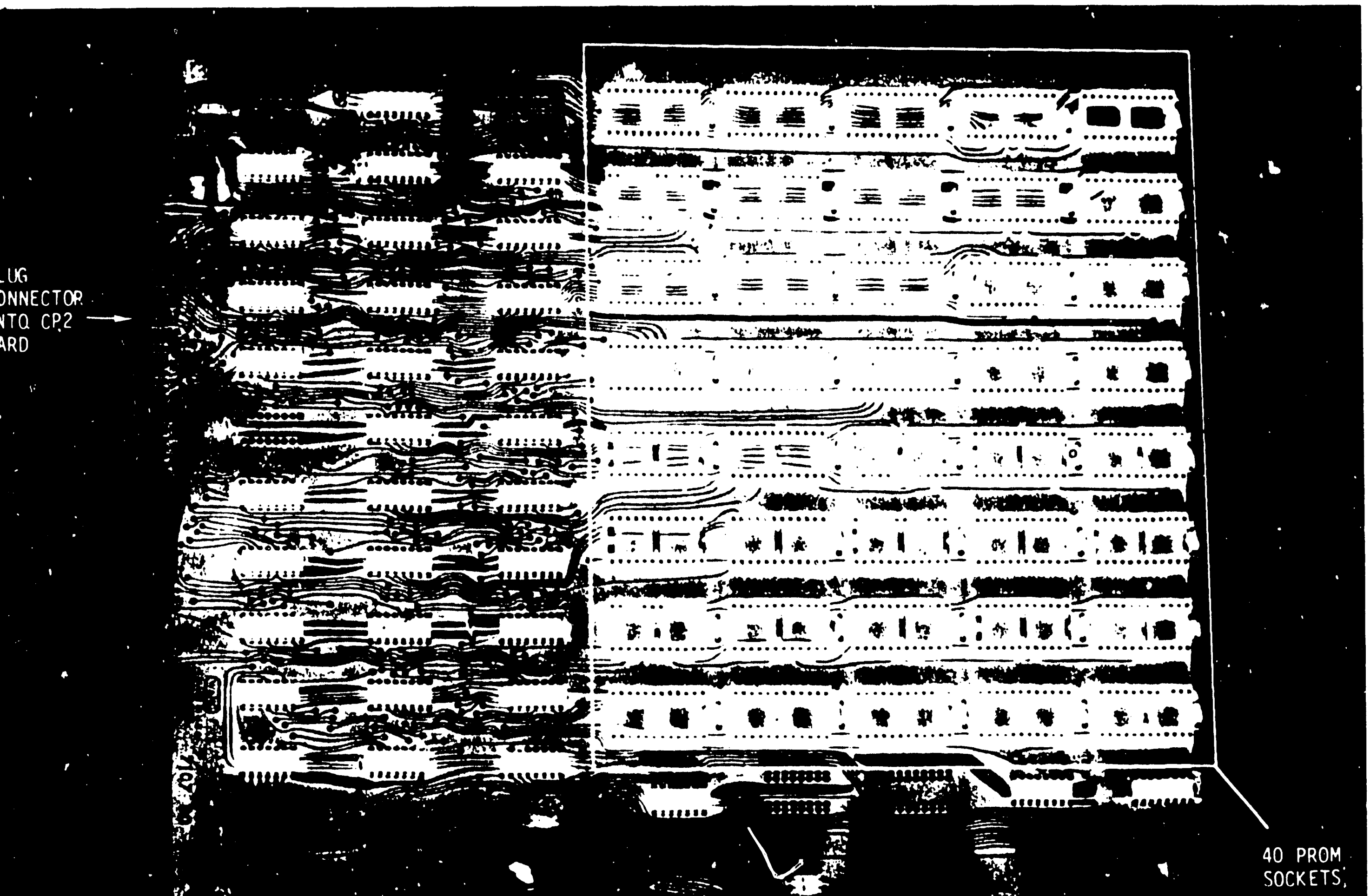
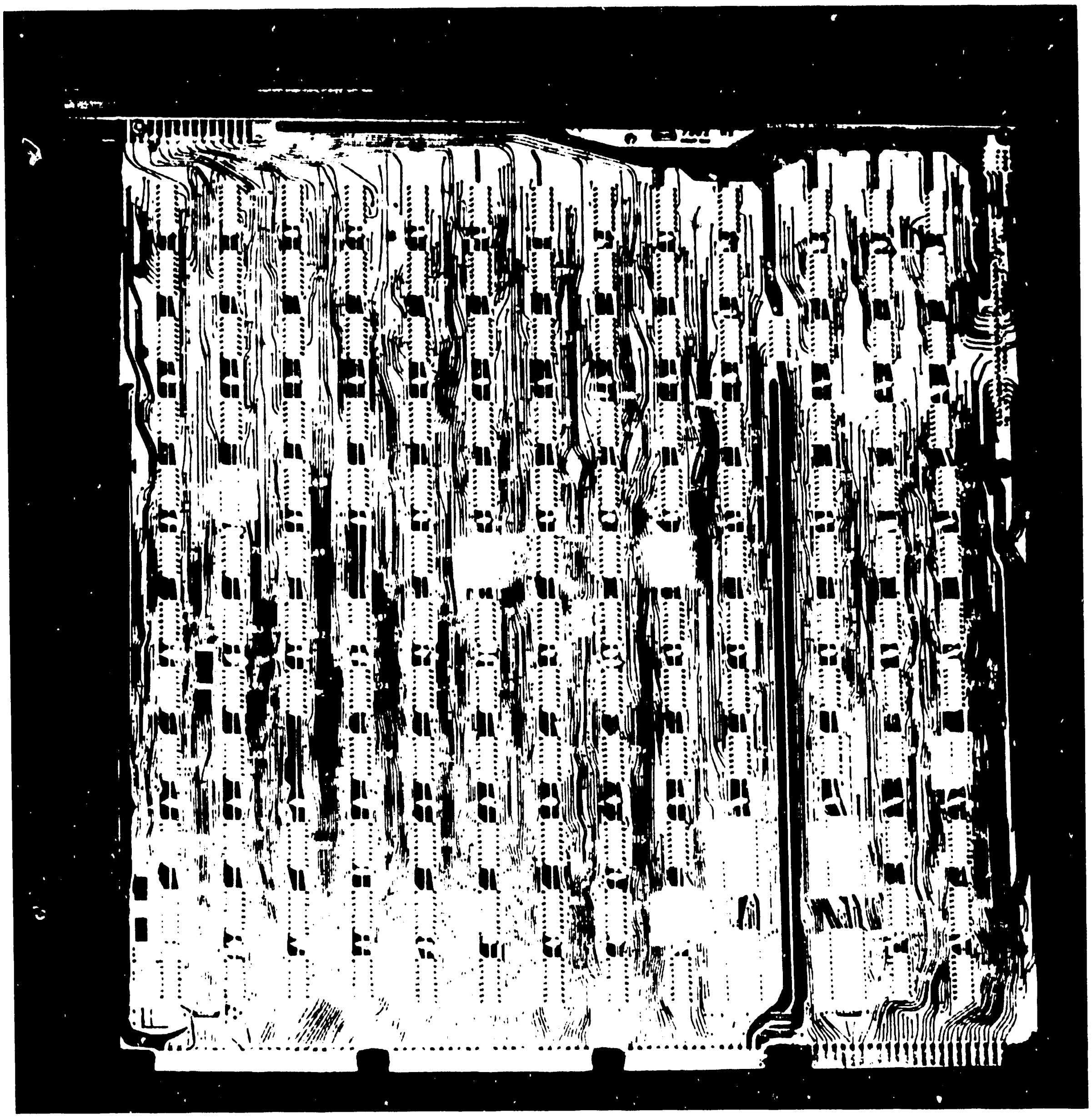
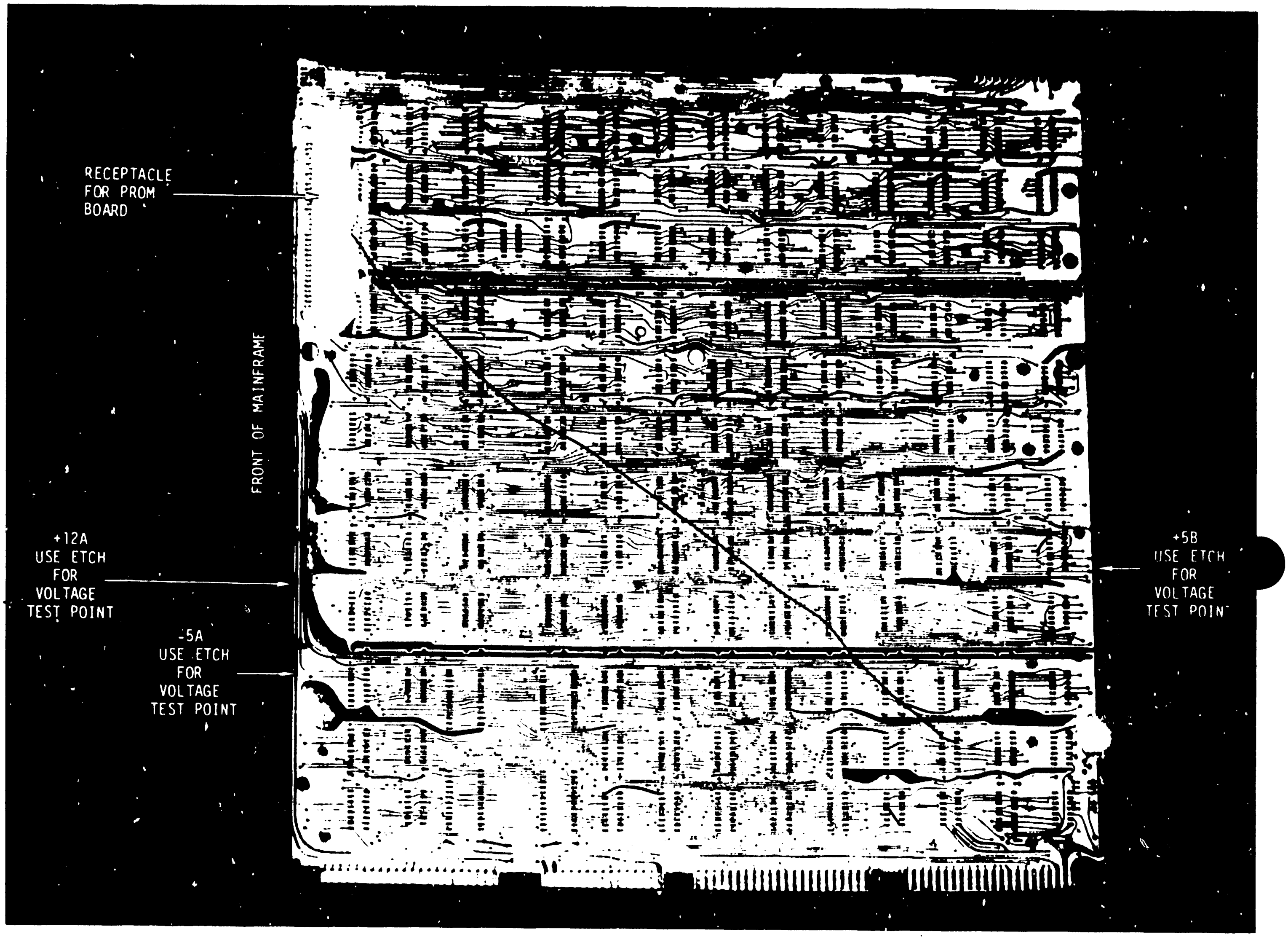


FIGURE 3-6



CP2 (210-7302)

FIGURE 3-7



CP2 (210-7302); BACKSIDE

2. Install the CP2 card into the appropriate motherboard slot (Ref: Figures 3-2 and 3-3), and be sure that the component side of the CP2 card (not the PROM card) faces the right side of the Mainframe, as viewed in Figure 3-2.

PCB (210-7300)

1. Install the PCB card into the appropriate motherboard slot (Ref: Figures 3-2 and 3-3), and be sure that the component side faces the right side of the Mainframe, as viewed in Figure 3-2.

2. Connect the ribbon cable from the CP1 card to the PCB ribbon cable receptacle shown in Figure 3-8, making sure that pin 1 of the CP1 ribbon cable plug matches up with pin 1 of the PCB ribbon cable receptacle.

NOTE:
The outside etch on the non-component side of the PCB card may be used as a test point for +5B (Ref: Figure 3-8).

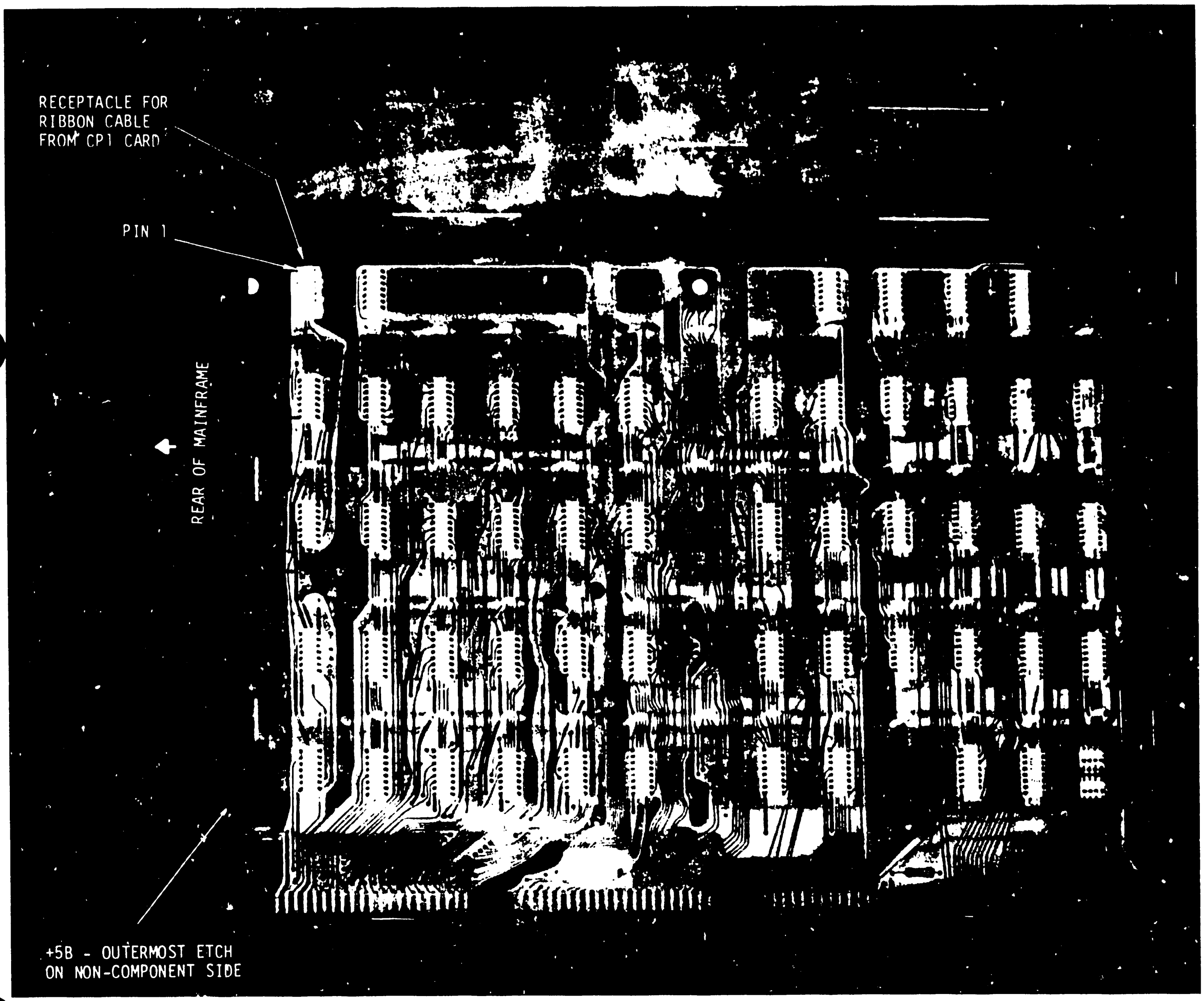


FIGURE 3-8
PCB (210-7300)

MMB (210-7303)

1. Determine what size main memory the system will contain (in increments of 32K). Set the memory size switches as indicated below.

Size:

OFF ←		→ ON	
	ECC On Active		Switch 1
	8 Bit Off Active		Switch 2
	4 Bit Off Active		Switch 3
	2 Bit Off Active		Switch 4
	1 Bit Off Active		Switch 5

Binary Count:

0 =	32K	
1 =	64K	1 Board
2 =	96K	
3 =	128K	2 Boards
4 =	160K	
5 =	192K	3 Boards
6 =	224K	
7 =	256K	4 Boards
8 =	288K	
9 =	320K	5 Boards
10 =	352K	
11 =	384K	6 Boards
12 =	416K	
13 =	448K	7 Boards
14 =	480K	
15 =	512K	8 Boards

If the MMB card is an early production version, the physical location of the ECC and memory size switches will be where shown in Figure 3-9).

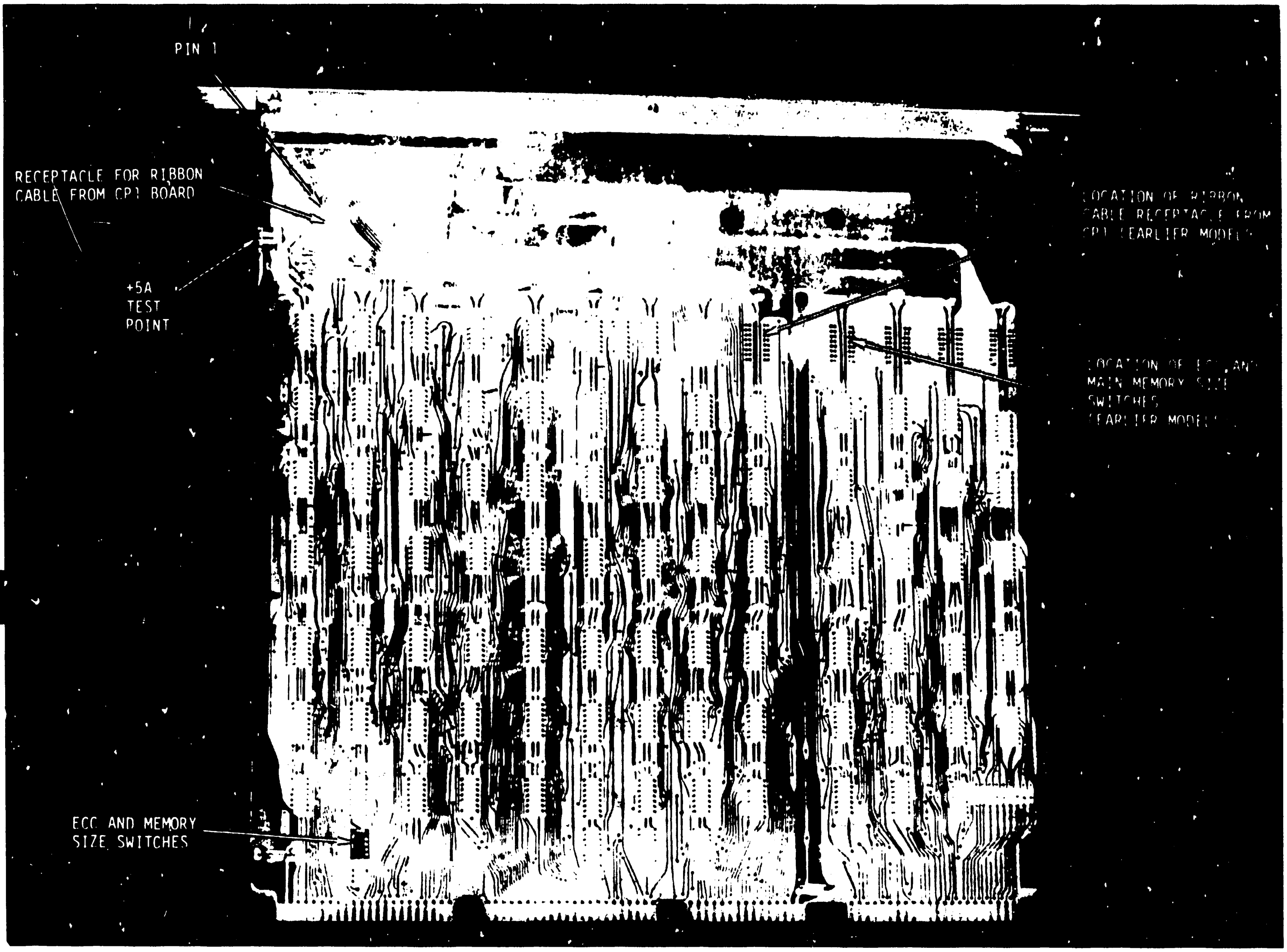


FIGURE 3-9

MMB (210-7303)

If such is the case, then use the following diagram to set up memory size.

OFF ←		ON →	
	1 Bit Off Active		Switch 1
	2 Bit Off Active		Switch 2
	4 Bit Off Active		Switch 3
	8 Bit Off Active		Switch 4
	ECC On Active		Switch 5

2. Install the MMB card in the appropriate motherboard slot (Ref: Figures 3-2 and 3-3), and be sure that the component side faces the right side of the Mainframe, as viewed in Figure 3-2.

3. Connect the ribbon cable from the CP1 card to the MMB ribbon cable receptacle shown in Figure 3-9; ensure that pin 1 of the CP1 ribbon cable plug matches up with pin 1 of the MMB ribbon cable receptacle.

NOTES:

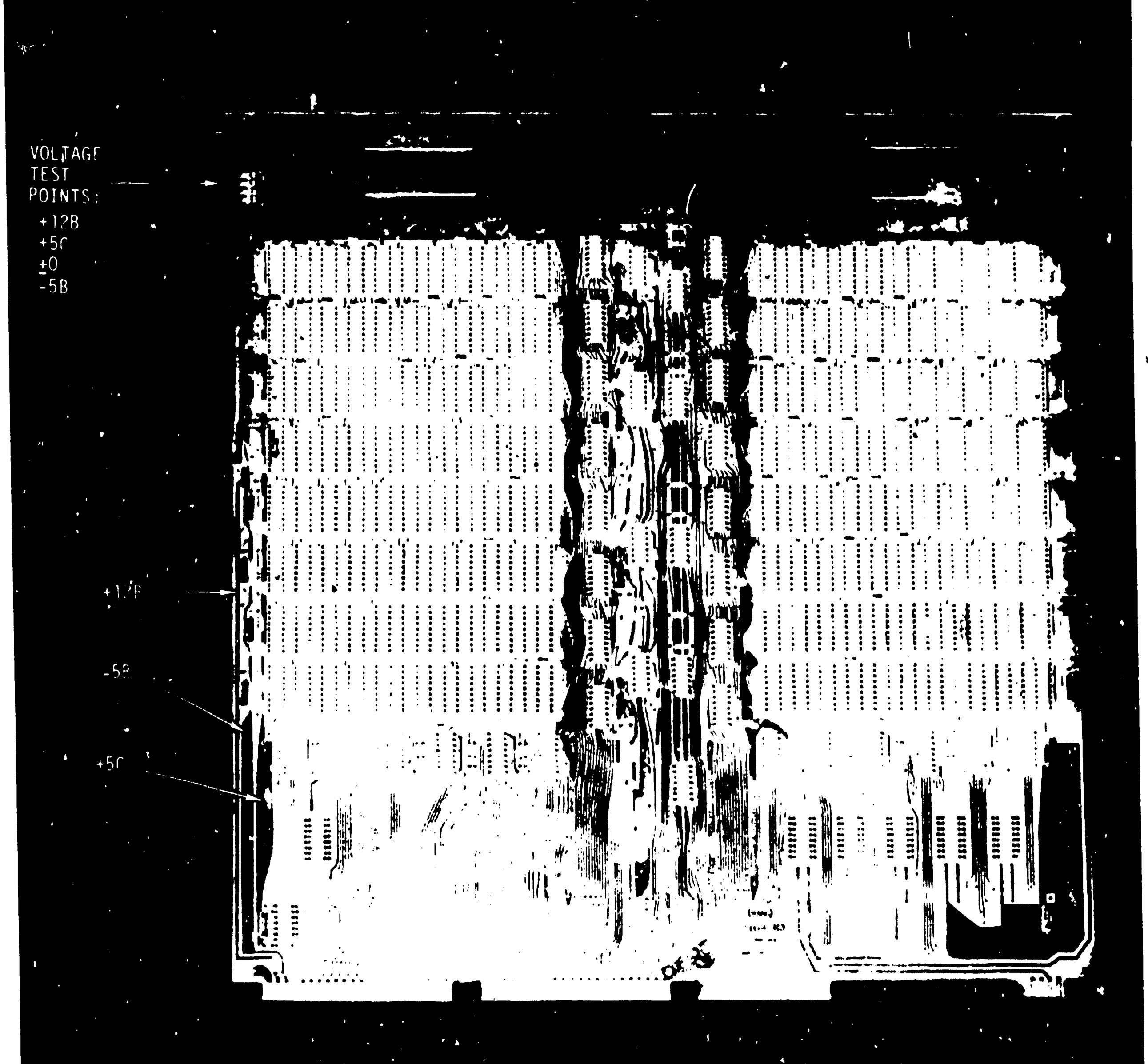
A. If the MMB logic card is an earlier version, the ribbon cable receptacle will be located where shown in Figure 3-9.

B. The outside etch on the non-component side of the MMB card may be used as a test point for +5A (Figure 3-9). A +5A test point was not provided on the component side of earlier versions of the MMB.

Main Memory (210-7104)

1. Visually inspect the component side for proper seating of RAM ICs. Install memory cards (Maximum number = 8) in the appropriate motherboard slots (Ref: Figures 3-2 and 3-3), and be sure that the component side of each memory card faces the right side of the Mainframe, as viewed in Figure 3-2.

FIGURE 3-10



MEMORY (210-7104)

NOTE: It is recommended that the etches called out in Figure 3-10 be used for testing voltages.

IOP (210-7110)

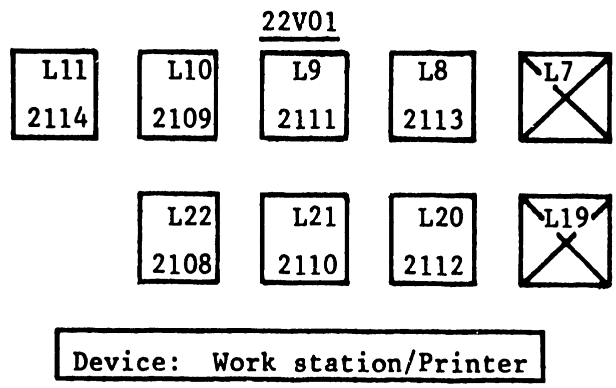
1. Determine which IOPs are to be installed in the system. Up to the date of this printing, there are four IOP/DA types in use. Documentation on new IOPs will be published either as CSNLs, 2200VS Volume 2 updates, or both.

   a) Work station/Printer - 22V01
   b) 10 Meg Disk/Floppy - 22V02
   c) 75/288 Meg Disk - 22V03/04
   d) 9 Track Tape (PE) - 22V05

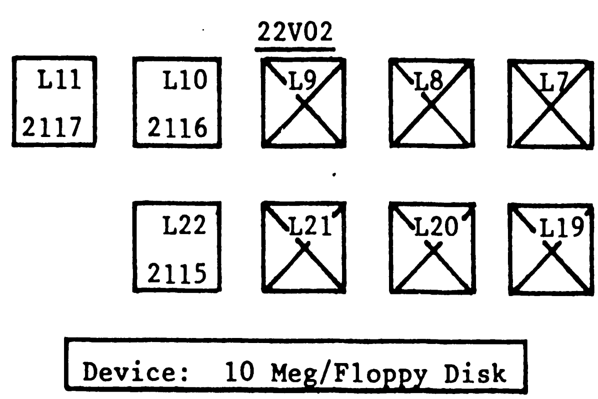
FIGURE 3-11

IOP (210-7110)

The 22V01 IOP comprises a 7110 Motherboard and a 7112 Device Adapter (daughterboard), and the following PROM chips must be mounted on the 7110:

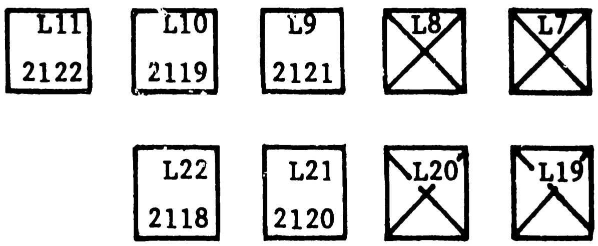


The 22V02 IOP comprises a 7110 Motherboard and a 7111 Device Adapter (daughterboard), and the following PROM chips must be mounted on the 7110:



The 22V03/04 IOP comprises a 7110 Motherboard and a 7114 Device Adapter (daughterboard), and the following PROM chips must be mounted on the 7110:

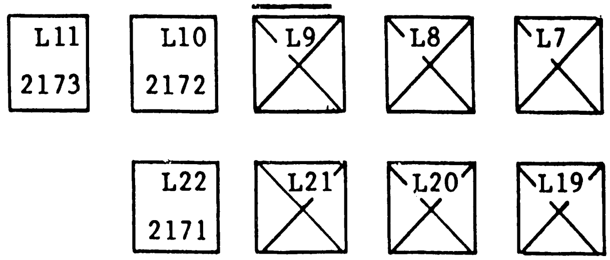
22V03/04



Device: 75/288 Meg Disk

The 22V05 IOP comprises a 7110 Motherboard and a 7117 Device Adapter (daughterboard), and the following PROM chips must be mounted on the 7110:

22V05



Device: 9 Track Tape Drive

2. Set device address switches (Ref: Figure 3-11) for each device according to the following chart:

OFF ←		→ ON	
	1 Bit Off Active		Switch 1
	2 Bit Off Active		Switch 2
	4 Bit Off Active		Switch 3
	N/A		Switch 4; <u>Leave On</u>
	N/A		Switch 5; <u>Leave On</u>
	N/A		Switch 6; <u>Leave On</u>
	N/A		Switch 7; <u>Leave On</u>
	N/A		Switch 8; <u>Leave On</u>

<u>Device Address Switches</u>

Binary Count	=	0	=	Devices 0-1-2-3
	=	1	=	Devices 4-5-6-7
	=	2	=	Devices 8-9-10-11
	=	3	=	Devices 12-13-14-15
	=	4	=	Devices 16-17-18-19
	=	5	=	Devices 20-21-22-23
	=	6	=	Devices 24-25-26-27
	=	7	=	Devices 28-29-30-31

NOTE:

When setting up device addresses on an IOP, make certain that each IOP has a unique address.

3. If a 22V03/04 IOP is to be used in the system, set the switches on the device adapter (7114) to reflect the total number of disk drives (from 1 to 4) and type drive (75 Meg or 300 Meg) attached to that IOP. See the chart below.

← OFF	ON →	
	On=Device 0 Present	Switch 1
	On=Device 1 Present	Switch 2
	On=Device 2 Present	Switch 3
	On=Device 3 Present	Switch 4
	On=Device 3 is 75 Meg Off=288 Meg	Switch 5
	On=Device 2 is 75 Meg Off=288 Meg	Switch 6
	On=Device 1 is 75 Meg Off=288 Meg	Switch 7
	On=Device 0 is 75 Meg Off=288 Meg	Switch 8

SWITCH SETTINGS ON 7114 ADAPTER

4. Install the IOPs into their appropriate motherboard slots (Ref: Figures 3-2 and 3-3), and be sure that the component side of each IOP (not the Device Adapter) face the right side of the Mainframe, as viewed in Figure 3-2.

NOTE:

Generally speaking, CPU access priority via the PCB is granted according to the following physical loading scheme:

22V03/04 - Highest priority - Should be loaded into the IOP 0 position of the Mainframe motherboard.

22V02 - Second highest priority - If a 22V03/04 IOP is present, the 22V02 should be loaded into the IOP 1 position of the Mainframe motherboard; otherwise, it will occupy the IOP 0 position.

22V01 - Next - Follows all disk IOPs in both Mainframe motherboard positioning and CPU access priority.

22V05 - Lowest Priority - Load 22V05 IOPs into the Mainframe motherboard after all Workstation IOPs (22V01s).

A typical setup of IOPs and device address settings is as follows:

MOTHERBOARD SLOT:	DEVICE ADDRESS/DEVICE NUMBER
IOP7	(22V05) Switch=Binary 7 Device #s 28-29-30-31
IOP6	(22V01) Switch=Binary 6 Device #s 24-25-26-27
IOP5	(22V01) Switch=Binary 5 Device #s 20-21-22-23
IOP4	(22V01) Switch=Binary 4 Device #s 16-17-18-19
IOP3	(22V01) Switch=Binary 3 Device #s 12-13-14-15
IOP2	(22V01) Switch=Binary 0 Device #s 0-1-2-3
IOP1	(22V02) Switch=Binary 2 Device #s 8-9-10-11
IOP0	(22V03/04) Switch=Binary 1 Device #s 4-5-6-7

TYPICAL EXAMPLE OF IOP's IN MOTHERBOARD

5. Once all of the IOPs have been installed, place all logic card support bars back into place and secure them. Do not attach any cables to the IOPs at this time, except for the gray data cable (WL# 220-3030) from the floppy drive. Attach that cable to the 22V02 IOP, making sure that pin 1 of that cable (indicated by a red stripe on the cable) matches up to pin 1 of the 22V02 floppy port (Ref: Figure 3-12).

CAUTION:

The Data cable from the diskette drive may not be keyed on earlier systems; this could allow the cable to be plugged into the 22V02 backwards. Plugging this cable in backwards will cause damage to the 22V02, three fuses on the back of the diskette drive will blow, and voltage regulator damage may also be incurred.

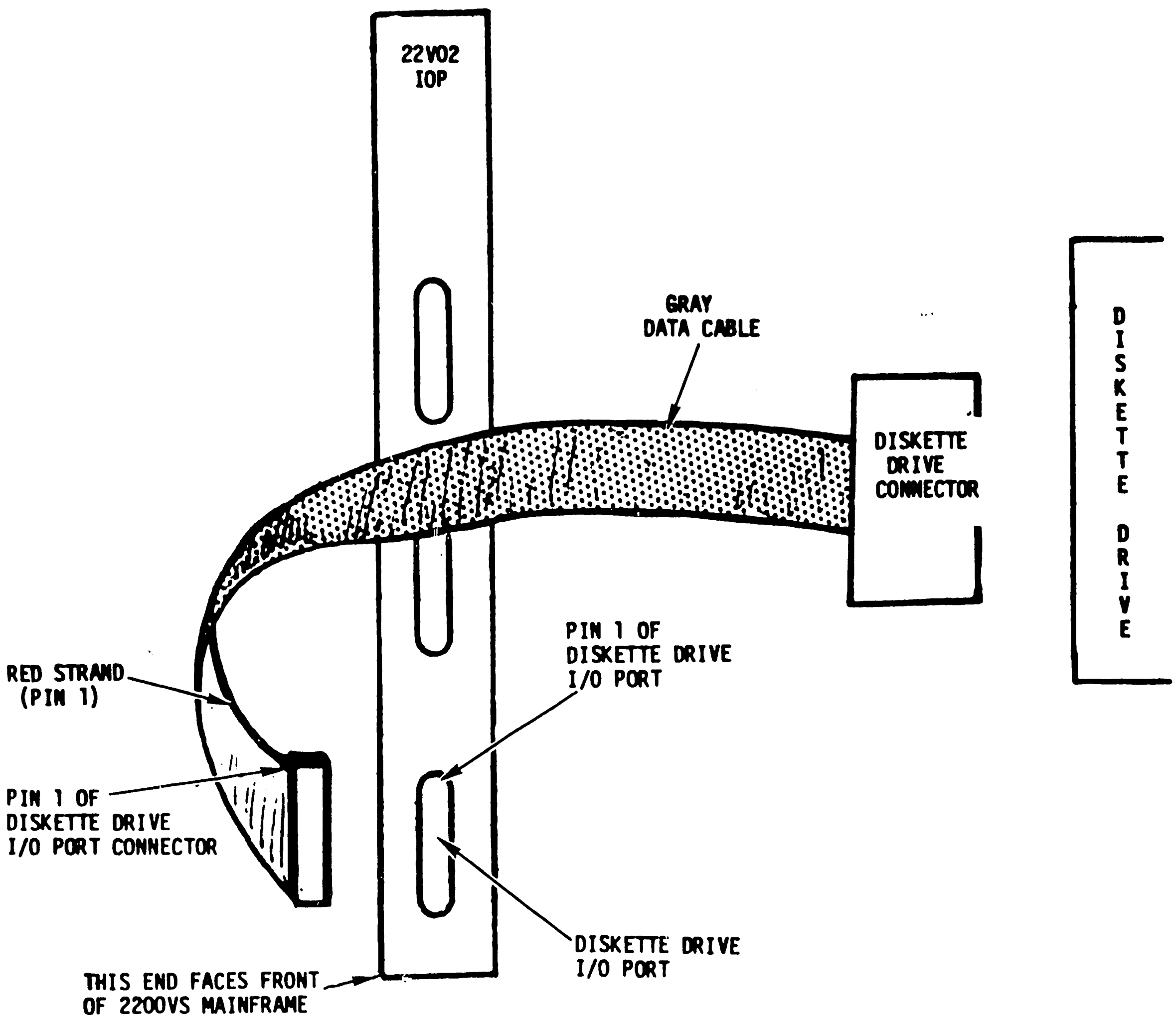


FIGURE 3-12

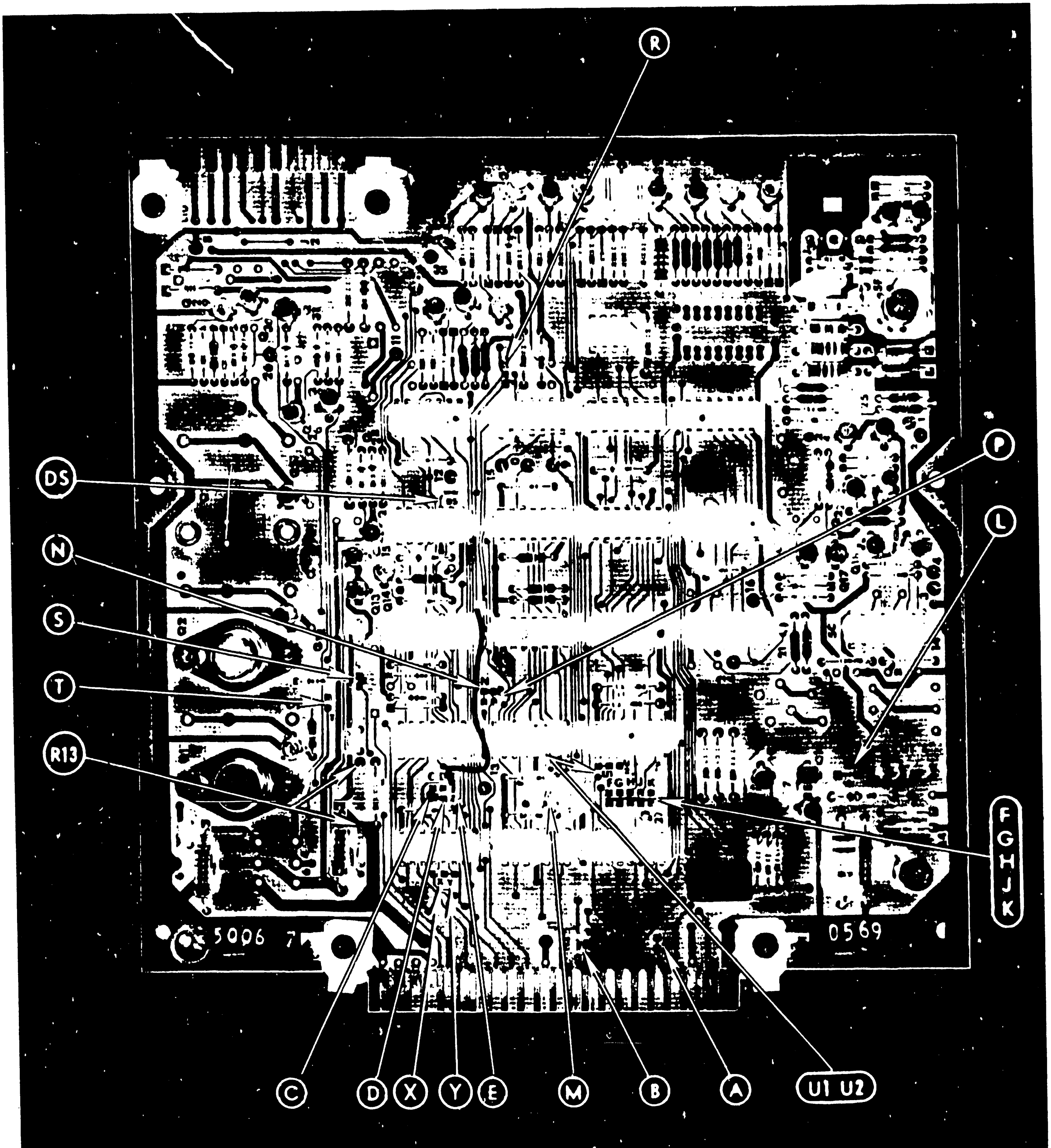
NOTE:

If the floppy drive is being used on a 22V02 without 10 Meg drives attached, check the logic card on the diskette drive for following jumper configuration:

JUMPER #	POSITION
A	IN
B	IN
C	OUT
D	OUT
E	IN
F	IN
G	IN
H	IN
J	OUT
K	IN
L	IN
M	IN
N	IN
P	OUT
R	IN
R13	IN
S	OUT
T	OUT
U1	IN
U2	OUT
X	IN
Y	OUT
DS	OUT

If 10 Meg drives are attached to a 22V02, use the following chart for jumper configuration:

JUMPER #	POSITION
A	IN
B	IN
C	OUT
D	OUT
E	IN
F	OUT
G	IN
H	OUT
J	OUT
K	IN
L	IN
M	IN
N	IN
P	OUT
R	IN
R13	IN
S	OUT
T	OUT
U1	IN
U2	OUT
X	IN
Y	OUT
DS	OUT



FLOPPY LOGIC CARD

JUMPER LOCATIONS

3.3 CPU POWER

1. Check the Mainframe power receptacle for proper wiring.

WARNING:

The 115 VAC primary power must be thoroughly tested prior to attaching the VS Processor Mainframe. Below is a diagram of the connector and the voltages to be measured across the various pins. Ensure that the voltages are correct, prior to attaching the Mainframe AC power connector. FAILURE TO PERFORM THIS TEST COULD RESULT IN SERIOUS DAMAGE TO THE PROCESSOR MAINFRAME AND ATTACHED EQUIPMENT.

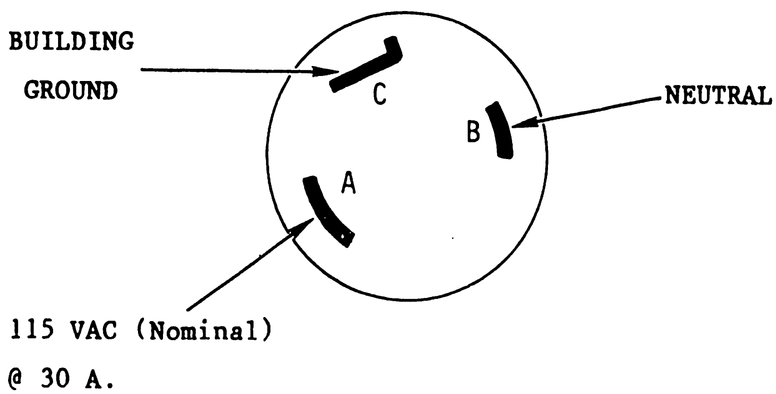


FIGURE 3-13

DVM CHART FOR MEASUREMENTS @ SOCKET

PRONG A TO B: 115 VAC (Nominal)
PRONG A TO C: 115 VAC (Nominal)
PRONG C TO B: 0 VAC

NOTE:

The AC plug must be Hubbel catalog no. 2611 (NEMA reference no. L5-30R) or suitable replacement.

The AC receptacle must be Hubbel catalog no. 2610 (NEMA reference no. L5-30P) or suitable replacement.

2. Plug the Mainframe power connector into the twist-lock receptacle. Turn on the Mainframe power breaker (Ref: Figure 3-2).

3. Ensure that the power supply fan and the logic fans are operating (Ref: Figure 3-2).

4. The power indicator on the Mainframe front panel should be lit.

5. Check front panel indicators for parity errors (Ref: Figure 3-1). If any indicators are lit and they cannot be cleared by pressing the IPL button, refer to Section 8, 'System-Level Troubleshooting'.

6. Ensure that the Diskette drive motor is turning.

7. Adjust Mainframe voltages. Potentiometers are located on the Mainframe power regulator card (WL# 210-7209; WL# 210-7109 on earlier systems); Refer to Figures 3-15a and 3-15b.

Make all Mainframe voltage adjustments using the test points described in the following text. Note that all test points can be reached from the rear of the Processor Mainframe.)

(SEE NEXT PAGE)

+24 ± 0V - This test point is located on a connector at the rear of the Diskette Drive. Use pin 2 on the back of that connector for the measurement (Ref: Figures 3-2 and 3-14).

+12B ± .05V - Use the outside etch on the component side of any memory card, as shown in Figure 3-10.

+12A ± .05V - Use the voltage test point on the component side of any IOP. If test points are not available, use the etch indicated in Figure 3-11.

-5A ± .02V - Use the voltage test point on the component side of any IOP. Note: If test points are not available, use the etch indicated in Figure 3-11.

-5B ± .02V - This test point is located on a connector at the rear of the Diskette drive. Use pin 20 on the back of that connector for the measurement (Ref: Figures 3-2 and 14).

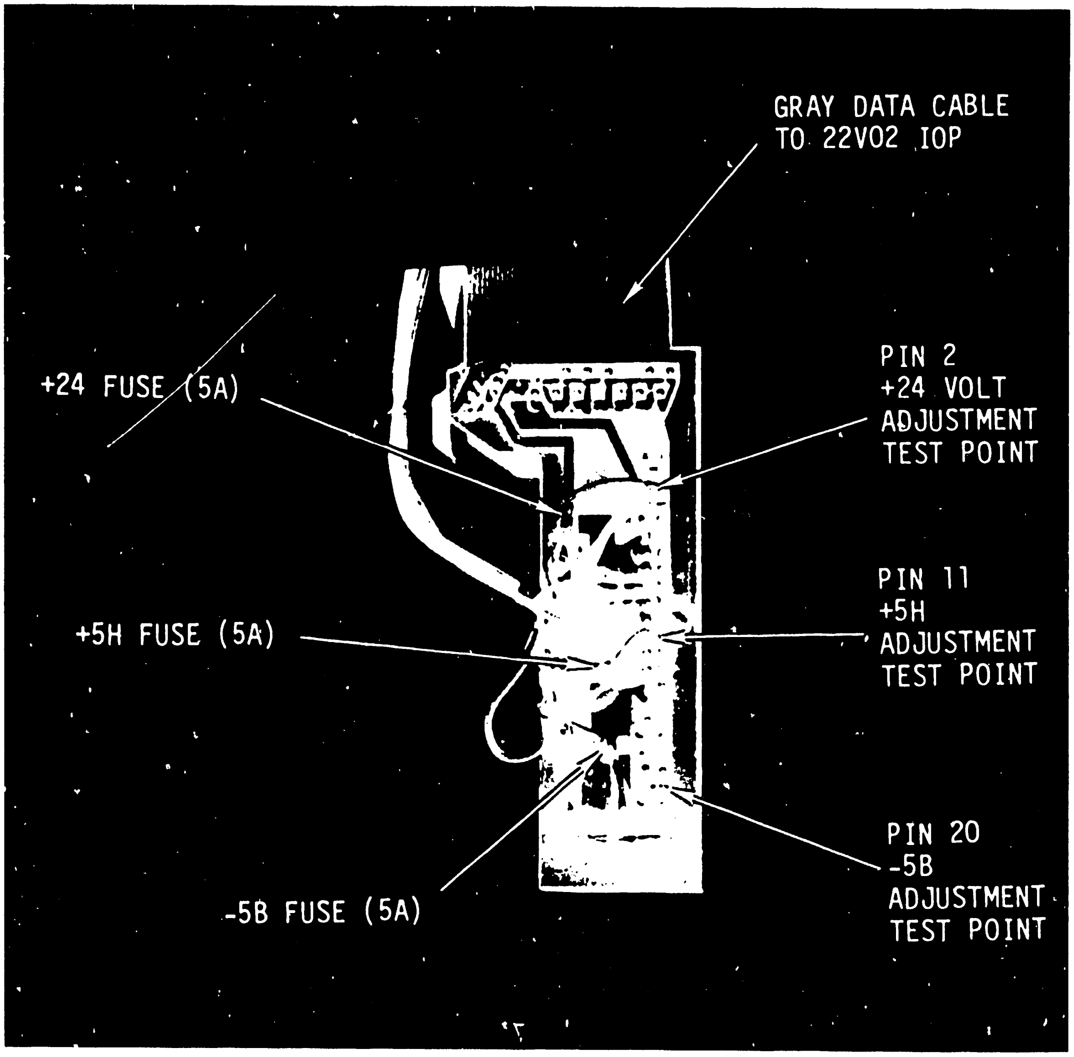
+5H ± .02V - This test point is located on a connector at the rear of the Diskette drive. Use pin 11 on the back of that connector for the measurement (Ref: Figures 3-2 and 3-14).

+5A ± .02V - Use the etch on the component side of the CP1 card, as indicated by Figure 3-4.

+5B ± .02V - Use the etch on the non-component side of the CP2 card, as indicated by Figure 3-7.

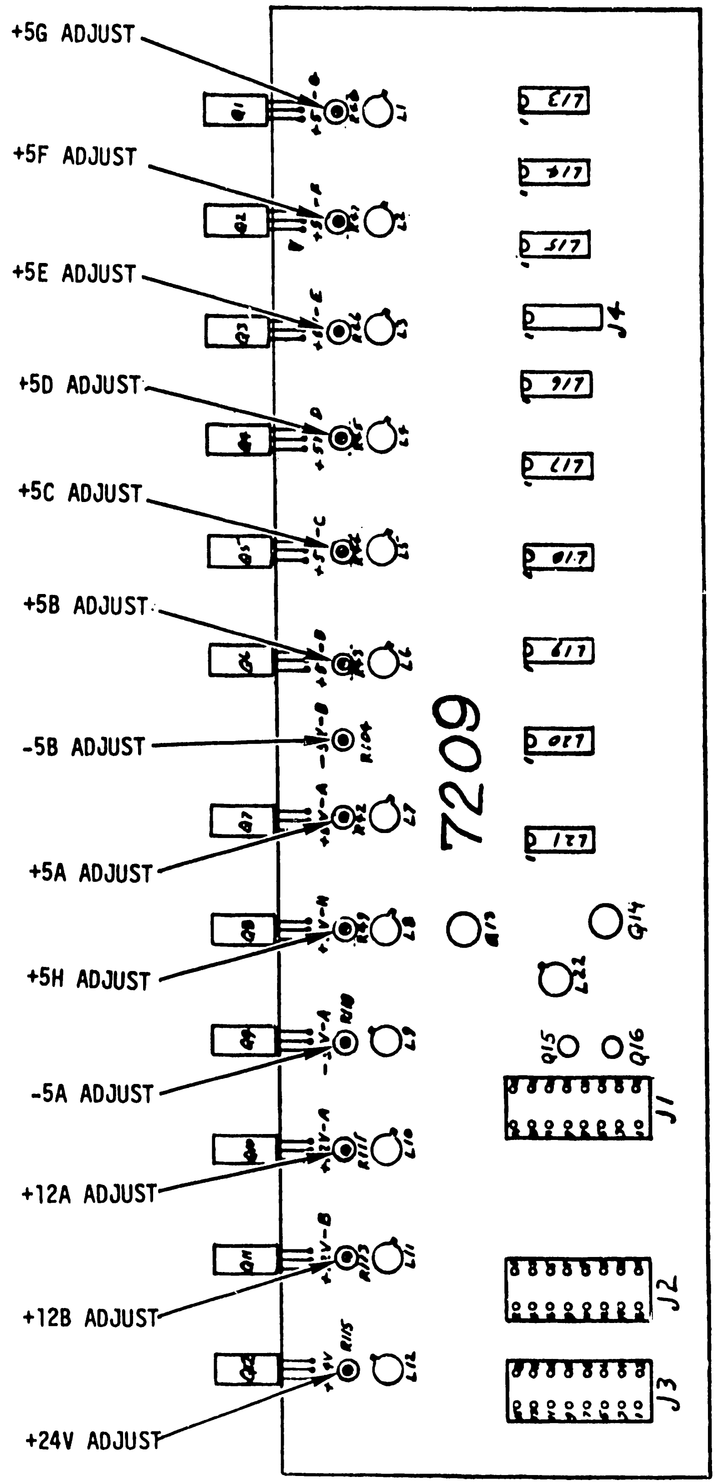
+5C ± .02V - Use the etch on the component side of any memory card, as indicated by Figure 3-10.

FIGURE 3-14



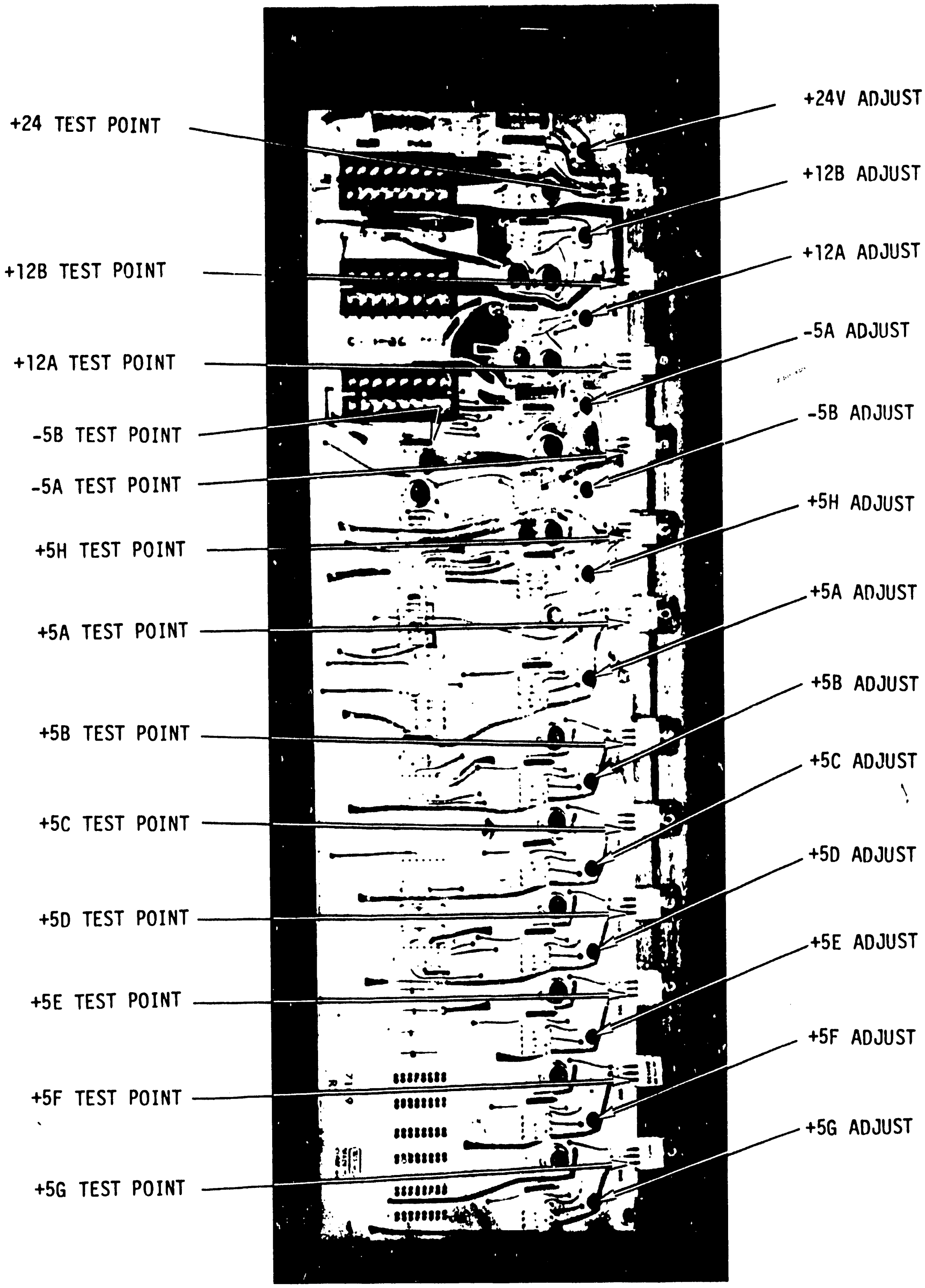
DISKETTE DRIVE DATA CONNECTOR

FIGURE 3-15a



MAINFRAME DC REGULATOR

FIGURE 3-15b



(210-7109)

CAUTION: ONLY USE THE ABOVE TEST POINTS AS A 'ROUGH' REFERENCE. THE MEASUREMENTS FOR CRITICAL ADJUSTMENT OF SYSTEM VOLTAGES MUST BE DONE AS DESCRIBED IN THE TEXT OF THIS SECTION.

+5D ± .02V - Use the voltage test point on the component side of the IOP plugged into IOP positions 0 or 1 (Ref: Figures 3-2 and 3-3). If test points are not available on either of these cards, use the etch indicated in Figure 3-11.

+5E ± .02V - Use the voltage test point on the component side of the IOP in IOP positions 2 or 3 (Ref: Figures 3-2 and 3-3). If test points are not accessible on these two cards, use the etch indicated in Figure 3-11.

+5F ± .02V - Use the voltage test point on the component side of the IOP in IOP positions 4 or 5 (Ref: Figures 3-2 and 3-3). If test points are not available on these two cards, use the etch indicated in Figure 3-11.

+5G ± .02V - Use the voltage test point on the component side of the IOP in IOP positions 6 or 7 (Ref: Figures 3-2 and 3-3). If test points are not available on these two cards, use the etch indicated in Figure 3-11).

NOTE:

I.O.P. voltages +5D, +5E, +5F, +5G must be adjusted, even if IOPs are not present. If this is not performed, with any of the above voltages maladjusted, the system will hang up in an initialized state. Use voltage test points on the rear of the motherboard if IOPs are not present.

8. At this point, the Mainframe CPU is ready for preliminary checkout. Ensure that the system is powered OFF, and proceed to Section 3.4 if no difficulties were encountered.

3.4 PRELIMINARY CENTRAL PROCESSOR CHECKOUT

Since the Central Processor (CP1/CP2 logic cards) shares the same bus lines as all the IOPs, it is affected not only by the IOPs in the system, but also by peripheral equipment. Accordingly, faulty peripherals, defective or incorrectly installed cables, or improper termination on lines may prevent the proper functioning of the Central Processor. To prevent errors due to faulty peripheral equipment, the following preliminary checkout should be performed before all peripherals are attached to the system.

First, note that the diskette drive (which should already be attached to 22V02 IOP) and one workstation (2246P) are all that are required for this preliminary checkout.

NOTE:

If satisfactory results are not obtained for any of the following steps, refer to Section 8, 'System Troubleshooting'.

A. Install one Workstation (refer to Section 4.4, 'Workstation Installation') on a 22V01 IOP that has device address switches set for binary count of 0. Attach the workstation to device port 0 on the IOP. See Figure 3-16.

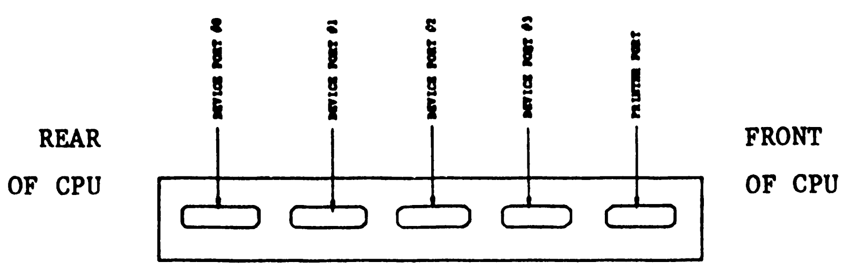


FIGURE 3-16
22V01 IOP

B. Switch the workstation ON. Random characters should appear on the workstation screen after warm up.

C. Switch the Processor Mainframe ON. When the Processor Mainframe is powered up, the workstation screen should clear and display the message "Control Mode F04" in the top screen line.

D. Perform an IPL (Initial Program Load) from the diskette drive. Mount the diskette containing the CPU instruction set diagnostic (WL# 701-2338, 2339). Determine the device number (decimal) and HEX address of the diskette drive:

<u>IF 22V02 IOP ADDRESS SWITCH</u>	= 1,	the floppy is device #7	= HEX 07
	= 2,	the floppy is device #11	= HEX 0B
	= 3,	the floppy is device #15	= HEX 0F
	= 4,	the floppy is device #19	= HEX 23
	= 5,	the floppy is device #23	= HEX 27
	= 6,	the floppy is device #27	= HEX 2B
	= 7,	the floppy is device #31	= HEX 2F

On the workstation keyboard:

1. Press the NEW LINE key.
2. Type F and the hexidecimal device number of the diskette drive (for example: F0B).
3. Press the ENTER key.

E. Execute the diagnostic (10 Passes).

NOTE:

Refer to Section 7, 'Diagnostics' for diagnostic execution instructions. After completion of the diagnostic, remove the diskette.

F. Perform an IPL from the diskette containing the Main Memory diagnostic (WL# 701-2340; refer to memory diagnostic execution instructions, Section 7) Execute two passes and remove the diskette.

G. If steps A through F were accomplished without error:

1. Power OFF the Processor Mainframe.
2. Power OFF the Workstation.
3. Disconnect the Workstation from the 22V01 IOP.
4. Install all peripheral equipment using the appropriate sections of this manual, and then refer to the System Checkout section of this manual (Section 6).

SECTION 4
INSTALLATION OF PERIPHERALS

SECTION 4
INSTALLATION OF PERIPHERALS

4.0 INTRODUCTION

This section contains installation, checkout, and system interconnection instructions for the 2200VS peripherals. The peripherals included in this section are listed below:

Model 2265V-1	75 Megabyte Disk Drive
Model 2265V-2	288 Megabyte Disk Drive
Model 2260V	10 Megabyte Disk Drive
Model 2246P	Parallel Workstation
Model 2221V	Matrix Printer
Model 2231V-1/2	Matrix Printers
Model 2261V	Matrix Printer
Model 2263V-1/2	Line Printers
Model 2281V	Daisy Character Printer
Model 2209V	Magnetic Tape Drive

For more complete information on these peripherals, refer to the service publications listed in Appendix B at the end of this manual.

4.1 2265V-1 (75 Megabyte Disk Drive)

4.1.1 POWER REQUIREMENTS

When laying out the site, consideration must be given to providing source AC power for each drive. A 20 amp 115 volt AC receptacle should be available for each drive. Carefully check to see that these requirements have been satisfied.

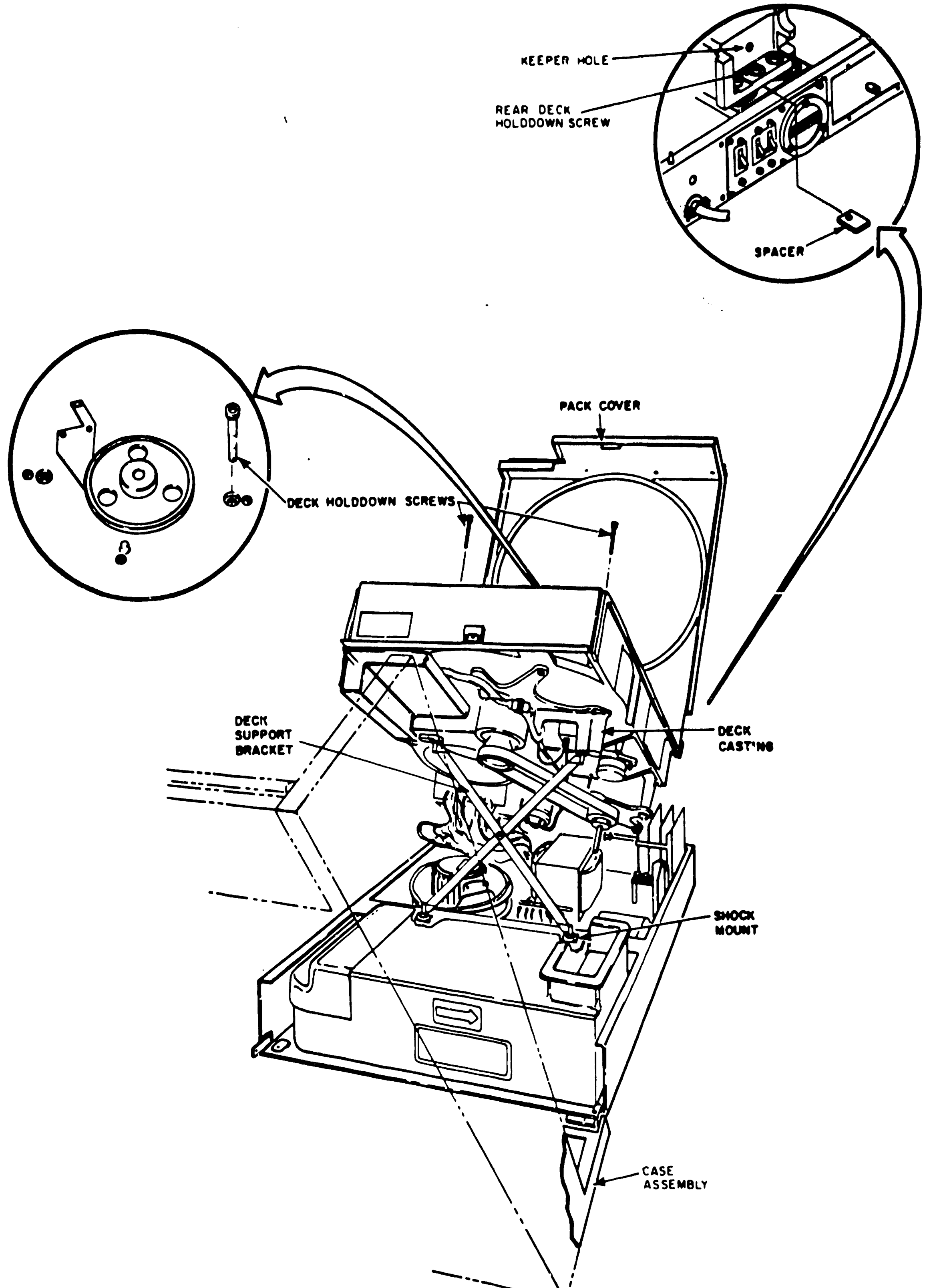


FIGURE 4-1 DECK MAINTENANCE POSITION

Additional Requirements for a single disk configuration:
1 - 75 Meg Disk Pack (PN 177-0066)
1 - 15 ft. "A" cable (PN 220-3041)
1 - 15 ft. "B" cable (PN 220-3033-1)
1 - Terminator (PN 210-7177 or PN 210-7477)

Each additional 75 or 288 Meg drive attached to system requires:
1 - 10 ft. "A" cable (PN 220-3031)
1 - 24 ft. "B" cable (PN 220-3033-4)
1 - 75 Meg Disk Pack (PN 177-0066) or 288 Meg Disk Pack (PN 177-0065)

4.1.2 DISK DRIVE INSPECTION

A. Inspect the drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved.

B. Verify that all logic cards are firmly seated in the logic chassis and power supply.

C. Verify that the control panel is firmly seated in the shroud.

D. Verify that all connectors are firmly seated.

E. Raise the deck and verify that all cabling is intact with no broken or damaged wires.

The deck can be in either of two positions: (1) normal operating, or (2) maintenance. In the normal operating position the deck is secured to the shock mounts on the base by two hold-down screws (inside the shroud and next to the spindle. While in this position, the rear deck hold-down screw (center of three screws at rear of deck casting) and the associated spacer are stored in the keeper hole at the rear of the deck casting. This procedure describes raising the deck to the maintenance position. Returning the deck to the normal operating position is performed by reversing this procedure.

F. Remove (and set aside for future use) the deck hold-down screws from inside the shroud (refer to Figure 4-1).

G. Remove the rear deck holddown screw and spacer from the keeper hole on back of deck casting.

H. Insert the spacer between deck and base hinge (refer to insert on Figure 4-1). Insert the rear deck hold-down screw through the deck and the spacer, and secure it to base hinge.

I. From the front of the drive, lift the deck and install the deck support bracket. The bracket is inserted into the shock mounts in the base and into the hold-down screw holes in bottom of the deck casting. Note that on newer model drives this bracket is permanently mounted.

J. Inspect the entire drive for any foreign material that may cause an electrical short.

K. Check the actuator and pack area for any material that may obstruct movement of the carriage and heads.

L. Ensure that the carriage locking pin and ring assembly is moved from the SHIPPING LOCK hole to the PIN STORAGE hole.

4.1.3 DISK CABINET LEVELING

Cabinet leveling should not be performed until the drive is in its final location, with no further need to move it. Cabinet leveling consists of installing leveling pads (shipped in a plastic bag taped inside the cabinet), moving the drive to its permanent location, screwing down leveling pads until the drive is aligned with the other peripherals, and ensuring that the weight of the drive is off the casters. Note that disk drives shipped in Wang cabinets have the leveling pads already installed.

A. Install a jam nut on each leveling pad and install a leveling pad at each corner of the cabinet frame (see Figure 4-2) by raising the corners of the cabinet and threading the pads into the corresponding weld nuts on the frame.

B. Move the disk drive to its permanent location. The disk drive must rest on a rigid surface (not carpeting) to ensure proper flow of cooling air.

C. Turn leveling pads down until they support the weight of the disk drive.

D. Adjust leveling pads until drive is aligned with adjacent equipment.

E. Place a spirit level on the drive case assembly; then adjust the leveling pads until the drive is level to within three degrees, front-to-back and side-to-side.

F. When the disk drive is level in both directions, tighten the jam nuts against the bottom of the frame.

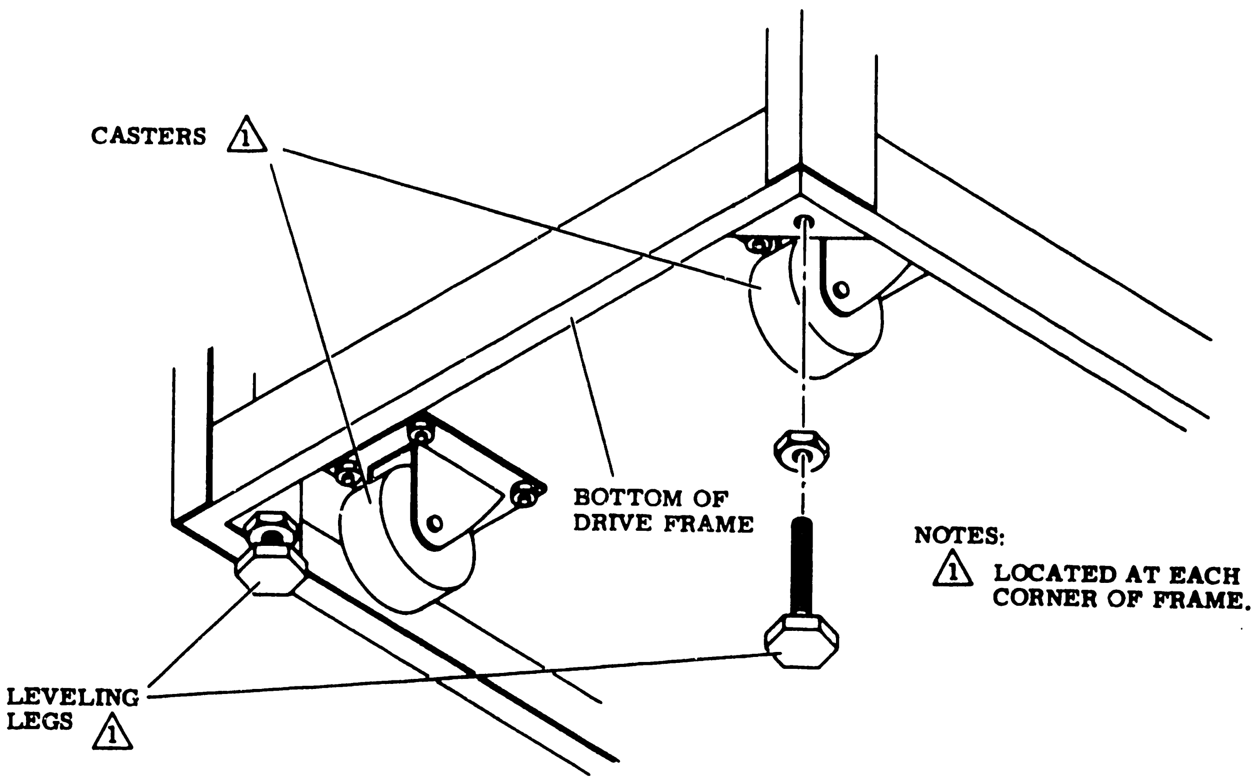


FIGURE 4-2 LEVELING PAD INSTALLATION

4.1.4 DISK SECTOR SWITCHES

The drive provides the capability for setting the number of sectors per disk revolution by means of sector switches (see Figure 4-3). The required number of sectors for the 2200VS system is 9; therefore, the sector switches located on the edge of logic card in location B08 must be set as follows:

Switch Number

0	Off
1	Off
2	On
3	Off
4	On
5	Off
6	On
7	On
8	On
9	Off
10	On
11	Off

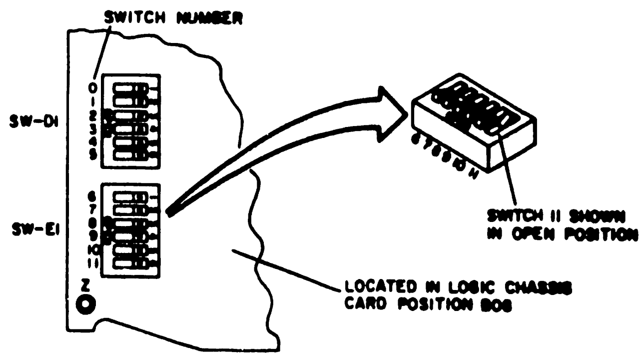


FIGURE 4-3 SECTOR SWITCHES

4.1.5 DISK DRIVE CLEANING

A. Carefully vacuum the interior of the cabinet and case, paying particular attention to flat surfaces where dust accumulates.

B. With the deck in the normal operating position, vacuum exterior surfaces of electronic assembly. Use a soft cloth dampened in a mild detergent solution to remove any greasy residue.

C. Raise deck to the maintenance position and vacuum the underside of the deck and base assembly. Again, use a dampened cloth to remove any residue.

D. Inspect all cables and connections for any sign of damage, and repair as necessary.

E. Inspect the drive belt for signs of fraying or cracking. Replace the belt if necessary.

F. Return the deck to normal operating position; close the case and the door assemblies.

G. Using a soft cloth dampened in a mild detergent solution, carefully wipe all cabinet surfaces. Use care to prevent moisture from entering the drive.

H. Carefully vacuum entire disk pack area.

I. Using a piece of adhesive tape, remove any dirt particles not removed during vacuuming.

J. Using a piece of lint free gauze dampened in media cleaning solution, wipe all surfaces of the shroud. Remove all smudges and dirt. Carefully clean all surfaces of the spindle.

K. Close the pack access cover immediately after cleaning to ensure that dust will not enter the pack area.

4.1.6 POWER-ON CHECKOUT

A. See that the AC and DC breakers of the drive are "OFF". Insert the power cord into the AC receptacle provided at the site. Turn the AC breaker to "ON" position.

B. Check the blower motor for proper operation.

C. Make certain that the start switch on the front panel is in the "OFF" position (not depressed).

D. Apply DC power by means of the DC breaker on the rear panel of the disk drive. Using a DVM, check for the following voltages on the fuse terminals at the top of the power supply cards (see Figure 4-4 for PCB locations). Check both terminals at each fuse.

<u>Voltage/Tolerance/Test Point</u>

+42 (-2, +5) Vdc	Check at test points on card A1A1.
-42 (+2, -5) Vdc	Check at test points on card A1A1.
+20V ($\pm$ 2) Vdc	Check at test points on card A1A2.
-20V ($\pm$ 2) Vdc	Check at test points on card A1A2.
+5.1 ($\pm$ .05) Vdc	Make initial checks at test points on card A1A3. Make final checks as described in section Section 4.1.8.
-5.1 ($\pm$ .05) Vdc	

E. If the voltages are present, power OFF the disk drive and attach the FTU (Field Test Unit).

4.1.7 FIELD TEST UNIT (FTU)

Specific instructions for interconnecting the drive and the FTU are contained in the preliminary set up instructions in the FTU appendix at the rear of this manual. The procedures for commanding the drive to perform the various operations (access, read, write, head selection) required for testing are also contained in the appendix. When performing the preliminary set up procedure, the drive oriented switches located on the FTU panel must be set as follows:

RPM to 3600 (HI).
TPI to 400 (HI).
Heads to 5 (LO).
BPI to 6000.
The sector switches (an 8-bank rocker switch DIP) are located in position A20 on the FTU logic board. Set these sector switches as follows:

Sector Switch	
1	On
2	Off
3	Off
4	On
5	Off
6	Off
7	Off
8	Off

A. Disconnect the yellow voice coil lead wire from the Faston connector located on the edge of the power amplifier assembly.

B. Apply AC and DC power to the drive.

C. Install a 75 Meg Disk Scratch Pack in the drive as follows:

   1. Raise the pack access cover. (AC POWER circuit breaker must be ON).

2. Lift up the disk pack by its plastic canister handle.
3. Disengage the bottom dust cover from the disk pack by turning the canister handle counterclockwise or by squeezing the latch under the bottom dust cover (in new versions only).. Set the cover aside in an uncontaminated area.

CAUTION:

Avoid abusive contact between the disk pack and the spindle. The read/write heads are sometimes manually positioned during maintenance procedures. Make certain that the heads are fully retracted.

4. Place the disk pack onto the spindle.
5. A spindle lock mechanism is actuated when the disk pack canister cover is on the spindle. This mechanism holds the spindle stationary while loading or unloading a disk pack.
6. Twist the canister handle clockwise to lock the disk pack in place. A click may be heard as the spindle lock mechanism engages.
7. Lift the canister clear of the disk pack, place the bottom dust cover on the canister, and then set aside the canister in an uncontaminated area.
8. Immediately close the front cover to prevent dust from entering the drive and contaminating the disk surfaces.

4.1.8 ALIGNMENT/ADJUSTMENT PROCEDURES

A. Press the start switch and allow the pack to purge for 10 minutes. After purging the pack, again press the start switch to disengage the spindle drive motor; then power the drive OFF, using the DC breaker.. Connect the yellow voice coil lead wire to the Faston edge of power amplifier assembly.

B. Raise the Logic Chassis -- The logic chassis can be in either of two positions: (1) normal operating, or (2) maintenance. In the normal operating position the logic chassis sits along side the actuator, and the 1/4-turn fastener at its rear is secured to the deck casting. The following procedure describes raising the logic chassis to the maintenance position. It also describes the removal of the logic chassis protective panel. Returning the logic chassis to the normal operating position is performed by reversing this procedure. Before performing the following steps, remove power from the drive.

1. Release the 1/4-turn fastener which secures the logic chassis to rear of deck casting. Ensure that the ring on the 1/4-turn fastener does not interfere with logic chassis bracket as the chassis is raised.
2. Slide the logic chassis toward the rear of the drive to disengage the chassis ears from the logic chassis support rod.
3. Slowly lift up the chassis until the flat spring pops into place.
4. Pivot the chassis 90 degrees and slide it over the top of the magnet assembly.
5. Remove the attaching hardware that secures the logic chassis protective panel.

CAUTION:

Use care not to damage any cables or connectors when removing the logic chassis cover.

The logic chassis must not be left in the service position for any great length of time. It will overheat and cause damage to the PCB's in the card cage.

6. Carefully slide the logic chassis protective panel toward the front of the drive, enough to disengage rear of panel from slot. Then, carefully slide the panel along the cables far enough to access the back panel.

C. Bring the drive up to the ready state and adjust +5, -5 volts.

1. Connect a digital volt/ohmmeter between GND and +5V Fastons on the logic chassis backpanel.
2. Command the drive to do repeat seeks between cylinders 0 and 32.
3. The +5 volt output should be +5.10 ± 0.05 volts. If it is not, adjust the +5V potentiometer on card A1A3 (see Figure 4-4) to obtain the correct voltage.
4. Move the volt/ohmmeter leads to the -5V faston.
5. The -5 volt output should be -5.10 ± 0.05 volts. If it is not, adjust the -5V potenticmeter on card A1A3 (see Figure 4-4) to obtain the correct voltage.
7. If any adjustment was necessary in preceeding steps, recheck both outputs.

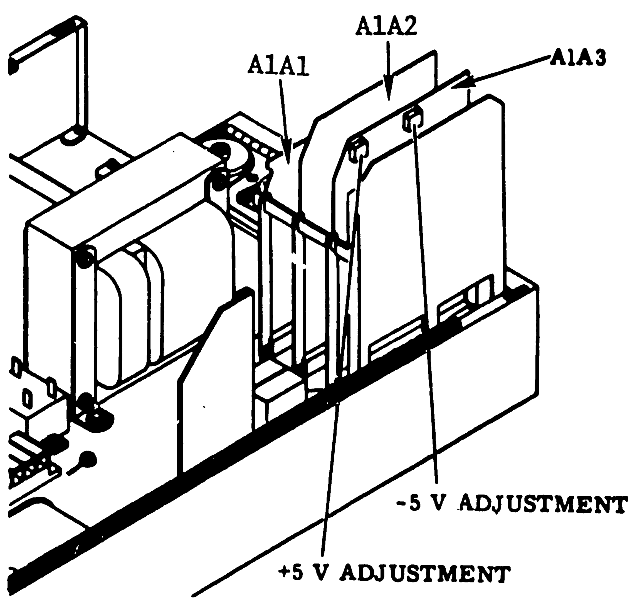


FIGURE 4-4 POWER SUPPLY ADJUSTMENT LOCATIONS

D. Perform the Head Arm Alignment - Before performing the head arm alignment, read and understand the following paragraphs. These concepts are important for accurate head alignment, and they are referenced by name only in the procedure.

Thermal Stabilization - In order to ensure accuracy during head alignment, it is important that the drive, the CE pack, and the FTU be at their normal operating temperatures. To ensure this, all three must be connected and allowed to operate (pack turning and heads loaded to cylinder zero) for a mininum of 60 minutes. For head alignments on more than one drive, the CE pack will require only a 15-minute stabilization, provided that the pack was taken immediately from a drive-under-test and provided that the second drive-under-test has been operating with heads loaded for a minimum of 60 minutes.

Alignment Tool - Use only the head alignment tool specified in the maintenance tools and materials table. Use of a different tool may cause damage to the head arm or the carriage. Always inspect the adjustment end of tool prior to use; it must be free of nicks and scratches, and must have a polished surface. If any aluminum deposits are present, polish the surface with crocus cloth. Any other polishing medium will damage the tool. Do not use a defective tool; repair or replace it if damage exists. When using the alignment tool, position it so that the pin in the end of the tool engages the adjustment slot in the head arm. Ensure that the tool is kept perpendicular to the hole in the carriage at all times; it should turn freely in the hole. If it does not, recheck the end for damage or aluminum build up.

Calculating Offset - The formula for calculating head offset is (P) - (N) = Offset, where P is equal to the meter reading with the head alignment card P/N switch in the P position, and N is equal to the reading with the switch in the N position. All meter readings to the left of zero are negative. Following are examples of offset calculation:

$P = +20$ mV, $N = +15$ mV:

$$(P) - (N) = (+20) - (+15) = +5 \text{ mV}$$

$P = +20$ mV, $N = -15$ mV:

$$(P) - (N) = (+20) - (-15) = +35 \text{ mV}$$

$P = -20$ mV, $N = +15$ mV:

$$(P) - (N) = (-20) - (+15) = -35 \text{ mV}$$

Seek Error Prevention - When the alignment tool is used to position the heads, a small amount of sideways pressure on the tool can cause the carriage to move. This relatively minor amount of movement generates an error voltage which is sensed by the logic as a seek error. The end result is that the logic clears the Slope flip-flop and causes the drive to seek to the next even cylinder. In order to prevent this nuisance error, the head alignment procedure recommends that the Not On Cylinder signal be grounded at back panel pin A2B09 03B.

CAUTION:

Do not install ground lead until instructed to do so by procedure.

The ground lead is installed after the heads are at the alignment cylinder, and it must be removed before another seek can be performed.

Excessive Misalignment - Occasionally, during the alignment check, a badly misaligned head (in excess of 300 mv offset for 75 Megabyte drives) may be discovered. If this is so, the head should not be realigned until all packs written by that drive have first been dumped (data transferred from pack to other storage). Failure to dump the packs before realignment of the heads will make the data unrecoverable.

Carriage Locking - During the alignment procedure, when the heads are over the alignment track, the carriage locking pin and ring assembly is installed in the ALIGN TRACK LOCK hole in the rail bracket assembly. This locks the carriage in place. Failure to install the pin and ring asssembly would allow the carriage to retract if any emergency retract signal were generated. Since the CE's hands are in the actuator during the head alignment procedure, a carriage retraction could be dangerous. It should also be noted that should a retract condition be generated, the carriage locking pin and ring assembly must be immediately removed and the heads manually retracted before a head crash occurs. Carefully observe the instructions regarding the installation and removal of the carriage locking pin and ring assembly.

CE Pack - The CE pack has odd-even dibits written on tracks 000 through 512 (14A) only, on the servo surface. Do not attempt to access beyond track 512 (14A).

NOTE:

All values are expressed in octal and (HEX).

The following procedure first checks the alignment of the servo head and then checks the alignment of the read/write heads (which are aligned in relation to the servo head).

Alignment instructions are provided if any head exceeds the allowable offset. Throughout the procedure, the numbers specified in brackets are hexadecimal values for the cylinder address.

1. With heads fully retracted, raise the logic chassis to its maintenance position and note the position of the servo head adjustment slot in relation to the hole in the carriage. The adjustment slot should be approximately centered in the carriage alignment hole (see Figure 4-5).

If the drive has been used to write data packs, the servo head should not be realigned until all read/write heads have been checked and it is known that excessive misalignment does not exist on any of them. See the introductory paragraph on Excessive Misalignment.

2. If the servo head is misaligned, loosen its mounting screw and (using alignment tool) position the adjustment slot as shown in Figure 4-5. When the servo head is properly positioned, tighten the head mounting screw to a torque of 12 pounds-force-inch. Lower the logic chassis to its normal operating position.

NOTE:

If the servo head is adjusted, all read write heads must be adjusted.

3. With the CE pack installed and with an oscilloscope connected to head alignment card test points Y and Z, load the heads to cylinder 000 (00) and perform thermal stabilization.

CAUTION:

Do not attempt to access beyond cylinder 512 (14A).

4. When thermal stabilization is completed, command continuous seeks between cylinders 360 (F0) and 365 (F5) for 30 seconds minimum. This allows the head gimbal springs time to settle to a normal operating position and also settles any binding between the head arm and the head mounting screw.
5. Stop continuous seeks and command a direct seek to cylinder 365 (F5).

When using the head alignment kit, set the sensitivity switch on the meter to position 50 and use the X.1/X1 switch on the head alignment card to control sensitivity.

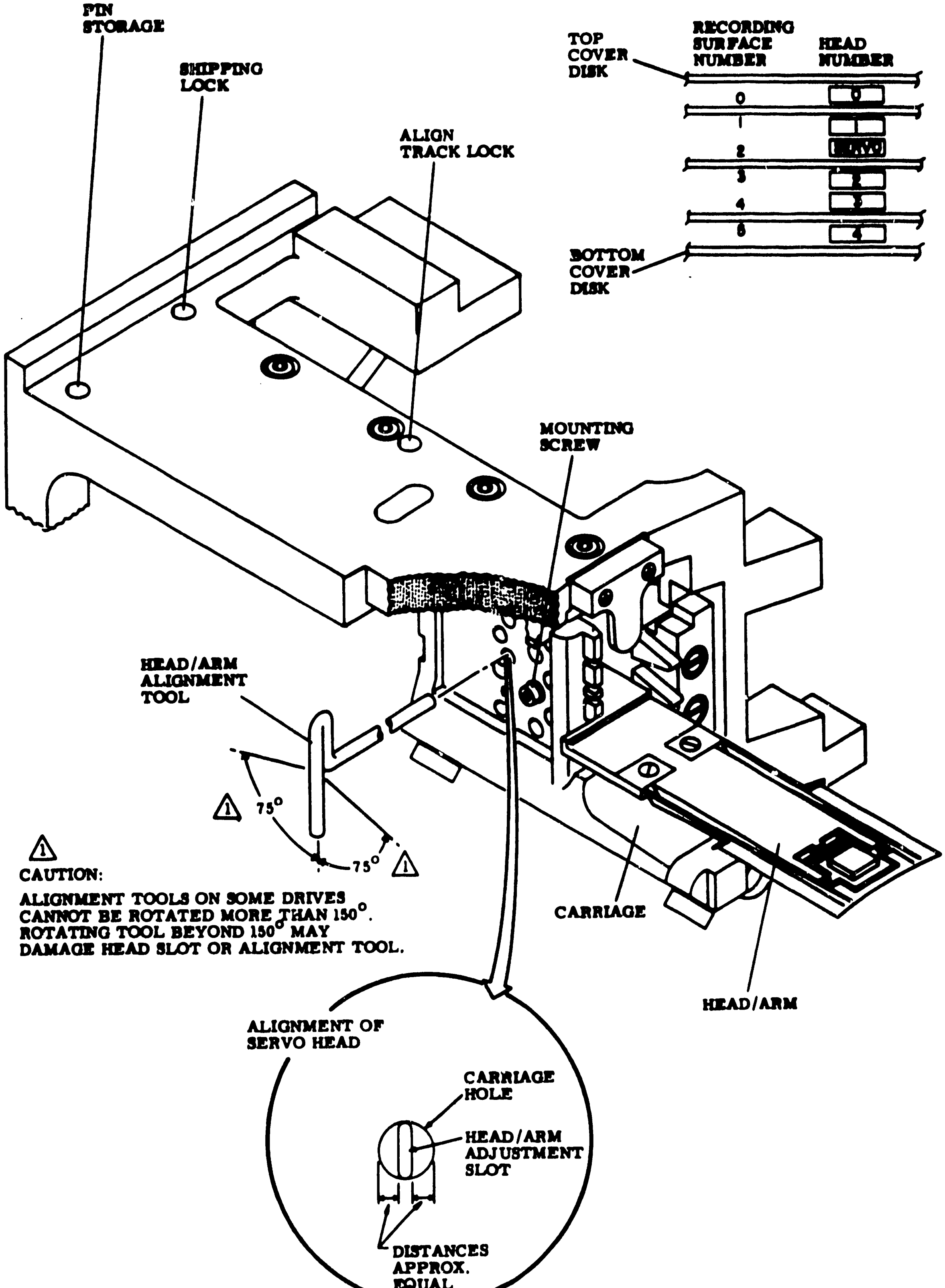


FIGURE 4-5 HEAD ARM ALIGNMENT

6. On the head alignment card, set the S/RW (servo/read/write) switch to the S position and set the X.1/X1 switch to X.1 position.

7. A balanced dibit pattern, similar to Figure 4-6, should be observable on the oscilloscope. If the pattern is not balanced, terminate the head arm alignment and refer to the servo checks in the trouble analysis section (Section 8).

NOTE:

When calculating head offset, if both P and N readings are less than 100 mv, set the X.1/X1 switch on head alignment card to the X1 position. Return the switch to X.1 position before proceeding to the next head.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH I - 2V
CH 2 - NOT USED

TIME / DIV
A - 2 μSEC
B - NOT USED

TRIGGERING
A - INTERNAL POSTIVE
B - NOT USED

PROBE CONNECTIONS (USE X10 PROBE)
CH I TO FTU DIBITS JACK
CH 2 - NOT USED

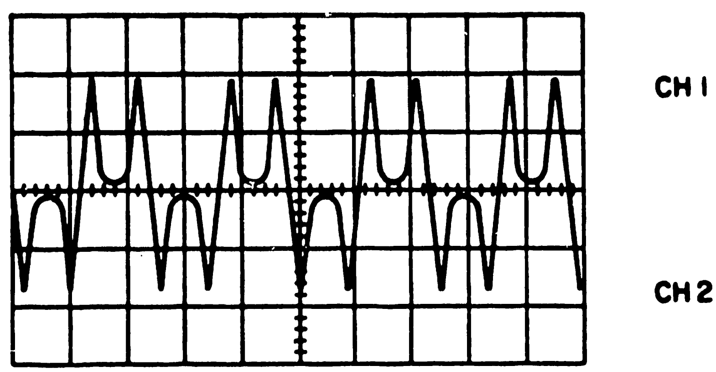


FIGURE 4-6 BALANCED DIBIT PATTERN

8. If a balanced dibit pattern was observed in the previous step, calculate head offset for the servo head. Servo head offset must be 0 ± 30 mv. If offset is greater than 30 mv, terminate this procedure and troubleshoot servo system.
9. On the head alignment card, set the S/RW switch to the RW position. Select head 0.
10. Calculate and record the offset for head 0.
11. Repeat the previous step for all remaining heads.

CAUTION:

If any read-write head exceeded 200 mv (300 mv) offset, excessive misalignment exists. Refer to introductory paragraph.

12. If calculated offset for any read/write head exceeded 100 mv (150 mv) proceed to next step. If all the heads were within the offset requirements, restore the drive to normal operation.
13. Command a return-to-zero seek. Press the START switch to stop the drive motor and unload the heads.
14. Raise the logic chassis to its maintenance position and loosen the head mounting screw for any head which exceeded the offset specification; then retighten each loosened screw to a torque of 4 pounds-force-inch. Remove the connector support bracket from head arm connectors. This will prevent possible electrical contact between the alignment tool and the bracket, which could cause a short circuit and damage the power amplifier.
15. Press the START switch to start the drive motor and load the heads. Command continuous seeks between cylinders 360 (F0) and 365 (F5) for 30 seconds minimum.
16. Stop continuous seeks and command a direct seek to cylinder 365 (F5).

WARNING:

Use care not to cause any short circuits when moving the logic chassis to install the locking pin. Failure to install locking pin could cause personal injury.

17. Swing down the logic chassis and install the carriage locking pin and ring assembly in the ALIGN TRACK LOCK hole. Return the logic chassis to the maintenance position.
18. Ground backpanel pin A2B09 03B (Not On Cylinder) to prevent nuisance errors. Ensure that the head alignment card X.1/X1 switch is set to the X.1 position and select a head to be aligned.
19. Using the recommended head alignment tool, perform a coarse adjustment as follows:

    a. Adjust the head until a balanced dibit pattern is visible on the oscilloscope.
    b. Continue to adjust the head for a minimum deflection of the null meter with respect to zero.
    c. While changing the position of the P/N switch, continue to adjust head until calculated offset is less than 100 mv. For optimum performance the heads should be adjusted as close to zero offset as possible.

    If the head cannot be aligned to less than 100 mv, it is possible that the read/write head is at the end of its travel. Recheck the servo head alignment.

20. Repeat the previous step for all heads to be aligned.
21. On head the alignment card, set the X.1/X1 switch to the X1 position.
22. Perform a fine head adjustment. Use the same procedure as for the coarse adjustment, but adjust the heads to obtain a calculated offset of less than 50 mv (75 mv). Perform a fine head adjustment for all heads to be aligned.

NOTE:

Failure to remove the ground wire will prevent any seek operations.

23. Remove the ground wire from backpanel pin A2B09 03B.
24. Move the carriage locking pin and ring assembly to the PIN STORAGE hole.
25. Perform a return-to-zero seek.
26. For each head adjusted, tighten its head mounting screw to a torque of 12 pounds-force-inch.
27. Command continuous seeks between cylinders 360 (F0) and 365 (F5) for 30 seconds minimum.
28. Stop continuous seeks and command a direct seek to cylinder 365 (F5).

WARNING:

When moving the logic chassis to install the locking pin, take care to prevent any short circuits. Failure to install the locking pin may cause personal injury.

29. Swing down the logic chassis and install the carriage locking pin and ring assembly in the ALIGN TRACK LOCK hole. Return the logic chassis to its maintenance position.
30. Ground backpanel pin A2B09 03B to prevent nuisance errors.
31. Ensure that the head alignment card X.1/X1 switch is in the X1 position.
32. Check the alignment of each head that was adjusted, to assure that tightening the screws did not change the alignment.

CAUTION:

Use care when using the alignment tool on heads which have been tightened to a torque of 12 pounds-force-inch. Misuse of tocl will damage the head arm or the carriage.

33. If calculated offset for any head exceeds 75 mv (110 mv) repeat the fine adjustment procedure until offset is less than 50 mv (75 mv).

NOTE:

Failure to remove the ground wire will prevent seek operations.

34. Remove the ground wire from backpanel pin A2B09 03B.
35. Move the carriage locking pin and ring assembly to the PIN STORAGE hole.
36. Restore the drive to normal operation.

E. Perform the Velocity Gain Adjustment - The following procedure is for checking and, if necessary, adjusting the 75 megabyte servo system velocity signal. If the adjustment cannot be completed satisfactorily, the procedure must be terminated. If this happens, perform a trouble analysis. This procedure assumes that the FTU is connected, and that a scratch pack is installed in the drive.

1. With the drive case closed, command random seeks for 10 minutes minimum, in order to thermally stabilize drive.
2. Stop random seeks and set up the oscilloscope per Figure 4-7. The oscilloscope ground references must be as shown.
3. Command 1466 (HEX 336) cylinder continuous seeks and adjust the oscilloscope trigger level to obtain the waveform shown in Figure 4-7.
4. Measure the full length seek time. The time between ON cylinder pulses should be 52 to 54 milliseconds.
5. If the full length seek time is not as specified, perform a velocity gain adjustment. On card A2A07, adjust the velocity gain potentiometer (E2R6 in Figure 4-8) to obtain a measurement of 52 to 54 milliseconds between the leading edges of the ON Cylinder pulses.

OSCILLOSCOPE SETUP

	VOLTS/DIV	TEST POINT	SIGNAL NAME
CH 1 - (USE X 10 PROBE)	0.2 V	A2B09 03A	+ ON CYLINDER
CH 2 - (USE X PROBE)	NOT USED		

	SLOPE/SOURCE	TEST POINT	SIGNAL NAME
TRIGGER A- (USE X 10 PROBE)	+/EXT	A2B09 07A	- FORWARD SEEK
TRIGGER B- (USE X PROBE)	NOT USED		

TIME/DIV: 10 ms   MODE TRIGGER: CH 1

ADDITIONAL SETTINGS: NONE

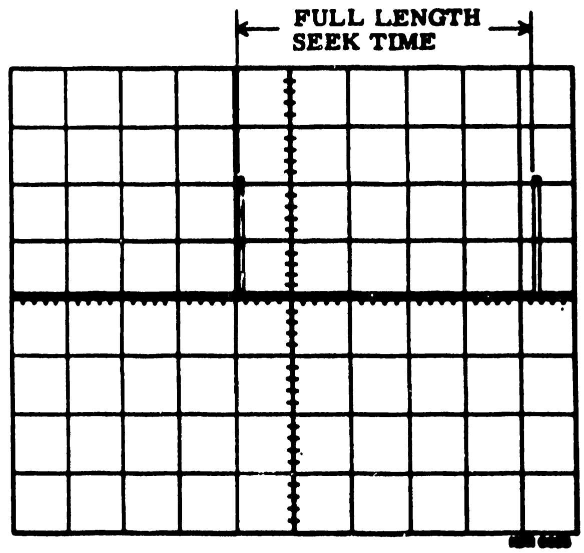


FIGURE 4-7   75 MEGABYTE VELOCITY GAIN WAVEFORM

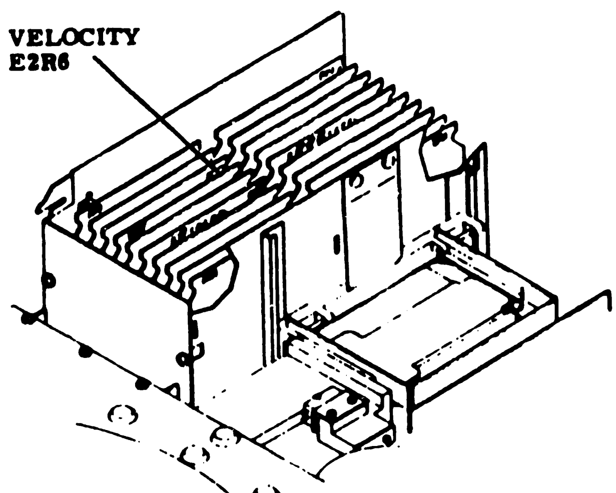


FIGURE 4-8   75 MEGABYTE VELOCITY GAIN ADJUSTMENT LOCATION

6. Return the drive to normal operation.

F. Power the drive off and remove the FTU.

G. Perform the same installation on all additional disk drives.

4.1.9 SYSTEM INTERCONNECTION

A. Attach the disk drive to the 2200VS system.

1. Attach the 15 ft. "A" cable (PN 220-3041) to receptacle J3 at the rear of the disk drive (see Figure 4-9).
2. Attach the other end of the "A" cable to the "A" cable receptacle on the 22V03/04 card in the processor mainframe.

   The "A" cable should be run from receptacle J3 on the back of the disk drive, down through the cable entrance space in the base of the disk drive cabinet, and up through the cable entrance space in the rear base of the processor mainframe.

   Since the "A" cable is not keyed, caution must be exercised to ensure its proper installation. Make certain that pin 1 on the disk side of the cable matches pin 1 on the 22V03/04 card. Use wire colors to accomplish this. For example, twisted pair brown/black is attached to the pin 1 side of the disk drive connector (Figure 4-9). Attach the same color twisted pair (brown/black) to the pin 1 side of 22V03/04 card (Figure 4-10).

3. Attach the 15 ft. "B" cable (PN 220-3033-1) to receptacle J2 at rear of the disk drive, making certain that cable shield ground strand (see Figure 4-11) is attached to the pin 1 side of J2 (Figure 4-9).

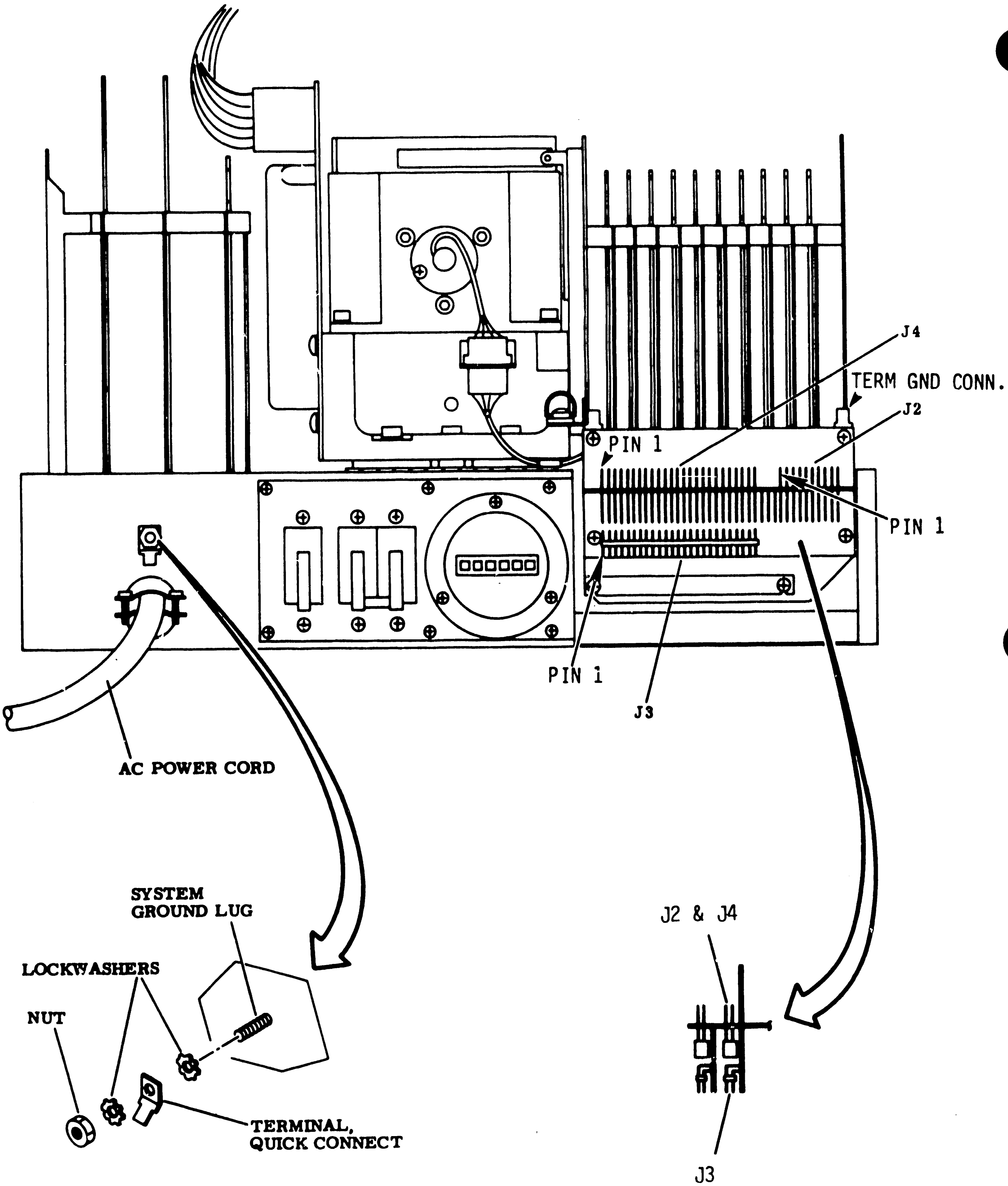


FIGURE 4-9 CABLE INSTALLATION - PARTS LOCATION VIEW

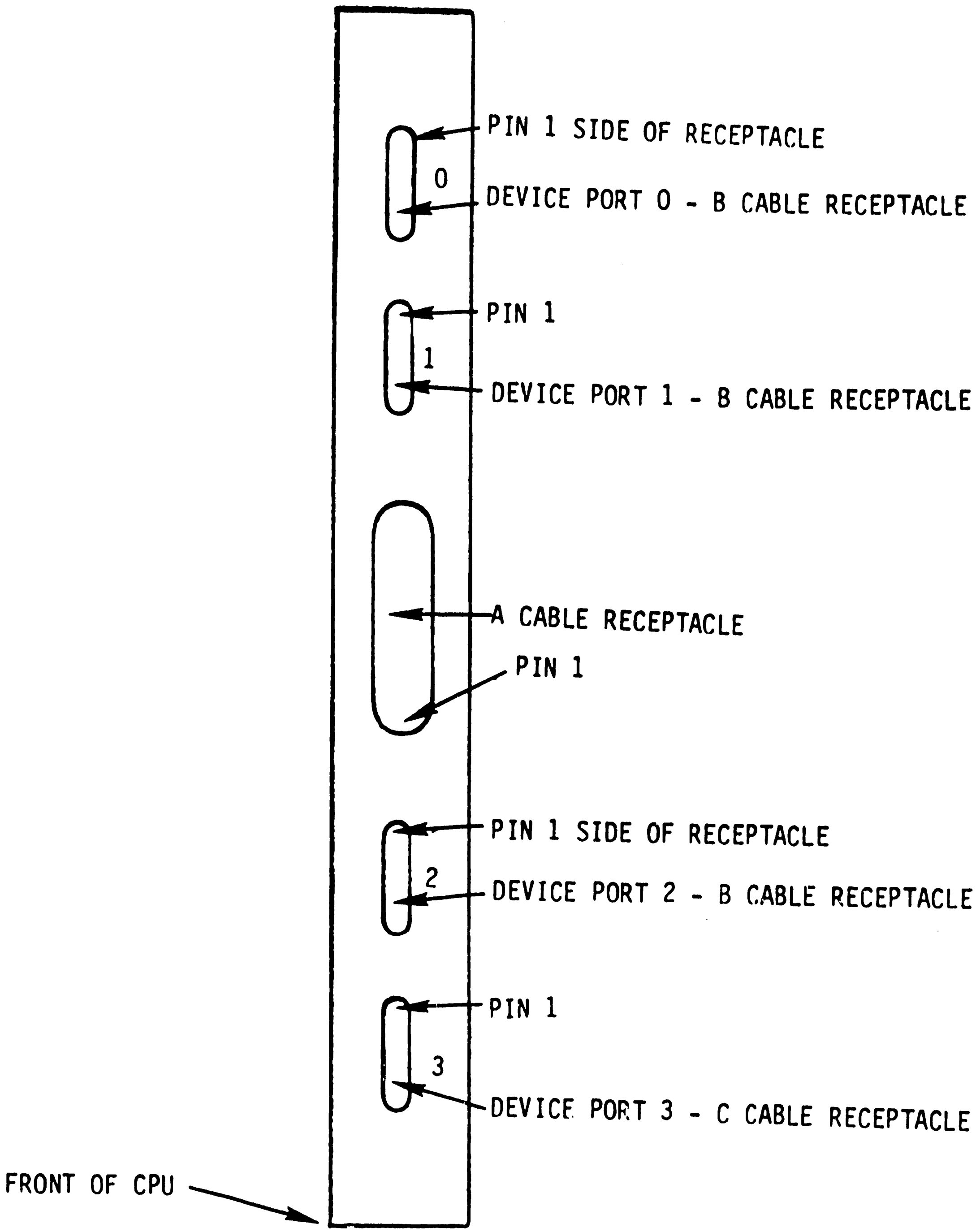


FIGURE 4-10 TOP VIEW OF 22V03/04 IOP

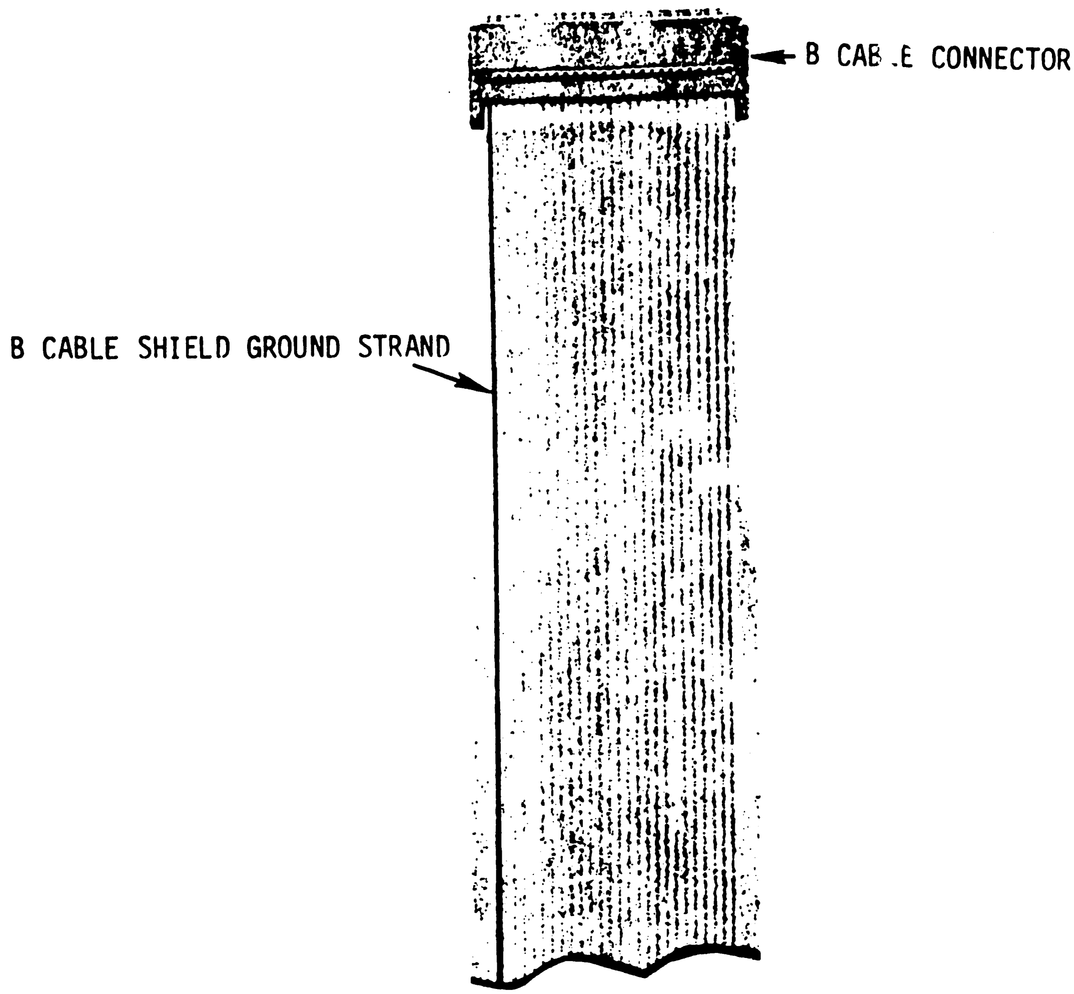


FIGURE 4-11 "B" CABLE

4. Attach the other end of the "B" cable to the port '0' receptacle on the 22V03/04 card in the processor mainframe, making certain that the "B" cable shield ground strand is on the pin 1 side of the receptacle (Figure 4-10).

The "B" cable should be run from receptacle J2 on the back of disk drive, down through the cable entrance space in the base of the disk drive cabinet, and up through the cable entrance space in the rear base of the processor mainframe.

B. If no other disk drives are to be attached to the system, install terminator card (PN 210-7177) in receptacle J4 on the disk drive. Attach the terminator ground lead to the terminator ground connector at the rear of disk drive (shown in Figure 4-9).

NOTE:

Pin 1 of the terminator must match pin 1 of receptacle J4.

C. If more than one disk drive is to be attached to the system, use 10 ft. "A" cables (PN 220-3031) and 24 ft. "B" cables (PN 220-3033-4) to daisy chain the additional drives in the configuration shown in Figure 4-12.

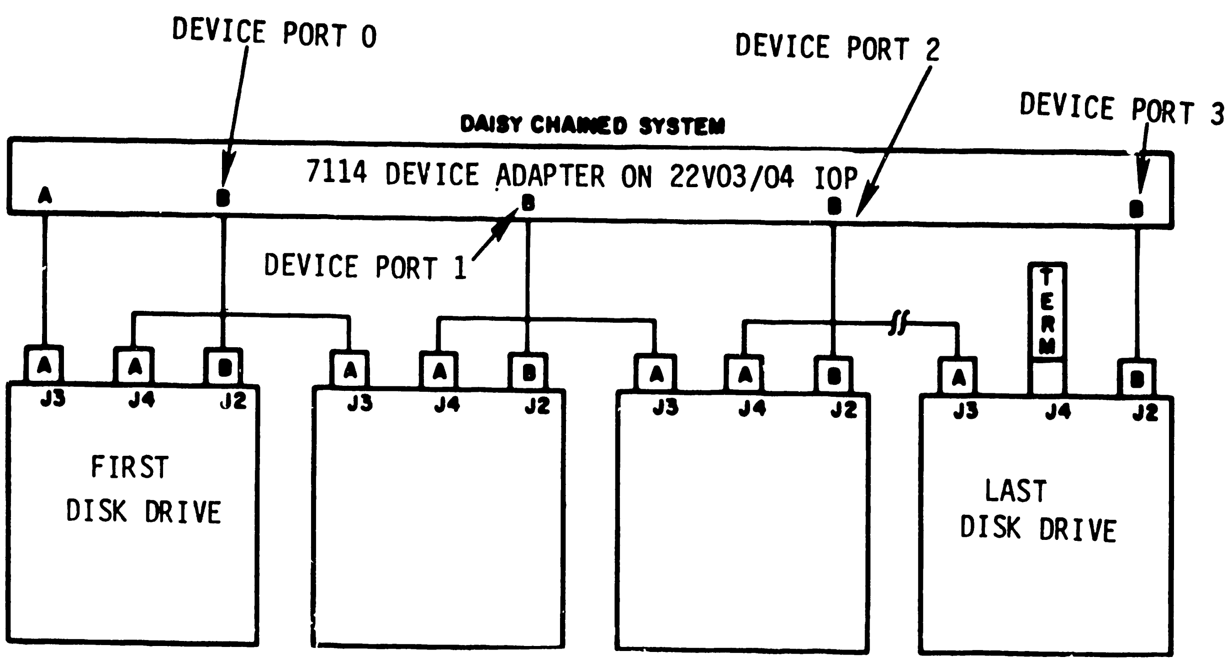


FIGURE 4-12 DAISY CHAIN CONFIGURATION

NOTE:

A terminator card is always attached to J4 on the last drive in a daisy chain.

NOTE:

When attaching daisy chain "A" cables, caution must be exercised to ensure pin 1 continuity from the IOP to the terminator.

D. Insert the appropriate device address plugs into the front panel of each disk drive.

   1. If the "B" cable is attached to port "0" of the 22V03/04, insert the "0" plug into the disk drive; if the "B" cable is attached to port "1" of the 22V03/04, insert the "1" plug into the disk drive, and so on.

   2. If two 22V03/04 IOP's are used in the system, thus providing the capability of 8 disk drives, the additional 4 disk drives must contain device address plugs 0-1-2-3, respectively.

E. Attach the system ground lead from the bolt on Processor Mainframe (shown in Figure 3-2) to the system ground lug on the back of the disk drives (Figure 4-9). If more than one drive is attached to a 22V03/04 IOP, attach the system ground lead in daisy chain fashion from one drive to the next.

4.2 2265-V2 (288 MEGABYTE DISK DRIVE)

4.2.1 POWER REQUIREMENTS

When laying out the site, consideration must be given to providing source AC power for each drive. A 230 VAC, single phase receptacle should be provided for each drive. In addition, a dual poled, 20 amp circuit breaker is recommended for each drive. Carefully check to see that these requirements have been satisfied.

WARNING:

The 230 VAC primary power must be thoroughly tested prior to attaching the disk drive. Below is a diagram of the connector and a chart of the voltages to be measured across the various pins. Ensure that the voltages are correct prior to attaching the power connector. FAILURE TO PERFORM THIS TEST COULD RESULT IN SERIOUS DAMAGE TO THE DISK DRIVE.

D. V. M Chart

X to Y - 230 VAC

X to G - 115 VAC

Y to G - 115 VAC

G is building Gnd.

NOTE:

The receptacle must be Hubble catalog no. 2320 (NEMA REF. L6-20R) or a suitable replacement.

The plug must be Hubble catalog no. 2321 (NEMA REF. L6-20P) or a suitable replacement.

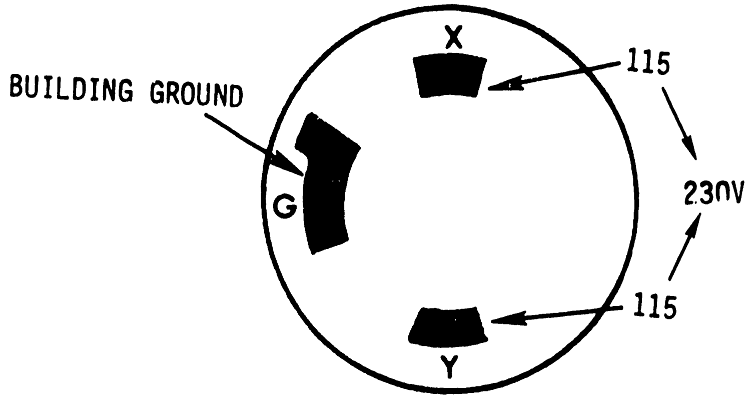


FIGURE 4-13 POWER CONNECTOR

Additional requirements for single disk configurations are as follows:

1-288 Meg Disk Pack (PN 177-0065)
1-15 ft. "A" cable (PN 220-3041)
1-15 ft. "B" cable (PN 220-3033-1)
1-Terminator (PN 210-7177)

Each additional 288 or 75 Meg drive attached to a system will require the following:

1-10 ft. "A" cable (PN 220-3031)
1-24 ft. "B" cable (PN 220-3033-4)
1-288 Meg Disk Pack (PN 177-0065) or 75 Meg Disk Pack (PN 177-0066)

4.2.2 DISK DRIVE INSPECTION

A. Inspect drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved.

B. Verify that all logic cards are firmly seated in logic chassis and power supply (Figures 4-14 and 4-16).

The logic chassis is located at the rear of the drive and is accessed by opening the rear door. Releasing the catch on the logic chassis allows it to swing outward, thus permitting access to the card cage (refer to Figure 4-14). The card cage cover must be removed in order to reach the logic cards. When opening and closing the logic chassis, use care not to damage the cables or air hose.

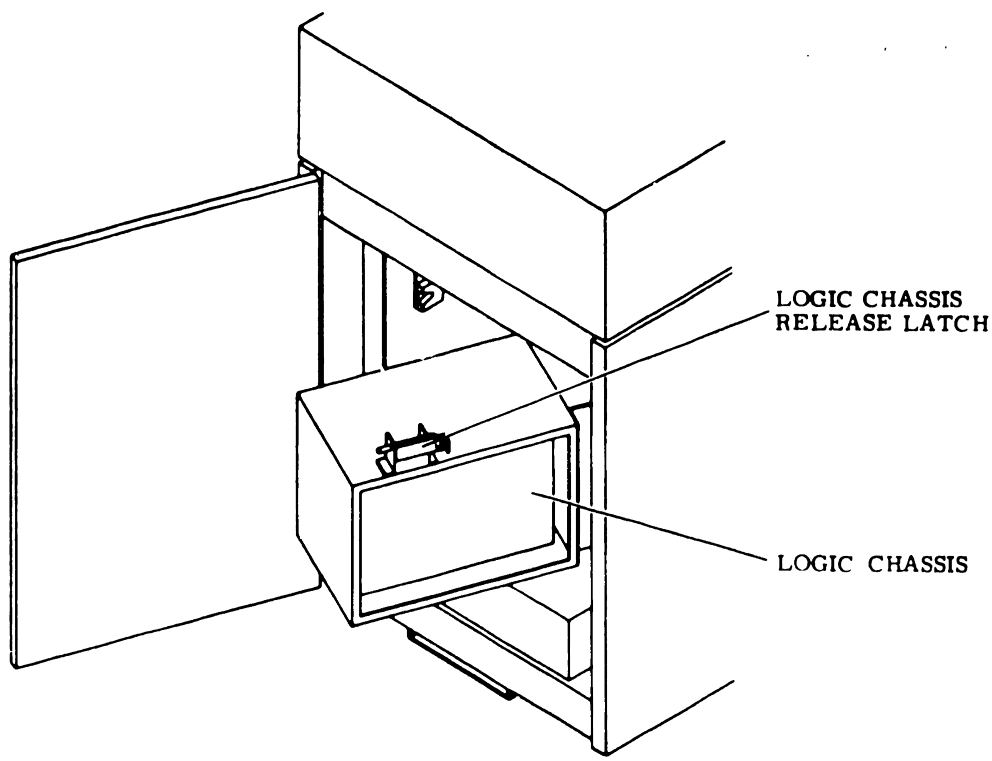


FIGURE 4-14 LOGIC CHASSIS

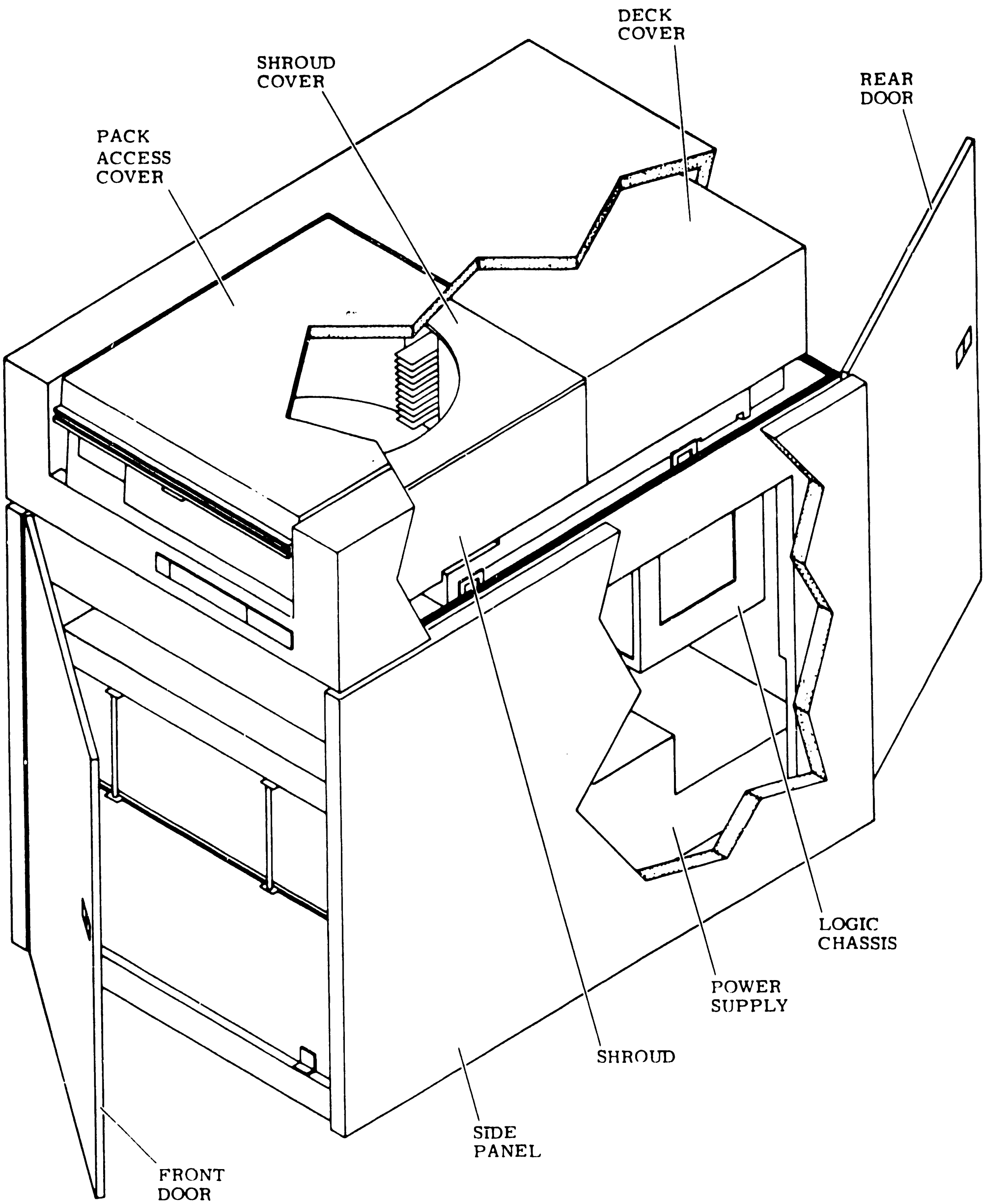


FIGURE 4-15 288 MEGABYTE DISK DRIVE

The power supply is mounted on slides at the bottom rear of the disk drive cabinet. They allow the power supply to be slid out of the cabinet for maintenance. The supply is slid out to the maintenance position by lifting the power supply release latch (refer to Figure 4-16) and then pulling the supply out.

When the power supply is in the maintenance position, the top cover can be removed to provide access to the inside of the supply. The top cover is removed by first removing the four screws at the rear of the cover (Figure 4-16) then loosening the four screws at the front of the cover and slipping the cover off.

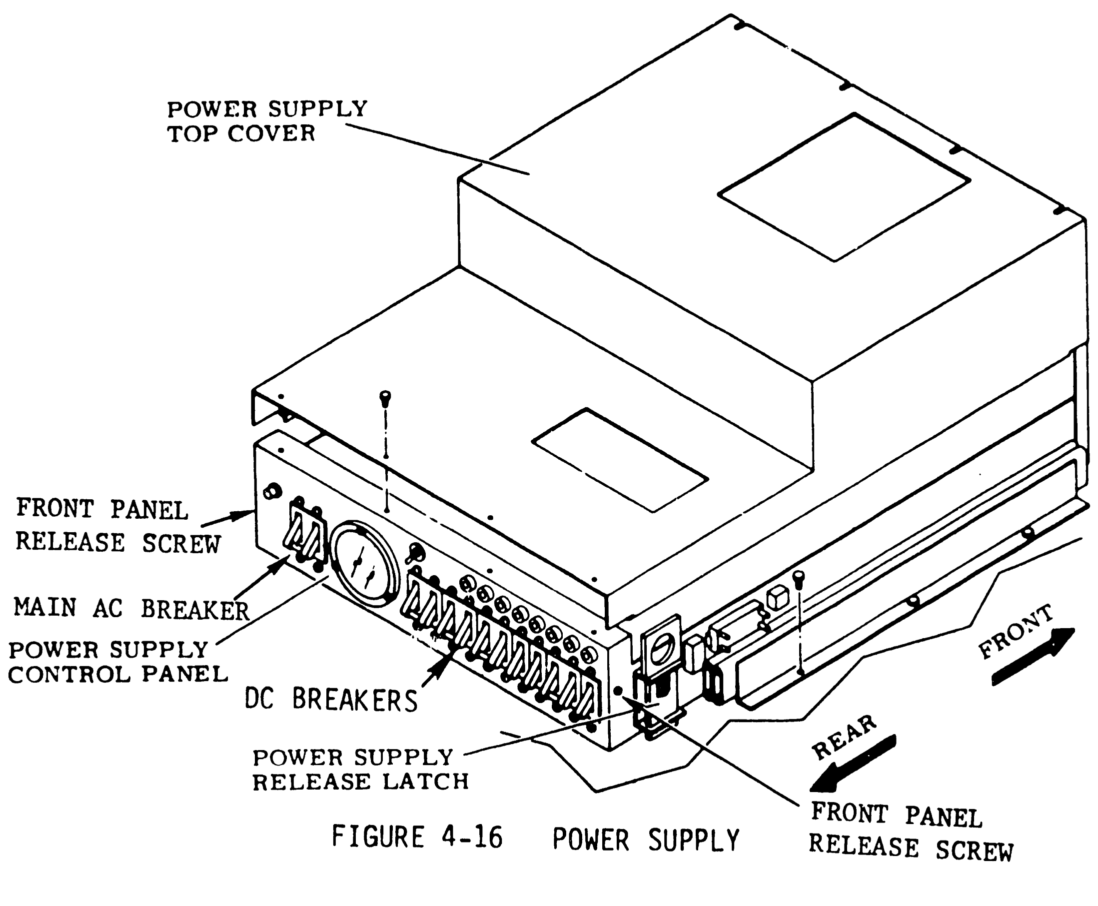


FIGURE 4-16 POWER SUPPLY

The power supply control panel is hinged on its bottom edge so that the panel may be opened to allow access to components on the back of the panel. To open the control panel, first remove the top cover, then remove the screws on each side of the panel and pull it open. See Figure 4-33.

C. Verify that all connectors are firmly seated.

D. Verify that the control panel is firmly seated in the shroud (Figure 4-15).

E. Verify that all cabling is intact with no broken or damaged wires.

F. Inspect the entire drive for any foreign material that may cause an electrical short.

G. Check the actuator and pack area for any material that may obstruct movement of the carriage and heads.

4.2.3 DISK CABINET LEVELING

Cabinet leveling should not be performed until the drive is in its final location, with no further necessity to move it. Cabinet leveling consists of installing leveling pads (shipped in a plastic bag taped inside the cabinet), moving the drive to its permanent location, screwing down the leveling pads until the drive is aligned with other peripherals, and ensuring that the weight of the drive is off the casters. Note that disk drives shipped in Wang cabinets have the leveling pads already installed.

A. Install a jam nut on each leveling pad; then install a leveling pad at each corner of the cabinet frame (see Figure 4-17) by raising the corners of the cabinet and threading the pads into the corresponding weld nuts on the frame.

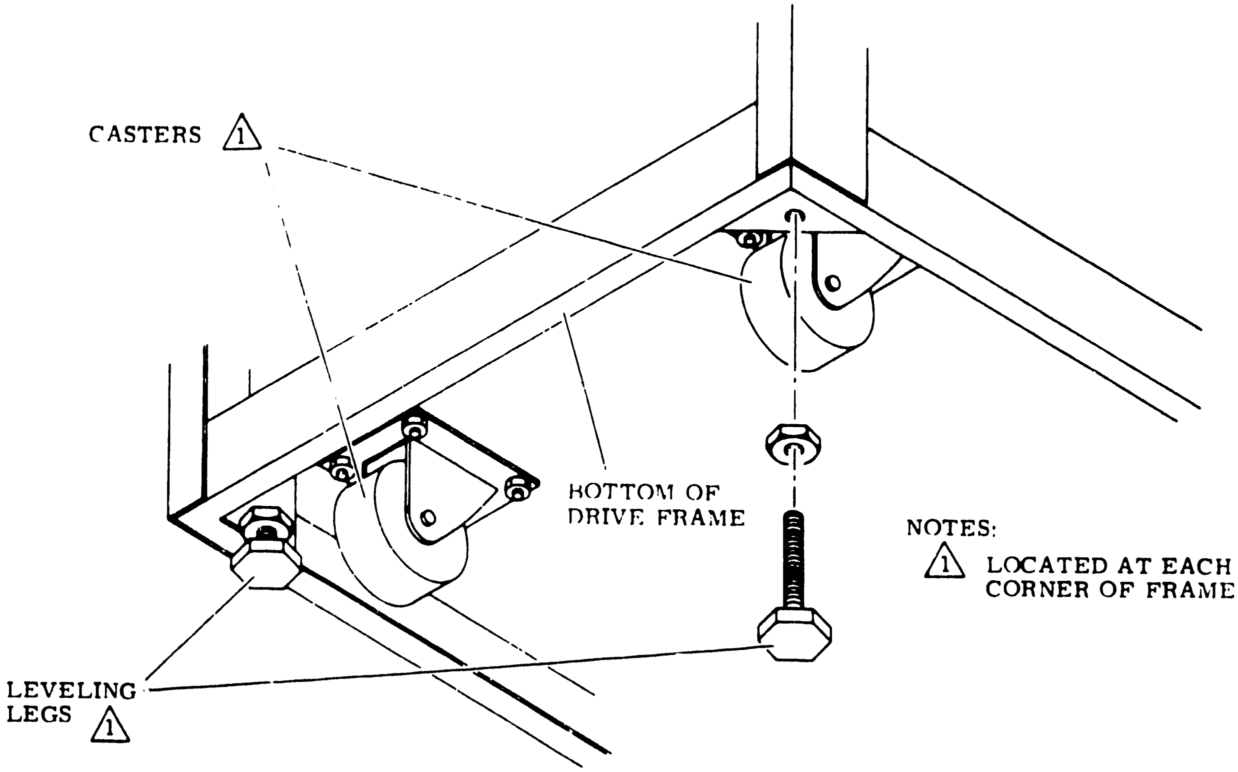


FIGURE 4-17 LEVELING PAD INSTALLATION

B. Move the drive to its permanent location. The disk drive must rest on a rigid surface (not carpeting) to ensure proper flow of cooling air through the unit.

C. Turn the leveling pads down until they support the weight of the drive.

D. Adjust the leveling pads until drive is aligned with adjacent equipment.

E. Place a spirit level on drive case assembly; then adjust the leveling pads until the drive is level to within three angular degrees, front-to-back and side-to-side.

F. When the disk drive is level in both directions, tighten the jam nuts against the bottom of the frame.

4.2.4 DISK SECTOR SWITCHES

The drive provides the capability for setting the number of sectors per disk revolution by means of sector switches (see Figure 4-18). The required number of sectors for the 2200VS System is 9; therefore, the sector switches, located on the LTV card in logic chassis location A06, must be set as follows:

Switch Number	
0	Off
1	Off
2	On
3	Off
4	On
5	Off
6	On
7	On
8	On
9	Off
10	On
11	Off

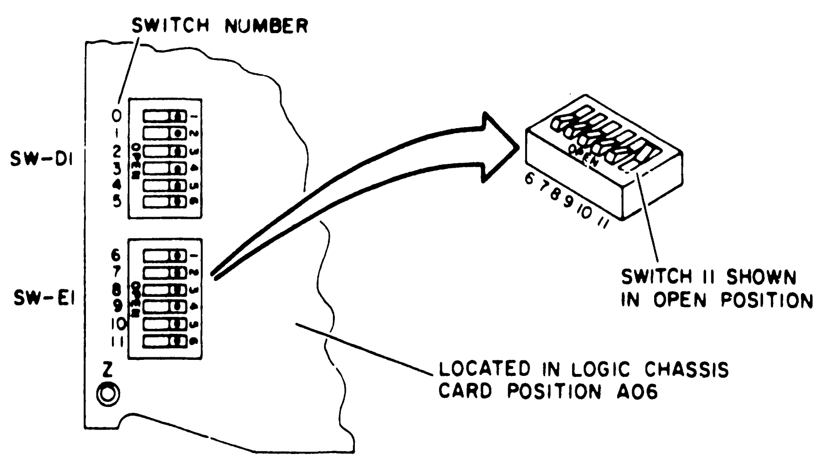


FIGURE 4-18 SECTOR SWITCHES

4.2.5 DISK DRIVE CLEANING

A. Carefully vacuum the interior of the cabinet and case, paying particular attention to flat surfaces where dust accumulates.

B. Vacuum all exterior surfaces of the electronic assembly. Use a soft cloth dampened in a mild detergent solution to remove any greasy residue.

C. Inspect cables and connections for any sign of damage, and repair as necessary.

D. Inspect drive belt for signs of fraying or cracking. Replace the belt if necessary.

E. Using a soft cloth dampened in a mild detergent solution, carefully wipe all cabinet surfaces. Use care to prevent moisture from entering the drive.

F. Carefully vacuum the entire pack area.

G. Using a piece of adhesive type tape, remove any dirt particles not removed during vacuuming.

H. Using a piece of lint free gauze dampened in media cleaning solution, wipe all surfaces of the shroud. Remove all smudges and dirt. Carefully clean all surfaces of the spindle.

I. Close the pack access cover immediately after cleaning to ensure that dust will not enter the pack area.

4.2.6 ROUTE POWER CABLE

A. The drive power cable is routed and connected as follows (refer to Figure 4-19). Remove the two screws securing the cable guide to the frame; remove the cable guide.

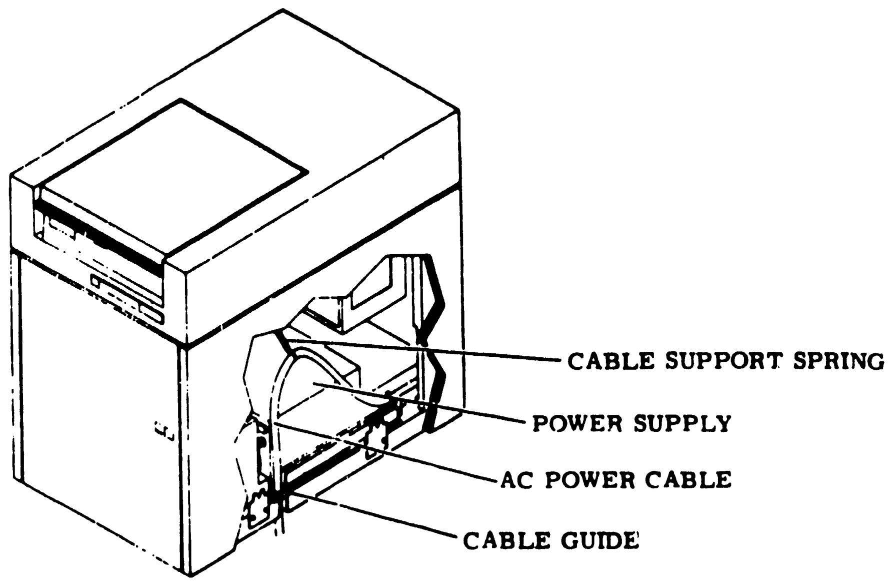


FIGURE 4-19 POWER CABLE ROUTING

B. Route the power cable through the cable guide and connect it to a power receptacle.

C. Position the cable guide on the frame and secure it with the two screws.

D. Connect the support spring to the power cable.

E. Remove the two shipping bolts located on the topside of the disk drive deck. To access these bolts, open the cabinet top cover and remove the deck cover.

F. Remove the carriage locking pin from the shipping hole in the actuator housing, and it store in the storage hole, also located on actuator housing (Figure 4-26).

4.2.7 POWER-ON CHECKOUT

A. Make certain that all breakers at the rear of the disk drive are in "OFF" position. Connect power cord connector to the AC power receptacle provided at the site. Turn the AC breaker to "ON" position.

B. Check the blower motor for proper operation.

C. Make certain that the start switch on the front panel is in the "OFF" position (not depressed).

D. Allow drive to operate for 10 minutes; then apply DC power by means of breakers (Figure 4-20). Using a DVM, check for the following voltages (indicated in Figure 4-20):

<u>Voltage TP/Tolerance</u>

+46 (-2, +5) Vdc
-46 (+2, -5) Vdc
+9.7 ($\pm$1) Vdc
-9.7 ($\pm$1) Vdc
+20 ($\pm$2) Vdc
-20 ($\pm$2) Vdc
+28 ($\pm$2) Vdc

These voltages are not adjustable. Any voltage that is out of tolerance must be repaired.

E. With an oscilloscope, check the following at test points (Figure 4-20):

Test Jack	Max. allowable Ripple
+46	4.5 V
-46	4.5 V
+9.7	6.5 mV
-9.7	6.5 mV
+20	1.0 V
-20	1.0 V
+28	1.0 V

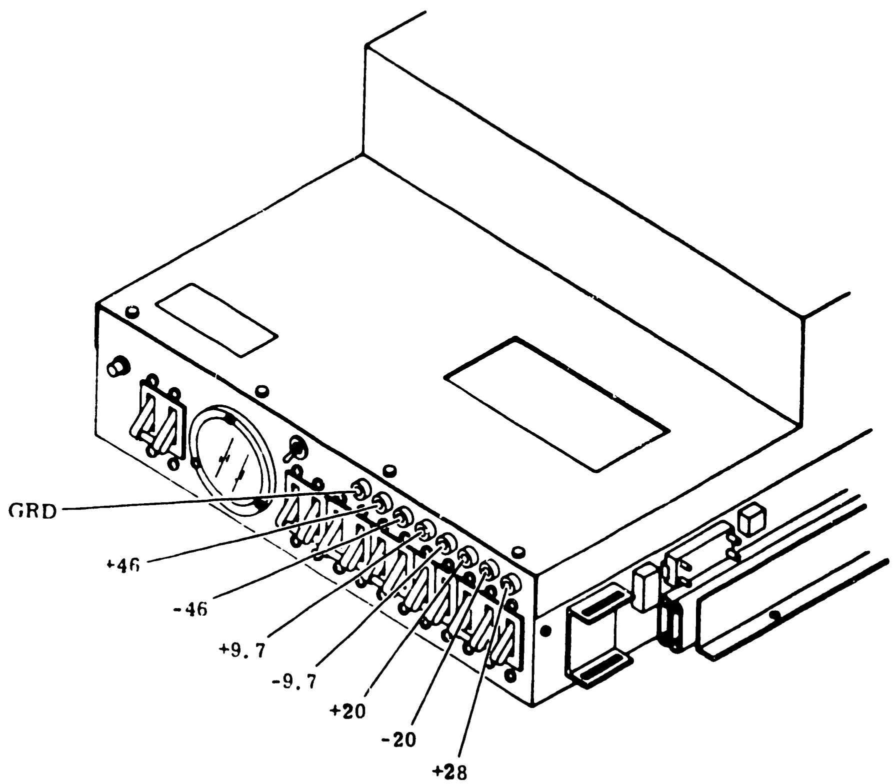


FIGURE 4-20 POWER SUPPLY CONTROL PANEL TEST POINTS

4.2.8 FIELD TEST UNIT (FTU)

If voltages are present and within specifications, power the drive off and attach the FTU as follows (refer to Figure 4-21):

A. Turn the I/O panel fastener counterclockwise and remove the panel from the upright support. This will allow the panel to be positioned for easy cable installation.

B. Remove the nuts and screws securing I/O panel cover to I/O panel; then remove the cover and set it aside. The cover is not replaced until maintenance is complete.

C. Terminate J4. Make sure pin 1 of the terminator matches pin 1 of J4.

D. Install tester A cable to J3; install B cables to J2. Make sure that pin 1 of the A and B cables matches pin 1 on J3 and J2.

E. Position the I/O panel on the upright support and secure it with I/O panel fastener.

F. Note that additional instructions for interconnecting the drive and the FTU are contained in the preliminary set up instructions in the FTU appendix of this manual. The procedures for commanding the drive to perform the various operations (access, read, write, head selection) required for testing are contained in the appendix. When performing the preliminary set up procedure, the drive oriented switches located on the FTU panel must be set as follows:

   RPM to 3600 (Hi)
   TPI to 400 (Hi)
   Heads to 19 (Hi)
   BPI to 6000

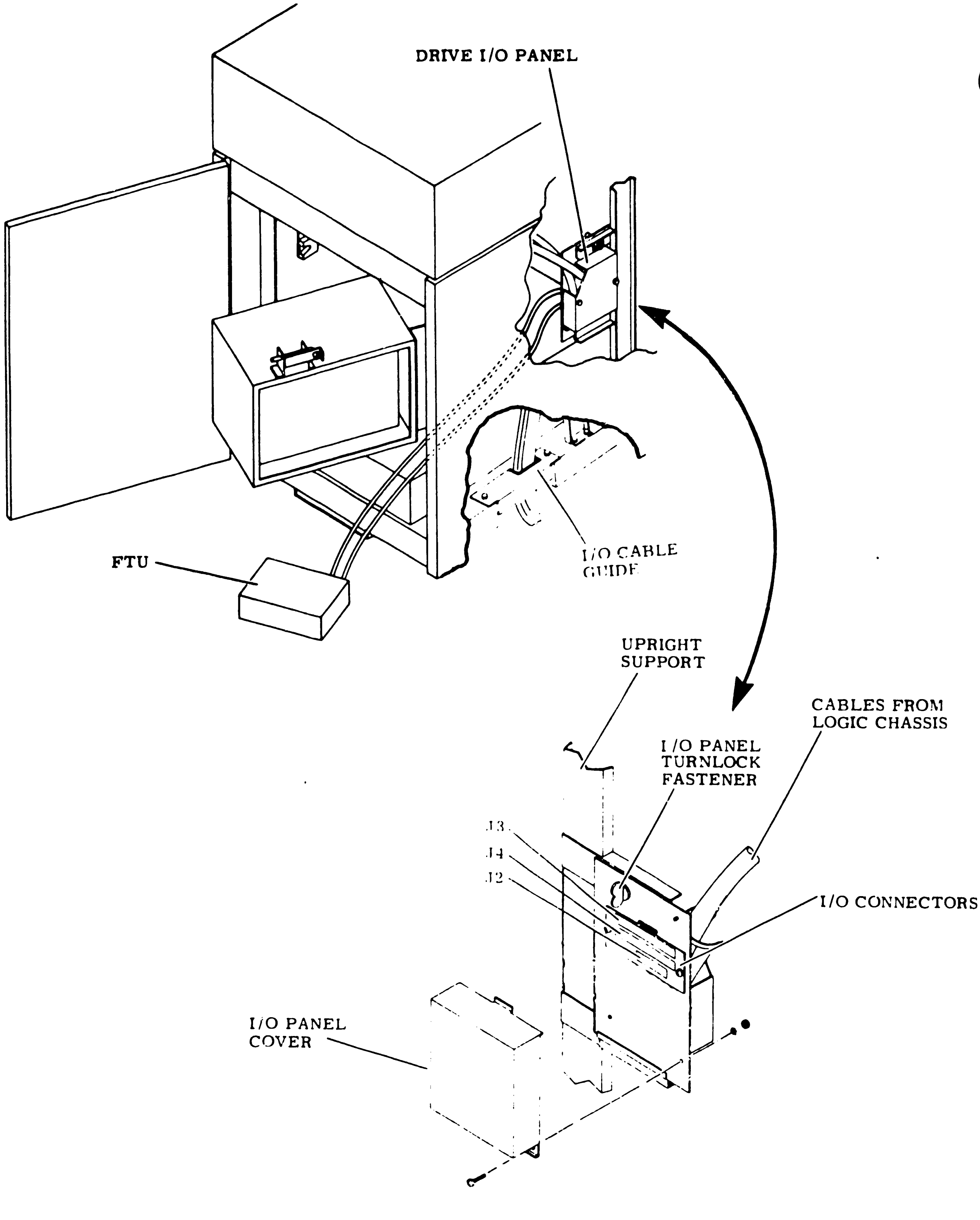


FIGURE 4-21 I/O PANEL AND I/O CABLE ROUTING

G. The sector switches (an 8 bank rocker switch DIP) are located in position A20 on the FTU logic board. Set these sector switches as follows:

Sector Switch

1	On
2	Off
3	Off
4	On
5	Off
6	Off
7	Off
8	Off

H. Disconnect the yellow lead wire from the voice coil.

I. Apply AC and DC power to the drive.

J. Install a 288 Meg Disk Scratch Pack into the drive as follows:

1. Raise the pack access cover.
2. Lift up the disk pack by its plastic canister handle.
3. Disengage the bottom dust cover from the disk pack by turning the canister handle counterclockwise. Set the cover aside in an uncontaminated area.

CAUTION:

Avoid abusive contact between the disk pack and the spindle. The read/write heads are sometimes manually positioned during maintenance procedures. Make certain that the heads are fully retracted.

4. Place the disk pack onto the spindle.
5. A spindle lock mechanism is actuated when the disk pack canister cover is on the spindle. This mechanism holds the spindle stationary while loading or unloading a disk pack.

6. Twist the canister handle clockwise to lock the disk pack in place. A click may be heard as the spindle lock mechanism engages.
7. Lift the canister clear of the disk pack, place the bottom dust cover on the canister, and then set aside the canister in an uncontaminated area.
8. Immediately close front cover to prevent dust from entering the drive and contaminating the disk surfaces.

4.2.9 ALIGNMENT/ADJUSTMENT PROCEDURES

A. Press the start switch and allow the drive to purge for 10 minutes. After purging the pack, press the start switch again to disengage the spindle drive motor; then power off the drive and connect the yellow lead wire to the voice coil.

B. Bring the drive up to its ready state and adjust +5, -5 volts as follows:

1. Command continuous seeks between cylinders 000 and 200 (80).

2. Check and adjust +5 volts as follows:
   a. Connect the positive meter lead to A2JD94-04A on the logic backpanel.
   b. Connect the negative meter lead to the terminal marked ground, on the front edge of the regulator card (Figure 4-22).
   c. The measured voltage should be +5.1 (±.05) VDC. If this requirement is not met, adjust the bottom pot on the regulator card until the voltage is within the specified limits.

3. Check and adjust -5 volts as follows:
   a) Connect the positive meter lead to the terminal marked GND, on the front edge of the regulator board. Connect the negative meter lead to wire wrap pin A2JD94-01A on the logic backpanel.

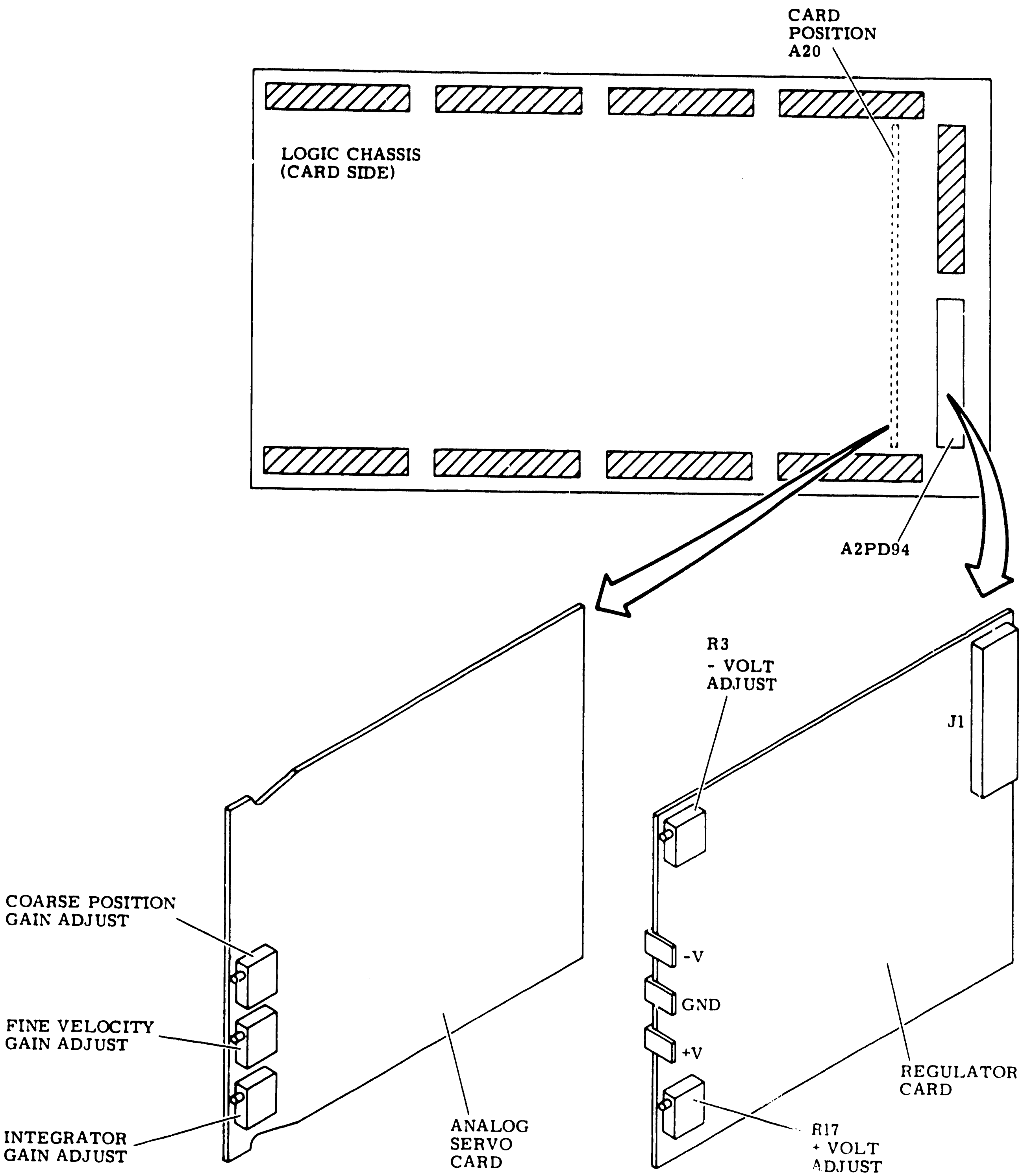


FIGURE 4-22 REGULATOR AND ANALOG SERVO CARDS

b) The measured voltage should be -5.1 ($\pm$.05) VDC. If this requirement is not met, adjust the top pot on the regulator board until the voltage is within the specified limits.

4. Command a return-to-zero seek.

C. Perform the Servo System test and adjustment as follows:

This procedure tests and adjusts the disk drive servo system. The servo system adjustments and their basic functions are as follows:

Coarse Position Gain - Adjusts the gain of the velocity signal applied to the summing amplifier when the servo system is in coarse mode (cylinders to go equals more than one half). This adjustment causes the seek time to be fast enough to meet the required specifications without causing excessive overshoot past the desired cylinder.

Integrator Gain - Adjusts the gain of the velocity signal applied to the integrator. The integrator output is summed with the output from the D/A converter during the last 200 (80) cylinders of a seek.

Fine Velocity Gain - Adjust the gain of the velocity signal applied to the summing amplifier when the servo system is in fine mode (cylinders to go equals less than one half). This adjustment optimizes servo system response by minimizing overshoot without overdamping the system.

These adjustments are interactive and must therefore be made in the proper sequence. The proper sequence is shown in Figure 4-23. The following describes test and adjustment of the servo system.

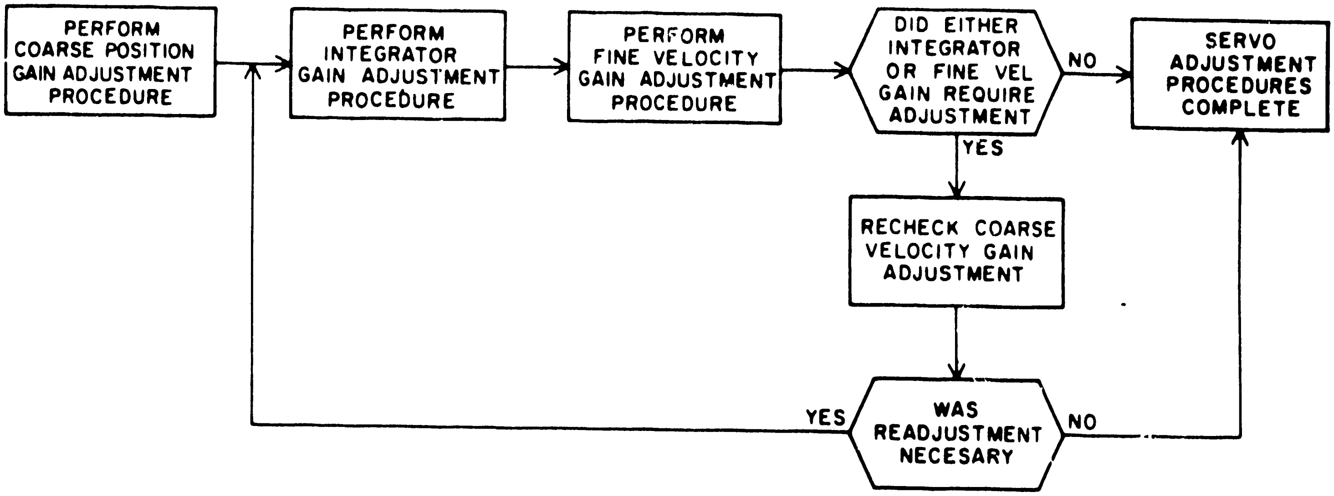


FIGURE 4-23 SERVO SYSTEM ADJUSTMENTS FLOW CHART

1. Test and adjust the coarse position gain as follows:
   a. Command continuous seeks between cylinders 000 and 1466 (366).
   b. Connect oscilloscope channel 1 to A07-03A (+ On Cylinder).
   c. Trigger the oscilloscope negative and external on A07-07A (- Forward Seek).
   d. Set other oscilloscope controls as necessary to make the measurements required in step e.
   e. Observe the display. The time between ON cylinder pulses should be within 50 to 54 msec; if it is not, adjust top potentiometer on card A20 until this requirement is met (Figure 4-22).
   f. Stop the continuous seeks and command a return-to-zero seek.

2. Test and adjust integrator gain as follows:

   a. Command continuous seeks between cylinders 000 and 200 (180).

   b. Set up the oscilloscope as indicated in Figure 4-24 and adjust it until the two sloped curves shown on Figure 4-24 are displayed. VOLT/CM and TIME/CM settings have to be changed to make the measurement required in step c.

   c. Make certain that the second to last discontinuity (indicated on Figure 4-24) has a difference of 0 ± .03V (ignore the spike). If it exceeds this value, adjust the bottom pot on A20 so that it meets these requirements.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.5V/CM
CH 2 - NOT USED

TIME / DIV
A - 0.5MS/CM
B - NOT USED

NOTE:
HORIZ DISPLAY SET TO MAG x 10

TRIGGERING
A - POSITIVE EXT ON A12-17B (+T ≤ 7)
B - NOT USED

PROBE CONNECTIONS
CH 1 TO A20-TPD (+ DESIRED VELOCITY)
CH 2 — NOT USED

NOTE:
IT IS NECESARY TO INCREASE VERTICAL SENSITIVITY TO MAKE THIS MEASUREMENT.

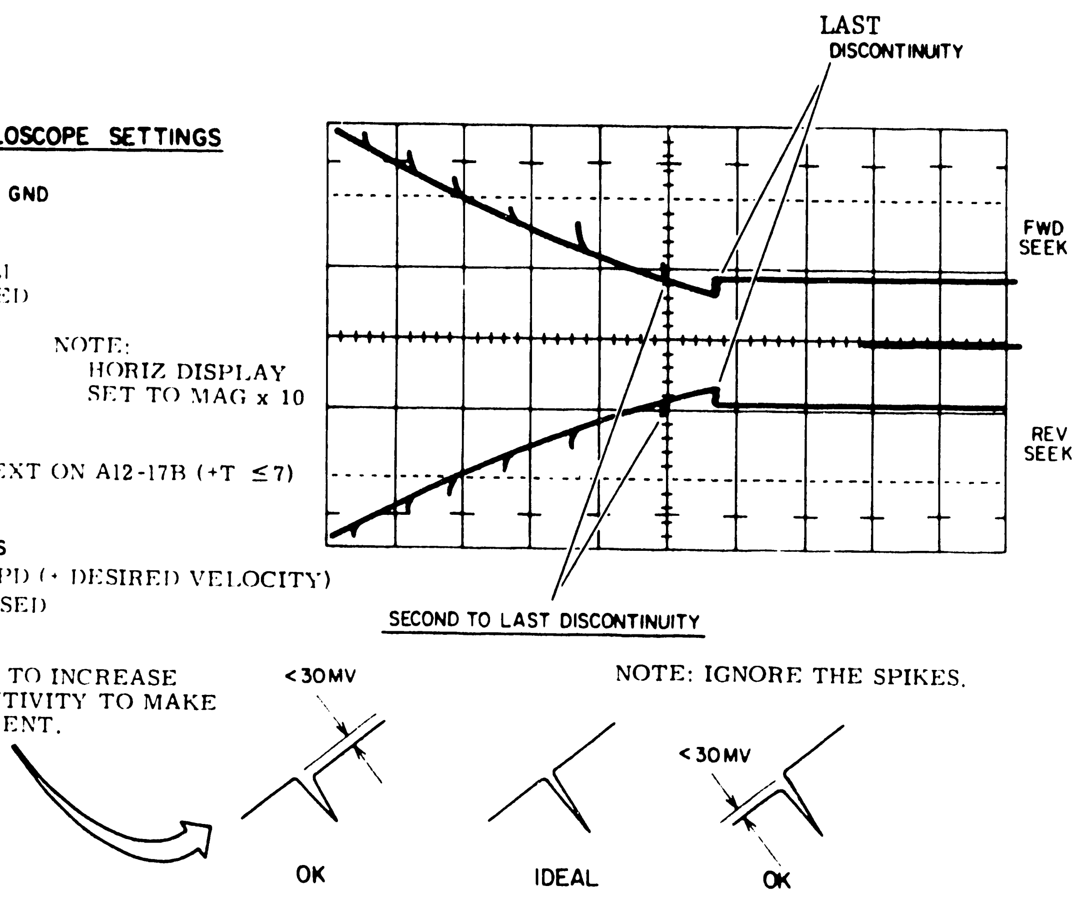


FIGURE 4-24 INTEGRATOR GAIN WAVEFORM

d. Stop the continuous seeks and command a return-to-zero seek.

3. Adjust fine velocity gain as follows:

   a. Command a read operation in conjunction with continuous seeks between cylinders 000 and 001. It may first be necessary to write format the disk.
   b. Connect and setup the oscilloscope as indicated in Figure 4-25.
   c. Referring to Figure 4-25, note that the displayed signal settles out with a maximum overshoot of less than 0.5V. If overshoot exceeds this value, adjust the middle pot on card in A20 to obtain the ideal waveform shown in Figure 4-25.
   d. Command sequential forward seeks from cylinder 000 through 1466 (366) (performed in conjunction with a read).
   e. Note that the displayed signal is as shown on Figure 4-25 at each cylinder. If overshoot exceeds 0.5V at any cylinder, adjust the middle pot on card A20 until the signal is within specifications.
   f. Prepare the drive for return to on-line operations.

D. Perform the Head Arm Alignment - Read and understand the following paragraphs. These concepts are important for accurate head alignment, and they are referenced by name only in the procedure. Remove the scratch pack and install the alignment pack.

NOTE:

Make certain that all packs created on the drive are backed-up prior to any servo head or R/W head adjustments

Thermal Stabilization - To ensure accuracy during head alignment, it is important that the drive, the CE pack, and the FTU be at their normal operating temperatures. To ensure this, all three must be connected and allowed to operate (pack turning and heads loaded to cylinder zero) for a mininum of 60 minutes.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 0.5V/CM
CH 2 -NOT USED

TIME / DIV
A- 0.1MS/CM
B - NOT USED

TRIGGERING
A- -EXT, A07-30A (-SEEK)
B- NOT USED

PROBE CONNECTIONS
CH 1 TO A19-TPC (+FINE POSITION ANALOG)
CH 2 - NOT USED

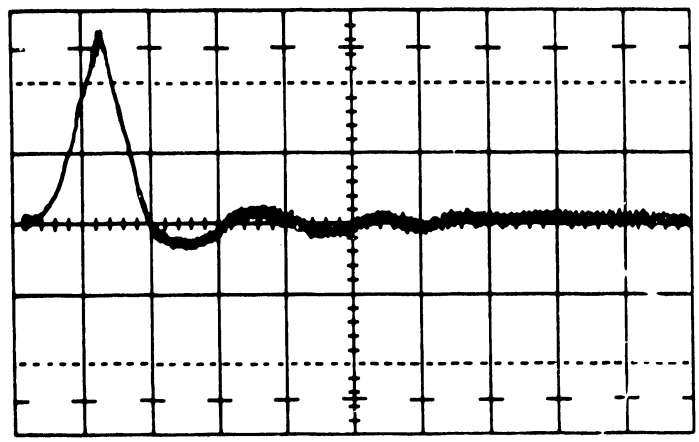


FIGURE 4-25 FINE VELOCITY GAIN FINAL CHECK WAVEFORM

For head alignments on more than one drive, the CE pack will require only a 15-minute stabilization, provided that the pack was taken immediately from a drive-under-test and provided that the second drive-under-test has been operating with heads loaded for a minimum of 60 minutes.

Alignment Tool - Use only the head alignment tool specified in the maintenance tools and materials table. Use of a different tool may cause damage to the head arm or the carriage. Always inspect the adjustment end of tool prior to use; it must be free of nicks and scratches, and must have a polished surface. If any aluminum deposits are present, polish the surface with crocus cloth. Any other polishing medium will damage the tool. Do not use a defective tool; repair or replace it if damage exists. When using the alignment tool, position it so that the pin in the end of the tool engages the adjustment slot in the head arm. Ensure that the tool is kept perpendicular to the hole in the carriage at all times; it should turn freely in the hole. If it does not, recheck the end for damage or aluminum build up.

Calculating Offset - The formula for calculating head offset is (P) - (N) = Offset, where P is equal to the meter reading with the head alignment card P/N switch in the P position, and N is equal to the reading with the switch in the N position. All meter readings to the left of zero are negative. Following are examples of offset calculation:

P = +20 mV, N = +15 mV:
(P) - (N) = (+20) - (+15) = +5 mV

P = +20 mV, N = -15 mV:
(P) - (N) = (+20) - (-15) = +35 mV

P = -20 mV, N = +15 mV:
(P) - (N) = (-20) - (+15) = -35 mV

Carriage Locking - During the alignment procedure, when the heads are over the alignment track, the carriage locking pin and ring assembly is installed in the ALIGN TRACK LOCK hole in the rail bracket assembly. This locks the carriage in place. Failure to install the pin and ring asssembly would allow the carriage to retract if any emergency retract signal were generated. Since the CE's hands are in the actuator during the head alignment procedure, a carriage retraction could be dangerous. It should also be noted that should a retract condition be generated, the carriage locking pin and ring assembly must be immediately removed and the heads manually retracted before a head crash occurs. Carefully observe the instructions regarding the installation and removal of the carriage locking pin and ring assembly.

CE Pack - Note that the CE disk pack and head alignment card must be temperature stabilized before the following procedure is performed. Pack, drive and FTU must be in the same temperature environment for a 60 minute minimum period immediately preceding head alignment. In addition, the CE pack must be purged a minimum of 30 minutes and the head alignment card must be plugged into the drive (location A16) a minimum of 10 minutes before performing the head alignment procedure.

NOTE:

All values are expressed in octal and (HEX).

1. R/W SERVO SWITCH - Set the R/W SERVO switch, (S2), on the head alignment card to the SERVO position, and set the card sensitivity switch (S3) to the X.1 position.

2. Check Servo head alignment as follows:
   a. Command a direct seek to cylinder 004.
   b. Put the card sensitivity switch to X.1. Meter readings to the left of zero are negative and to the right are positive.

c. Set the card POS/NEG switch (S1) to POS position and record the meter reading.

d. Set the card POS/NEG switch (S1) to NEG position and record meter reading.

e. Algebriacally subtract the reading obtained in step d from that obtained in step c. Example: If POS READING = -15 mV and NEG READING = +20 mV P-N = ALIGNMENT ERROR (-15) - (+20) = -35 mV.

f. Set the card sensitivity switch to X.1.

g. Command a direct seek to Cylinder 005 and repeat steps b through f.

h. Alignment error must not exceed 60 mV at either track 4 or 5, and the difference in readings between 4 and 5 must be less than 30 mv.

i. Command a seek to track 753 (IED).

j. Install the carriage locking pin in the head alignment hole (refer to Figure 4-26).

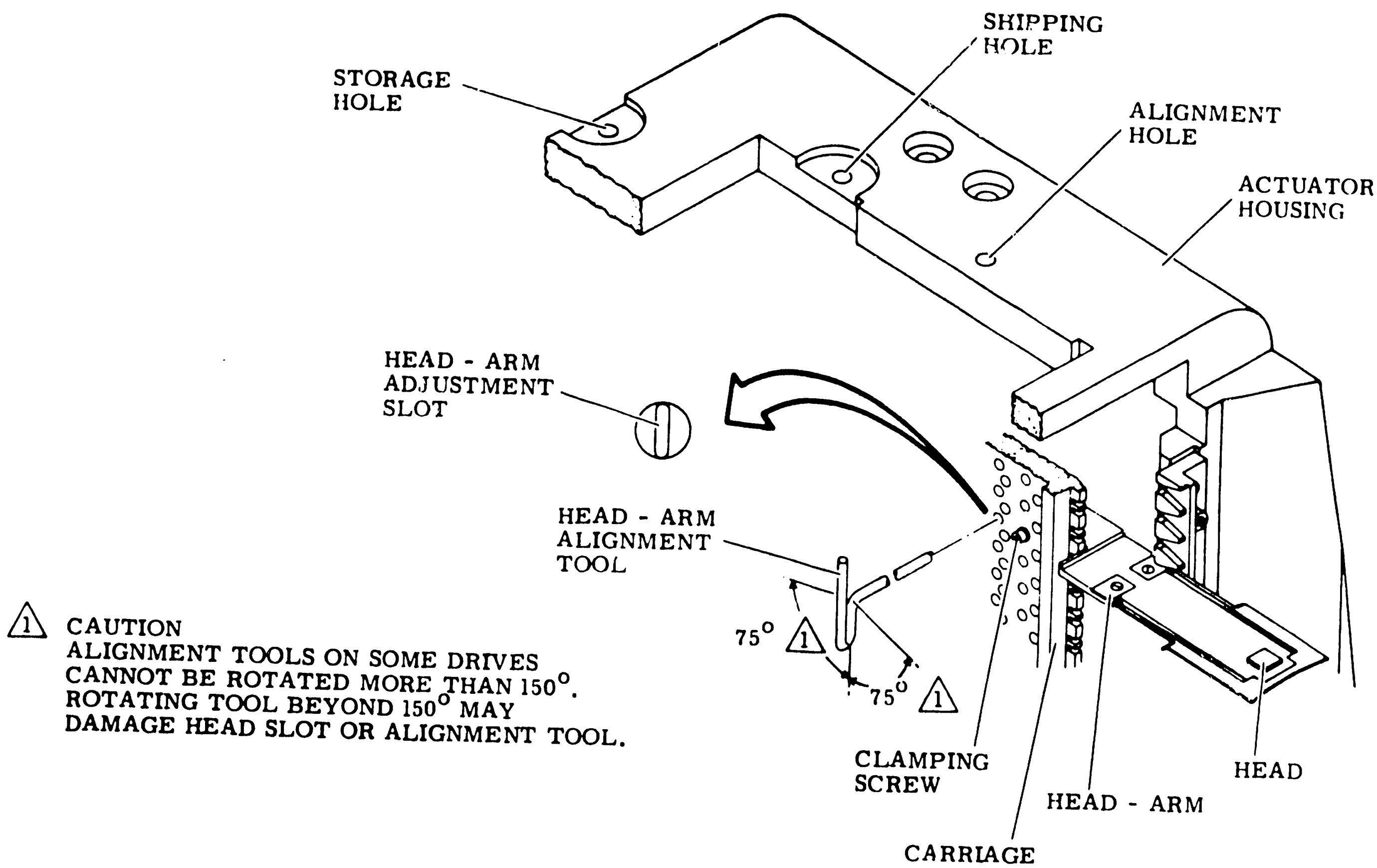


FIGURE 4-26 HEAD ALIGNMENT

k. Perform steps b through f. Alignment error should be less than 60 mV.

l. Remove the carriage locking pin.

m. Command a direct seek to track 1440 (320).

n. Perform steps b through f. Alignment error should be less than 60 mV.

o. If the readings obtained in steps h, k, or d do not meet the specified values, replace the card in position A18.

3. Command a direct seek to cylinder 753 (1ED).

4. Set card's R/W SERVO Switch, (S2), to R/W.

5. Check the read/write head alignment as follows:

   a. Select the head to be checked.

   b. Calculate and record the alignment error of this head, using same method as in items b through f in step 2.

   c. Repeat steps 5a and 5b for all heads to be checked.

6. If any alignment error readings obtained in step 2e exceed 150 mV, the corresponding heads must be adjusted as described in the remainder of this procedure. If no heads require this additional adjustment, proceed to step 17.

7. Press the START switch to stop the drive motor and unload the heads. If head 16, 17, or 18 (Figure 4-27) requires adjustment, move the preamp housing. To move the preamp housing:

   a. Set the MAIN AC circuit breaker to OFF.

   b. Remove the disk pack.

   c. Open the cabinet top cover and remove the deck cover.

d. Remove the two hex head screws securing the servo preamp cover and remove the cover.

e. Disconnect the servo head cable plug and output plug P8 from the servo preamp board.

f. Remove the two pan head screws, inside the preamp housing, that secure the housing to the deck.

g. Move the housing to permit access to the heads.

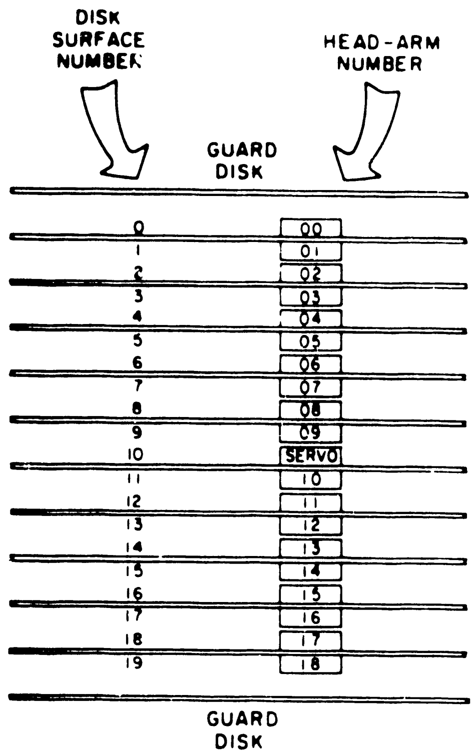


FIGURE 4-27 HEAD LOCATION

8. For each head to be aligned, loosen its head arm clamp screw and retighten it to a torque of 4 inch-pounds.

9. First reconnect the servo cables that were disconnected in step e; then, press the START switch to start the drive motor and load the heads.

10. Command a direct seek to cylinder 753 (1ED).

11. Select the read/write head to be aligned (refer to Figure 4-27).

12. Perform a coarse alignment of the read/write head as follows:

    a. Setup the oscilloscope as indicated on Figure 4-28.

OSCILLOSCOPE SETTINGS

LOGIC GND TO SCOPE GND

VOLTS / DIV
CH 1 - 20MV/CM
CH 2 - NOT USED

TIME / DIV
A - 1μS/CM
B - NOT USED

TRIGGERING
A- +INTERNAL
B- NOT USED

PROBE CONNECTIONS
CH 1 TO TPY (RD SIGNAL) ON HD ALIGNMENT CARD
CH 2 TO NOT USED

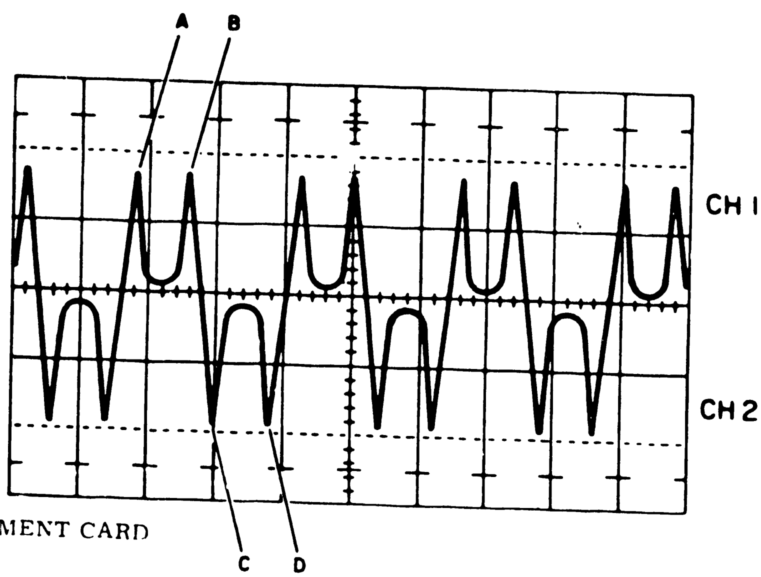


FIGURE 4-28 HEAD ALIGNMENT WAVEFORM

WARNING:
Install the carriage locking pin in the head alignment hole (refer to Figure 4-26) prior to positioning the head adjustment tool. Also ensure that the end of the tool is clean and free of any aluminum buildup before inserting it into the adjustment slot.

b. Refering to Figure 4-26, position the head alignment tool such that the tool pin engages the adjustment slot in the head arm. It may not be possible to align a head, because its adjustment slot is at its end of travel. If this is the case, see if the servo adjustment slot is centered, and, if necessary, recenter it. However, it should be noted that any slight adjustment of the servo head adjustment slot requires a realignment of all read/write heads.

c. Adjust the head to obtain balanced dibit pattern on oscilloscope (refer to Figure 4-28). The pattern is balanced when the amplitude of points A and B are equal and when the amplitude of points of C and D are equal.

13. Perform a fine alignment of the read/write head as follows:
    a. Set the sensitivity switch to 1.
    b. Calculate the alignment error of this head using the same method as in subset b through e in step 2.
    c. If the calculated alignment error exceeds 75 mV, adjust the head arm (refer to step 12) until the alignment error is less than 75 mV. For optimum performance the head should be adjusted as close to 0mV as possible.
    d. Set the card sensitivity switch (S3) to X.1.

14. Repeat steps 11 through 13 on all heads to be aligned. While torquing the clamp screws, use only a straight-arm Allen wrench and keep it as perfectly aligned as possible with head arm clamp screw. If care is not taken during this operation, the head may be pushed out of alignment.

15. Torque the head arm clamp screw (of each head adjusted) to 12 inch-pounds. Do not attempt to adjust any head that has been torqued to 12 inch-pounds. This will damage the adjustment slot in the head arm and/or the head carriage assembly.

16. Check (as described in step 5) each adjusted head to see if torquing the screws affected the head alignment. If any alignment error reading exceeds 150 mV, readjust that head as described in step 11 through 13.

17. Remove carriage locking pin.

18. Perform the following operations to ensure that the heads will remain aligned under normal operating conditions.
    a. Command continuous seeks between cylinders 740 (1EO) and 753 (1ED) for a minimum of 30 seconds.
    b. Unload and load the heads at least twice.
    c. Command a direct seek at cylinder 753 (1ED).
    d. Install the carriage locking pin.
    e. Check the alignment error of each adjusted head by following the procedure in step 2. If any head has an alignment error reading exceeding 150 mV, readjust that head starting with step 11.

19. Remove the carriage locking pin.

20. Command a return-to-zero.

E. Power OFF the drive and remove the FTU.

F. Perform the same installation on all additional disk drives.

4.2.10 SYSTEM INTERCONNECTION

A. Attach the disk drive to the 2200VS System.

1. Remove the left side panel of the disk drive.

2. Remove the two screws that secure the I/O cable guide to disk drive chassis and remove the guide.

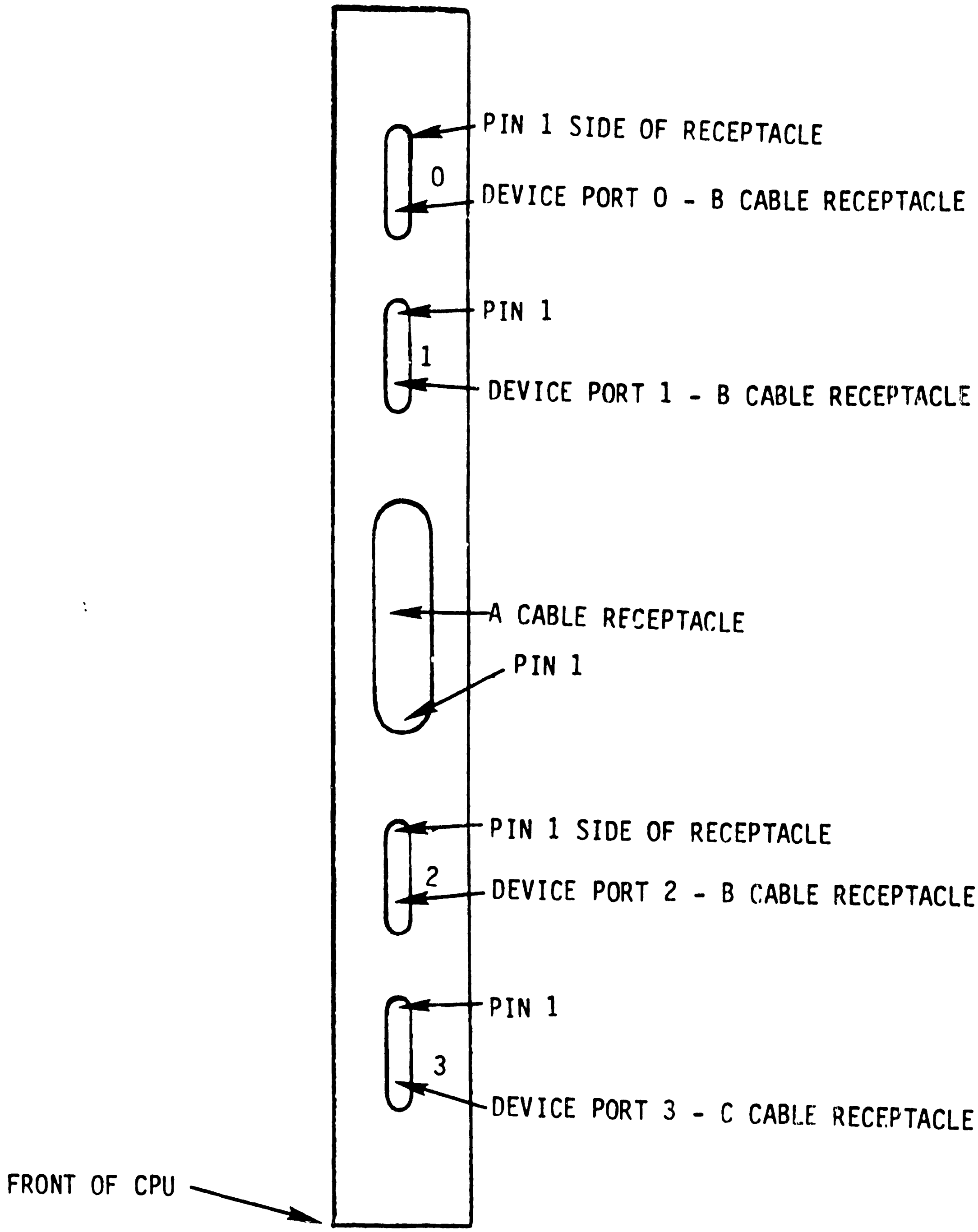


FIGURE 4-29 TOP VIEW OF 22V03/V04 IOP

3. Turn the I/O panel fastener (refer to Figure 4-21) counter-clockwise and remove the I/O panel from the upright support. This will allow the I/O panel to be positioned for easy installation of the cables.

4. Remove the nuts and screws securing the I/O panel cover to the I/O panel, and remove the cover. All cables installed in the following steps are routed through the I/O cable cutoff (opening left by removal of cable guide).

5. Attach one end of the "A" cable to "A" cable receptacle J3 on the disk I/O panel. Attach the other end of the "A" cable to the "A" cable receptacle on the 22V03/04 card in the processor mainframe. The "A" cable should run from receptacle J3 on I/O panel, down through I/O cable cutoff, and up through spare cable entrance in the rear base of the CPU cabinet.

   Since the "A" cable is not keyed, caution must be exercised to ensure its proper installation. Make certain that pin 1 on disk side of the cable matches pin 1 on the 22V03/04 card. Use wire colors to accomplish this. For example, twisted pair brown/black is attached to the pin 1 side of the disk drive I/O connector. Attach the same color twisted pair (brown/black) to the pin 1 side of the 22V03/04 card. See Figure 4-29.

6. Attach the 15 ft. "B" cable (PN 220-3033-1) to receptacle J2 on the I/O panel of the disk drive, making certain sure that the cable shield ground strand (Figure 4-30) is attached to the pin 1 side of J2 on the disk drive (Figure 4-21).

7. Attach the other end of the "B" cable to the port "0" receptacle on the 22V03/04 card in the mainframe, making certain that the "B" cable shield ground strand is on the pin 1 side of the receptacle (Figure 4-29).

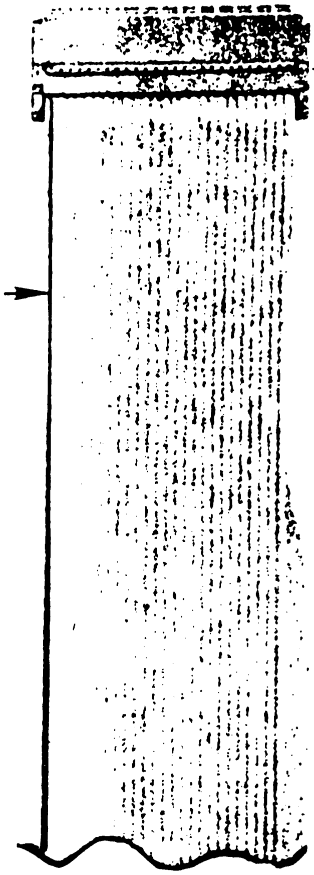


FIGURE 4-30 "B" CABLE

The "B" cable should run from receptacle J2 on disk drive I/O panel, down through cable cutoff, and up through cable entrance space in the rear base of the 2200VS Processor Mainframe.

B. If no other disk drives are to be attached to the system, install terminator card (PN 210-7177) in receptacle J4 on the disk drive I/O panel. Attach the terminator ground lead to terminator ground connector.

NOTE:

Pin 1 of the terminator must match pin 1 of receptacle J4.

C. If more than one drive is to be attached to the system, use 10 ft. "A" cables (PN 220-3031) and 24 ft. "B" cables (PN 220-3033-4) to daisy chain the disk drives in the configuration shown in Figure 4-31.

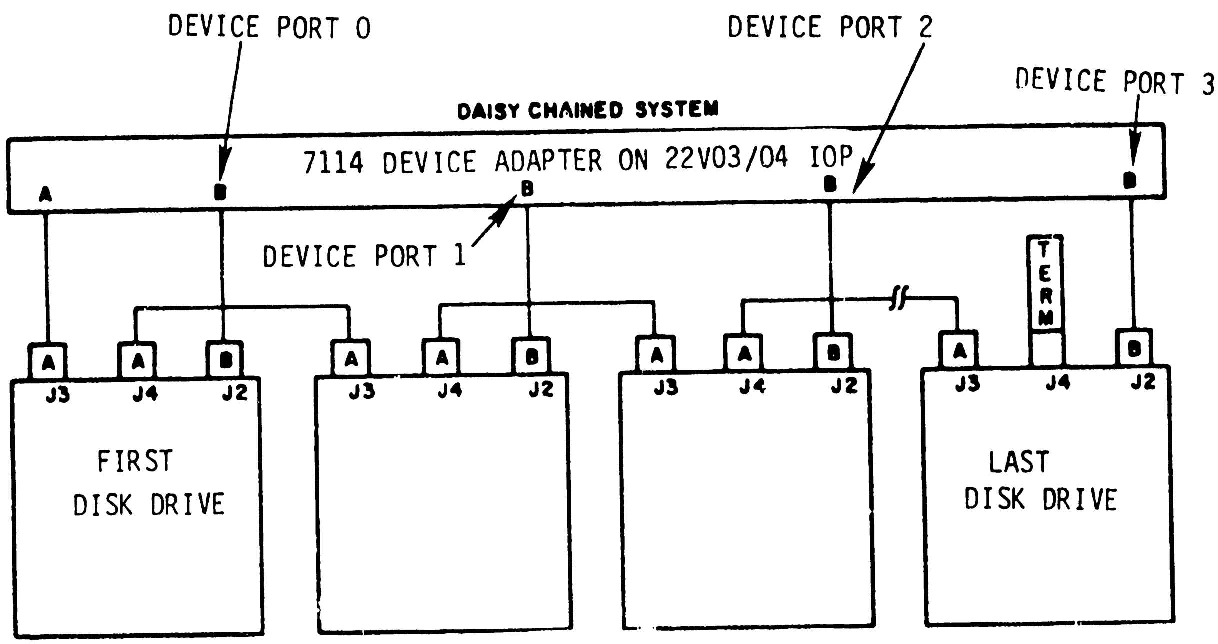


FIGURE 4-31 DAISY CHAIN CONFIGURATION

NOTE:

The terminator card is always attached to J4 on the last disk drive in the daisy chain.

NOTE:

When attaching daisy chain "A" cables, caution must be exercised to ensure pin 1 continuity from the IOP to the terminator.

D. Insert the appropriate device address plugs into front panel of each disk drive.

1. If the "B" cable is attached to port "0" of the 22V03/04, insert the "0" plug into the disk drive; if the "B" cable is attached to port "1" of the 22V03/04, insert the "1" plug into disk drive, and so on.

2. If two 22V03/04 IOP's are used in the system, thus providing the capability of 8 disk drives, the additional 4 disk drives must contain device address plugs 0-1-2-3, respectively.

E. Attach the system ground lead from the bolt on the Processor Mainframe (shown in Figure 3-2) to the system ground screw (middle screw on right side of logic chassis) on the logic chassis of the disk drive (Figure 4-32). If more than one disk drive is attached to the 22V03/04 IOP, attach the system ground in daisy chain fashion from one disk drive to the next.

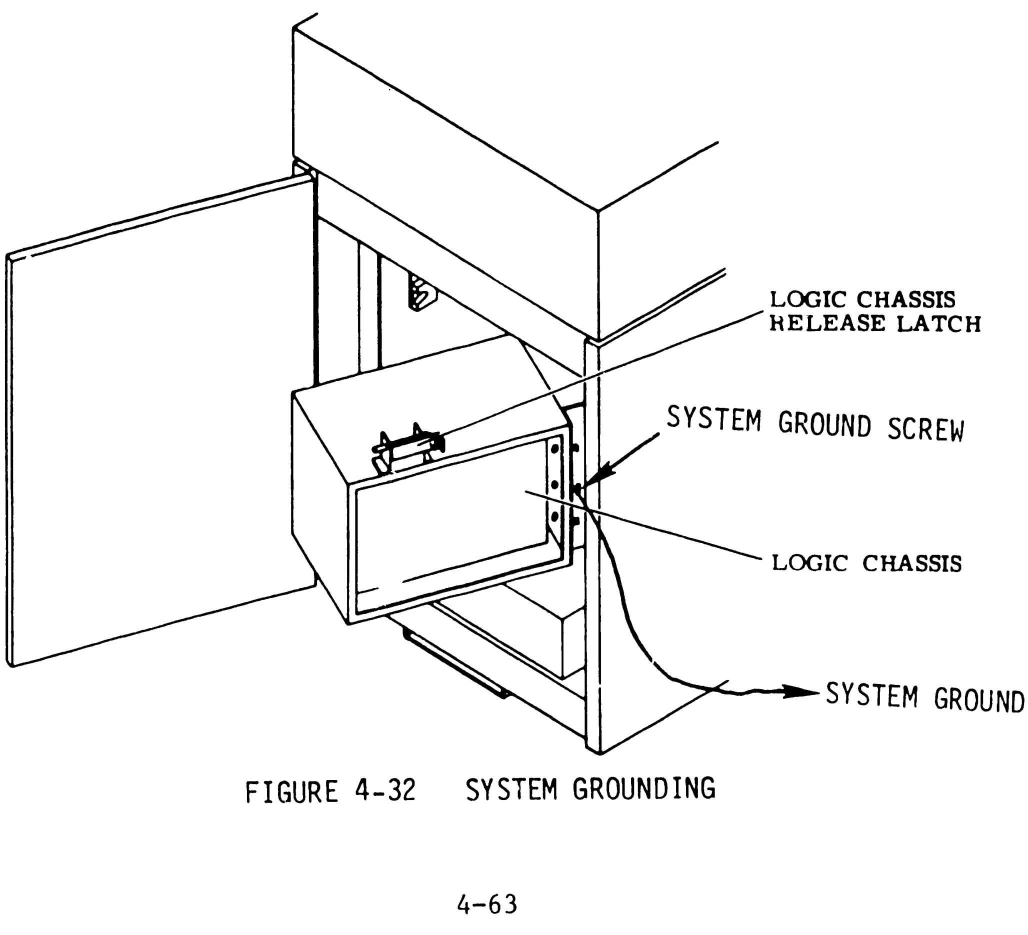


FIGURE 4-32 SYSTEM GROUNDING

4.3 2260V (10 MEG DISK DRIVE)

4.3.1 POWER REQUIREMENT

When laying out the site, consideration must be given to providing source AC power for each drive. A 115 volt AC receptacle must be available for each drive. Note that no more than 3 disk drives can be driven off of one 20 amp line.

Additional requirements for single disk configuration:

1 - 10 Meg disk pack (PN 177-0062)
1 - 10 ft. I/O cable (PN 220-0188)
  Note: Use this cable if only one disk drive is to be attached to the system.
1 - 10 ft. I/O cable (PN 220-0169)
  Note: Use this cable if more than one disk drive is to be attached to the system.

Each additional 10 Meg disk drive attached to the system requires:

1 - 10 Meg disk pack (PN 177-0062)
1 - 5 ft. I/O cable (PN 220-0170)
  Note: If the additional disk drive is the last disk drive in the daisy chain, a 5 ft. I/O cable with terminator must be used (PN 220-0187).

4.3.2 DISK DRIVE INSPECTION

A. Inspect the disk drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved.

B. Verify that all logic cards are firmly seated in logic card cage assembly. To gain access to the logic cards, first lift the disk drive cabinet cover, and then remove the electronics cover, which is mounted with three Phillips screws (Figure 4-33).

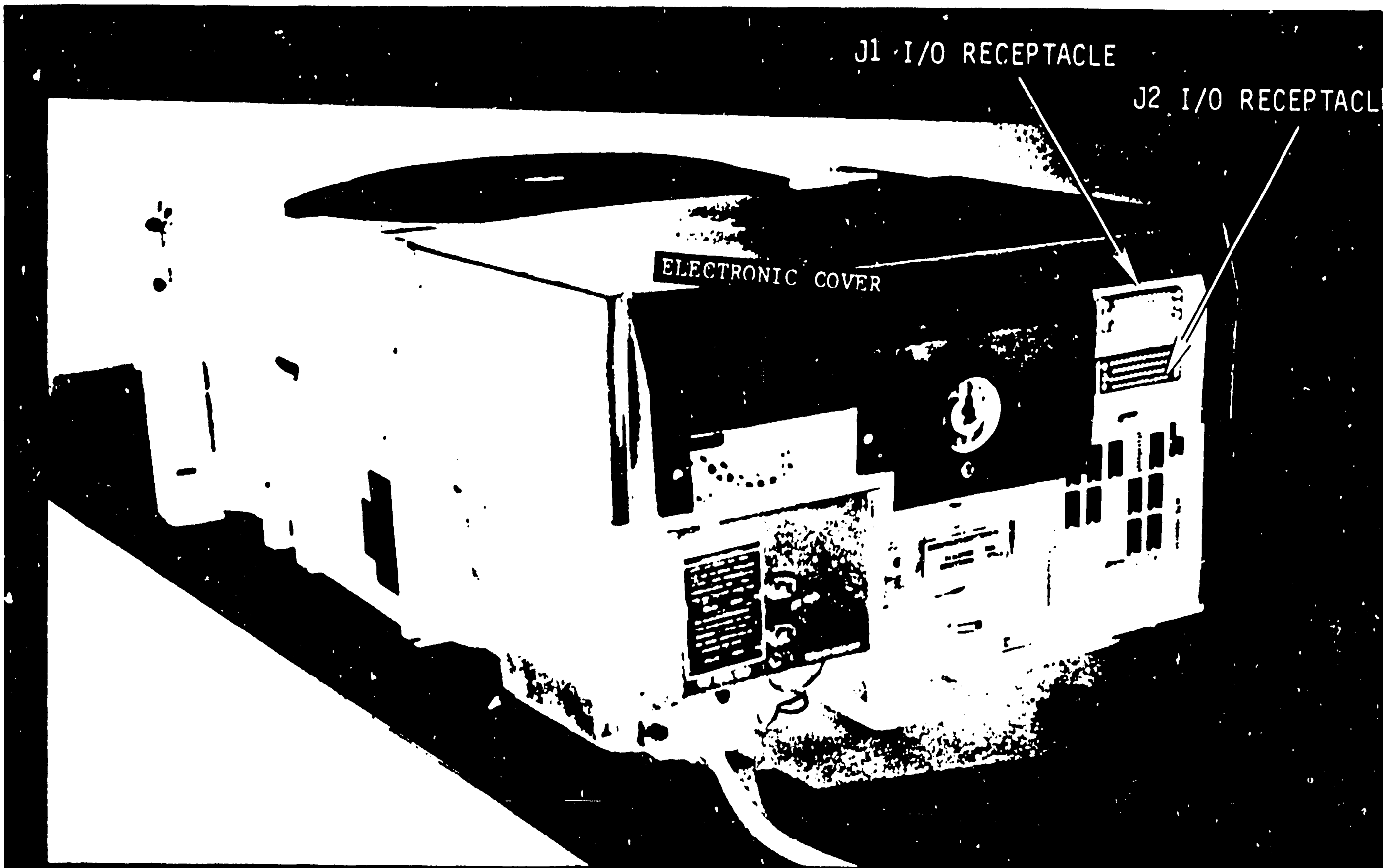


FIGURE 4-33 REAR VIEW OF 2260V DISK DRIVE

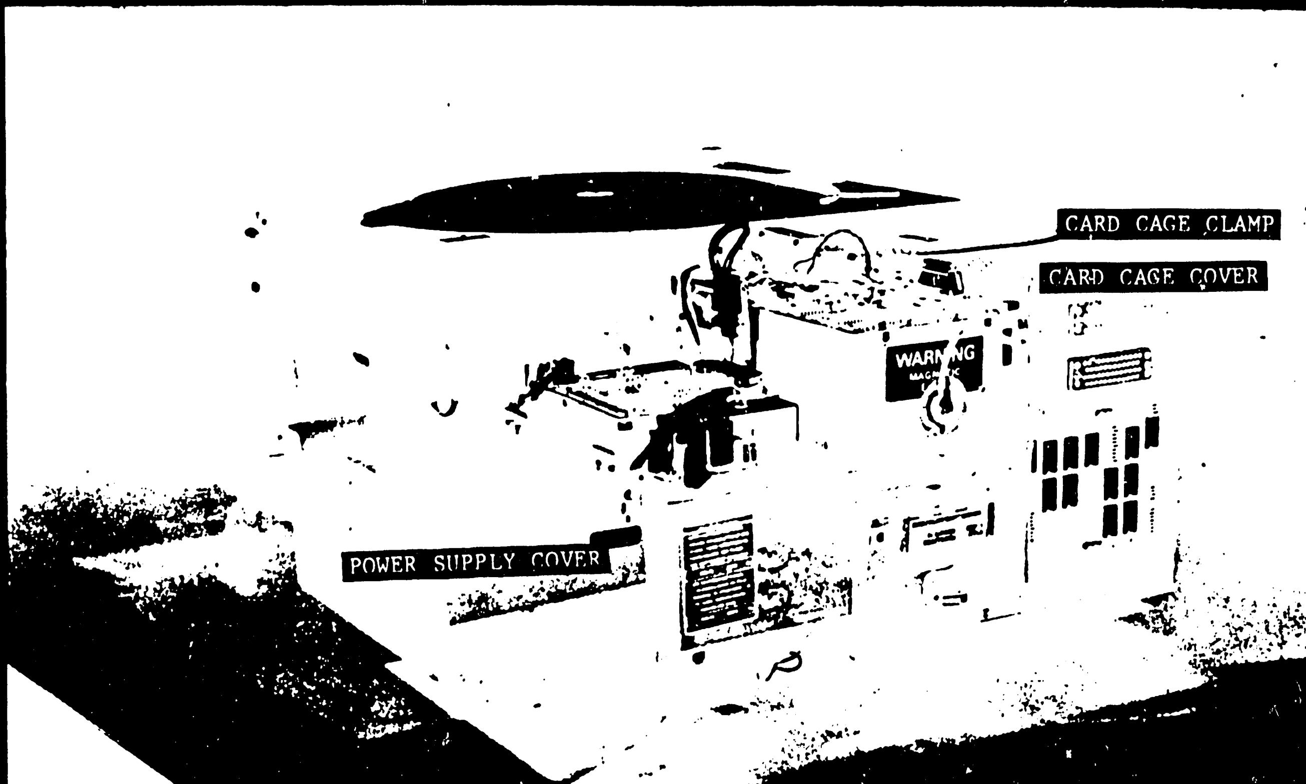


FIGURE 4-34 REAR VIEW OF 2260V DISK DRIVE (WITH COVER REMOVED)

C. Remove the power supply assembly cover (Figure 4-34), and check the cards and connectors for proper seating.

D. Inspect the entire drive for any foreign material that may cause an electrical short.

E. Check the servo actuator and pack area for any material that may obstruct movement of the carriage and heads.

4.3.3 DISK CABINET LEVELING

Cabinet leveling should not be performed until drive is in its permanent location with no further necessity to move it. Cabinet leveling consists of the following:

A. Move the drive to its permanent location.

B. Turn the leveling pads down until they support the weight of the disk drive (Figure 4-35).

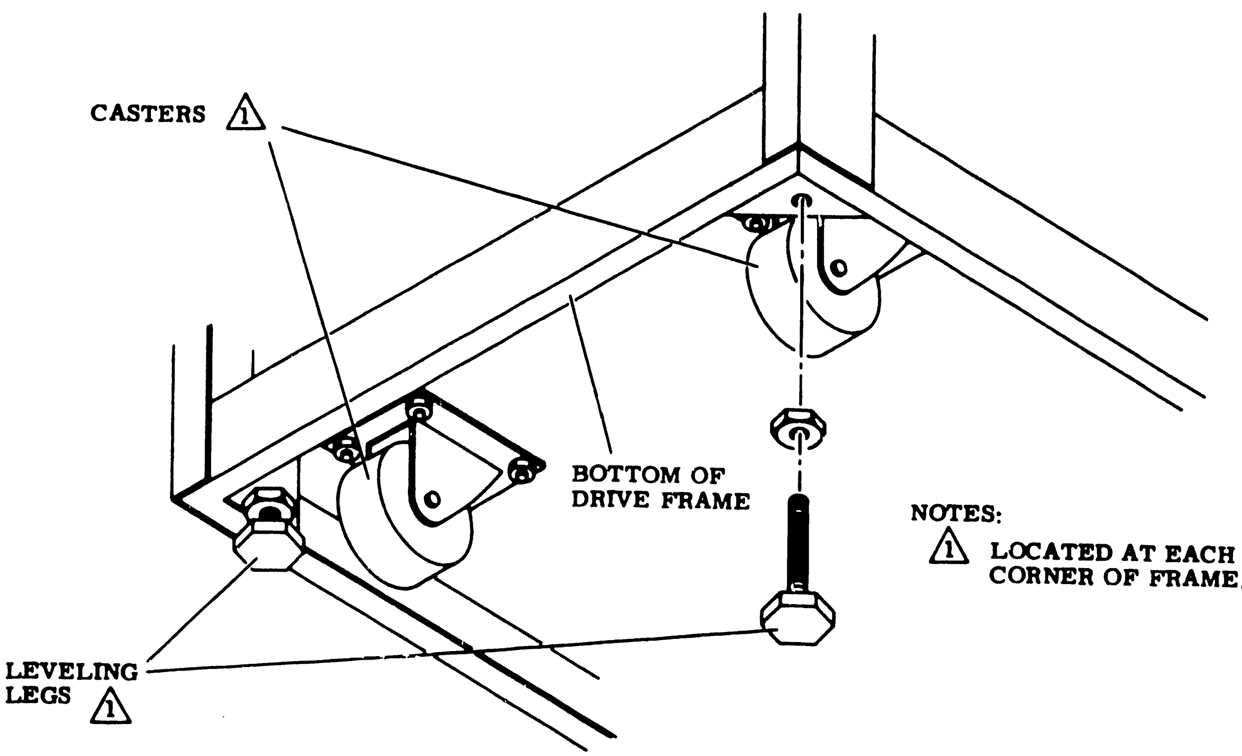


FIGURE 4-35 LEVELING PAD ADJUSTMENT

C. Place a spirit level on drive case assembly; then adjust the leveling pads until drive is level to within three degrees, front-to-back and side-to-side.

D. When drive is level in both directions, tighten the jam nuts against the bottom of the frame.

4.3.4 DISK DRIVE CLEANING

A. Carefully vacuum the interior of the cabinet and case, paying particular attention to flat surfaces where dust accumulates.

B. Vacuum the exterior surfaces of the electronic assembly. Use a soft cloth dampened in a mild detergent solution to remove any greasy residue.

C. Using a soft cloth and a mild detergent solution, carefully wipe all cabinet surfaces. Use care to prevent moisture from entering the drive.

D. Carefully vacuum the entire pack area.

E. Using a piece of adhesive tape, remove any dirt particles not removed during vacuuming.

4.3.5 OPTION SWITCH SETTINGS

Various modes of operation are made possible by option switches, located on the I/O board (Figure 4-36) mounted on the rear of the disk drive ssis. These switches should be set as follows:

NOTE:

Switch settings for the disk drive logic cards are given in Section 4.3.10.

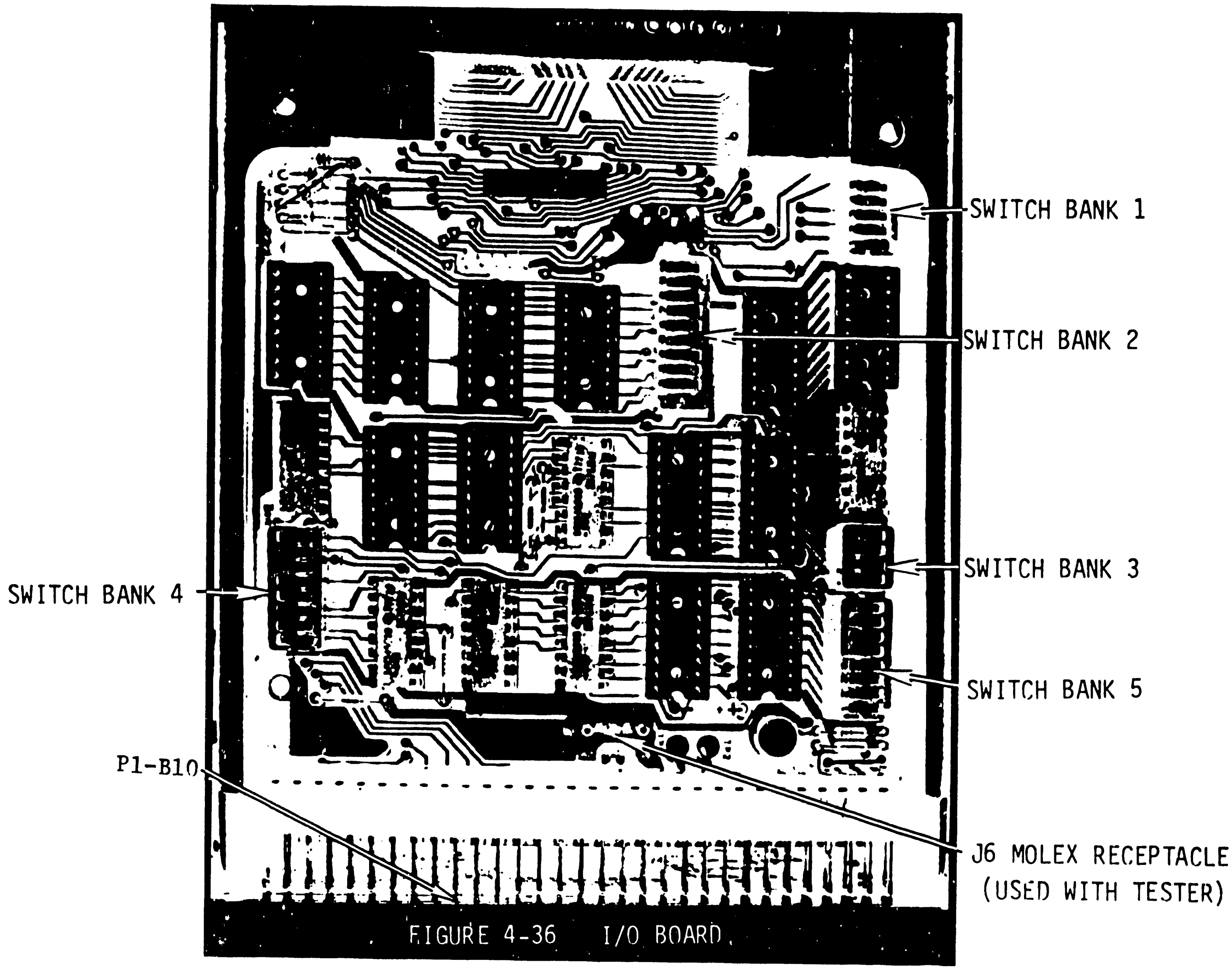


FIGURE 4-36 I/O BOARD

Switch Bank #1		
	OFF	Switch 5
	OFF	Switch 4
	OFF	Switch 3
	OFF	Switch 2
	ON	Switch 1

Switch Bank #2		
	OFF	Switch 10
	ON	Switch 9
	OFF	Switch 8
	OFF	Switch 7
	OFF	Switch 6
	ON	Switch 5
	OFF	Switch 4
	OFF	Switch 3
	OFF	Switch 2
	ON	Switch 1

Switch Bank #3		
	OFF	Switch 4
	OFF	Switch 3
	ON	Switch 2
	OFF	Switch 1

Switch Bank #4		
	ON	Switch 8
	OFF	Switch 7
	OFF	Switch 6
	OFF	Switch 5
	ON	Switch 4
	OFF	Switch 3
	ON	Switch 2
	OFF	Switch 1

Switch Bank #5	OFF	Switch 8
	OFF	Switch 7
	OFF	Switch 6
	OFF	Switch 5
	OFF	Switch 4
	OFF	Switch 3
	OFF	Switch 2
	OFF	Switch 1

4.3.6 POWER-ON CHECKOUT

A. Check that the AC breaker, located at the rear of disk drive, is in the "OFF" position (Figure 4-37).

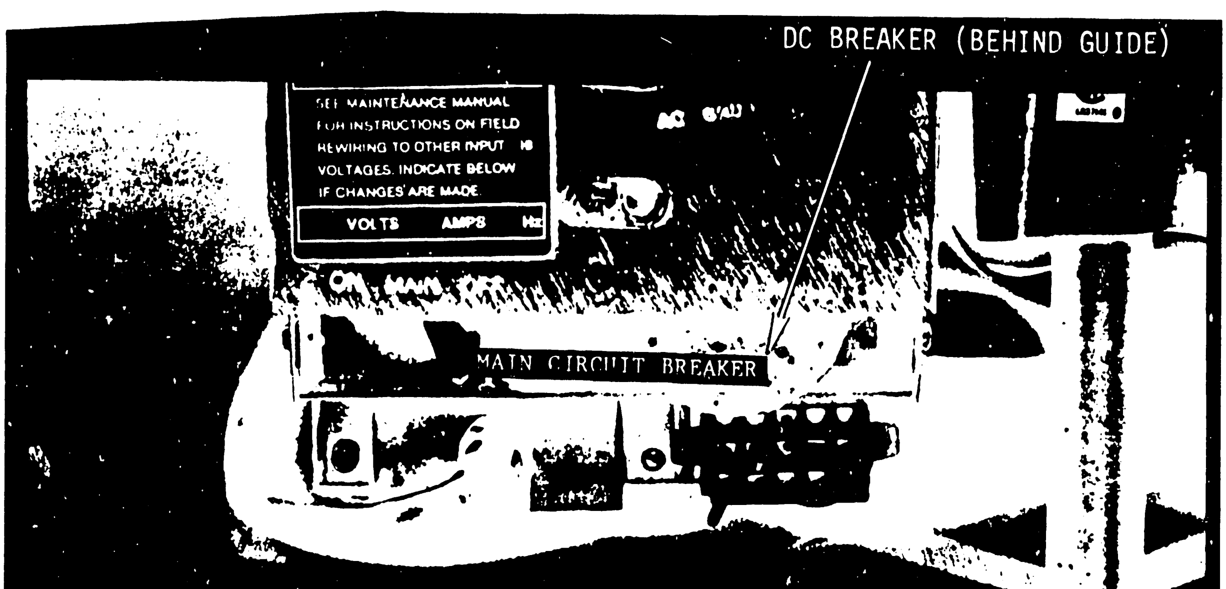


FIGURE 4-37 REAR VIEW OF DISK DRIVE

B. Connect the AC power cord connector to the power source receptacle provided at the site.

C. Check that the start/stop switch is in the OFF position (not depressed) See Figure 4-38.

D. Check that the DC power breaker is in the "ON" position (Figure 4-37).

E. Turn the AC breaker to the "ON" position.

F. Check for proper operation of the blower motor.

G. Using a DVM, check for the following voltages on power supply board number 2 (Figure 4-39).

Use connector J4 Pin #3 for GND (Figure 4-39).

+11 volts at P6, pin 11	(Figure 4-40)		
+35 volts at P6, pin 19	"	"	
-35 volts at P6, pin 29	"	"	
+22 volts at P6, pin 43	"	"	
-22 volts at P6, pin 35	"	"	
+5 volts at P6, pin 7	"	"	

NOTE:

These voltages are not adjustable. Should any voltage be out of tolerance, repair the power supply before continuing.

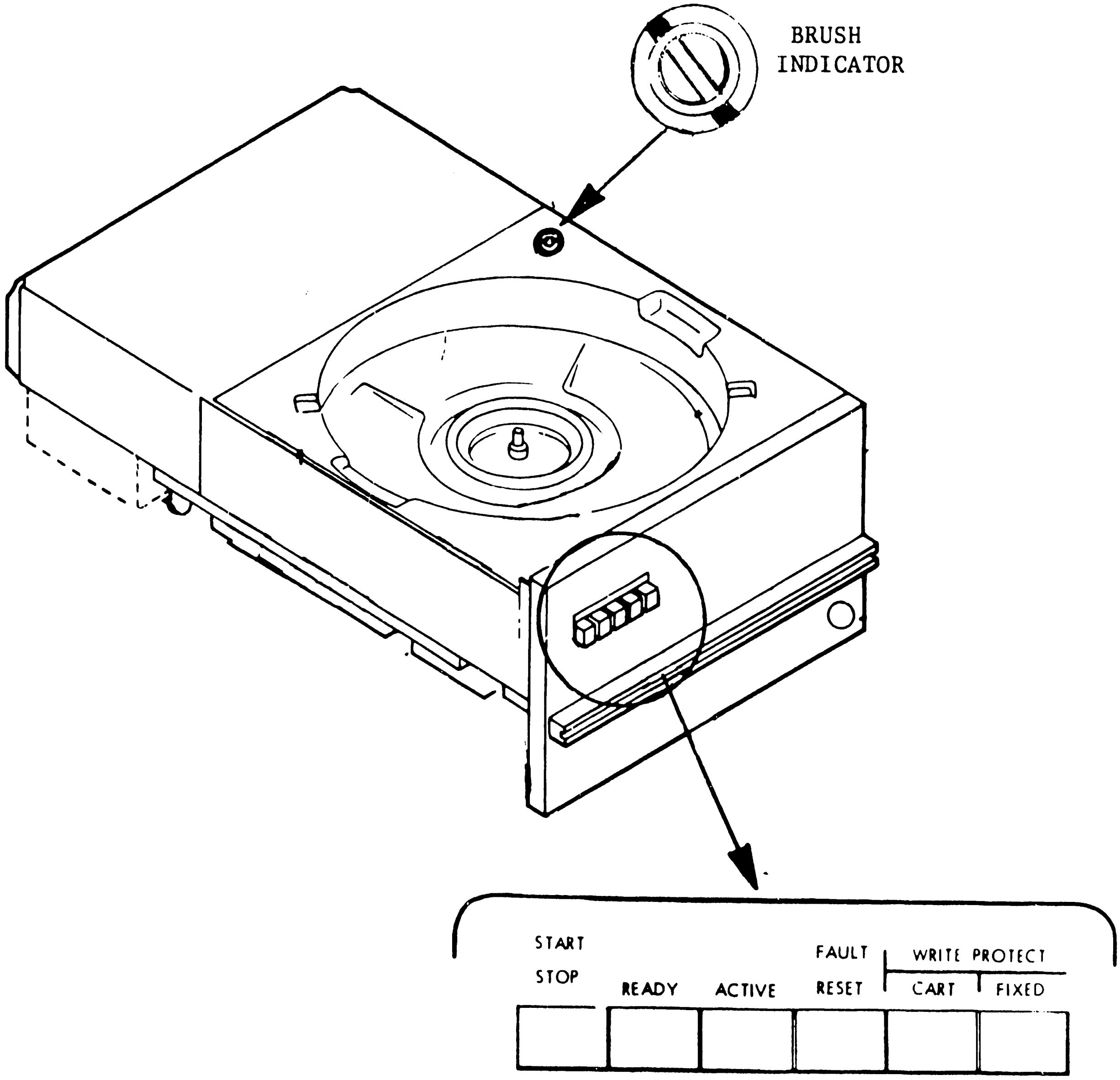


FIGURE 4-38 FRONT PANEL INDICATORS

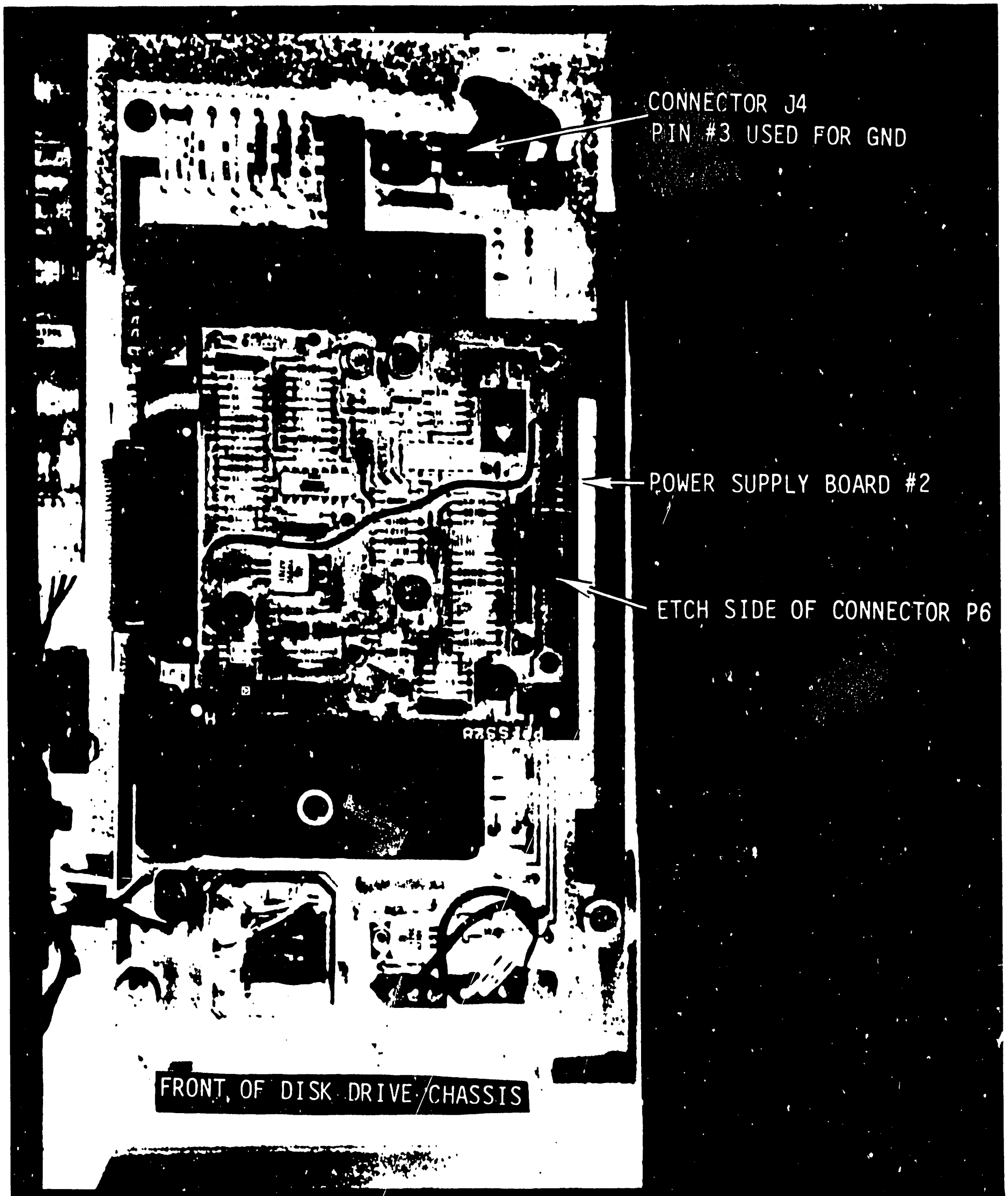


FIGURE 4-39 TOP VIEW OF POWER SUPPLY

FRONT OF DISK DRIVE CHASSIS

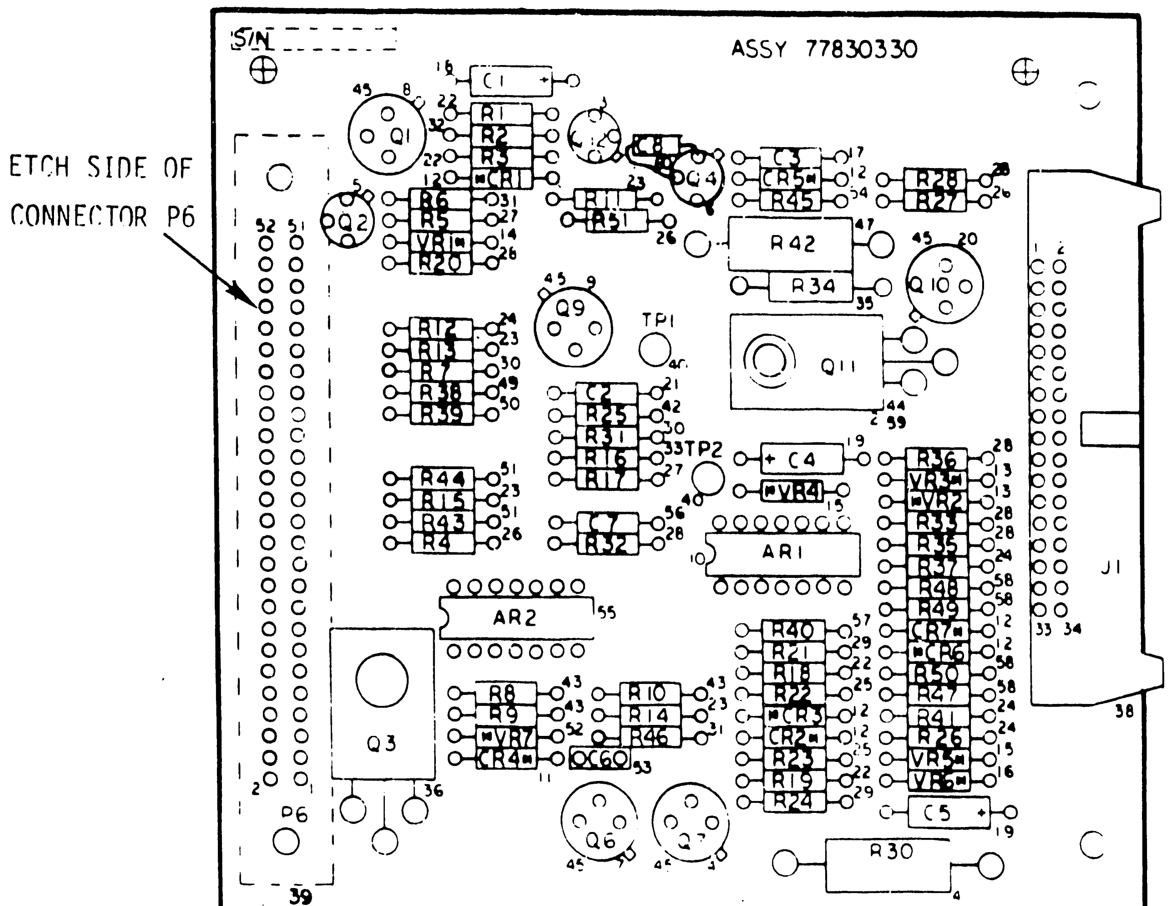


FIGURE 4-40 TOP VIEW OF POWER SUPPLY BOARD #2

4.3.7 DISK EXERCISER (7213)

The 7213 hard disk exerciser is a testing device that allows a user to operate the 2260V disk drive off-line.

A. If voltages are present, remove AC power by means of AC breaker, and attach 7213 disk exerciser as described in the following paragraphs.

B. The 7213 tester has two rows of switches, 6 cables, and 4 test points. Their labels and functions are as follows:

1. TK1 through TK256 (switch #'s 2 through 10 in Figure 4-41). These are the track address switches. A track address is selected by setting the appropriate track address switches to ON. When the SEEK button is then pressed, the heads will move to the selected track. If the LOAD button is pressed, the selected track address will be loaded into the multiplexer of the exerciser board.

2. DS - DISK UPPER/LOWER (switch #11 in Figure 4-41) - When ON, the upper (removable) disk is selected; when OFF, the lower (fixed) disk is selected.

3. HS - HEAD UPPER/LOWER (switch #12 in Figure 4-41) - When ON, the upper head is selected; when OFF, the lower head is selected.

4. RND - RANDOM TRACK GENERATOR (switch #13 in Figure 4-41) - When ON, a random track pattern is generated; when OFF, the random track generator is off.

5. ALTERNATE SEEK (switch #14 in Figure 4-41) - When ON, the head positioner will continuously seek between two addresses: the address set on switches TK1 through TK256, and the address loaded in the multiplexer of the exerciser board (by a LOAD operation).

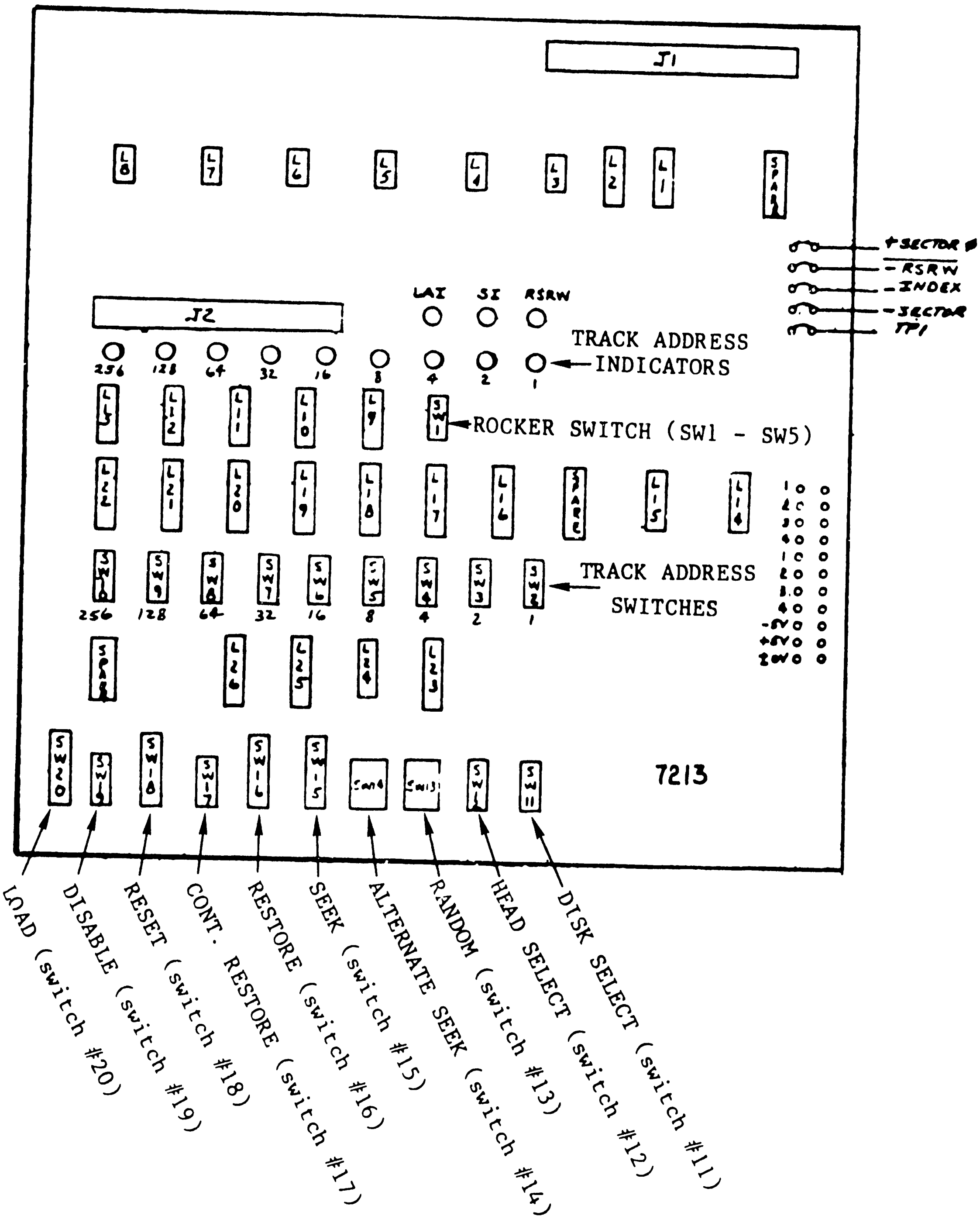


FIGURE 4-41 7213 DISK EXERCISER

6. SEEK (switch #15 in Figure 4-41) - Pressing this momentary contact switch will move the heads to the address set on switches TK1 through TK256.

7. RST - RESTORE (switch #16 in Figure 4-41) - Pressing this momentary contact switch will position the heads at track zero.

8. CONT. RST (switch #17 in Figure 4-41) - When ON, the heads are repeatedly positioned to track zero.

NOTE:

RST or CONT. RST will override the RND and ALTERNATE SEEK switches.

9. RESET (switch #18 in Figure 4-41) - This momentary contact switch resets the exerciser.

10. DISP - DISABLE (switch #19 in Figure 4-41) - When ON, the track address is disabled. The head will remain positioned wherever it is when the DISP switch is turned on.

11. LOAD (switch #20 in Figure 4-41) - This momentary contact switch loads the track address (selected by switches TK1 through TK256) into the multiplexer of the exerciser.

12. UNIT SELECT (switch #1 in Figure 4-41) - This 5-bank rocker switch has the following functions:

    a. SW1 - Selects 100 TPI or 200 TPI for the random generator. During the random mode, switch 1 of rocker switch has control of the random generator. If SW1 is ON, the random address generated at any time will not be greater than 128. If SW1 is OFF, the random address can be greater than 128. This switch is active only when the RANDOM switch is on.

b. SW2 - Selects Unit 1.

c. SW3 - Selects Unit 2.

d. SW4 & SW5 - Not used.

13. The 7213 board has 12 LED indicators; nine of these LEDs indicate the selected track address (1 through 256). The remaining indicators are described below.

    a. LAI - LOGICAL ADDRESS INTERLOCK - When ON, it indicates that an illegal track address has been selected. The maximum legal address is 407 for the Model 2260V Disk Drive.

    b. SI - SEEK INCOMPLETE - If ON, it indicates that the head did not move to the selected track address.

    c. RSRW - READY/SEEK/READ/WRITE - When ON, it indicates that the disk drive is ready to do another Seek, Read, or Write operation.

14. The 7213 board has six cables.

    a. The +5V cable with Molex connector is used to provide power to the 7213 board.

    b. The +5V cable with E-Z hook connector is used to provide power to the 7213 board when the tester is used with Diablo disk drives.

    c. The -5V cable provides the -5V that is needed to operate the amplifier of the 7213. It is used only during head alignments.

    d. The GND cable provides $\pm$0V to the exerciser.

    e. This head cable (see Figure 4-42) plugs into the 2260V disk drive heads (also, the Diablo Model 44B).

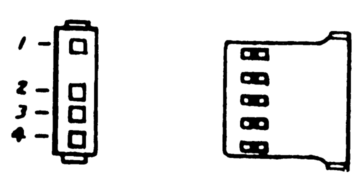


FIGURE 4-42 2260V HEAD CONNECTOR

f. This head cable (Figure 4-43) plugs into Diablo disk drives (Models 43, 44A, and 44B).

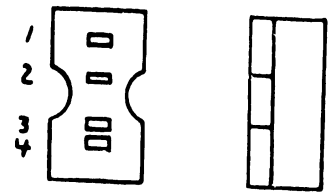


FIGURE 4-43 DIABLO HEAD CONNECTOR

15. The 7213 has four test points.

    a. INDEX - Index Mark coming from the disk.
    b. RSRW - Monitors Drive Ready.
    c. SECTOR MARK - Monitors Drive Sector marks.
    d. SECTOR 0 - Time from Index to first sector, used to obtain index to sector compatibility.

C. Install the tester cable on the tester.

1. The long cable plugs into J1 (Figure 4-41) on the tester. Caution must be exercised to ensure that pin 1 on the cables matches pin 1 on the receptacles.

2. The short cable plugs into J2 (Figure 4-41) on the tester.

D. Attach the other end of cable to I/O receptacle J1 (Figure 4-33) on the back of the disk drive.

E. Attach the single pin Molex connector to the Molex receptacle on I/O board, located on rear of disk drive (Figure 4-36). This step provides the tester with +5V.

F. Attach the -5 volt cable to TP9 on the AGC servo preamp board (Figures 4-44 and 4-45).

G. Attach the ground cable to the GND point (Figure 4-45) on the AGC servo preamp board.

H. Plug the head cables (Figure 4-42) into the upper head cables of the disk drive.

Prior to the next step, a scratch pack should be mounted to ensure that no head crash occurs and that the drive is capable of loading heads.

I. Power the disk drive ON and mount the disk alignment cartridge. Check that power lamp is ON and Start/Stop lamp is OFF. Refer to Figure 4-46 during for the following steps.

J. Pull back the hold-down arms.

K. To separate the dust cover from the disk cartridge, hold the cover release button to the left while lifting the cartridge handle.

L. Disengage the dust cover from disk cartridge. Set the cover aside.

CAUTION:

Do not make abusive contact between the disk cartridge and the spindle. Make certain that the read/write heads are fully retracted and the disk cleaning brushes are completely out of the cartridge area. Remove any dirt from the magnetic chuck.

M. Place disk cartridge onto spindle hub; ensure that the head opening is toward the rear of the drive.

N. Slowly rotate the cartridge back and forth until it detents.

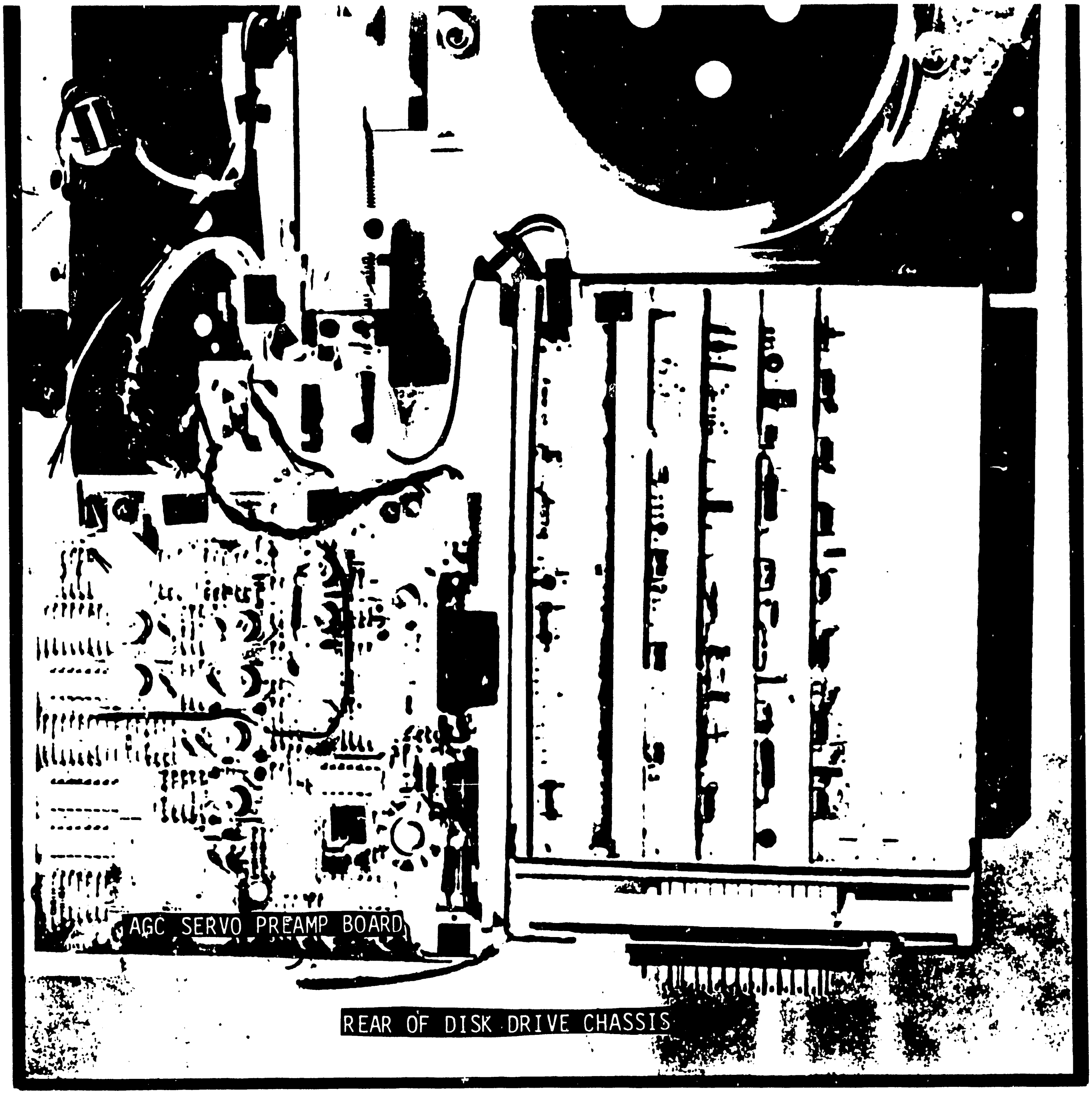


FIGURE 4-44 TOP VIEW OF DISK DRIVE (WITH COVER REMOVED)

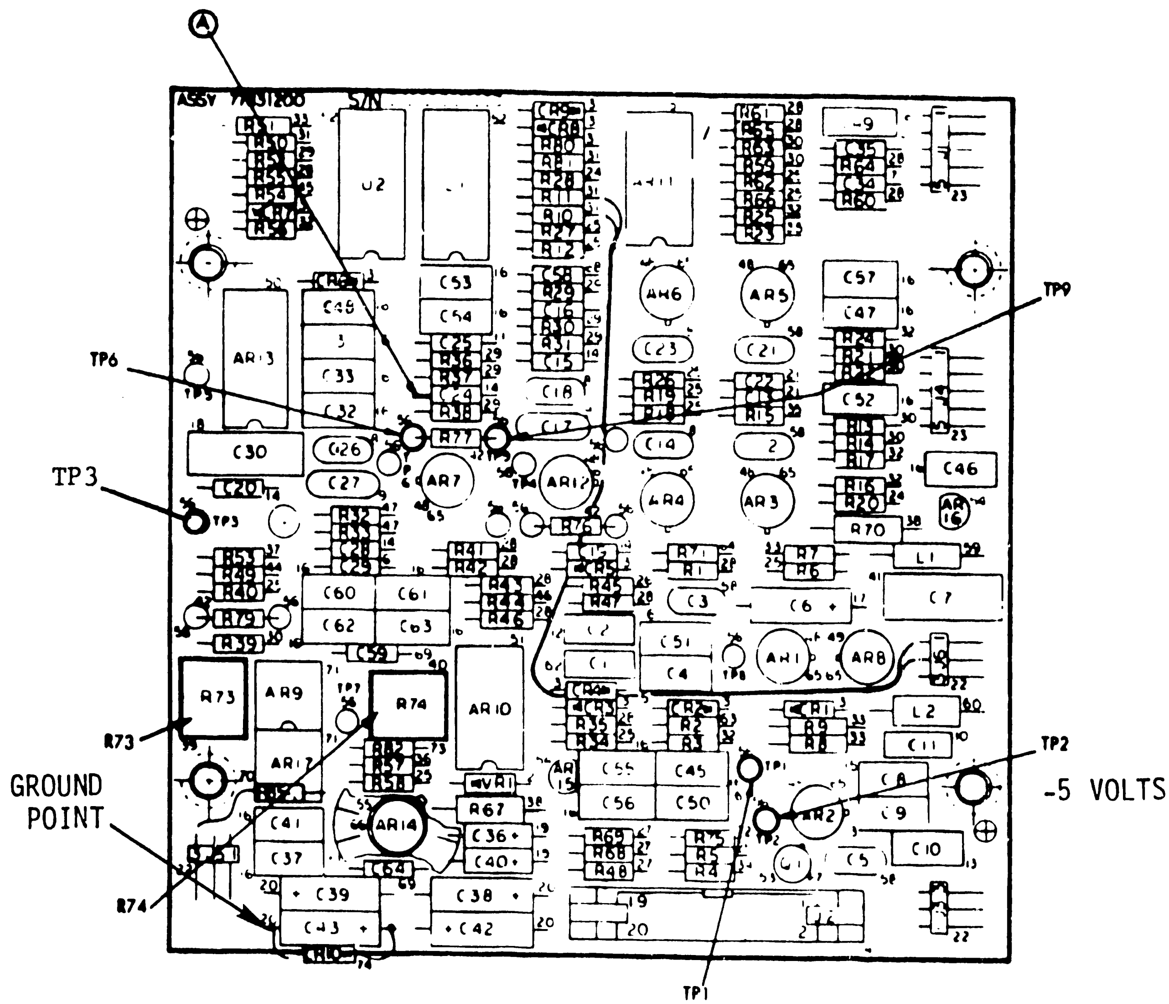


FIGURE 4-45 AGC SERVO PREAMP BOARD

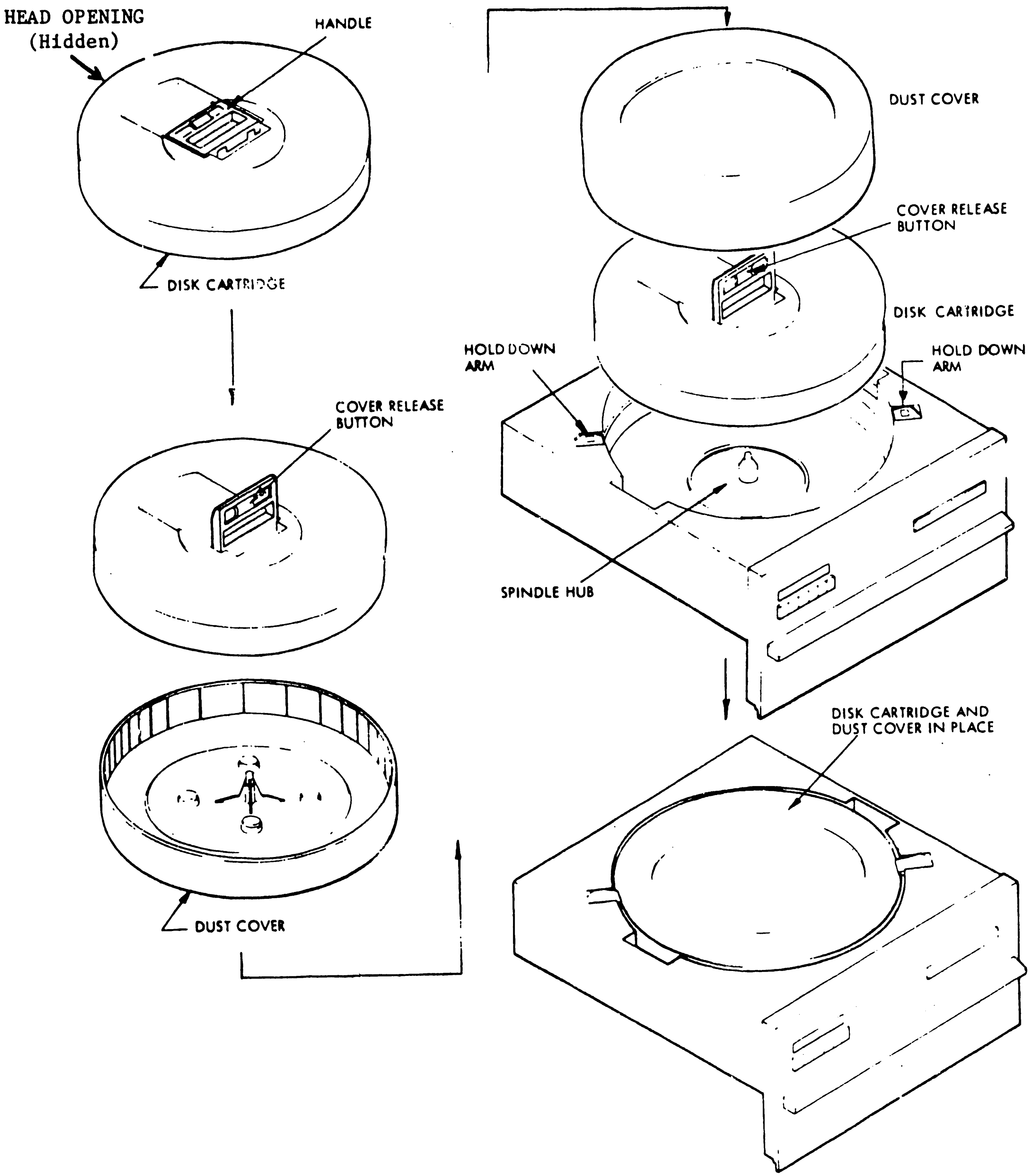


FIGURE 4-46 DISK CARTRIDGE INSTALLATION

O. Push the handle down to seat cartridge.

P. Place the dust cover (removed in step L) over the cartridge, open end down .

Q. Position the hold-down arms over the cartridge and dust cover.

4.3.8 DISK ALIGNMENT/ADJUSTMENT PROCEDURES

A. Remove the carriage lock pin. See Figure 4-47.

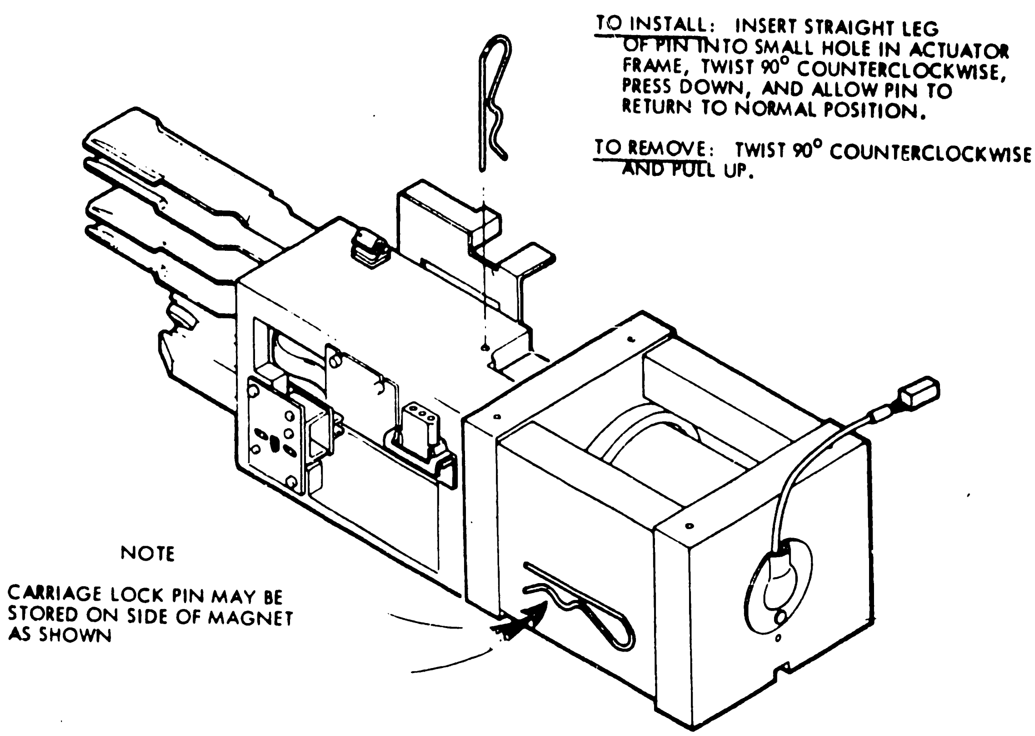


FIGURE 4-47 CARRIAGE PIN REMOVAL

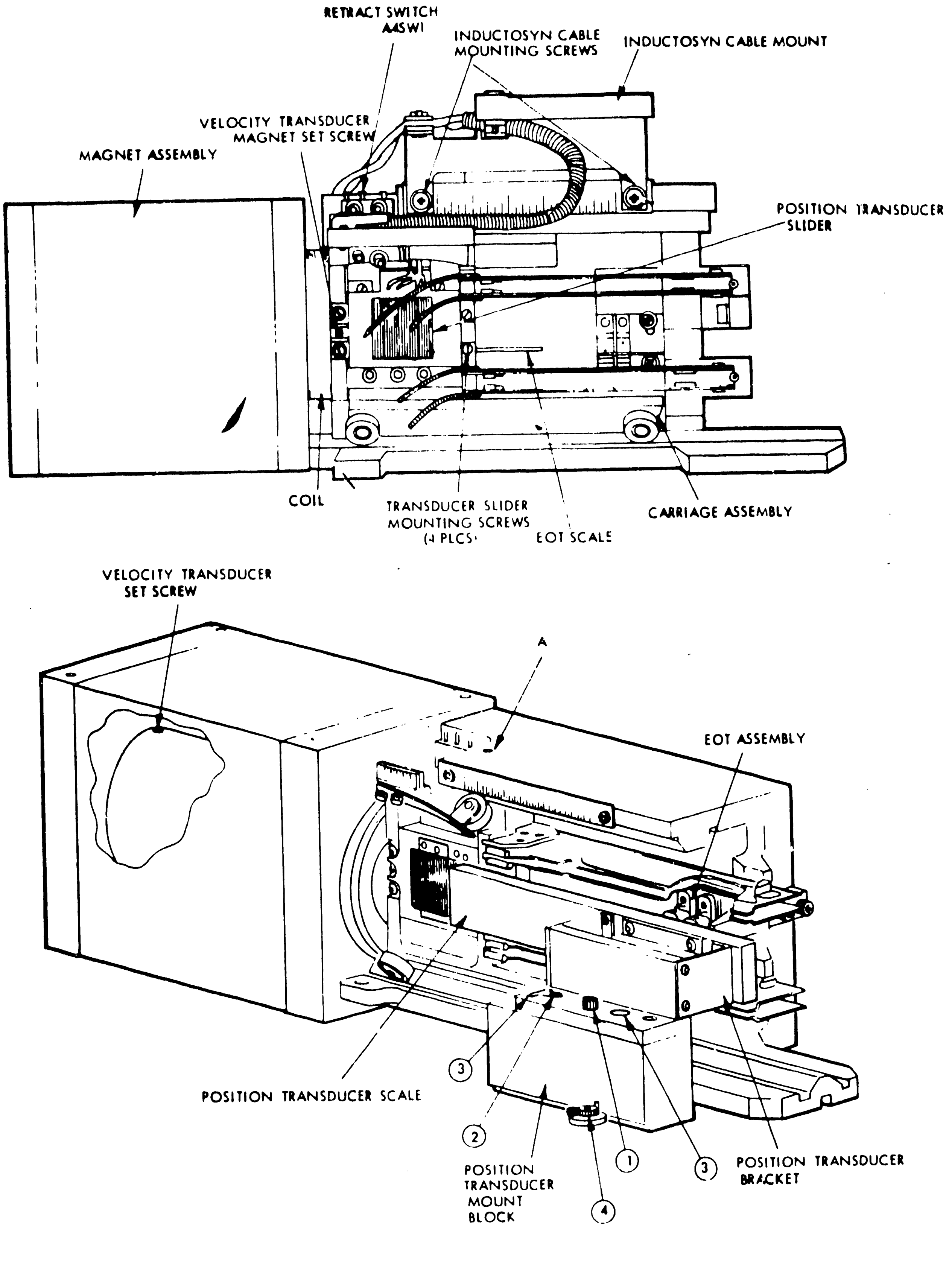


FIGURE 4-48 ACTUATOR ASSEMBLY (MAIN ALIGNMENT AREA)

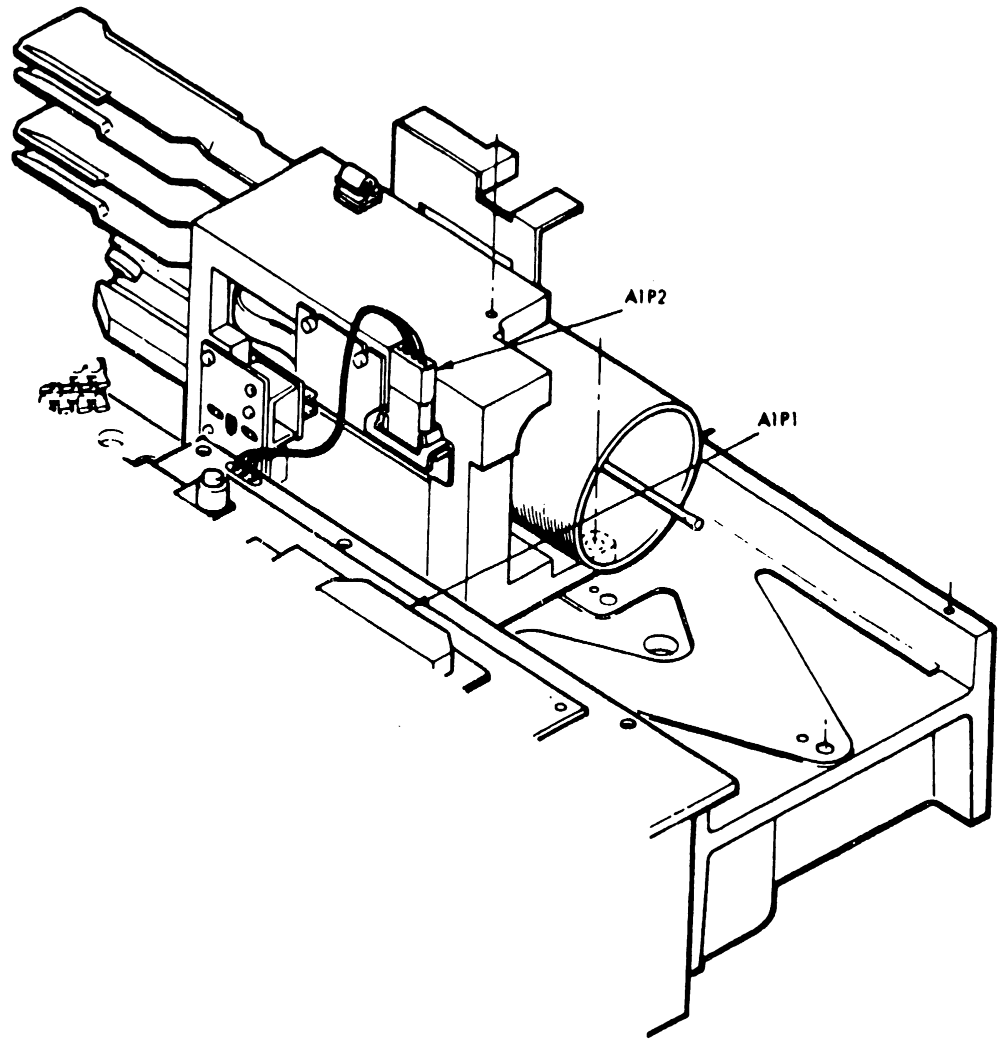


FIGURE 4-49 ACTUATOR ASSEMBLY (PARTIAL - SHOWING A1P2 LOCATION)

B. Press the start/stop switch and wait for the disk drive to become READY.

C. Perform the AGC servo preamplifier and Inductosyn adjustment as follows.

CAUTION:

In performing this procedure, care must be exercised to prevent severe and extended contact between the position tranducer and the slider. See Figure 4-48.

1. Remove A1P2 from the servo actuator (Figure 4-49).

2. Install a jumper from TP1 to TP9 (-5 volt supply) on the AGC servo preamp board (Figure 4-45).

3. Connect the oscilloscope to C24 (point A, Figure 4-45). Set the scope for internal trigger and auto sync.

4. Carefully move the carriage by hand, back and forth, between cylinders 000 and 405 and observe the waveform.

5. If the amplitude of the waveform is 1.0 ± .05 volts peak-to-peak (Figure 4-50), do not make any adjustment and proceed to step 7. If the waveform is not within tolerance, perform step 6.

6. If the waveform is NOT within the above stated tolerances, loosen the transducer mount block forward-most screw (right item 3, Figure 4-48), and adjust the cam (item 4, Figure 4-48) for the proper amplitude.

   If this adjustment is not sufficient, loosen the transducer scale mounting screw (item 1, Figure 4-48). It may be necessary to make sequential adjustments of the cam and eccentric screw to obtain proper amplitude tolerances.

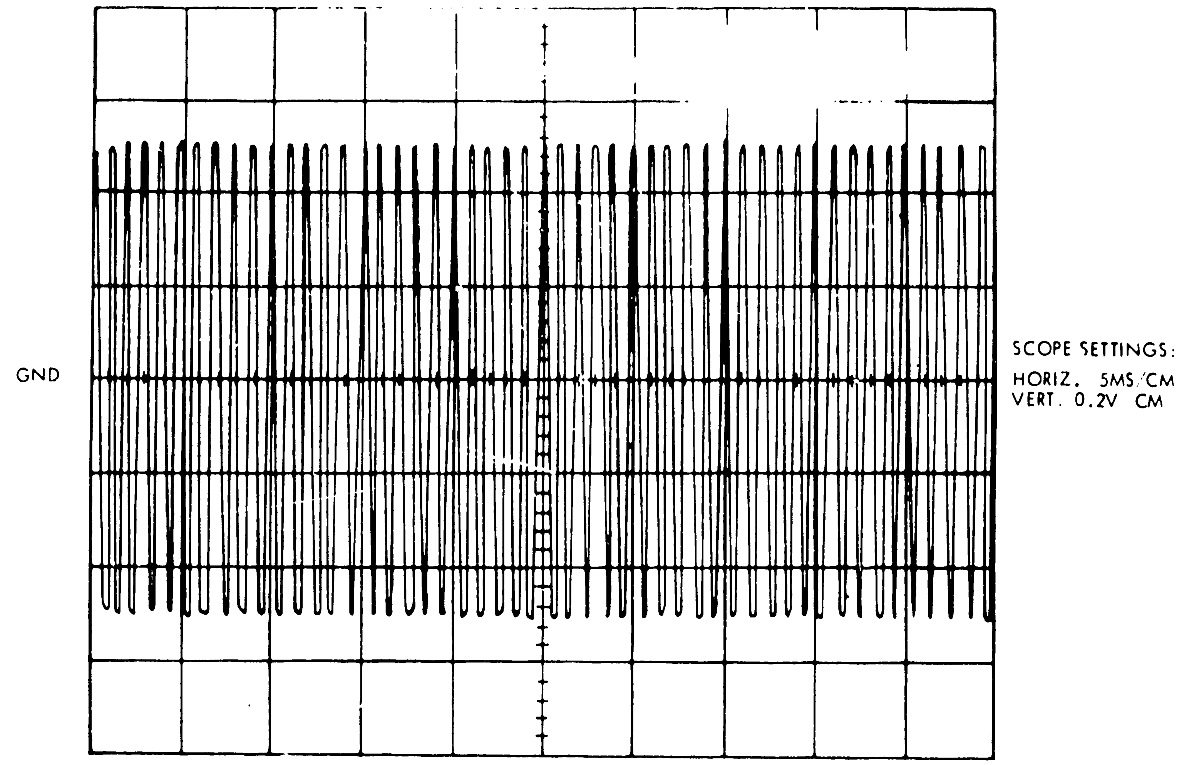


FIGURE 4-50 POSITION TRANSDUCER WAVEFORM

7. Tighten the transducer scale mounting screw (item 1, Figure 4-48) to 20 inch-lbs.

8. Verify that the waveform amplitude is still 1.0 ± .05 volts peak-to-peak between cylinders 000 and 405.

9. Remove the jumper from TP1 and TP9. See Figure 4-45.

10. Connect the oscilloscope to TP3. See Figure 4-45.

11. Carefully move the carriage by hand, back and forth, between cylinders 000 and 405 and observe the waveform.

12. The amplitude of the waveform must be 5.0 (+0.6, -0.2) volts peak-to-peak. If it is not, repeat steps 2 through 9. If the adjustment cannot be performed, replace the ACC Preamp.

NOTE:

The waveform will be similar to Figure 4-50 except for difference in amplitude.

13. Gently push the carriage forward so that it is at the forward stop position.

CAUTION:

While performing step 13, keep hands clear of the carriage.

14. Reconnect A1P2.

D. Perform average seek time adjustments.

1. Command RTZ with 7213 exerciser by pressing the RST (Restore) button (switch 16 in Figure 4-41).

2. Perform alternate seeks between cylinders 293 and 405. To initiate alternate seeks:

   a. Reset the exerciser.
   b. Press the RST button (switch #16 in Figure 4-41) to restore the head positioner to track zero.
   c. Select one seek address with switches TK1 through TK256.
   d. Press the LOAD switch (switch #11 in Figure 4-41) to load this seek address into the multiplexer.
   e. Select the other seek address with switches TK1 through TK256.
   f. Turn the Alternate Seek switch ON (switch #14 in Figure 4-41).
   g. The drive should now seek between the two selected addresses.

h. Monitor test point RSRW (ON cylinder pulse) on the exerciser (Figure 4-41). Adjust the velocity gain potentiometer (R73 in Figure 4-45) for a seek time of 35 $\pm$ 1 milliseconds (Figure 4-51).

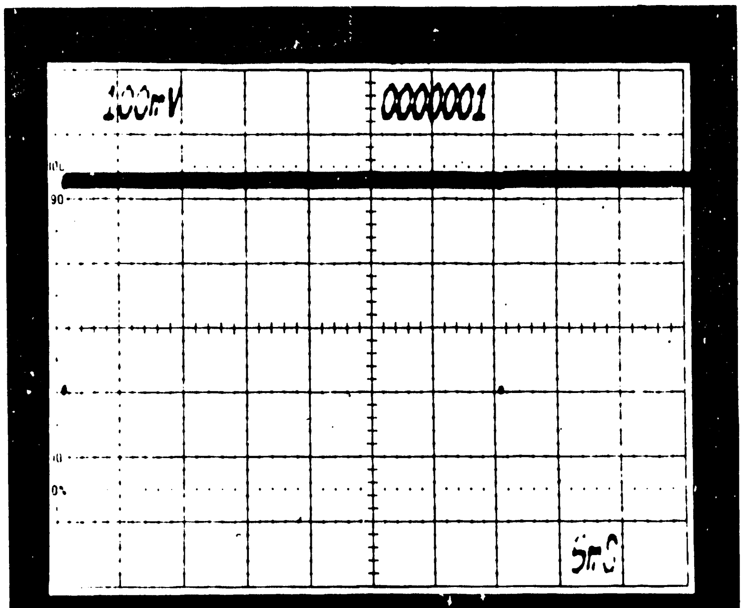
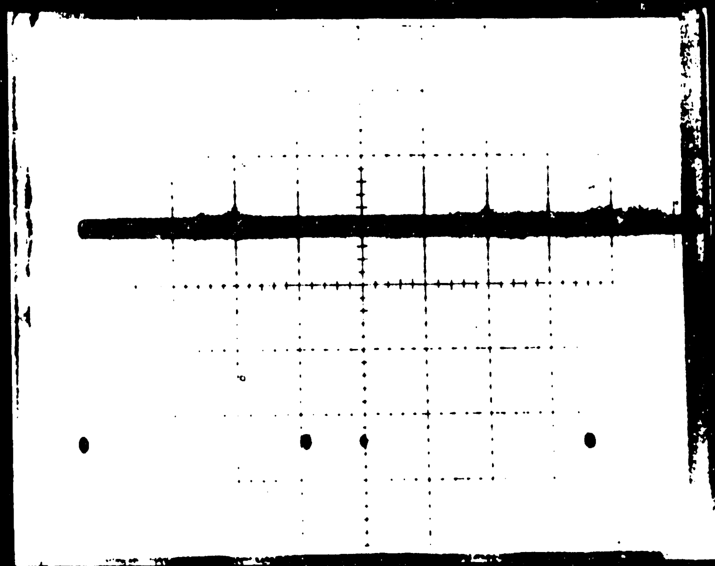


FIGURE 4-51 ON CYLINDER PULSE

E. Perform the servo balance adjustment.

1. Perform alternate seeks between cylinders 200 and 201.

2. Monitor Test Point RSRW on the 7213 exerciser. The heads should position at the same place on each of the tracks during foward and reverse seeks. The waveform should be the same as in Figure 4-53.



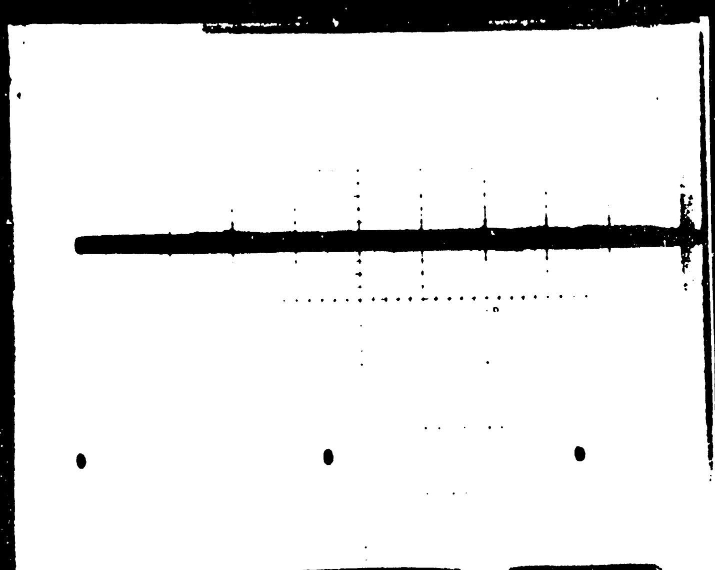
SCOPE SETTINGS

Channel A on TP RSRW

Horizontal 2ms/cm

Vertical 1V/cm

FIGURE 4-52 ONE TRACK SEEK UNBALANCED



SCOPE SETTINGS

Channel A on TP RSRW

Horizontal 2ms/cm

Vertical 1V/cm

FIGURE 4-53 ONE TRACK SEEK BALANCED

3. If the heads are not positioning at the same place during foward and reverse seeks, the waveform will be as shown in Figure 4-52.

4. Adjust R74 on the preamp board until the waveform is as shown in Figure 4-53.

5. Repeat the same procedure for alternate seeks between cylinders 000 and 001. If the waveforms are balanced, perform alternate seeks between cylinders 400 to 401. It may be necessary to adjust R74 to bring all three locations into adjustment.

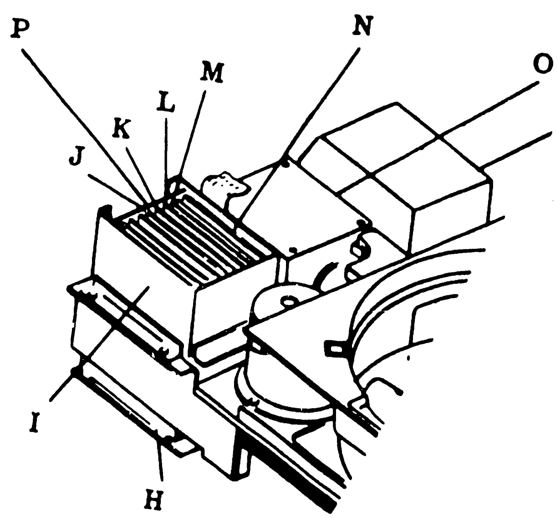
NOTE:

Do not alter the oscilloscope settings during this adjustment.

F. Perform the End of Travel (EOT) check and adjustment.

1. Depress the start/stop switch to disengage the spindle motor. Remove AC power from disk drive by means of its AC breaker.

2. Install the servo board on a card extender (Figure 4-54).



ASSEMBLY TITLE

- H. Mother Board Asm
- I. Card Cage Asm
- J. Control Board Asm
- K. Sector Board Asm
- L. Servo Board Asm
- M. Data Recovery Board Asm
- N. R/W/E Board Asm
- O. Inductosyn Pre-Amp Board Asm
- P. I/O Board Asm

FIGURE 4-54 PC CARD LOCATIONS

3. Apply AC power to disk drive. Depress the start/stop switch and wait for the drive to be ready.

4. Perform temperature stabilization.

NOTE:

Allow the disk drive to operate in the "READY" mode for ten minutes with the electronics cover on.

5. Unplug A1P2 on the actuator assembly (Figure 4-49).

6. On servo board, ground TP20 and TP21 (Figure 4-55).

7. Set actuator at forward stop and reconnect A1P2.

8. Perfrom RTZ by pressing the RST button.

9. Monitor TP19 (Figure 4-55) on the servo board, with channel A of oscilloscope; sync negative on this signal. Monitor TP3 (Figure 4-45) on the AGC preamp board, with channel B of oscilloscope. Place channel B in uncalibrated vertical position and adjust it until the waveform is five centimeters in amplitude. Perform alternate seeks between cylinders 408 and 410.

10. Adjust the oscilloscope until the waveform looks similar to Figure 4-56 or 4-57.

11. Place the crossover point of signals A and B in the middle of screen and set the horizontal sweep time to 10X. The waveform should be similar to Figure 4-58, depending upon the sweep time.

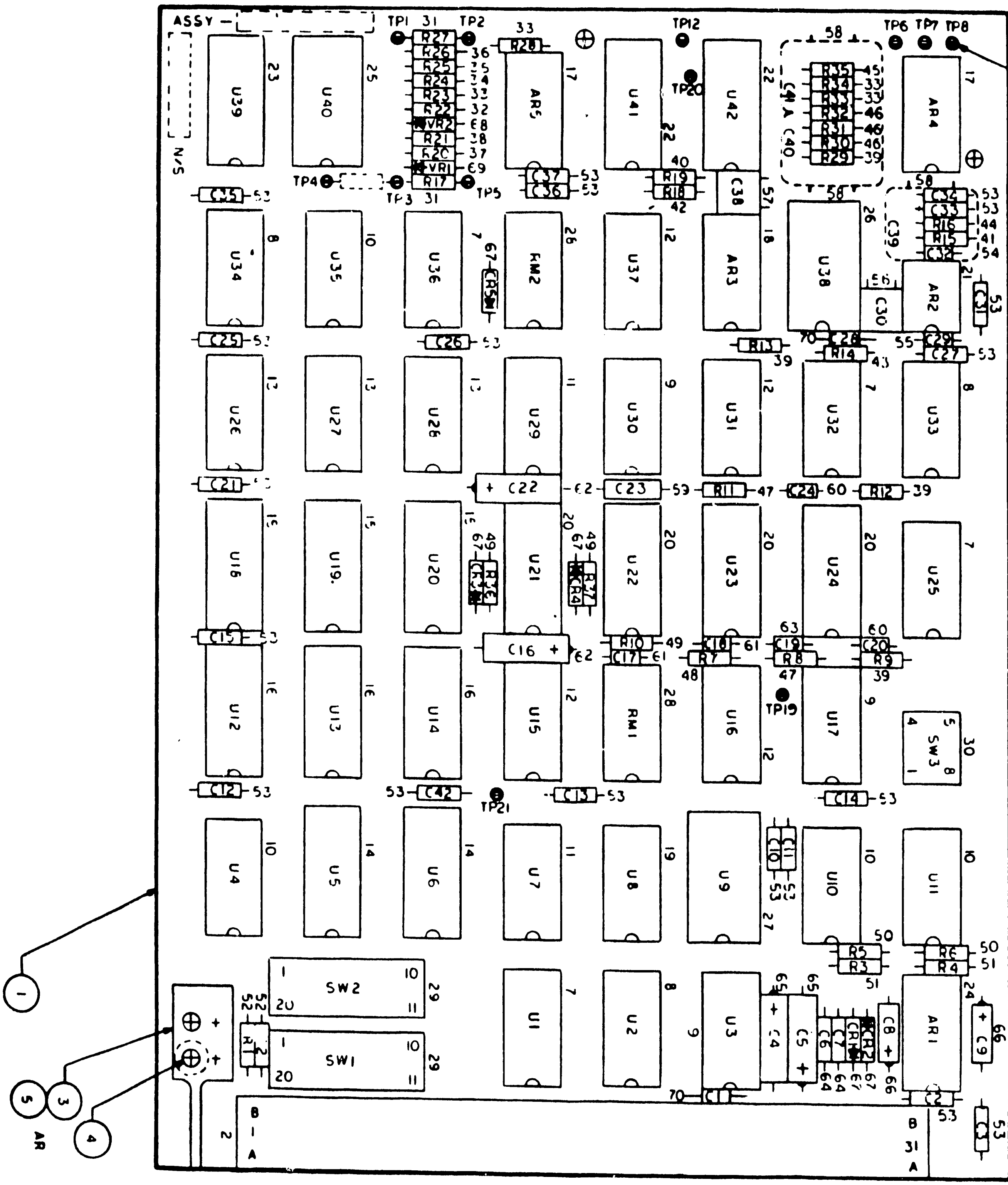


FIGURE 4-55 SERVO BOARD

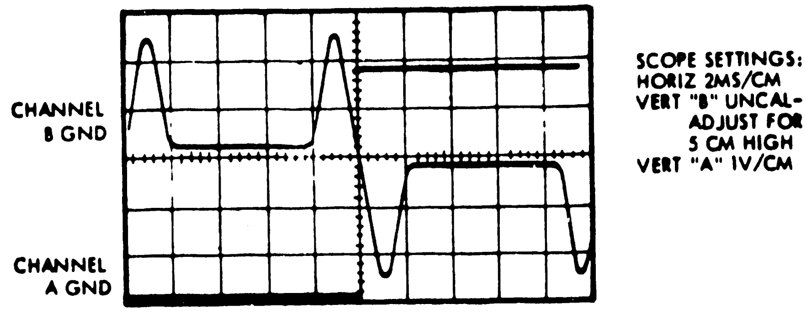


FIGURE 4-56 EOT WAVEFORM

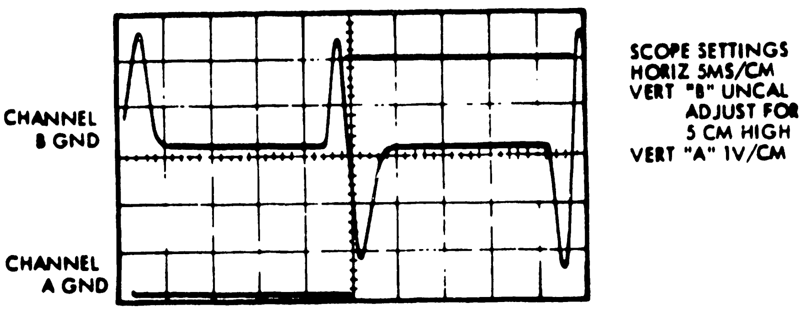


FIGURE 4-57 EOT WAVEFORM

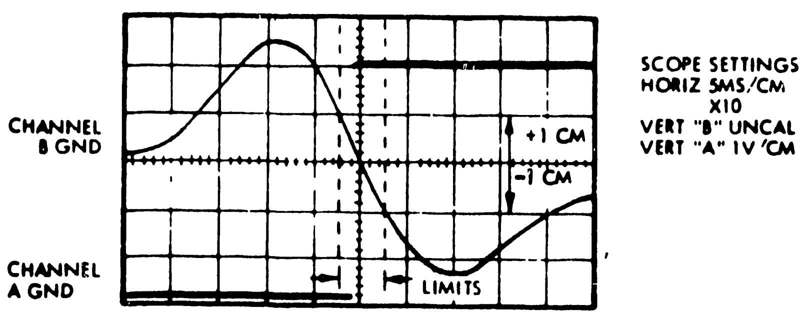


FIGURE 4-58 EOT WAVEFORM

12. If waveform is not within the limits shown in Figure 4-58, slightly loosen the two socket head screws (Phillips on early units) on the E.O.T. detector (see Figure 4-59). Place a screwdriver in the slot and adjust the detector horizontally to the limits shown in Figure 4-58.

NOTE:

The limits specify that signal A must go Positive within ± 1 vertical centimeter of signal B ground along the slope of signal B.

13. Tighten the screws and verify that the adjustment has not changed.

14. Unplug A1P2 on the actuator (Figure 4-49).

15. On the Servo Board (Figure 4-55), remove ground leads from TP20 and TP21.

16. Set the actuator at forward stop and reconnect A1P2. (See 4-49).

17. Perform RTZ (return-to-zero) by pressing the restore button.

G. Preliminary Head and Index Transducer Alignment.

1. Press start/stop switch on the disk drive to disengage the spindle drive motor. Power "OFF" the drive.

2. Remove the power supply cover (Figure 4-34), and remove relay K1 (Figure 4-33).

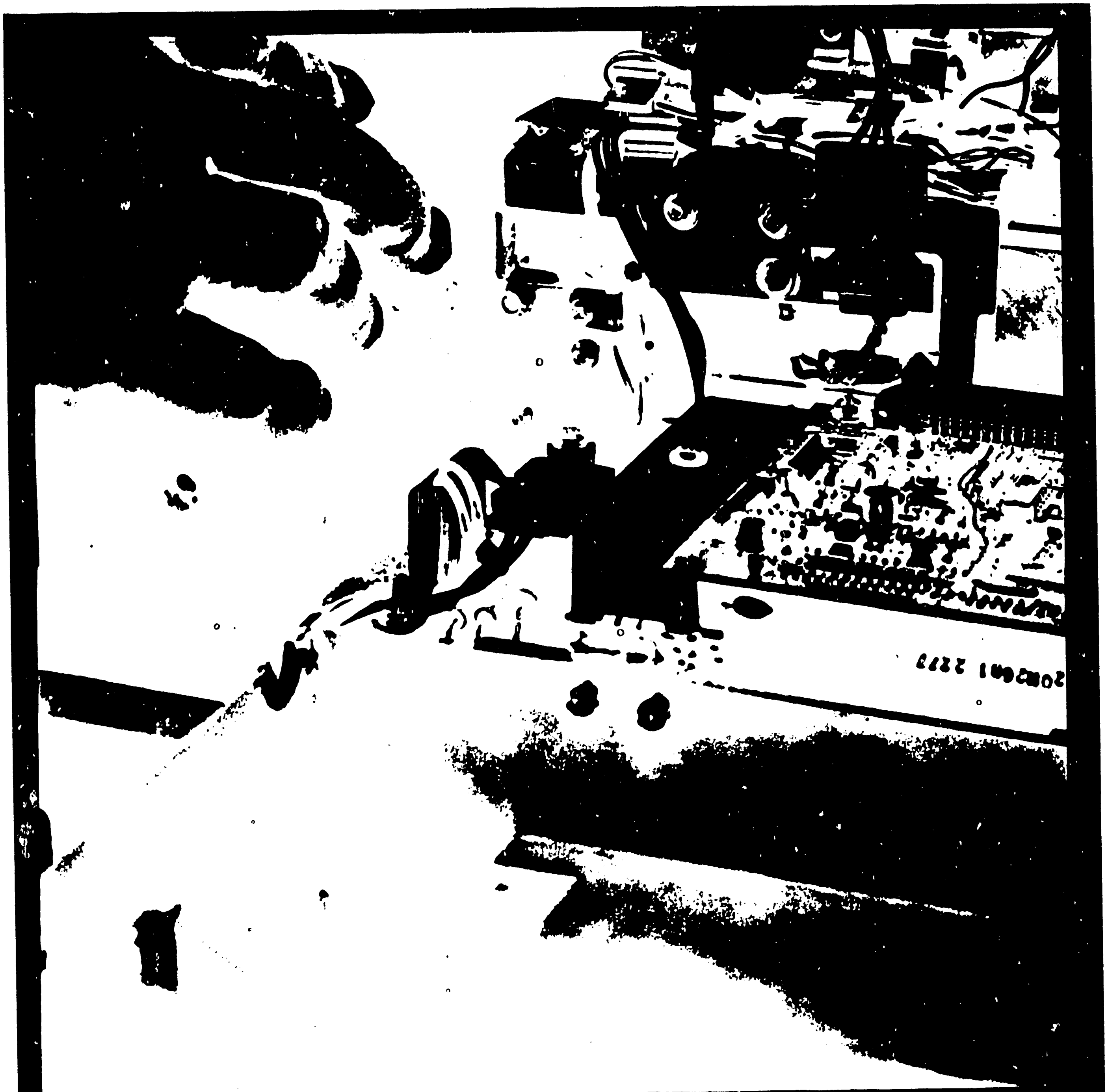


FIGURE 4-59 EOT DETECTOR ADJUSTMENT

NOTE:

With K1 removed, emergency retract is disabled. Consequently, the heads must be manually retracted if spindle slows down below the tolerance limit.

3. Disconnect connector A1P2 (Figure 4-49).

4. Open the pack lock as shown in Figure 4-60.

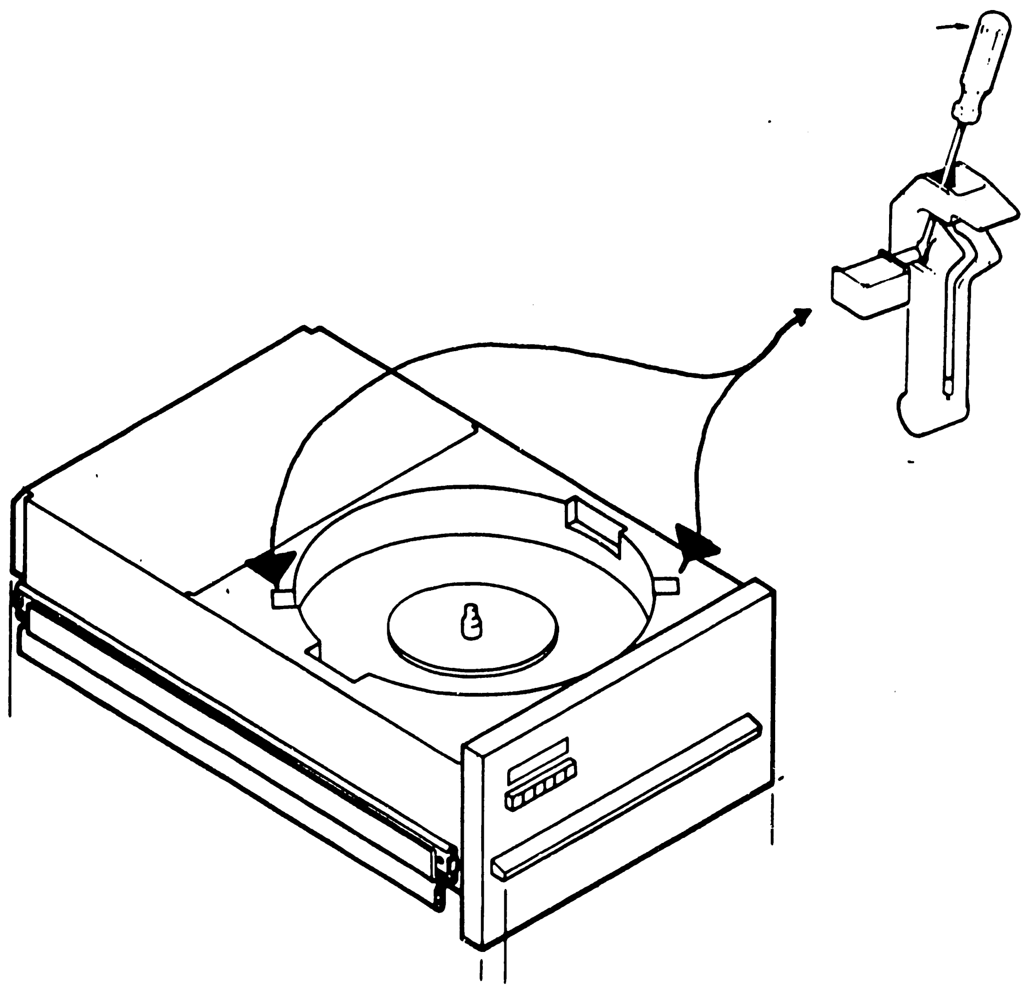
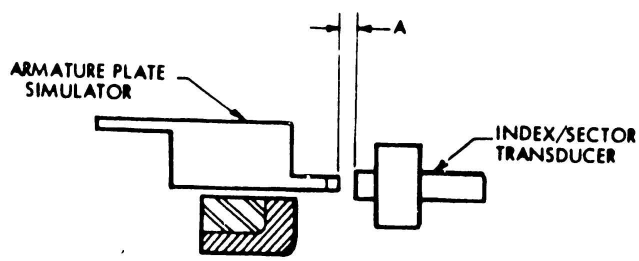


FIGURE 4-60 PACKLOCK RELEASE

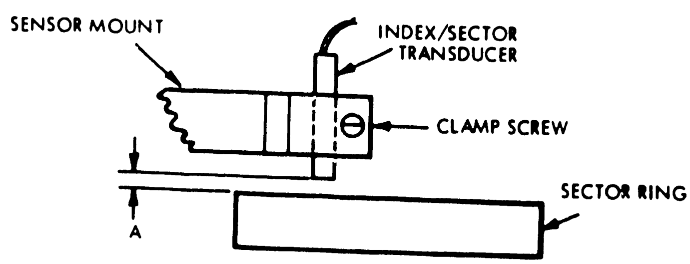
FIGURE 4-61 INDEX ALIGNMENT TOOL INSTALLATION

5. Install the Index Alignment Tool (PN 726-9663) in accordance with Figure 4-61.

6. Using a plastic shim, check the clearance at point "A" (Figure 4-62). The clearance should be 0.010" (nominal) to 0.013" (max.). If the clearance is out of tolerance, loosen the transducer clamp (Figure 4-63) and slide the index transducer in or out as needed to adjust for the proper clearance.



Index/Sector Transducer Adjustment



Fixed Disk Index/Sector Transducer Adjustment

FIGURE 4-62 CLEARANCE CHECK

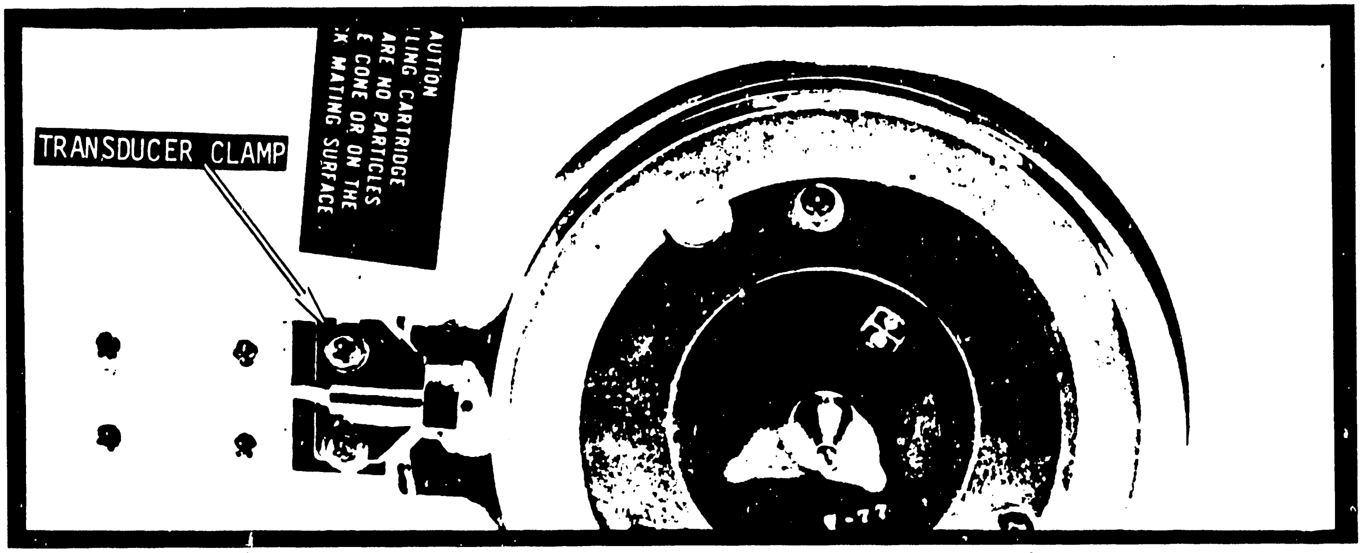


FIGURE 4-63 TRANSDUCER CLAMP (LOCATIONAL VIEW)

7. Tighten the transducer clamp.

8. Disconnect the 7213 disk exerciser from the disk drive.

CAUTION:

If the drive contains a new style R/W/E board (WLI #726-5795, CDC #75891100), head alignments cannot be performed correctly using the R/W/E board signals and the I/O board switches. In this case, alignments are performed using the 7213 exerciser and its track address switches. The alignment signal must be taken at TP1 on the 7213 disk exerciser board.

9. Remove the quadraclip, which is holding all four heads firmly in R/W/E board. (Figure 4-54)

10. Remove the clip which is holding the head cables to the card chassis.

11. Remove the head cables from the R/W/E logic card (Figure 4-54) and pull the R/W/E card out of card cage.

12. Connect channel 1 of the oscilloscope to TP1 or TP2 on R/W/E board and connect channel 2 to P1-B10 on I/O board connector (Figure 4-36).

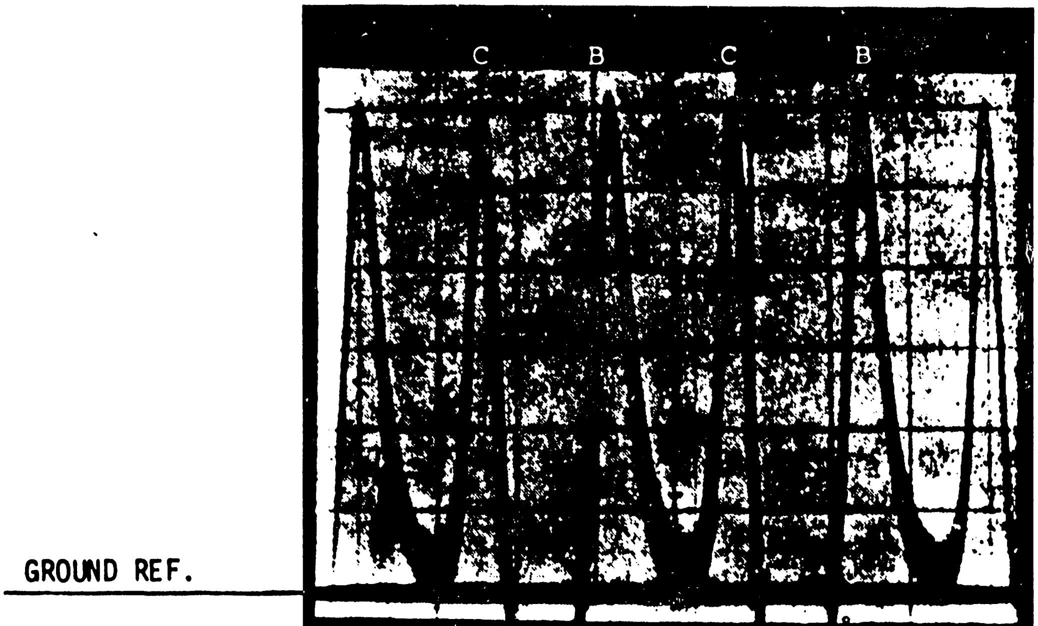


FIGURE 4-64 HEADS ALIGNED

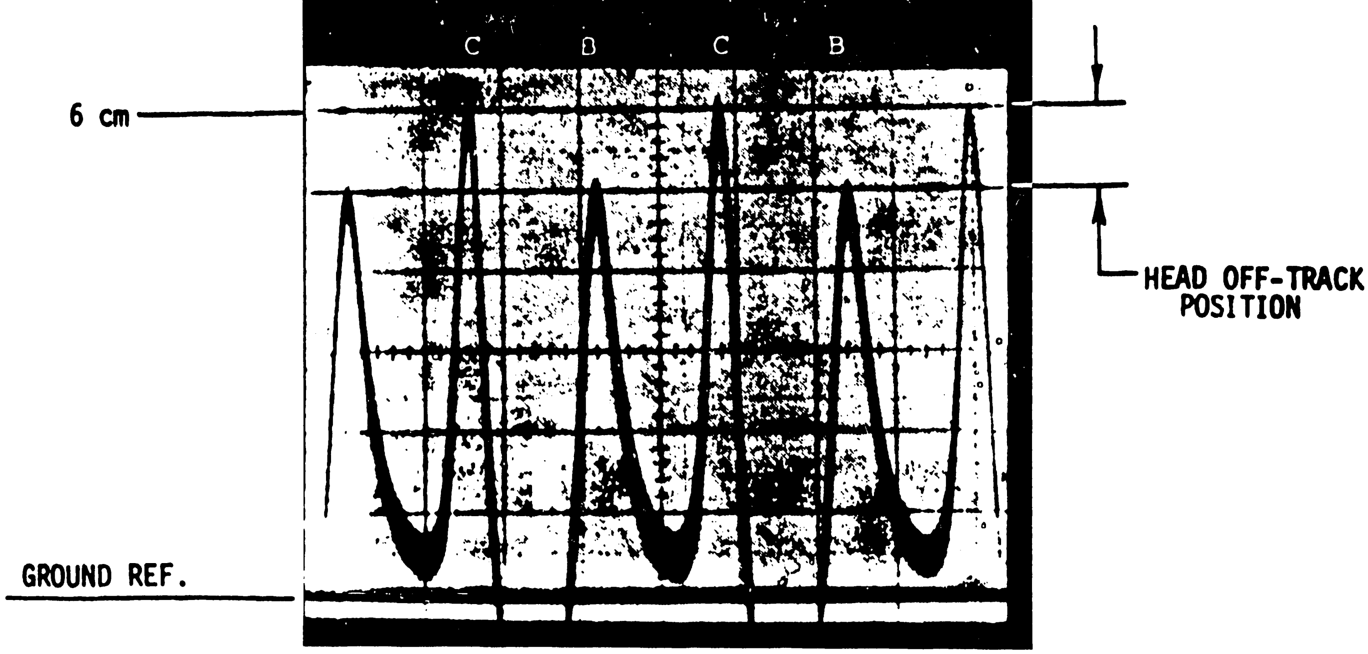


FIGURE 4-65 HEADS NOT ALIGNED

NOTE:

An X1 probe (PN 726-9652) is needed for channel 1 because of low signal amplitude at TP1 or TP2.

13. Reinstall the R/W/E board in its original position in the card cage.

14. Plug the lower head of the top disk into the R/W/E card (second from the top) first; then plug the upper head of the top surface into the R/W/E card.

15. Power the disk drive ON; press the start/stop switch and wait until the brush cycle completes.

16. Immediately after completion of the brush cycle, reconnect A1P2, but reverse its orientation (connect it backwards).

17. Set the switches on the I/O board (Figure 4-36) to the following configuration:

Switch Bank #1	ON	Switch 5
	OFF	Switch 4
	OFF	Switch 3
	OFF	Switch 2
	ON	Switch 1

Switch Bank #2	OFF	Switch 10
	ON	Switch 9
	OFF	Switch 8
	ON	Switch 7
	OFF	Switch 6
	ON	Switch 5
	OFF	Switch 4
	OFF	Switch 3
	OFF	Switch 2
	ON	Switch 1

Switch Bank #3	OFF	Switch 4
	ON	Switch 3
	OFF	Switch 2
	OFF	Switch 1
Switch Bank #4	ON	Switch 8
	OFF	Switch 7
	OFF	Switch 6
	OFF	Switch 5
	ON	Switch 4
	OFF	Switch 3
	OFF	Switch 2
	ON	Switch 1
Switch Bank #5	OFF	Switch 8
	OFF	Switch 7
	OFF	Switch 6
	OFF	Switch 5
	OFF	Switch 4
	ON	Switch 3
	ON	Switch 2
	ON	Switch 1

18. Toggle switch 8 of switch bank #5. The actuator should move to track #146.

19. If the display on the oscilloscope is the same as in Figure 4-64 or if it is inverted, the head does not need alignment. But if the display is the same as Figure 4-65, continue on to step 20.

NOTE:

TP1 and TP2 are 180 degrees out of phase.

20. Loosen the selected head clamp screw for the upper head (Figure 4-66). Using head alignment tool (WLI Part #726-9647), adjust the selected head to obtain the signal shown in Figure 4-64. Tighten the upper head clamp and torque to 3.6 ± .05 inch-lbs.

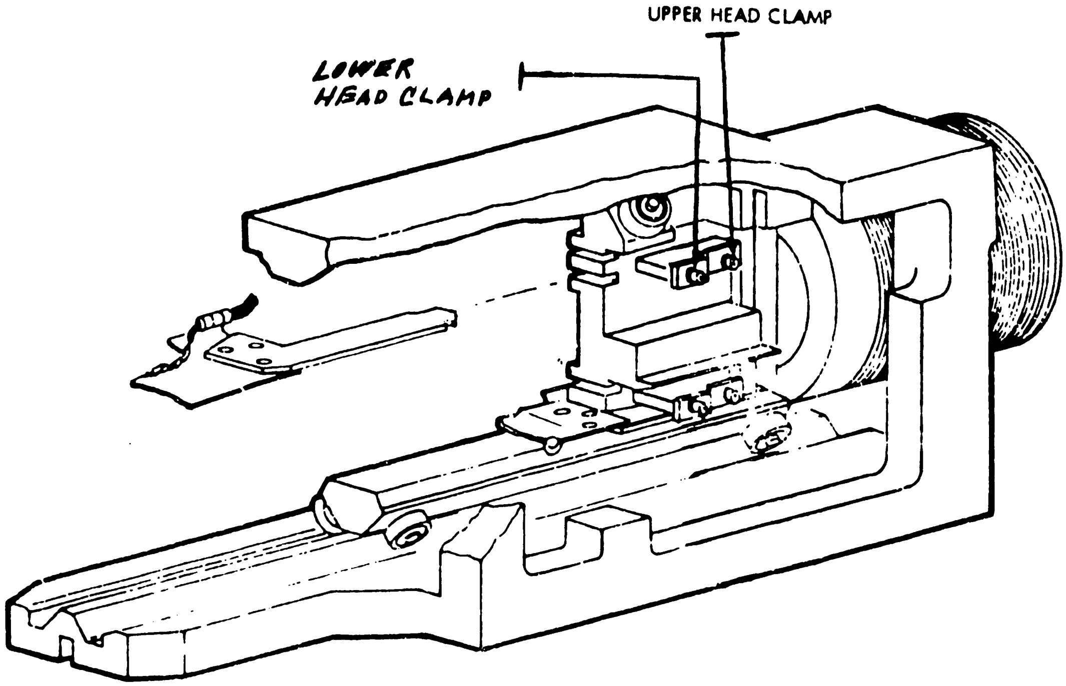


FIGURE 4-66 HEAD CLAMP SCREWS

21. Select lower head on the upper platter by setting switch bank #3 on the I/O board (Figure 4-36) to the following configuration:

Switch Bank #3	OFF	Switch 4
	OFF	Switch 3
	ON	Switch 2
	OFF	Switch 1

22. Perform steps 19 and 20 for lower head, using the lower head clamp screw for adjustment (Figure 4-66) if necessary.

23. Depress the start/stop switch to stop (out) the spindle, allowing the spindle speed to reach zero. Unplug A1P2. Depress the start/stop switch to start (in) and let the brush cycle complete. Plug A1P2 back in (backwards).

    Recheck the upper and lower head alignment to ensure that the torquing did not change the position of the heads.

24. Change switch bank #5 on the I/O board to access track 10 as follows:

	OFF	Switch 8
<u>Switch Bank #5</u>	OFF	Switch 7
	OFF	Switch 6
	ON	Switch 5
	OFF	Switch 4
	ON	Switch 3
	OFF	Switch 2
	OFF	Switch 1

    Toggle switch #8 on switch bank #5. The actuator should move to track 10.

25. Trigger channel 2 of the oscilloscope (slope and level negative, sweep rate 5 us/div). The index on channel 1 must be 19 $\pm$ 3 usec from the leading edge (Figure 4-67).

26. If the index measurement is out of tolerance, adjust the potentiometer (only pot available) on the sector board as needed to bring the measurement to within specifications.

27. Change switch bank #3 as follows to select the upper head and make the same checks as in steps 25 and 26.

	OFF	Switch 4
<u>Switch Bank #3</u>	ON	Switch 3
	OFF	Switch 2
	OFF	Switch 1

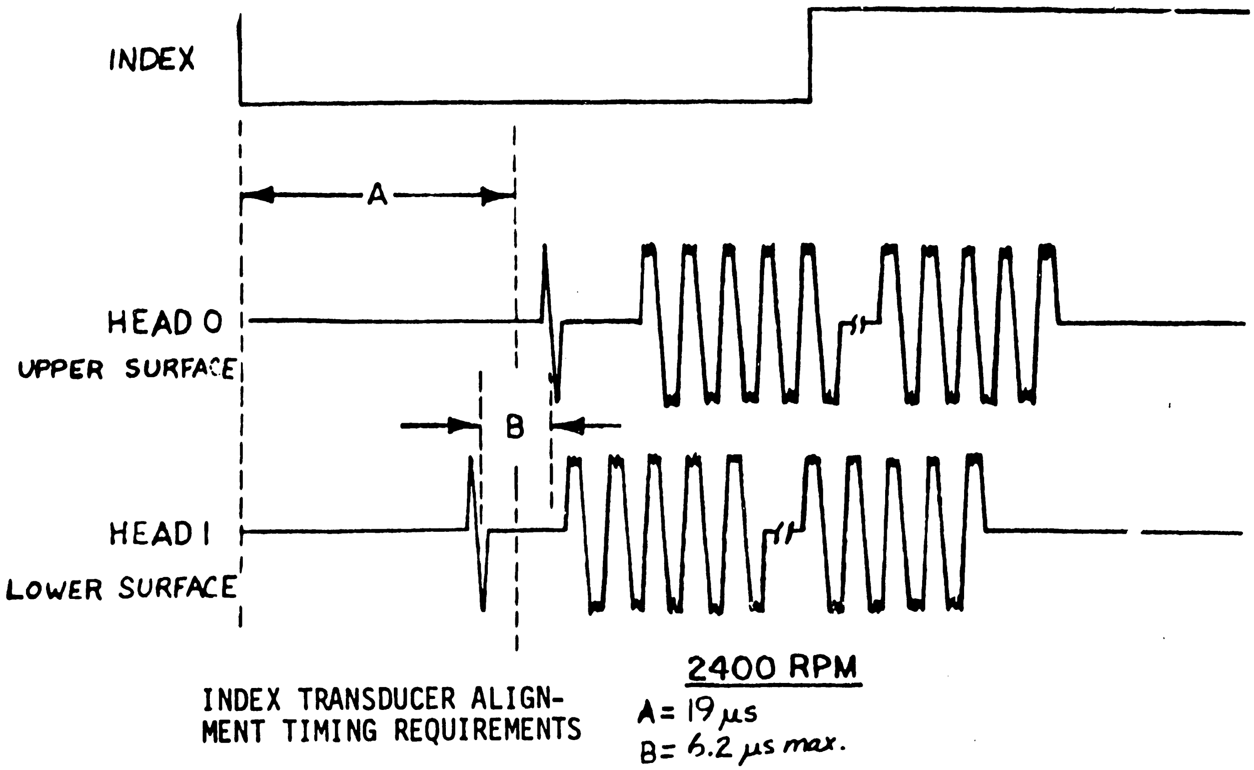


FIGURE 4-67 INDEX WAVEFORM PRESENTATION

NOTE:

Because the same potentiometer is used for both heads, a compromise setting between the heads may be necessary.

28. Stop the drive, and remove the alignment pack. Turn the main circuit breaker to OFF. Reinstall relay K1. Put A1P2 into its normal plugged-in configuration. Plug the heads for the lower disk back in.

29. Install the head cable clip, the quadraclip, the power supply cover, and the electronics cover.

Return the I/O switch on the I/O board (Figure 4-36) to normal operating settings as described in Section 4.3.5.

4.3.9 SYSTEM INTERCONNECTION

A. Attach disk drive to system.

1. Remove the side and rear cover panels from the disk drive.

2. Attach a 10 ft. I/O cable to J1 at the rear of the disk drive (see Figure 4-33). If only one drive is to be attached to the system, use I/O cable PN 220-0188; if more than one drive is to be attached to the system, use I/O cable PN 220-0189.

3. Attach the other end of the I/O cable to the 22V02 IOP in the mainframe (Figure 4-68). The I/O cable should run from receptacle J1 on back of the disk drive, through the cable entrance space on the side of disk drive chassis, and up through the cable entrance space in rear base of processor mainframe.

   The connector on cable J1 should be attached to port J1 on the 22V02 IOP (Figure 4-68). Since the earlier model cables were not labled, note that the connector to be attached to the J1 port has external twisted pairs.

   Attach the connector on cable J2 to port J2 on the 22V02 IOP (Figure 4-68).

4. If no other drives are to be attached to the system, install side and rear cover panels on the disk drive.

5. If more than one drive is to be attached to system, use 5 ft. I/O cables to interconnect the disk drives in the configuration shown in Figure 4-69. If this drive is to be the last drive in a daisy chain, use I/O cable PN 220-0187; if not, use PN 220-0170.

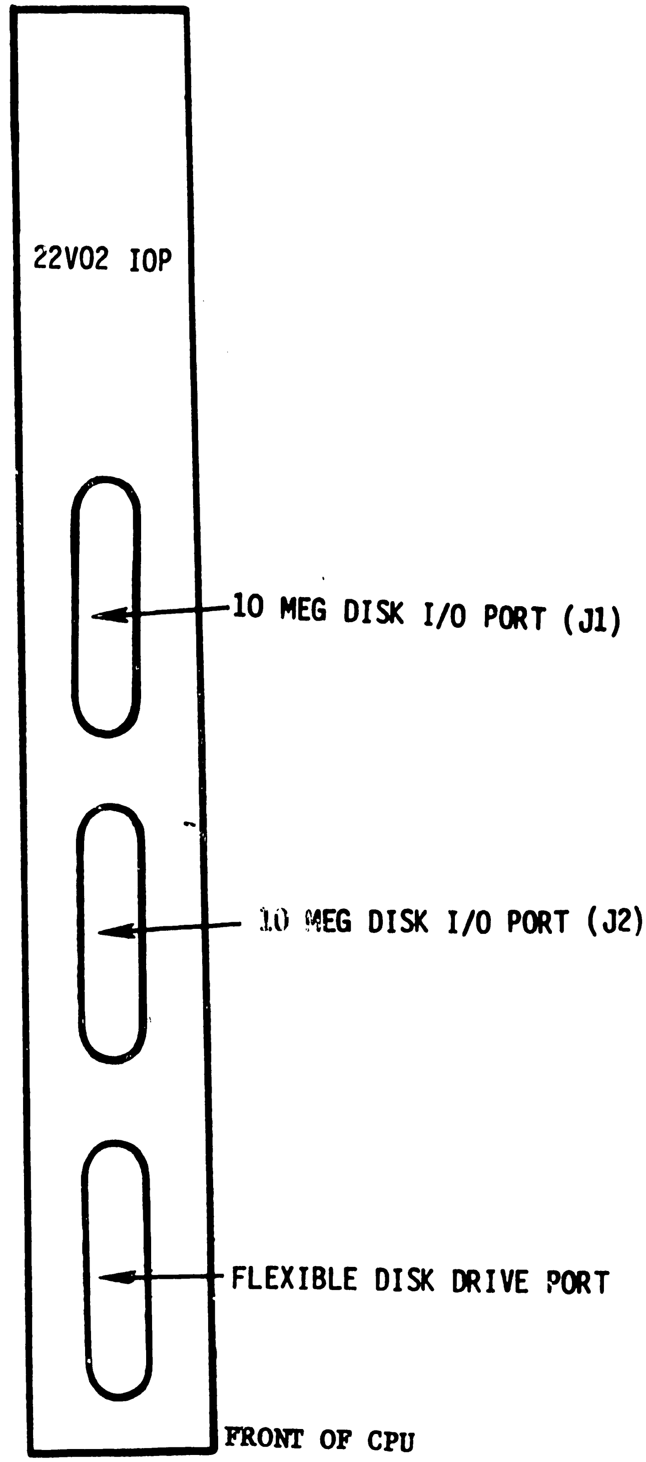


FIGURE 4-68 TOP VIEW OF 22V02 IOP

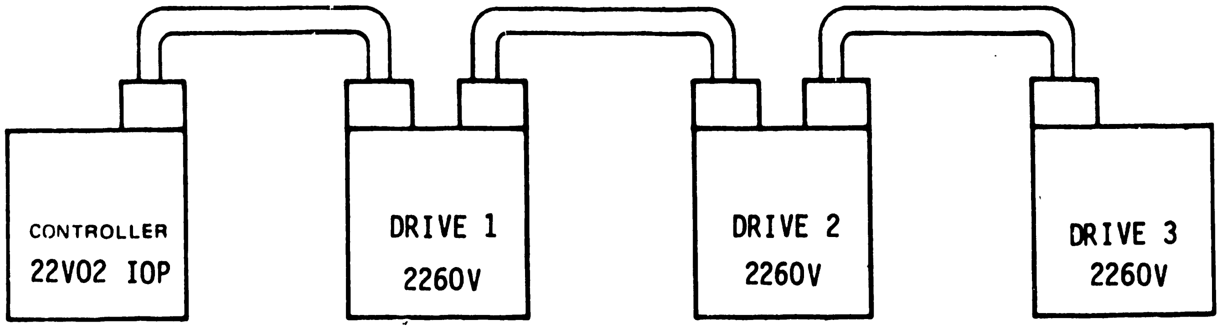


FIGURE 4-69 DAISY CHAIN CONFIGURATION

6. Set device number switch bank (switch bank #1 on device I/O card, Figure 4-36) to reflect the drive number in the daisy chain.

Examples:

Switch Bank #1 setting for
<u>Drive #1</u>

OFF	Switch 5
OFF	Switch 4
OFF	Switch 3
OFF	Switch 2
ON	Switch 1

Switch Bank #1 setting for
<u>Drive #2</u>

OFF	Switch 5
OFF	Switch 4
OFF	Switch 3
ON	Switch 2
OFF	Switch 1

Switch Bank #1 setting for
<u>Drive #3</u>

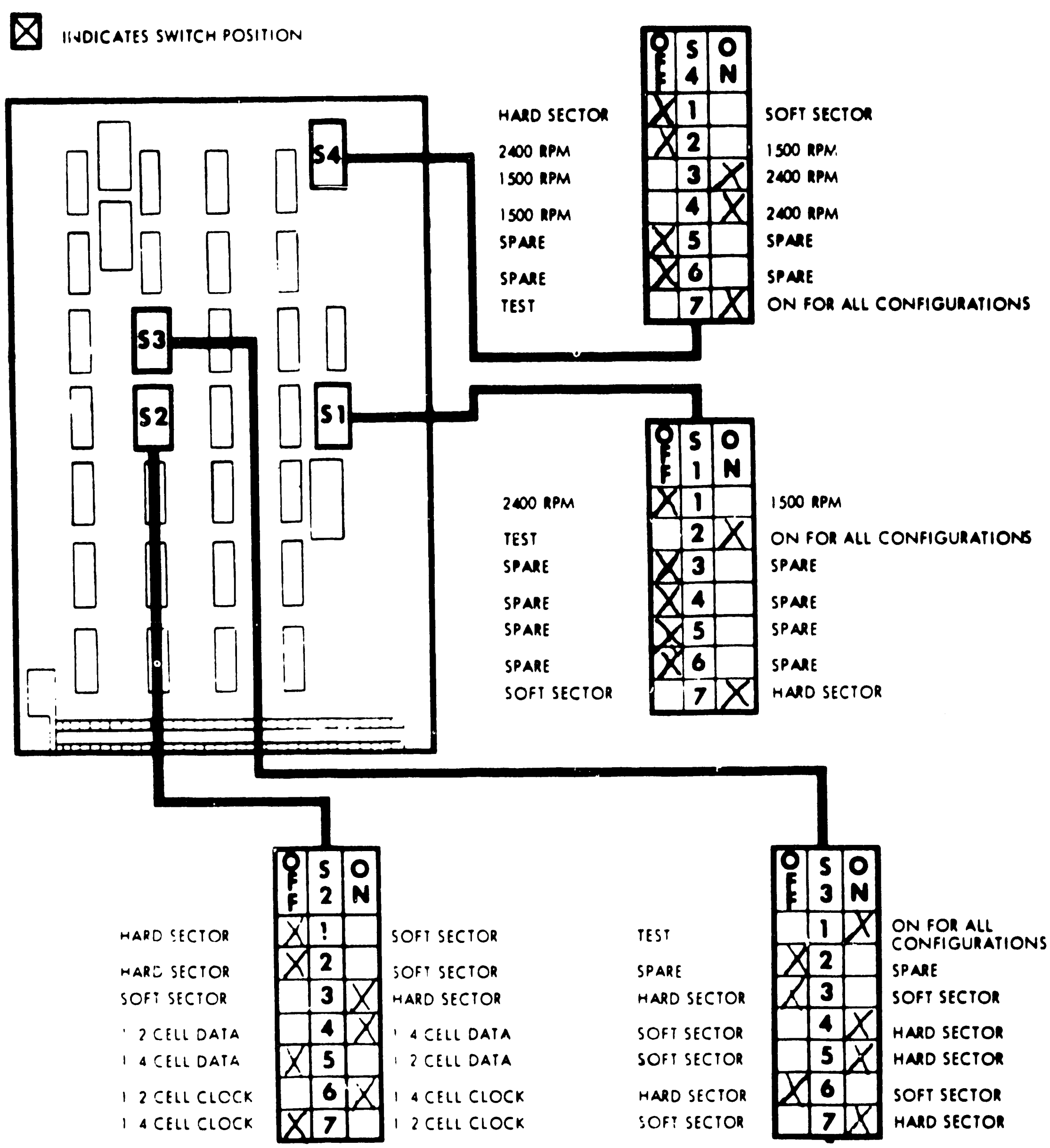
OFF	Switch 5
OFF	Switch 4
ON	Switch 3
OFF	Switch 2
OFF	Switch 1

7. All unit panels and covers should now be reinstalled on their respective units.

4.3.10 LOGIC CARD SWITCH BANK SETTINGS

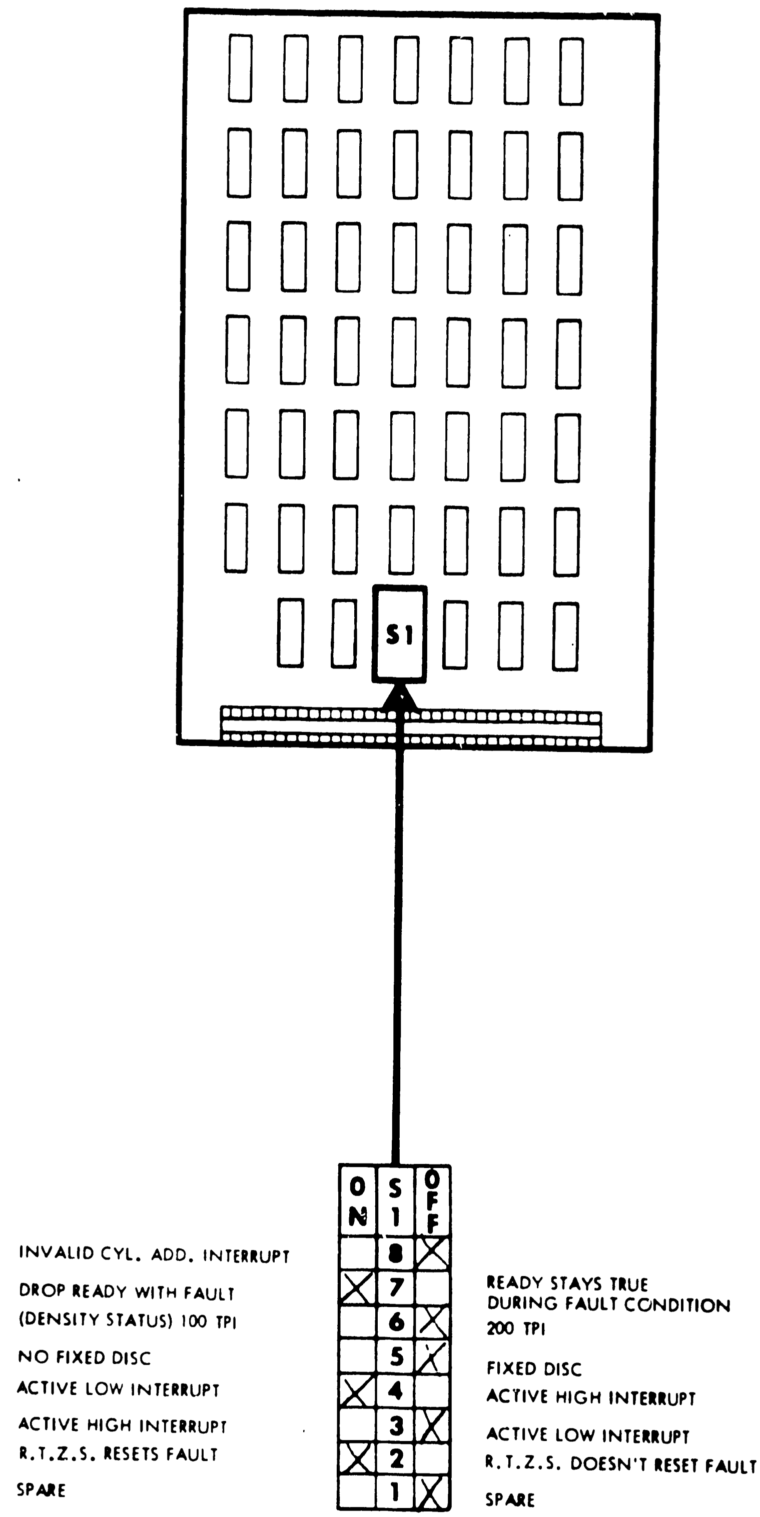
The Model 2260V Disk Drive has rocker switch banks on its various logic cards. These switches are set at the factory and should not need to be changed. Use the following diagrams to check the rocker switches for their correct settings.

DATA RECOVERY BOARD

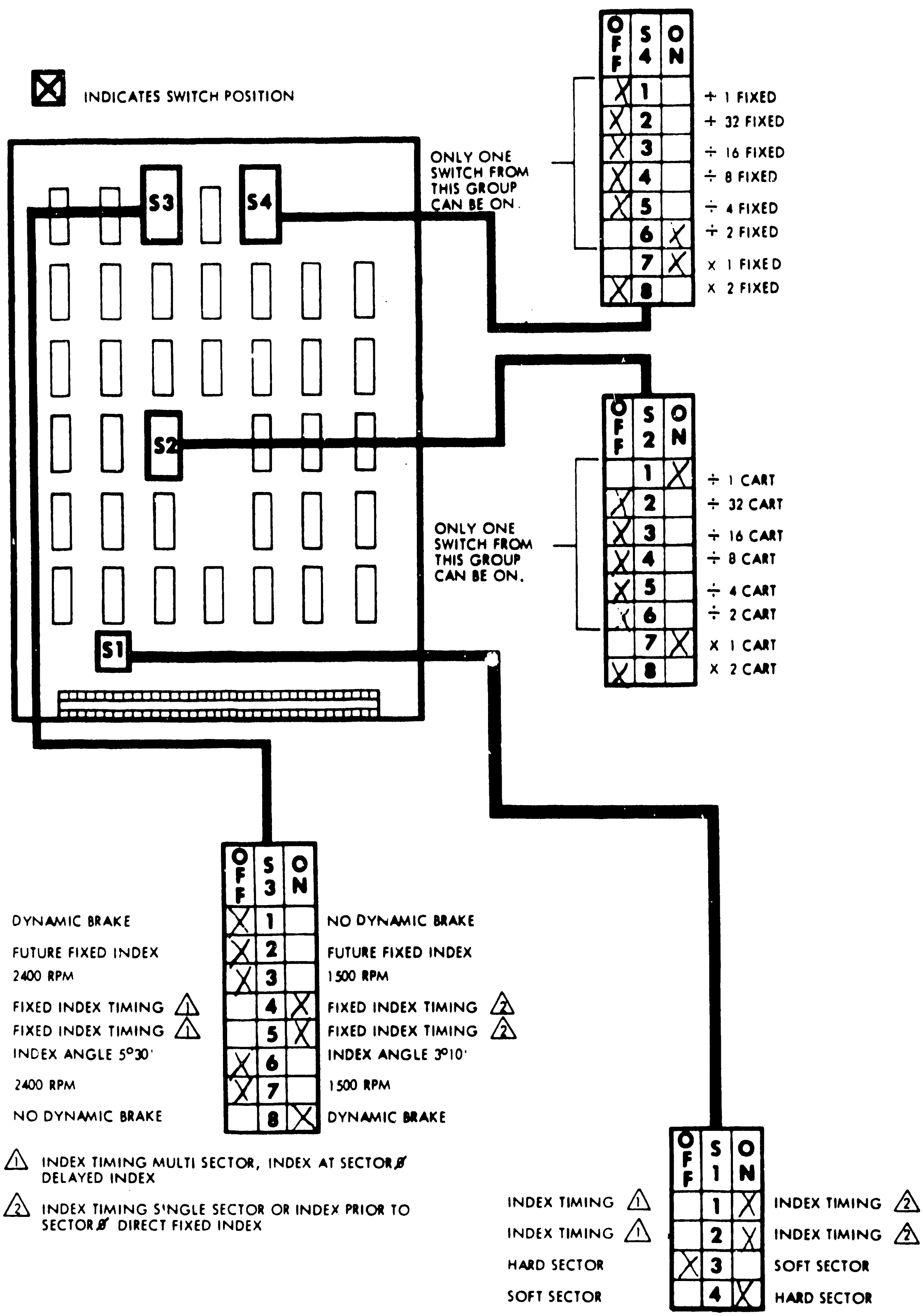


CONTROL BOARD

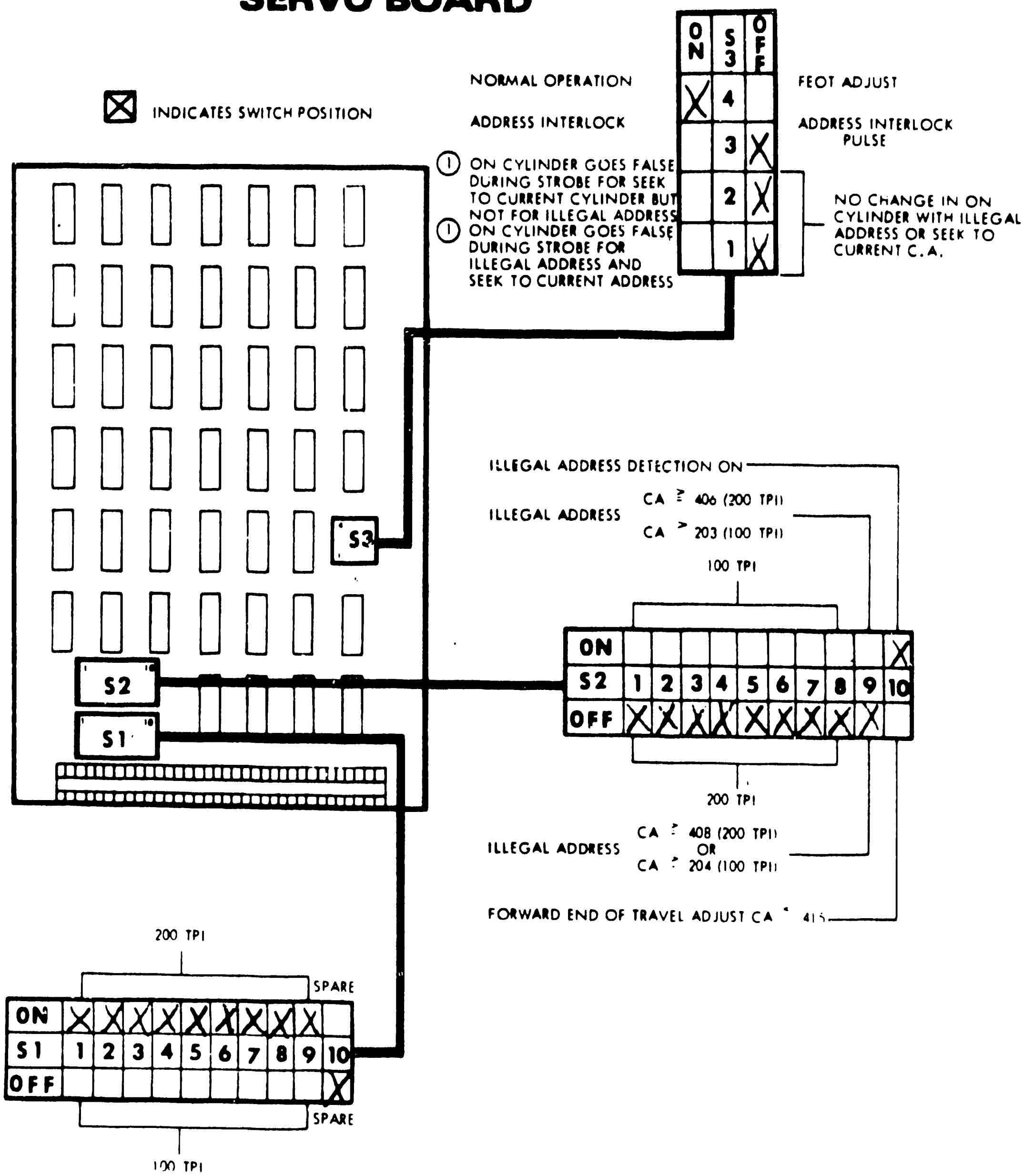
☒ INDICATES SWITCH POSITION



SECTOR BOARD - SYNCHRONOUS SECTOR COUNTER



SERVO BOARD



(1) SW3-1 & SW3-2 MUST NOT BE ON AT THE SAME TIME, HOWEVER, THEY CAN BE OFF AT THE SAME TIME.

4.4 2246P WORKSTATION

4.4.1 POWER & CABLE REQUIREMENTS

A standard 115 volt receptacle should be provided for each Workstation. Check to see that this requirement has been satisfied.

An additional requirement for a Workstation installation is the I/O cable:

25 ft.	- WL# 120-22VS-2
50 ft.	- WL# 120-22VS-5
100 ft.	- WL# 120-22VS-1
150 ft.	- WL# 120-22VS-15
200 ft.	- WL# 120-22VS-20
300 ft.	- WL# 120-22VS-30
400 ft.	- WL# 120-22VS-40
500 ft.	- WL# 120-22VS-50

4.4.2 INSTALLATION PREPARATIONS

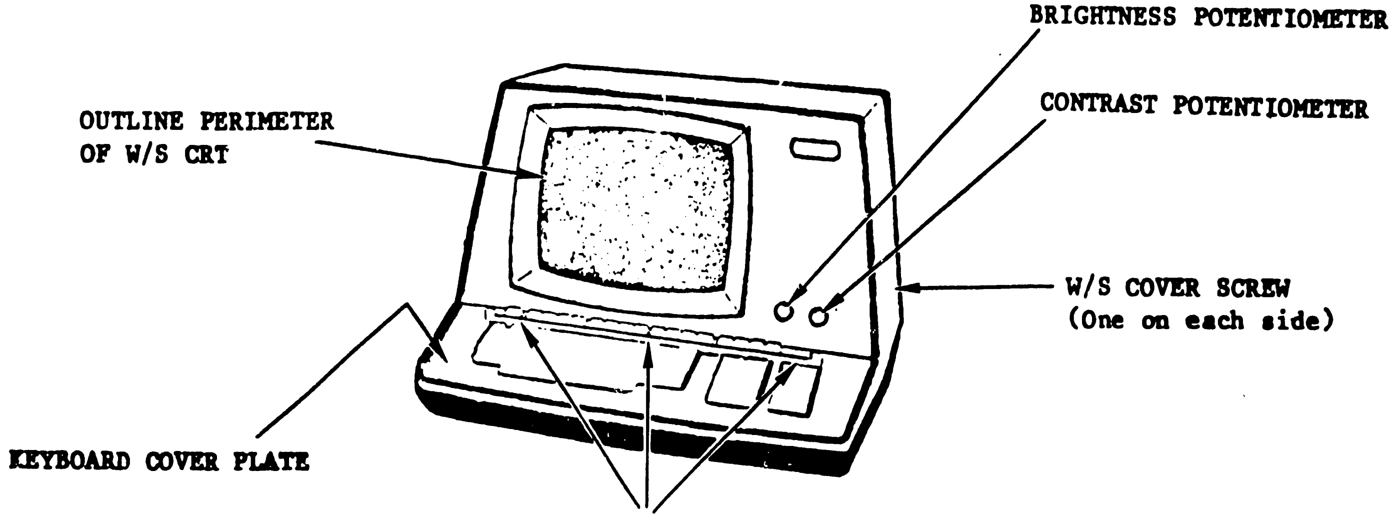
A. With the Workstation cover still on, and using a grease pencil or a 'Flair' pen, outline the perimeter of the CRT within the Workstation cover as indicated in Figures 4-70 and 4-74. Note that this will provide a reference for Workstation display adjustments performed later in this text.

B. Remove three keyboard cover plate screws, and lift off the keyboard cover plate (Ref: Figure 4-70).

CAUTION: In this next step, the fan power cable and the contrast/brightness control cables are attached to the Workstation cover. Do not disconnect these, and exercise caution when removing the Workstation cover.

C. Remove two top cover screws, lift the Workstation cover off, and set it down on its right side, adjacent to the unit.

FIGURE 4-70 2246P WORKSTATION



4.4.3 WORKSTATION INSPECTION

A. Inspect Workstation for possible shipping damage. Any claim for damage should be filed promptly with the transporter involved.

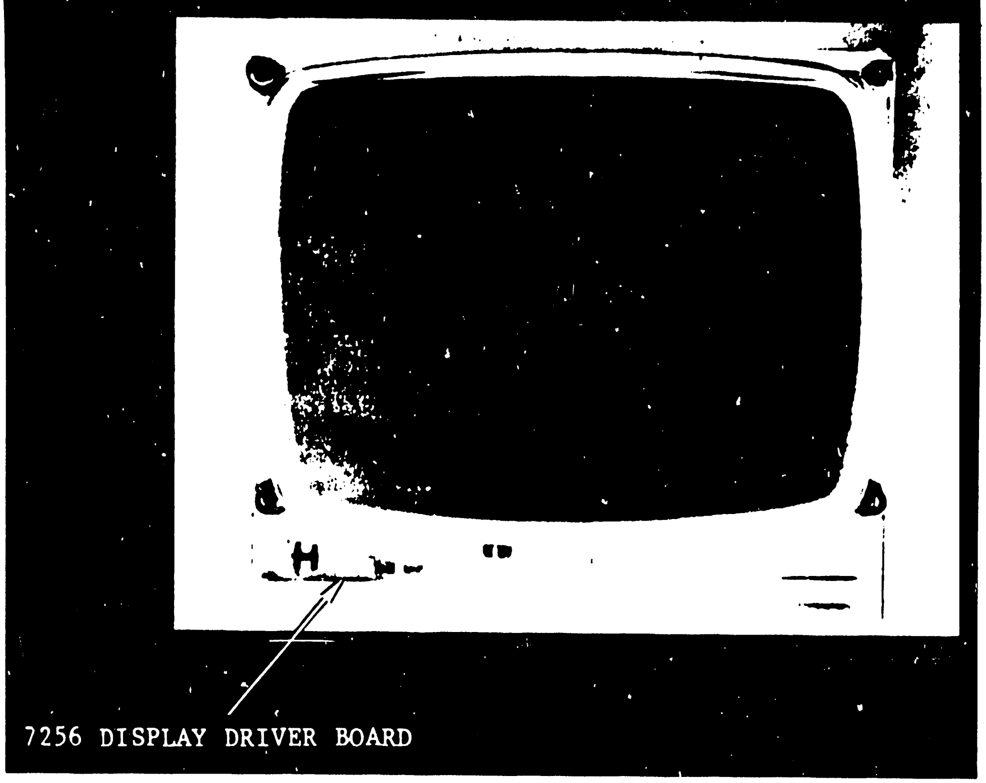
B. Verify that all circuit boards are seated in their proper receptacles. Note that the 2246P Workstation contains 3 circuit boards:

7121 Workstation Logic (Ref: Figure 4-72)
7123 Power Supply (Ref: Figure 4-72)
7256 Video Display Driver (Ref Figure 4-71)
(the 7256 is replaced by the 210-7456 on later models)

C. Verify that all internal cable connectors are firmly joined.

D. Carefully check the entire chassis for the presence of solder splashes. Obviously, this type of problem could cause an electrical short.

FIGURE 4-71 FRONT VIEW OF MONITOR



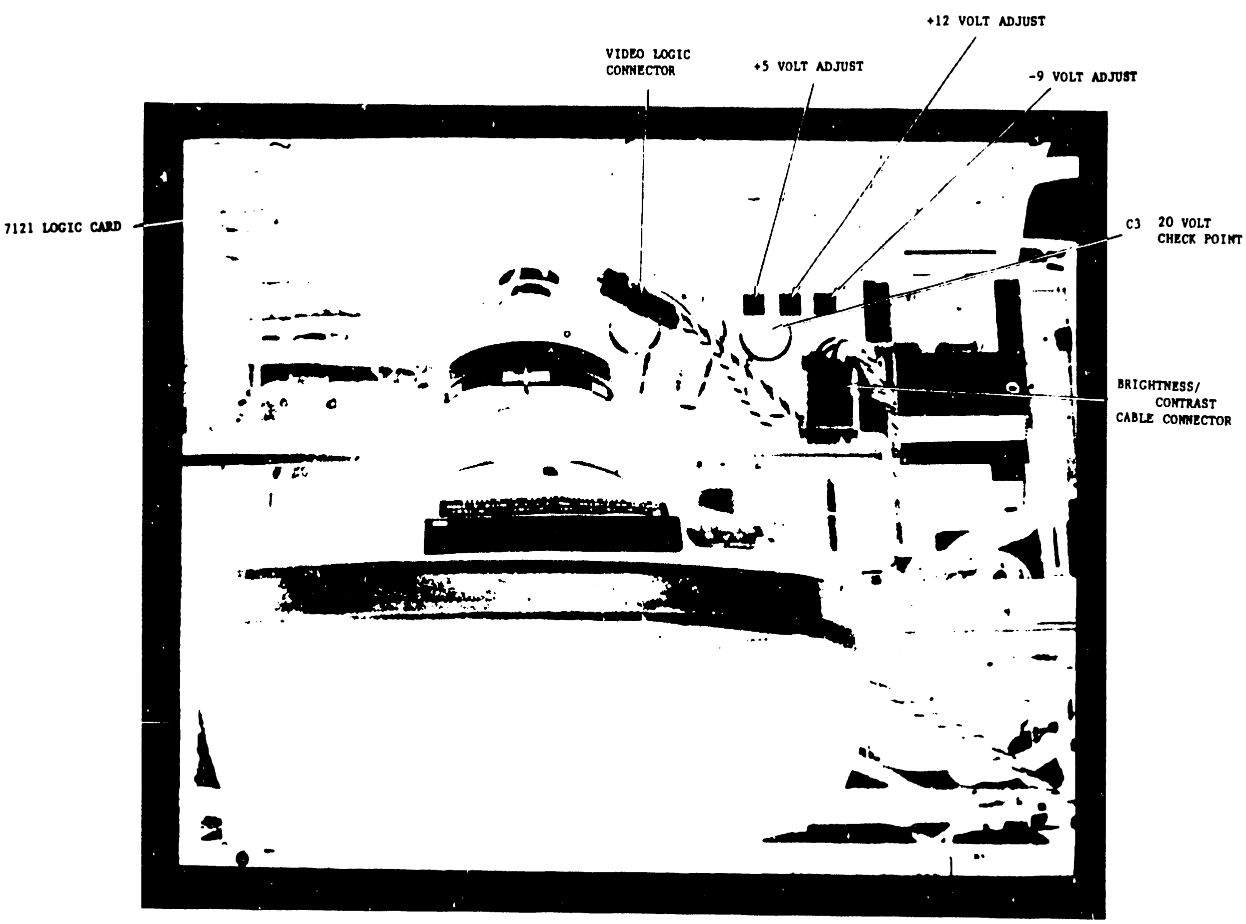


FIGURE 4-72 TOP VIEW OF WORKSTATION

4.4.4 CLEAN WORKSTATION

A. Carefully vacuum the interior of the Workstation case, paying particular attention to flat surfaces where dust accumulates.

B. Using a soft cloth dampened in a mild detergent solution, carefully wipe all external surfaces of the Workstation cabinet. Do not allow moisture from the cloth into the Workstation. Also, do not clean the CRT display surface this time.

4.4.5 POWER-ON CHECKOUT

A. Ensure that the AC power switch at the rear of the Workstation is in the OFF position. Connect AC power cord to a standard 115 VAC/60 hz outlet. Now move the Workstation AC power ON/OFF switch to the ON postion.

B. Visually check for proper operation of the cooling fan located on the Workstation cover.

C. After a very brief warm-up period, random characters should appear on the screen. Note that initially, some adjustment of the brightness potentiometer on the Workstation cover may be necessary. (Fig. 4-70)

4.4.6 VOLTAGE TEST & ADJUSTMENT

A. Check the following voltages:

+20 - At C3 on the power supply card (Ref: Figure 4-72). There is no adjustment for this voltage.

NOTE: THE FOLLOWING TEST POINTS ARE ACCESSIBLE FROM THE REAR OF THE WORKSTATION.

-5VR - At pin Z of 7121 connector 4 (Ref: Fig. 4-73). There is no adjustment for this voltage.

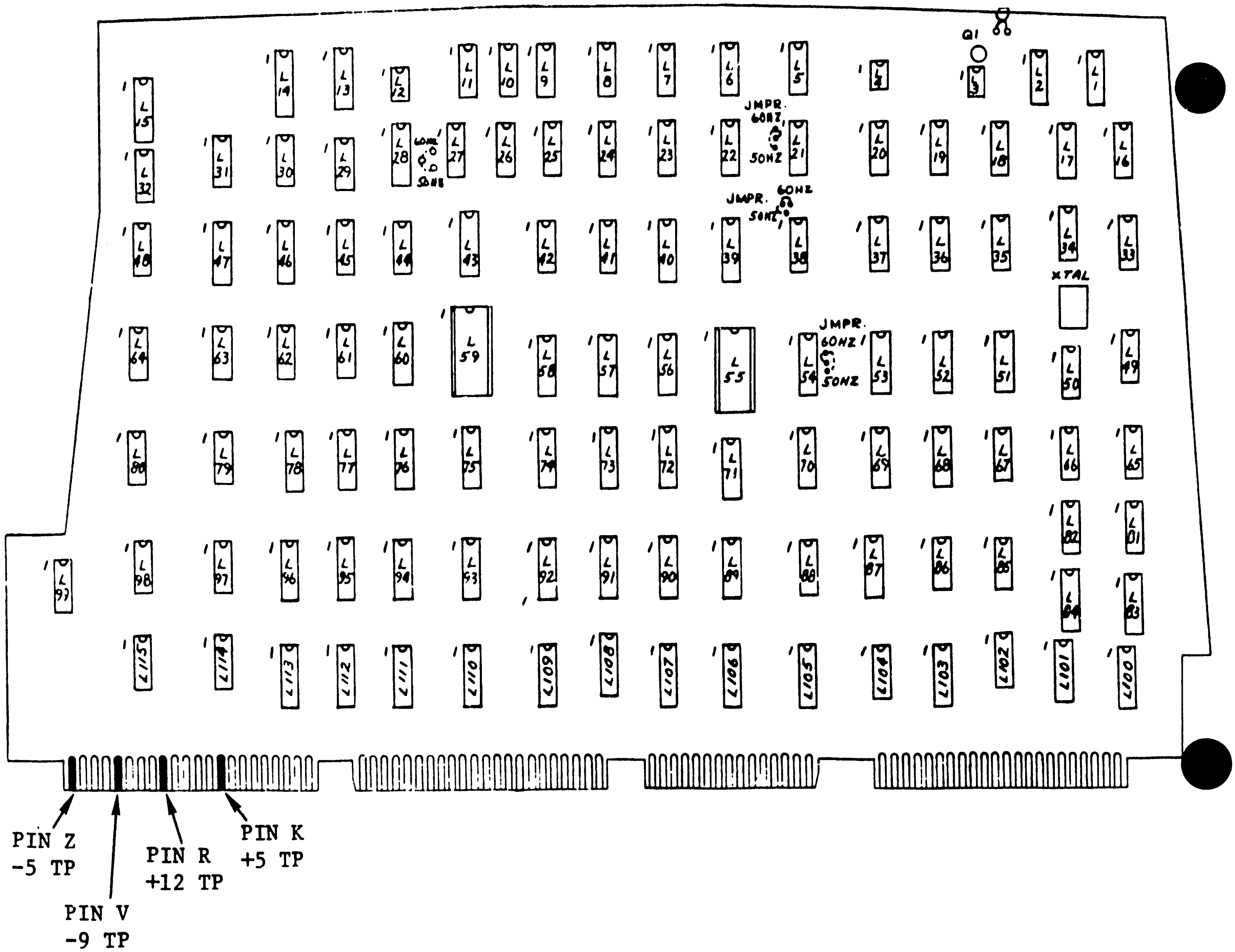


FIGURE 4-73 7121 LOGIC CARD TEST POINTS

+5VR $\pm$ .1 - At pin K of 7121 connector 4 (Ref: Fig. 4-73). If this voltage is not within specification, adjust it (Ref: Fig. 4-72).

+12V $\pm$ .1 - At pin R of 7121 connector 4 (Ref: Fig. 4-73). If this voltage is not within specification, adjust it (Ref: Fig. 4-72).

-9V - At pin V of 7121 connector 4 (Ref: Fig. 4-73). If this voltage is not within specification, adjust it (Ref: Fig. 4-72).

4.4.7 VIDEO DISPLAY ADJUSTMENT

A. BRIGHTNESS:

Adjust the brightness potentiometer until the video raster appears on the screen (along with a random character set).

B. VERTICAL LINEARITY:

Check the display for character rows of equal height. If the display is out of adjustment, adjust using the verticle linearity potentiometer (R18) on the 7256 video display driver (Ref: Fig. 4-75).

C. VERTICAL SIZE:

Check the distance between the perimeter line (drawn at the start of installation) and the top edge of the CRT raster. An acceptable gap is 3/4" ± 1/4" (Fig. 4-74). If this measurement is not within specification, adjust the vertical size using potentiometer R24 on the 7256 video display driver (Ref: Fig. 4-75).

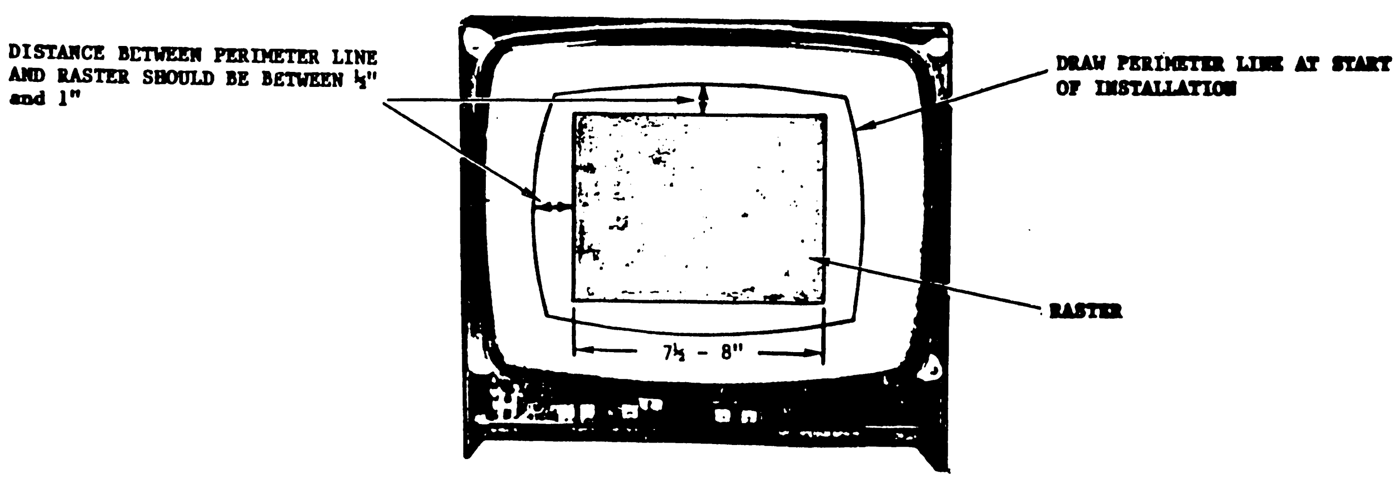


FIGURE 4-74 CRT ADJUSTMENTS

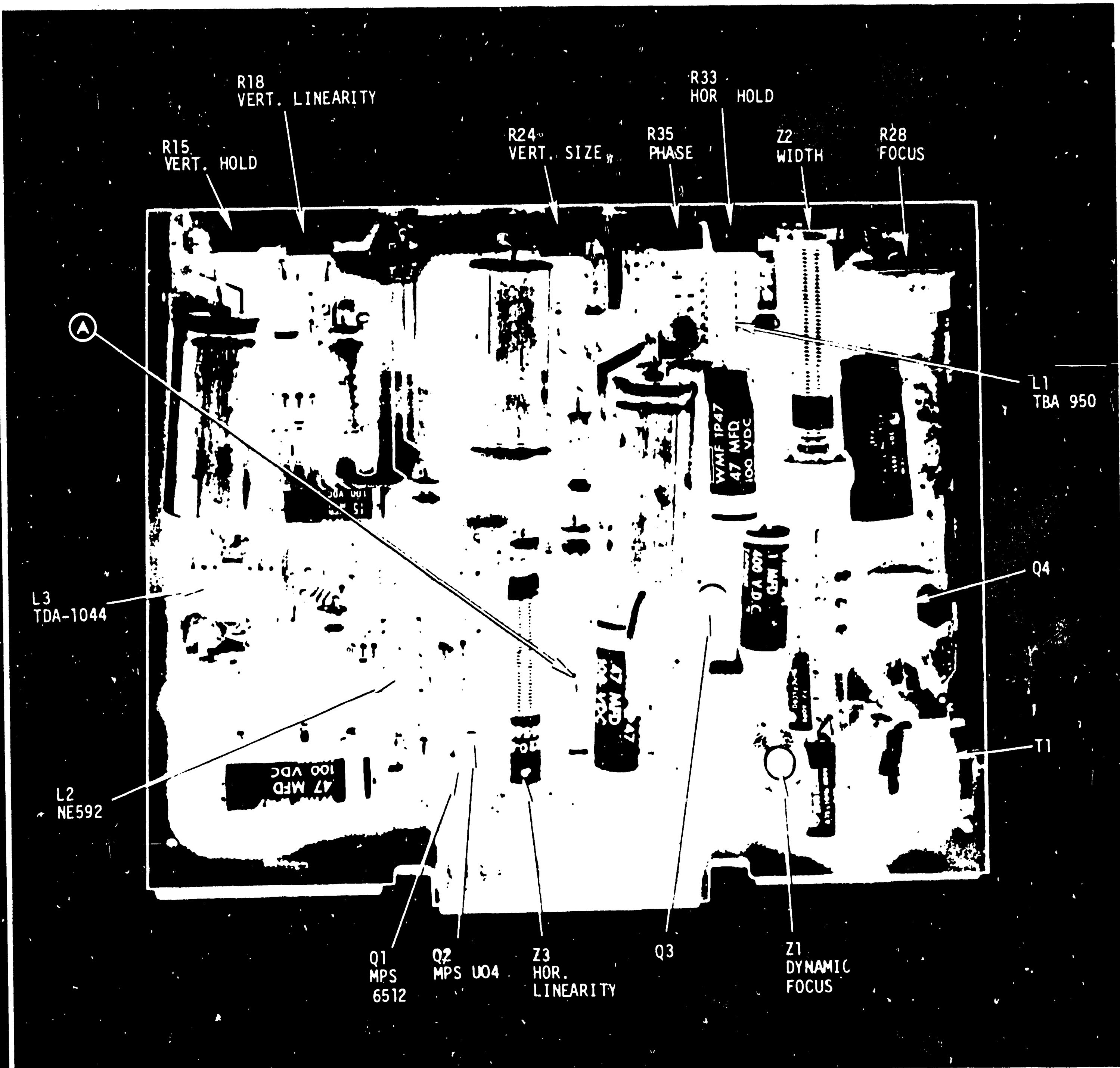


FIGURE 4-75 7256 & 7456 ADJUSTMENTS

D. HORIZONTAL SIZE:

Check horizontal size of the display raster. The horizontal size should be 7-3/4" $\pm$ 1/4" (Ref: Fig. 4-74). If this requirement is not within specification, adjust horizontal size using the width coil (Z2) on the video display driver card (Ref: Fig. 4-75).

E. HORIZONTAL PHASING CHECK

The random character set should be horizontally aligned within the CRT display raster. If this is not the case, center the character set using the horizonal phase potentiometer (R35) on the video display driver (Ref: Fig. 4-75).

F. FOCUS

Adjust the focus potentiometer (R28) on the 7256 (or 7456) video display driver (Ref: Fig. 4-75) for best overall focus.

G. Power the Workstation OFF, clean the CRT display screen with a <u>mild</u> detergent solution, and then reassemble the unit.

4.4.8 SYSTEM INTERCONNECTION

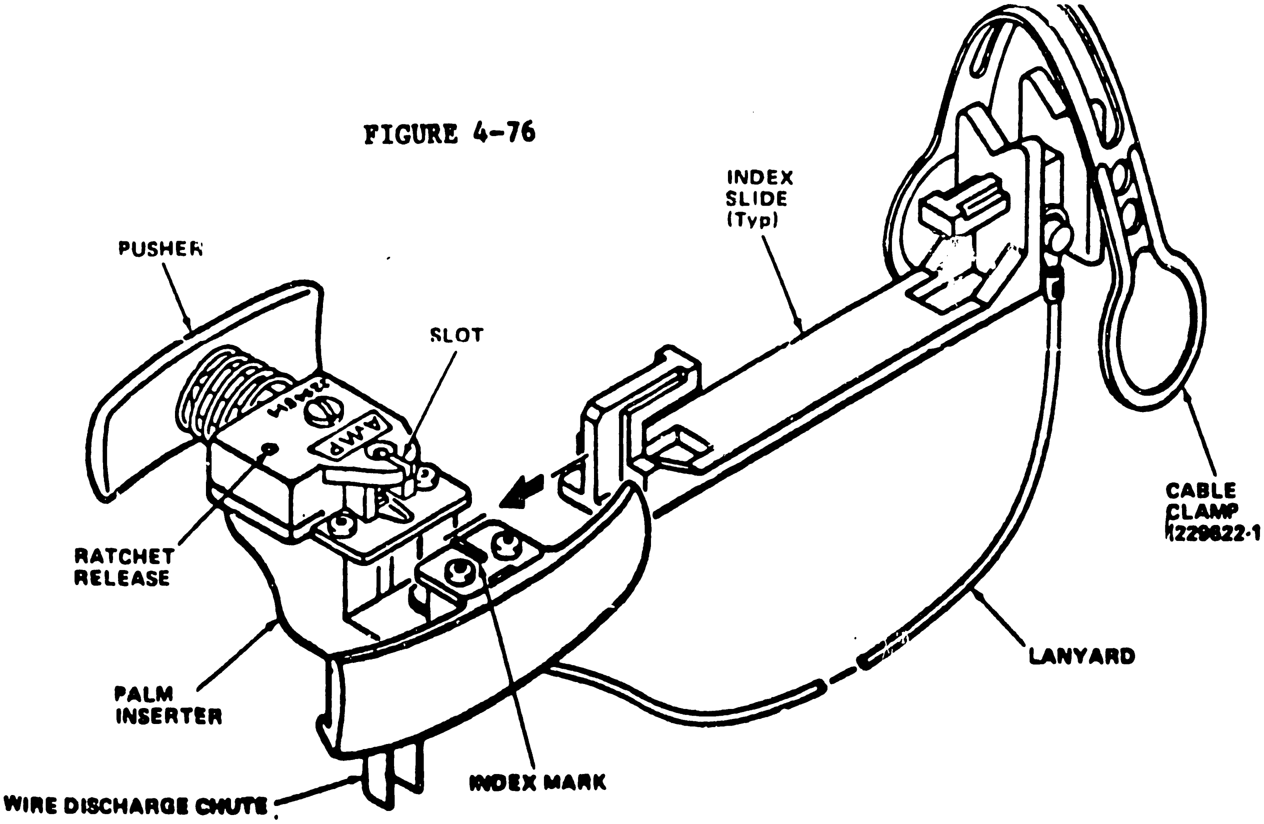
A. Attach a Workstation I/O cable to the Workstation by firmly securing the Amphenol connector on the end of the cable to the I/O port at the rear of the Workstation.

NOTE: If Workstation I/O cables are routed through conduit, ceilings, walls, or floors, it may be necessary to install connectors on the ends of these cables. To accomplish this, use procedure 'B' below.

B. Install I/O cable connectors.

To install the I/O connectors, use a a Champ Palm Grip Insertion Tool (PN 726-9412). The tool consists of a palm inserter, a lanyard, and an index slide (Ref: Figure 4-76).

FIGURE 4-76



1) Position the connector in the index slide, attach the I/O cable to the index slide, and slide the index slide into the palm inserter as indicated in Figure 4-77.

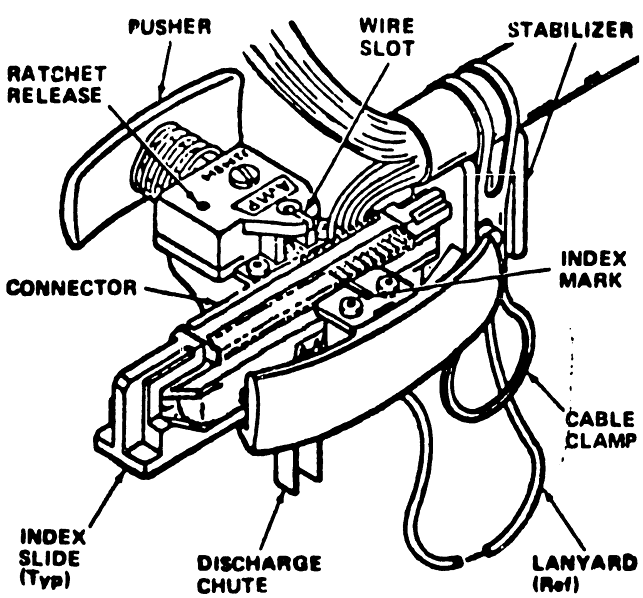


FIGURE 4-77

NOTE:

The I/O cable should be placed, so as to allow 1/2 inch of sheathing to extend beyond the stabilizer. Four inches of unsheathed twisted pairs should be allowed for correct use of this tool.

2) Orient the palm inserter with the connector, making certain that a contact about to receive a wire is on the same side as the wire slot in the inserter.

3) Align the contact to be terminated with the index mark on the palm inserter.

4) Place the palm inserter so that the pusher faces towards the heel of your hand, and your fingers should grip the base (allow the wire discharge chute to extend through your fingers).

5) Select a wire from the connector color code chart (Ref: Figure 4-78) and insert that wire through the wire slot and discharge chute; do this until all slack is out of the wire.

6) Make certain the contact and wire are centered on the index mark, then squeeze the palm inserter until the pusher is bottomed.

7) Release your grip and allow the pusher to retract.

NOTE:

If the palm inserter jams during this step, rotate the ratchet release in a clockwise direction with a hex wrench (supplied with the kit); this should effect release.

CONNECTOR COLOR CODE CHART

CONN. PIN NO.	WIRE COLOR	TWISTED PAIR
1 19	RED GRN	PAIR
2 20	RED BRN	PAIR
3 21	RED GRY	PAIR
4 22	RED ORN	PAIR
5 23	RED BLU	PAIR
6 24	ORN WHT	PAIR
7 25	ORN YEL	PAIR
8 26	ORN BLK	PAIR
9 27	GRN YEL	PAIR
10 28	GRN WHT	PAIR
11 29	GRN BLK	PAIR
12 30	BLU YEL	PAIR
13 31	BLU BLK	PAIR
14 32	BLU WHT	PAIR
15 33	BRN WHT	PAIR
16 34	BRN BLK	PAIR
17 35	GRY WHT	PAIR
18 36	GRY BLK	PAIR

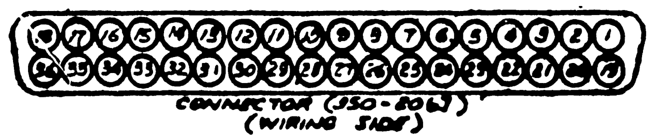


FIGURE 4-78

8) Remove the scrap wire from the discharge chute.

9) Repeat 4-77 until all contacts have been terminated on that side of the connector.

10) With the pusher released, remove the index slide and connector from the palm inserter.

11) Perform steps 1) through 10) for contacts on the other side of the connector.

12) After all contacts have been terminated, loosen the cable clamp and remove the index slide.

13) Inspect each termination, making sure that each wire has been FULLY inserted into BOTH wire slots of its contact (Ref: Figure 4-79), and that all wires have been cut to the proper length (no exposed wire strands should be visible). Also, make sure that the insulation is NOT cut in any area other than the slot insertion area. Finally, make sure that the contacts are not crushed or deformed (Fig. 4-79).

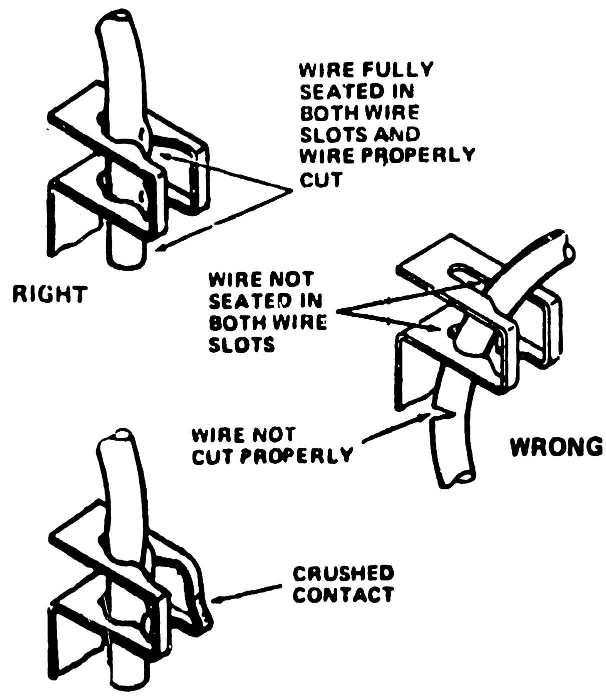


FIGURE 4-79

If a faulty termination is found, carefully remove the wire and contact from its connector. Install another contact, trim 1/8 inch off the end of the faulty wire, and reinstall that wire using steps 2) through 8).

14) Before connector covers are installed, the I/O cable ground shield must be soldered to a ground lug, and and that lug must be attached to the connector by one (of two) screws.

15) Install a connector cover over the finished connector.

16) Connector installation is now completed.

C. Attach the other end of the Workstation I/O cable, as follows, to a 22V01 IOP in the VS Mainframe.

1) The I/O cable should be routed through the static shield panel located at the rear of the VS Mainframe cabinet.

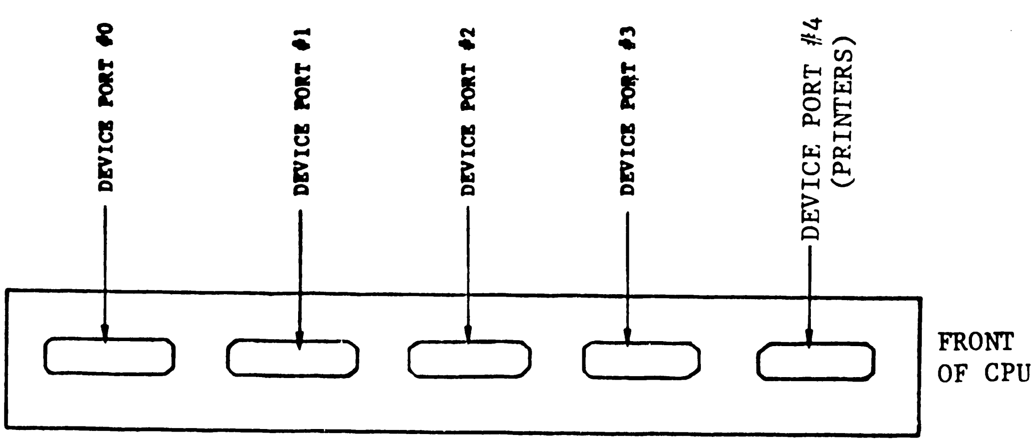
2) After the cable is routed through this panel, attach the cable ground shield to one of the grounding lugs provided and secure it using a number 6 nut. That accomplished, attach a plastic stress relief clip to the cable.

3) Attach the I/O cable to a workstation ('Device') port on any of the available 22V01 IOP's in the system (Ref: Figure 4-80). The device number of the workstation will be determined by the device address of the 22V01 IOP, and the device port number used on the IOP (refer to IOP installation).

NOTE:

Workstation device number 0 is required for system operation. This Workstation must be located near or preferably in the computer room for maintenance and diagnostic reasons.

FIGURE 4-80 22V01 IOP



4. Repeat the entire procedure in section 4.4 for all other workstations to be attached to the system.

4.5 PRINTER INSTALLATIONS

Note that all printers currently used in the VS system already have separate manuals or other Service documentation for general field use. However, for installations, the following actions must be verified and/or performed.

4.5.1 POWER & CABLE REQUIREMENTS

A standard 3-prong 115V, 20A receptacle should be provided for each printer. A maximum 3 printers may be powered from one 20 Amp line.

An additional requirement for printer installation is an I/O cable:

For all printers except 2261V:

15 ft - WL #220-0185
25 ft - WL #120-22VS-2
50 ft - WL #120-22VS-5

The 2261V printer is shipped with a 12 ft I/O (WL #220-0184) cable permantly attached.

Extension Cables for 2261V, 2231V, 2281V printers:

10 ft - WL #120-22VS-1P
25 ft - WL #120-22VS-2P
50 ft - WL #120-22VS-5P
100 ft - WL# 120-22VS-10P

4.5.2 SYSTEM INTERCONNECTION

A. Attach an I/O cable to the printer. (Plug the amphenol connector into the I/O port located at the rear panel of the printer). Note that if printer I/O cables have been run through conduit, walls, floors, or ceilings, it may be necessary to install connectors on the ends of these cables. To accomplish this, refer to paragraph 4.4.8 in the Workstation installation section of this manual.

B. Attach the other end of the printer I/O cable to port 4 of a 22V01 IOP in the Mainframe. Note that the I/O cable should be routed through the static shield panel at the rear of the Mainframe (Ref: Fig. 3.2).

After the cable has been properly routed, attach the cable ground shield to one of the grounding lugs provided, and secure that connection using a Number 6 nut. Attach a plastic stress-relief clip to the cable.

NOTE: The first printer on the system <u>must</u> be device #3. Therefore, it is attached to port 4 of the 22V01 IOP, with device address switches set to binary 0. Furthermore, if port #4 on the IOP is to be used for a printer, then port #3 may <u>not</u> be used for a workstation. (A max of 4 devices may be attached to a 22V01 IOP).

4.6 2209V (1600 BPI Tape Drive)

4.6.1 POWER REQUIREMENTS

When laying out the computer site, consideration must be given to providing source AC power for each tape drive. A standard 115 volt, 20 amp receptacle should be provided for each tape drive attached to the system. A maximum of 2 tape drives can be driven by one 20 amp line.

Additional requirements for tape drive installation are:

1 - 10 ft. I/O cable (PN 220-0168).
2 - Formatter data/control cables for single tape drive configuration.
2 - Formatter data/control cables, daisy type (PN 220-3059), for each additional tape drive.

4.6.2 TAPE DRIVE INSPECTION

A. Inspect tape drive for possible shipping damage. Any claim for this type of damage should be filed promptly with the transporter involved.

B. Remove all cabinet covers by the following procedure:

   1. Disengage the DZUS fastener on rear panel of tape drive.

   2. Release the tape drive top cover by means of the lever on the front of tape drive.

   3. Lift off the top cover.

   4. Lift the red, spring loaded, upper side panel levers and remove the side panels.

C. Verify that all logic cards are firmly seated in the logic card cage assembly.

D. Check all connectors for proper seating.

E. Inspect the entire tape drive for any foreign material that may cause an electrical short during power-on.

F. Inspect the vacuum columns, reel hubs, and other moving parts for dirt and foreign material.

4.6.3 TAPE DRIVE CABINET LEVELING

Cabinet leveling should not be performed until drive is in its permanent location, with no further necessity to move it. Cabinet leveling consists of the following:

A. Move the drive to its permanent location.

B. Turn the leveling pads down until they support the weight of the tape drive. See Figure 4-81.

C. Place a spirit level on drive case assembly; then adjust the leveling pads until drive is level to within 3 degrees, front-to-back and side-to-side.

D. When the drive is level in both directions, tighten the jam nuts against the bottom of the frame.

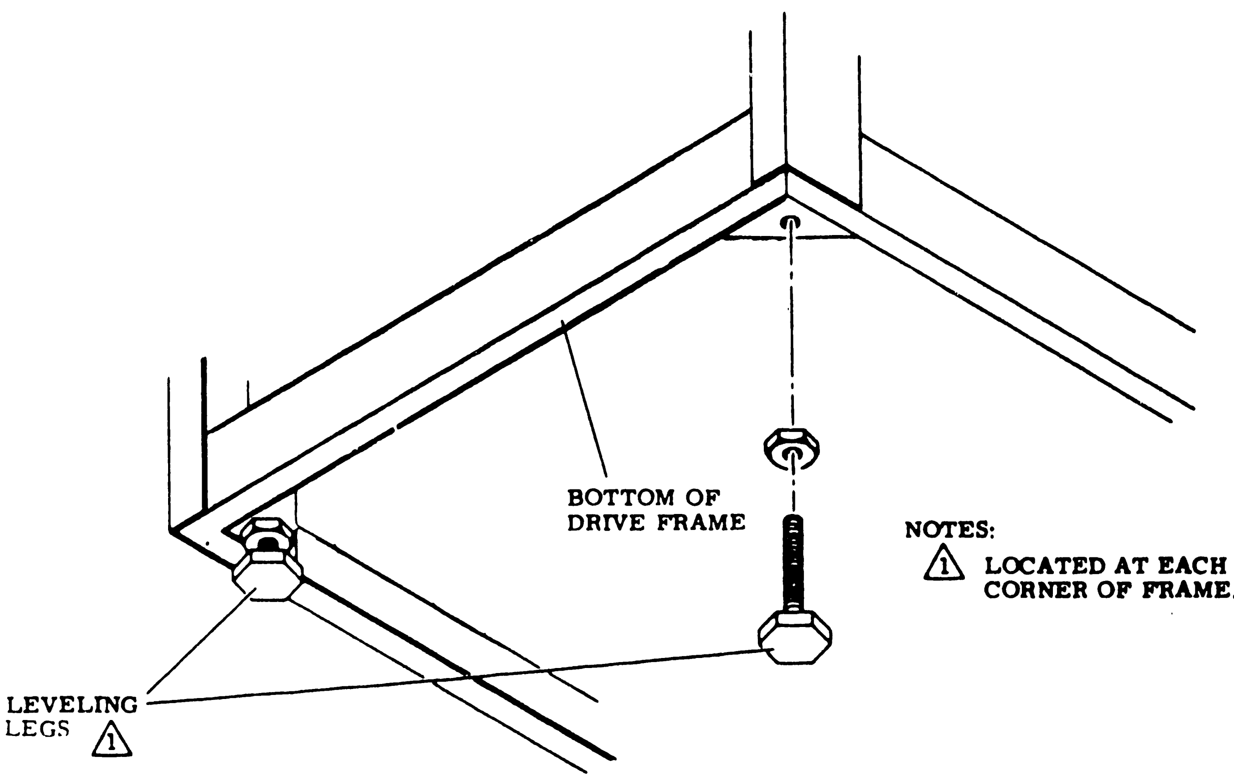


FIGURE 4-81 TAPE DRIVE LEVELING

4.6.4 TAPE DRIVE CLEANING

A. Carefully vacuum the interior of cabinet and case, paying particular attention to flat surfaces where dust accumulates.

B. Vacuum exterior surfaces of the electronic assembly. Use a soft cloth dampened in a mild detergent solution to remove any greasy residue.

C. Using a soft cloth and a mild detergent solution, carefully wipe all cabinet surfaces. Use care to prevent moisture from entering the drive.

D. Using a piece of adhesive tape, remove any dirt particles not removed during vacuuming.

E. Carefully clean the tape head:

Oxide or dirt accumulation on the head surfaces are removed using a mild organic solvent and a swab. Q-tips are convenient for this use, but they must be used with caution. Be sure the wooden portion of the Q-tip does not contact head surfaces. Lint free cloths are also recommended.

An ideal solvent is 1.1.1 trichlorothane. However, others such as isopropyl alcohol are acceptable.

DO NOT USE - acetone or lacquer thinner
- aerosol spray cans
- rubbing alcohol

Do not use an excess of any solvent, and be extremely careful to prevent the solvent from penetrating the ball bearings of the tension rollers, the capstan motor, and other moving parts, since it will destroy their lubrication. See Figure 4-82.

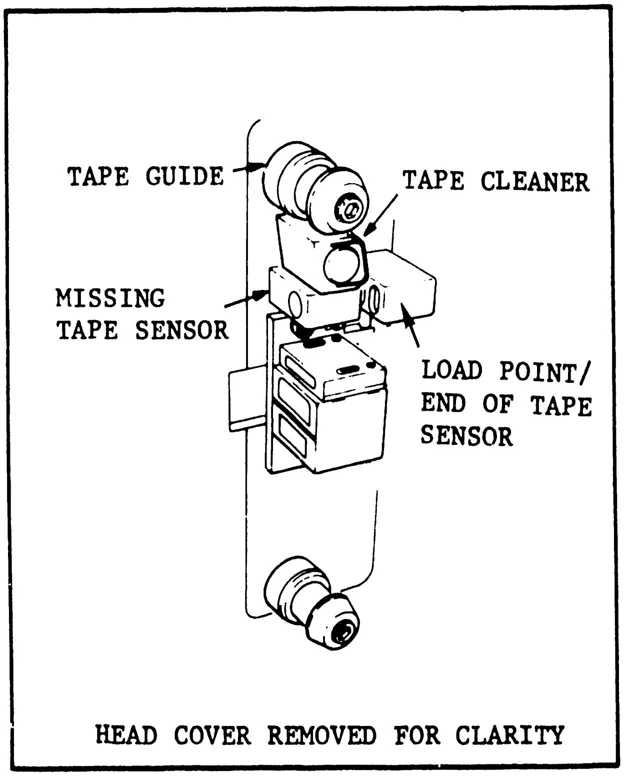


FIGURE 4-82 TAPE HEAD AREA

F. Carefully Clean Tape Path

Other items in the tape path must be cleaned at the same time as the magnetic head. These include:

Vacuum Columns
Idler Rollers
Tape Guides
Capstan
Tape Cleaner Surface

Clean the tape path, using the guidelines given in step E (head cleaning).

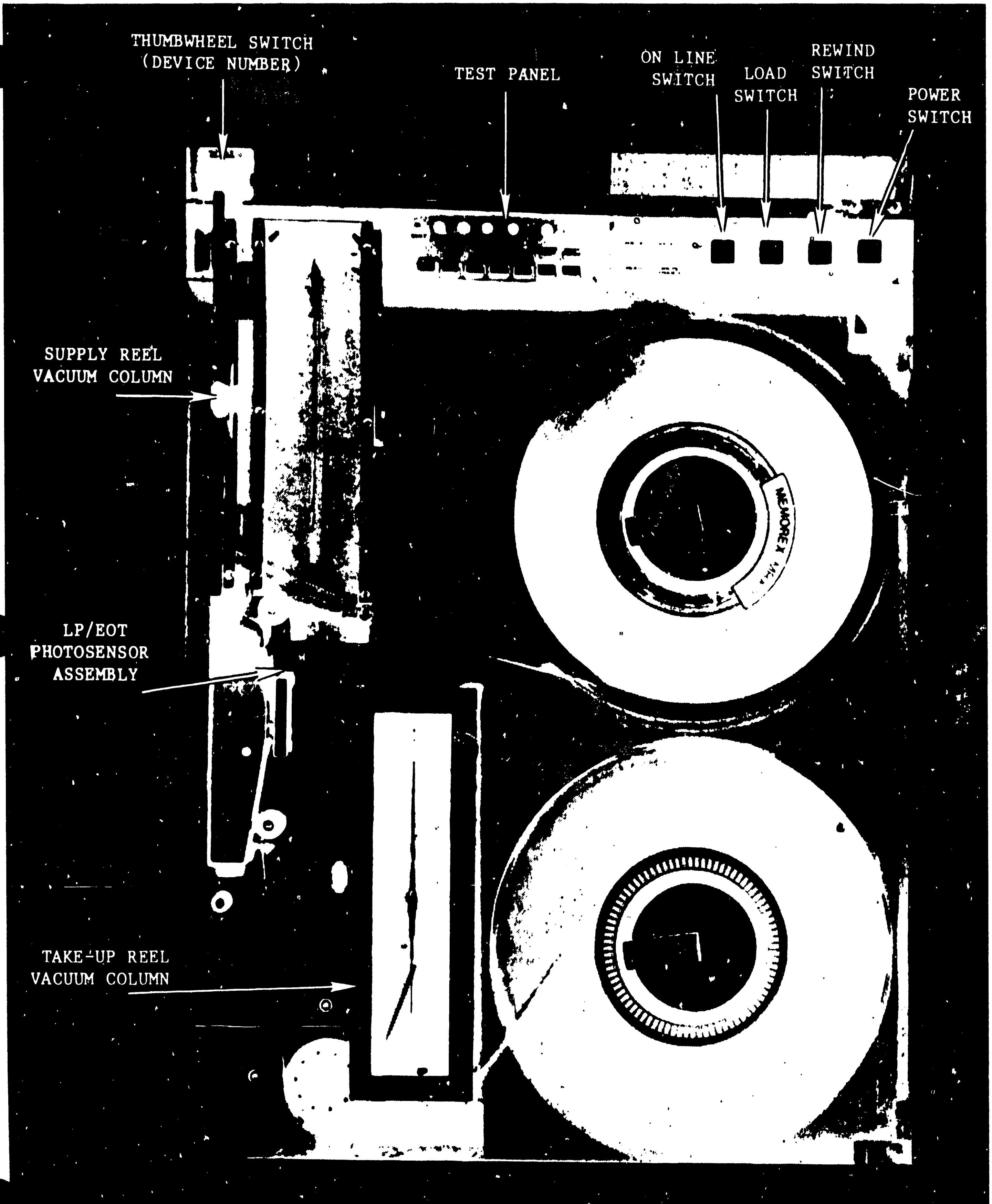


FIGURE 4-83 TAPE DRIVE FRONT VIEW

4.6.5 DEVICE SWITCHES

The 2209V tape drive provides the option of setting the drive device number in two ways:

(a) By setting the device number using the Thumbwheel Switch (Figure 4-83).

(b) By setting the device address switches on the Kennedy adapter card (modifies the tape drive from a Kennedy Model 9218 to a Kennedy Model 9100).

NOTE:
The Wang Model 2209V is a Kennedy Model 9100 Tape Drive.

For 2200VS applications, the device number for the 2209V tape drive will be set by the thumbwheel switch on the front panel of the drive. Therefore, the device address switches on the Kennedy adapter card (plugged into the underside of the logic card rack) must all be in the "OFF" position. Ensure that this is the case.

4.6.6 POWER-ON CHECKOUT

Make certain that the power switch on the front panel of the tape drive (Figure 4-83) is in the "OFF" position (not depressed). Ensure that the power cable is properly seated in its receptacle at the rear of the tape drive (Figure 4-84).

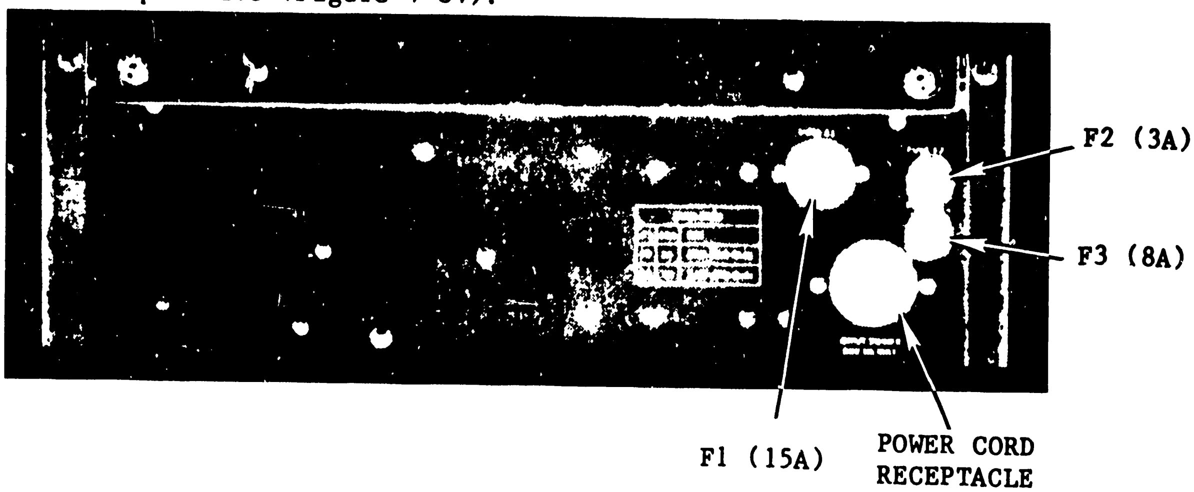


FIGURE 4-84 POWER CHASSIS (REAR OF TAPE DRIVE)

Connect the power cord connector to the AC receptacle provided at the site. Power-on the tape drive by means of the power switch. The power-on indicator should be illuminated, and the LP/EOT photosensor assembly light source should also be on (Figure 4-83).

4.6.7 TAPE THREADING

Mount a customer engineering scatch tape; then thread the tape on the transport, using the following procedure:

A. Raise the latch of the quick-release hub and place the tape file reel on the supply hub (Figure 4-85) with the write-enable ring side next to the transport deck.

B. Hold the reel flush against the hub flange and secure it by pressing down the hub latch.

C. Thread the tape along the path as shown by the threading diagram (Figure 4-85).

D. Holding the end of the tape with a finger, wrap a few turns clockwise around the take-up reel hub.

4.6.8 TAPE LOADING

Pressing the load pushbutton (Figure 4-83) on the front panel of the tape drive energizes the reel servos and initates a load sequence. Tape advances to the load point marker and stops. If for some reason the load point marker is already past the sensor (for example, in restoring power after a shutdown), the tape continues to move for approximately 6 seconds, and then an automatic rewind is initiated. Once pressed, the load switch becomes inactive until the power has been turned off or until the tape is removed from the machine.

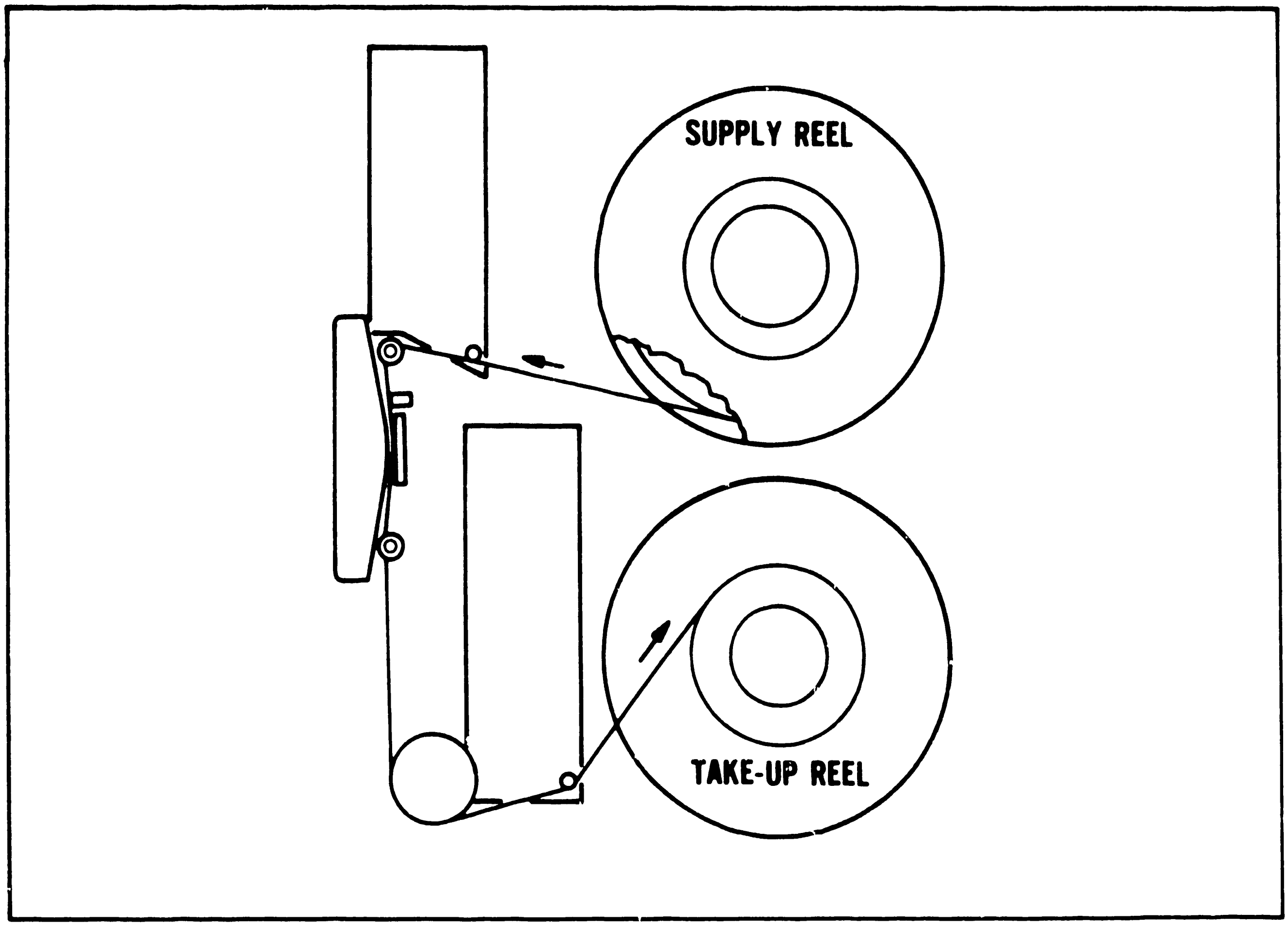


FIGURE 4-85   TAPE THREADING DIAGRAM

4.6.9 PCB IDENTIFICATION

Below is a list of 2209V logic chassis circuit boards along with a PCB location diagram. It will be an aid in performing the checks and adjustments in the sections that follow.

LOC	PN	DESCRIPTION
1.	726-6172	5 Channel Write Amplifier
2.	726-6173	4 Channel Write Amplifier
3.	726-6103	Data Terminator
4.	726-6104	Quad Read Amplifier
5.	726-6104	Quad Read Amplifier
6.	726-6105	Dual P Channel/Clipping
7.	726-6106	Dual Density Control
8.	726-6108	Control Terminator
9.	726-6107	Interface Control
10.	726-6109	Pushbutton Control
11.	726-6110	Ramp Generator
12.	726-6111	Sensor Amplifier/Driver

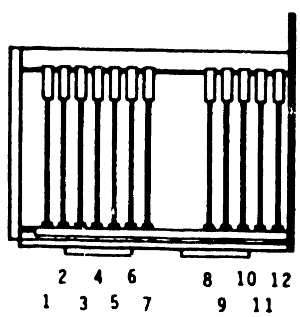


FIGURE 4-86 LOGIC CHASSIS

4.6.10 VOLTAGE CHECKS

With tape in the load mode, check for the following voltages, using a DVM. Use chassis ground for following checks.

VOLTAGE (TOLERANCE)	TEST POINT
+24 (+3)	For test point use C10 on the right side of the tape drive chassis (Figure 4-87).
-24 (-3)	For test point use C11 on right side of tape drive chassis (Figure 4-87).
+10V (+.5V, -.2V)	Use test point "A" on the Sensor Amplifier/Drive card in the logic chassis (Figure 4-87).
-10V (± 8)	Use test point "B" on the Sensor Amplifier/Drive card in the logic chassis (Figure 4-87).
+5V (± 0.25)	Use test point "C" on the Sequencer Amplifier/Driver card in the logic chassis (Figure 4-87)

NOTE:
Voltages are not adjustable.

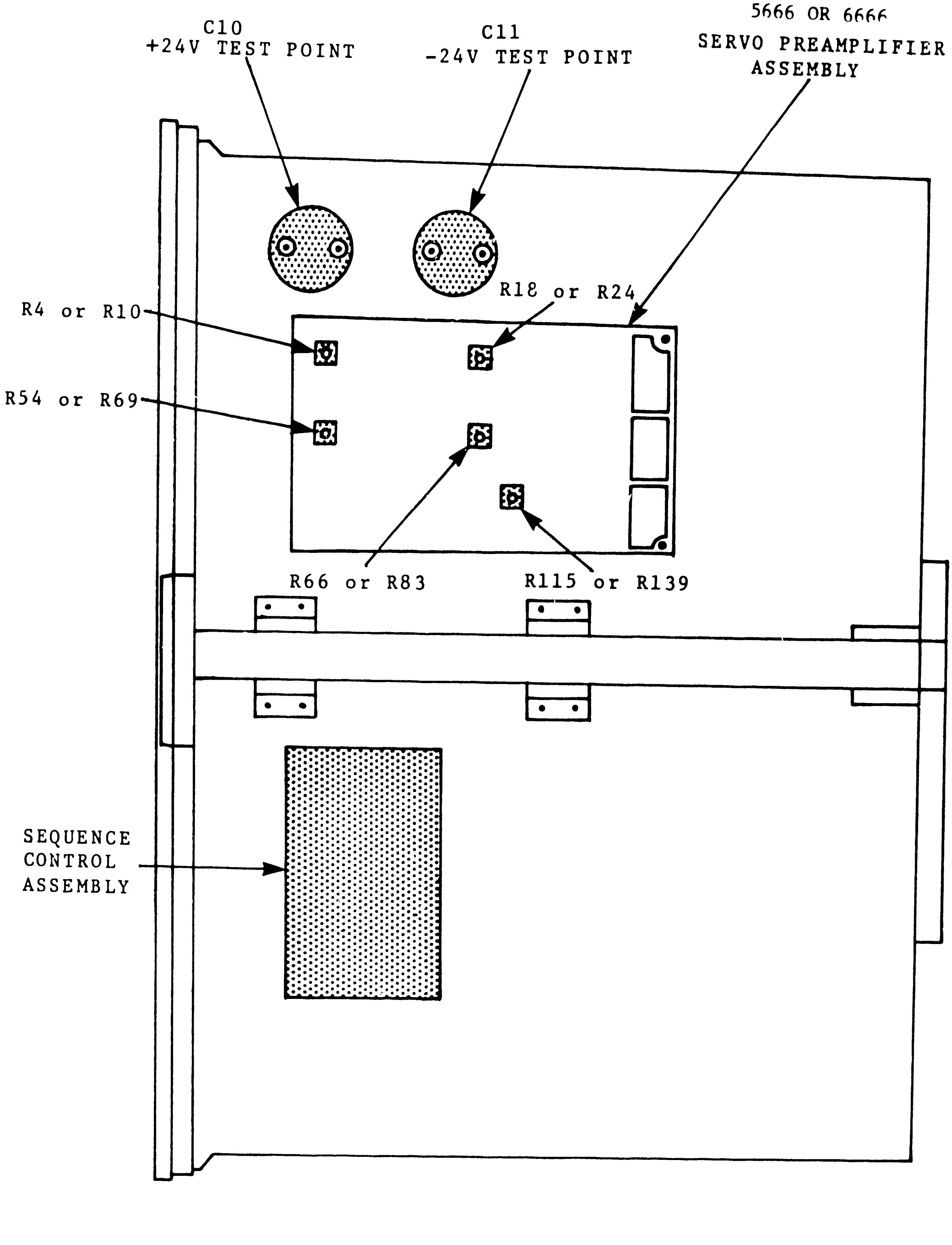


FIGURE 4-87 RIGHT SIDE VIEW OF TAPE CHASSIS

4.6.11 TEST PANEL CONTROLS AND INDICATORS

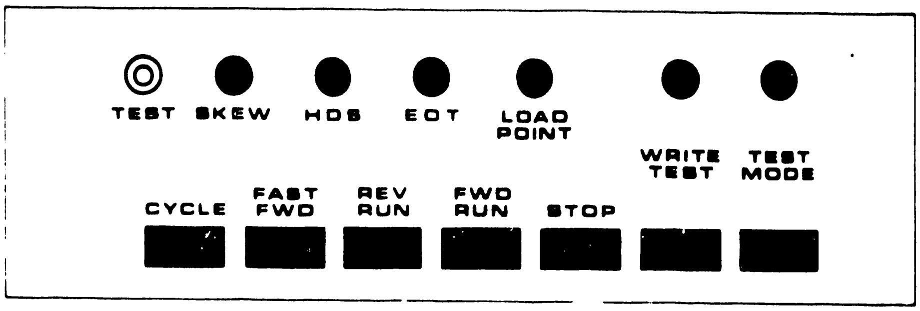


FIGURE 4-88 TEST PANEL

NOTE:
Tape transport must be off-line and STOP pushbutton depressed before test panel can become functional.

A. TEST point and SKEW indicator. Indicator lights if tape skew exceeds the appropriate skew (read or write) gate setting. An oscilloscope test point is available for monitoring skew gate timing.

B. HDS indicator. Indicates that high density mode has been selected.

C. EOT indicator. Indicates when tape has reached or passed end of tape.

D. LOAD POINT indicator. Indicates when tape is at load point.

E. CYCLE pushbutton. An interlocked pushbutton switch which runs tape in alternating forward and reverse modes. Useful for making ramp or vacuum sensor adjustments. Depressing STOP pushbutton terminates this operation.

F. FAST FORWARD pushbutton. An interlocked pushbutton switch that allows tape unit to run forward at fast speed. Depressing STOP pushbutton or load point marker terminates this operation.

G. STOP pushbutton. An interlocked pushbutton switch that terminates all tape motion.

H. WRITE TEST pushbutton and indicator. A momentary pushbutton which programs 1's to be written on all channels to facilitate write skew adjustment. WRITE TEST remains active in FORWARD RUN mode only. (STOP pushbutton must be depressed and TEST MODE selected to actuate this feature.) The indicator remains illuminated while unit is in this mode.

I. TEST MODE pushbutton and indicator. A momentary pushbutton selects test mode and activates test panel. When indicator is illuminated, test panel is active. (Tape unit must be off-line and STOP pushbutton depressed before test panel will functon.)

4.6.12 ADJUSTMENT PROCEDURES

A. Perform Hub-O Ring Tension Check

1. Power off the tape drive. Check both tape reels, supply and take-up (Figure 4-85), to ensure that they are firmly locked on their respective hubs, with each hub latch locked.

2. If a reel is found to be loose and the neoprene O-ring is not worn or faulty, perform the following:

   a. Loosen the hub setscrew (Figure 4-89) until the inner hub turns freely.
   b. With the hub latch up, rotate the inner hub clockwise while restraining the outer hub. This will exert more pressure on the O-Ring when the latch is depressed.
   c. Place the tape reel on the hub and lock the hub latch to determine whether more or less tightening is required.

d. Note that there are several holes in the bottom of the outer hub to accommodate the hub setscrew. After the adjustment is correct, the hub must be turned slightly until the setscrew fits into one of these holes.

e. After the correct setting is found, retighten the hub setscrew.

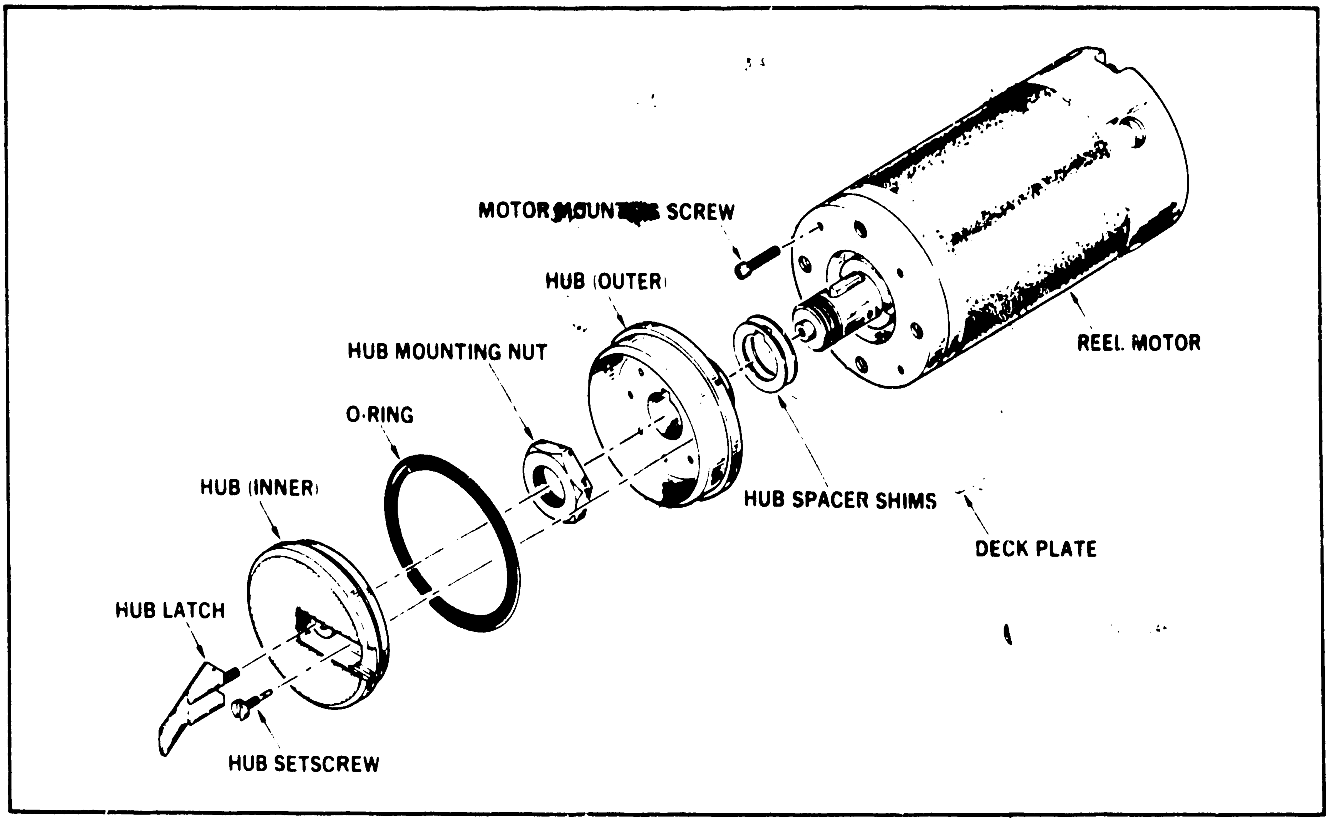


FIGURE 4-89 REEL MOTOR ASSEMBLY

3. If a reel is found to be loose and the neoprene O-ring is worn or faulty, perform the following:

a. Loosen the setscrew until the inner hub turns freely.

b. Unscrew the inner hub from the hub assembly.

c. Replace the worn O-ring with a new O-ring. Prior to installation, the new O-ring should be lubricated with silicone grease and wiped, leaving a light lubricating film.

d. Replace the inner hub and readjust O-ring pressure, using the procedure in step 2.

B. Perform Capstan Parallelism Check

The tape should not travel laterally (ride in or out) on the capstan in the forward or reverse mode. To check this, observe the tape on the capstan while the machine is in the CYCLE mode. Refer to section 4.6.11 for instructions of the use of the test panel.

1. Power on the tape drive and load the CE scratch tape. Then, using the Test Panel, cause the tape to cycle forward and reverse.

2. If there is any lateral tape movement in the cycle mode, perform the following:

   a. With tape stopped, loosen the capstan screws. See Figure 4-90.

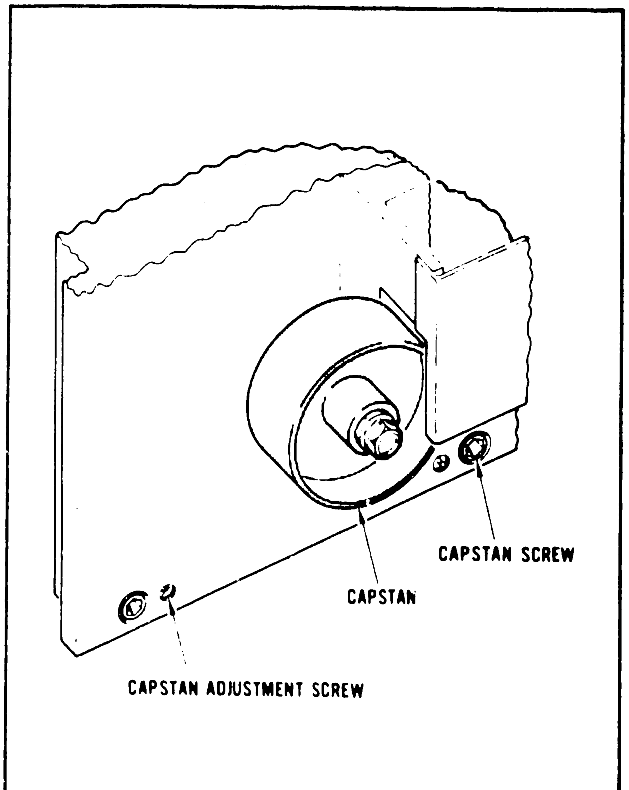


FIGURE 4-90 CAPSTAN PARALLELISM ADJUSTMENT

b. Back off both capstan adjustment setscrews until they no longer touch the capstan motor mounting plate.

c. Retighten both capstan adjustment setscrews until they press lightly against the capstan motor mounting plate.

d. Place machine in CYCLE test mode. Observe the tape position on the capstan. If the tape moves OUTWARD, tighten both adjustment screws equally until outward lateral movement ceases. If tape moves INWARD, loosen both adjustment screws equally until inward lateral movement ceases.

e. Retighten the capstan setscrews and recheck. If lateral tape movement has been eliminated, adjustment is complete. Otherwise, repeat this adjustment procedure.

C. Perform Reel Servo Adjustments

1. Centering Adjustment

a. Tape must be loaded and be advanced to the load point.

b. Adjust R10 on the servo preamp card (Figure 4-87) until tape loop is centered in the supply vacuum column.

NOTE:

While adjusting, make certain that tape loops remain within both vacuum columns.

c. Using R69 on the servo preamp card (Figure 4-87) repeat step a and b for the takeup reel servo adjustment.

d. When completed, both reels should be stationary, with the tape centered in both vacuum columns.

NOTE:

If the tape drive servo preamp card is type 5666 rather than 6666 use potentiometer R4 instead of R10, and R24 instead of R69. These pots are in the same physical locations on the respective cards. (See Figure 4-87)

2. Tape Overshoot Check

By means of the TEST mode and CYCLE pushbuttons on the test panel, place the drive in the CYCLE mode. The tape will alternate between forward and reverse continuously. Check for overshoot when the tape changes direction. Overshoot is present when the tape loop travels rapidly to the end of the vacuum chamber before settling near the center of the chamber. In normal operation, the tape loop should rise slowly in the column until it reaches its proper height. If overshoot occurs perform the following:

a. Gain Adjustment - to eliminate any overshoot of the tape loop in the vaccum column when tape changes direction.
   (1) Tape must be loaded and be advanced to the load point.
   (2) Place tape drive in the FORWARD RUN mode.
   (3) Adjust potentiometer R83 (See Figure 4-87) so that the tape loop rides at $1\frac{1}{4}'' \pm \frac{1}{4}''$ from the top of metallized mylar diaphram in the take-up reel vacuum column (See Figure 4-91).

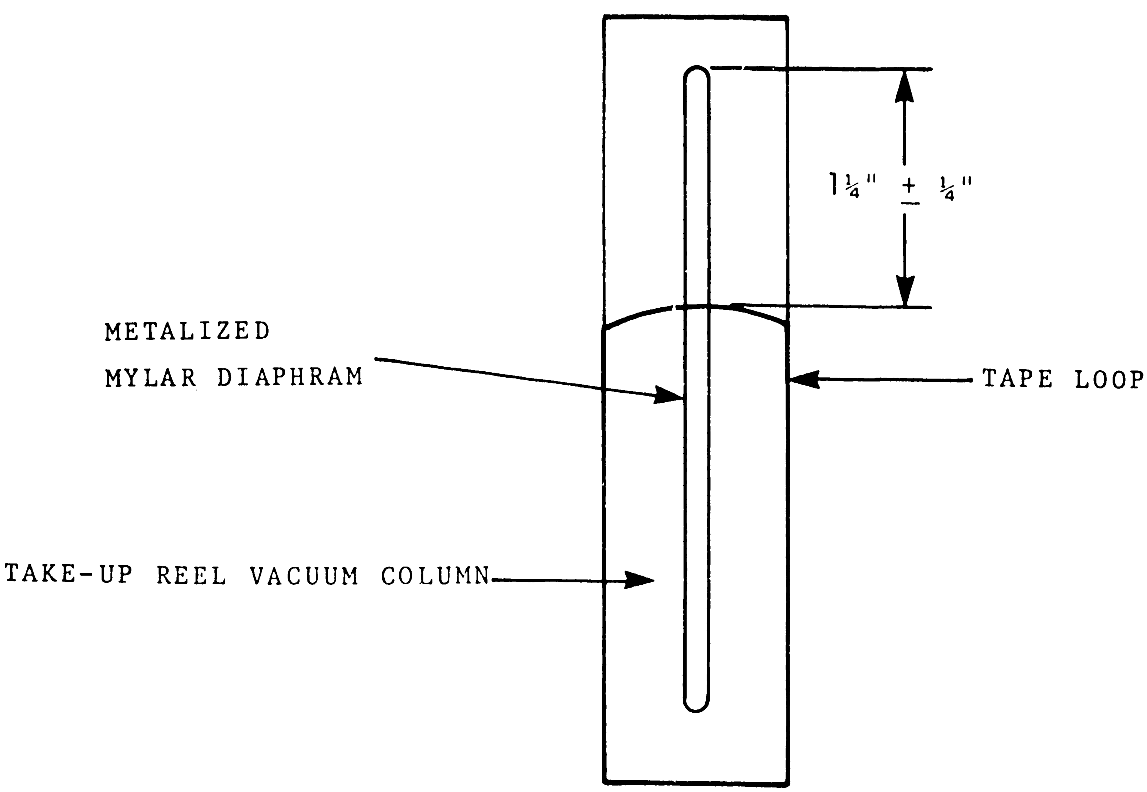


FIGURE 4-91 TAKE-UP REEL VACUUM COLUMN

NOTE:

If the tape drive servo preamp card is type 5666 use potentiometer R66 instead of R83. These pots are in the same physical location on the respective cards.

(4) Depress STOP on the test panel; then place tape drive in the REVERSE Mode.

(5) Adjust potentiometer R24 (See Figure 4-87) so that the tape loop rides at 1¼" ± ¼" from the top of the metallized mylar diaphram in the supply reel vacuum column (See Figure 4-92).

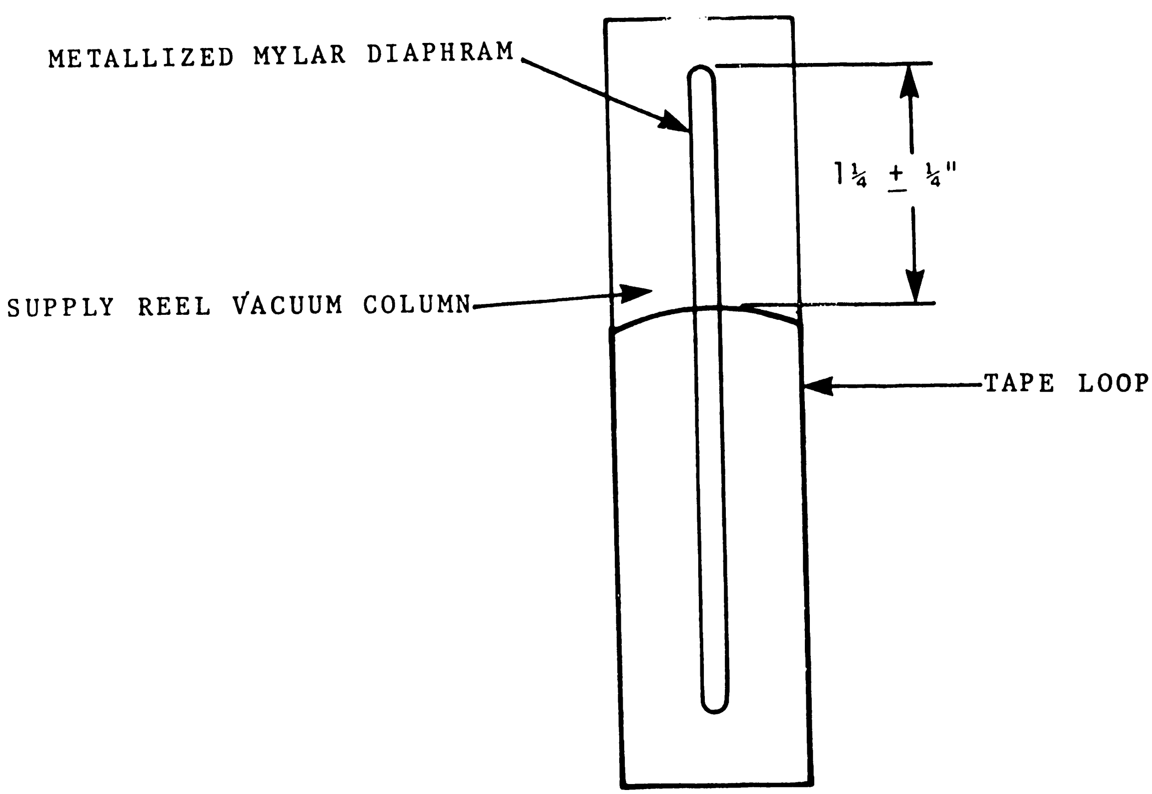


FIGURE 4-92 SUPPLY REEL VACUUM COLUMN

NOTE:

If the tape drive servo preamp card is type 5666 use potentiometer R18 instead of R24. These pots are in the same physical location on the respective cards.

b. After the adjustment is complete, place the tape drive in the cycle mode and recheck for tape overshoot.

D. Perform Vacuum Switch Check

The vacuum switch is located in the rear of the deck assembly, in the upper right-hand corner on the column plenum cover. This switch is a safety device to prevent possible tape breakage. It will operate to shut off the tape transport whenever the vacuum pressure within either vacuum column drops below a predetermined level. Perform the following check:

1. Tape must be loaded and be advanced to the load point.

2. Turn the supply reel clockwise, thus forcing the tape up into the supply reel vacuum column.

3. When the tape reaches the top of the column, the vacuum switch should activate, removing power from the vacuum motor.

4. Reload the tape and turn the take-up reel counterclockwise, causing tape to be forced up into the take-up reel vacuum column. When tape reaches the top of the column, the vacuum switch should again activate, removing power from the vacuum motor.

5. If these results are not obtained perform the following:

a. Connect a vacuum meter and ohmmeter to the vacuum switch as shown in Figure 4-93. To do this, one end of the vacuum switch hose must be detached and connected to the vacuum meter "T" fitting. The hose on the opposite end of the T fitting is attached to the vacated hose fitting on the vacuum switch. Also, detach the green/white (+) wire from its terminal on the vacuum switch. Connect it to chassis ground prior to attaching the ohmmeter to the positive terminal on the vacuum switch.

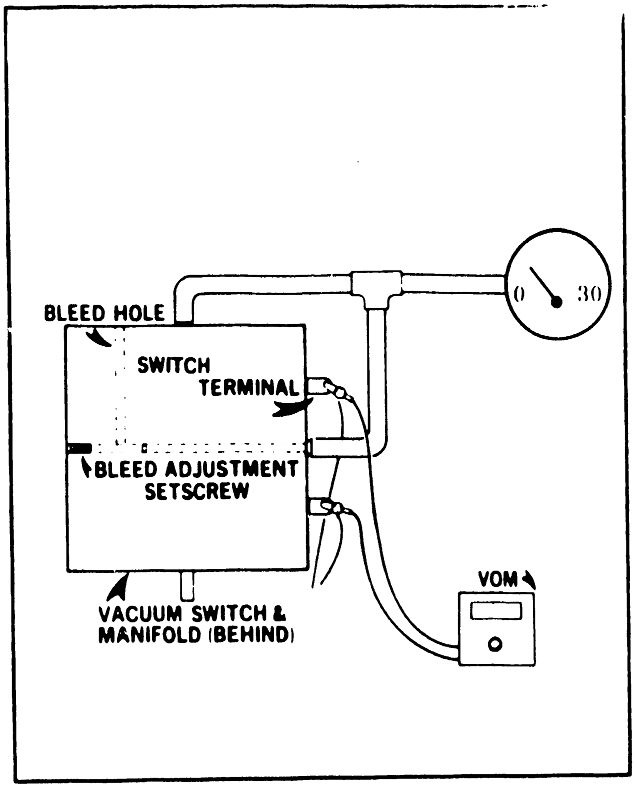


FIGURE 4-93 VACUUM SWITCH ADJUSTMENT

b. With machine on and a tape at load pont, cover the bleed hole (Figure 4-93). This gives maximum vacuum pressure, which should measure between 17 and 21 inches of water at sea level, or 15 to 19 inches of water at 4000 feet altitude.

c. Uncover the bleed hole. Adjust the bleed adjustment screw until the switch closes. The ohmmeter will indicate 0 ohms. The pressure should be between 10 inches and 14 inches of water.

d. Tighten the bleed adjustment screw to obtain a pressure reading which is 4 inches higher than the pressure obtained in step c. The adjustment is now complete.

E. Perform Capstan Zero Adjustment

The capstan should not move when the tape is stopped. A zero adjustment is provided on the Servo Preamplifier to remove the effects of component tolerances.

This adjustment should be made even if the capstan appears not to be moving, because the setting could still be off slightly. After several hours of tape drive operation the tape could move to the top of the vacuum chamber; the drive would then power off due to loss of vacuum.

Perform the following adjustment:

1. The tape must be loaded and be at the load point.

2. Connect a volt-ohmmeter or scope probe to test point D of the servo module.

3. Advance the tape to load point and adjust potentiometer R139 (Figure 4-87) to bring measured voltage to zero.

NOTE:

If the tape drive servo preamp card is type 5666, use pot R115 instead of R139. These pots are in the same physical locations on the respective cards.

F. Perform Tape Speed Check

Normal tape speed is controlled by R14 (the bottom pot) on the Ramp Generator card (See Figure 4-86). This control is set at the factory and normally will not require adjustment. Yet, because proper tape speed is crucial, the following check should be made.

1. Mount a skewmaster tape (PN 726-9659) on the tape drive.

2. Place the tape drive in the "Forward Run" mode.

3. Observe the waveform at one of the read preamplifier test point (card mounted on left side of tape drive). Display three complete sine wave cycles on the screen. The time for 3 complete cycles should be 100 usec. If this is not the case, adjust R14 accordingly.

NOTE:

The waveform will not be entirely stationary on the scope owing to small rapid speed variations. These should be visually averaged.

G. Perform Ramp Time Adjustment

Tape is brought up to speed at constant acceleration. To control tape velocity a ramp voltage is generated by the ramp generator, which rises linearly to the required running speed and falls linearly to zero at stop (Figure 4-94). Ramp time is set such that the tape will accelerate to running speed in 0.19 inch of travel. This timing is of critical importance in gap generation on the tape, and it must be accurately set. Ramp time is 5 msec at 75 ips. This waveform can be observed at test point A of the Ramp Generator card.

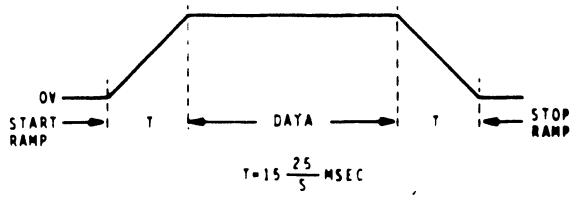


FIGURE 4-94 RAMP TIME WAVEFORM

The test panel may be used to make ramp time measurements by starting and stopping the machine by means of the CYCLE pushbutton. This is difficult, however, because the recurrence frequency is slow. Measurement under rapid start/stop commands fed to the synchronous forward input is much easier. In reverse operation, timing is the same as in foward operation, but the polarity is reversed; that is, the ramp is negative going. To adjust ramp time:

1. A CE scratch tape should be mounted and advanced to the load point.

2. Establish a start/stop motion by using the "cycle mode" on the test panel.

3. Observe the waveforms at ramp generator test point A. (see Figure 4-86)

4. If start rise time is not 5 usec, adjust R3 on the ramp generator module.

5. If stop fall time is not 5 usec, adjust R4 on Ramp Generator module.

H. Perform Read Level Check/Adjustment

Too much read preamplifier gain will introduce noise, and too little will aggravate dropouts. This check ensures these levels to be within specifications.

1. A CE scratch tape should be mounted and advanced to the load point.

2. Place tape drive in the "Write Test/Forward Run" mode.

3. Observe waveforms at test points for each channel of the Read Preamplifier.

NOTE:

The Read Preamplifier Module is located on the left side of the tape drive chassis.

4. Measure the peak-to-peak amplitude at each channel and set for 8 $\pm$ 0.5 volts using the channel gain control pots on the Read Preamplifier. Note that the read level is about 10 percent higher when the drive is operating in read-after-write mode than in the read mode. This effect is caused by small unavoidable magnetic remanence in the write head and the erase head. For this reason, Skewmaster tapes should NOT be used as amplitude reference.

I. Perform Read Skew Check/Adjustment.

Skew is one of the most important parameters in reading NRZI data. Since, in a read-after-write head, data is read with one gap and written with a second gap, read and write skews are in general different and must be compensated separately. Only when both are properly set can the machine be said to be deskewed. In the Model 9100 the read gap is deskewed mechanically while the write gap is deskewed using digitally controlled delays.

When deskewing the read gap, the head is mechanically tilted to position its gap at a precise right angle to the tape. This is accomplished using a skewmaster tape.

1. A skewmaster tape should be mounted and advanced to the load point.

2. Place the drive in the "Forward Run" mode.

3. Observe the skew indicator on the test panel. If indicator does not light up, adjustment is not required. Otherwise, continue with the next step.

4. Adjust the skew adjusting screw on the head mounting plate (See Figure 4-95) until the indicator light goes off.

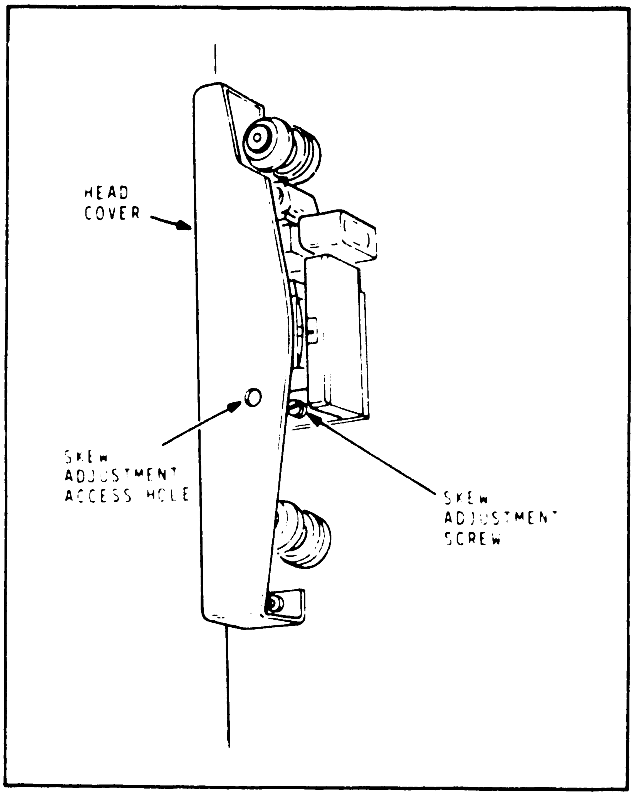


FIGURE 4-95 SKEW ADJUSTMENT

NOTE:

For greater precision a scope probe may be connected to the TEST terminal on the test panel. At this point the pattern will be a grouping of nine pulses as each channel "reports in." For an optimum skew setting, these pulses should occupy the minimum possible spread.

J. Perform Write Skew Check/Adjustment

The Model 2209V features a unique digital deskewing arrangement for deskewing the write head. Since write skew is a function of head geometry and does not change, write deskewing delays are determined at the factory and each head has a deskewing chart showing the appropriate write amplifier deskew switch settings for that head. All channels are referenced to the P channel.

To check for proper adjustment of these delays, perform the following:

1. Mount a CE scratch tape and advance it to the load point.

2. Place the drive in the "Write Test Forward Run" mode.

3. Observe the skew indicator. If the indicator light is off, no adjustment is required; otherwise, proceed as follows:

   (a) Using a dual channel scope, connect channel 1 to the P channel test point on the Read Preamplifier. Set the scope for alternate sweep, trigger channel 1 internal.

   (b) Connect scope channel 2 to the test point for tape channel 5 and observe the pattern. Set the sweep speed to display one half sine wave cycle.

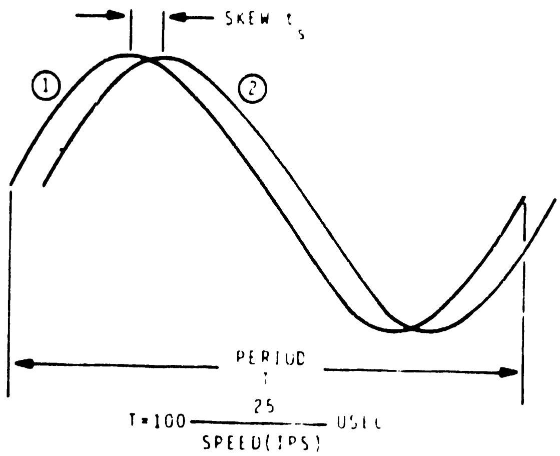
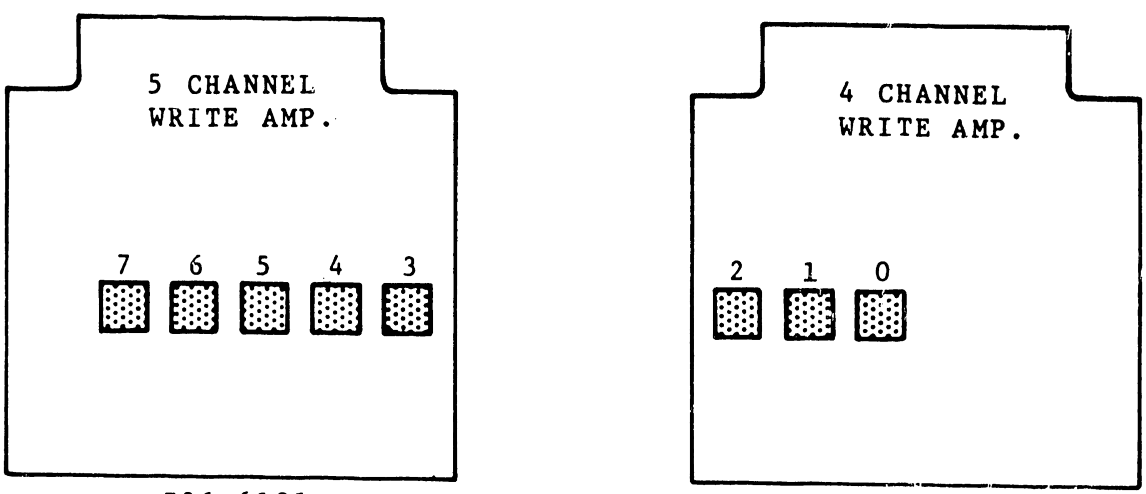


FIGURE 4-96 SKEW ADJUSTMENT WAVEFORMS



726-6101 726-6102

FIGURE 4-97 LOCATION OF SKEW SWITCHES

(c) Observe separation of the peaks displayed. Note that, because of small variations in speed and skew, the pattern will not be entirely stationary. (See Figure 4-96)

(d) Set the channel 5 skew switch (Figure 4-97) for minimum peak separation.

(e) Repeat this procedure for each of the remaining seven channels.

4.6.13 ATTACHING THE FORMATTER

NOTE:

The tape drive must be powered off.

The tape drive formatter is located in the base of the first tape drive cabinet. AC power should already be applied to the formatter by means of a female AC power cord extending from the rear of the drive. The data cable and control cable should also be installed from the formatter to the first drive.

A. Ensure that these cables are installed as shown in Figure 4-98.

NOTE:

Connector A10J1 (Control Connector) is located on the Kennedy adapter card (modifies the tape drive from a Kennedy Model #9218 to a Kennedy Model 9100). This connector is the forwardmost connector of the two on the card. Pin 1 is toward the front of the connector. Connector A11J1 (Data Connector) is also located on the Kennedy adpater card. This connector is positioned at the rear of the card. Pin 1 is toward the front of the connector.

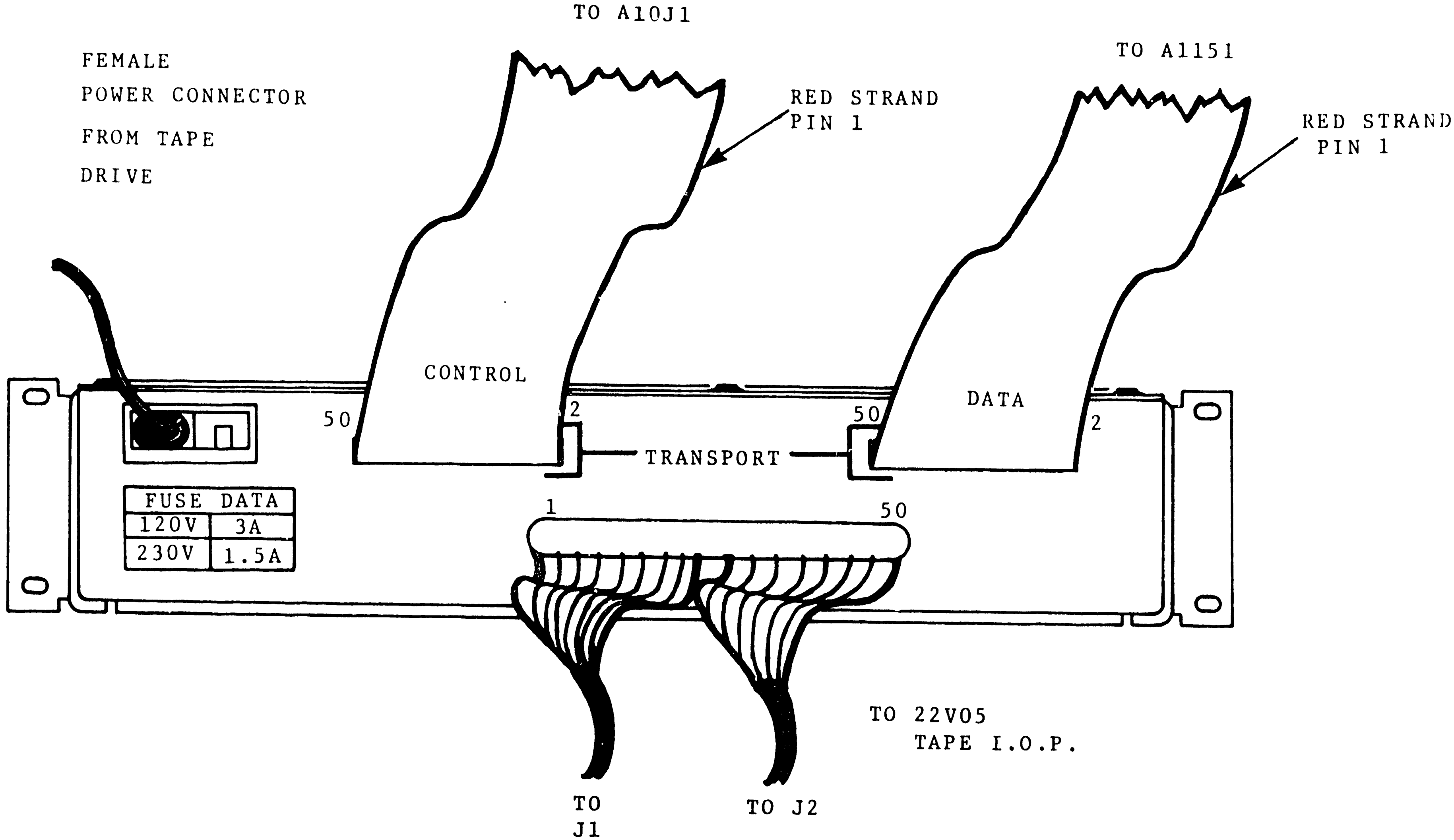


FIGURE 4-98 REAR VIEW OF FORMATTER ASSEMBLY

B. Remove the faceplate of the formatter unit by removing the two securing screws. Apply power to the drive and formatter and check for +5V $\pm$ .05V on any chip. If the voltage is out of tolerance:

1. Power-off the tape drive.

2. Remove the four screws securing the formatter unit to the tape drive chassis.

3. Remove any stress release straps holding the power cord, data cable and control cables to the tape drive chassis.

4. Carefully slide the formatter assembly out the front of the drive chassis, paying careful attention to the cables attached to the formatter.

5. Remove the machine screws holding the top cover on the formatter assembly and remove the cover.

6. Power-on the drive and formatter. Adjust the potentiometer mounted on the top of the formatter power supply for the proper voltage.

7. Power-off the drive and formatter, and return the assembly to its original location.

NOTE:

On the 4831 interface board in the formatter assembly (the card with two cables attached to it internally) there are four switch banks. These switches are set at the factory and should require no change. However, if problems are encountered while installing the tape drive in the system, check the switch settings. The switches should be set as follows:

Switch Bank #E1

Switch 1 - ON
Switch 2 - OFF
Switch 3 - ON
Switch 4 - OFF
Switch 5 - OFF
Switch 6 - OFF
Switch 7 - OFF

Switch Bank #E2

Switch 1 - OFF
Switch 2 - OFF
Switch 3 - ON
Switch 4 - OFF
Switch 5 - OFF
Switch 6 - OFF
Switch 7 - OFF

Switch Bank #E3

Switch 1 - OFF
Switch 2 - OFF
Switch 3 - ON
Switch 4 - OFF
Switch 5 - OFF
Switch 6 - OFF
Switch 7 - OFF

Switch Bank #E4

Switch 1 - ON
Switch 2 - OFF
Switch 3 - ON
Switch 4 - OFF
Switch 5 - OFF
Switch 6 - OFF
Switch 7 - OFF

4.6.14 SYSTEM INTERCONNECTION

A. Attach a 10 ft. I/O cable (PN 220-0168) to J101 (50 pin connector) at the rear of the formatter assembly.

B. Attach the other end of the I/O cable to the 22V05 IOP in the mainframe (see Figure 4-99). The cable should run from J101 at the rear of the formatter assembly, through the cable entrance space at the rear of the drive cabinet, and through the cable entrance space in the rear base of processor mainframe.

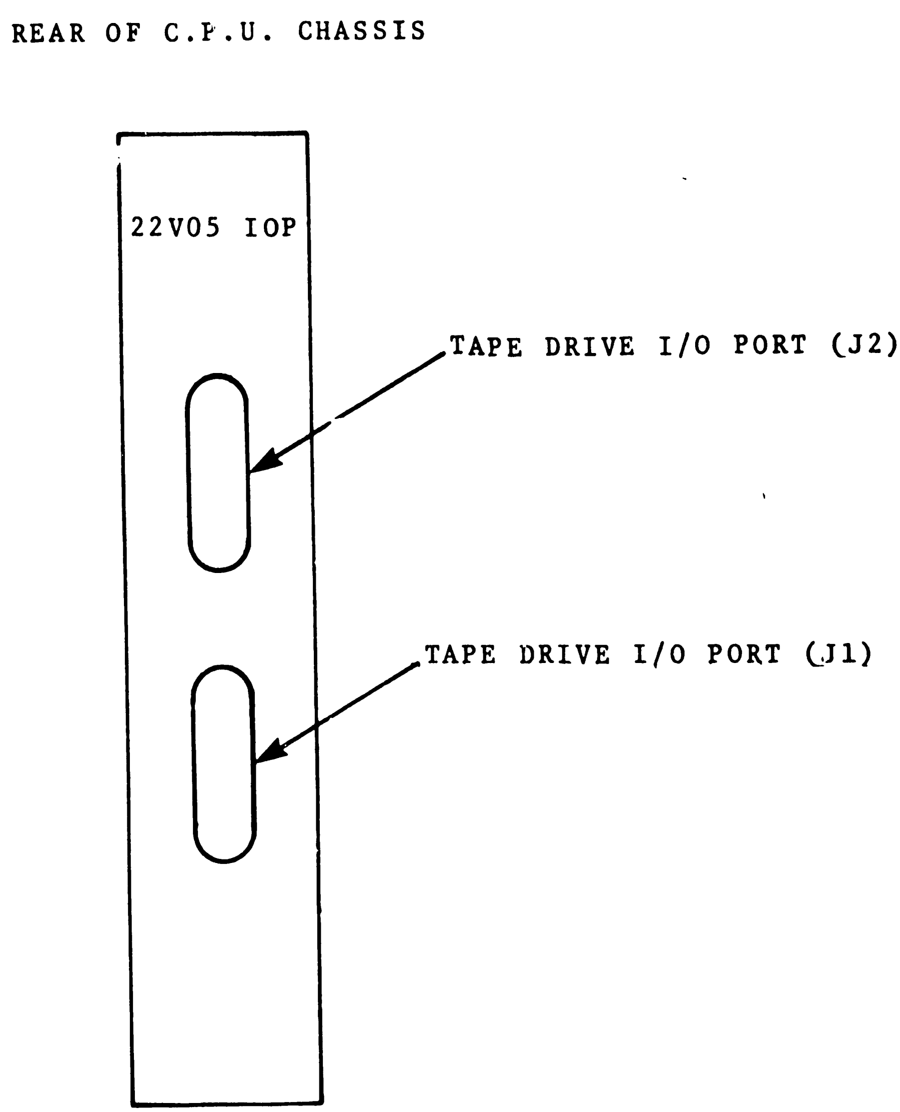


FIGURE 4-99 TOP VIEW OF 22V05 IOP

C. The connector on cable J2 should be attached to port J2 on the 22V05 IOP. (See Figure 4-99)

D. Attach connector on cable J1 to port J1 on the 22V05 IOP. Early model cables were labeled in reverse of what is stated above. To remove any doubt as to the proper cabling of the formatter or the 22V05 IOP, use the following procedure:

1. Attach the connector belonging to the cable which is attached to the high numbered pins of J101, at the back of the formatter assembly, to port J2 on the 22V05 IOP.

2. Attach the remaining cable to port J1 on the 22V05 IOP.

E. If no other tape drives are to be attached to the system:

1. Ensure that the control and data terminator cards are in the logic rack (see Figure 4-86).

2. Install all tape drive covers and panels.

F. If more than one tape drive is to be attached to system, use 8 ft I/O daisy cables (PN 220-3059), to interconnect the tape drive in the configuration shown in Figure 4-100.

NOTE:

In a daisy chain configuration, the control and data terminator cards must be removed from the logic rack (Figure 4-86) in all tape drives except the last. Even if the last drive is not in use, the power must remain ON. This provides DC power for the terminator.

E. Set the device transport address (from 1-4) using the thumbwheel switch (See Figure 4-83) to reflect the tape drive number in the daisy chain. Each drive should have a different number.

F. All unit panels and covers should now be reinstalled on their respective units.

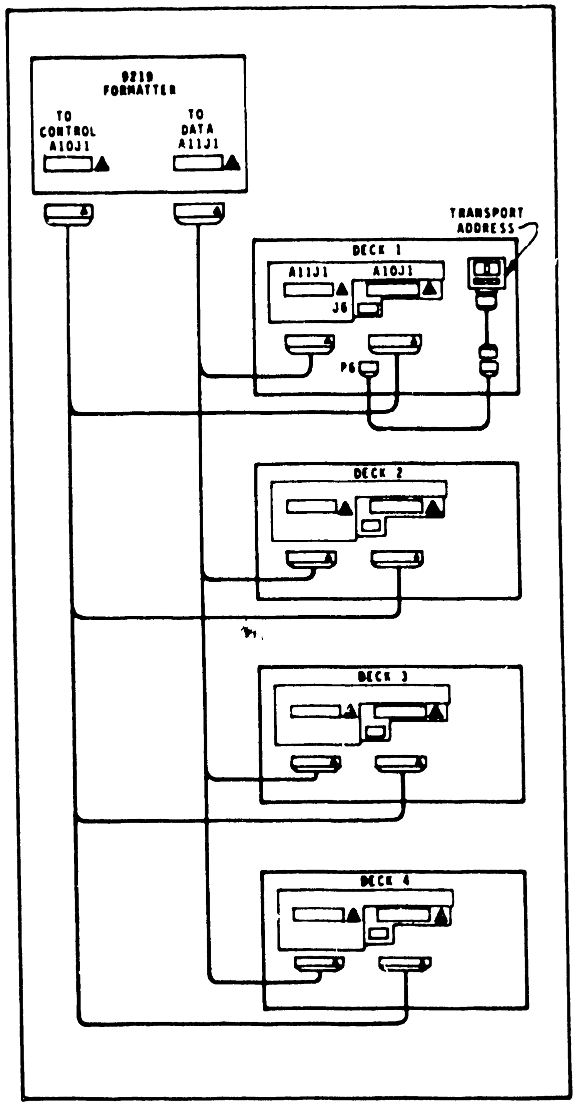


FIGURE 4-100 DAISY CHAIN CONFIGURATION

4.7 VERY LARGE DISK ADAPTER BOARD

4.7.1 INTRODUCTION

This section describes the device switch settings for the 22V78/22V88 Very Large Disk Adapter Board. The 22V78/22V88 Very Large Disk Device Adapter Board is an addition to the existing 7114 SMD Device Adapter and the 8214 Dual Port SMD Device Adapter. It will control the single and dual port SMD type drives including 675 Meg drives. Four versions of the Device Adapter will be offered as listed below:

- a.) A 1 Port Disk Controller
- b.) A 2 Port Disk Controller
- c.) A 3 Port Disk Controller
- d.) A 4 Port Disk Controller

A hardwired 2 bit code to define the version will be readable by the IOP. Each version will not be upgradable to support more drives.

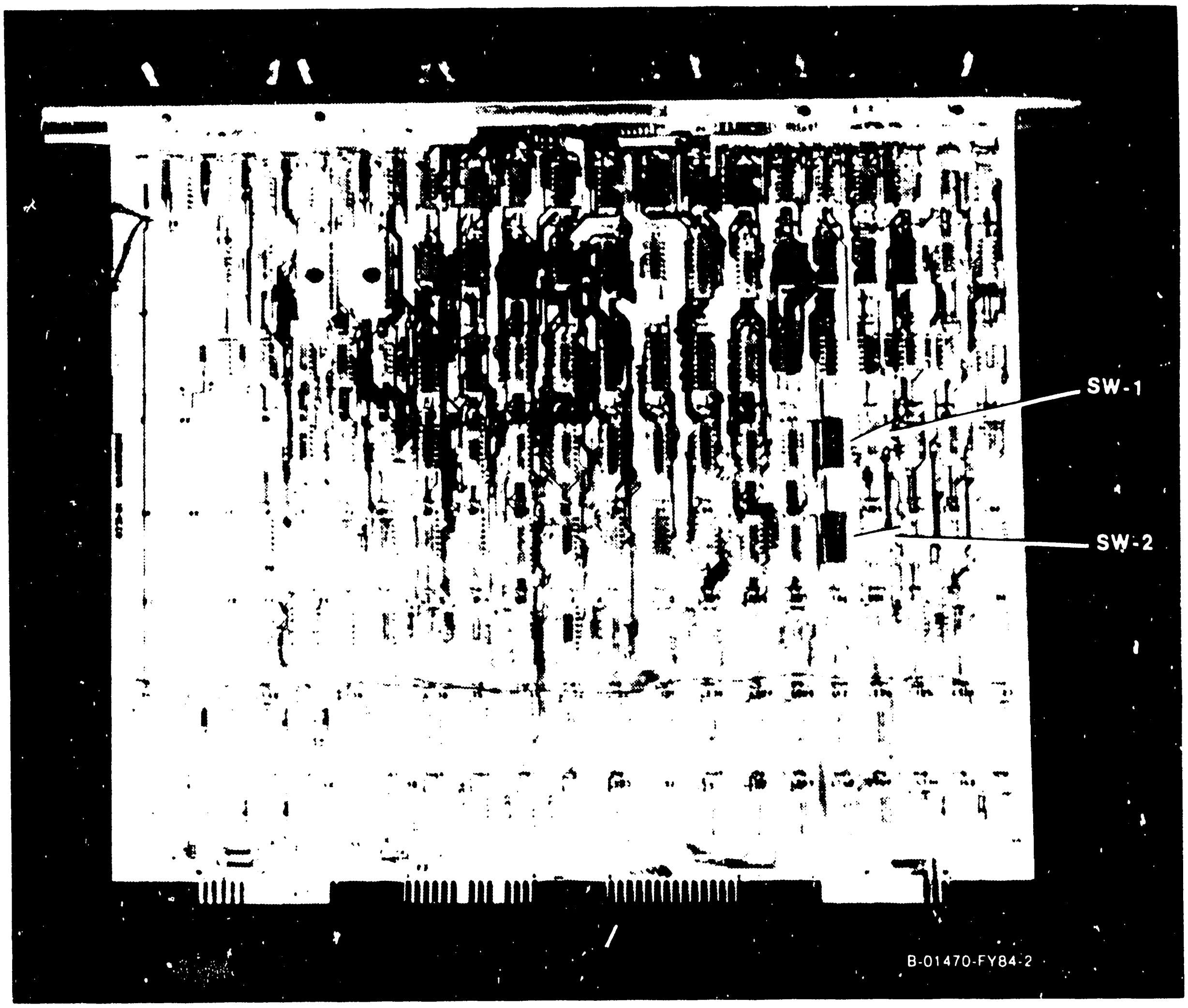
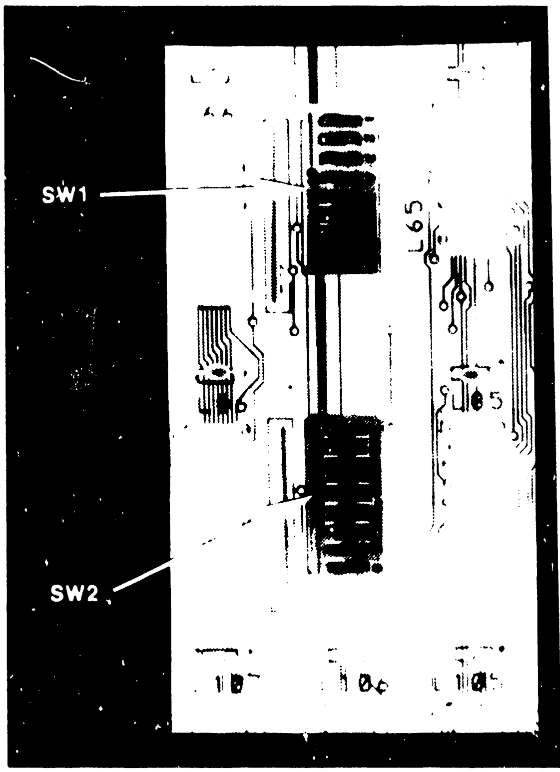


FIGURE 4-101 210-8321 SMD/CMD DISK DEVICE ADAPTER

4.7.2 22V78/22V88 SMD/CMD DA SWITCH SETTINGS

The two 8-position disk device type switches, SW1 and SW2, define the type of drive connected to the SMD/CMD Device Adapter ports 0-3. Set the switches for the type of drive(s) to be connected to the system, referring to Figures 401 and 402. On the #210-8318 (1-port) and #210-8319 (2-port) adapters, SW1 may not be installed. The switch location may be hard-wired to indicate that ports number 2 and 3 cannot be used.



	OPEN	SW1	CLOSED
DRIVE 3		1	BIT 3
		2	BIT 2
		3	BIT 1
		4	BIT 0
DRIVE 2		5	BIT 3
		6	BIT 2
		7	BIT 1
		8	BIT 0

	OPEN	SW2	CLOSED
DRIVE 1		1	BIT 3
		2	BIT 2
		3	BIT 1
		4	BIT 0
DRIVE 0		5	BIT 3
		6	BIT 2
		7	BIT 1
		8	BIT 0

FIGURE 4-102 210-8321 SMD/CMD DISK DEVICE ADAPTER.
DISK DEVICE TYPE SWITCH SETTINGS.

DRIVE TYPE	BIT 3	BIT 2	BIT 1	BIT 0
75 MEG SMD	OPEN	OPEN	OPEN	OPEN
288 MEG SMD	OPEN	OPEN	OPEN	CLOSED
30 MEG CMD	OPEN	CLOSED	OPEN	OPEN
60 MEG CMD	OPEN	CLOSED	OPEN	CLOSED
90 MEG CMD	OPEN	CLOSED	CLOSED	OPEN
620 MEG SMD	CLOSED	OPEN	CLOSED	CLOSED
NO DRIVE	CLOSED	CLOSED	CLOSED	CLOSED

SMD/CMD DISK DRIVE TYPES.

4.7.3 PART NUMBERS

This section contains a breakdown of the various part numbers used in ordering a Very Large Disk IOP for either a VS80 or VS100.

Part Number	Description
212 - 3042	1 Port 22V78 Very Large Disk IOP for VS80
212 - 3043	2 Port 22V78 Very Large Disk IOP for VS80
212 - 3044	3 Port 22V78 Very Large Disk IOP for VS80
212 - 3045	4 Port 22V78 Very Large Disk IOP for VS80
212 - 3050	1 Port 22V88 Very Large Disk IOP for VS100
212 - 3049	2 Port 22V88 Very Large Disk IOP for VS100
212 - 3048	3 Port 22V88 Very Large Disk IOP for VS100
212 - 3047	4 Port 22V88 Very Large Disk IOP for VS100

SECTION 5 SYSTEM GENERATION

SECTION 5

SYSTEM GENERATION

5.1 GENERAL

This is a procedure for generating Operating System Release 2.1 only. Refer to Computer Systems Newsletters (CSNLs) for later Operating System releases.

5.2 THE SYSGEN DISKETTE SET

Since diskette drives are common to all systems in the field, System Generation software is distributed in diskette sets.

There are sixteen diskettes in the SYSGEN set. The set is divided into four groups, each group having a specific function. The diskette groups are as follows:

A. "GEN" GROUP - This first group contains the start-up software for System Generation. The group contains three diskettes (GEN10, GEN75, and GEN288), but only one of these diskettes is used per generation. The storage capacity of the disk drive at device address 4 determines which diskette (GENxxx) will be used r a system generation. For example: GEN75 is used for installations that have a 75 megabyte disk drive as device number 4.

GEN10	WLI #701-2375A
GEN75	WLI #701-2376A
GEN288	WLI #701-2377A

B. "SYS" GROUP - The second group of diskettes (SYS001 to SYS007) contains the new Operating System. These will be changed as future software releases become available. All seven diskettes are used in a system generation procedure.

SYS001	WLI #701-2360A
SYS002	WLI #701-2361A
SYS003	WLI #701-2362A
SYS004	WLI #701-2363A
SYS005	WLI #701-2364A
SYS006	WLI #701-2365A
SYS007	WLI #701-2366A

C. LANGUAGE GROUP - The three diskettes of the third group contain the high-level languages -- BASIC, COBOL, RPGII. Only the ones purchased by the customer will be used. As the languages are updated, these diskettes will be changed. One language is included per installation; additional languages may be ordered.

COBOL	WLI #701-2369A
BASIC	WLI #701-2370A
RPGII	WLI #701-23671

D. "BAK" GROUP - The fourth group contains three diskettes -- BAK10, BAK75, and BAK288. Each diskettes contains a cut-down Operating System which allows the customer to make his own backups. They have software for copying disk-to-disk, tape-to-disk, and disk-to-tape. When these diskettes are used, the disk drives must be device numbers 4 or 5, and the tape drives must be device numbers 28 or 29. The diskettes also include the initialization program DISKINIT. Provide the customer with a copy of the appropriate "BAK" diskette.

BAK10	701-2372A
BAK75	701-2373A
BAK288	701-2374A

5.3 SYSGEN PROCEDURE

System generation can only be accomplished with the system 'taken down', with the customer engineer as the sole user. This is called a 'cold start' SYSGEN.

NOTE:

Customers must have Release 2.0 software BEFORE this procedure can be used.

The following addressing conventions must be adhered to in the SYSGEN procedure.

1) The generation software recognizes disks at device addresses 04 (HEX) and 05 (HEX). The output volume (new system disk) must be at one of these addresses.
2) The diskette drive may be either device number 7 (HEX 07) or 11 (HEX 0B).
3) The first tape must be device number 28 (HEX 2C).
4) Workstations must be at device addresses 00 and 01 (HEX).
5) The printer must be at device address 03 (HEX).

NOTE:

Before starting the following procedures, copy all existing data from the output (new system) disk.

A step-by-step procedure to generate a 2200VS Operating System follows:

A. If the SYSGEN is being performed on a VS that is not being installed for the first time (an upgrade), be sure to copy the customer's existing Operating System on a backup disk.

B. The new Operating System may be generated on the present system disk or on some other disk, as long as the output volume is at device address 04 or 05 (HEX); therefore, ensure that the disk volume that is to receive the start-up system is mounted on a disk at Hex address 04 or 05.

C. MOUNT the appropriate GENxxx diskette in the diskette drive.

D. IPL from the GENxxx diskette. For this IPL, the workstation waits with a blank screen for a longer time than usual. Approximately 20 seconds after IPL, Workstation #0 should contain the initial menu. It will give a choice between PF Key #1 (create start-up system) and PF Key #5 (scratch to new system). Select the system generation option (PF1).

E. The next prompt will request information about the receiving disk. Enter that information. If disk initialization is selected, the run time will be 5, 15, or 30 minutes depending on storage capacity of the disk. Set the option to "S" (for Scratch) whenever a message is displayed about a file being in both input and output libraries; then, key ENTER.

F. When the program finishes, the GENxxx diskette will have been copied onto the receiving disk. IPL from the receiving disk (device numbers 4 or 5) when prompted to.

G. After IPLing from the receiving disk, Workstation #0 will contain a message to switch to Workstation #1. The remainder of System Generation is performed from Workstation #1.

H. At the start of the Generate program, a prompt will ask for the following items:

1. DISKETTE DEVICE NUMBER - The device number of the diskette drive -- 7 or 11.

2. LANGUAGE(S) - Answer YES for each language purchased. Normally, a YES response is given to only one of the language compilers; but, if the customer has purchased others, respond appropriately. Make certain that the customer work order includes additional languages before supplying them.

3. VOLUME TO RECEIVE SYSGEN WORK FILES - Any volume except the diskette, including the present system disk.

4. VOLUME TO RECEIVE OUTPUT OF SYSGEN - Enter the name of the disk that is to receive the newly generated system. This may be any volume except the diskette. The receiving disk may be the present system disk, but it does not have to be; either of the drives at device addresses 04 and or 05 may be used. The receiving disk may also be the disk that was specified in #3, above.

5. VOLUME THAT HAS CONFIGURATION FILE - If you wish to use the existing configuration, enter the volume name; otherwise, leave it blank.

6. MODIFY CONFIGURATION FILE - Enter YES if the system configuration needs to be changed (after a system upgrade, for instance), or if it is being specified for a new system installation.

I. Press ENTER to begin the program. The GENERATE program will issue a series of mount requests for the diskettes SYS001 to SYS007, in order. If the wrong diskette is mounted, a prompt will be issued. The program has no provisions for restarts; if a restart becomes necessary, the diskette mounting procedure must be repeated in its entirety.

J. If modification of the configuration file was requested earilier in step H.6, the program will now call up the EDITOR and configuration file.

```
WANG VS TEXT EDITOR - VERSION 4.04.01
INPUT FILE IS CONFIG   IN LIBRARY @SYSTEM@ ON VOLUME CSG200

****************************************************************
* SYSTEM SPECIFICATION SAMPLE.                         -------  *
* EDIT AS [illegible] CONFIGURATION; THEN     REPLACE  *
* AND TERMINATE EDITOR TO START SYSTEM GENERATION      -------  *
* (PRESS PF16, THEN PF6, THEN ENTER, THEN PF16).                *
* (DO NOT REMOVE THESE COMMENT LINES ! YOU MAY ADD OTHERS.)     *
****************************************************************
*
* SAMPLE STARTUP SYSTEM - 80-MEG DISKS ON 4 AND 5.
* ------ ------- ------ - 10-MEG DISKS ON 8 AND 9.
*                       - DISKETTE ON 11.
*                       - CONSOLE AND ONE WORKSTATION ON 0 AND 1.
*                       - PRINTER ON 3
*
CONTROL STATEMENT ----> CONTROL PRINT=ALL
                        TASK  WS=1
                        TASK  WS=2
                        TASK  WS=12
                        TASK  WS=13
TASK STATEMENTS         TASK  WS=14
                        TASK  WS=15
                        TASK  WS=16
                        TASK  WS=17
                        TASK  WS=18
                        TASK  WS=19
                        DEVICE NUMBER=0,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=1,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=2,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=3,CLASS=PST,TYPE=2263V-2
                        DEVICE NUMBER=4,CLASS=DISK,TYPE=2265V-1
                        DEVICE NUMBER=5,CLASS=DISK,TYPE=2265V-1
                        DEVICE NUMBER=6,CLASS=DISK,TYPE=2265V-1
                        DEVICE NUMBER=7,CLASS=DISK,TYPE=2265V-2
                        DEVICE NUMBER=8,CLASS=DISK,TYPE=2260V
DEVICE STATEMENTS       DEVICE NUMBER=9,CLASS=DISK,TYPE=2260V
                        DEVICE NUMBER=10,CLASS=DISK,TYPE=2260V
                        DEVICE NUMBER=11,CLASS=DISK,TYPE=2270V
                        DEVICE NUMBER=12,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=13,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=14,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=15,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=16,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=17,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=18,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=19,CLASS=WS,TYPE=2246P
                        DEVICE NUMBER=28,CLASS=MTAPE,TYPE=2209V
GENERATE STATEMENT      DEVICE NUMBER=29,CLASS=MTAPE,TYPE=2209V
                        GENERATE
*
* THE DEVICE NUMBERS IN USE ARE:
*                                    WORKSTATION               2246P
*                                    1600-BPI MAGNETIC TAPE    2209V
*                                    10-MEG DISK               2260V
*                                    80-MEG DISK               2265V-1
*                                    300-MEG DISK              2265V-2
*                                    DISKETTE                  2270V
*                                    200CPS PRINTER            2221V
*                                    120CPS PRINTER            2231V-1
*                                    120CPS PRINTER            2231V-2
*                                    240LPM PRINTER            2261V
*                                    300LPM PRINTER            2263V-1
*                                    600LPM PRINTER            2263V-2
*                                    30CPS  PRINTER            2281V
END STATEMENT ------>   END

*** END OF LISTING ***********************************************
```

An explanation of EDITOR parameters follows:

EXPLANATION OF EDITOR STATEMENTS

1. The Control Statement -There is only one Control Statement, and it is always the first line of edited text after the COMMENT lines. The options are:

MEMORY: Specifies the maximum memory size that can be used by the generated Operating System. Specified values must be in multiples of 2K. The lowest allowable value is 64K; the maximum allowable value (and default value) is 512K. On installations, specify the memory size purchased by the customer. If a larger value is specified, without the extra RAM to support that value, system performance will be degraded. The Control Statement for MEMORY should appear typically as follows:

CONTROL MEMORY=192K

CLK RATE: This option is used to specify the AC power line frequency in cycles per second (Hertz). The default value is 60; therefore, 60 cycle machines do not require use of this option. Since 50 Hertz is the only optional line frequency, if the CLK RATE option is used, the Control Statement should appear as follows:

CONTROL CLKRATE=50

PRINT: ALL or BLOCKS. The Default value of this option is BLOCKS, and that value is recommended for installations. If 'BLOCKS' is used, only System Control Blocks will be printed. When the Print option 'ALL' is used, the Control Statement should appear as follows:

CONTROL PRINT=ALL

NOTE: If more than one 'Control' option is desired, the following format should be used.

CONTROL MEMORY=192,CLKRATE=50,PRINT=ALL

2. The Task Statements -One Task Statement is required for each workstation to be generated in the system, except for Workstation #0. The options are:

WS: Reflects the device number of the workstation associated with this task, and it should appear in the task statement as follows (typical):

TASK WS=1

SEG2LTH: This option provides for a variation in the length of Segment 2 (in bytes to be provided for each task). The specified value must be a multiple of 2K. The lowest allowable value is 64K. The maximum allowable value is 512K. The default value of 256K is recommended for installations. When the SEG2LTH option is used, the task statement should appear typically as follows:

TASK WS=1,SEG2LTH=512K

3. The Device Statements -One Device Statement is required for each peripheral device to be generated into the system. All Device Statement options are required. Those options are:

NUMBER: Reflects the device number (in decimal) of the peripheral to be generated.

CLASS: Specifies the kind of peripheral that is being generated into the Operating System.

The variables for "CLASS" are:

-WS for Workstations
-PRT for Printer
-DISK for Disk Drives
-MTAPE for Magnetic Tape

CLASS should appear in the device statements as follows (typical):

DEVICE NUMBER=4,CLASS=DISK,TYPE=2265V2

TYPE: Reflects the device type number (taken from the 2200VS Principles of Operations Manual) for the peripheral to be generated into the Operating System.

The variables for TYPE are:

Workstation = 2246P
1600 BPI Magnetic Tape = 2209V
10 Meg Disk = 2260V
75 Meg Disk = 2265V1
288 Meg Disk = 2265V2
Diskette = 2270V
200 CPS Printer = 2221V
120 CPS Printer = 2231V
240 LPM Printer = 2261V
400 LPM Printer = 2263V-1
600 LPM Printer = 2263V-2

"TYPE" should appear in the Device Statement as in the example used for "CLASS".

4. Generate Statement -Appears in its default state, immediately after the last Device Statement .

5. END Statement -Appears immediately after the Generate Statement and is the last line of the edited text. The END statement appears in its default state.

K. Use the REPLACE option (PF6) on the EDITOR menu to modify the system configuration, and then TERMINATE the editor with PF16. Note that the edit file does not include an example of a mag tape drive. Here is a sample line:

DEVICE NUMBER=28,CLASS=MTAPE,TYPE=2209V

L. There will be a wait of 10 to 20 minutes, depending on the configuration of the system. Then the program will then request the high-level language(s) specified earlier. Respond by mounting the appropriate language compiler diskette(s).

M. A request to remove the last diskette will be issued when copying is complete.

N. Mount and IPL from the "GEN" diskette when prompted to.

O. Press PF5 and enter the name of the volume that received the output of the SYSGEN; this will scratch the old Operating System and rename the new one @SYSTEM@. IPL from the new system disk.

P. Test the new customer system. Note that existing customer files on the ouput disk should not have been affected.

NOTE:

A possible problem exists with old disk packs that were crowded and had files scratched to make room for the new system. If a file will not fit in a single extent (contiguous disk space of N blocks), it can occupy up to thirteen extents. However, the Operating System and all segment 2 paging files are not permitted to occupy more than three extents. If any of the previously mentioned files occupies more than three extents, then the newly generated system software will put the system into control mode part way through the IPL process with no message or explanation. This problem will not be predicted by the system generation software. To get around the problem, copy the customer libraries and reformat the output disk.

Q. When the generation is completed, scratch the file GENERATE from the library @SYSTEM@. Also scratch the library @SYSGEN@.

5.4 KNOWN PITFALLS OF SYSGEN RELEASE 2.1

If the system is being generated on a 10 meg disk, there will not be enough space on disk for more than six Segment 2 areas of the default size (256K). The system will be generated correctly, but when an IPL is attempted, one or more workstations will flash a message indicating insufficient disk space. This occurs because the SYSGEN procedure does not generate Segment 2 paging files for the new system. Instead, the new system establishes its paging files at IPL time, scratching any old files.

If customer files were preserved on the disk, there may be a limit to the number of workstations that can be generated into the system (less than six). It is possible that one of the two disk platters on a ten meg drive will have to be reserved for the Operating System and its utilities. It may not be possible to create backup files, except on tape or diskette, if the system has only one ten meg drive.

There is an optional segment 2 length parameter in the system generation syntax which allows modification of the Segment 2 length in 4K increments.

Example: TASK WS=1,SEG2LTH=128K

It may be possible to reduce the disk usage in this manner, but certain utilities will not execute in a small Segment 2 area. CONSULT WITH THE CUSTOMER'S PROGRAMMER OR ANALYST BEFORE TRYING THIS APPROACH. If some workstations will be used only for small data entry routines, reducing the segment 2 space may work.

It may also be possible to gain enough space for all Segment 2 paging files by scratching certain <u>system</u> programs. DO THIS ONLY WITH THE CUSTOMER'S UNDERSTANDING AND PERMISSION. Library @SYSTST@ can be copied to floppy disk and then scratched, since it contains only field service tests.

There are, in fact, two possible messages pertaining to Segment 2 space at IPL time. Be sure you understand the difference.

A. "INSUFFICIENT SPACE FOR SEGMENT 2 PAGING FILE" quite literally means that the situation described above exists.

B. "A PREVIOUS SEGMENT 2 PAGING FILE COULD NOT BE SCRATCHED" means that an old segment 2 paging could not be located in the VTOC. This is usually caused by a hard I/O error in the VTOC area of the disk platter. Depending on the reason for the error, reinitializing the disk may or may not make it usable. Be sure to copy whatever customer files from that platter before initializing.

CONTROL MODE HALTS:

During IPL, there are several places in the Operating System initialization routine where the machine could, without message or explanation, go into control mode (bit 33 of the PCW on). These traps are usually caused by errors so severe that no on-screen message is attempted. Most control mode entries are due to hardware failure; however, control mode can be entered when IPLing from a disk that has had a lot of files SRATCHed.

When a file is scratched, its extents (areas on disk) are simply redefined as 'free space' in the FDAV section of the VTOC. Note that when these extents are added to the FDAV, they are not combined, even if they are contiguous on disk.

START BLOCK		END BLOCK	START BLOCK		END BLOCK
100	FREE SPACE	250	251	DATA FILE	500

If the data file is scratched, there will be two free extents listed in the FDAV -- 100 through 250, and 251 through 500. They are not combined into a single extent, even though they could be.

Although any file created on disk may occupy up to thirteen extents, the Operating system and Segment 2 paging files are not permitted to occupy more that three extents. This is because the first three extents of a file are listed on an FDR1 record in the VTOC and additional extents are on FDR2 records. The Operating System and segment 2 paging files are referenced so often that it would not be practical to permit more than three extents, due to the time involved in additional I/O on the VTOC.

The system generation software has no way to find out how many extents the new system occupies or how many extents will be occupied by the segment 2 paging files at IPL time. If any of these files occupies more than three extents, the CP will go into Control Mode at IPL time.

The only way to recover a disk platter in this condition is to copy the files elsewhere, and reformat the disk. Reformatting writes a new VTOC with the entire disk as one free extent. Copying everything back should clear the problem.

SECTION
6
SYSTEM
CHECK-
OUT

SECTION 6
SYSTEM CHECKOUT

6.0 GENERAL

At this point, all peripherals should be installed, powered off, and attached to their respective IOPs. Note that if the desired results are not obtained in any of the following steps, commence system-level troubleshoooting procedures.

A. Visually inspect all Mainframe logic cards for:

-appropriate switch settings on IOP's
-appropriate switch settings on device adapters (disk).
-proper cabling of peripherals (e.g., printers must be attached to port #5 on 22V01 IOPs; Ref: Figure 3-16)

B. Visually inspect all peripherals. Insure that I/O cables are properly installed, power off, and the start switches on the peripherals are in the 'inactive' state, and all covers and panels are in place on all equipment. All shielded workstation and printer cables must be fastened to the grounding panel at the rear of the Mainframe (Ref: Figure 3-2).

C. Perform the following steps:

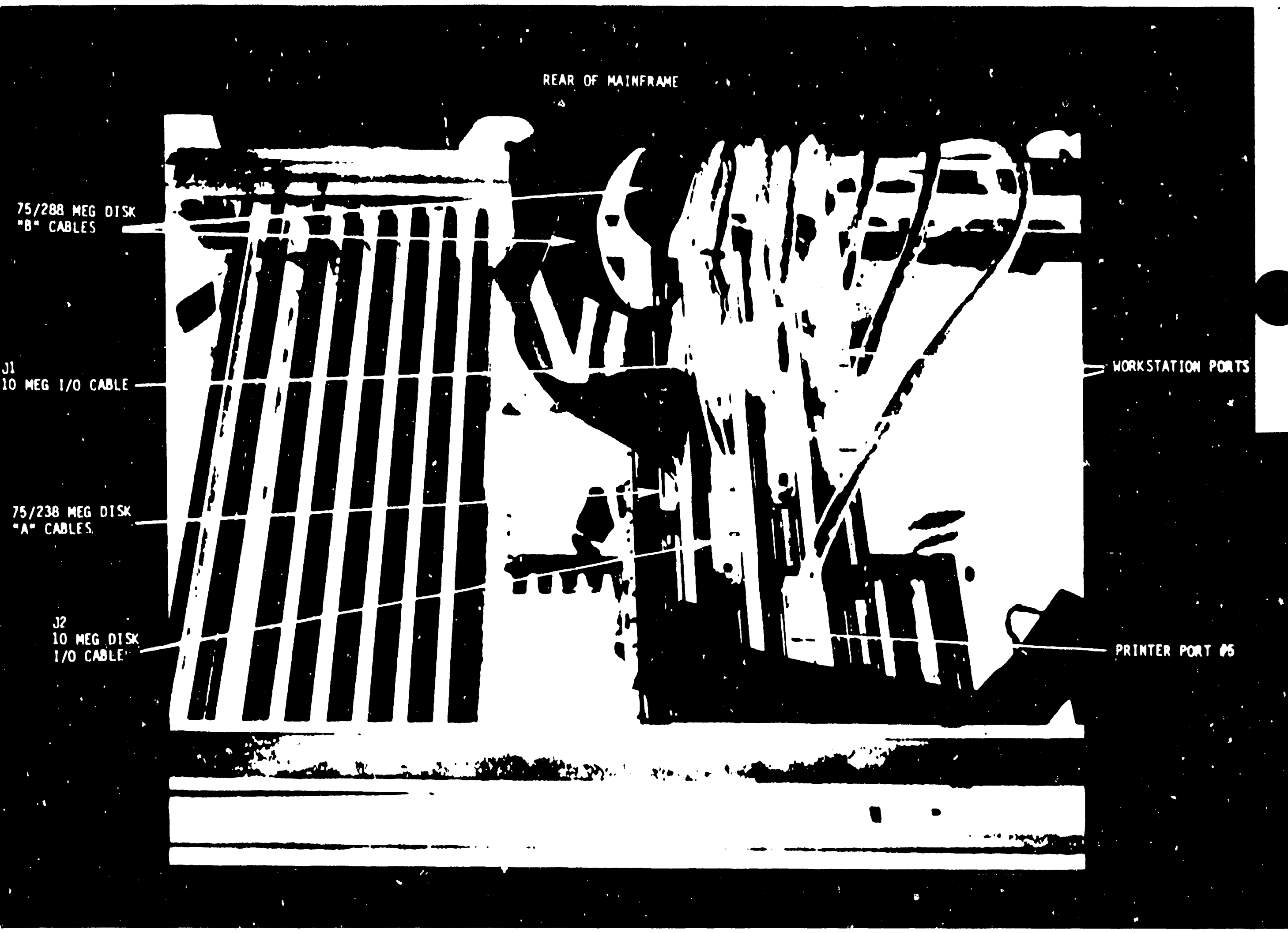
1) Power on workstation #0 (operators console). Random characters should appear on the Workstation screen.

2) Power ON one printer (Device #3); also, "ready" the printer.

3) Power ON the Mainframe. Workstation #0 should clear and "Control Mode F04" should appear on the screen.

4) To ensure that the addition of peripheral equipment has not affected operation of the CPU, execute 25 passes of the CP diagnostics. After successful completion of the CP diagnostics, execute several passes of the Main Memory diagnostic (at least 30 minutes execution time).

FIGURE 6-1



CABLING INSPECTION

5) Upon successful completion of the Memory diagnostic, return the ECC switch on the MMB to the ON position (Ref: page 3-16, and Figure 3-9). Depress the LOAD switch (IPL) on the Mainframe front panel.

6) On workstation #0, type:

(NEW LINE key)
D Ø Ø Ø Ø Ø Ø
(ENTER key)
F F F F F F
(ENTER key)

This will cause device #3 to begin printing the entire contents of memory. After printing several pages, key ENTER to halt printing.This test indicates that normal communication is taking place between the CPU and printer.

7) Power on all workstations. Note that all workstations, after warm-up period, should have random characters on screen.

8) Depress the LOAD switch (IPL) on the Mainframe front panel. All workstations should clear.

9) Power on all printers.

10) Apply AC and DC power to all disk drives attached to the mainframe. Mount a Customer Engineering Operating System pack on device #4.

NOTE:

If a Customer Engineering system pack is not available, a "SYSGEN" must be performed (applicable to all systems with 10 meg disk drives, and systems that have more than one 75/288 meg disk drive).

a) Mount a Customer Engineering scratch pack on an additional drive (if any). Bring drives up to a ready state and perform an IPL using the System pack. Note that if device #4 is a 75/288 meg disk, merely depressing the enter key on Workstation #0 will cause an IPL. If device #4 is a 10 Meg disk, type the following on Workstation #0:

(NEW LINE key)
R04
(ENTER key)

b) A prompt should be displayed on Workstation #0, requesting the date and time, and displaying the size of Main Memory. Provide the requested information and depress the ENTER key.

c) If the Operating System on device #4 was generated to match the hardware configuration of your system, a 'LOGON' screen will now be displayed at each workstation (Figure 6-2).

FIGURE 6-2:

```
                         ***  WANG VS LOGON  ***


WORKSTATION 001 READY          TIME = 13:27            DATE = 03/05/78


                              HELLO NEW USER


   PLEASE IDENTIFY YOURSELF BY SUPPLYING THE FOLLOWING INFORMATION:


                              YOUR USER ID  =
                              YOUR PASSWORD =
```

To determine if your Operating System was generated to match the hardware configuration of this system, list all peripherals attached to the Mainframe by the physical device number (determined by the IOP address switch settings). Refer to IOP installations in Section 3 of this manual if necessary. For user ID, type CSG into the logon screen of a workstation.

Once the Command Processor prompt is displayed on that screen, use PF key #4 to show "DEVICE STATUS" of the devices that are generated into the Operating System. Compare the list of devices that are attached to the CPU to the Operating System's device list. If devices attached to the CPU are not found in the Operating System's device list, or if the devices listed do not match up with the actual devices that are attached to the Mainframe, a new Operating System must be generated.

11) Perform Initialize and a Compatability check on all drives as follows:

<u>For systems with a single 75/288 megabyte disk drive attached:</u>

a) Mount and IPL from the Floppy diagnostic containing the program 'DISKINIT' along with a modified version of the Operating System. Using the verify option of the DISKINIT program, verify the Customer Engineering Operating System pack mounted on device #4. The verify should complete with no errors logged in the Error Log.

b) Next, mount a Customer Engineering 'scratch pack' on device #4. Using the 'initialize' option of the DISKINIT program, initialize the scratch pack on device #4. After completion of the initialize function, perform a verify on the pack. Both these functions should complete without error.

c) Mount a Customer Engineering Operating System pack and IPL.

For systems with a single 10 meg disk drive attached:

a) Execute the program "DISKINIT." Using the 'initialize' option of the program, initialize the fixed platter of the disk drive (F04). After completion of the initialize function, perform a verify on the pack by using the 'verify' option of the program.

b) Execute the program "BACKUP." Perform a Backup of the active volume onto the fixed platter. After completion of the Backup program, perform a verify of the fixed platter.

c) Perform an IPL from the fixed platter of device #4 by depressing the LOAD button on the front panel of the Mainframe. On Workstation #0, depress the ENTER key.

d) Log on to a Workstation and repeat steps 12 a) and b); this time perform the operation on the removable platter (R04). No errors should be logged in the error log during this procedure.

For multiple disk systems:

a) Execute the program "DISKINIT." Using the 'initialize' option of the program, initialize the scratch pack mounted on the additional drive.

b) After completing initialization, perform a verify of the pack using the verify option of the DISKINIT program.

c) Dismount the scratch pack and mount it on another drive (if there is another drive on the system).

d) Repeat steps 13 a) and b) for all additional drives.

e) After all additional drives have been initialized and verified, mount the scratch pack on device #4 and mount a Customer Engineering Operating System pack on device #5.

f) IPL from device #5. Execute the DISKINIT program, and using the verify option, perform a verify on the Customer Engineering scratch pack mounted on device #4.

g) Upon successful completion of the verify function, perform an initialize operation on device #4 (upper and lower platters if that drive is a 10 megabyte unit).

h) Again, perform a verify on device #4.

i) Execute the program "BACKUP." Perform a Backup of the active volume (device #5) onto device #4 (fixed platter if 10 meg). After program completion, perform an IPL from device #4 by depressing the LOAD switch on the front panel of the Mainframe. On Workstation #0, key ENTER.

j) Perform a verify on device #5 (removable if 10 meg drive).

k) After completion of the verify, dismount the System pack from device #5 and sucessively mount and verify that pack on each drive, thus checking compatability between disk drives.

l) No I/O errors should be incurred during this process.

12) Check out all printers attached to the system.

a) Release all printers from the System Spooler. To accomplish this, on Workstation #0 (printer status display screen), do the following:

- Press the PF key corresponding to the desired printer (e.g. for printer #3, press PF key #5; for printer #15, press PF key #6).

- A prompt will be displayed, allowing the following options for the selected printer.

  - Return to Main Status Display
  - IDLE
  - Release Printer

- Depress PF key #3 to release a printer.

b) Execute diagnostic "TESTPRNT". The printer must be in the 'released' mode. Note that TESTPRINT will not run on a printer that is in use by the system spooler.

1) Use option to print the character set; ripple one character at a time. (PF key 1)

2) Check print quality.

3) After several pages of print, terminate the TESTPRINT program. Using the same procedure as the one for printer release, place the printer in the "IDLE" mode.

4) Perform same test for all printers attached to the system.

15) Check out Tape Drive(s).

a) Mount a Customer Engineering scratch tape on a tape drive.

b) Execute diagnostic "TPTEST". Perform "Miscellaneous Tests" (PF 5) on that tape drive for 20 passes.

c) After completion, dismount Customer Engineering tape, mount on additional tape drive (if any) and repeat process.

d) No I/O errors should be logged during process.

16) Check out workstations.

To perform the following section, it is necessary to provide valid user IDs to facilitate execution of programs at each workstation simultaneously. If sufficient user IDs are not available, then execute the "SECURITY" program. Add IDs so that there is one for every workstation attached to the system (not including W/S #0).

a) LOGON a workstation.
b) Execute diagnostic "WSTEST"* from the library @SYSTST@.
c) The diagnostic provides the capability of testing each key on the keyboard, and of displaying the keys in various modes. Also, check the display for proper focus and character display in the following modes:

- low intensity mode
- blank mode
- numeric only mode
- non-display mode
- uppercase lowercase mode

*If the WSTEST program fails with the message "CURSOR NOT AT COLUMN 1", then the microcode in the 22V01 IOP should be updated. The test IODWS runs on 22V01 microcode, rev 0 and rev 1. WSTEST runs on rev 2 and above.

There are also provisions for testing of the ERASE, INSERT and DELETE keys. Using these functions, test all keys on the keyboard, with the exception of the program function keys. Note that at present, diagnostics are not available to test PF keys; but, a test of all lowercase PF keys can be accomplished by accessing different functions from the Command Processor. (Ref: Vol 1, 2200VS)

d) After all keys have been tested on the Workstation, press the "ENTER" key to allow the WSTEST program to continue. Proceed on to the next workstation until all workstations have been tested.

e) WSTEST should now be running error-free on all workstations.

17) Final Checks:

a) Attach a line analyzer to the 2200VS Mainframe A.C. line.

b) Mount scratch packs on all additional disk drives attached to the system. Note that the Customer Engineering Operating System pack should be mounted on Device #4.

c) Terminate some of the WSTEST programs in order to execute certain other diagnostics. The LMT2 diagnostic will cause program page-ins and page-outs on the Operating System pack. Also, execute diagnostic "DKTEST" on all additional volumes mounted on system. And finally, execute diagnostic TPTEST on all tape drives.

d) Allow the following programs to run simultaneously for at least eight hours.

- LMT2
- DKTEST on each additional disk volume
- WSTEST (on remainder of workstations)
- TPTEST (2 hrs max)

e) If all of these tests are completed, error-free, the system can now be readied for turnover to the customer.

SECTION 7 DIAGNOSTICS

SECTION 7
DIAGNOSTICS

7.1 GENERAL

To the date of this printing, the following diagnostics are either available on diskette, or are resident on the user's library @ SYSTST @.

DEVICE TEST DIAGNOSTIC	(WL Diskette #701-2343)
DISK VERIFY DIAGNOSTIC	(WL Diskette #701-2345)
FIELD TEST UNIT SIMULATOR	(See Computer Systems Newsletter #77)
PRTEST DIAGNOSTIC	(Resident on library '@ SYSTST @')
DKTEST DIAGNOSTIC	(Resident on library '@ SYSTST @')
TPTEST DIAGNOSTIC	(Resident on library '@ SYSTST @')
WSTEST DIAGNOSTIC	(Resident on library '@ SYSTST @')

7.2 DEVICE TEST DIAGNOSTIC (WL Diskette #701-2343)

A. OBJECTIVES:

1) To identify the system device configuration and list it on Workstation #0.

2) To give each device an operation to perform and present an analysis of the results via Workstation #0 (disks) or by direct observation (workstations, printers).

3) To report the names of all mounted volumes.

B. OPERATION:

1) Mount the diskette.

2) Bring all devices to their ready state.

3) Press the Mainframe LOAD buttom to clear any unsolicited device-ready interrupts.

4) IPL from the diskette.

5) Observe the screen of Workstation #0.

6) The results will roll up from the bottom of the screen. If more than 5 IOPs are in the system, the first data will roll off.

7) Every workstation screen (with the exception of Workstation #0) will fill with the word "TEST", and the alarm will sound.

8) Every printer will print a line of the character "A" and then do a Top-of-Form.

9) The program will hang (branch-to-self) at the end. Use the LOAD button to terminate the program.

NOTES:

a) There is a 34-second timeout for every I/O operation. If a 75 or 288 MEG disk has CRC errors, it may take as long as two minutes to determine the size of the disk and its error condition. The program can not hang up until it has finished. BE PATIENT!

b) The program code is not re-entrant. To run the program again, reload it.

c) Running this program will upset the real time clock. When an IPL (from Operating System) is performed after this test, the IPL will request a date and time entry. Enter the correct date/time.

C. KNOWN ANOMALY:

A 75/288 MEG disk or tape drive not operating or cabled will be indentified as a "????".

D. GENERAL THEORY

1) MEMORY SIZE

Workstation #0 is used to determine the size of the Main Memory. Before any peripheral devices are identified, Workstation #0 is commanded to read into the bottom half of the eighth memory card. If BIT 10 (address error) in the IOSW is set, the read address is decremented by half a board, and the command is repeated. The process is repeated until BIT 10 is reset. Workstation #0 displays the result.

2) DEVICE IDENTIFICATION

To identify the system device configuation, the program issues illegal or invalid read commands to each peripheral device, and examines their responses.

First, an IOCW is established to read 2K from block 33,554,732 into memory location X'8000'. A workstation order area also specified, in case the device under test is a workstation. (The "order area" is an extension of the IOCW for workstation commands only.) The order area says to read the screen, starting at Row 255 (an illegal row).

These commands are invalidated for every device (except a tape drive), each for a different reason. The type of invalidation is used to determine the type of device.

- A tape drive should read, possibly with an indication of incorrect length (bit 13 of the IOSW is set).

- A disk rejects the command with BIT 20 of the IOSW set (illegal disk address).

- A workstation rejects the command with BIT 24 of the IOSW set (order check).

- A printer rejects the read command as invalid (BIT 8).

If the Order Check bit (bit 24 of the IOSW) is on, the device is not necessarily a workstation; it could also be a write-protected diskette in the floppy drive. The distinction is found by changing the workstation order area to read from Row 1 (now a legal read). If the order check bit is then reset, the device is identified as a workstation.

The program cycles through every possible device address in HEX from 01 to FF (0-255). Device #0 is not checked like the others, because it is the system console. It is used to start the program, and it is the only device that can be counted on to present the test results. (There may not be a usable printer.)

3) DISK STORAGE CAPACITY

When a device in identified as a disk (by the procedure in step 2), additional IOCWs are issued to that device to determine its storage capacity. The result of this determination is displayed on the screen of Workstation #0. Disk block zero is read first; this gives the VOLUME NAME.

The next IOCW addresses the last block of a 10 Meg Disk. If the command is invalidated as an illegal disk address, the device is identified as a floppy, and this result is displayed.

However, if that disk address is valid, a new IOCW addresses the last block of a 75 Meg Disk. If the new command is invalidated, the device is a 10 Meg Disk, and this result is displayed.

If that disk address is valid, a new IOCW addresses the last block of a 288 Meg Disk. If the command is invalidated, the device is a 75 Meg disk. If the response is valid, the device is a 288 Meg Disk. In each case, the results are displayed.

7.3 DISK VERIFY DIAGNOSTIC (WL Diskette #701-2345)

A. PURPOSE:

This diagnostic does a sequential read of each track on any model disk, while checking for errors. Unlike the error log which prints errors as hexadecimal block numbers, this program reports errors by cylinder and surface, in decimal. The cylinders are numbered from the edge (zero) to the hub (76, 407, or 821). The disk surfaces are numbered from top to bottom, starting with zero. All floppy disk errors report as disk surface zero. This program is a stand alone type; that is, the system must IPL from this diagnostic diskette, instead of from an operating system.

B. **PROCEDURE:**

The disk to be tested must be brought to the ready state before starting. Press the load button on the CP to clear the "ready" interrupt from the device(s). DO NOT USE THE HELP KEY ON ANY WORKSTATION AT ANY TIME.

IPL from the floppy diskette. Workstation zero will display:

DEVICE NUMBER?_____ PF1=DECIMAL, PF2=HEX.

If the above message does not appear, it means that the program disk is unreadable.

Fill in the blank area with the device address of the disk to be tested, either in HEX or in DECIMAL. Press the PF1 key if the address was entered in decimal, or the PF2 key if the address was entered in hex. For any of the four errors that follow, the number that was keyed will be erased, and the question will be asked again.

1. Illegal digit in number.
2. Entry made by key other than PF 1 or PF 2.
3. Device selected cannot be identified as a disk.
4. Program hangs -- a nonexistent IOP has been addressed.

NOTE

The selected device is actually tested to verify that it is a disk. The configuration in the Operating System is meaningless here, because the Operating System is not loaded or running.

If the device is a disk, the program will identify the model and verify block zero. Workstation #0 will display the following:

DEVICE (YOUR NUMBER) IS A DISK (MBYTE CAPACITY) VOLUME NAME

The message may also report a soft or hard error on this line. If the disk is a 10 MEGABYTE, the volume name will be followed by the word

"FIXED". The fixed disk will be verified. The above message will then be repeated with the word "REMOVABLE", and the removable disk will then be verified.

When the test is over, "TEST DONE" will appear and the program will hang. Errors are reported in the following format:

CYLINDER ### SURFACE ## HARD/SOFT ERROR ERROR TYPE

The errors will roil up from the bottom of the screen. Error types are CRC, header, sector overrun, seek incomplete, not ready during operation, timeout, and short sector. Any other error will report as "UNKNOWN".

This program takes almost nine minutes to complete a normal verify on a 288 MEGABYTE disk. It cannot hang up because a 34 second timeout is built into every I/O operation.

NOTE:

Do not stop this program and step it in the control mode. Stepping through this program will result in nothing but timeout errors, since the real time clock is always running.

To verify a floppy diskette other than the program diskette, change platters while the device address input message is displayed.

C. KNOWN ANOMALY:

If errors are displaying on screen rapidly, pressing the HELP key may stop the program for 34 seconds. This may be useful for reading the screen; however, the next track will be skipped with a timeout message.

7.4 PRTEST DIAGNOSTIC

PRTEST, a file in the library @SYSTST@, can be used as an on-line printer diagnostic. The library @SYSTST@ is found on the User's Operating System Volume.

Normally, all printers are acquired (under the control of workstation zero), and the printer under test must first be released from workstation zero before it can be tested. The PRTEST diagnostic will be controlled from some other workstation.

When reading the following explanation, refer to Figure 7-1. The diagnostic defaults to device address 3. If printer 3 is already released, the options menu (Figure 7-2) will be displayed and the test can begin.

In order to test a printer other than 3, the operator must first acquire printer 3 on workstation zero, thus making it unavailable for testing. Acquire printer 3 by using PF5 on workstation zero. When the operator tries to run PRTEST, once printer 3 is acquired, a device possession conflict screen will be displayed at the controlling workstation, allowing the operator to enter the device address of another printer.

NOTE:

A device possession conflict screen will be displayed whenever the operator tries to test a printer that is is presently acquired by Workstation 0.

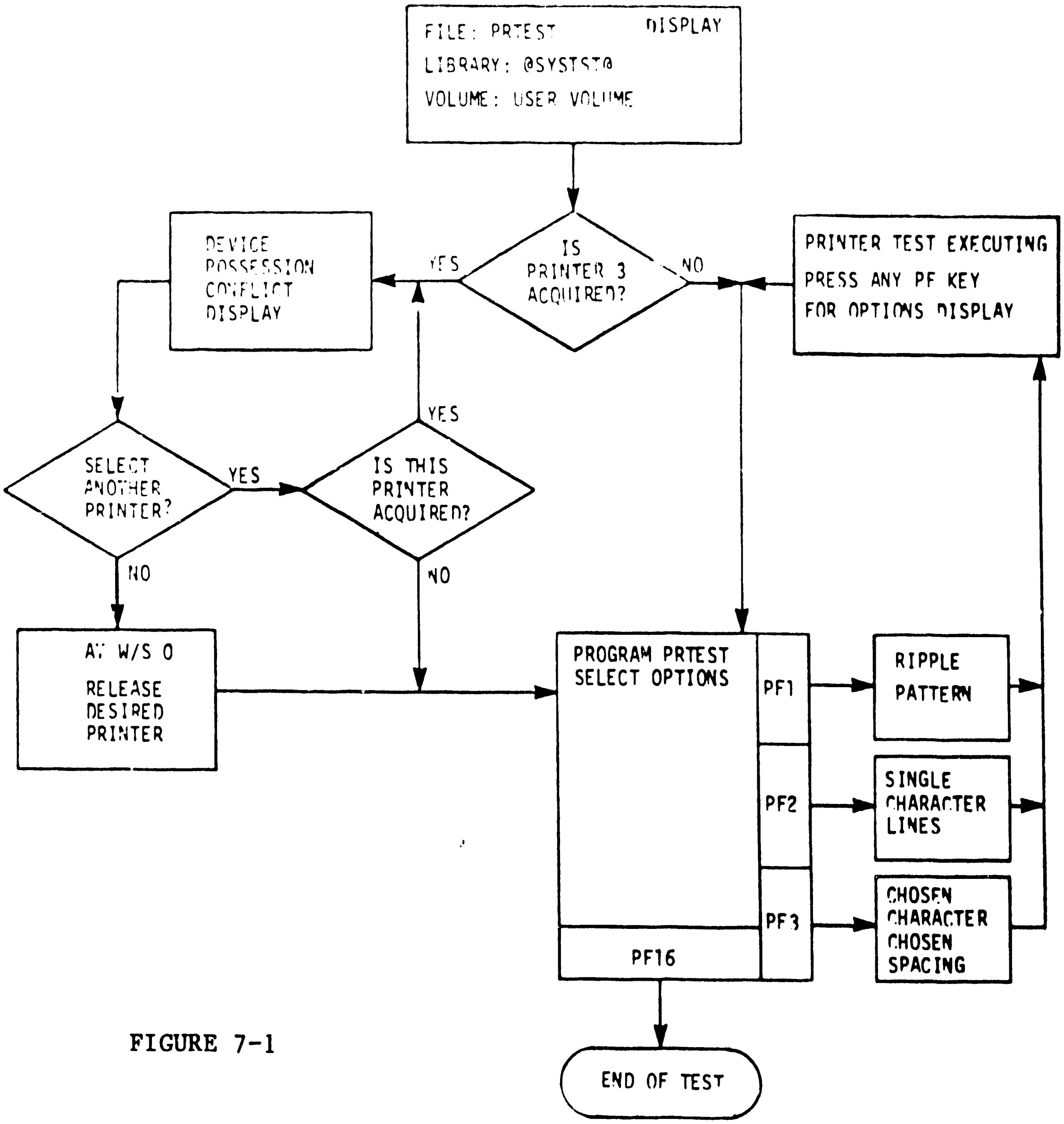


FIGURE 7-1

By using the appropriate PF key at workstation zero, any printer can be released for test (provided that it is not printing). Once the options menu is displayed (see Figure 7-2), the operator can select any of three tests:

Test one (PF1) will print a rippled character set. The character set displayed at the bottom of the options menu is the standard 64 character set.

Test two (PF2) will print a full line of each character, until the entire character set is printed.

Test three (PF3) will repeatedly print any chosen character, while leaving a selected number of spaces (0 through 9) between characters.

The operator can stop the current test and return to the options menu simply by pressing any PF key. When the options menu returns to the screen, PF16 will terminate the program. After the program is terminated, reacquire the printer by means of the appropriate keys on workstation zero, to resume normal printing operations.

```
***MESSAGE 001 BY PRINT
            RESPONSE REQUIRED BY PROGRAM PRTEST
                     TO SELECT OPTIONS

PRINTER TEST
PLEASE USE THE PROGRAM FUNCTION KEYS TO SELECT A COMMAND:

(1)  PRINT CHARACTER SET, RIPPLE 1 CHARACTER AT A TIME
(2)  REPEAT ONE CHARACTER PER LINE
(3)  PRINT CHAR =    WITH SPACES BETWEEN OCCURRENCES:
     SPACES =
(16) END OF JOB

CHARACTER SET =
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[ ]^_
```

FIGURE 7-2

7.5 DKTEST DIAGNOSTIC

A. GENERAL

DKTEST is an on-line diagnostic for checking the operation of the 2270V Floppy, the 2260V (10 MEG), the 2265V-1 (75 MEG), and the 2265V-2 (288 MEG) disk drives.

It can be found in library @SYSTST@ on the users Operating System volume. The tests that are found in DKTEST are:

1. Disk I/O test.
2. Disk timing test.
3. Error correction code test.
4. Read one spot on disk.
5. Write one spot on disk.
6. Read and write one spot on disk.
7. Test entire disk for correct I/O (a test that reads and writes every sector on the disk except for 0 and 1).
8. An option to modify the test data used in reading and writing.

B. 'PREPARATION

Before running any of the tests, mount an initialized disk pack on the drive to be tested, using the normal MOUNT function. The volume must be mounted for exclusive usage (EX).

If for any reason the test is canceled by use of the HELP key, the disk pack must be reformatted (using the utility DISKINIT) before it can be used again for any purpose.

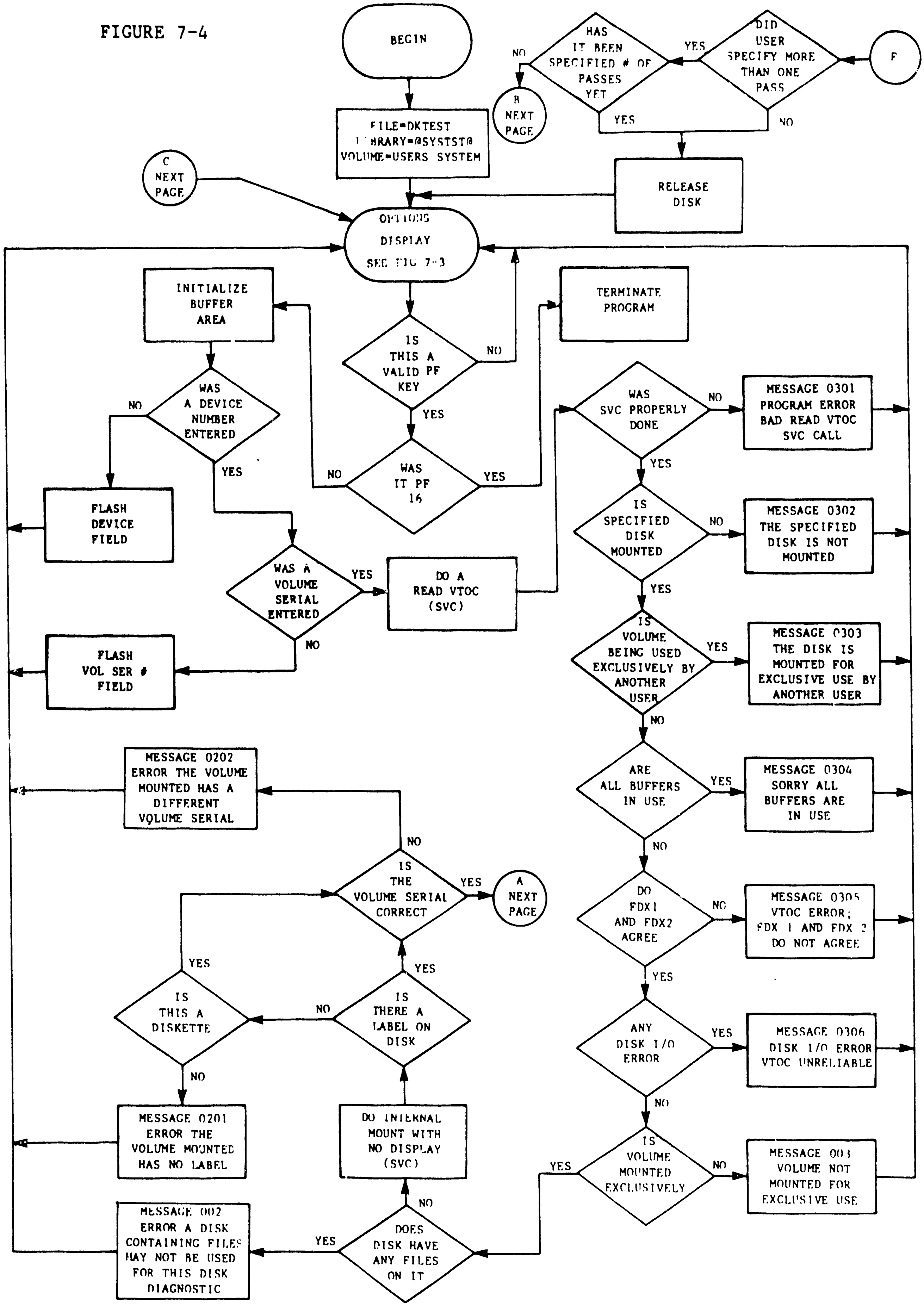
C. CONTROL PROGRAM

Refer to Figures 7-4 and 7-5 during the following explanation. After the initiation of DKTEST from the workstation, the standard options display will appear on the screen. See Figure 7-3. Notice the message "THE SPECIFIED DISK IS NOT MOUNTED." Any error resulting from the operations in Figures 7-4 and 7-5 will be displayed in this same area of the screen. Also notice the bottom line, "REPEAT = 1 TIMES." This is a modifiable field that allows any selected test to be repeated a specified number of times. Before selecting a test, enter the device number of the drive to be tested and the volume name of the disk that was mounted.

```
***     MESSAGE 0302 BY DKTEST

             CORRECTION REQUIRED BY PROGRAM DKTEST
                       TO DEFINE OPTIONS

THE SPECIFIED DISK IS NOT MOUNTED

     DEVICE =              VOLSER =

                (2)  DISK I/O TEST
                (3)  DISK TIMING TEST
                (4)  ERROR CORRECTION CODE TEST
                (5)  READ ONE SPOT ON DISK
                (6)  WRITE ONE SPOT ON DISK
                (7)  READ AND WRITE ONE SPOT ON DISK
                (8)  SEEK ONE SPOT ON THE DISK
                (9)  TEST ENTIRE DISK FOR CORRECT I/O
                (15)  MODIFY TEST DATA
                (16)  END OF JOB

     REPEAT    =      1 TIMES
```

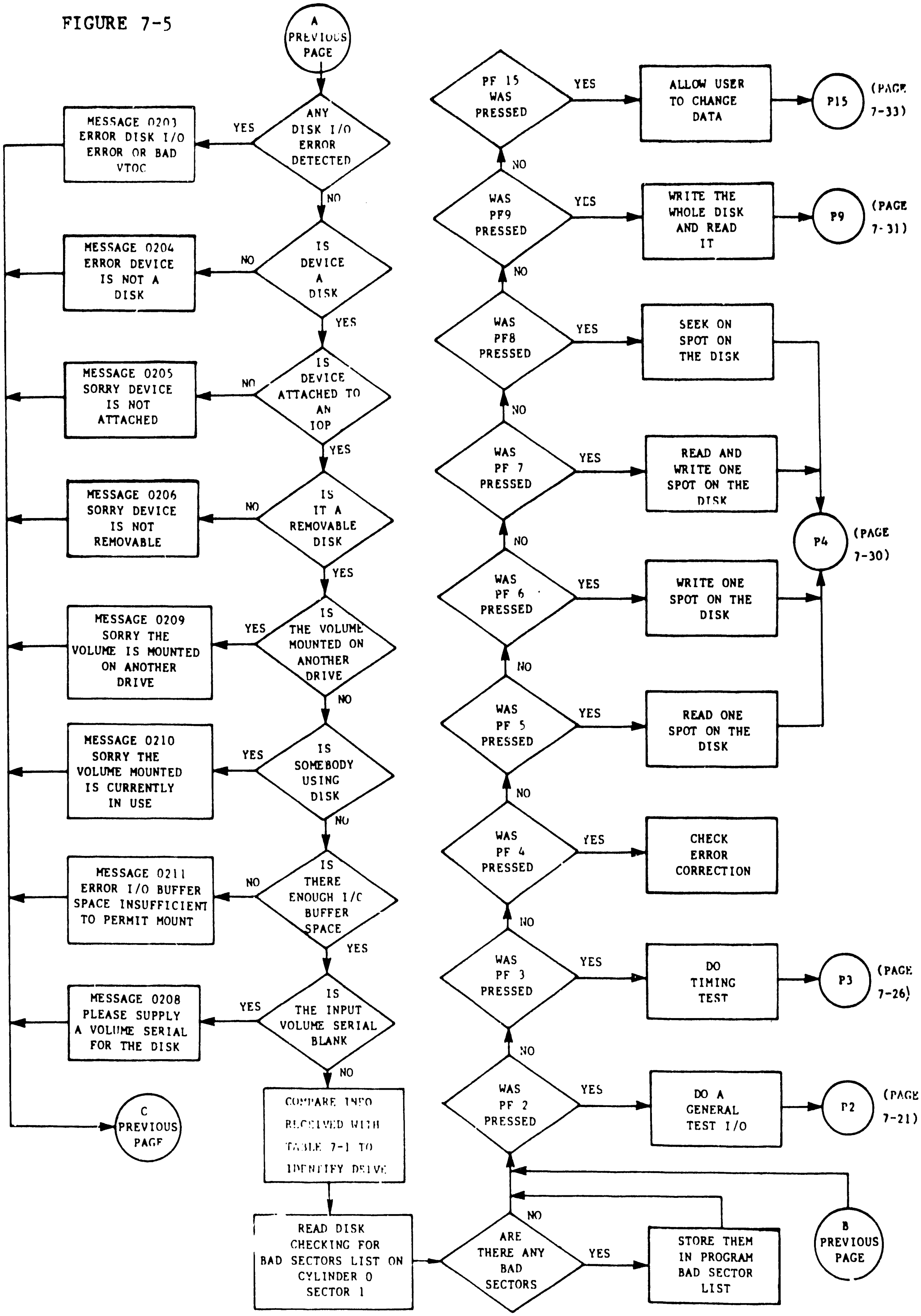
FIGURE 7-3

FIGURE 7-4



FLOWCHART 1A DKTEST CONTROL PROGRAM

FIGURE 7-5



FLOWCHART 1B DKTEST CONTROL PROGRAM

The control program performs the following steps, in order:

1) See Figure 7-4. Whenever a test is selected, the control program initializes a buffer area in memory for reading and writing.

2) The control program attempts to read the VTOC of the specified volume; it uses an SVC READVTOC to accomplish this. An SVC instruction is used as the normal interface between user programs and supervisory routines. After the SVC is accomplished, the control program checks the return code for errors and identifies the error type. For more information about the SVC's used in this program, refer to the 2200VS System Programmers Guide.

3) The control program does an SVC MOUNT, used to mount the volume parameters into the program. There will be no mount display since this is an internal mount. Several of the error conditions generated by the mount will, in reality, never be seen, because errors resulting from the SVC READVTOC will occur first. For example, if the disk is not attached to an IOP, the error message from the READ VTOC will say "THERE WAS A DISK I/O ERROR, VTOC UNRELIABLE" rather than "SORRY DEVICE IS NOT ATTACHED."

4) The control program compares all of the information received up to this point with its Disk Characteristics Table (see Table 7-1) to determine what type of disk drive it will be testing. Table 7-1 shows the type of parameters the program uses when it tests the disk drive.

5) Next, the control program reads the bad extents list on cylinder 0 sector 1, checking for bad sectors. If the program finds any bad sectors, it stores them in its bad sector list for later use.

	DISKETTE			10 MEG			75 MEG			288 MEG		
	OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX
# OF CYLINDERS	115	77	4D	630	408	198	1467	823	337	1467	823	337
ABSOLUTE # OF SECTORS	232	154	9A	4620	2448	990	110253	37035	90AB	1042675	140733	225BD
SECTORS PER TRACK	2	2	2	3	3	3	11	9	9	11	9	9
SECTOR SIZE IN BYTES	4000	2048	800	4000	2048	800	4000	2048	800	4000	2048	800
TRACKS PER CYLINDER	1	1	1	2	2	2	5	5	5	23	19	13
SECTORS PER CYLINDER	2	2	2	6	6	6	55	45	2D	253	171	AB
MINIMUM SEEK TIME IN MICROSECONDS (10)	11,000			9,000			6,000			6,000		
MAXIMUM SEEK TIME IN MICROSECONDS (10)	847,000			130,000			55,000			5,500		
ROTATION TIME IN MICROSECONDS (10)	167,000			25,000			16,660			16,660		
TIME FOR ONE SECTOR TRANSFER IN MICROSEONDS(10)	83,500			8,333			1,851			1,851		

TABLE 7-1 DISK CHARACTERISTICS

6) Finally, depending on which key was depressed, the control program will do the particular test that was requested.

NOTE:

Even when "modify test data" is selected, the program will perform all the previous steps first. When the test is finished, the control program will repeat the test the specified number of times. If more that one pass was not specified, the program will return to the main options display.

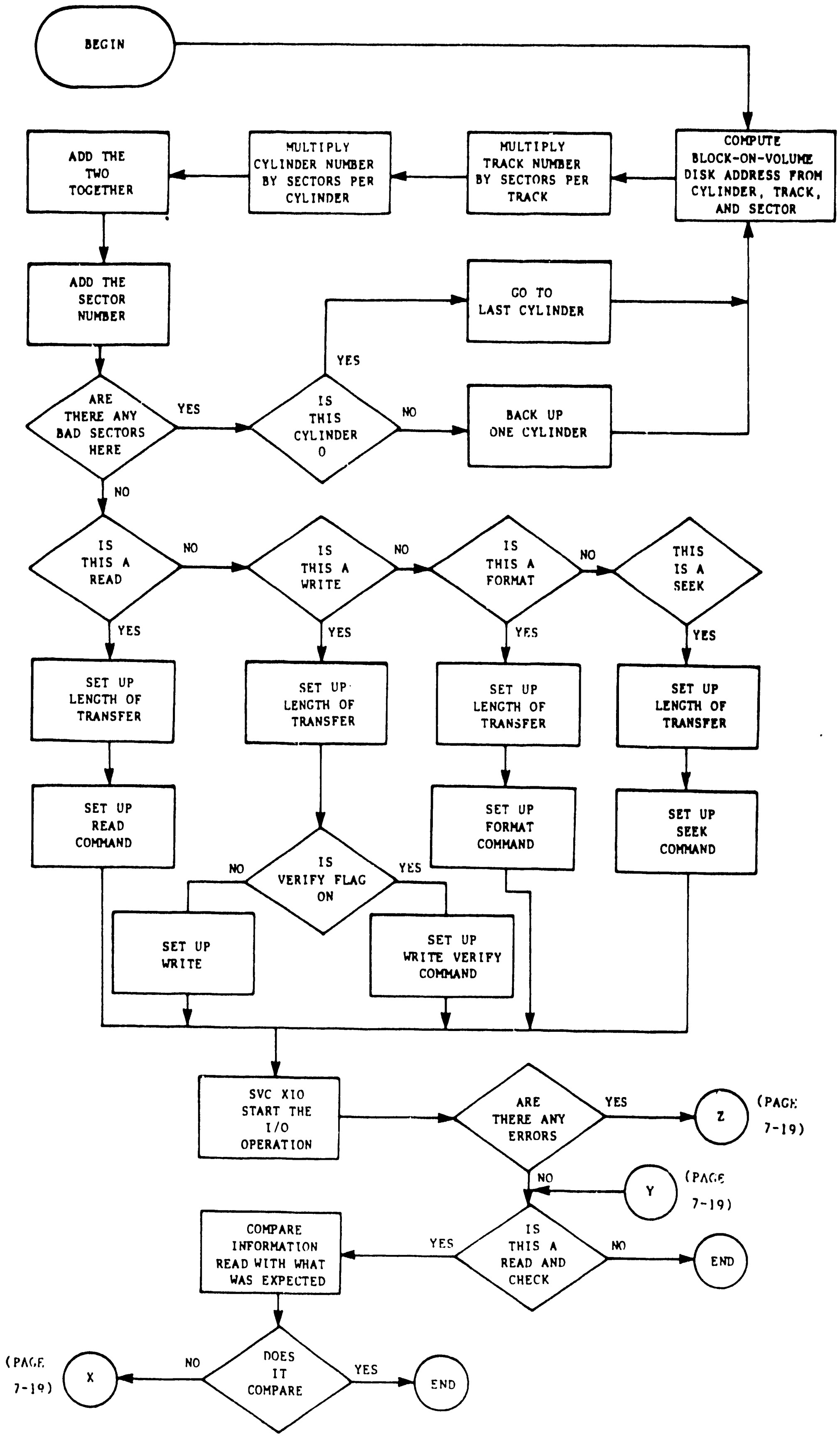
D. PROGRAM FLOW

Following is a discussion how the program actually operates the disk and how errors are handled.

When the program reads, writes, write verifies, formats, seeks or reads and checks, it uses the same procedure every time. The program first computes an absolute sector disk address using the algorithm shown in the Figure 7-6.

Next, the program examines the bad sector list to determine if the computed address is there. If it is, the program will back up one cylinder and compute a new address that is not on the bad sector list, unless it is at cylinder 0. In this case, it will go to the last cylinder and try again. When the program has finally computed an address that is not on the bad sector list, it sets up the appropriate IOCW and performs an SVC XIO, which is, in essence, a Start I/O. When the requested operation is over, the program checks the return code for errors.

FIGURE 7-6



FLOWCHART 2 READ. WRITE. WRITE VERIFY, FORMAT, SEEK, READ AND CHECK

For a read and check operation (with no unexpected errors), the program compares the data read with the data expected; if it doesn't compare, an error display will appear on the screen. The handling of errors is discussed in the next paragraph. If there are no errors, the program returns to the sub-program that requested the I/O operation.

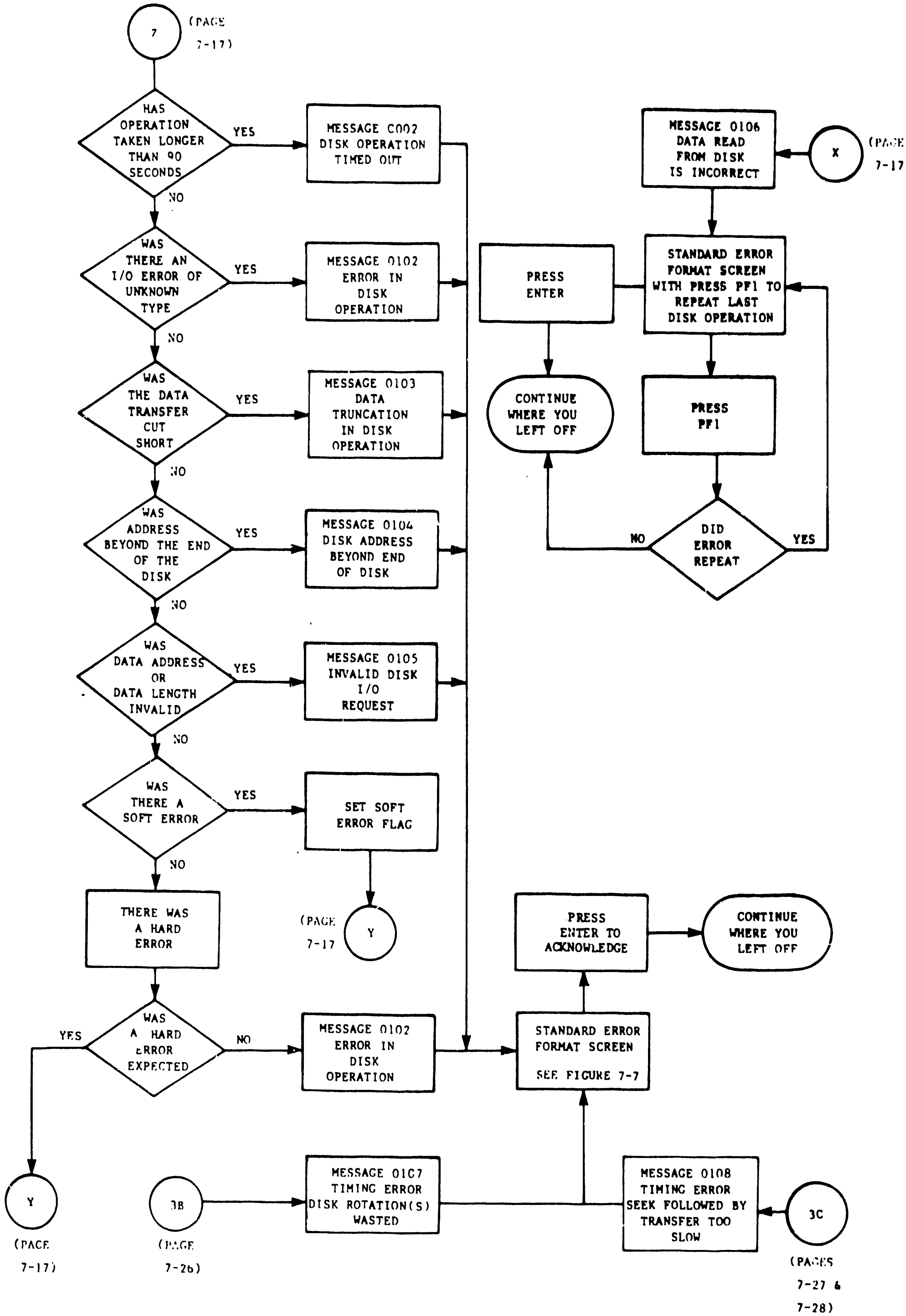
HANDLING OF ERRORS

Whenever the program finds errors from an I/O operation or from timing, they are all handled the same way. See Figures 7-7 and 7-8. Notice that the display contains an error message, the last command, the length of transfer, the I/O status word, the virtual location of the write buffer, and the virtual location of the read buffer.

```
***        MESSAGE 0104 BY DKTEST

                  RESPONSE REQUIRED BY PROGRAM DKTEST
                         TO ACKNOWLEDGE ERROR

DISK ADDRESS BEYOND END OF DISK

     LAST COMMAND = 40        LENGTH = 14336      IOSW = 40000000 000000
     I/O BUFFER AREAS       WRITE BUFFER  239000     READ BUFFER  234800

  PRESS "ENTER" TO CONTINUE
```

FIGURE 7-7

FIGURE 7-8



FLOWCHART 3 ERROR HANDLING

E. TEST OPTIONS

Following is a discussion of each individual test.

1) DISK I/O TEST

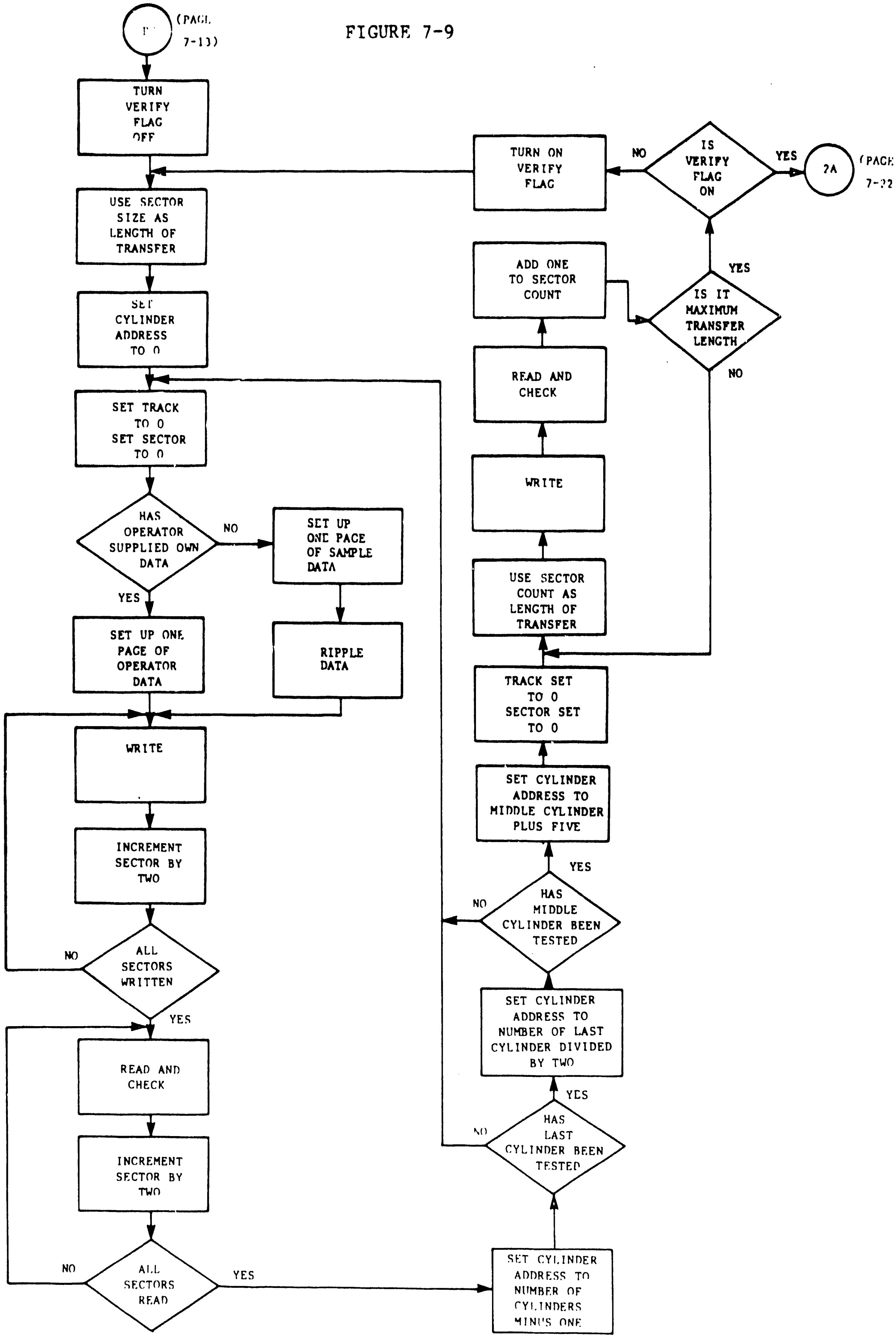
The DISK I/O TEST is divided into three main parts: a 'cylinder test', a 'sector table test', and a 'format test'. The disk I/O test is selected by the PF2 key.

Cylinder Test - See Figure 7-9. The first time through the cylinder test, all writes are plain writes; the second time through, all writes are write verifies. First, all sectors on cylinder 0 are written then read; the data is then checked. The last and middle cylinder are then tested the same way. Next, using the middle cylinder plus five and a sector count as the transfer length, the program writes, reads, and compares the data, while incrementing the sector count, until a maximum transfer length is reached.

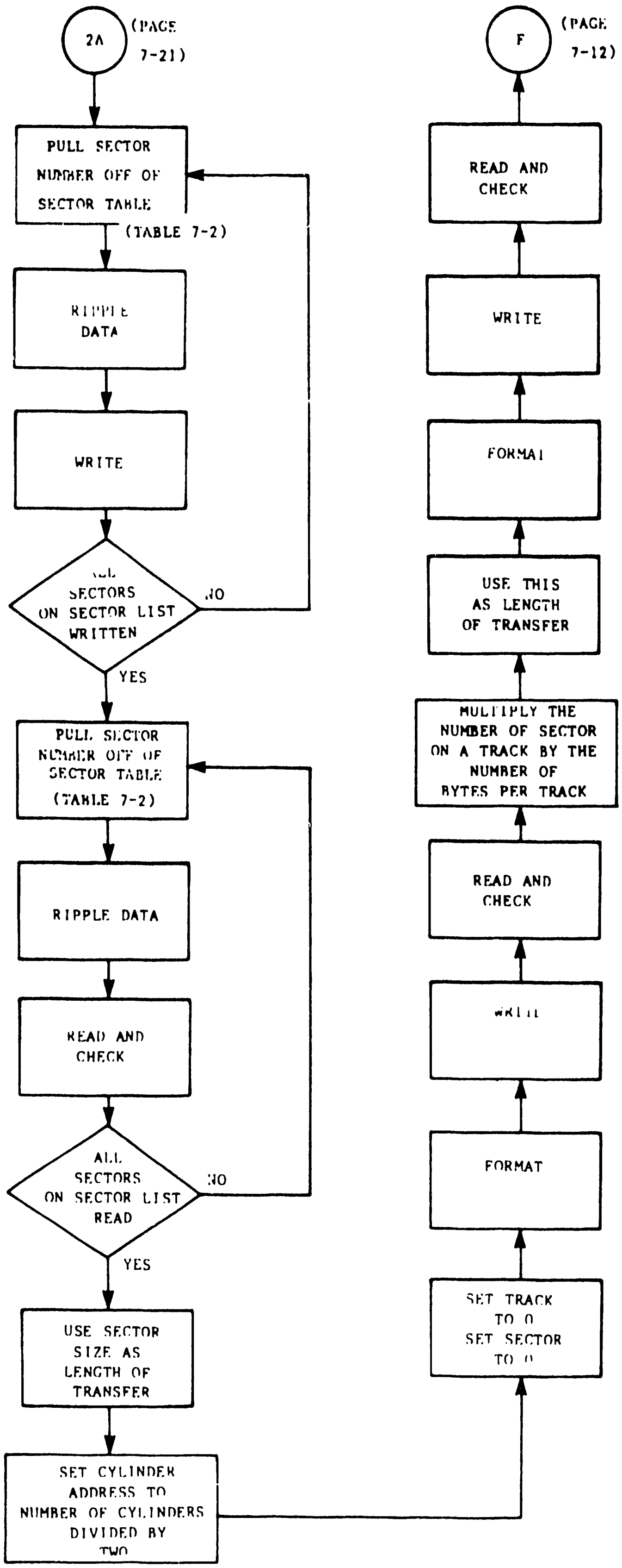
Sector Table Test - See Figure 7-10 and Table 7-2. The program pulls the sectors off of the table, one at a time. The first time through the table, it writes on all the sectors listed. The second time through the table, it reads all the sectors listed and checks the data read for accuracy.

Format Test - See Figure 7-10. Using the middle cylinder, track 0 sector 0, and a one sector transfer length, the program formats, writes, and "reads and checks" the data received. Then, using a transfer length equal to the sectors per track multiplied by the bytes per track, the program formats, writes, and "reads and checks" the data received once again. When this part of the test is completed, the program returns to the DKTEST control program (See Figure 7-4, circle F).

FIGURE 7-9



FLOWCHART 4A DISK I/O TEST



FLOWCHART 4B DISK I/O TEST

DISKETTE SECTORS			10 MEG SECTORS			75 MEG SECTORS			288 MEG SECTORS		
OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX
5	5	5	1601	897	381	22600	9600	2580	260277	90303	160BF
74	60	3C	3244	1700	6A4	42200	17536	4480	332644	112036	1B5A4
2	2	2	4256	2222	8AE				7	7	7
231	153	99	27	23	17				421340	140000	222E0
132	90	5A	461	305	131						
			2424	1300	514						

TABLE 7-2 SECTOR TABLE FOR DISK I/O TEST

2) DISK TIMING TEST

The disk timing test, accessed by the PF3 key, tests for two possible types of errors (see Figure 7-8): disk rotations wasted, and transfer too slow errors (a seek followed by a transfer of information happening too slow). See Figures 7-11 and 7-12.

```
***     MESSAGE 0401 BY DKTEST

            RESPONSE REQUIRED BY PROGRAM DKTEST
                    TO ACKNOWLEDGE HALT



THE DISK TIMING MUST BE THE ONLY RUNNING PROGRAM ON THE SYSTEM.
   PLEASE HALT OR CANCEL ALL OTHER TASKS, THEN PRESS (ENTER).
```

FIGURE 7-11

When the PF3 key is pressed, a display informs the operator that the disk timing test must be the only program running on the system. Inform all other system users before beginning this test.

When ENTER is pressed, the program runs the first portion of the disk timing test, which checks for wasted rotations. First, the program establishes a minimum "same track" seek time to be used for the rest of the program. Then, using the middle cylinder, it tries varying length transfers, always checking to see if they can be accomplished within a minimum allowable time. If they cannot, a missing rotation error occurs.

The next major portion of the disk timing test uses a list of sectors from Table 7-3 (Ref: Figures 7-13 and 7-14, and Table 7-3). The program writes, reads, and checks data; and at the same time, the program varyies cylinder, forward and reverse, and then repeats this operation while varying the track. Any error that occurs here will be of the "transfer too slow" type.

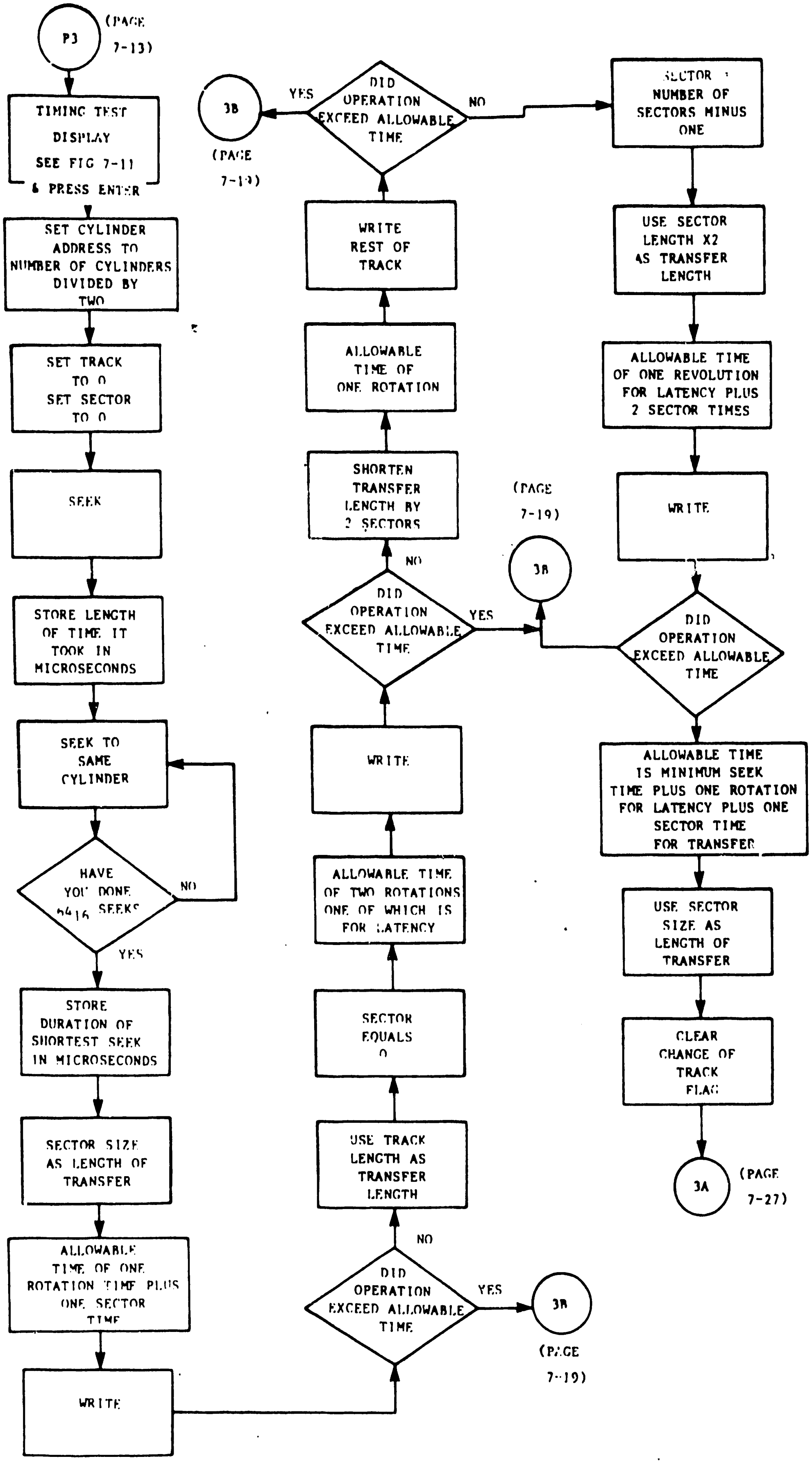
Next, the program tests the middle cylinder and the cylinders that are seven cylinders from the middle cylinder (ahead and behind), again checking for "transfer too slow" errors.

The last portion of the disk timing test commands a disk drive seek from cylinder 0 to the last cylinder and then back again, all the while checking for "transfer too slow" errors. When this step is completed, program returns to the DKTEST control program (see Figure 7-4, circle F).

OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX	OCTAL	DECIMAL	HEX
0	0	0	3	3	3	14	12	C
2	2	2	22	18	12	23	19	13
5	5	5	2	2	2	10	8	8

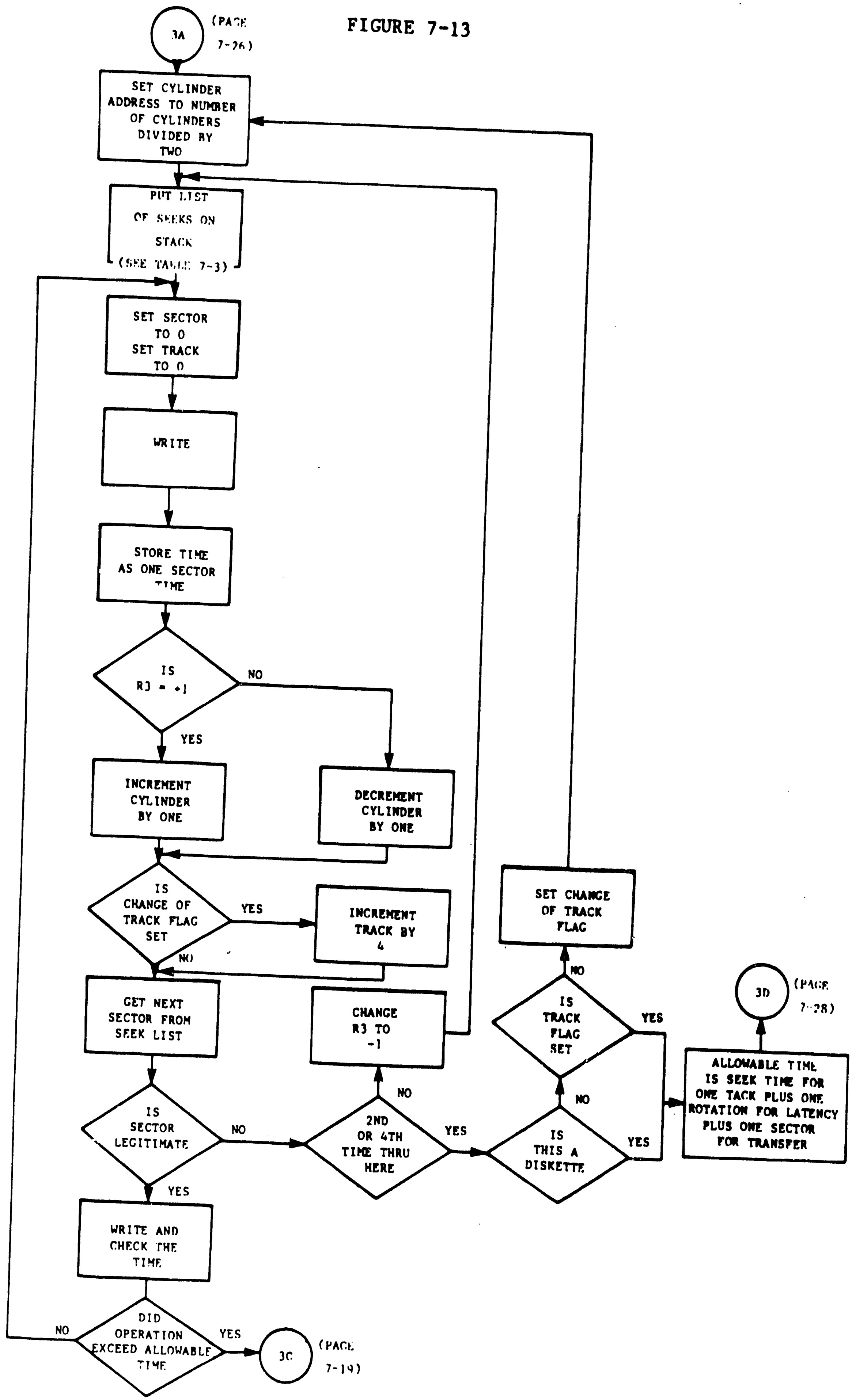
TABLE 7-3 SECTORS FOR SEEKS DURING TIMING TEST

FIGURE 7-12



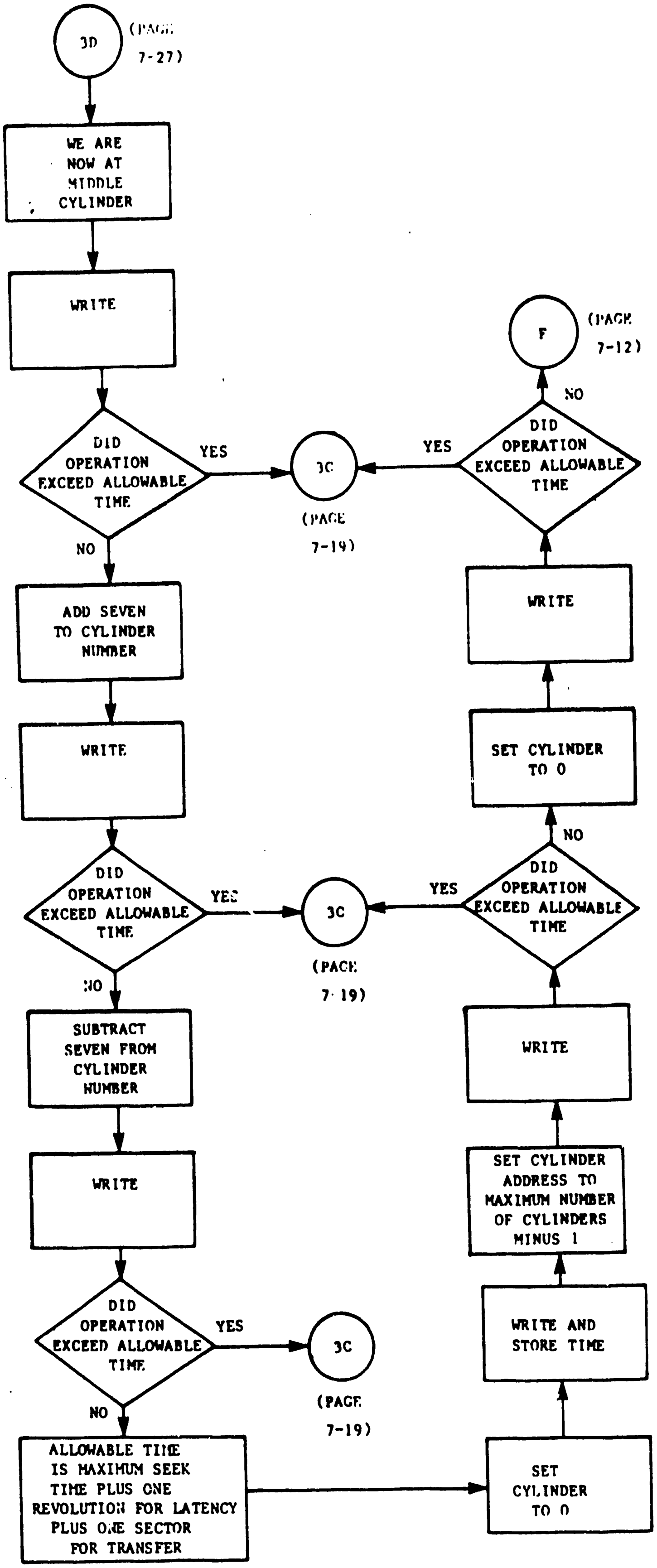
FLOWCHART 5A DISK TIMING TEST

FIGURE 7-13



FLOWCHART 5B DISK TIMING TEST

FIGURE 7-14



FLOWCHART 5C DISK TIMING TEST

3) ERROR CORRECTION CODE TEST

The error correction code test is not recommended. This test takes an unusually long time to run, and it slows down the system response time. It will thus affect the users at the other terminals. The procedure for this test will not be presented.

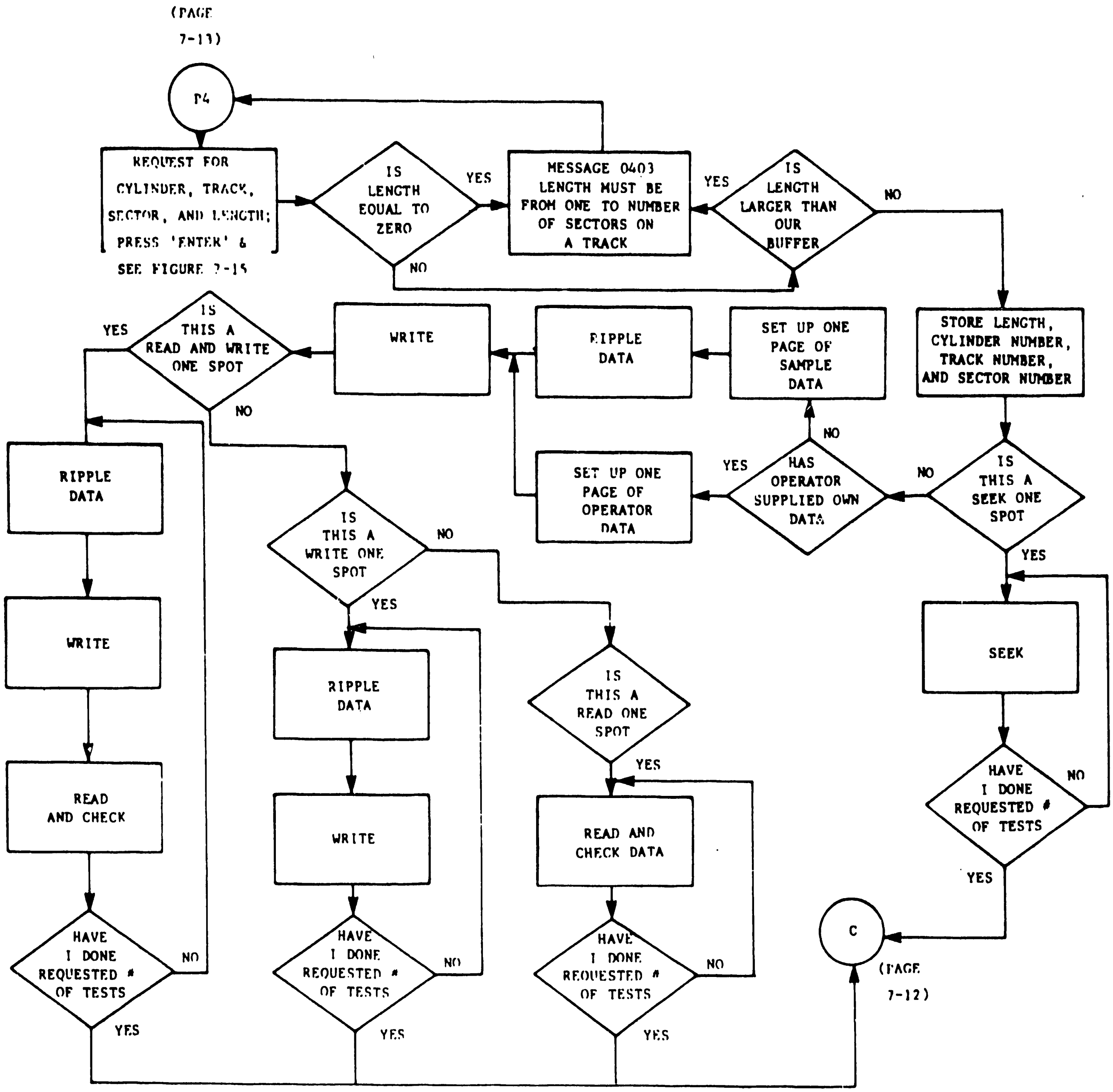
4) NEXT FOUR TESTS

The next four tests, read one spot on disk, write one spot on disk, read and write one spot on disk, and seek one spot on disk, all operate similarly. They are accessed by PF keys 5, 6, 7, and 8 respectively. See Figures 7-15 and 7-16. When any of these tests are selected, the program presents a display requesting the following input parameters: the starting address (cylinder, track, and sector) and the length of transfer. If an incorrect transfer length is filled in, a message will be displayed, saying "LENGTH MUST BE FROM ONE TO NUMBER OF SECTORS ON A TRACK."

```
***     MESSAGE 0402 BY DKTEST

             INFORMATION REQUIRED BY PROGRAM DKTEST
                         TO DEFINE TEST

PLEASE SUPPLY THE DISK ADDRESS AND LENGTH AND PRESS (ENTER)

     STARTING ADDRESS:

             CYLINDER  =           TRACK    =          SECTOR

     LENGTH    =     IN SECTORS
```

FIGURE 7-15

FIGURE 7-16



FLOWCHART 6 READ, WRITE, READ AND WRITE, SEEK ONE SPOT ON DISK

To find out the number of sectors on a track, refer to Table 7-1 (Disk Characteristics). Once all the input data is filled in correctly and the ENTER key is pressed, the program does exactly as requested. Notice that this sub-program does its own check of the repeat option and returns to Figure 7-4 (DKTEST CONTROL) at circle C.

5) TEST ENTIRE DISK FOR CORRECT I/O

The next test, test entire disk for correct I/O, is selected by the PF9 key. See Figure 7-17. This test does a write and "read and check" for every sector on the disk except sectors 0 and 1, using either operator or program supplied data.

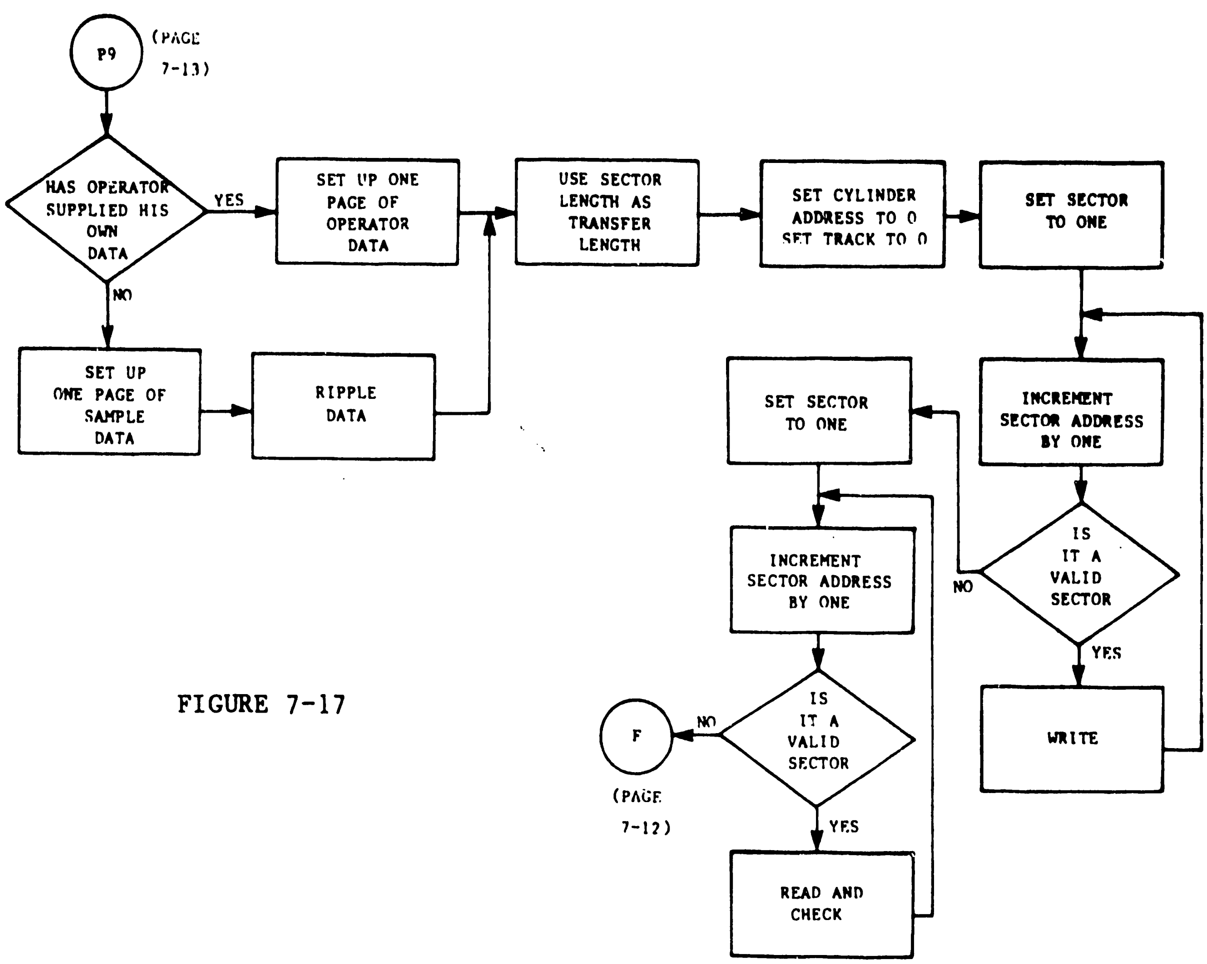


FIGURE 7-17

FLOWCHART 7 TEST ENTIRE DISK FOR CORRECT I/O

6) MODIFY TEST DATA

This option, accessed by PF15, permits the operator to modify the data used for reading and writing on any test. See Figures 7-18 and 7-19. When PF15 is pressed, a display appears, having a modifiable field that allows the test data to be changed. Change the data as required and press ENTER; the main options display will return to the screen. This operation sets a flag, informing the program that the data has indeed been changed. The flag will stay set for all the subsequent tests.

```
***     MESSAGE 1501 BY DKTEST

            INFORMATION REQUIRED BY PROGRAM DKTEST
                          TO DEFINE DATA

MODIFY TEST DATA

        DATA        =  2000000000000003

     MODIFY THE TEST DATA AND PRESS (ENTER), OR
        PRESS (1)  TO CONTINUE WITH NO CHANGE,
              (2)  TO USE STANDARD DATA.
```

FIGURE 7-18

To return to the program supplied data, press the PF15 key (while at the main options display of DKTEST) and then PF2 (while at the "modify test data" display). This operation will reset the flag, informing the program to again use its own data for all subsequent tests. If PF1 is pressed while the "modify test data" display is showing, the program will return to main options display, without changing the state of the flag.

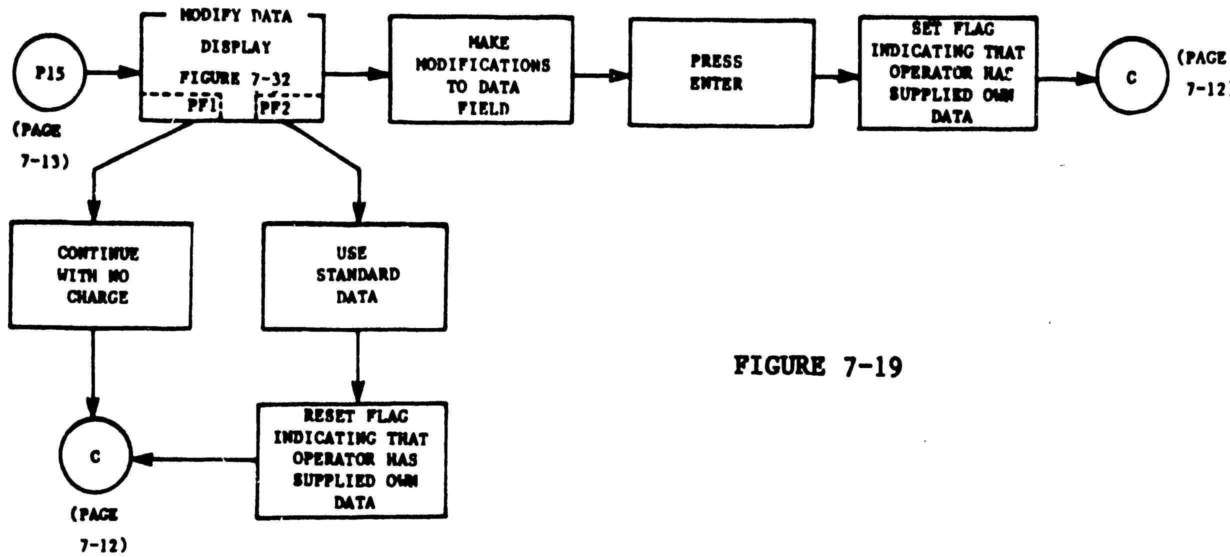


FIGURE 7-19

FLOWCHART 8 MODIFY TEST DATA

7.6 TPTEST DIAGNOSTIC

A. GENERAL

TPTEST is an on-line diagnostic for the 2209V (Kennedy) tape drive. This test can be accessed from the library @SYSTST@ on the customer's Operating System volume. The following test options can be executed.

A. Tape-movement test
B. End-of-tape sensing test
C. Verify write-protect
D. Miscellaneous tape tests

B. PREPARATIONS FOR TPTEST

1) Mount a 'scratch' tape (with a write-enable ring) on the tape drive to be tested.

2) Using the Command Processor, and with the exception of the drive under test, DETACH all other tape drives in logical sequence:

   Press PF11 (Select Special Commands) on the Command Processor menu, then press PF4 (Detach Device). Fill in the device number of the first drive to be detached, and then press ENTER. Repeat detachment for all remaining tape drives.

3) RUN the desired TPTEST option <u>according to the specific instructions in paragraphs D and E</u>.

4) When all of the desired TPTEST options have been run, reattach all of the tape drives previously detached:

   Press PF11 (Select Special Commands), then press PF3 (Attach Device); fill in the device number of the first drive to be attached, and press ENTER. Repeat for each remaining drive.

C. AN ALTERNATIVE TECHNIQUE

1) Mount scratch tapes (with write enable rings) on each of the drives to be tested.

2) Ensure that every tape drive to be tested is on-line.

3) Following the instructions in paragraphs IV and V, specify a high 'repeat count' and RUN the desired TPTEST option simultaneously from as many terminals as there are tape drives to be tested (i.e., each terminal runs TPTEST for the diagnosis of one particular tape drive). This method will verify the multi-drive handling capability of the Formatter unit.

D. THE TPTEST CONTROL PROGRAM

The following sequence of events occurs once the TPTEST Control program has been initiated: (Ref: Figure 7-21)

1) Read and Write buffers are initialized.

2) The Write buffer is filled with data.

3) The standard 'options screen' for TPTEST is invoked by TPTEST. (Ref: Figure 7-20).

FIGURE 7-20

```
***   MESSAGE 0001 BY TPTEST

                    INFORMATION REQUIRED BY PROGRAM TPTEST
                              TO DEFINE OPTIONS

TPTEST PROGRAM VERSION 1.1
PLEASE SUPPLY A VOLUME SERIAL NUMBER
AND SELECT AN OPTION USING THE PROGRAM FUNCTION KEYS.

      VOLSER     =

              (2)   TAPE MOVEMENT TEST
              (3)   END-OF-TAPE SENSING TEST
              (4)   WRITE PROTECT AND UNLOAD TEST
              (5)   MISCELLANEOUS TESTS
             (16)   END OF JOB

         REPEAT   =    1 TIMES
```

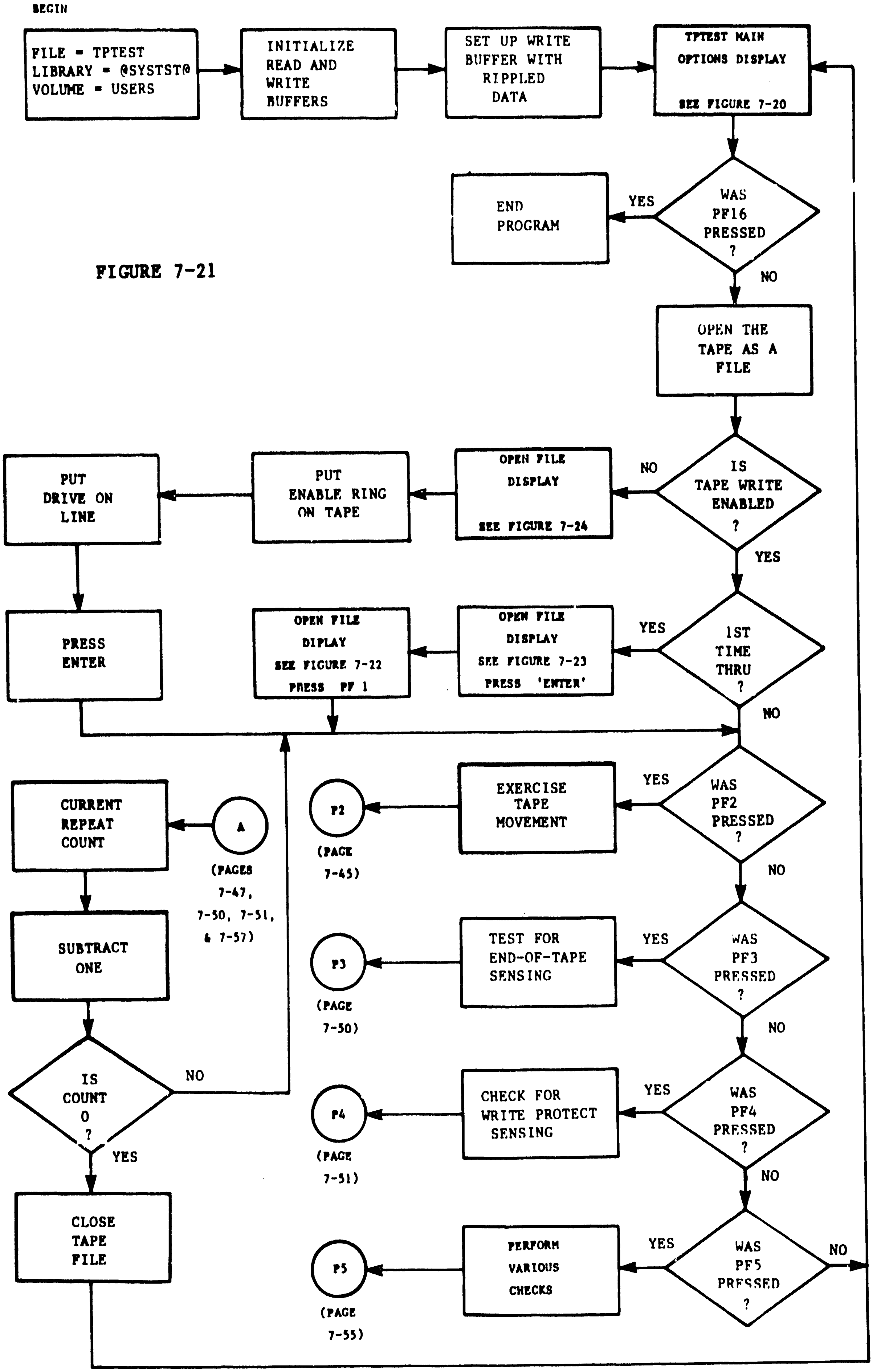


FIGURE 7-21

FLOW CHART #1

TPTEST CONTROL

4) Fill in a volume name for the tape that is mounted on the drive to be tested. The name specified bears no relevance to the operation of TPTEST.

5) Fill in a repeat count (if desired) for the test to be executed. After the above information has been filled in, press the appropriate PF key; the tape will be 'MOUNTED'. (Note that if PF16 is keyed, the program will terminate.)

6) When the Control program is executed, an 'OPEN FILE' display will appear on screen (Ref: Figure 7-22). There is no need to fill in any further information; simply key ENTER.

FIGURE 7-22

```
***   MESSAGE 000 BY OPEN

                    INFORMATION REQUIRED BY PROGRAM TPTEST
                                  TO DEFINE TAPE

PLEASE ASSIGN "TAPE"      (TO BE CREATED AS OUTPUT BY THE PROGRAM)

TO ASSIGN THIS FILE TO A DISK OR TAPE FILE, PLEASE SPECIFY:
      FILE     =    IN LIBRARY =      ON VOLUME    =    TEST
      RECORDS  =       RETAIN  =  DAYS   RELEASE   =    YES
      FILECLAS =
TO SELECT ANOTHER DEVICE, SPECIFY:
      DEVICE   =    TAPE          (ALTERNATES = DISK,TAPE)

      MAGTAPE OPTION:     FILESEQ = 0001
```

7) Next, the 'OPEN FILE' display with a 'NOT MOUNTED' message will be invoked (Ref: Figure 7-23). Disregard the message, and key PF1; the selected test will execute.

FIGURE 7-23

```
***   MESSAGE R012 BY OPEN

                    CORRECTION REQUIRED BY PROGRAM TPTEST
                                  TO DEFINE TAPE

THE TAPE VOLUME SPECIFIED IS NOT MOUNTED.
PLEASE RESPECIFY THE VOLUME NAME AND USE THE ENTER KEY:
OR, MOUNT THE TAPE VOLUME SPECIFIED BELOW ON TAPE DRIVE 028,
    AND PRESS THE PF1 KEY AFTER THE TAPE VOLUME IS IN PLACE.

PLEASE ASSIGN "TAPE"      (TO BE CREATED AS OUTPUT BY THE PROGRAM)

TO ASSIGN THIS FILE TO A DISK OR TAPE FILE, PLEASE SPECIFY:
      FILE     =    IN LIBRARY =                ON VOLUME  =  TEST
      RECORDS  =       RETAIN  =      DAYS        RELEASE  =  YES
      FILECLAS =
TO SELECT ANOTHER DEVICE, SPECIFY:
      DEVICE   =    TAPE          (ALTERNATES = DISK, TAPE)

      MAGTAPE OPTION:     FILESEQ  =  0001
```

8) To reload the TPTEST Control program, you must go through the 'OPEN FILE' routine again; the procedure is the same as in steps A through G, above.

9) If the last test was 'WRITE PROTECT AND UNLOAD', after keying the PF key for the next desired test option, an 'OPEN FILE' display with an 'INSERT THE WRITE-ENABLE RING' prompt will be invoked (see Figure 7-24). Put the write enable ring in place, ensure that the tape drive is on-line, and then press ENTER.

FIGURE 7-24

```
***    MESSAGE R031 BY OPEN

                        CORRECTION REQUIRED BY PROGRAM TPTEST
                                TO DEFINE TAPE

PLEASE RE-MOUNT THE TAPE VOLUME BELOW
AFTER INSERTING THE WRITE-ENABLE RING.
(THE RING IS REQUIRED IN ORDER TO WRITE ON THE TAPE.)

PLEASE ASSIGN "TAPE"      (TO BE CREATED AS OUTPUT BY THE PROGRAM)

TO ASSIGN THIS FILE TO A DISK OR TAPE FILE, PLEASE SPECIFY:
    FILE     =    IN LIBRARY  =       ON VOLUME    =     TEST
    RECORDS  =      RETAIN    =    DAYS   RELEASE  =     YES
TO SELECT ANOTHER DEVICE, SPECIFY:
    DEVICE  =  TAPE     (ALTERNATES = DISK, TAPE)

    MAGTAPE OPTION:      FILESEQ = 0001
```

When any selected test has completed a pass, the TPTEST program will check the current 'repeat count', subtract one from that stored number, and will then repeat that test until the repeat count reaches zero. That accomplished, the program will return to the TPTEST option display.

Other operational considerations occur when the 'END OF TAPE SENSING' test or the 'WRITE PROTECT AND UNLOAD' test is executed. If the 'END-OF-TAPE SENSING' test is run, a screen prompt will inform you that if end-of-tape is not properly sensed, the tape will run off the supply reel (Ref: Figure 7-25). All one need do is read the display and press ENTER. Note that if a 'repeat count' of more than one exists, this display will be present only on the first pass. If the 'WRITE PROTECT AND UNLOAD' test is chosen, each pass of the test will render a display (Ref: Figure 7-26) asking for removal of the write enable ring. At this point, unload the tape, remove the ring, reload the tape, make sure that the tape is on-line, and then press ENTER.

FIGURE 7-25

```
***   MESSAGE 0101 BY TPTEST

                        RESPONSE REQUIRED BY PROGRAM TPTEST
                              TO ACKNOWLEDGE EOT

PRESS (ENTER) TO PROCEED WITH THE TEST.

   THE END-OF-TAPE SENSING TEST WILL WRITE THE ENTIRE LENGTH OF THE TAPE.
   IF THE TEST FAILS, THE TAPE WILL BE REMOVED FROM IT'S UPPLY REEL.
```

FIGURE 7-26

```
*** MESSAGE 0101 BY TPTEST

                        RESPONSE REQUIRED BY PROGRAM TPTEST
                              TO ACKNOWLEDGE RING

PRESS (ENTER) TO PROCEED WITH THE TEST.

   THE FILE-PROTECT SENSING TEST REQUIRES A TAPE WITH NO WRITE RING.

   PLEASE UNLOAD THE TAPE, REMOVE THE WRITE RING, AND REMOUNT THE TAPE.
   ATTEMPTS WILL BE MADE TO WRITE ON THE TAPE.
   IT WILL THEN BE UNLOADED.
   CLOSE WILL THEN REQUIRE THAT THIS PROGRAM BE CANCELLED, WHICH IS NORMAL.
```

When the test is over, another screen prompt will inform you of an 'ERROR DETECTED BY SVC CLOSE' (see Figure 7-27); this is normal. Since this test ultimately puts the drive being tested off-line, put the drive back on-line and then press ENTER. If a repeat count greater than '1' has been specified for this test, the drive will be off-line at the end of each pass and 'REMOVE THE WRITE ENABLE RING' will be prompted. Do not forget to put the tape drive back on-line before complying with that prompt at the end of each pass.

FIGURE 7-27

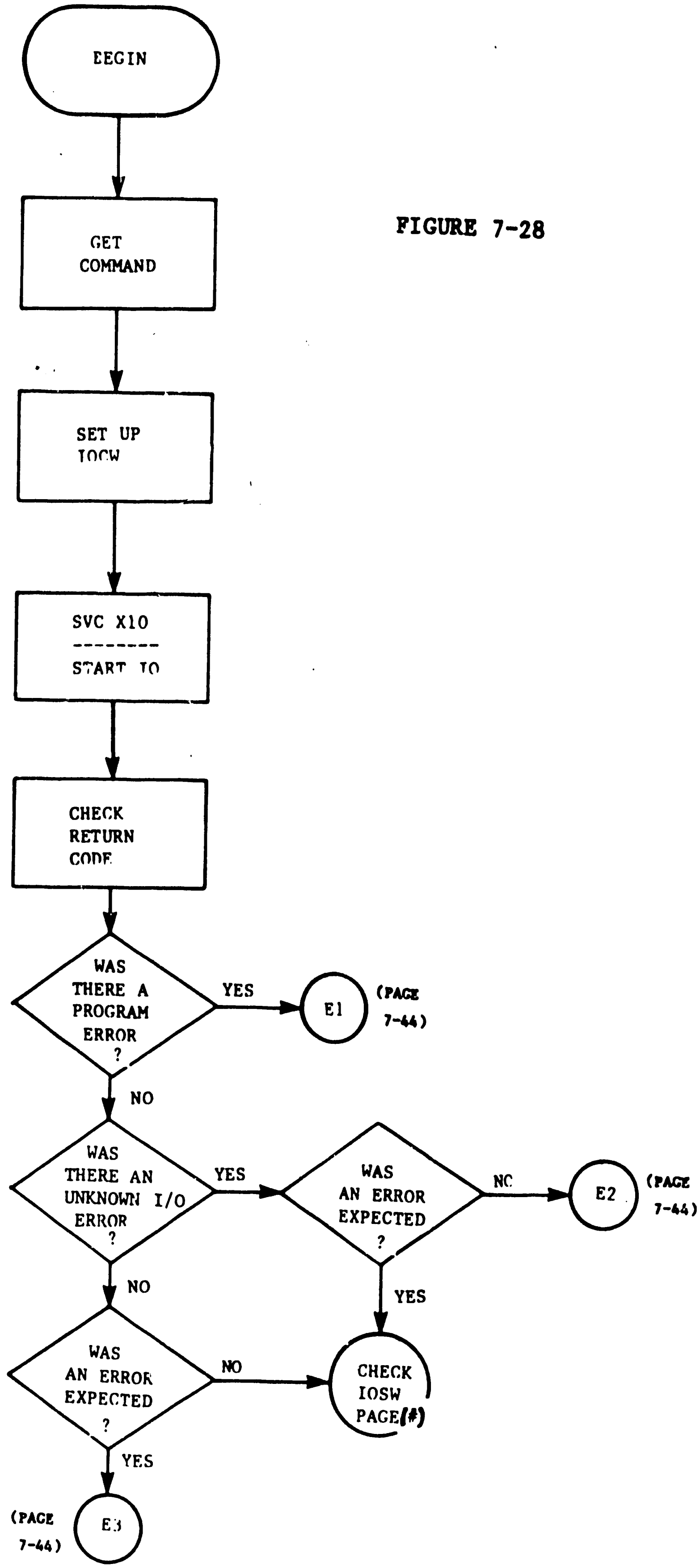
```
***  MESSAGE 000 BY DMS

                    RESPONSE REQUIRED BY PROGRAM TPTEST
                            TO ACKNOWLEDGE ERROR

PRNAME = TAPE          (INSTRUCTION ADDRESS = 1000DA/UFB=23ECCO)
ERROR DETECTED BY SVC CLOSE.
FILE STATUS = 30.
PERMANENT IO ERROR, IOSW = 20180001  48000000.

THE ERROR CONDITION DESCRIBED ABOVE OCCURRED WHILE CLOSING THE FILE.
AFTER ACKNOWLEDGE, THE FILE WILL BE CLOSED NORMALLY.
```

D. TPTEST PROGRAM FLOW -- TEST OPTIONS

The following text explains in greater detail how the routine for each test option actually operates the tape drive, and how any errors that occur are handled. (Refer to Figure 7-28)

When TPTEST begins an operation, the I/O Command Word is set for the particular tape command, and a SVC XIO is executed (this, in essence, is a 'START I/O'). After the tape command has been executed, TPTEST checks the Return Code for errors. If an unexpected error is found, an error routine is executed. If no errors are found, or if an 'expected error' occurs, TPTEST checks the I/O Status Word. TPTEST checks the I/O Status Word after every tape operation, and reports error conditions accordingly.

FIGURE 7-28



FLOW CHART #2
EXECUTE I/O OPERATION

In order to simplify tape I/O operations in flow chart format, a block labelled 'Tape I/O' will contain the particular command and the expected IOSW bits. Starting at the Tape I/O flow chart (Figure 7-28), a tape I/O is executed, the I/O Status Word is checked (Ref: Figure 7-30), and then the next tape I/O is executed per Figure 7-28.

Next, refer to Figure 7-31. Whenever a tape I/O error occurs, TPTEST displays a standard error message (Ref: Figure 7-29) showing:

1. What type error
2. The last tape command executed
3. The length of transfer
4. The I/O Status Word
5. The virtual locations of the write buffer and the read buffer.

FIGURE 7-29

```
***  MESSAGE 0207 BY TPTEST

                    RESPONSE REQUIRED BY PROGRAM TPTEST
                           TO ACKNOWLEDGE ERROR

TAPE I/O ERROR.

     LAST COMMAND = 80   LENGTH = 2048      IOSW 2018F004 000004
     I/O BUFFER AREAS   WRITE BUFFER 23A000     READ BUFFER 235800
```

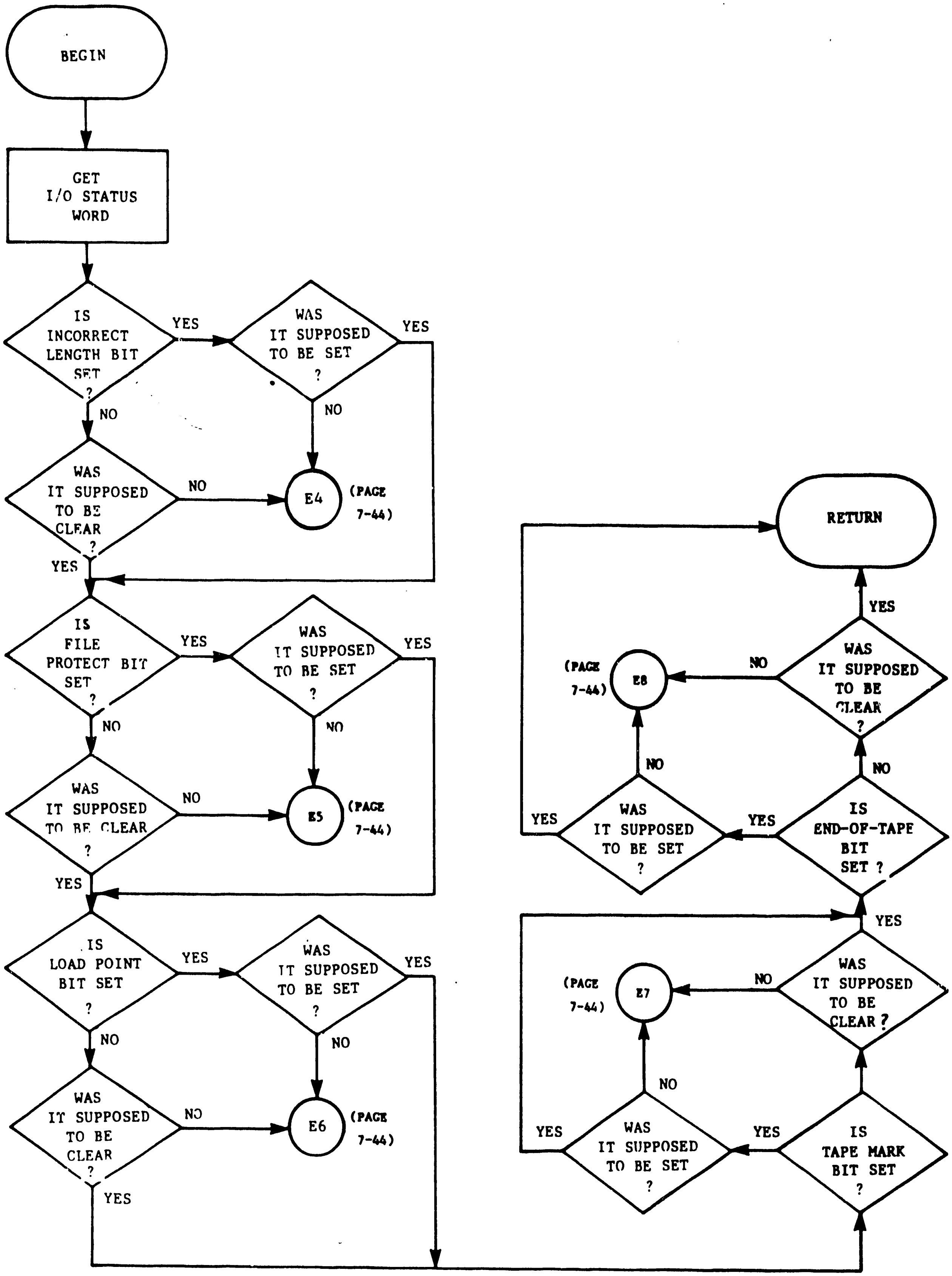
After examining the error display, press ENTER and the program will continue.

1) TAPE MOVEMENT TEST: (Ref: Figures 7-32, 33, & 34)

The 'Tape Movement' option of TPTEST is accessed by keying PF2 . The following actions occur:

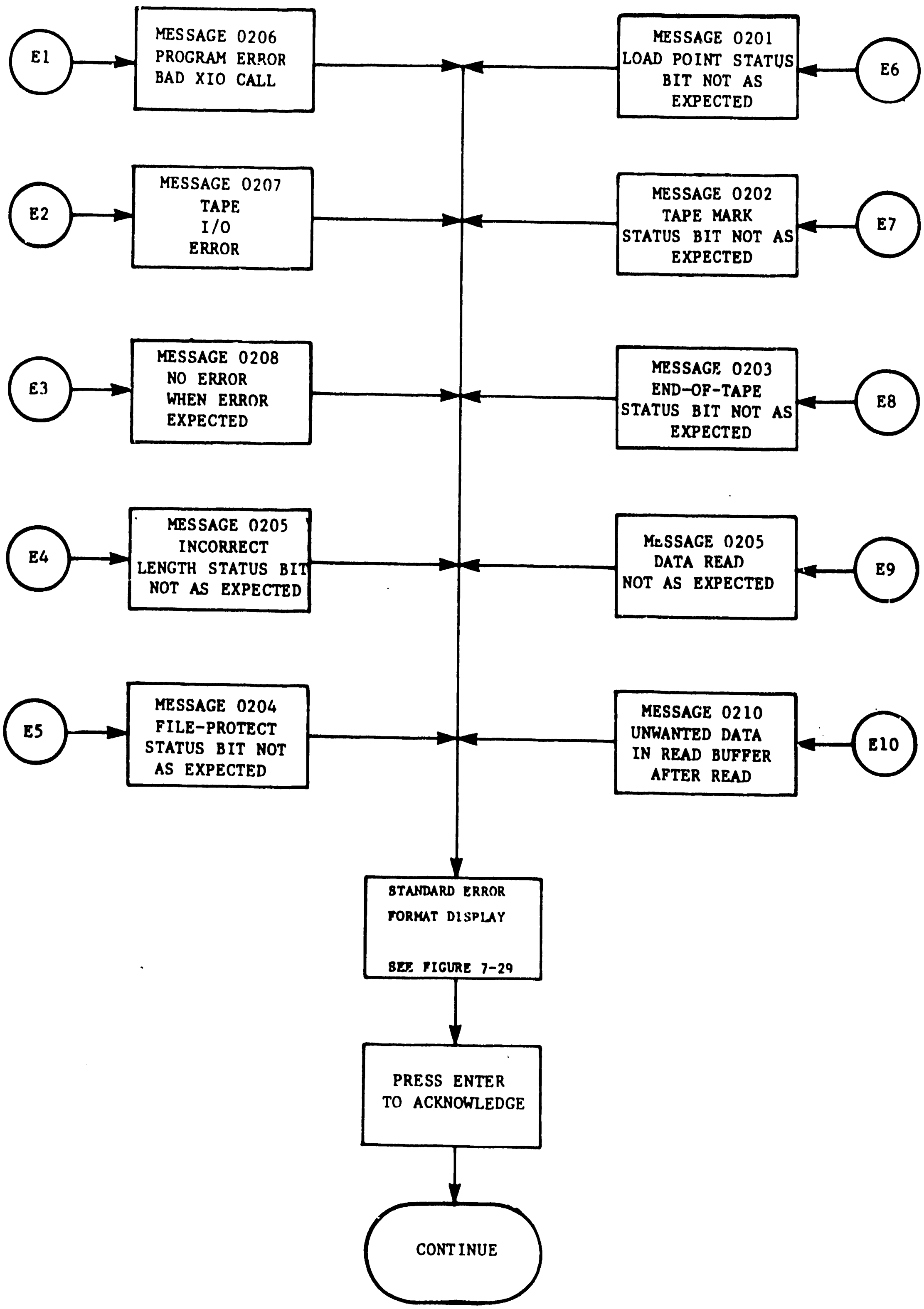
a) REWIND tape (check for 'load point' twice).

FIGURE 7-30



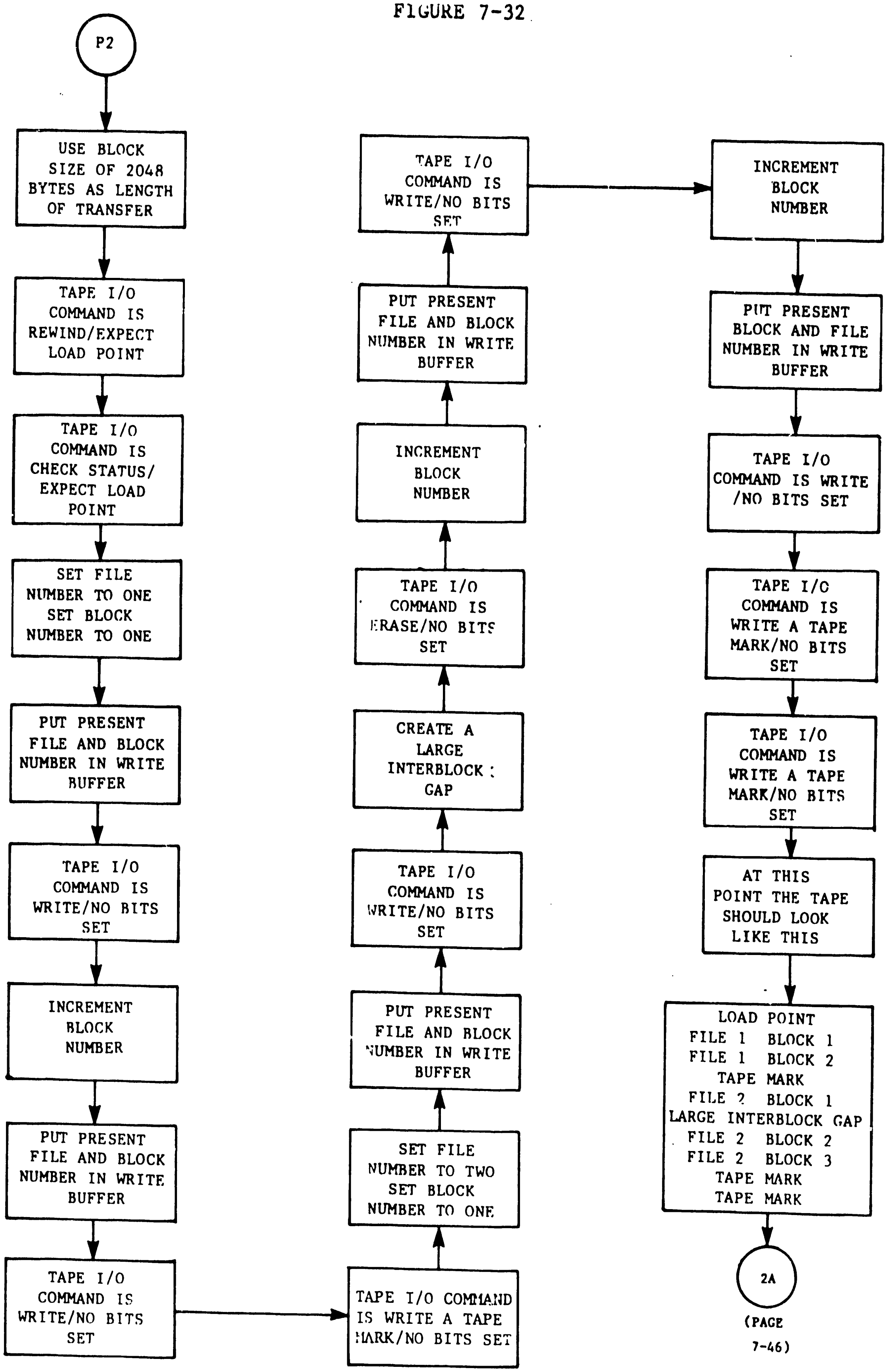
FLOW CHART #3 CHECK I/O STATUS WORD

FIGURE 7-31



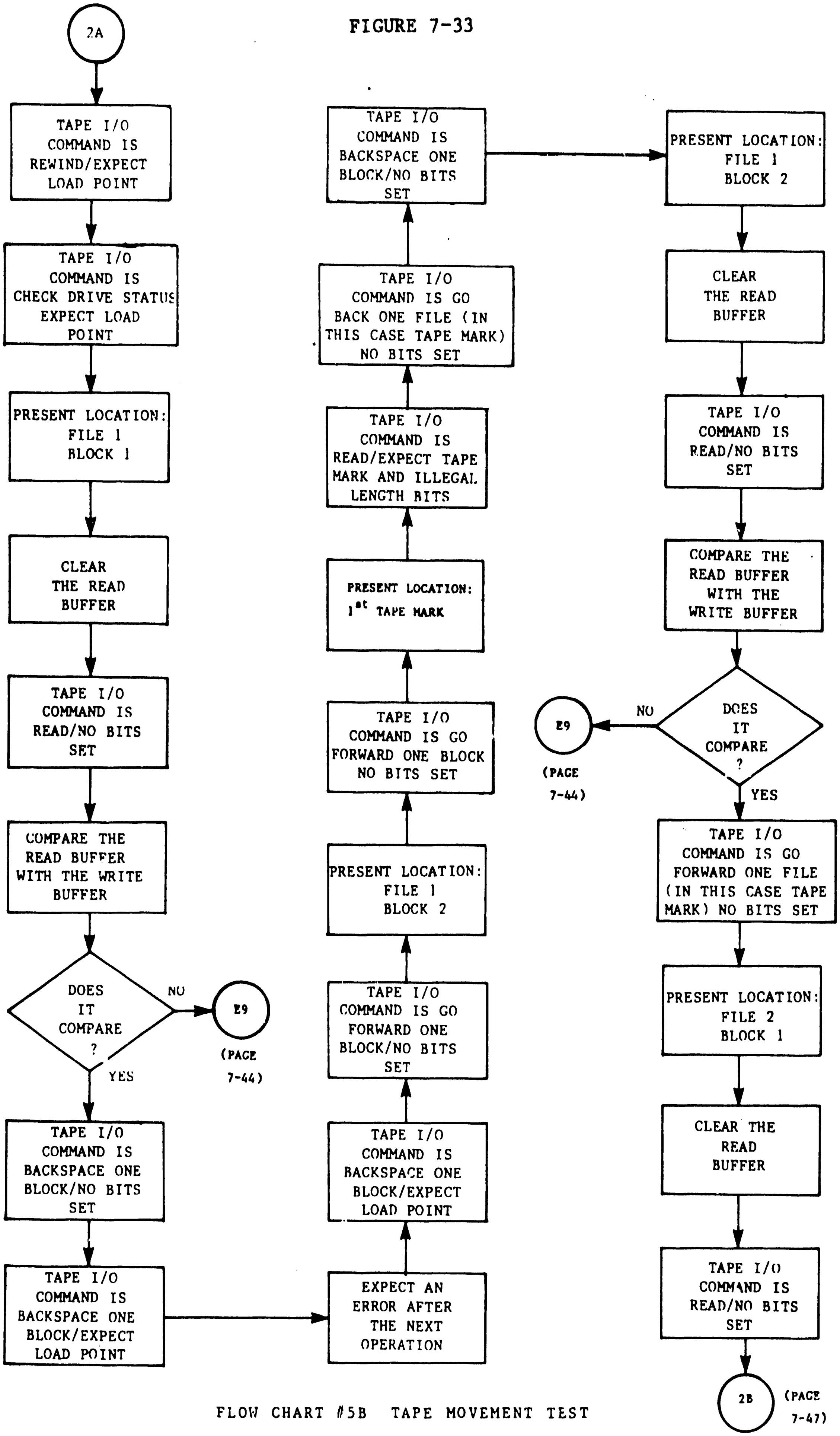
FLOW CHART #4 STANDARD ERROR ROUTINE

FIGURE 7-32



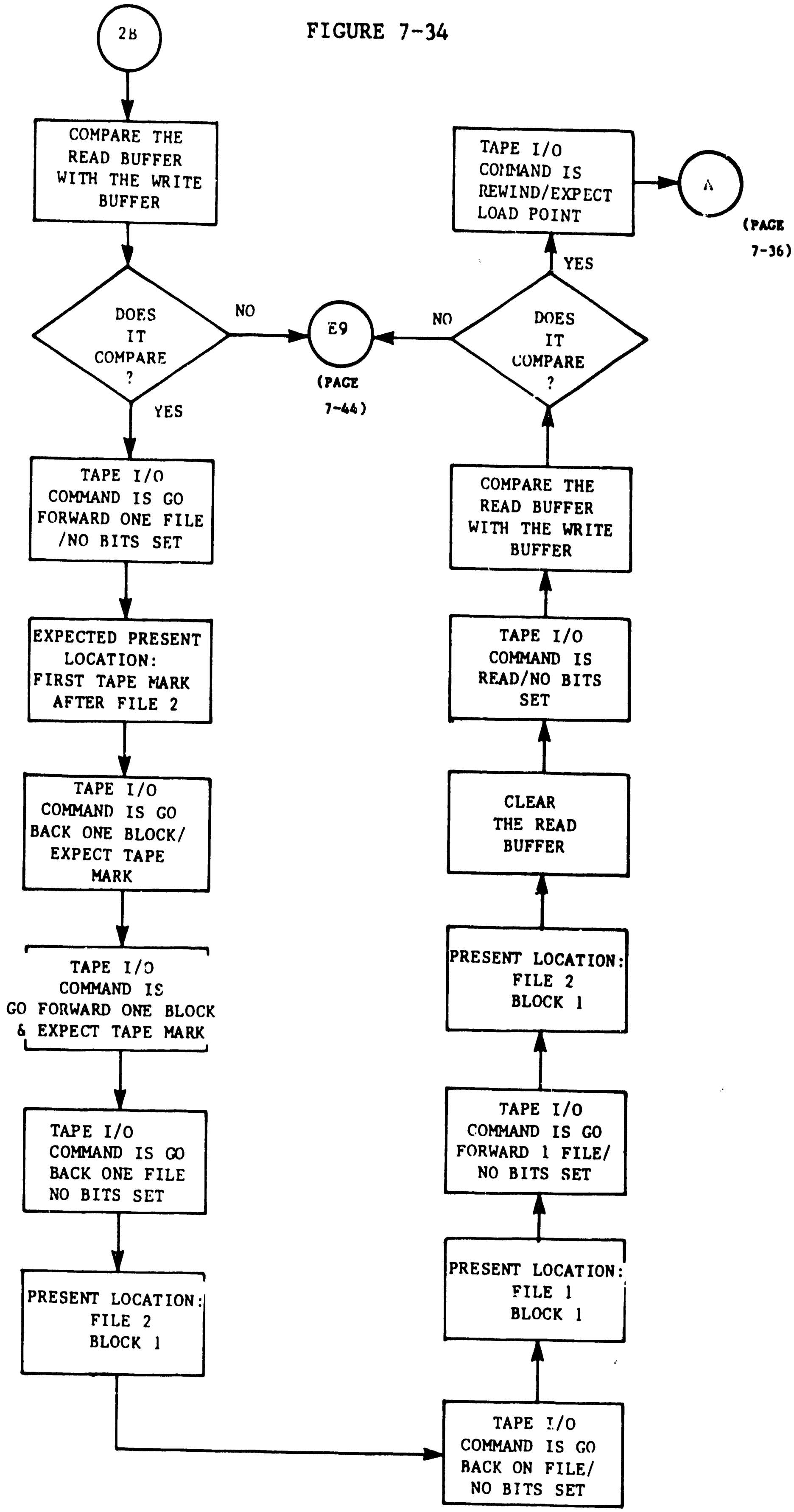
FLOW CHART #5A TAPE MOVEMENT TEST

FIGURE 7-33



FLOW CHART #5B TAPE MOVEMENT TEST

FIGURE 7-34



FLOW CHART #5C TAPE MOVEMENT TEST

b) WRITE: File 1, block 1; File 1, block 2; Tape Mark; File 2, block 1; Interblock Gap; File 2, block 2; File 2, block 3; 2 tape marks. (Each block is 2048 bytes long.)

c) REWIND tape (again, check for load point twice).

d) READ File 1, block 1 (check for correct data).

e) BACKSPACE two blocks to reach the load point (an attempt is made to backspace over the load point; the drive logic should prevent this). An 'expected' error should occur here, but it will not be displayed.

f) SKIP the two blocks of File 1 and attempt to read the Tape mark as a block. TPTEST expects an Illegal Length error here, but it is not displayed.

g) BACKSPACE to the beginning of File 1, block 2.

h) READ File 1, block 2, and compare the data for accuracy.

i) SKIP forward to File 2, block 1, READ, and then compare the data for accuracy (Ref: Figure 7-34).

j) SKIP File 2 in order to reach the first Tape Mark after File 2. TPTEST will then command the tape drive to skip forward and backward over the tape mark, checking for its prescence each time.

k) BACKSPACE over File 2 and File 1, then go forward over File 1 to the first block of File 2.

l) READ that block, check for correct data, and then return to the TPTEST Control program to check the repeat count.

m) If the repeat count is not yet zero, another test pass is executed; if the repeat count has reached zero, the screen will return to the basic option display if the Control program.

2) END-OF-TAPE SENSING: (Ref: Figure 7-35)

The End-of-Tape Sensing test is accessed by keying PF3. If this is the first or the only pass of the test, an 'end-of-tape test' display (see Figure 7-25) will appear on screen. Read the message presented in that screen and key ENTER. The following subsequent action occurs:

Starting at File 1, block 1, TPTEST writes consecutive 2,048-byte blocks on tape until the end-of-tape mark is detected. When this happens the program clears the End-of-Tape flag and backspaces over the last block written. At this point, Tape Marks are written until End-of-Tape is once again detected. After clearing the End-of-Tape flag for the last File and block, TPTEST rewinds the tape to the load point. TPTEST returns to the Control routine to check the repeat count. If the repeat count is not yet zero, another test pass is executed; if the repeat count has reached zero, the screen will return to the basic option display of the TPTEST Control program.

3) WRITE PROTECT AND LOGICAL UNLOAD: (Ref: Figure 7-36)

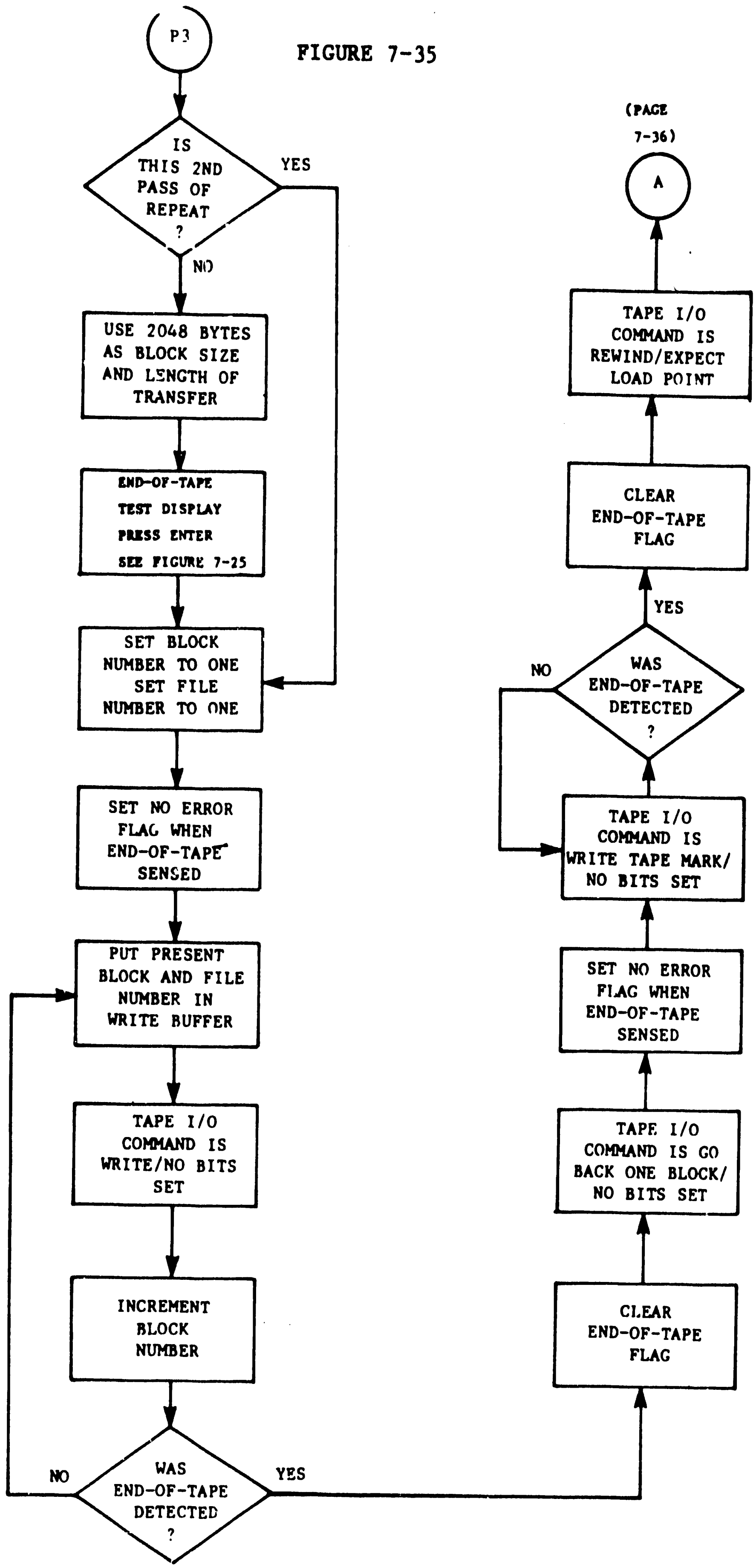
The WRITE PROTECT AND UNLOAD test option is accessed by keying PF4. Each pass will render a display (Ref: Figure 7-26) requiring removal of the write enable ring. Unload the tape, remove the ring, reload the tape, make sure that the tape is on-line, and then press ENTER.

TPTEST will write one 2,048-byte block and a tape mark after ensuring that the tape is at the load point, and after setting the 'error expected' flag. The 'no ring' bit will be set in the I/O Status Word, and no error will be displayed.

At the <u>end</u> of each pass, a screen prompt informs you of an 'ERROR DETECTED BY SVC CLOSE' (see Figure 7-27). <u>This is normal</u>.

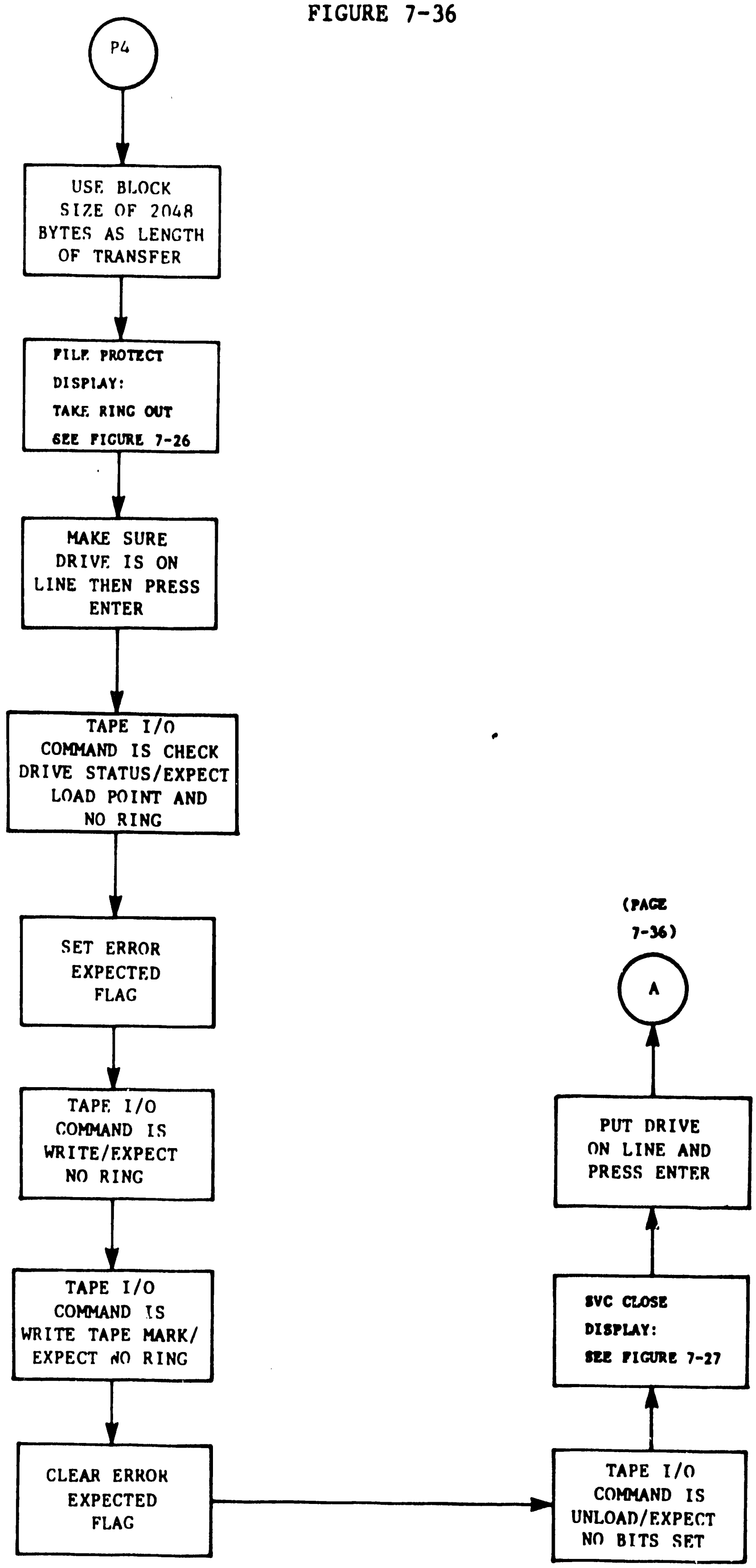
If, at the end of each pass, a repeat count greater than '1' has been specified for this test option (and after clearing the 'error expected' flag), 'REMOVE THE WRITE ENABLE RING' (file protect display)

FIGURE 7-35



FLOW CHART #6 END OF TAPE SENSE TEST

FIGURE 7-36



FLOW CHART #7 WRITE PROTECT SENSING TEST will be prompted, and a logical unload will put the drive off-line. Note that the term 'logical unload' does not mean that the tape is completely rewound onto the supply reel and unthreaded.

Do not forget to put the tape drive back on-line before acknowledging the file-protect display at the end of each pass.

4) MISCELLANEOUS TESTS: (Ref: Figures 7-37, 38, & 39)

The so-called 'Miscellaneous Tests', which comprise three major subtests, are accessed by keying PF5. One test writes and reads blocks of varying lengths, another test writes a standard block of 2,048 bytes and reads back only a small portion of that, and still another test reads and writes at 800 BPI and 1600 BPI. Note that even though the 2200VS does not yet support 'dual density', the latter test still runs and no errors should be expected.

a) BLOCK LENGTH TEST: (Ref: Figure 7-37)

The following actions take place during the Block Length test:

- If this is the first pass, REWIND the tape, fill the write buffer, and write File one, block one, consisting of 2,048 bytes.

- LIST all block lengths currently on the stack (Ref: Table 7-4). As each length value is popped off the stack, WRITE, BACKUP, READ, and check the data on consecutive blocks.

- After each read and write, TPTEST checks for end-of-tape. If end-of-tape is detected, the tape will rewind and go on to the next sub-test (the 'Long Write -- Short Read' test). Other than end-of-tape sensing, the program will also advance to the next sub-test if the last length value stored in the stack is a -1.

TABLE 7-4

LIST OF BLOCK LENGTHS FOR MISCELLANEOUS TAPE TEST

TOP OF STACK			MIDDLE OF STACK			BOTTOM OF STACK		
HEX	DECIMAL	OCTAL	HEX	DECIMAL	OCTAL	HEX	DECIMAL	OCTAL
12	18	22	1006	4102	10006	180A	6154	14012
17	23	27	1007	4103	10007	180B	6155	14013
64	100	144	1008	4104	10010	180C	6157	14014
12C	300	454	1009	4105	10011	180D	6157	14015
1A1	417	641	100A	4106	10012	180E	6158	14016
2BC	700	1274	100B	4107	10013	180F	6159	14017
3E8	1000	1750	100C	4108	10014	1810	6160	14020
509	1289	2411	100D	4109	10015	1F40	8000	17500
5DC	1500	2734	100E	4110	10016	2001	8193	20001
7FF	2047	3777	1388	5000	11610	2002	8194	20002
17	23	27	1801	6145	14001	290B	10507	24413
800	2048	4000	1802	6146	14002	2EE0	12000	27340
801	2049	4001	1803	6147	14003	3A98	15000	35230
802	2050	4002	1804	6148	14004	3FF3	16371	37763
1001	4097	10001	1805	6149	14005	4650	18000	43120
1002	4098	10002	1806	6150	14006	All F's	-1	All SEVENS
1003	4099	10003	1807	6151	14007			
1004	4100	10004	1808	6152	14010			
1005	4101	10005	1809	6153	14011			

b) LONG WRITE -- SHORT READ TEST (Ref: Figure 7-38):

This program writes a 2,048-byte block, backspaces, and reads only the first 256 bytes of the same block. Since the program 'expects' the Illegal Length bit to be set in the I/O Status Word, no error will be displayed. In order to ensure that only 256 bytes were read, TPTEST checks the data just read. That accomplished, the program advances to the next subtest (the 'Density Change' test) . Note also that after a one-block write and read, if 'end-of-tape' is detected, the tape will rewind and TPTEST will advance to the next subtest.

c) DENSITY CHANGE TEST: (Ref: Figure 7-39)

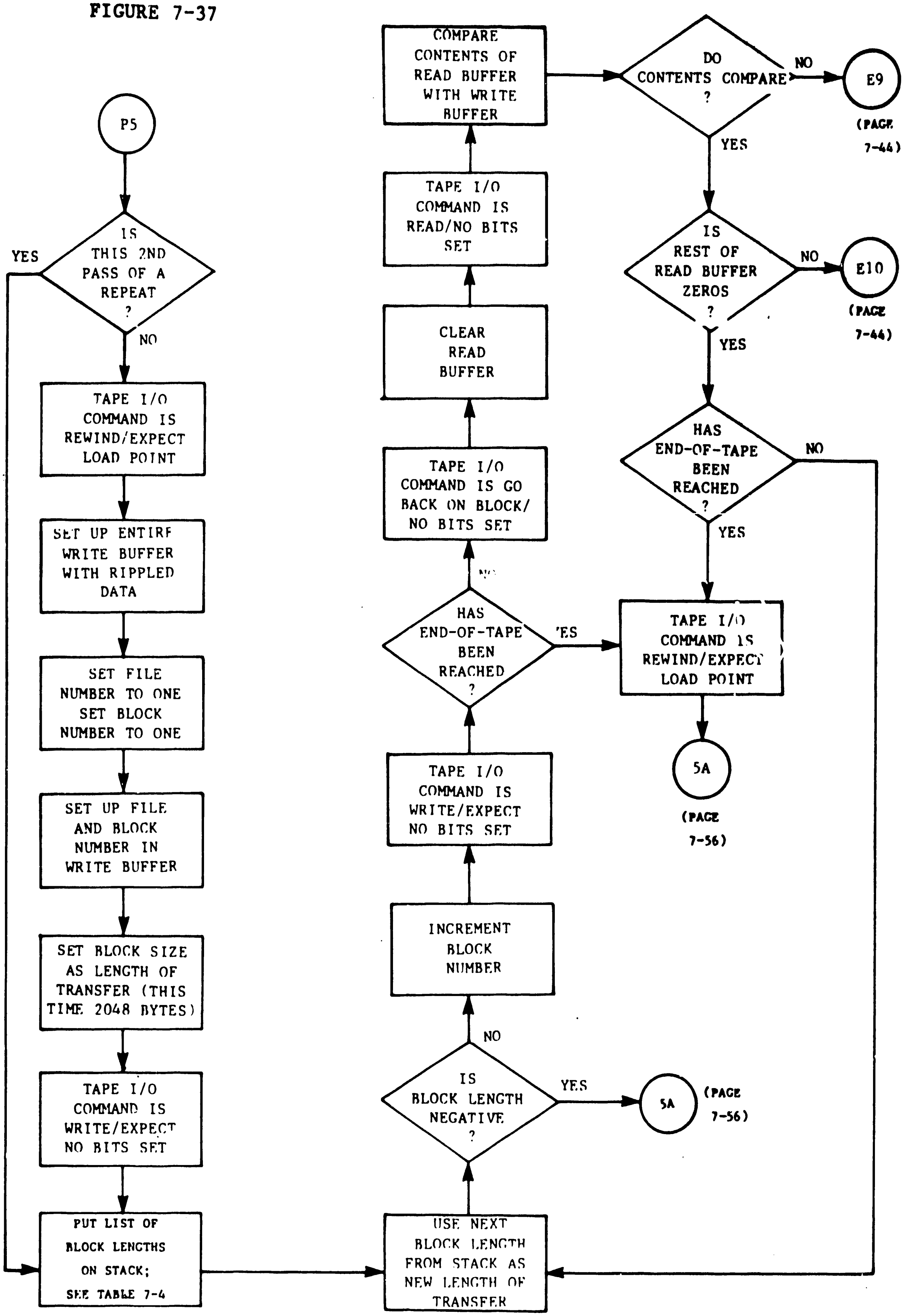
Using a block size of 2,048 bytes, and starting at File one, block one, the program writes one block normally. TPTEST then sends the tape drive a 'Change to Density 800' command, increments the block number and writes File one, block 2 at 800 BPI (remember that the 2200VS does not yet support 800 BPI). The tape then backspaces over File one, block two, and then reads (checks) for correct data.

Next, the program sends the tape drive a 'Change to Density 1600' command, increments the block number, and writes File one, block three at 1600 BPI. The tape then backspaces over File one, block 3 and reads (checks) for correct data. This is the normal end of this test.

After every read and write, the TPTEST checks for end-of-tape. If end-of-tape is detected, TPTEST rewinds before the Control Program is checked for a repeat count.

NOTE: The command code for a 'Change to Density 800' instruction will be HEX F4; the code for a 'Change to Density 1600' will be HEX F0. Bits 25 and 26 of the I/O status word will indicate current drive density when the 2200VS does support dual density drives.

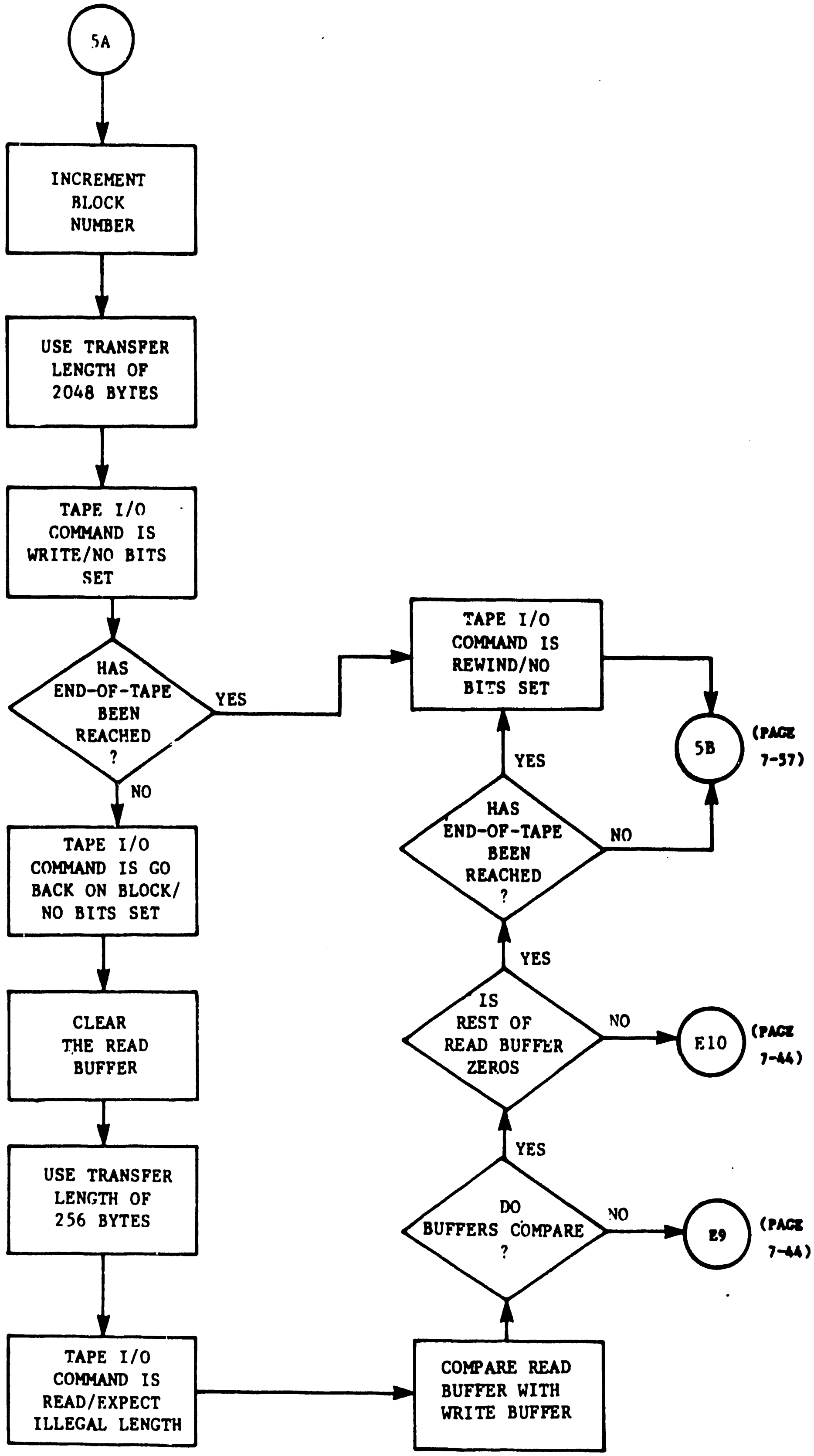
FIGURE 7-37



FLOW CHART #8

A VARYING BLOCK LENGTH TEST OF TAPE MISCELLANEOUS TESTS

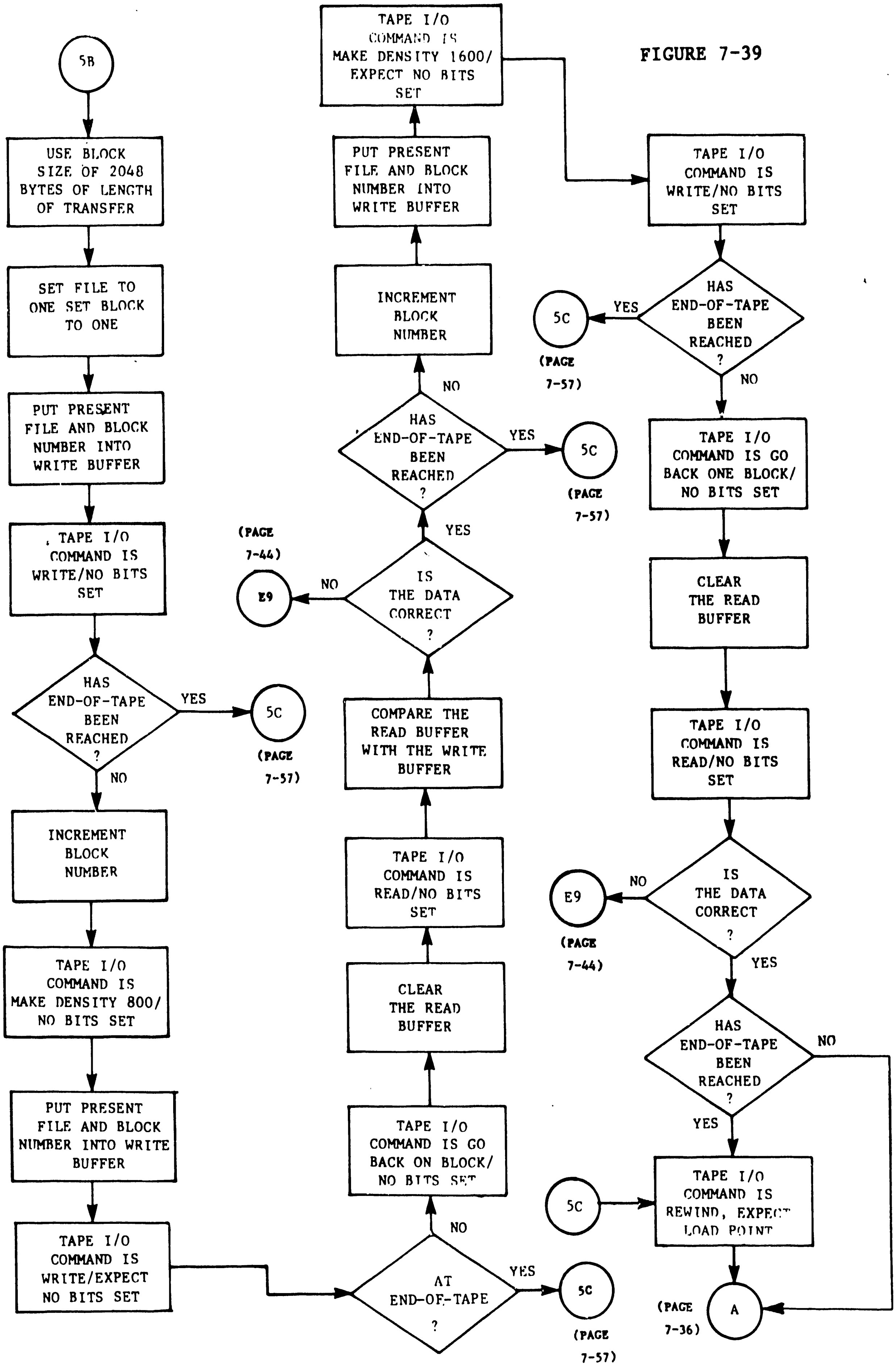
FIGURE 7-38



FLOW CHART #8B

LONG WRITE, SHORT READ TEST OF TAPE MISCELLANEOUS TESTS

FIGURE 7-39



FLOW CHART #8C DENSITY CHANGE TEST OF TAPE MISCELLANEOUS TESTS

SECTION 8 SYSTEM UPGRADES AND CONVERSIONS

SECTION 8

SYSTEM UPGRADES AND CONVERSIONS

8.0 GENERAL

To prevent unauthorized field upgrading of 2200VS systems, the mainframes of the Model 60 and the Model 80 are manufactured with different faceplate guide rails. The rail for the Model 60 has two less IOP slots than the rail for the Model 80, thereby preventing the installation of additional IOPs.

A matching lead seal is wired through a hole in the guide rail and upper flange on the side panel. The seal is stamped with the labels "WANG" and either "60" or "80"; it is for identification purposes only.

Update kits containing rails and seals for existing Model 60's and 80's are available through marketing, under corporate control. These conversion kits will be distributed by work order only.

8.1 PRINTER CONVERSION PROCEDURE -- MODEL 2221W TO 2221V

The purpose of this procedure is to enable a 2221W printer to be used on a 2200VS system, thus making that printer a 2221V. The standard 2200 system calls for the 2221W printer to do an automatic line feed after each carriage return. The 2200VS does not require this feature; the automatic line feed that occurs after a carriage return must be suppressed. There are no prerequisites for this conversion procedure, other than having an up-to-date printer with all pertinent ECNs installed. The entire procedure, including on-line testing, should not require more than thirty minutes, and no special parts are required.

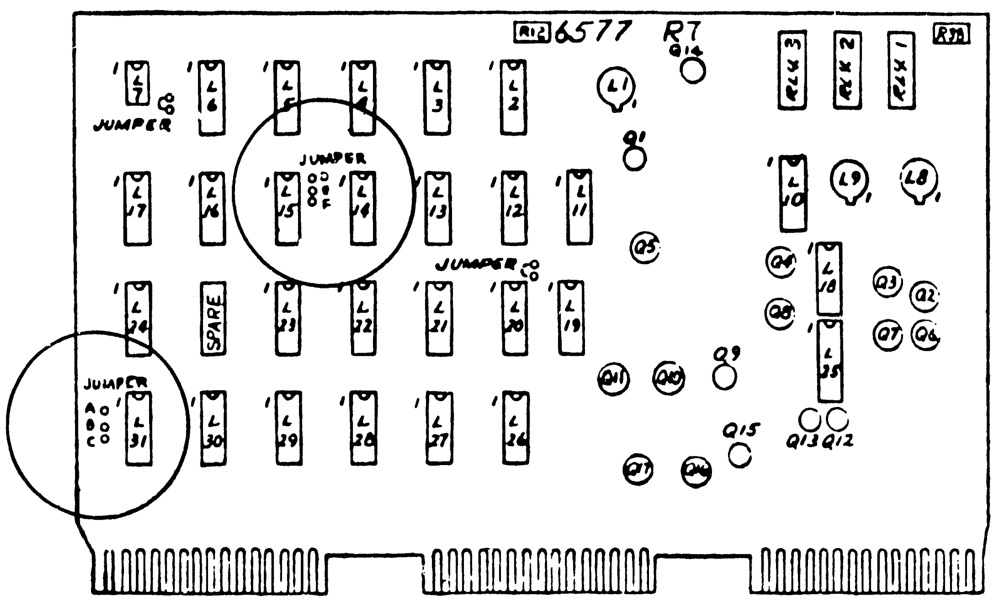
PROCEDURE:

On the 210-6577 Format and Printing Control board:
(ART REV 5 and above).

1. Remove the jumper from A to B (to the left of L31) and reinstall that jumper from B to C.

2. Remove the jumper from D to E (between L14 and L15) and reinstall that jumper from E to F.

FIGURE 8-1



3. No E-REV update is necessary.

4. Test the printer on-line to ensure that constant double spacing does not occur.

OR: On the 210-6577 Format and Printing Control board (ART REV 4 and below).

1. Cut the etch that connects L31-3 to L31-4. (Ref: Figure 8-2A)

2. Add a wire from L31-4 to L31-5. (Ref: Figure 8-2A)

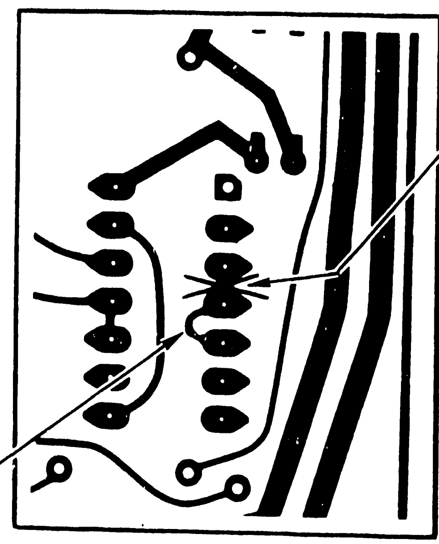
3. Cut the etch that connects L15-1 to L4-1. (Ref: Figure 8-2B)
   CAUTION: Cut this etch on the non-component side, at pin 1 of L15).

4. Add a wire from L15-1 to L15-2. (Ref: Figure 8-2B)

FIGURE 8-2A

L31

(Ref: Figure 8-1)



CUT

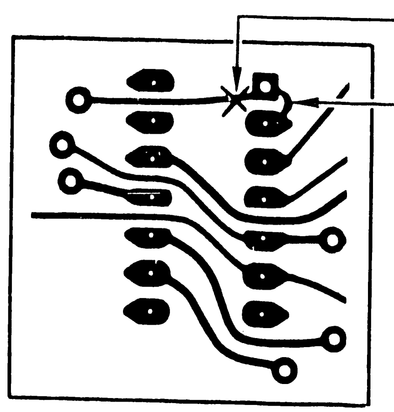
ADD

NON-COMPONENT SIDE

FIGURE 8-2B

L15

(Ref: Figure 8-1)



CUT

ADD

NON-COMPONENT SIDE

5. No E-REV change is necessary.

6. Test the printer on-line to ensure that constant double spacing does not occur.

8.2 PRINTER CONVERSION PROCEDURE -- MODEL 2231W TO 2231V

The purpose of this procedure is to enable a 2231W printer to be used on a 2200VS system, thus making that printer a 2231V. The standard 2200 system calls for the 2231W printer to do an automatic line feed after each carriage return. The 2200VS does not require this feature; the automatic line feed that occurs after a carriage return must be suppressed. There are no prerequisites for this conversion procedure, other than having an up-to-date printer with all pertinent ECNs installed. The entire procedure, including on-line testing, should not require more than thirty minutes, and no special parts are required.

PROCEDURE:

For 2231W printers with the Timing and Format Control PCB (WLI #210-6761, ART REV Level 3 and above), do the following:

1. Remove the jumper (located to the left of L9) from A to B and reconnect it from B to C.

2. Remove the jumper (located to the left of L9) from D to F and reconnect it from E to F.

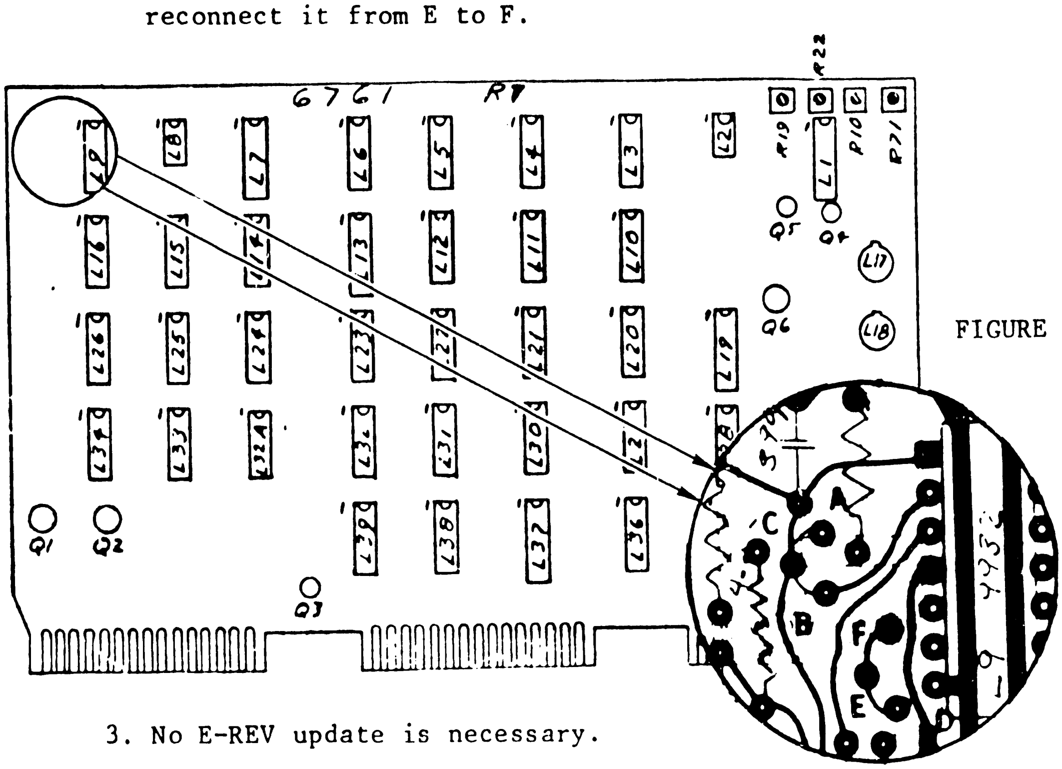


FIGURE 8-3

3. No E-REV update is necessary.

4. Test the printer on-line to ensure that constant double spacing does not occur.

OR: For printers with the Timing and Format Control PCB (WLI #210-6761, ART REV Level 2 and below), do the following:

1. This information is still pending; therefore, replace the ART REV level 0, 1, or 2 board with an ART REV 3 board (art rev 3 or higher), and ensure that the changes listed on page 8-4 are incorporated.

FIGURE 8-4 (for 6761, art rev 2 & below)
NOT AVAILABLE AS OF THIS PRINTING

2. Test the printer on-line to ensure that constant double spacing does not occur.

8.3 PRINTER CONVERSION PROCEDURE -- MODEL 2261W TO 2261V

The 2261W will either not print, or will skip two lines when connected to a 2200VS; this is remedied by the changes performed in the 61W-to-61V conversion. The entire procedure, including on-line testing, should require approximately 3.5 hours to complete. A number of prerequisites must be satisfied:

A. PREREQUISITES:

1. The 7131 board must be at E REV level 1. (E.C.N. #7165 previously installed). ECN 7480 will be installed on this board for the conversion procedure, but when that has been accomplished, the 7131 E REV will <u>still</u> be at <u>level 1</u>.

2. The 7132 board must be at E REV level 3. (E.C.N. #7969 previously installed). If the board is above E REV 3, replace it with a 7232 board and omit section C.2 of the procedure that follows. Certain hardware changes will be implemented on the 7132 E-REV <u>3</u> board for the conversion procedure, and when these have been accomplished, the board designation will be changed to 210-<u>7232</u>, E REV level <u>0</u>

3. The 7137 board must be at E REV level 4. (E.C.N. #7358 previously installed) If the 7137 board is below E REV level 4, order a new board. If the new board received is at E REV level 5, omit section C.3; if the board received is at E REV level 4, performing section C.3 will bring the board to E REV level 5.

4. The 210-7112 Workstation/Printer Adapter must be at E REV level 1. (E.C.N. #7516 previously installed; Ref: CSNL #38).

B. PARTS REQUIRED:

Two 100 pf, 10% ceramic capacitors, WL# 300-1100.
One .02 uf, 20% ceramic capacitors, WL# 300-1904.
Two 470 ohm, 1/4 watt resistors, WL# 330-2047.
Eight 1K ohm, 1/4 watt resistors, WL# 330-3010.
One 10K ohm, 1/4 watt resistors, WL# 330-4010.
One PROM chip, WL# 378-2159 R1.
One PROM chip, WL# 378-2160 R1.
A length of #24-gauge solid wire, WL# 600-9012.

C. PROCEDURE:

1. On the 210-7131 board, proceed as follows: (Ref: Fig. 8-5)

   a. Remove the PROM chip, WL# 378-2086 R2, from location L21 and replace it with PROM chip WL# 378-2159 R1.

   b. Remove the PROM chip, WL# 378-2087 R2, from location L22 and replace it with PROM chip WL# 378-2160 R1.

   c. do not increment the E Rev level of the board.

2. On the 210-7132 board, proceed as follows:

   a. On the component side of the board: (Ref: Figure 8-6)

      1. Remove the 150 pf capacitor C2, located to the left of L17 pin 1.

      2. Cut the etch between L17 pin 6 and L10 pin 4. Make the cut close to L10 pin 4.

   b. On the non-component side of the board, cut the following etches: (Ref: Figure 8-7)

      1. Between L19 pin 6 and L5 pin 5. Be sure that the 'running time meter' jumper between L5 pin 5 and L14 pin 5 remains intact.

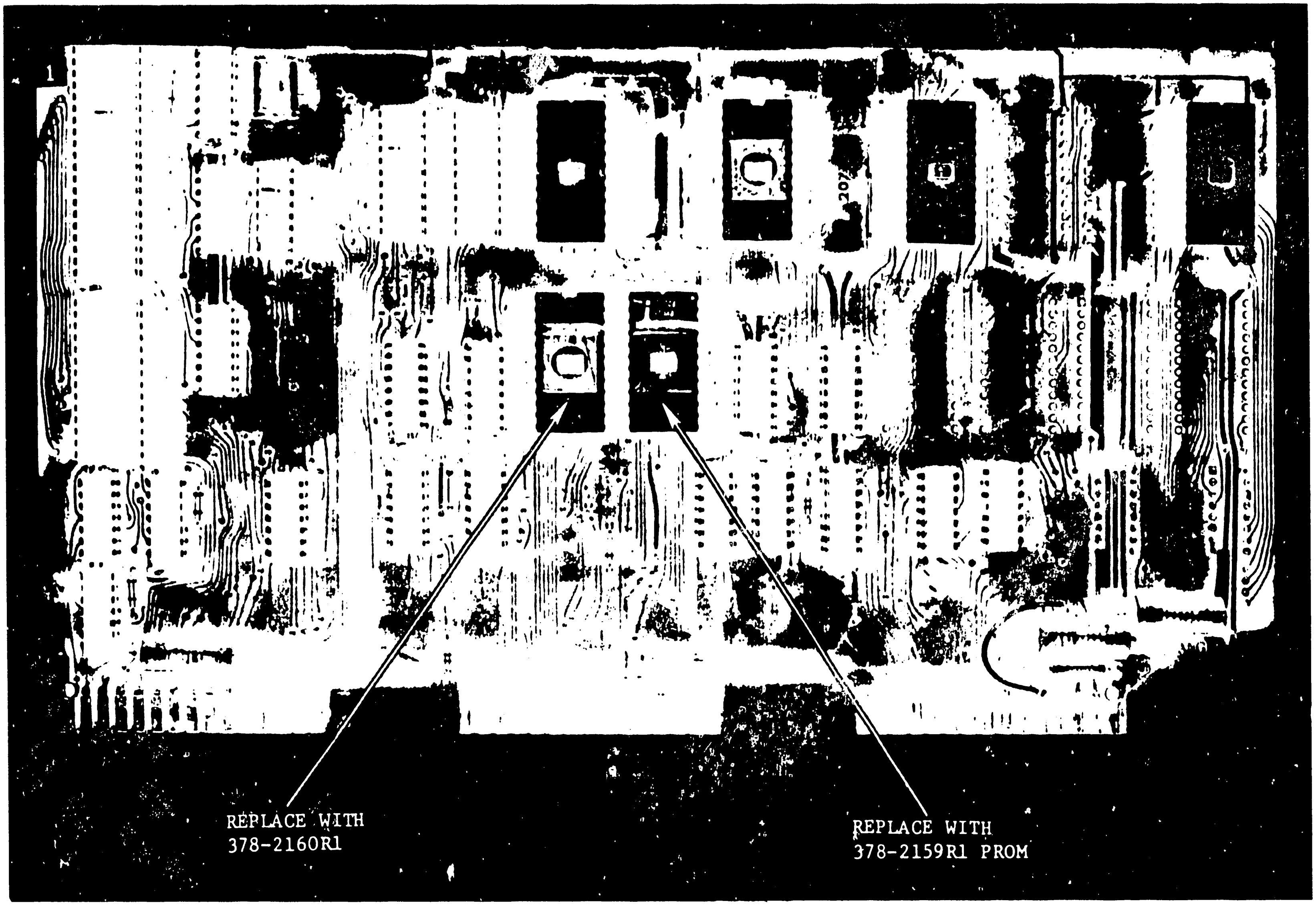


FIGURE 8-5 7131 PCB

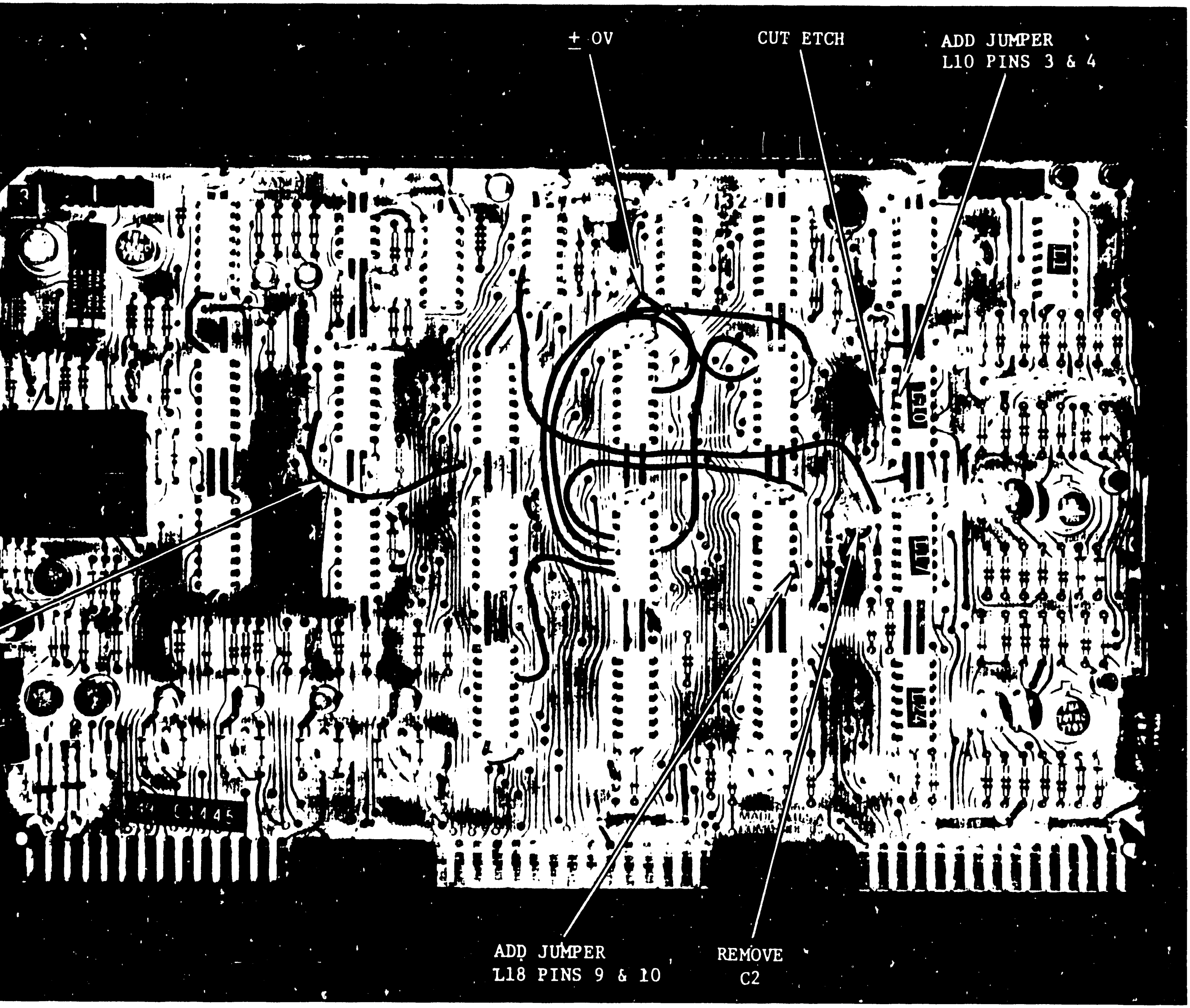


FIGURE 8-6 7132 PCB

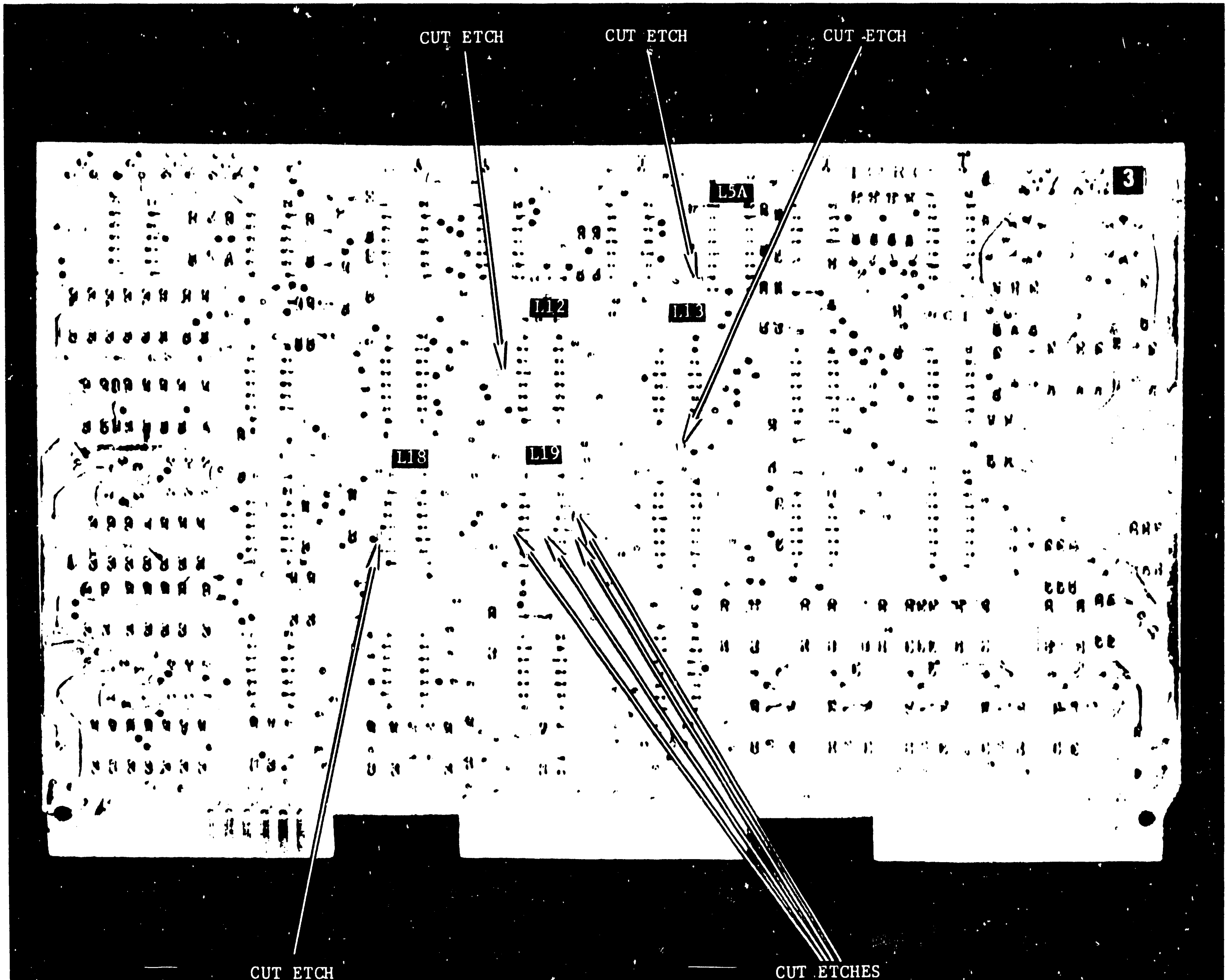


FIGURE 8-7 7132 PCB
(NON COMPONENT SIDE)

2. Between L11 pin 4 and L19 pin 4. Make this cut close to L19 pin 4.
3. Between L11 pin 9 and L19 pin 5. Make this cut close to L19 pin 5.
4. Between L11 pin 1 and L19 pin 3. Make this cut close to L19 pin 3.
5. Between L11 pin 10 and L19 pin 11. Make this cut close to L19 pin 11.
6. Between L11 pin 7 and L12 pin 13. Make this cut close to L12 pin 13.
7. Between L27 pin 14 and L5A pin 10. Make this cut close to L5A pin 10.
8. Between L11 pin 7 and L18 pin 10. Make this cut close to L18 pin 10.

c. On the component side of the board, add the following jumper wires: (Ref: Figure 8-6)

1. From L19 pin 3 to L11 pin 10.
2. From L19 pin 4 to L11 pin 2.
3. From L19 pin 5 to L11 pin 12.
4. From L19 pin 6 to L27 pin 14.
5. From L19 pin 11 to L11 pin 1.
6. From L12 pin 13 to 0 ± volts.
7. From L5 pin 5 to L17 pin 2.
8. From L10 pin 3 to L10 pin 4.
9. From L18 pin 9 t L18 pin 10.

d. The board may now be relabeled WL# 210-7232, E-Rev level 0.

3. On the 210-7137 board, proceed as follows. (Ref: Figure 8-8 in this publication, and the 7137 schematic in the Model 77 Quad-Head Maintenance Manual, CE publication #03-0061, Appendix E, page 10.)

a. Remove the ten 220 ohm, 1/4 watt resistors, R1 thru R10, and the ten 180 ohm, 1/4 watt resistors, R11 thru R20.
b. Replace R9 and R10 with two 100 pf, 10% capacitors, WL# 300-1100.
c. Replace R11 thru R18 with eight 1K ohm, 1/4 watt resistors, WL# 330-3010.
d. Replace R19 and R20 with two 470 ohm, 1/4 watt resistors, WL# 330-2047.
e. Remove diode D2, located to the lower-right of L15.
f. Replace diode D2 with a jumper wire.
g. Unsolder and lift pin 4 of L18 from the feed thru hole. This will remove pin 4 from its present signal run. Cut the pin close to the feed thru if necessary, but leave enough of the pin to accomplish step k. Be careful to preserve the surrounding etches. If the IC is damaged, replace it. (WL# 376-0276)
h. Unsolder and lift pin 1 of L17 from the feed thru hole. This will remove pin 1 from its present signal run. Observe the same precautions as in step 'g', and leave enough of pin 1 to accomplish step 's'. The part number for the IC at L17 is WL# 376-0003.
i. Remove the jumper wire between L11 pin 12 and L13 pin 12.
j. NOTE: Some manufactured boards do not correspond to the revised schematic of the 7137 board after ECN #7358 (E-Rev level 4) was installed. Before proceeding to the next step, verify the wiring of chip L6A, as described below, and correct if necessary:

   1) A jumper should be present between L6A pin 1 and L29 pin 7.
   2) A jumper should be present between L6A pin 2 and L6 pin 13.
   3) A jumper should be present between L6A pin 3 and pin 10 of connector 3.
   4) No other elements of L6A should be in use.

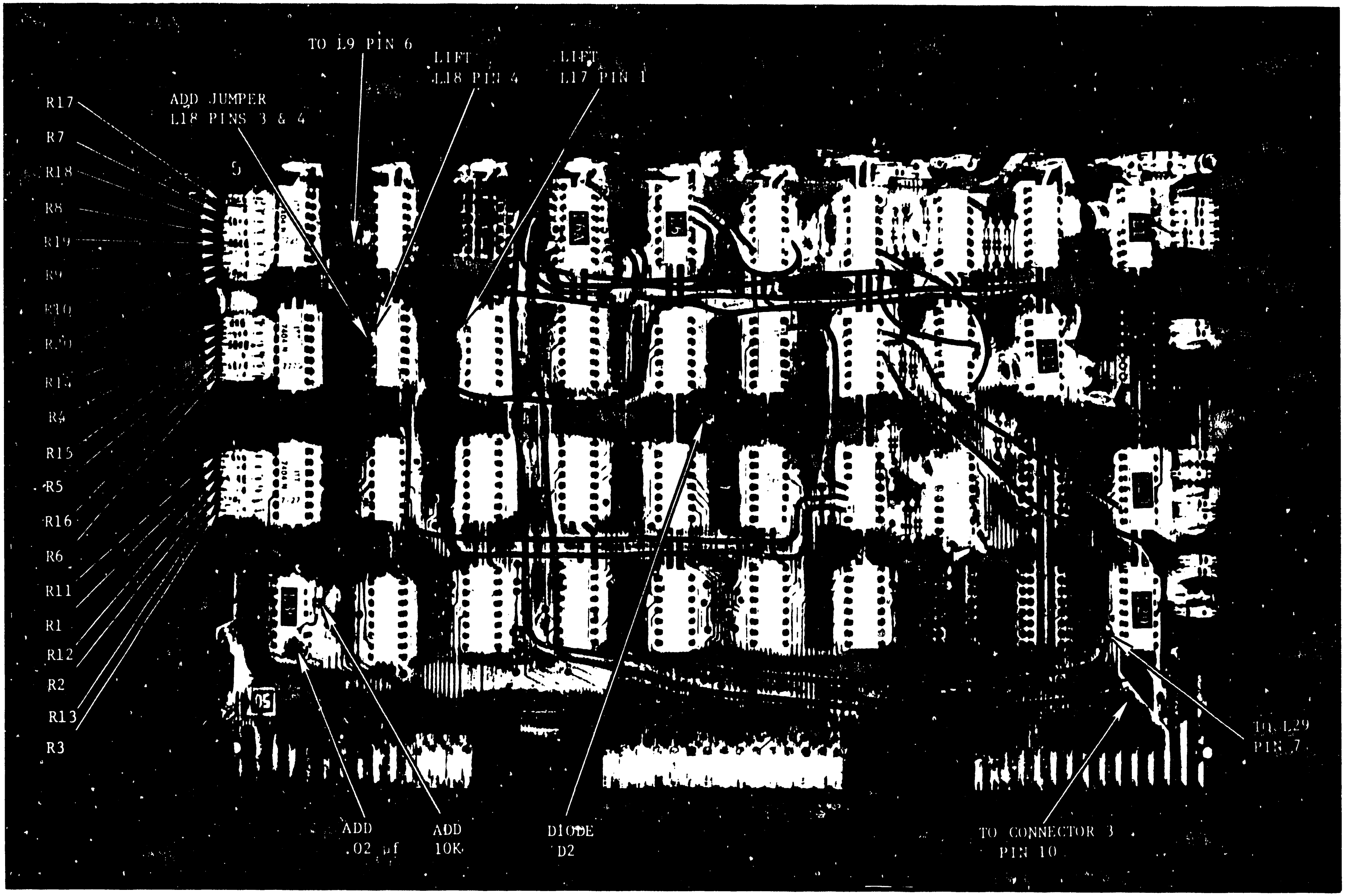


FIGURE 8-8 7137 PCB

k. Add a jumper wire between L18 pin 3 and L13 pin 4.

l. Add a jumper wire between L9 pin 6 and L6A pin 10.

m. Add a jumper wire between L11 pin 12 and L6A pin 9.

n. Add a jumper wire between L6A pin 4 and L6A pin 5.

o. Add a jumper wire between L6A pin 5 and L6A pin 8.

p. Add a jumper wire between L6A pin 6 and L13 pin 12.

q. Add a jumper wire between L14 pin 13 and L22 pin 4.

r. Add a jumper wire between L22 pin 5 and L18 pin 9.

s. Add a jumper wire between L22 pin 6 and L17 pin 1.

t. Add a 10K ohm, 1/4 watt resistor (WL# 330-4010) between L36 pin 12 and L36 pin 16 (+5VR).

u. Add a .02 uf, 20% capacitor, (WL# 300-1904) between L36 pin 12, and L36 pin 8 (0+ volts).

v. Increment the E REV sticker to level 5.

4. The left and right carriage bumper screws (Figures 8-9 & 8-10) must be adjusted to prevent the carriage from striking the carriage backstops and then bouncing back into the photocell area. As the carriage approaches either the left or right margin, the corresponding bumper screw should barely make contact with its respective margin spring.

5. Servo speed and window duty cycle electrical adjustments must be completed on the 7132 card as described on page 125 of the 2200VS Preventive Maintenance Manual, CE publication #03-0066, or on page 5-6 of the Model 77 Quad-Head Matrix Printer Maintenance Manual, CE publication #03-0061.

CAUTION:

A new and untested 7132 board may be so far out of electrical adjustment that, initially, there will be no carriage movement. Especially critical are the 10/12-pitch 50% window signal duty cycle adjustments.

6. Run diagnostic "PRTEST" on the printer to check for proper operation.

7. Correct the 7132 schematic, sheet 1 of 1, to reflect this change. The updated 7137 schematic has been published.

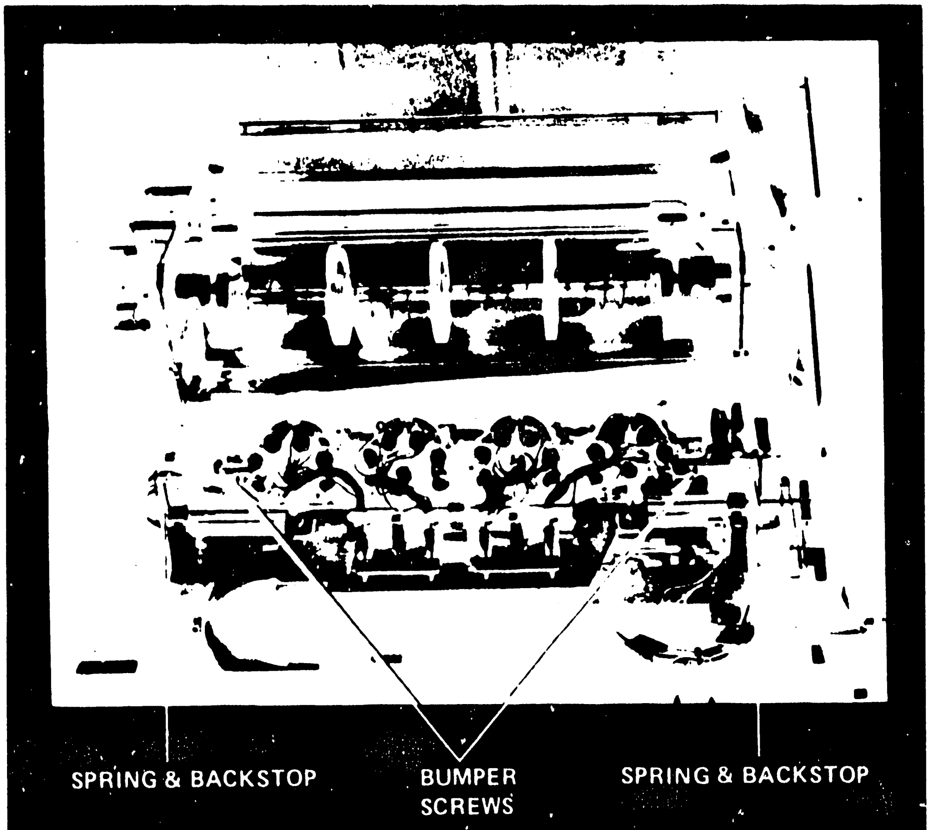


FIGURE 8-9 LOCATION OF BUMPER SCREWS

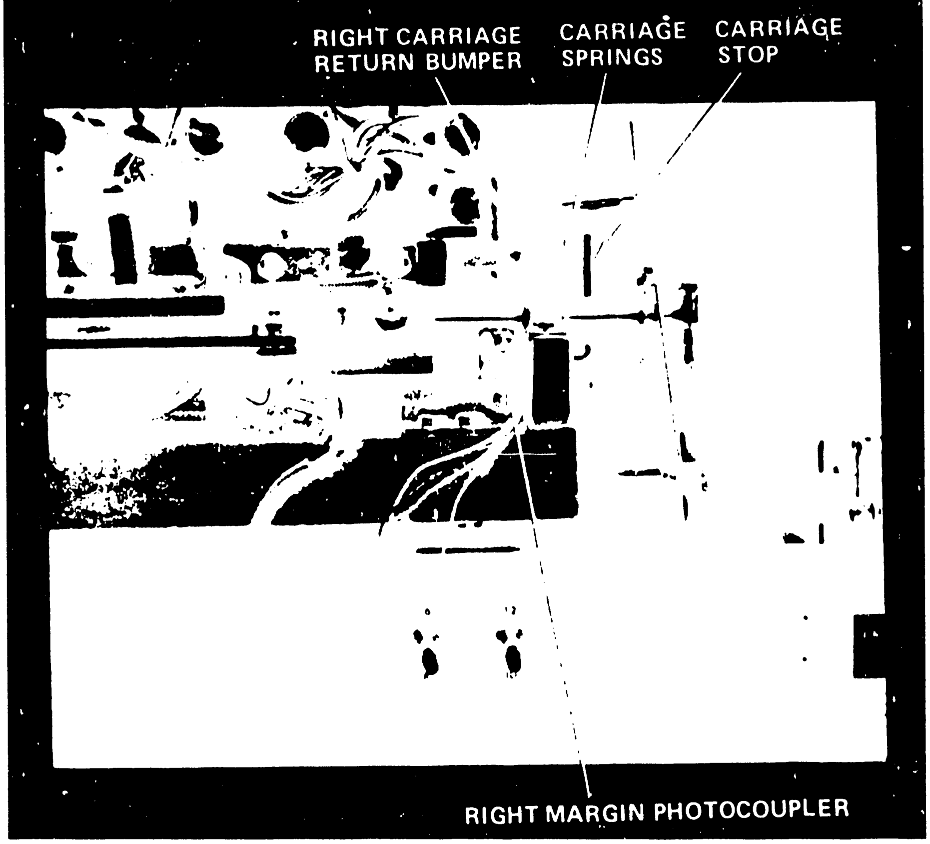


FIGURE 8-10 BUMPER SCREW ADJUSTMENT

8. Amend the parts list for the 7131, 7132, and 7137 boards to include these changes.

8.4 PRINTER CONVERSION PROCEDURE -- MODEL 2281 TO 2281V

The purpose of this procedure is to enable a 2281 (Diablo Corp.; Daisy-Wheel printer) to be used on a 2200VS system, thus making that printer a 2281V. The 2200VS requires a delay in the 2281 ACK signal that the standard 2281 does not provide.

Except for parts, there are no special prerequisites for this conversion, and the entire procedure, including on-line testing, should not require more than thirty minutes.

All changes are made to the printer control board (7443 or 7143), and, in general, the solutions to the problem are as follows:

1. Replace the 7143 board or the 7443 board (artwork revision 1 or below) with a new version of the 7443 board. There is logic on the new 7443 board that cannot be duplicated in the field, due to the lack of space on the old board.

2. For 7443 boards of artwork revision 2, the PROMs at locations L11 and L12 are replaced.

PARTS REQUIRED:

One PC Board, WLI #210-7443C. Specify artwork revision 2.
One PROM chip, WLI #378-2217.*
One PROM chip, WLI #378-2218.*

PROCEDURE:

1. For printers that contain a 7143 board or a 7443 board (artwork revision 1 or below), replace the board with a 210-7443C.

2. For printers that contain a 7443 artwork revision 2 board:
   a. Remove the board from the printer.
   b. Remove the PROM from location L11 and replace it with PROM WL# 378-2218. (Ref: Figure 8-12)
   c. Remove the PROM from location L12 and replace it with PROM WL# 378-2217.
3. Ensure that the CE signal jumpers are wired as shown in Figure 8-13.
4. Do not increment the E-Rev of the board.
5. Run PRTEST to check for proper operation.
6. Correct the PROM loading chart on the 7443 schematic, sheet 3 of 3, to include this change.

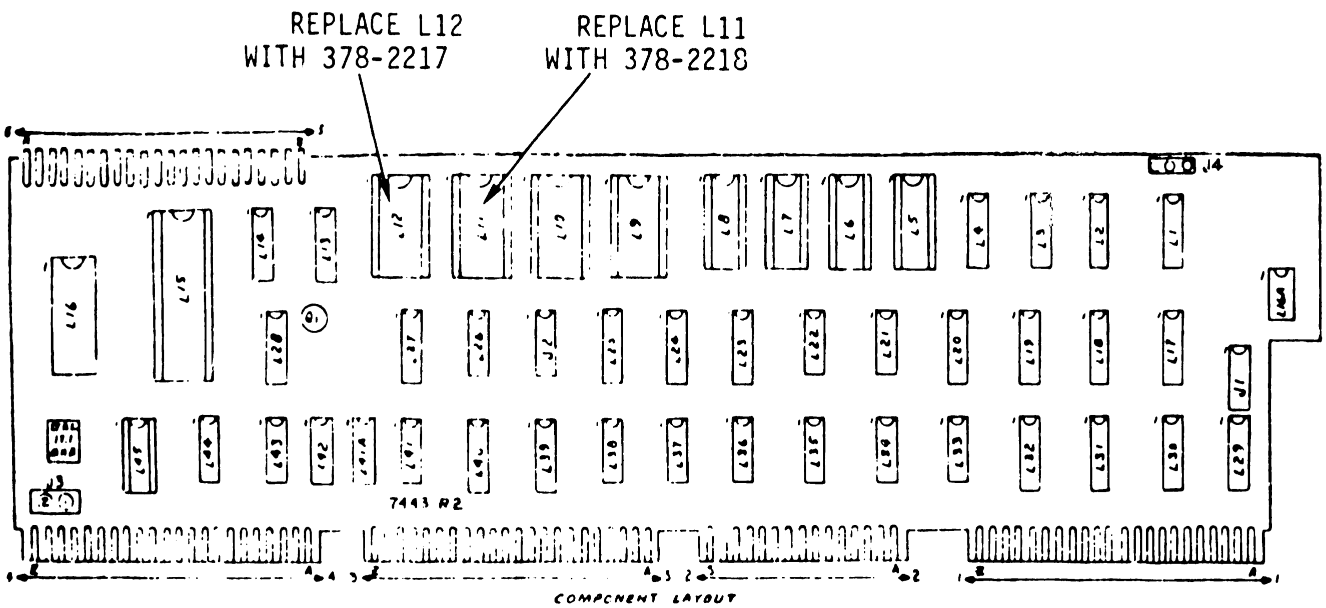


FIGURE 8-12

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* If the present 7443 board is artwork revision 2, order the PROM chips only; otherwise, order the complete 7443C. The 210-7443C already contains the correct PROMs for the 2281V. PROMs that are swapped out must be returned, 'Attention: VS PROM LOGISTICS' in Billerica, MA.

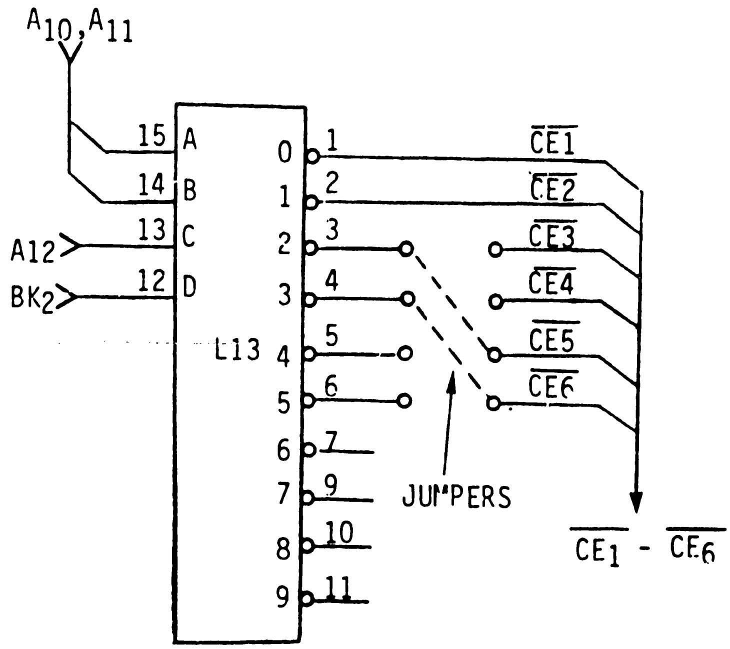


FIGURE 8-13 JUMPER CONFIGURATION FOR 2281V PRINTER

SECTION 9
SYSTEM TURNOVER PROCEDURE

SECTION 9

SYSTEM TURNOVER PROCEDURE

9.0 GENERAL

A. Remove the Customer Engineering Operating System pack and scratch packs from the disk drives.

B. Mount the customer's Operating System pack. Perform an IPL from the Operating System. Log on to a Workstation, and, utilizing the display functions of the Command Processor, display the 'Files in Library' @ System @ on the customer's Operating System pack.

Check through the files to ensure the presence of customer purchased options.

For example, if the BASIC compiler was purchased by the customer, the following files should be present in library @ System @:

BASIC
WB1PASS1
WB2PASS2

If the COBOL compiler was purchased, the following files should be present:

COBOL
WC1PASS1
WC1PASS2

The file "RPGII" is the only file required if the RPG compiler was purchased.

If any of the above compilers were not purchased by the customer, 'scratch' the related files by means of the Command Processor Scratch function.

C. Mount the customer scratch packs on all additional disk drives. (The customer makes the determination of which packs will be his scratch packs.)

CAUTION:

Ensure that the customer's scratch packs have no files on them before performing the initialize procedure. Also, demonstrate to the customer or computer operator how the disk initialize procedure is performed. Include in the demonstration a description of the disk drive's operation, such as loading nd unloading disk packs, emergency power off of the disk drive, and disk drive fault recovery.

Perform a disk initialization procedure on each of the customer's scratch packs.

D. Evening Shut-down Procedure (Perform & Explain to Customer).

1. Depress the "Control Mode" button on the front panel of the 2200VS Mainframe. This prevents a disk I/O command from being halted prior to normal completion.
2. Place all disk drives into "LOAD MODE" (heads unloaded).
3. Using the power switch at the rear of each workstation, power down all workstations with the exception of workstation #0 (turn the intensity down on W/S #0).
4. Power down all printers.
5. Unload tape from tape drives and power down.

E. Daily Start-up Procedure (Perform & Explain to Customer).

1. Bring all disk drives up to the ready condition.
2. On W/S #0, type the following:

    X

    (Enter) Key

3. Power on all workstations and depress the "Help" key at each workstation (a LOGON screen should be displayed in each screen).

4. Power on all printers.

5. Power on all tape drives.

F. Allow the customer to test the system using his programs. If the customer is satisfied with the operation of the system, officially turn the system over to the customer. (As of this printing, there is no official form to sign which effects turnover, nor has one been proposed. This should be merely a verbal notification given by the CE performing installation.

APPENDIX
A
SMD FIELD
TEST UNIT

APPENDIX A

SMD FIELD TEST UNIT

PAGE

FIGURES

TABLES

CHAPTER 1 GENERAL DESCRIPTION

CHAPTER 1 GENERAL DESCRIPTION

1.1 INTRODUCTION

The CONTROL DATA TB304A Field Test Unit (FTU) is a portable, self-contained tester for exercising and/or simulating on-line operations in Storage Module Drives (SMDs) of the following series: BK5, BK7.

The FTU is housed in a suitcase-type carrying case that provides a control panel, a logic board, and an integral power supply. The case contains space for storing the power cable, all necessary I/O cables, and a head alignment card. The head alignment card plugs into the logic chassis of the SMD and permits individual head alignment, using a null meter mounted in the FTU control panel. In addition, a special I/O Bypass cable is provided that enables head alignment and servo maintenance to be performed without disconnecting the I/O cables between the SMD and its controller.

1.2 SPECIFICATIONS

Specifications for the TB304A are given in Table 1-1.

1.3 FUNCTIONAL DESCRIPTION

The TB304A provides five access (seek) modes, four read/write modes, and two modes for determining head selection.

1.3.1 Access Modes

Direct Seek

The drive under test will perform a single seek to the track number set in the Cylinder Address switches on the FTU control panel.

Continuous Seek (When used with Direct Seek)

The drive under test will perform repetitive seeks between any two tracks selected by the operator. Operation will continue until the Stop switch on the FTU control panel is actuated.

Sequential Forward Seek

The drive under test will perform single-track incremental seeks until the last track is reached, then seek to track 00 and continue incremental seeks in the same manner until the Stop switch is actuated on the FTU control panel.

Sequential Reverse Seek

The drive under test will perform single-track decremental seeks, starting with the track nominated by the Cylinder Address switches, until track 00 is reached. The SMD will then return to the nominated track and repeat the operation until the Stop switch is actuated on the FTU control panel.

Random Seek

The drive under test will perform seeks to random tracks as selected by a free-running counter within the FTU. Operation will continue until the Stop switch is actuated.

1.3.2 Read/Write Modes

The TB304A generates serial NRZ write data at a rate determined by the servo clock signals transmitted from the unit under test. When a repeated access mode is selected (that is, any mode except Direct), a read/write operation will be completed at the selected cylinder, after which a seek will be initiated to the next cylinder address (as determined by the access mode) and the read/write sequencing will continue until the Stop switch is actuated or an error occurs. For Direct seeks, the R/W operation will continue at the selected track or cylinder (depending upon the head select mode) until the Stop switch is actuated.

The number of tracks read or written during each R/W operation is controlled by the mode of head selection chosen. For Manual head selection, only the track under the head selected by the Head Address switches will be read or written. For Sequential head selection, the heads will be sequenced so as to read or write each track in the cylinder. When the highest-numbered head (or cylinder track) has been exercised, the SMD will seek to another cylinder (except in Direct Seek) and the R/W operation will be repeated at that new cylinder, starting with head 00.

Write Format

When the FTU Wrt-Rd Select switch is set to WRT FORMAT, the FTU will write each selected track with the appropriate track address and a repetitive 8-bit data pattern that has been set in the Data Pattern switches on the FTU control panel. The FTU also provides a means for indicating a defective track when using the Write Format mode.

Write

When the FTU Wrt-Rd Select switch is set to WRT, the FTU will write the repetitive 8-bit data pattern on the selected track, after having first read and verified the track address.

Read

When the FTU Wrt-Rd Select switch is set to RD, the FTU will read the data from the selected track, after having first read and verified the track address.

Write Then Read

When the FTU Wrt-Rd Select switch is set to WRT RD, the FTU will verify the track address and write the 8-bit data pattern on the selected track during one revolution of the drive, then verify the track address and read back the data during the second revolution

Off

A fifth position (OFF) of the Wrt-Rd Select switch is available for "access only" operations. This position is also used during the head alignment procedure.

TABLE 1-1. TB304A SPECIFICATIONS

Characteristic	Condition	Specifications
Size	L x W x H	20.5 x 16.0 x 8.0 inches (52.0 x 40.6 x 20.3 cm)
Weight		30 lbs. (13.6 kg)
Temperature	Operating	+60°F to +90°F (15.5°C to 32°C)
	Gradient (rise per hour)	+12°F (+6.6°C)
	Non-operating	+30°F to +150°F (-34°C to +66°C)
Relative Humidity (no condensation)	Operating	20% to 80%
	Non-operating	5% to 95%
Altitude	Operating	-1000 ft to +10,000 ft (-306 m to +3048 m)
	Non-operating	-1000 ft to +35,000 ft (-306 m to +10.7 km)
Input Power	50/60 Hz, single phase	120 (+8, -18) Vac @ 1.5 A, max. 240 (+17, -27) Vac @ 0.8 A, max. (conversion is via terminal board in power supply)
Minimum Input Voltage	120 Vac	90 Vac (100 Vac nominal, ±10%)
	240 Vac	180 Vac (200 Vac nominal, ±10%)

CHAPTER 2 OPERATION

CHAPTER 2 OPERATION

2.1 INTRODUCTION

This section provides installation information for the TB304A, including the purpose and use of the various cables supplied with the tester, and gives detailed operating instructions for the many test procedures that are possible with the FTU. A general view of the FTU and its associated hardware is shown in Figure 2-1.

2.2 INSTALLATION

2.2.1 Operating Voltage

The FTU is connected at the factory for use with a 120-Vac 50/60-Hz power source. To reconnect for 240-Vac operation, proceed as follows.

1. Open the FTU cover. Unhinge cover and set aside if desired.

2. Raise the control panel.

3. Remove head alignment card from its compartment on top of the power supply box.

4. Remove four screws securing cover plate of power supply; remove the cover plate.

5. Remove jumper straps connecting terminals 1 and 2, and terminals 3 and 4 of A1TB1.

6. Install both junpers so as to connect terminals 2 and 3.

7. Replace and secure the power supply cover plate.

8. Replace the head alignment card in its compartment.

9. Procure a 120-to-240 Vac conversion plug from a local supply house and attach to the FTU power cord plug. Alternatively, remove the molded 3-prong plug attached to the FTU line cord and install one suitable for 240-Vac receptacles.

The FTU is now ready for 240-Vac operation.

2.2.2 I/O Cables

Five I/O cables are provided. The standard A-cable has a 75-pin block-type connector on each end. The standard B-cable is equipped with two 34-pin block-type connectors. For the BK series SMD's, two adapter cables are provided for converting the block connectors on the standard I/O cables to the flat connectors on the BK-series machines.

The fifth cable is the I/O Bypass cable that contains a 28-pin female connector on one end, the other end fanning out to two 14-pin male connectors. These male connectors plug into locations F01 (P1) and F06 (P2) on the FTU logic board. Pin 1 of the 14-pin connectors P1 and P2 should be aligned with pin 2 of the 16-pin locations on the logic board. The 28-pin connector (P3) connects to the drive logic chassis according to the type of information needed. Refer to Table 2-1.

TABLE 2-1. I/O BYPASS CABLE CONNECTIONS

SMD Series	Connect 28-pin connector P3 to
BK5xx	A02 *
BK7xx	JA84

*Pin 1 of P3 corresponds to pin 16 of A02

NOTE

The I/O Bypass cable is useful when doing head alignment and for exercising the drive access mechanism. Read/write operations, however, cannot be performed using the Bypass cable.

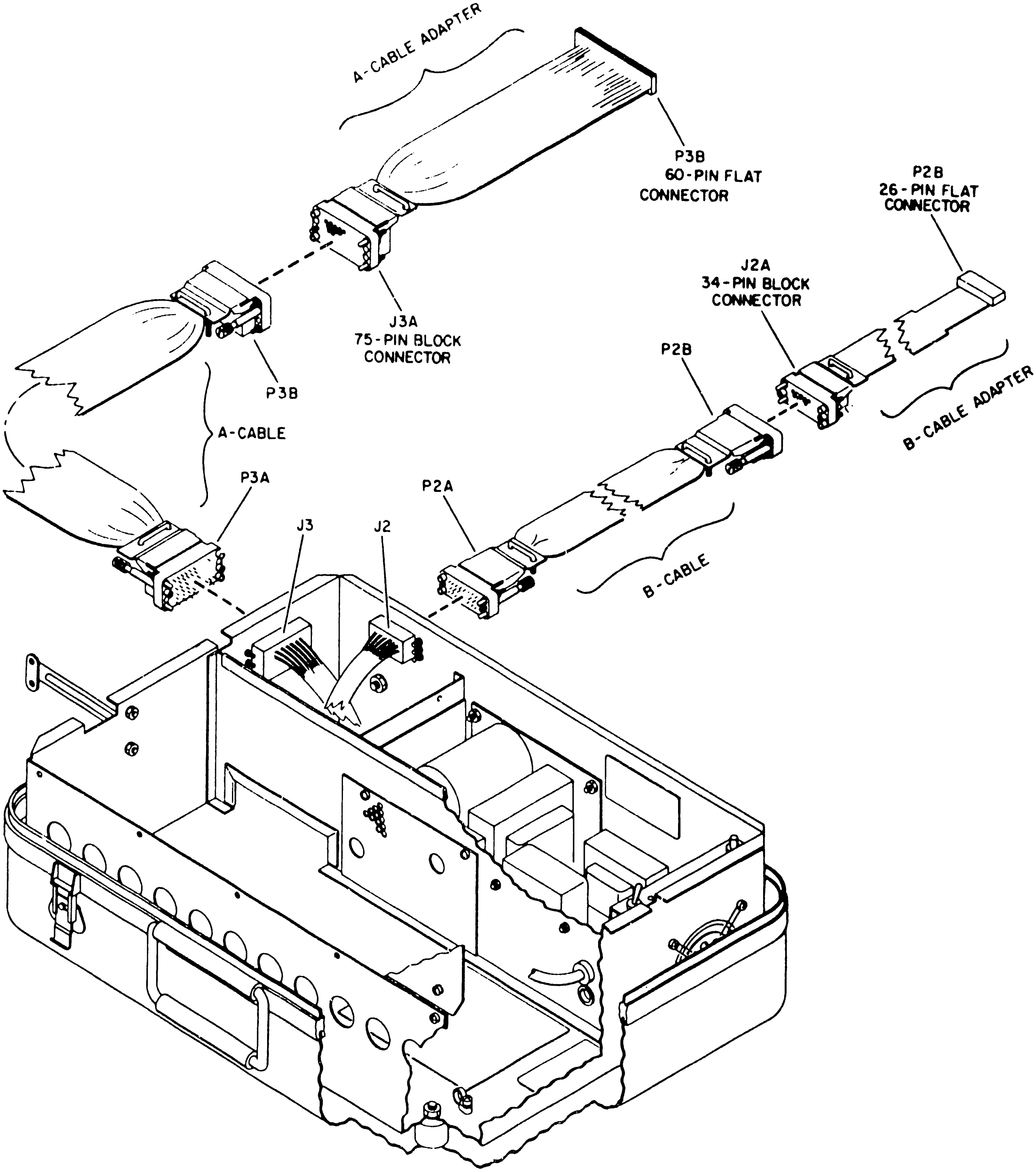


Figure 2-1. TB304A and Associated Hardware (Sheet 1)

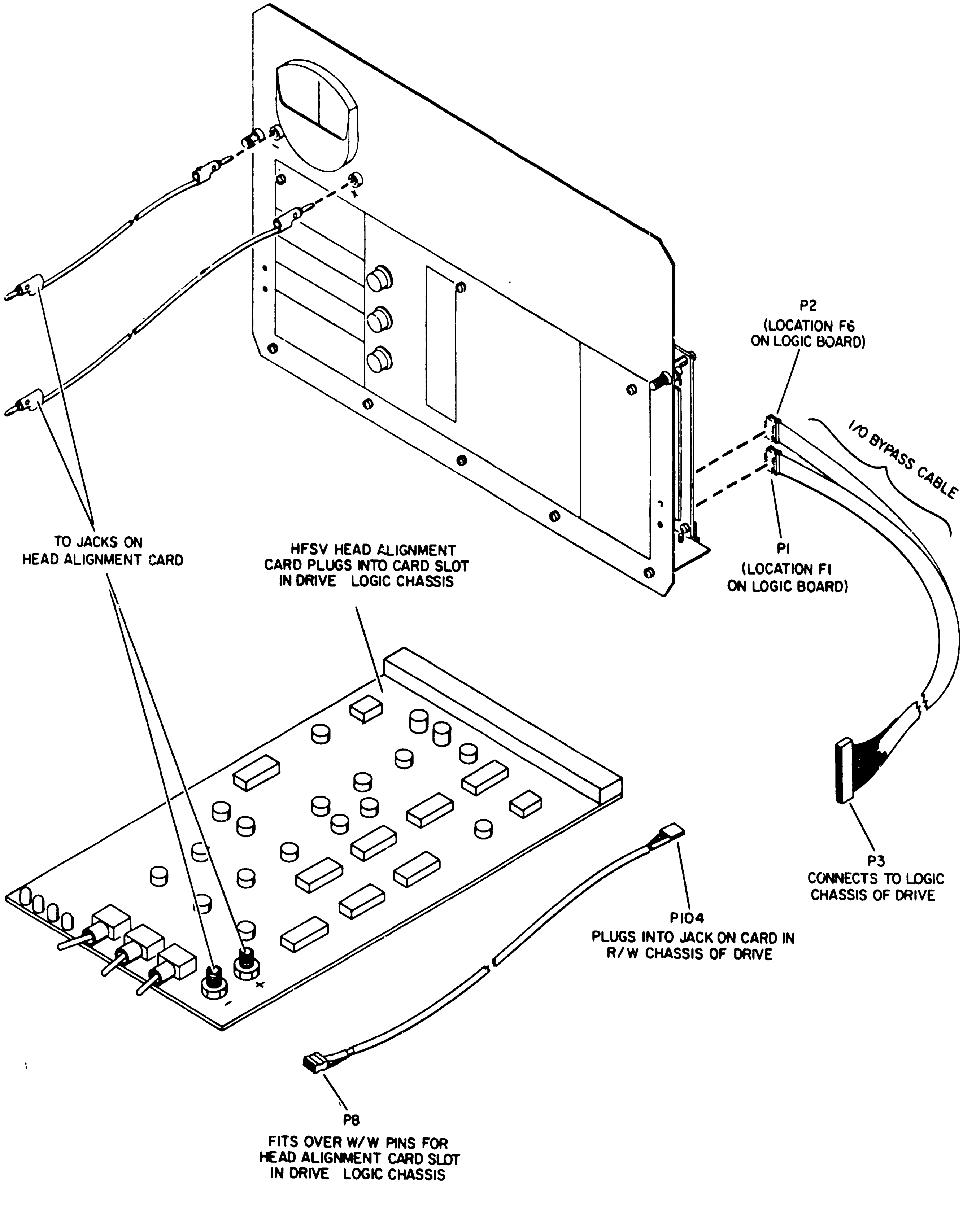


Figure 2-1. TB304A and Associated Hardware (Sheet 2)

2.2.3 Head Alignment Cable

Head alignment using the TB304A requires installing the special head alignment card in the proper position of the drive logic chassis, and connecting the 4-wire head alignment cable between the logic chassis and the appropriate jack in the drive's R/W assembly. Table 2-2 gives the needed information for the SMD series. A pair of test leads (provided) is then installed between the banana jacks on the head alignment card and the null meter on the FTU control panel.

TABLE 2-2. HEAD ALIGNMENT CONNECTIONS

SMD Series	Head Alignment Card Location	Head Alignment Cable P104	Head Alignment Cable P8
BK5xx	A02	Plugs into J104 on Head Select/Read Amplifier card in R/W Chassis.	Slips over W/W pins 8A,B through 11A,B at location reserved for Head Alignment card. (See column at left.)
BK7xx	A16	Plugs into J1 on Read Amplifier card in location E03 of R/W chassis.	

2.3 CONTROLS AND INDICATORS

Except for the power switch and circuit breaker mounted on the power supply box, and the sector switches mounted in location A20 on the logic board, all controls and indicators for operation of the TB304A are located on the control panel (figure 2-2). The controls and indicators are described below, moving from top left to bottom right across the panel. An asterisk following the switch or indicator name denotes that it is for use only with the standard I/O cables. That is, the function/indication is not provided when the I/O Bypass cable is used in lieu of the standard A and B cables. Sector switch settings are given in table 2-3.

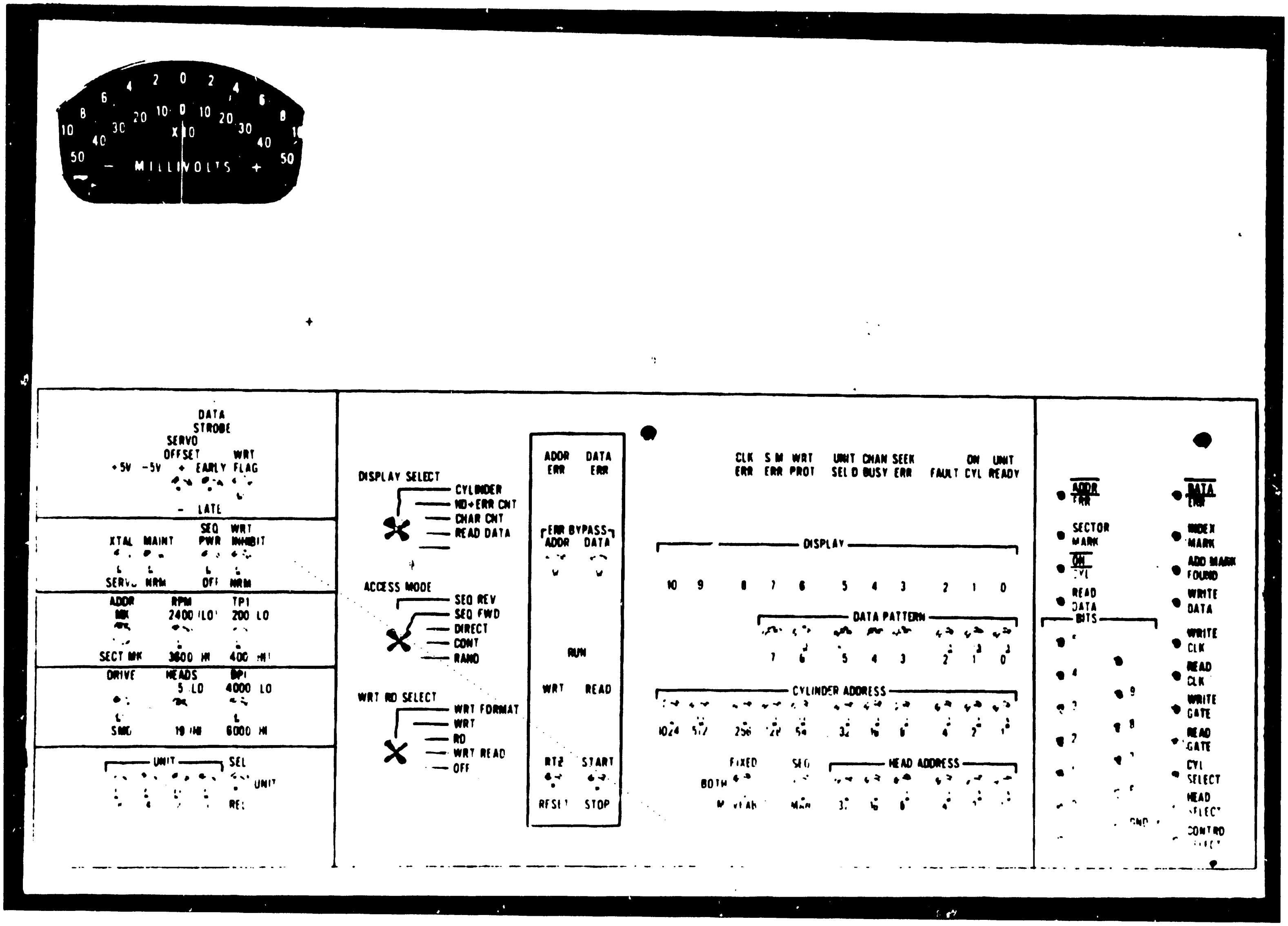


FIGURE 2-2. TB304 CONTROL PANEL

+5V, -5V indicators	Indicate that the respective power supply voltages are present.
SERVO OFFSET switch	A 3-position switch with center "off":
	+ Commands the drive to offset the carriage in the positive direction (toward the spindle).
	CENTER Nominal positioning (no offset).
	- Commands the drive to offset the carrige in the negative direction (away from the spindle).

NOTE

The Start/Stop switch must be actuated to effect any change in offset by the drive when in Direct mode.

DATA STROBE* switch	A 3-position switch with center "off""
	EARLY Moves the drive Read strobes from nominal to an earlier time with respect to data.
	CENTER Drive strobes at nominal timing.
	LATE Moves the drive Read strobes from nominal to a later time, with respect to data.
WRT FLAG* switch	When moved UP, this switch causes a Defective Track flag bit to be inserted in Bit 6 of Address Word 1, provided that:
	a. WRT-RD SELECT switch is set to WRT FORMAT
	b. ACCESS MODE switch is set to DIRECT
	c. Head Select switch (SEQ-MAN) is set to MAN.

XTAL/SERVO switch	XTAL	A crystal oscillator within the FTU provides a nominal 9.667 MHz clock signal. Used for tester maintenance.
	SERVO	Servo Clock signals from the drive provide the basic timing for the FTU.
MAINT/NRM switch	MAINT	Used to perform maintenance on the FTU without a drive connected. Provides pseudo Ready and ON Cylinder signals to simulate a drive response.
	NRM	Normal testing of a drive is done in this position.
SEQ PWR/OFF* switch	SEQ PWR	In this position, the FTU commands the drive to power up, provided that: a. The drive is in the REMOVE mode. b. Primary power is available at the drive. c. The drive START switch is ON (Indicator lighted).
	OFF	In this position, the FTU cannot power up the drive.
WRT INHIBIT/NRM* switch	WRT INHIBIT	Prevents writing by the drive. Writing is inhibited even though all other FTU switches are set to perform a write operation.
	NRM	Allows a normal Write operation in the drive, provided that other FTU switches are set to perform a write operation.
ADDR MK/ SECTOR MK* switch	ADDR MK	The FTU writes an Address Mark when in the Write Format mode, or reads the Address Mark in other active positions of the WRT-RD SELECT switch.
	SECTOR MK	Disables the writing or reading of Address Marks; permits reading of Sector Marks only.
RPM switch	2400 (Lo) 3600 (Hi)	Set to 3600 for CDC 75 Meg and 288 Meg drives.
TPI switch	200 (Lo) 400 (Hi)	Must be set to correspond to the number of tracks per inch of the drive under test. Set to 400 for CDC 75 Meg and 288 Meg drives.
DRIVE switch	( ) SMD	Set to SMD for CDC 75 Meg and 288 Meg drives.
HEADS switch	5 (Lo) 19(Hi)	Must be set to correspond to the number of heads present in the drive under test.

BPI switch	4000 6000	Must be set to correspond to the bits-per-inch rating of the drive under test. Set to 6000 for CDC 75 Meg and 288 Meg drives.
UNIT* switches	8 4 2 1	Used to indicate the binary value of the four Unit Select lines to the drive. This code must match that of the logic plug in the drive under test.
UNIT SEL/REL* switch		A 3-position, center-off switch with locking "up" end momentary "down" positions:
	SEL	(locking) Sends a Unit Select Tag to the drive under test.
	Center	Drops the Unit Select Tag to the drive under test.
	REL	(momentary) Sends a Release Signal for dual-access drives. Has no function for single-access drives.
DISPLAY SELECT switch		A 4-position rotary switch that controls the eleven DISPLAY lamps on the FTU control panel. The interpretation of the display is shown below. When the switch is set on READ DATA, the cylinder address will be displayed as long as the FTU is running. The data pattern read will be displayed if the FTU has stopped because of a data error, otherwise the display wil be zeros.

DISPLAY SELECT SWITCH	DISPLAY-BIT LED's										
	10	9	8	7	6	5	4	3	2	1	0
CYLINDER	-	512	256	128	64	32	16	8	4	2	1
HD ERR CNT	-	8	4	2	1	-	16	8	4	2	1
		ERROR COUNT					HEAD REGISTER				
CHAR CNT	-	8192	4096	2048	1024	512	256	128	64	32	16
READ DATA	-	-	-	7	6	5	4	3	2	1	0
				READ BITS							

ACCESS MODE switch	A 5-position rotary switch that controls the Seek (access) mode of the drive under Test:	
	SEQ REV	(Sequential Reverse) The drive seeks to the address in the FTU Cylinder Address Switches, sequences down to zero, and then repeats.
	SEQ FWD	(Sequential Forward) The drive performs a series of incremental seeks, starting with the address that is in the Cylinder Address register at the start of the operation. When maximum cylinder address is reached, the cycle begins again at address zero.
	DIRECT	The drive seeks to the address in the Cylinder Address switches. Seeking to another address requires chnging the address in the switches and manually initiating another Seek operaion by actuating the START switch.
	CONT	(Continuous) The drive seeks alternately between the address in the Cylinder Address switches and that in the Cylinder Address register (CAR). The contents of CAR does not change during this operation.
	RAND	(Random) The drive seeks to random addresses generated by increasing the count in the CAR during the time that the drive is not "on cylinder".

WRT-RD SELECT* switch	A 5-position rotary switch that determines the manner in which data will be exchanged between the FTU and the drive under test:

WRT FORMAT	(Write Format) Writes an Address Mark (if selected), the correct Track Address (HA and CA), and a pre-selected 8-bit Data Pattern field on each selected track. The format is as shown in figure 2-3.
WRT	(Write) Writes a pre-selected pattern in the Data field of each selected track, after first verifying the Track Address.
RD	(Read) Verifies the Track Address, then reads the selected track.
WRT-READ	(Write Then Read) Verifies the Track Address, writes the Data field on the selected track, then reads the track. (operation requires two revolutions.)
OFF	Disables all Read/Write functions; restricts the drive under test to Seek operations only.

ADDR ERROR* indicator	Indicates that the address information received from the drive differs from the address requested, or that an Address Mark is missing when reading in the Address Mark mode, or that the Address sync bit was not received from the drive.
DATA ERROR* indicator	Indicates that the 8-bit data pattern received from the drive differs from the pattern set in the DATA PATTERN switches.
ERROR BYPASS* switches	

ADDR	(Address) If this switch is in the "up" position, it allows the FTU to continue operating when an Address or S-M error occurs. In the "down" position, an Address error will stop the FTU.
DATA	If this switch is in the "up" position, it allows the FTU to continue operating when a Data error occurs. In the "down" position, a Data error will stop the FTU.

RUN indicator	Indicates that the FTU is running or that the RTZ switch (Return to Zero) is being actuated. Five conditions will turn off the indicator. a. Returning the RTZ switch to neutral (but provided that RUN was not lit before the RTZ operation). b. A valid (unbypassed) error. c. Actuating the STOP switch. d. Actuating the RESET switch. e. If the Ready signal from the drive goes low.
WRT indicator	Indicates the the FTU is writing.
RD indicator	Indicates that the FTU is reading.
RTZ/RESET switch	A 3-position momentary switch with center "off": RTZ — Clears HAR and CAR; clears the drive's Fault register and causes the drive to perform a Return-to Zero seek. The RUN light on the FTU control panel will be lit as long as this switch is actuated to the RTZ position. CENTER — Neutral position. RESET — Clears the Error FF's in the FTU and the drive. This switch must be actuated after a valid error has occurred in order to be able to restart the FTU.
START/STOP switch	A 3-position momentary switch with center "off": START — Generates a pulse that starts the FTU; turns on the RUN indicator. An existing Error condition must be cleared by actuating the RESET switch before START will have any effect. CENTER — Neutral position. STOP — Stops the FTU; extinguishes the RUN indicator.
CLK ERROR	Indicates that a period of 200 nanoseconds has expired without a servo clock pulse from the drive under test.
S M ERROR* indicator	Indicates that an incorrect number of Sector Marks was received from the drive under test between successive Index Marks.
WRT PROTECT* indicator	Indicates the presence of a Write Protect signal from the drive under test.

CHAN BUSY* indicator	Indicates the presence of a Channel Busy signal from the drive under test.
SEEK ERROR* indicator	Indicates the presence of a Seek Error signal from the drive under test.
FAULT* indicator	Indicates the presence of a Fault signal from the drive under test.
ON CYL indicator	Indicates the presence of an On Cylinder signal from the drive under test, or a pseudo On Cylinder signal generated by the FTU if in Maintenance mode.
UNIT READY indicator	Indicates the presence of a Ready signal. This signal comes from the drive if the A and B I/O cables are connected between the drive and the FTU. If the I/O Bypass cable is connected, this signal is present continuously.
DISPLAY indicators	Refer to diagram shown for the DISPLAY SELECT switch (page 12).
DATA PATTERN switches	These switches permit setting the repetitive 8-bit Data Pattern that is written in the Data field of the selected track during a Write operation. For Read operations, the data read from the track is compared with these switches to check for the presence of a Read error. A 1 is indicated when a switch is in the "up" position, a zero when the switch is "down".
CYLINDER ADDRESS switches	These switches enter the binary value of the cylinder address to which a Seek is desired. Used in conjunction with the Access Mode switch. A 1 is indicated when a switch is in the "up" position, a zero when the switch is "down".
FIXED/BOTH/MOVABLE switch	Not used.
SEQ/MAN switch	This switch determines the manner in which the head address is selected. SEQ — (Sequential) After performing a Write or Read operation the FTU increases the count in the Head Address Register by 1 for each Index Mark or, when in Random, for each access. When the count is maximum (5 or 19), Head zero is the next head selected, and the incrementing continues. MAN — (Manual) The FTU will select the head address set in the Head Address switches.

ADDR ERROR* test point	This test point goes to a logical 0 when an Address Error occurs.
DATA ERROR* test point	This test point goes to a logical 0 when a Data Error occurs.
SECTOR MARK* test point	This test point goes to a logical 1 when the FTU receives a Sector Mark signal from the drive under test.
INDEX MARK test point	Test test point goes to a logical 1 when the FTU receives an Index Mark signal from the drive under test.
ON CYL test point	This test point will be a logical 0 when the drive under test in On Cylinder.
ADD MARK FOUND test point	This test point goes to a logical 1 when the FTU receives an Address Mark Found signal from the drive under test.
READ DATA* test point	This test point reflects the binary value of the serial data bits being received from the drive under test during a Read operation. The test point is inoperative during Maintenance mode or when the I/O Bypass cable is installed.
WRITE DATA test point	This test point reflects the binary value of the serial data bits being processed by the FTU during a Write operation ("0"=0, "1"=1). The indication is valid for any Write operation, even though the I/O Bypass cable may be connected or the FTU is in the Maintenance mode. The test point remains a logical 0 during Read operations.
BITS 0-9 test points	These ten test points reflect the logical value of the Bus Out Bits (BOB) delivered to the drive under test via the A-cable. Logically, these bits are present in the FTU's Bus Out multiplexer, and are available at the test point panel regardless of the operating mode (including Maintenance mode or I/O Bypass cable connected) of the TB304A.
GND test point	This test point is a common ground point between the FTU logic board and the control panel.
WRITE CLK test point	This test point reflects the logic level of the 9.667 MHz Read Clock signal that the FTU sends to the drive under test during any Write operation.
READ CLK* test point	This test point reflects the logic level of the 9.667 MHz Read Clock signal received from the drive under test during any Read operation. A Read Error forces the test point to logical zero.

WRITE GATE test point	A logical 1 at this test point indicates the presence of a Write Gate signal generated by the FTU during any Write operation.
READ GATE test point	A logical 1 at this test point indicates the presence of a Read Gate signal generated by the FTU during any Read operation.
CYL SELECT test point	This test point goes to a logical 1 when the FTU sends a Cylinder Select signal (Tag 2) to the drive.
CONTROL SELECT test point	This test point goes to a logical 1 when the FTU sends a Control Select signal (Tag 3) to the drive.

2.4 OPERATION

2.4.1 General

The TB304A is used to pin-point a problem in the drive, once the nature of that problem has been defined. Suppose, for example, that a drive is suspected of intermittent Read errors. That's the nature of the problem. The TB304A can be set up to repeatedly write and read back any chosen data pattern on a given track, or on the entire pack, or on any portion of the pack between two selected cylinders, stopping when an error occurs.

By making several such error-stop passes, and by using the Display Select switch to identify the cylinder, head, character count, and the data pattern read for each error stop, the CE can create a record of error parameters that will provide a failure pattern for pin-pointing the problem.

The character-count disolav provides an indication of how far from Index the error occurred. If you suspect a bad spot on the disk because errors consistently occur for the same head (track) and cylinder, the character count can confirm it. If the character count is random for that situation, suspect intermittent data failures on the selected head, rather than a bad spot on the disk.

That is to say, the degree of flexing to which the head lead is subject at a particular head/arm location, plus machine vibration, might cause head/write errors; but they would most logically be random errors, not occurring at the same spot for every revolution of the disk. Discriminations between random errors and honest-to-goodness bad spots are important when writing the track format on a new scratch pack, as described under Operating Procedures.

Data and address errors are the most prevalent causes for failure. The TB304A provides Bypass switches for each of these errors. This allows the FTU to alternately write and read a suspected track (or cylinder or pack area) for an extended period without stopping when an error of this type appears. After the test, the Error Count display will show the number of errors that occurred during the test period, up to a maximum of 15.

2.4.2 Preliminary Set-Up

1. Determine which of the following conditions will be required of the drive to be tested:

a. The drive is to be tested for Read/Write, as well as Seek functions.

b. The drive is to be powered up from the FTU.

c. Only the access (Seek) functions of the drive are to be tested.

d. Head alignment (but no R/W) of the drive is to be performed.

For conditions a or b, the A and B I/O cables from the controller must be disconnected from the drive and the I/O connections made between the drive and the FTU, via the A and B calbes provided with the tester.

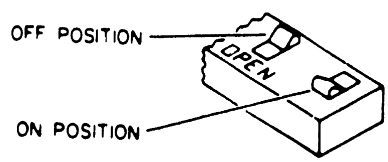
For conditions c, d, or e, the I/O Bypass cable connection between the FTU and the drive to be tested will be sufficient. Of course, any of the five conditions may be realized by connecting as shown for conditions a or b.

2. Remove ac power from the drive and make the I/O cable connections as determined in step 1. DO NOT reapply ac power to the drive.

3. Set the Sector switches on the Field Test Unit according to table 2-3. The switches are located on a dual in-line package located in position A20 on the FTU logic board. The number of sectors used in the disk drive and selected in the FTU must be the same; if this is not the case, sector-mark error indications will occur in the FTU.

TABLE 2-3. SETTING SECTOR SWITCHES

NUMBER OF SECTORS	SECTOR SWITCHES					
	1 (=2^0)	2 (=2^1)	3 (2^2)	4 (=2^3)	5 (=2^4)	6 (2^5)
1	ON					
2		ON				
3	ON	ON				
4			ON			
5	ON		ON			
6		ON	ON			
7	ON	ON	ON			
8				ON		
9*	ON			ON		
10		ON		ON		



* WANG uses 9 sectors.

4. Set the following switches as shown for normal testing:

Switch	Position
Servo Offset	center (off)
Data Strobe	center (normal)
Wrt Flag	down (off)
Xtal/Servo	SERVO
Maint/Nrm	NRM
Wrt Inhibt/Nrm	NRM
Addr Mk/Sector Mk	ADDR MK
Unit (4 switches)	to logical address of the drive
Addr Error/Data Error Bypass	

5. Install a scratch pack on the drive to be tested.

6. Turn on the FTU.

7. Apply ac power to the drive.

8. Select the drive by placing the Sel/Rel switch to SEL. The UNIT SELD indicators should light up, as will the WRT PROT indicator if the drive under test has the Write Protect Feature.

9. Power up the drive. The WRT PROT lamp, if on, will go out when the drive is up to speed. The UNIT READY lamp will light up when the heads are loaded.

10. Actuate the RTZ switch, then the RESET switch on the FTU panel.

    The drive is now ready for exercising. It has performed a Seek to Cylinder zero and has selected Head zero. The remaining switches on the FTU panel may now be set for the desired function and operating modes, as illustrated in Operating Procedures.

2.4.3 Operating Procedures

The first five of the procedures described below embody every access, read/write, and head-select mode provided by the TB304A. Procedure 6 checks the data error logic and Procedure 7 describes the use of the Head Alignmnt card. If an ERROR STOP occurs, refer to CDC Manual 893319600, Page 2-17, Touble Analysis Decision Logic.

Procedure 1: Continuous Seek, no R/W

(Perform alternate Seeks between the cylinder address in the CAR and the address set in the Cylinder Address switches.)

1. Assure that the FTU switches are positioned as described in the Preliminary Set-up procedure. In addition, position the following switches as shown:

Switch	Position
Display Select	CYLINDER
Wrt-Rd Select	OFF

2. Set the Cylinder Address switches to the value of one of the cylinder addresses to which the drive will seek. (For illustrations, choose CA 8.)

3. Set the Access Mode switch to DIRECT.

4. Momentarily actuate the START switch. When the ON CYL indicator is lit, move the switch momentarily to STOP. Address 8 is now in the CAR, and will be displayed on the panel.

5. Set the Cylinder Address switches to the value of the second cylinder address. (For illustration, choose CA16.)

6. Set the Access Mode switch to CONT.

7. Actuate START.

   The drive will perform alternate Seeks between addresses 8 and 16. The ON CYL indicator will blink rapidly as the heads move on and off cylinder. The Cylinder Address display lights wil alternate between 8 and 16.

8. STOP the FTU.

9. Actuate the RTZ.

10. Start the FTU.

    The tone of the drive will change as it now seeks between cylinders 0 and 16. Observe the display.

11. To stop the operation, actuate either STOP or RESET.

<u>Procedure 2: Random Seek, no R/W</u>

1. Maintain the Preliminary Set-up switch positions. In addition, set the following switches as shown:

Switch	Position
Display Select	CYLINDER
Wrt-Rd Select	OFF
Access Mode	RAND

2. Actuate START.

3. Assure that cylinders are being selected randomly by observing the changing pattern on the display lamps.

4. Stop the FTU by actuating STOP or RESET.

NOTE

Procedure 3 through 6, following, require that the A and B I/O cables be connected between the FTU and the drive under test.

Procedure 3: Write Format

This procedure is used to write a perscribed format on every track of the disk pack. The next procedure, Read, determines whether any of the tracks so written contain errors. The final procedure, Write Flag, shows how to select a single track, write a "defective track" flag bit on that track, and check to ensure that the flag bit was indeed written. The track format is shown in figure 2-3.

1. Maintain the switch positions as given in the Preliminary Set-up procedure. In addition, set the following switches as shown:

Switch	Position
Display Select	READ DATA
Access Mode	SEQ FWD
Wrt-Rd Select	WRT FORMAT
Cylinder Address (8)	all down (off)
Seq/Man	SEQ
Head Address (6)	all down (off)
Data Pattern (8)	anything but "all zeros"

2. Move RTZ/RESET switch to RESET, then to RTZ.

3. Actuate START.

   Observe the progression of the display lights as the drive moves away from cylinder zero. (With the Display Select switch set to READ DATA, the cylinder address is displayed while the FTU is running.)

4. If an error stop occurs, remove the cause of the error by proceeding as indicated in the Trouble Analysis decision logic, CDC Manual 83319600, table on page 2-17. (Data errors will not occur during WRT FORMAT.) Then proceed as follows:

   a. Actuate RESET to clear the error indication in the FTU.

   b. Actuate START. This rewrites the track that was selected when the error occurred, then continues the Write Format operation.

   c. DO NOT actuate RTZ. To do so would cause the operation to begin anew at cylinder zero, head zero.

5. After all tracks have been written, STOP the FTU. (Writing will begin again at cylinder zero, so the actual stopping point is immaterial.)

Procedure 4: Read

This operation tests the entire data pack for errors, using the Sequential Reverse Access mode.

1. Set the following switches as shown. All others should remain as given for the Write Format procedure.

Switch	Position
Display Select	CYLINDER
Access Mode	SEQ REV
Wrt-Rd Select	RD

2. Set the Cylinder Address switches to the maximum cylinder address of the drive under test.

3. Actuate START.

   Reading will begin at maximum cylinder, head zero. Should an error occur, the RUN light will go out and the panel lamps will display the type of error, as well as the cylinder that was being read when the error occurred. Follow steps 4 and 5 for each separate error stop. If no errors, skip to step 6.

4. Record the error parameters, moving the Display Select switch as needed.

NOTE

It is not necessary to record the ERROR COUNT. This will remain at count 1 for any stop-on-error operation.

5. After the error parameters have been recorded, actuate RESET to clear the error indication in the FTU, then actuate START to continue reading.

Procedure 5: Write Flag

The above Read procedure allows for reading each track of the scratch pack but one time. A single read may well produce random errors that in an on-line environment would be eliminated by the system's error-recovery program. Before flagging a track as bad -- that is, as one that continually produces errors that are not recoverable -- it is best to WRT-RD the track several times. If the error persists, the Trouble Analysis procedure (see Procedure 7) should be executed in an effort to recover the error. Only after both of these attempts have failed, should the track be flagged.

This procedure writes a "defective track" flag bit in Bit 6 of Address Word 1 (see figure 2-3).

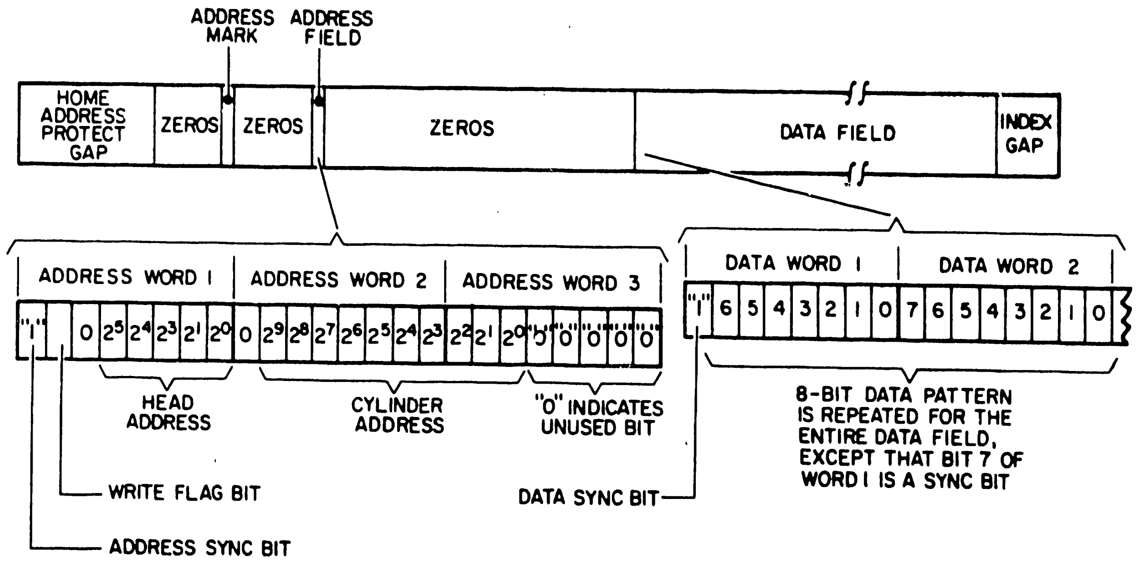


Figure 2-3. Track Format

1. Set the following FTU switches as indicated. Other switches should remain as shown for the Preliminary Set-up procedure.

Switch	Position
Wrt Flag	up (on)
Display Select	READ DATA
Access Mode	DIRECT
Wrt-Rd Select	WRT FORMAT
Data Pattern	as set when the track was most recently written.
Cylinder Address	to select the track to be flagged
Head Address	As required
Seq-Man	MAN

2. Actuate RESET, then START.

   Drive will seek to the selected track.

3. When on CYL light comes on, wait about 1/2 second and then actuate STOP.

4. Set WRT-RD SELECT switch to RD.

5. Actuate START.

   The "defective track" flag bit will prohibit reading the track. The ADDRESS ERROR and DATA ERROR lights should not light up.

6. Actuate STOP.

   Repeat steps 1 through 6 for each track to be flagged as defective.

NOTE

The WRT FLAG switch must be turned off before reading a track that has not been written as defective, otherwise an address error will occur.

Procedure 6: Check Data-Error Logic

This procedure assures the operation that data errors will be recognized by the FTU. It is used when the FTU is exercising a drive in any situation where data errors are expected -- an intermittent Read-failure for example -- but none occur. It assumes that the procedure in question is still running and that the scratch pack therefore has a data field written on the tracks being tested.

1. STOP the FTU.

2. Set the following FTU switches as indicated:

Switch	Position
Wrt-Rd Select	RD
Data Error Bypass	down (off)
Data Pattern	choose any one switch and move it to the opposite position. (Move just one!)

   All other switches must remain as they were at the start of the procedure being questioned.

3. START the FTU.

   The FTU should stop with the DATA ERROR indicator lit.

4. Actuate RESET to clear the error indication.

5. Set the Data Error Bypass switch up (on).

6. Actuate START.

   The FTU should run without error, but the Rd/Wrt Error Counter will count the errors (up to 15).

7. STOP the FTU. Return all switches used during this procedure to the state they were in at the start of the procedure being questioned.

Procedure 7: Using the Head Alignment Card

This procedure describes the use of the type HFSV Head Alignment card and the null meter on the FTU control panel to perform R/W- and/or Servo-head alignment on the drive under test. The procedure may be implemented using either the A and B cables or the I/O Bypass cable. The cabling involved is seen in figure 2-1, and table 2-2 gives specific connection information. The switches and indicators on the HFSV card are shown in figure 2-4.

This procedure assumes that the I/O connections between the drive and the FTU have already been made as described in the Installation portion of this manual. The installation and cabling of the Head Alignment card, as detailed in table 2-2, must be made with ac power removed from the drive and the FTU.

1. Install the proper CE pack on the drive to be tested.

2. Install the HFSV card in the drive's logic chassis at the location specified in table 2-2 for the type of drive under test.

3. Install the Head Alignment cable between the drive's logic chassis and the jack on the card in the R/W chassis, as specified in table 2-2. Note that P104 is keyed so that it will fit on the R/W card only one way.

4. Connect the test leads, provided with the FTU, between the HFSV card and the null meter on the FTU panel. Observe polarity.

5. Set the WRT INHIBIT/NRM switch on the FTU to WRT INHIBIT.

6. Apply AC and DC power to the drive. The POWER lamp on the HFSV card should light up.

7. Power-up the drive. Turn on the FTU.

8. Assure that S3 on the HFSV card is set to X1 (no attenuation of output), and that S2 is set as required for the first head, Servo (S) or Data (RW), to be checked for alignment.

9. Set the Maint/Norm switch on the FTU to MAINT.

   If the drive under test has the Write Protect feature, the WRT PROT light on the FTU Panel will be lit.

10. When the drive is up to speed and the READY light on the FTU panel is lit, actuate RESET, then RTZ.

Carry on as detailed by the head alignment procedure in the Maintenance manual for the drive under test. When the heads have been aligned, remove the CE pack from the drive. Install the scratch pack if further tests are to be conducted using the FTU.

Installing the Head Alignment card automatically "write protects" the drive. (This is true even if the drive does not have the Write Protect feature, which merely allows Write Protect to be implemented from the drive's operator panel, and in addition provides the Write Protect signal in the I/O lines.) Therefore, if Write, Write then Read, or Write Format operations are to be conducted, the HFSV card must first be removed from the drive.

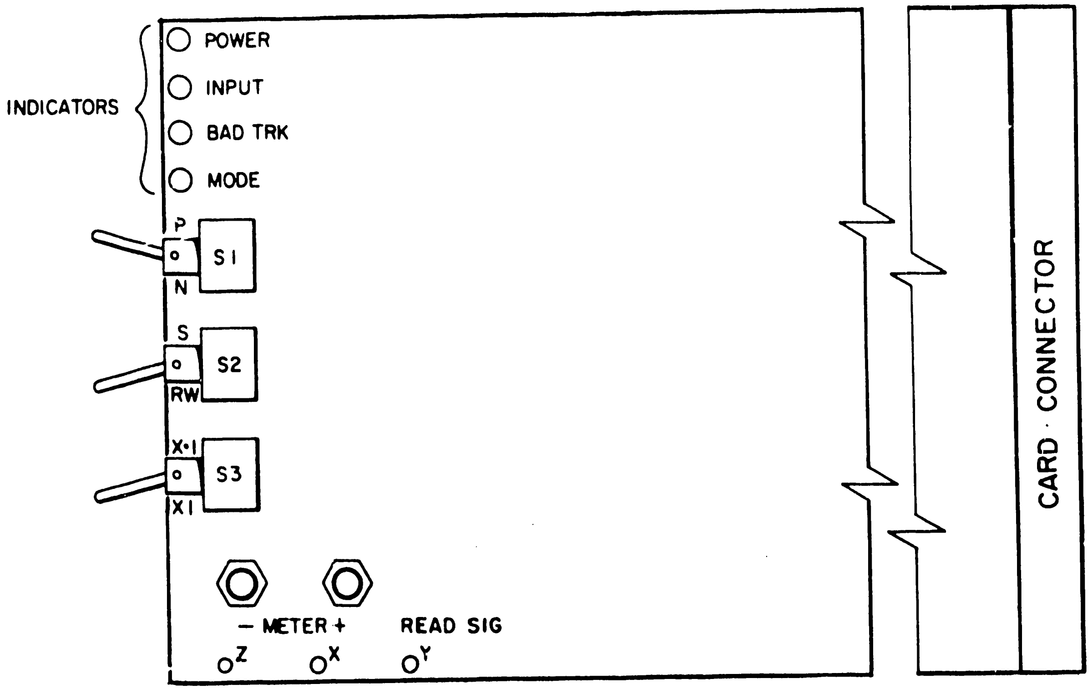


Figure 2-4. Head Alignment Card

	Indicators
POWER	Lit when power is applied to the card.
INPUT	When lit, indicates that input input signals are too low for for HFSV to operate.
BAD TRK	When lit, indicates a loss of input. A one-shot keeps the LED lit for at least four seconds when S1 is toggled.
MODE	Lit when S2 is in the S (Servo) position or X.1/X1 is in X.1 position, when either of these conditions exists, read/write head alig. error cannot be measured.

	Switches
S1	Changes the polarity of the alignment signal to the null meter. P = positive, N = negative. Algebraically subtract P from N to determine alignment error: P = + 30 mV N = -40 mV; Error = 70 mv.
S2	"S" position selects Servo head as input to HFSV. "RW" position selects a data head as input.
S3	Changes sensitivity of HFSV X.1 "X 1" position attenuates card output by a factor of 10, and alignment error cannot be measured. "X1" position does not attenuate HFSV output; alignment error can be measured.

WRITE FORMAT SEQUENCE

The Write Format Sequence writes an entire track from the address Mark to the end of the data field, arbitrarily timed to coincide with character 13,376.

Figure 2-5 shows the track format, with the character counts that start and stop the various fields.

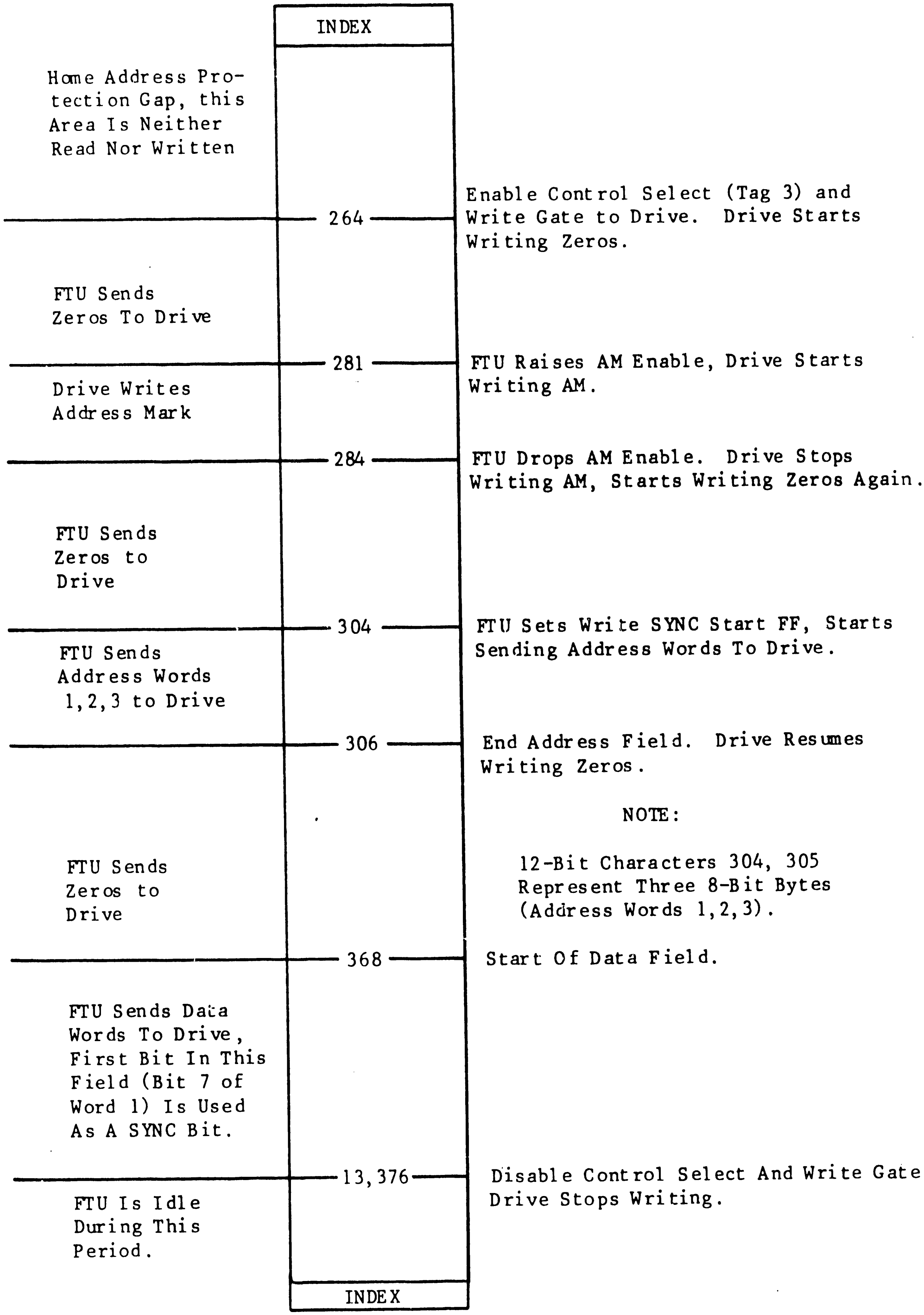


Figure 2-5 Write Format

APPENDIX B
2200 VS DOCUMENTATION

APPENDIX B

2200VS DOCUMENTATION

THE FOLLOWING DOCUMENTS CONTAIN INFORMATION THAT IS EITHER TOTALLY DEDICATED, OR, TO SOME DEGREE, AT LEAST RELEVANT TO THE CORRESPONDING UNIT LISTED IN THE LEFT-HAND COLUMN. THIS LISTING IS VALID THROUGH SEPTEMBER, 1978.

UNIT:	CE DIV. DOCUMENTATION:
2200VS Mainframe	CE Div. WCS 60/80 Volumes 1, 2, & 3 CP Hardware Manual -- Interim Publication CSNL #s 2, 18, 19, 39, 40, 41, 45, 46, 47, 53, 54, 59, 74, and 82
2200VS IOPs	IOP Master Processor Manual -- Interim Publication Parallel IOP Manual -- Interim Publication IOP Tester Manual -- Interim Publication Hard/Floppy Disk Adapter Manual -- Interim Publication
2209V Tape	Kennedy Mod. 9100 Vacuum Column Tape Transport Manual Kennedy Mod. 9219 Formatter Manual (OEM) 2200VS VOL. 2 SNL #s 99, 104, & 107 CSNL #8
ALL WANG MATRIX PTRS	Matrix printer FLMG #03-0060 2200VS, Volumes 1, 2, & 3
2221V Matr. Ptr.	Model 72 Matrix Printer (2221W) Manual (CE) (03-0027) ISN #s 83, 96, 102, 108.1, & 176 SNL #s 4, 21, 26, 30, 36, 41, 48, 52, & 100 CEA #s 7 & 32 CSNL #s 24 & 81
2231V-1,2 Matr. Ptr.	Model 61/62 Matrix Printer (2231W) Manual (CE) (03-0029) Service Bulletin #76 ISN #s 118 & 163 SNL #s 54, 61, 81, 83, & 100 CEA #18 CSNL #s 23 & 83
2246P Workstation	Limited info: (Ref: CE Div. 'WCS 60/80, VOL. 2') Service Bulletins #73, 79 WPNL #s 15, 37 ISN #s 149 & 121 SNL #90 CEA #31 CSNL #s 9, 26, 31, 34, 62, 76, & 78
ANY CDC DRIVE	CDC Microcircuits Manual (OEM) SNL #87

2260V Disk Drive	CDC 10 Meg 'Hawk' Maintenance Manual (CE/OEM) " " " " Training Manual CE Div # 03-0059 Wang 'Hawk' Manual #03-0072 WPNL #s 39 & 44 CSNL #s 22 & 36
2261V Matr. Ptr.	Model 77 Quad Head (2261W) Printer Manual (CE) (03-0061) ISN #s 157, 167, & 176 SNL #s 102, 111, & 119 CSNL #s 29 & 69
2263V-1,2 Chain Ptr.	Chaintrain - Logic & Troubleshooting Manual (OEM) Chaintrain - Maintenance Instructions Manual (OEM) Chaintrain - Operation Instructions Manual (OEM) Chaintrain - Principles of Operation Manual (OEM) Chaintrain - Illustrated Parts Breakdowns (OEM) ISN #s 162, 168, & 169 SNL #98 CSNL #s 25 & 84
2265V1 Disk Drive	CDC 75 Meg Disk Manuals (OEM - Reprinted under one cover): a) CDC Storage Module Drive BK4XX-BK5XX b) CDC BK4XX-BK5XX Installation & Checkout c) CDC BK4XX-BK5XX Diagrams & Wire Lists CSNL #s 14, 20, 64, 67, & 79
2265V2 Disk Drive	CDC 288 Meg Disk Manuals (OEM - Reprinted under one cover): a) CDC Storage Module Drive BK6XX-BK7XX b) CDC BK6XX-BK7XX Installation & Checkout CSNL #s 21, 52, 60, 68, & 80
2270V Floppy Disk	Service Bulletins 43.2, 46.2, 46.3, & 46.3A WPNL #21 ISN #s 4, 39, 39.1, 85, 87, 91, 92, 94, 99, 101, 122, and 129A SNL #32, 65, & 123 CSNL #s 10 & 51

2281V	Service Bulletin #74
Daisy Ptr.	Diablo HY-TYPE II Maintenance Manual
	Diablo HY-TYPE II Illustrated Parts Catalog
	WPNL #s 6, 7, 13, 17, 27, 32, 42
	SNL #s 74, 97, & 128
	Module Repair Guide #s 5, 7, & 9
	CSNL #s 28 & 65
GENERAL, SYSTEM, & REFERENCE	SNL #s 6, 10, 27, 66, 85, 93, 93A, 93B, 108, & 114
	CEA #s 3 & 6
	WPNL #s 9.1 & 42
	ISN #150
	Module Repair Guide #4A
	Service Bulletins 33.1 & 85
	Standards for IC Symbols #03-0010
	Customer Engineering Schematics Manual #03-0019
	Technical Procedures Manual #03-0013
	Field Price Catalog #03-0022
	Standard Tool Kit, Special tool list, & Extender Board listing #03-0064
	2200VS, Volumes 1, 2, & 3
	2200VS Reference Summary Guide
	Intel 8080 Reprint #03-0030
	8080 Self-Study Course #03-0050
	Zilog Z-80 Reprint #03-0058

APPENDIX
C
IPB

APPENDIX C

IPB

C.1 SCOPE

This appendix contains the illustrated parts breakdown for the VS-60/80 Computer Systems. Use this breakdown for part number identification when ordering field-replaceable components.

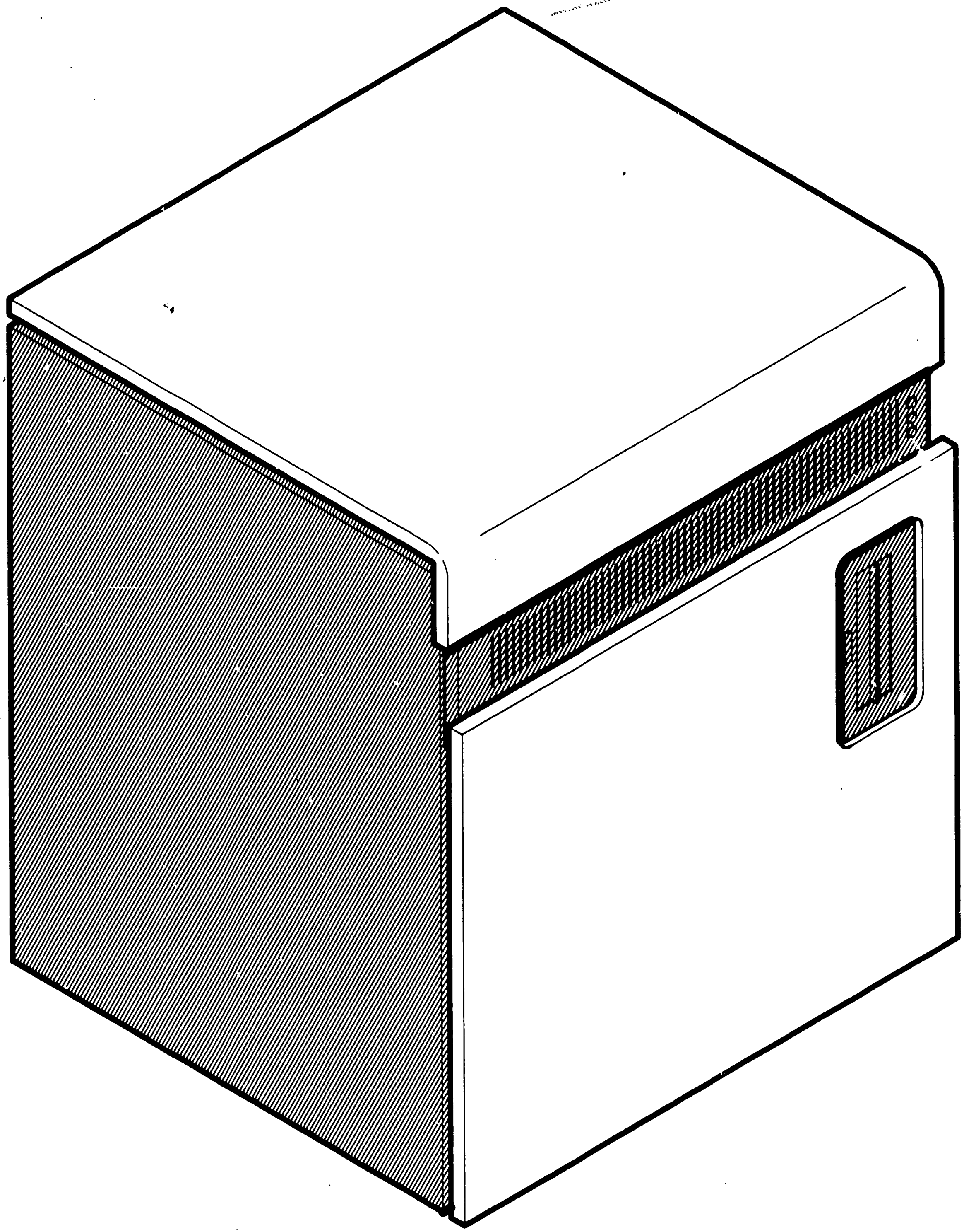


FIGURE 1 FRONTISPIECE (ASSEMBLY PART NO. 176-6019)

CABINET ASSEMBLY (ASSEMBLY PART NO. 279-4101)

ITEM NO.	PART NO.	DESCRIPTION
1	449-0188	COVER, TOP FINISHED
2	655-0254	BUMPER, .640OD x .340
3	458-0499	STOP, TOP COVER
4	452-2594	CLAMP, FACEPLATE
5	615-0396	INSULATOR
6	462-0067	6-32 SPACER
7	310-1205	TERMINAL BLOCK
8	650-3080	6-32x1/4 PAN HD PHIL
9	650-3167	6-32x1/2 FLANGE WHIZ LOCK
10	451-4622	BRKT, SWITCH (2200VS)
11	220-1170	POWER CORD ASSEMBLY
12	279-0303	2200VS POWER BOX ASSEMBLY
13	654-1286	FLAT CABLE CLAMP
14	220-1191	WIRE & LUG ASSEMBLY TYPE PO85
15	653-6034	WASHER 10 EXTERNAL TEETH
16	650-6122	10-32x3/8 FLANGE WHIZ LOCK
17	478-0177	1220 MOUNTING PEG
18	458-0827	RIBBON RETAINER
19	458-0828	CABLE CLAMP RETAINER
20	650-4120	8-32x3/8 PAN HD PHIL
21	650-4240	8-32x3/4 PAN HD PHIL
22	458-0829	CABLE CLAMP RETAINER
23	458-0826	RIBBON RETAINER
24	458-0854	BLANK FILTER
25	650-4120	8-32x3/8 PAN HD PHIL
26	451-2327	COVER PANEL
27	451-3113	DRESS PANEL
28	650-4169	8-32x1/2 TRUSS HD PHIL
29	451-3114	CABLE PANEL
30	451-3898	PANEL, SIDE L.H.
31	660-0629	FOAM VENT AIR FILTER
32	451-3894	PANEL VENT
33	650-9013	1/4-20x1/2 FLANGE WHIZ LOCK
34	451-3899	FRONT DOOR PANEL
35	650-9013	1/4-20x1/2 FLANGE WHIZ LOCK
36	451-3900	PANEL MODE
37	650-4081	8-32x1/4 FLAT HD PHIL
38	451-3902	PANEL DEAD FRONT
39	652-0032	6-32 LOCKNUT KEPS
40	650-6201	10-32x5/8 FLANGE WHIZ LOCK
41	451-4614	BRACKET DISK PANEL
42	210-7408	FRONT PANEL INDICATOR
43	462-0067	SPACER, 6-32x5/8
44	650-3120	6-32x3/8 PAN HD PHIL

CABINET ASSEMBLY (ASSEMBLY PART NO. 279-4101)

ITEM NO.	PART NO.	DESCRIPTION
45	653-3002	WASH #6 .141ID .250OD .062 NYLON
46	278-4002	FLOPPY DISK DRIVE
47	449-0101	FAN GUARD 4" BLACK
48	279-0487	FAN ASSEMBLY
49	458-0497	FRAME, UPPER
50	451-4613	BRACKET DISK MOUNTING
51	650-9012	1/4-20x3/4 FLANGE WHIZ LOCK
52	458-0708	FILTER, AIR
53	652-0032	6-32 LOCKNUT KEPS
54	451-3082	PANEL VENT DWR. SUPPLY
55	650-6201	10-32x5/8 FLANGE WHIZ LOCK
56	449-0229	PAD, LATCH MOUNTING
57	220-1155	WIRE & LUG ASSEMBLY
58	655-0016	GUIDE, LEVELING 1/2x13 2.000 DIA.-PAD
59	655-0020	CASTER 2"DIA., DUAL WHEEL
60	652-0020	1/4-20 WHIZ LOCK FLANGE NUT
61	451-3897	PANEL, SIDE R.H.
62	458-0496	FRAME, LOWER
63	650-9012	1/4-20x3/4 FLANGE WHIZ LOCK
64	650-4133	8-32x3/8 FLANGE WHIZ LOCK
65	400-1003	FAN, TUBE AXIAL 115V, 100CFM
66	685-0900	CVR PROTECTIVE TNC/BNC PNL LEADS
67	458-0501	FACE PLATE RAIL
68	652-0032	6-32 LOCKNUT
69	452-2618	CLAMP, BNC TNC CABLE
70	650-4133	8-32x3/8 FLANGE WHIZ LOCK
71	462-0305	SPACER, FACEPLATE
72	660-0590	FOAM CARD HOLD DOWN
73	650-9013	1/4-20x1/2 LG.FLANGE WHIZ LOCK
74	654-1011	GND LUG 3/8
75	350-2078	TNC BULKHEAD CONN
76	350-1036	BNC SOCKET
77	270-0763	I/O PANEL ASSEMBLY EXTENDED
78	650-6122	10-32x3/8 FLANGE WHIZ LOCK
79	458-0709	STOP LATCH-2263
80	458-0498	REAR DOOR
81	650-4133	8-32x3/8 FLANGE WHIZ LOCK
82	654-0125	TERMINAL LUGS .200 HOLE x 1/4 SPADE
83	651-0228	SNAP RING #4 "D-ZUS"
84	652-0032	6-32 LOCKNUT KEPS
85	650-3280	6-32x7/8 LG. PAN HD PHIL
86	651-0225	STUD OVAL HEAD "D-ZUS" AJ4-60
87	651-0226	RECEPTICLE "D-ZUS" #SL4X-280
88	220-3030	CABLE

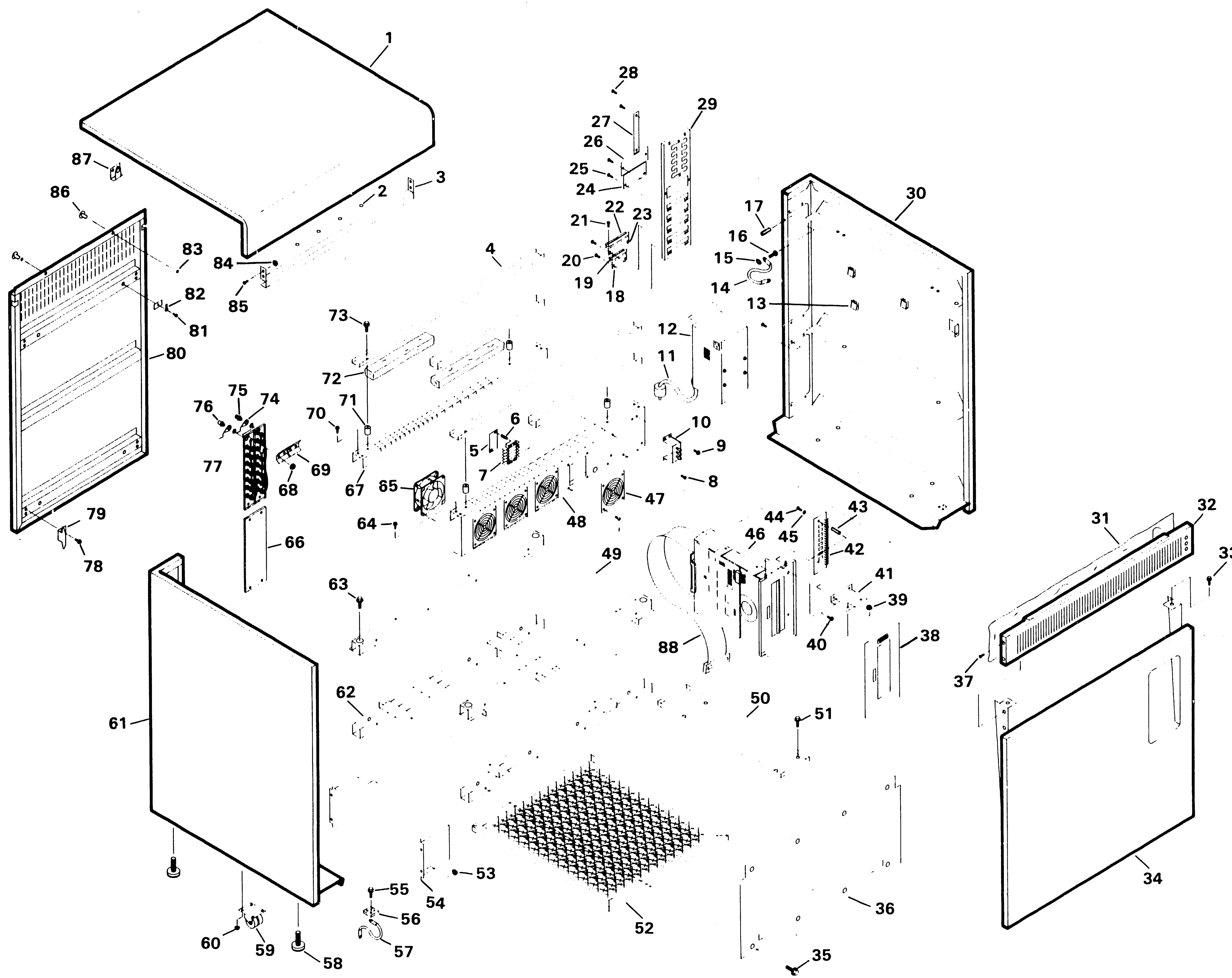


FIGURE 2 CABINET ASSEMBLY (ASSEMBLY PART NO. 279-4101)

CHASSIS & TRANSFORMER ASSEMBLY (ASSEMBLY PART NO. 270-0440)

ITEM NO.	PART NO.	DESCRIPTION
1	270-0686	HEATSINK & HARNESS ASSEMBLY
2	654-1310	GROMMET, .125 EXT. CHANNEL (18")
3	220-1169	8300 INT. POWER CABLE ASSEMBLY
4	220-1131	8300 PS FAN CABLE ASSEMBLY
5	300-3050	124K CAPACITOR (4 PLACES)
6	220-1186	POWER CORD
7	300-9025	CAP CLAMP, J TYPE
8	PART OF 12	
9	650-6160	10-32x1/2 PAN HD SEMS SCREW
10	653-6001	#10 INT. TH. WASHER
11	652-6002	10-32 LOCKNUT
12	270-3080	TRANSFORMER & HARNESS ASSEMBLY
13	650-6201	10-32x5/8 WHIZ LOCK SCREW
14	452-3554	SHIELD, HIGH VOLTAGE
15	653-3000	#6 FLAT WASHER
16	650-3120	6-32x3/8 SEMS SCREW
17	300-9006	CAP CLAMP - 2 1/2"
18	300-3046	25K CAPACITOR (2 PLACES)
19	220-1163	100 AMP CABLE
20	650-9013	1/4-20x1/2 FLANGE WHIZ LOCK
21	451-1117	CHASSIS, POWER SUPPLY
22	654-1292	GROMMET, PLASTIC SNAP-IN
23	300-3067	12K CAPACITOR
24	652-6002	10-32 LOCKNUT KEPS
25	650-3120	6-32x3/8 SEMS SCREW
26	653-3000	#6 FLAT WASHER
27	300-9004	CAP CLAMP - 1 3/4"
28	653-6001	#10 INT. TH. LOCKWASHER
29	650-6240	10-32x3/4 SCREW
30	300-9022	CAP CLAMP - 2 1/16"
31	300-3049	77K CAPACITOR
32	653-6000	#10 FLAT WASHER
33	652-6002	10-32 LOCKNUT
34	650-6160	10-32x1/2 PHL SEMS SCREW
35	653-6001	#10 INT. TH. WASHER
36	458-0468	BUSS BAR LONG
37	452-0100	PLATE, CHASSIS
38	458-0467	BUSS BAR SHORT
39	650-3200	6-32x5/8 PAN HD PHL
40	650-3121	6-32x3/8 FLAT HD SCREW
41	310-1206	TERMINAL BLOCK
42	650-3120	6-32x3/8 SEMS SCREW
43	652-0029	8-32 LOCKNUT KEPS
44	451-4364	BRACKET, FAN
45	650-3560	6-32x1 3/4 SLT. P H SCREW

CHASSIS & TRANSFORMER ASSEMBLY (ASSEMBLY PART NO. 270-0440)

ITEM NO.	PART NO.	DESCRIPTION
46	653-3001	#6 INT. TH. LOCKWASHER
47	653-3000	#6 FLAT WASHER
48	650-4160	8-32x1/2 PHL SEMS SCREW
49	400-1003	FAN, MUFFIN
50	452-4042	CARD GUIDE
51	220-3001	FLAT CABLE ASSEMBLY
52	652-0029	8-32 LOCKNUT KEPS
53	650-4160	8-32x1/2 PAN HD SEMS SCREW
54	210-7209	REGULATOR BOARD
55	650-3120	6-32x3/8 PAN HD PHIL

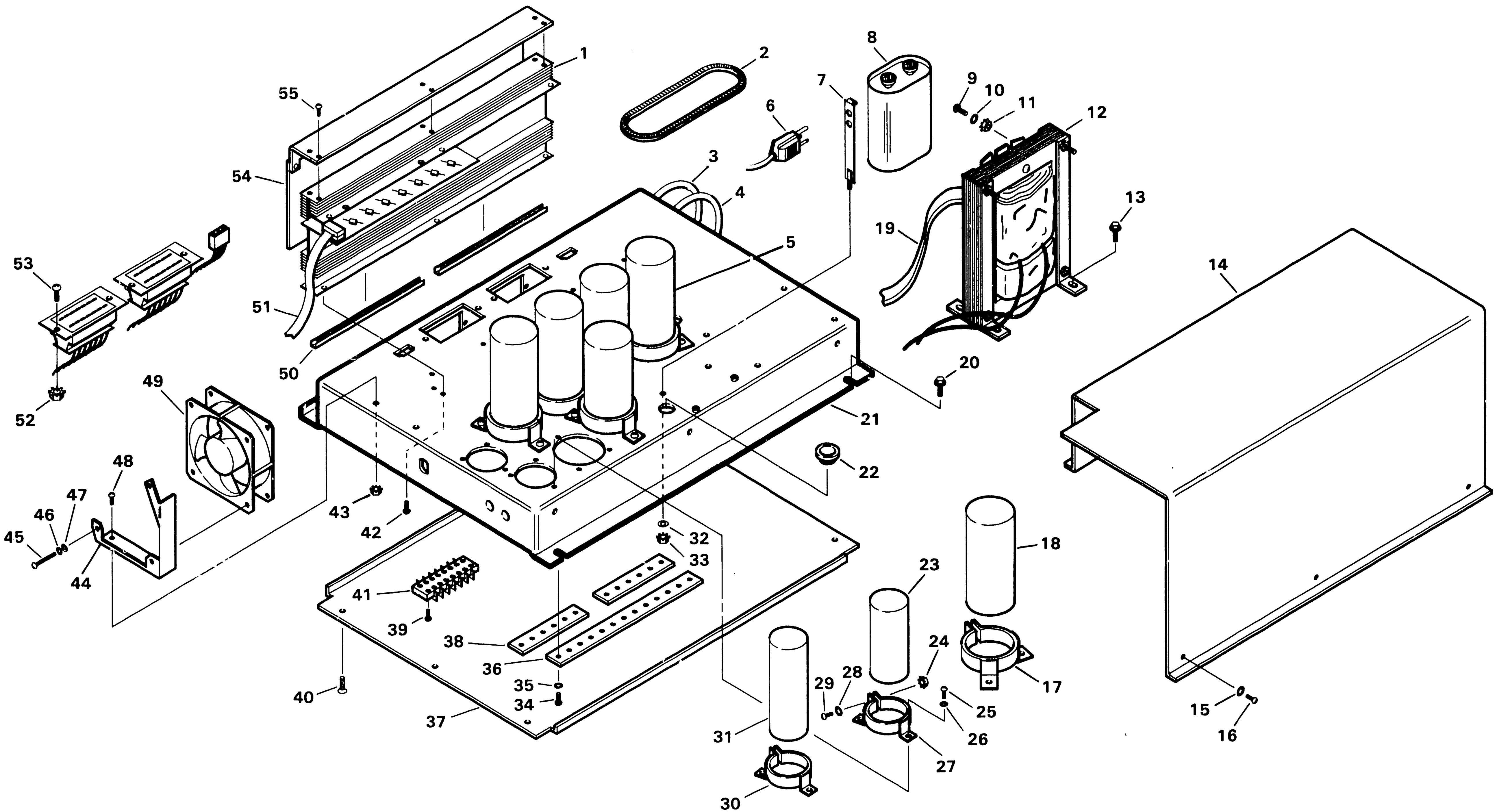


FIGURE 3 CHASSIS & TRANSFORMER ASSEMBLY (ASSEMBLY PART NO. 270-0440)

2200 VS MOTHER BOARD ASSEMBLY (ASSEMBLY PART NO. 270-0435)

ITEM NO.	PART NO.	DESCRIPTION
1	*212-0V06-1,-2,-3	PCB 7426
2	*212-3010	PCB 7110-A
3	*212-3009	PCB 7110-A
4	*212-3001	PCB 7110-B
5	*212-3003	PCB 7110
6	210-7401	PCB 7401
7	210-7401-3A	PCB 7401-3A 256K
8	210-7413	PCB 7413
9	210-7300	PCB 7300
10	*212-3000	PCB 7302
11	210-7301-A	PCB 7301-A
12	210-7406	PCA 2200VS MOTHERBOARD
13	270-0435	MOTHERBOARD ASSEMBLY
14	615-0395	L.H. INSULATION M.B. FRAME
15	654-1289	SNAP BUSHING
16	650-9013	1/4-20x1/2 FLANGE WHIZ LOCK
17	458-0495	FRAME MOTHERBOARD
18	615-0393	R.H. INSULATION M.B. FRAME
19	615-0394	MIDDLE INSULATION M.B. FRAME
20	650-2200	4-40x5/8 PAN HD PHIL
21	653-3002	WASHER #6 FLAT NYLON
22	653-3000	WASHER #4 FLAT
23	650-2120	4-40x3/8 PAN HD PHIL
24	270-3078	8300 M.B. HARNESS J5
25	270-3077	8300 M.B. HARNESS J4
26	654-1246	HEYCO GROMMET 7P-2
27	654-1240	HEYCO STRAIN RELIEF
28	451-4635	BRKT., CABLE CLAMP 2200VS
29	650-6160	10-32x1/2 PAN HD PHIL
30	220-1156	WIRE & LUG ASSEMBLY PO-69

* THESE MOTHER & DAUGHTER PCA'S ARE OF A HIGHER ASSEMBLY. THEY CANNOT BE ORDERED SEPARATELY.

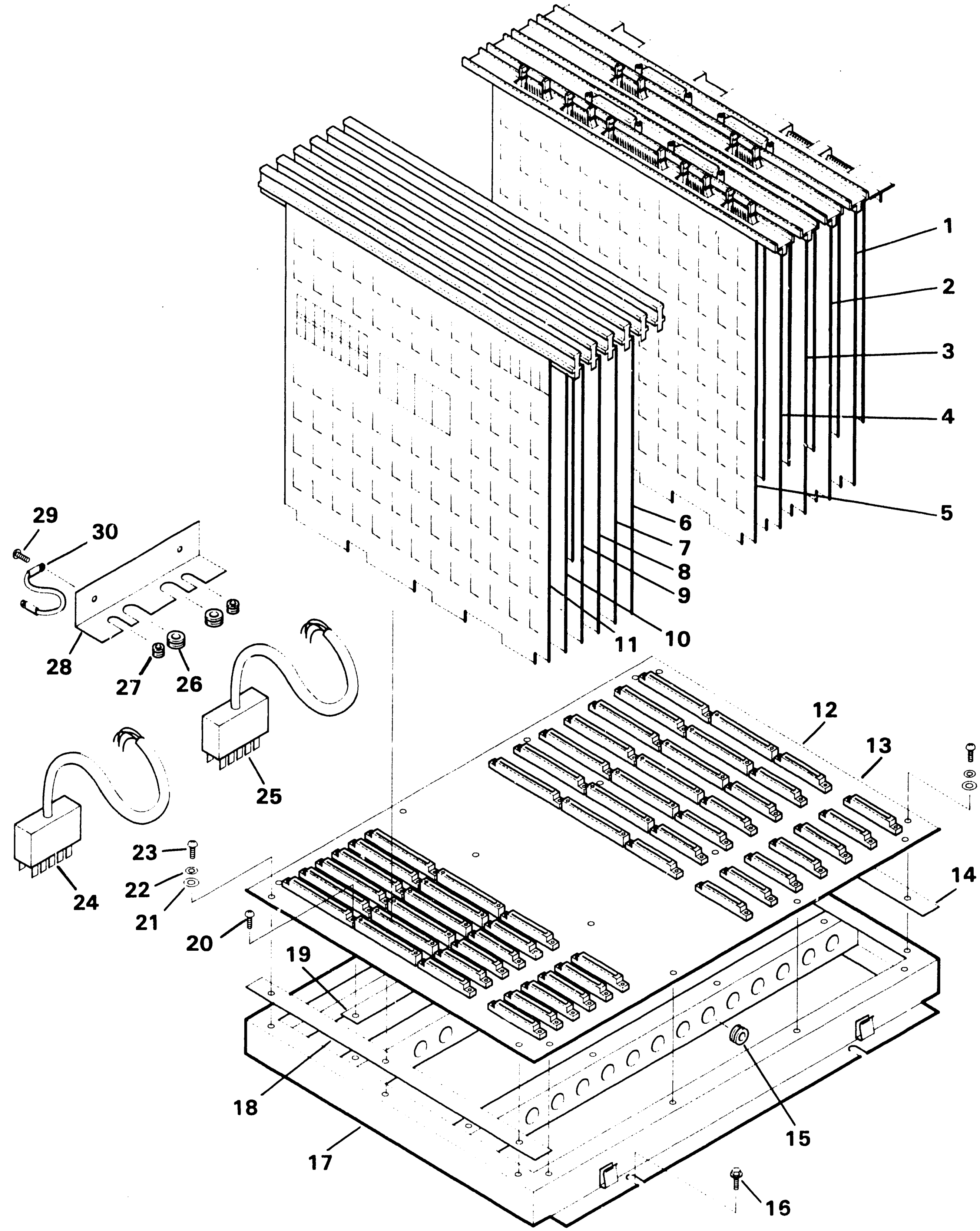


FIGURE 4 2200 VS MOTHERBOARD ASSEMBLY (ASSEMBLY PART NO. 270-0435)

END