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**CDC®ICEM ERGONOMIC  
WORKSTATION**



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**HARDWARE MAINTENANCE MANUAL  
(ON-SITE INFORMATION)**

DAS ANSCHLUSSKABEL DARF NUR VON EINEM  
CONTROL-DATA TECHNIKER AUSGEWECHSELT WERDEN.  
EIN ORIGINAL-ANSCHLUSSKABEL IST ZU VERWENDEN. P/N \_\_\_\_\_

# REVISION RECORD

REVISION	DESCRIPTION
A (09-27-84)	Manual released.
B (1-12-85)	Manual reissued

Publication No.  
62950149

01989-2

REVISION LETTERS I, O, Q AND X ARE NOT USED

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by Control Data Corporation  
Printed in the United States of America

Address comments concerning this manual to:

Control Data Corporation  
Technical Publications Department  
2401 North Fairview Avenue  
St. Paul, Minnesota 55113

or use Comment Sheet in the back of this manual.

## LIST OF EFFECTIVE PAGES

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## Chapter 1

### GENERAL INFORMATION

#### INTRODUCTION

This hardware maintenance manual provides the information necessary for a qualified technician to install, operate, and maintain the CDC 790 Integrated Computer-Aided Engineering and Manufacturing (ICEM) Ergonomic Workstation.

#### HOW TO USE THIS MANUAL

The material in this manual is arranged in a logical sequence that anticipates reader needs. If you go directly to desired information, you may find you need additional information previously given.

#### Organization

This manual contains the following chapters and appendixes:

- ✘ Chapter 1. GENERAL INFORMATION - How to use the manual effectively, how the manual is updated, safety information, and radiation requirements.
- ✘ Chapter 2. PHYSICAL DESCRIPTION - A physical description of the workstation and list of specifications.
- ✘ Chapter 3. INSTALLATION AND OPERATION - Receiving, installation, and operation instructions, checkout procedures and reshipping instructions.
- ✘ Chapter 4. FUNCTIONAL DESCRIPTION - A functional description of the workstation.
- ✘ Chapter 5. MAINTENANCE - Preventive and corrective maintenance procedures.
- ✘ Chapter 6. PARTS LIST - Spare parts kits and parts list.
- ✘ Chapter 7. FOLDOUT ILLUSTRATIONS - Illustrations larger than one page.
- ✘ Appendix A. DESIGN CONCEPTS - An explanation of design concepts embodied in the workstation.
- ✘ Appendix B. HEXADECIMAL CONVERSION - A hexadecimal conversion chart.

#### Conventions Used In This Manual

Digital byte values are given in hexadecimal (H). All numbers not so marked are in decimal. Signal mnemonics are all capitals. An asterisk denotes a low-active signal (logic 0). All other signals are high-active (logic 1). Keyboard key captions are enclosed in angle brackets (for example, <CTRL>).

## REVISION INFORMATION

Periodically, a change package is issued or a manual is reissued to stay current with equipment developments. This manual contains the following:

- ✕ Revision record
- ✕ List of effective pages
- ✕ Reader comment form

### Revision Record

This record shows the date of each revision and outlines the changes made.

### List Of Effective Pages

This list shows the current revision level of each page. A new list of effective pages is included in each reissue or change package.

### Reader Comment Form

An addressed comment form is provided at the end of the manual. Please enter any comments, suggestions, or complaints on the form. Include page, paragraph, figure, or table number as applicable. If you are submitting a technical comment, also submit a Technical Action Request (TAR).

## RELATED DOCUMENTS

Workstation peripherals are documented in separate manuals. Table 1-1 lists workstation related documents. The information supplied in table 1-1 was correct when this manual was published. Request the latest issue when you order.

Table 1-1. Related Documents

Name	Part Number
CDC 790 ICEM Workstation Customer Planning Guide	62950147
CDC 790 ICEM Ergonomic Workstation Software Reference Manual	62950148
CDC 790 ICEM Workstation Owner's Manual	62950150
Amtron RGB Color Video Data Display Model CD19 Maintenance Manual	802-030001-006
CDC CC63X Display Terminal Hardware Maintenance Manual	62940034
CDC 721 Enhanced Display Terminal Operator's Guide/Installation Instructions	62950101
CDC CC63X Display Terminal Hardware Maintenance Manual (Repair Center Information)	62940037



## **SAFETY**

This paragraph has important safety information that you should read and understand before installing, operating, or servicing a workstation. Only qualified maintenance technicians should service or adjust internal components. Never reach into the equipment unless someone who can render aid is present.

This manual contains safety warning and caution notices. A warning indicates conditions that could result in personal injury or loss of life. A caution indicates conditions that could result in damage to equipment.

### **Electrical Safety**

Each workstation is equipped with a switching power supply that has large storage capacitors. These capacitors can deliver a high-current discharge that can seriously damage test equipment. Be careful when servicing equipment with the power on.

#### **WARNING**

High voltage capable of causing death or serious injury exists when power is applied to equipment. Be careful when internal components are exposed.

Within the workstation, signal ground is isolated from the chassis and from earth ground, but a chassis that is not grounded can develop an electric potential if leakage occurs between the ac supply and the chassis. This condition can pose a health hazard to anyone touching the chassis (or cabinet). For this reason, the chassis must be connected to earth ground through the power cable.

#### **WARNING**

To avoid serious injury or death, verify that the chassis is connected to a good earth ground.

The workstation is shipped with a three-conductor power cable and corresponding three-conductor plug. The 220-240 Vac power plug (NEMA 6-20P) has three pins; one pin connects to the high side of the ac supply, one pin connects to the low side, and the third, offset pin connects to ground. At the installation site, the mating power receptacle must have a ground socket that is tied to a good earth ground. Chapter 3 has additional grounding information.

## **Fire Safety**

Detection systems designed for installations requiring fire protection or special building construction are listed in the National Fire Protection Association (NFPA) Standard Number 75. To obtain a copy of this standard, write to:

National Fire Protection Association  
470 Atlantic Avenue  
Boston, Massachusetts 02210

Fire control requirements are normally included in local building codes, and your insurance carrier can recommend appropriate fire control apparatus.

## **Underwriter's Laboratory**

The workstation complies with Underwriter's Laboratory (UL) standard 478.

## **Canadian Standard Association**

The workstation complies with Canadian Standard Association (CSA) standard 22.2.

## **VDE**

The workstation complies with Verband Deutcher Electrotechniker (VDE) standard 0871.

## **International Electro-Technical Commission**

The workstation complies with International Electro-Technical Commission (IEC) standard 380.

## **ELECTROMAGNETIC COMPATIBILITY REQUIREMENTS**

The workstation complies with Federal Communications Commission (FCC) and VDE electromagnetic compatibility requirements.

## **FCC**

The workstation complies with FCC requirements for a Class A computing device when installed and operated as directed in workstation manuals. **To minimize radio-frequency (RF) interference, tighten all screws that fasten connectors to the workstation;** do this during installation and any time you remove and refasten connectors to the workstation.

Instructions To User. The user should observe the following precautions when installing and operating the workstation:

1. Operate the workstation in accordance with the instructions in this manual.
2. Make sure the workstation is always operated with factory-installed covers securely fastened.

3. Make no modification to the workstation that might violate specified limits of FCC rules.
4. Properly maintain the workstation.
5. Make sure that interconnection cables are shielded and shields are connected to chassis ground at both cable ends.

User Responsibility. The user has the ultimate responsibility to correct problems caused by radio-frequency interference from equipment under his control. If a workstation generates interference that disrupts radio or television reception, (determined by turning the workstation off and on), the user may correct the interference with one of the following measures. Any corrective action taken is at user expense.

1. Change equipment orientation.
2. Change equipment location.
3. Change equipment power source.

If these actions fail, the user should consult CDC or an experienced radio-television technician for additional suggestions. The user may find the following Federal Communications Commission booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

#### NOTE

The FCC may require the operator of a computing device that is causing harmful interference to stop operating the device until the interference problem is corrected.

#### VDE

The workstation complies with VDE standard 0871, Class A, for radiated and conducted RF emissions.



## Chapter 2

### PHYSICAL DESCRIPTION

#### GENERAL DESCRIPTION

The 790 ICEM workstation is a high-resolution interactive colorgraphic display unit that is designed for operator convenience. The workstation processes and displays colorgraphic information useful to the design process, and can increase the productivity of engineering and manufacturing designers.

#### PHYSICAL DESCRIPTION

There are two 790 workstation models: the 790-20 and the 790-20+. The 790-20 workstation consists of a display assembly (figure 2-1), table assembly, keyboard, and graphic tablet. Figure 2-2 shows how the workstation breaks down into major assemblies. Each major assembly breaks down into major components. Table 2-1 lists the major components for each major assembly. The descriptive names given in the table are used in this manual. The display generator in the 790-20+ has two additional PCBs. Otherwise, the 790-20+ is the same as the 790-20.

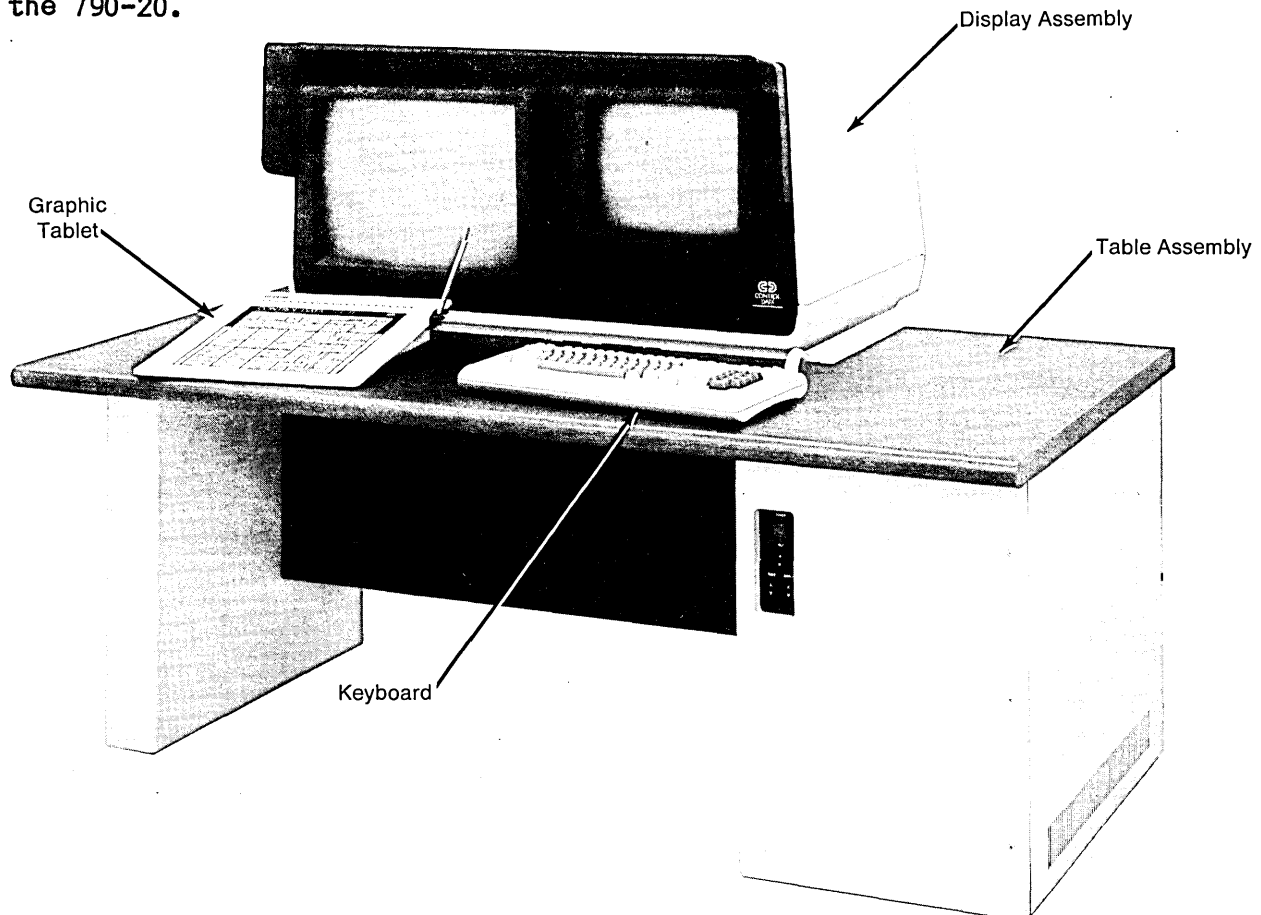


Figure 2-1. 790-20 ICEM Workstation

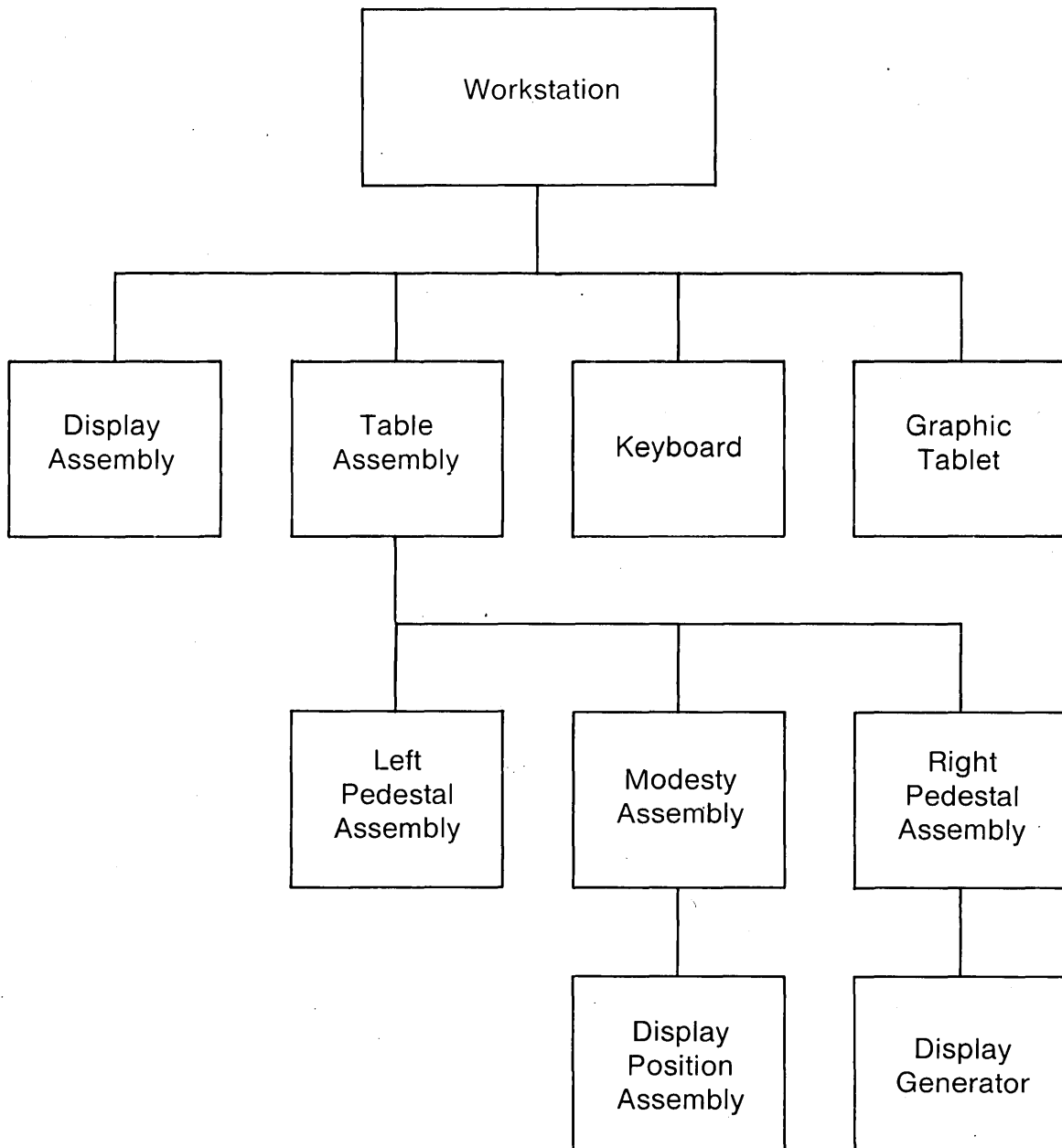


Figure 2-2. Major Assembly Tree

Table 2-1. Major Assemblies and Components

Descriptive Name	Parts List Name	Part Number
Display assembly	Monitor Assy	510200-01
Color monitor	Color Monitor Assy	510175-01
Monochrome monitor	Black & White Monitor Assy	510180-01
Display cover	Cover Assy	510160-01
Display base	Base Assy	510165-01
Display control panel	Front Panel Assy	510170-01
Disk drive	Floppy Drive	0510041-01
Table assembly	None	-
Table top	Table Top Assy	510220-01
Left pedestal assembly	None	-
Mechanism enclosure	Enclosure, Mechanism	510246-01
Left table support	Actuator Support Housing Assy	510215-01
Left table actuator	None	-
Modesty assembly	None	-
Modesty enclosure	Enclosure, Modesty	510247-01
Rear access panel	Rear Cover, Modesty	510277-01
Table up/down motor	None	-
Circuit breaker assembly	Circuit Breaker Assy	510240-01
Display position assembly	None	-
Outer housing	Housing Assy, Outer	510650-01
Inner housing	Housing Assy, Inner	510230-01
Display up/down motor	None	-
Display up/down actuator	None	-
Tilt motor	None	-
Tilt actuator	None	-
Right pedestal assembly	None	-
Display generator enclosure	Enclosure, Display Generator	510248-01
Front door	Door, Front	510206-01
Rear door	Door Assy, Rear	510690-01
Right table support	Actuator Support Housing Assy	510215-01
Right actuator	Actuator, Secondary, Tandem drive	510227-01
Movement control panel	Control Panel Assy	510225-01
Display generator	None	-
DLP PCB	PCB Assy, DLP DRAM	509964-01
Raster processor PCB	PCB Assy, Raster Proc DRAM	510070-01
Dynamic refresh memory PCB	PCB Assy, Memory, 10x12 DRAM	510074-01
Video C PCB	PCB Assy, Video C	510032-01
Draw processor PCB*	PCB Assy, Draw Proc	509069-02
Geometry processor PCB*	PCB Assy, Geometry Proc	510081-01
Backplane PCB	PCB Assy, Backplane	510057-01
Chassis	Main Chassis	510251-01
Test panel	Panel, Control	510260-01
Card cage	Card Cage Assy	510255-01

\* Installed in model 790-20+ only

Table 2-1. Major Assemblies and Components (continued)

Descriptive Name	Parts List Name	Part Number
Disk interface PCB	PCB Assy, Disk IF/Arbiter	510092-01
Power supply	Power Supply, Switching	510009-01
I/O panel	Panel, Rear Cable	510345-01
Intake fan assembly	Fan Plate Assy	510265-01
Keyboard	Keyboard	510753-01
Graphic tablet	Tablet	0510067-01

### Display Assembly

The display assembly (figure 2-3) has the following major components:

- ✕ Color monitor
- ✕ Monochrome monitor
- ✕ Display cover
- ✕ Display base
- ✕ Display control panel
- ✕ Disk drive

The two monitors are individually pivoted to allow the operator to manually adjust the horizontal angle of each for convenient viewing.

The display cover has a hood that can be manually extended over the monitor screens to minimize glare.

The display base has two connectors that interface with the keyboard and graphic tablet.

The display control panel (figure 2-4) is protected by the control panel door which opens to provide access to five controls, six indicators, and the disk drive, which is mounted on the panel.

### Table Assembly

The table assembly (figure 2-5) consists of the table top and the following major assemblies:

- ✕ Left pedestal assembly
- ✕ Modesty assembly
- ✕ Right pedestal assembly

The table top is supported by the two pedestal assemblies, which move the table top up and down. The modesty assembly is mounted between the two pedestal assemblies. The workstation rides on four swivel casters, two on each pedestal assembly, and three ball casters on the right pedestal assembly.



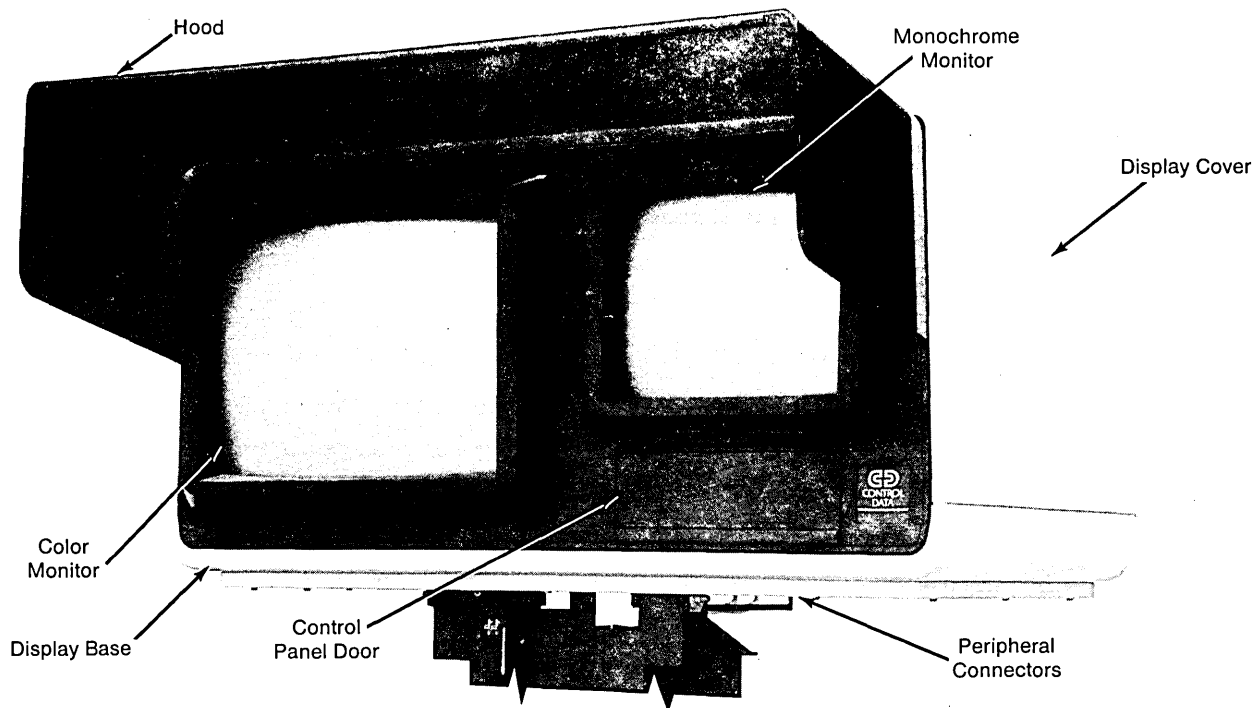


Figure 2-3. Display Assembly

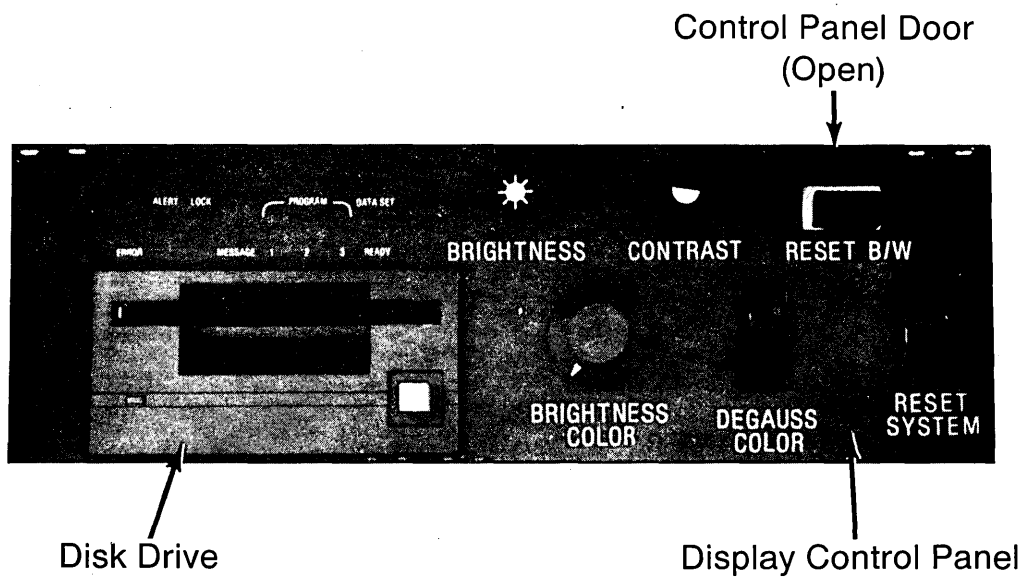


Figure 2-4. Disk Drive

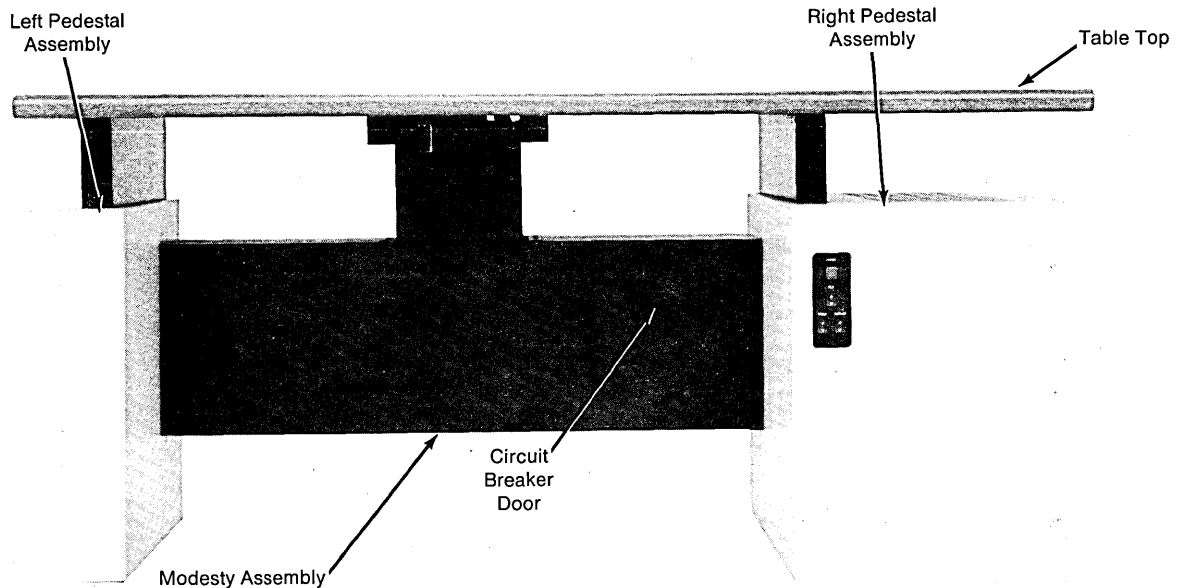


Figure 2-5. Table Assembly

### Left Pedestal Assembly

The left pedestal assembly (figure 2-6) consists of the mechanism enclosure, left table support, and left actuator. The left table support is bolted to the table top, and moves up and down within the mechanism enclosure to raise and lower the table top in conjunction with the right table support.

### Modesty Assembly

The modesty assembly (figure 2-7) comprises the following:

- ✕ Modesty enclosure
- ✕ Rear access panel
- ✕ Table up/down motor
- ✕ Circuit breaker assembly
- ✕ Display position assembly

The rear access panel may be removed from the modesty enclosure (figure 2-8) to gain access to the table up/down motor, circuit breaker assembly, and display position assembly. The circuit breaker assembly consists of five circuit breakers and a switch mounted on a panel. The circuit breaker door protects the panel controls from accidental contact.

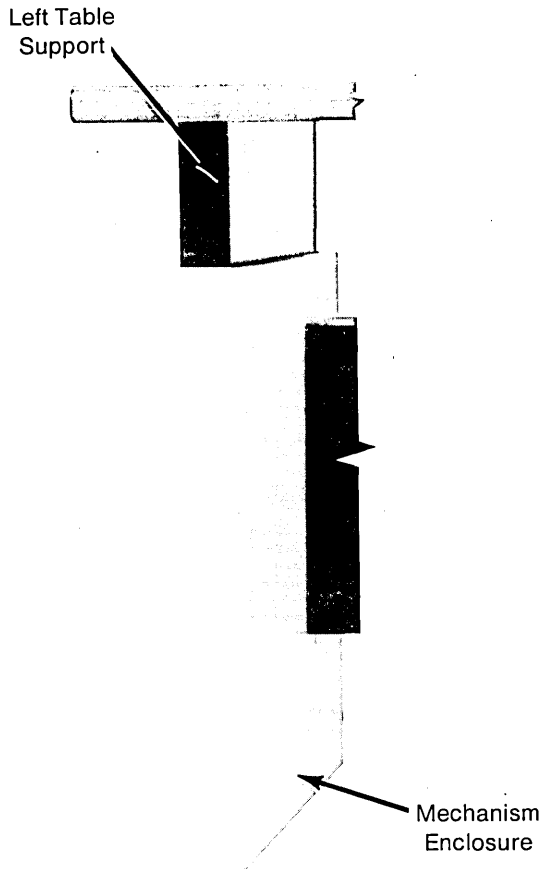


Figure 2-6. Left Pedestal Assembly

### Display Position Assembly

The display position assembly is attached to the underside of the display assembly, and can move the display assembly up or down or tilt it for convenient viewing. The display position assembly (figure 2-9) has the following major components:

- ✦ Outer housing
- ✦ Inner housing
- ✦ Display up/down motor
- ✦ Display up/down actuator
- ✦ Tilt motor
- ✦ Tilt actuator

The outer housing is mounted inside the modesty enclosure. The inner housing is attached to the underside of the display base, and moves up and down within the outer housing to raise and lower the display assembly.

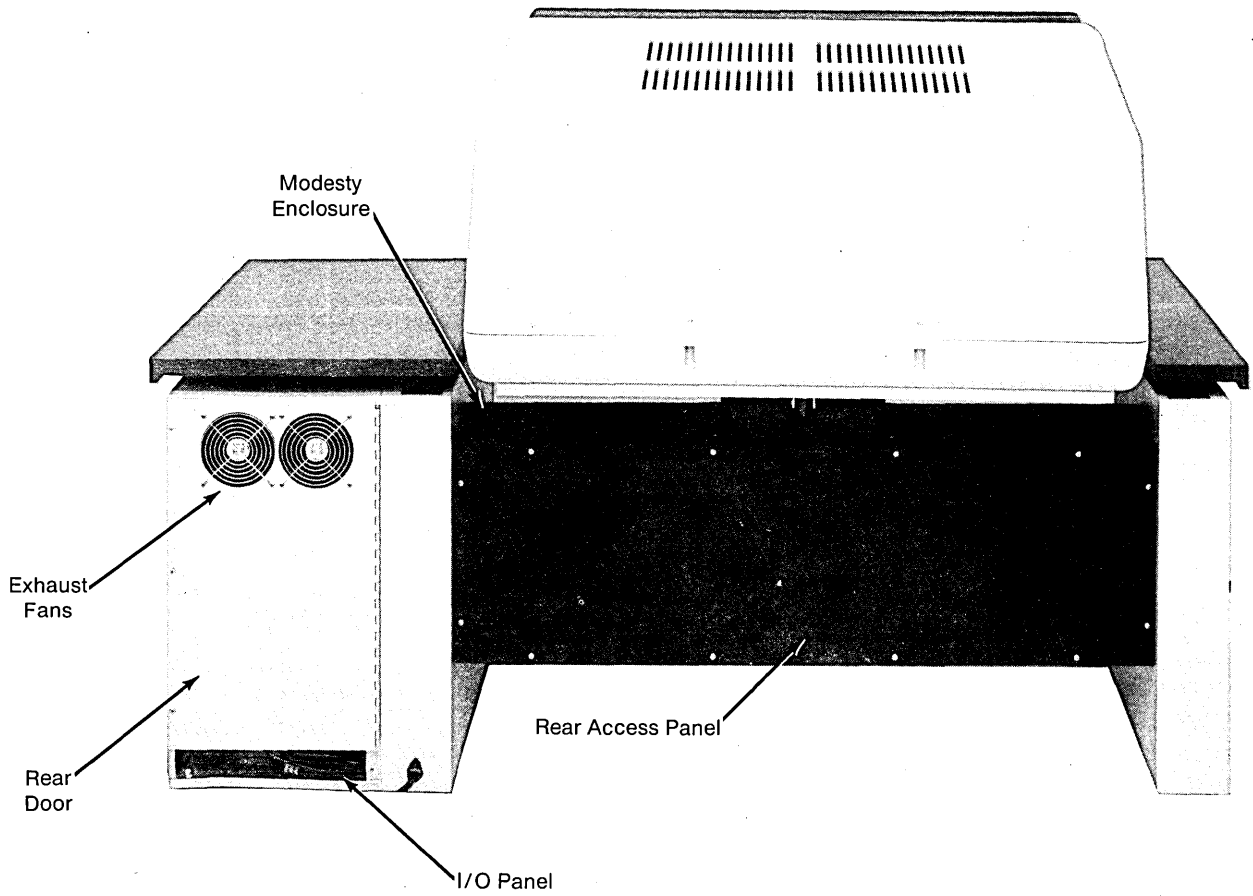


Figure 2-7. Workstation Rear View

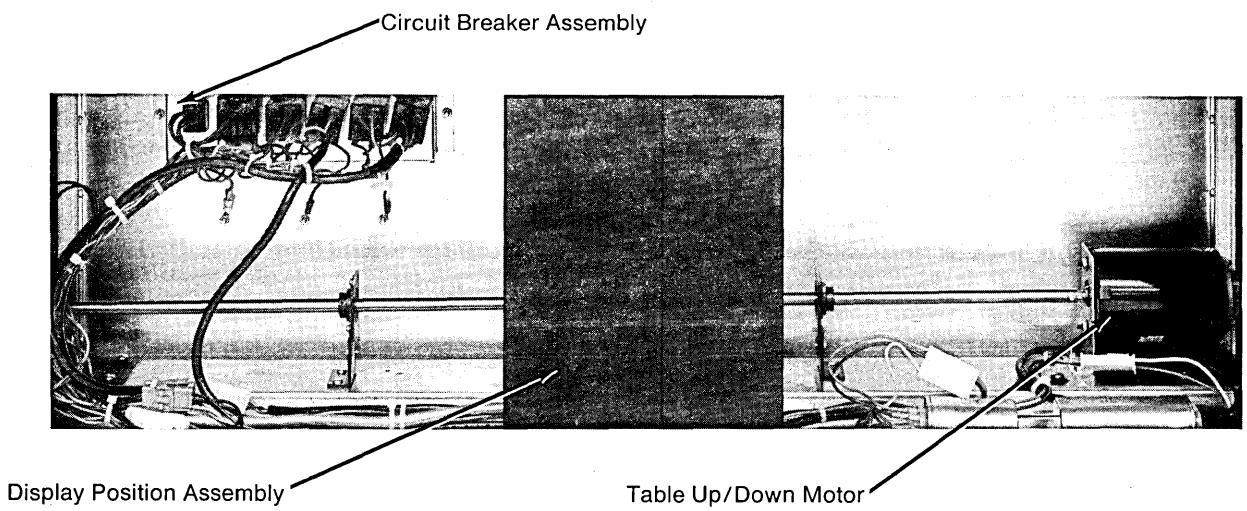


Figure 2-8. Modesty Enclosure Interior

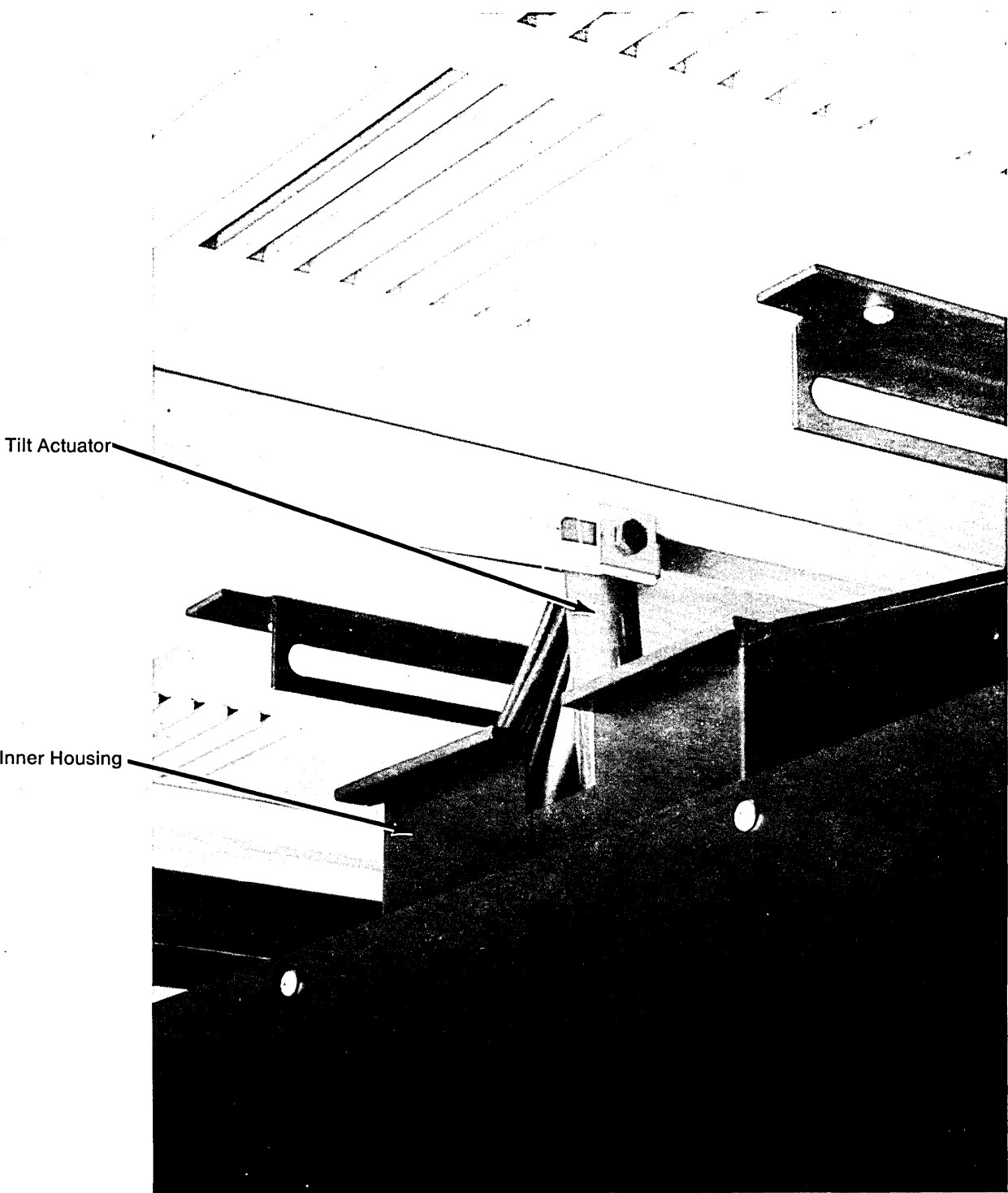


Figure 2-9. Display Position Assembly

## **Right Pedestal Assembly**

The right pedestal assembly (figure 2-10) consists of the following:

- ✕ Display generator enclosure
- ✕ Front door
- ✕ Rear door
- ✕ Right table support
- ✕ Right actuator
- ✕ Movement control panel
- ✕ Display generator

The front and rear doors open to provide access to the interior of the display generator enclosure. Two exhaust fans are mounted on the rear door.

The right table support is bolted to the table top and moves up and down within the enclosure to raise and lower the table top in conjunction with the left table support.

The movement control panel consists of four switches mounted on a panel that is accessible whether the front door is open or closed.

## **Display Generator**

In the model 790-20 workstation, the display generator (figure 2-11) contains the workstation electronics, and has the following major components:

- ✕ Display list processor (DLP) PCB
- ✕ Raster processor PCB
- ✕ Memory PCB
- ✕ Video PCB
- ✕ Test panel
- ✕ Chassis
- ✕ Backplane PCB
- ✕ Card cage
- ✕ Intake fan assembly
- ✕ I/O panel
- ✕ Power supply
- ✕ Disk interface PCB

Four plug-in printed-circuit boards (PCBs) and the test panel (figure 2-12) are accessible with the front door open. The four front-loaded PCBs (cards) are housed in the card cage, and plug into mating connectors on the backplane PCB. Upper and lower card guides have grooves that guide the PCBs to their mating connectors. Each PCB slides into the card cage in its own card slot. PCBs and card slots are color coded for easy matching to minimize the risk of a PCB being inserted in a wrong slot as damage to equipment could result. The intake fan assembly, consisting of six fans on a mounting plate, is positioned horizontally beneath the PCBs to supply cooling air. Table 2-2 shows PCB slot locations. An asterisk indicates an optional PCB. A dynamic refresh memory PCB with eight planes is optional in place of the standard four-plane PCB.

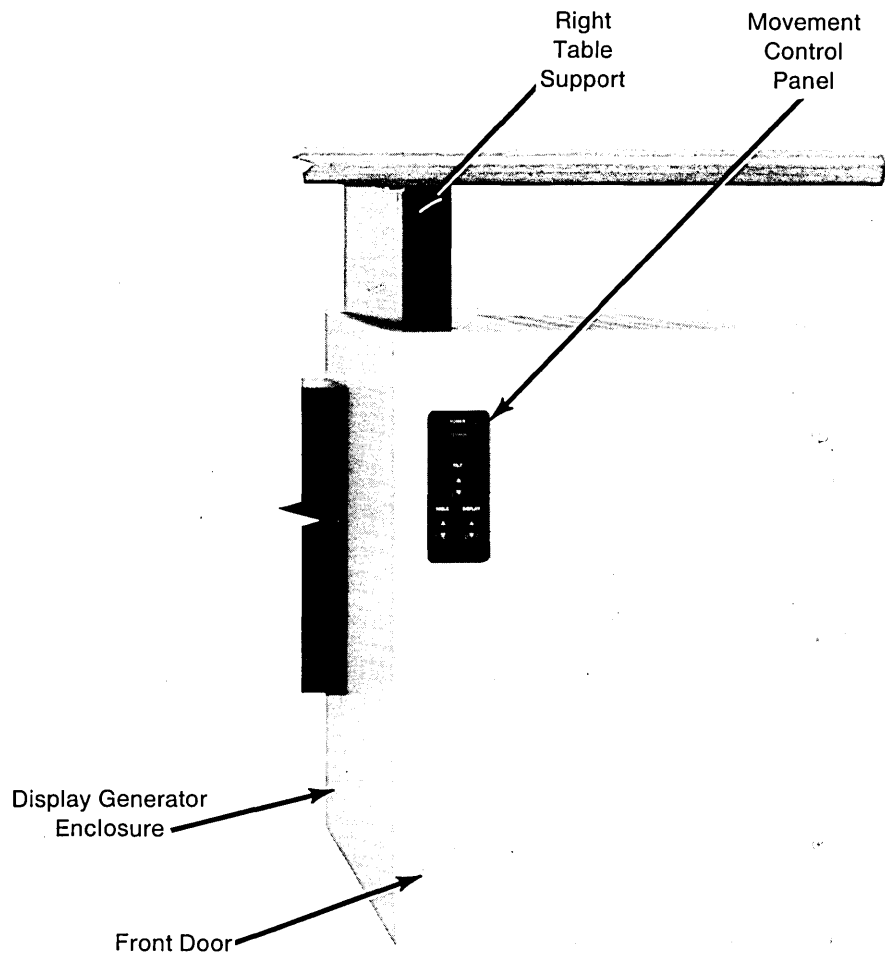
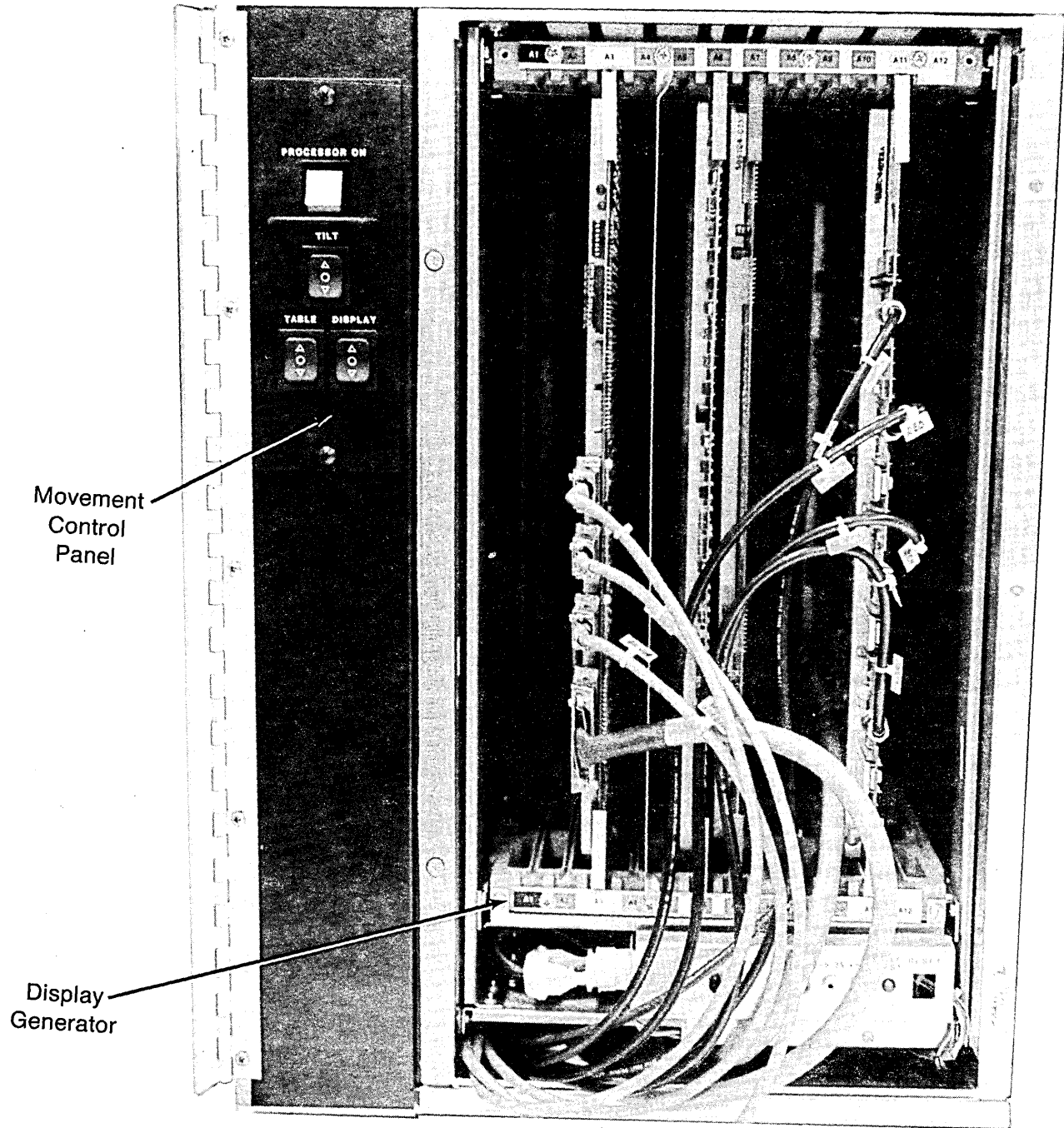


Figure 2-10. Right Pedestal Assembly



Movement  
Control  
Panel

Display  
Generator

Figure 2-11. Right Pedestal Assembly, Front Door Open



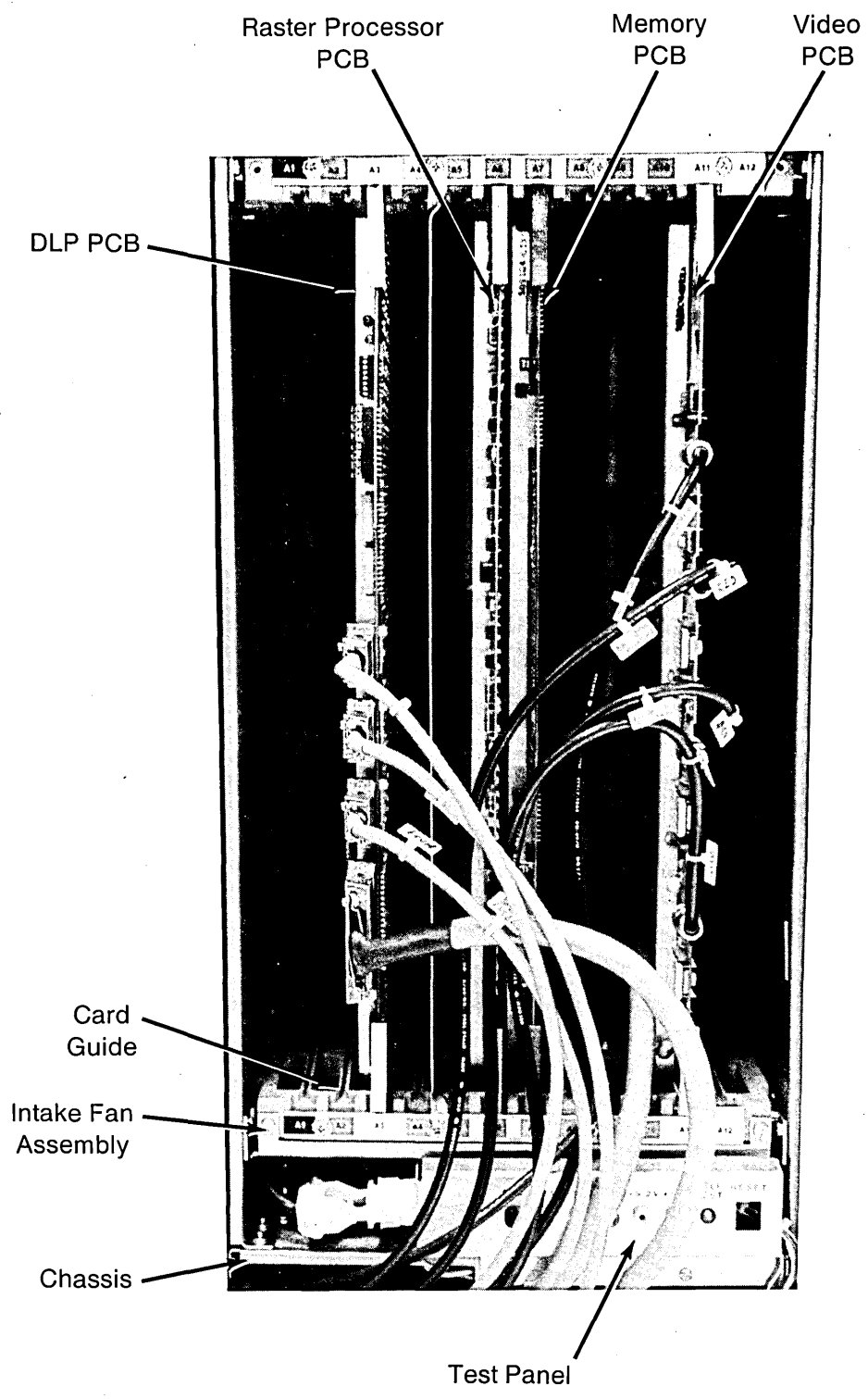


Figure 2-12. Display Generator, Front

## CAUTION

To avoid serious damage to equipment, always observe the color code when inserting a PCB in a card slot.

Table 2-2. PCB Locations

Slot	PCBs
A1	DCSL*
A2	Geometry Processor**
A3	Display List Processor
A4	Display List Memory*
A5	Draw Processor** or GPIF*
A6	Raster Processor
A7	Dynamic Refresh Memory
A8	Dynamic Refresh Memory*
A9	Not used
A10	Not used
A11	Video C
A12	Not used

\*Option

\*\*Installed in model 790-20+ only

The input/output (I/O) panel (figure 2-13) is mounted at the rear of the chassis. The power supply is accessible with the rear door open. The power supply is mounted on a hinged bracket, and is held in an upright position by two screws. A layer of sound foam above the power supply reduces the noise. After the holding screws are removed, the power supply can be tilted backward (figure 2-14) to provide access to the circuit side (rear) of the backplane and the disk interface PCB, which is mounted on the circuit side of the backplane.

PCBs. The front-loaded PCBs are made of epoxy glass laminate. Each board has at least four layers of laminate. Components and integrated-circuit (IC) sockets are mounted on one side of the board and soldered to copper-foil circuit traces etched on the board. An alphanumeric coordinate grid facilitates component location. Component rows are identified by number, columns by letter. Each front-loaded PCB has three 96-pin connectors that mate with backplane PCB connectors. Each front-loaded PCB is equipped with two extractors (figure 2-15) that are color-coded for PCB identification, and serve as handles for convenient PCB removal. After a PCB is inserted, the extractors lock when pressed, holding the PCB in place. Each PCB is marked with a serial number, assembly number, and revision level. The disk interface PCB, which is smaller than the other PCBs, has two 96-pin connectors that plug into mating connectors on the rear side of the backplane. A cable from the disk drive plugs into a 26-pin connector on the disk interface.

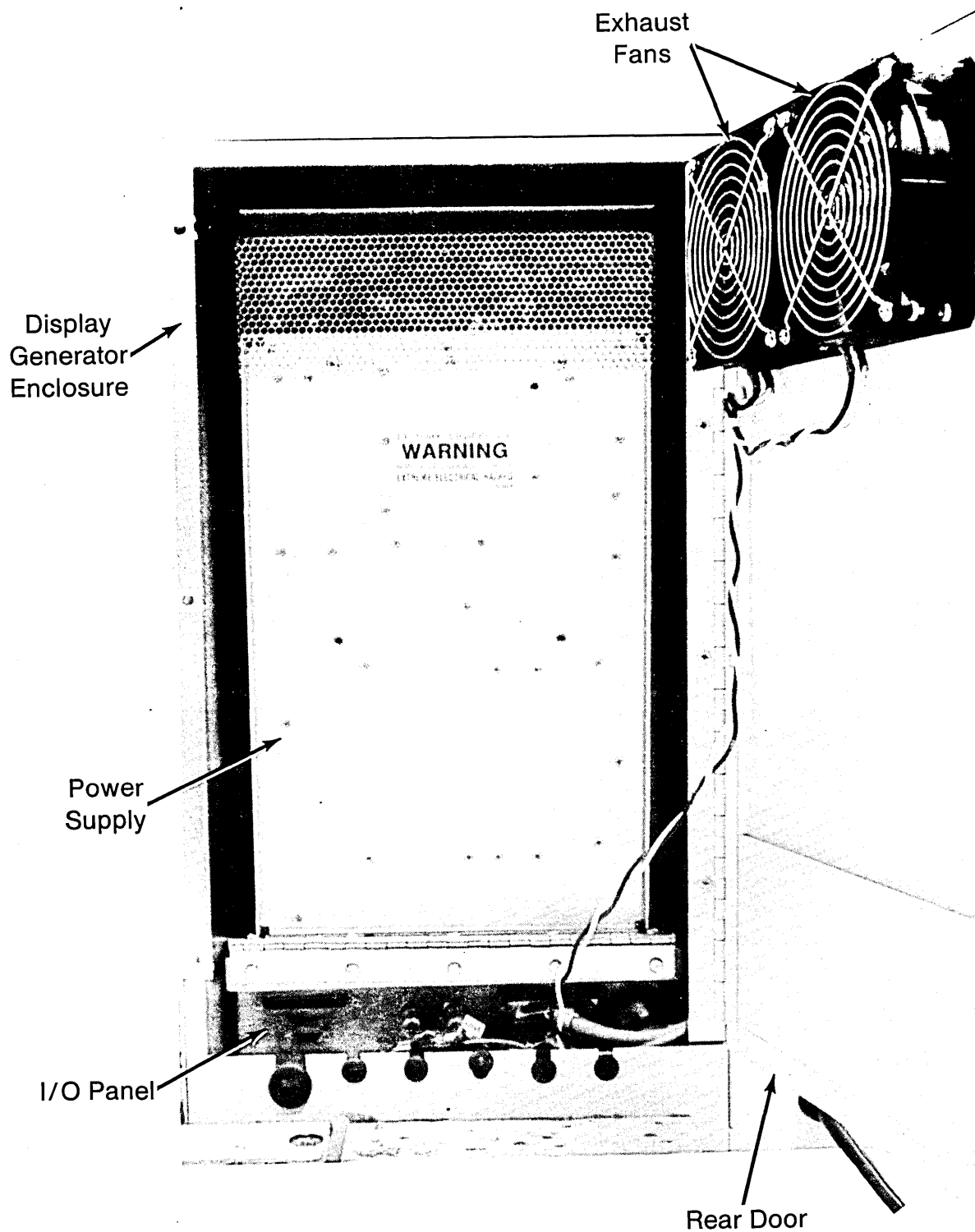


Figure 2-13. Display Generator, Rear

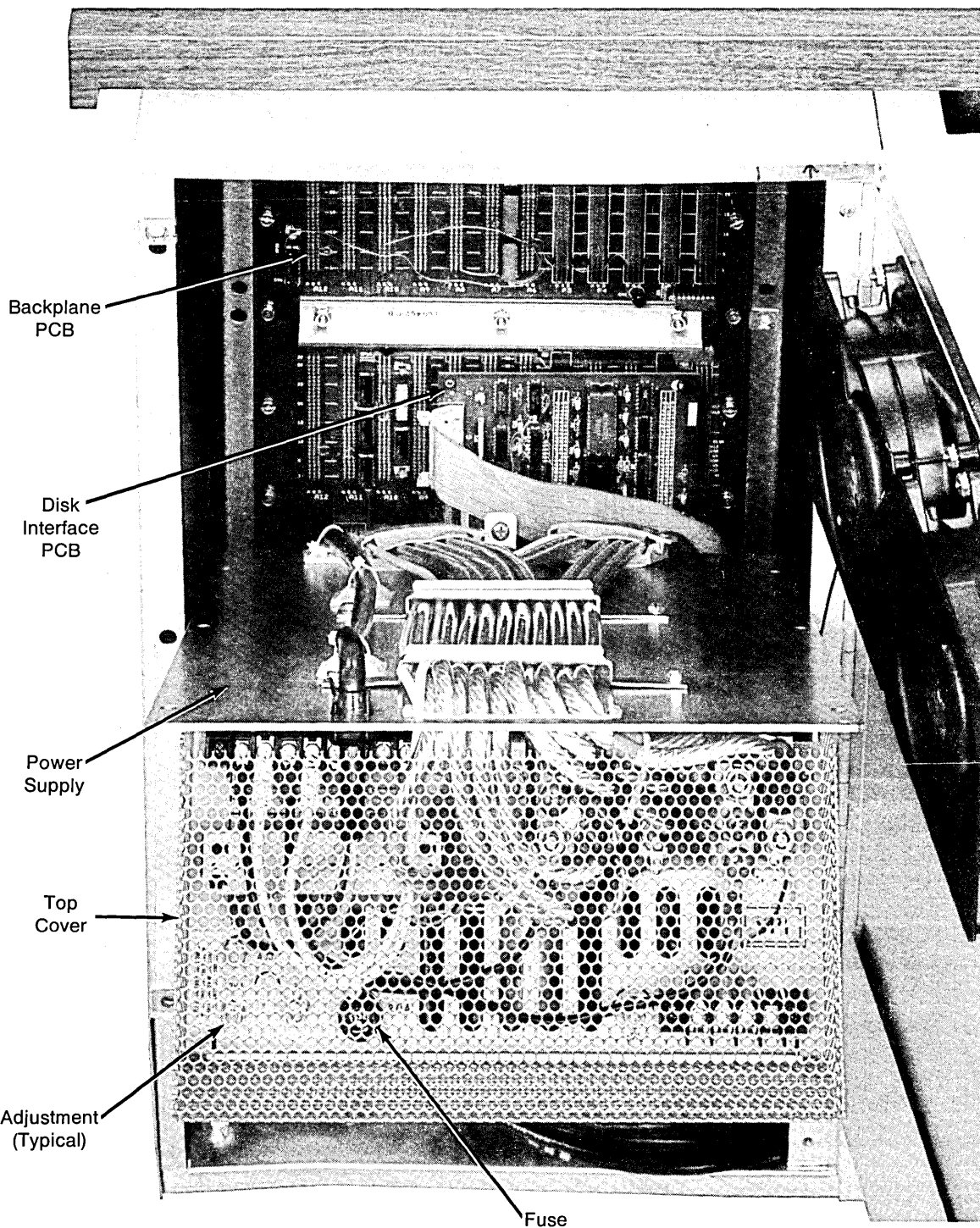


Figure 2-14. Power Supply in Tilted Position with Sound Foam Removed

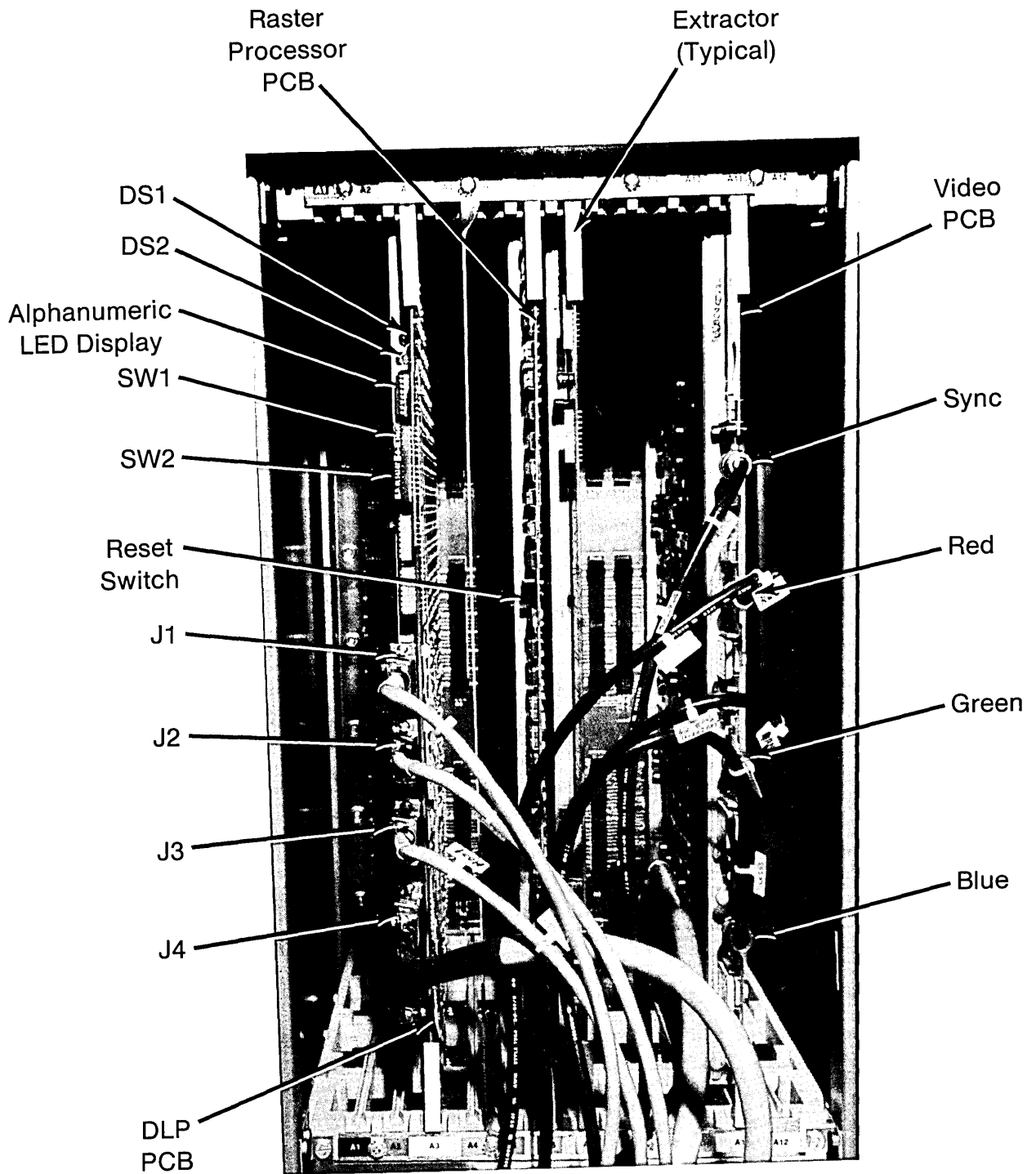


Figure 2-15. PCB Features

The DLP PCB has an 8-bit alphanumeric LED display, two additional LEDs (DS1 and DS2), two configuration select switch banks (SW1 and SW2), and four connectors (J1 through J4). Connector and LED functions are as follows:

- ✕ J1 Monochrome Monitor (RS232C)
- ✕ J2 Graphic Tablet (RS232C)
- ✕ J3 Host Computer (RS232)
- ✕ J4 Printer
- ✕ DS1 Halt (red)
- ✕ DS2 Self-test (green)

The raster processor PCB has a RESET switch.

The video C PCB has RED, GREEN, BLUE, and COMPOSITE SYNC BNC connectors.

Backplane PCB. The backplane PCB is the rear wall of the card cage, and has 36 PCB connectors arranged in 12 rows of 3. Each row of 3 represents a slot for one PCB. The slots are designated A1 through A12. Two more connectors are mounted on the rear side of the backplane for the disk interface PCB. The backplane has four additional connectors, J1 through J4. Functions are as follows:

- ✕ J1 - Test panel
- ✕ J2 - Not used
- ✕ J3 - Not used
- ✕ J4 - Disk drive

Power Supply. Power cables from the backplane PCB are connected to terminals on the top end of the power supply. Five screwdriver controls for voltage adjustment and a 20-ampere fuse are also mounted on the top end. A perforated cover protects the components from accidental contact.

## SPECIFICATIONS

Table 2-3 lists workstation specifications. Peripheral specifications are listed in separate manuals.

Table 2-3. Specifications

Category	Description
Color Monitor	
Display Area	19-inch color tube 13.33 ± 0.1 inch horizontal x 10.0 ± 0.1 inch vertical display area centered ± 0.2 inch
Horizontal Frequency	64.35 ± 0.02 kilohertz
Vertical Frequency	60.0 ± 0.1 Hertz (not line-locked)

Table 2-3. Specifications (continued)

Category	Description
Pixel Time	9.25 ns
Vector Setup Time	14.43 us
Resolution	1280 horizontal by 1024 vertical pixels
Addressability	$3.4 \times 10^{38}$ coordinate elements (IEEE 32-bit floating point)
Line Types	Arbitrary patterns of colors and space up to 256 pixels in length
Graphic Primitives	2D and 3D polygons 2D and 3D linked vectors 2D and 3D unlinked vectors Raster text Stroked text Area flood Rational cubics Cubic patches Arcs Circles
Color System	Video outputs to drive color monitor are RGB
Character Set	ASCII standard 128-character, stored in ROM as series of 8 by 8 matrixes. Each 5 by 7 character cell is displayed in an 8 by 10 dot matrix. User may define all dots in the matrix when downloading a programmable font.
Input Power	
Voltage	204 to 260 volts ac (no wiring changes required to accommodate entire range)
Current (maximum, at nominal line voltage)	11.0 amps
Frequency	49 to 61 hertz (no wiring changes required to accommodate entire range)
Power consumption	2400 watts

Table 2-3. Specifications (continued)

Category	Description
DC Voltages (at test panel)	+5.1 $\pm$ 0.1 -5.3 $\pm$ 0.1 volts -2.1 $\pm$ 0.1 volts +12.0 $\pm$ 0.1 volts -12.0 $\pm$ 0.1 volts
Physical	
Weight	800 pounds maximum
Height	52.00 inches maximum
Width	66.00 inches
Depth	44.37 inches (34 inches in shipping configuration)
Reliability	
MTBF	2500 hours minimum
Maintainability	
MTR	.5 hour maximum, including diagnosis, correction and verification
Preventive Maintenance	No regularly scheduled preventive maintenance is required
Special Tools	No special tools are required to service or maintain the workstation
Product Life/Refurbishment	
Product Life	10 years minimum
Refurbishment	No calendar or clock refurbishments are required. Refurbishment is limited to cosmetic considerations and installation of ECO/FCO.
Temperature	
Operating	10°C to 40°C
Non-operating (storage)	Maximum three months without damage -10°C to 50°C



Table 2-3. Specifications (continued)

Category	Description
Non-operating (transit)	Maximum one week -40°C to 60°C
Extreme Power On Range	Maximum one hour at a time, with accumulated duration of 0.1% of specified life of equipment +0.5°C to 45°C
Humidity	
Operating	20% to 80% relative humidity, noncondensing
Non-operating (storage)	Three months maximum 10% to 90% relative humidity, noncondensing
Non-operating (transit)	One week maximum 5% to 95% relative humidity
Extreme Power On Range (exclusive of disk media)	Maximum one hour at a time, with accumulated duration of 0.1% of equipment specified life 10% to 95% relative humidity, noncondensing
Altitude	Maximum 3000 meters (9850 feet)
Acoustical Noise	Normal operation noise levels are below 62-dB sound power. When making motorized adjustments (to table top or display enclosure) noise levels are below 73-dB sound power.
Shock or Vibration	
Operational	Normal
Transit	Meets National Safe Transit Association test (revised Dec 1975) for workstation and spares.



## Chapter 3

### INSTALLATION AND OPERATION

#### INTRODUCTION

This chapter contains receiving instructions, installation requirements, installation procedures, operating instructions, checkout instructions, and reshipping procedures.

#### RECEIVING

The workstation is shipped mounted on a wooden pallet and encased in a wooden crate that is 70 inches long, 36.5 inches wide and 56.75 inches high. This is too big to go through an average doorway. To move the workstation before unpacking, you need a forklift that can handle 1000 pounds. The pallet rests on eight plastic doughnuts. Be sure to insert the fork at least 37 inches under the pallet on the heavy side of the crate before lifting.

Examine the crate for external damage before accepting delivery. If the crate is damaged, unpack the workstation while the shipping agent is present.

Unpack the workstation as follows:

1. Remove plastic banding from shipping crate.
2. Carefully remove crate and packing material. Save packing material for possible future use.
3. Inspect equipment, while still on pallet, for scratches, dents or chipped paint, especially in any places where shipping crate is damaged.
4. Remove two bolts attaching left retaining bar (figure 3-1) from pallet, and remove retaining bar.
5. Remove four bolts attaching four leftmost plastic doughnuts to pallet.

#### WARNING

To avoid personal injury, do not allow hands or feet to get under the pallet during the following procedure.

6. Use retaining bar as a lever to jack up left end of pallet enough to free four leftmost doughnuts.

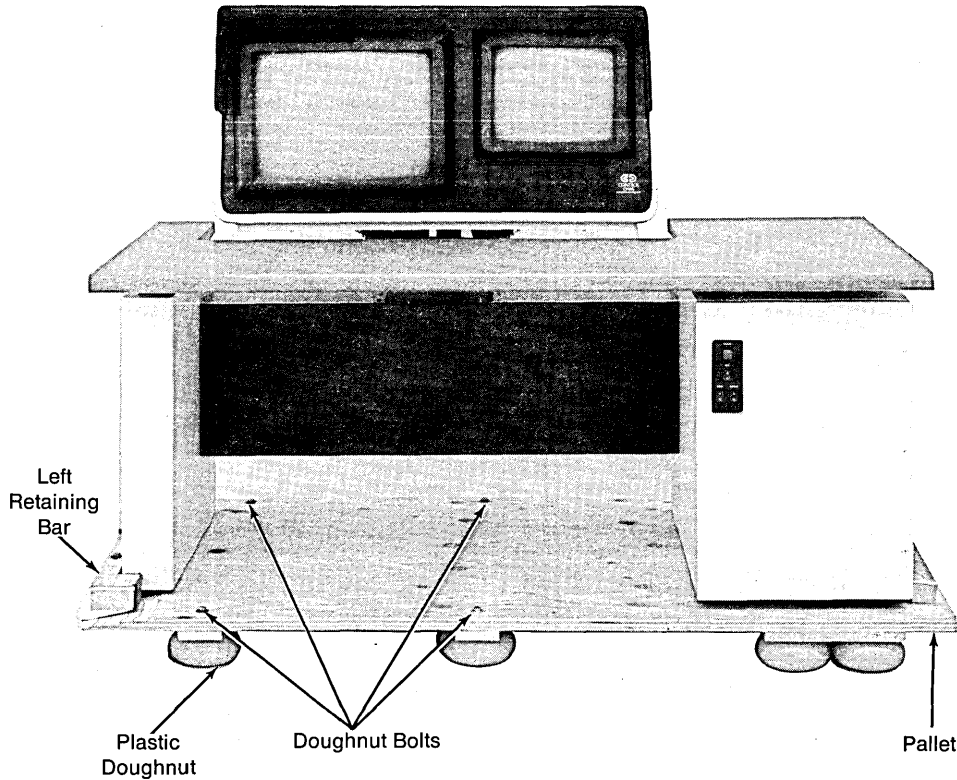


Figure 3-1. Shipping Pallet

7. Remove four doughnuts and their attached boards from under pallet.
8. Carefully lower left end of pallet to floor and remove retaining bar. Pallet then becomes a 6° ramp.
9. Roll workstation off pallet.
10. Check that all items on packing list have been received.
11. Inspect equipment for screws loosened by vibration. Tighten any loose screws.
12. Inspect connectors for foreign material that may impair electrical contact with mating connectors. Remove any foreign material with a soft brush and vacuum cleaner.

#### DISK STORAGE

The floppy disks are enclosed in rigid plastic shells for extra protection and reduced disk-to-case friction. The shutter mechanism protects the recording surface from foreign object contamination. The shutter prevents dust, dirt, and fingerprints from degrading the integrity of stored data. Keep floppy disks away from magnetic fields, direct sunlight, and extreme heat and cold.

## **SPACE REQUIREMENTS**

The workstation table top measures 66 x 34 inches. The display assembly extends 10.4 inches beyond the table top at the back. Additional space is needed to allow the front and rear doors to open. With both doors open, the workstation measures 66 x 60 inches overall.

## **FLOOR CONSIDERATIONS**

Surface loading, floor types and floor surfaces merit consideration when planning installation.

### **Surface Loading**

Most office floors are rated at 50 pounds per square foot with an additional 20 pounds for partitions. This load rating is more than adequate for the workstation.

### **Floor Types**

Standard floors, raised floors, and floors with subfloors are all adequate for the workstation. Raised floors are advantageous during cable installation, and provide cool air for equipment. Maximum incline to a raised floor is 15°.

### **Floor Surfaces**

The floor surface may be concrete, tile, or other material, but concrete requires treatment to prevent excessive dust accumulation. In addition, concrete requires insulation with material rated for a breakdown voltage greater than 400 volts.

## **WARNING**

Concrete floors-on-grade (concrete laid directly on the ground) are classified as "wet locations" by the National Electric Code (NEC) and have unique grounding requirements. Consult your local building code office before installing the workstation on this kind of surface.

Raised tile floors are usually constructed of plywood faced with tile adequate for floor insulation. If tile is installed on a concrete surface, the tile breakdown voltage must exceed 400 volts.

Because carpeting can produce electrostatic charges capable of damaging electronic components, carpeting is not recommended. If you require carpeting, use specially-manufactured carpeting that has a rubber backing with a network of

metal filaments between the backing and the nap. Make sure the metal filaments are grounded, but do not connect this carpet ground to the workstation ground.

### CAUTION

Make sure the workstation and interconnected equipment are insulated from the metal filaments in carpeted installations.

### GROUNDING

The workstation is grounded through the power cable connector. You must have a good single point ground to provide sufficient noise immunity for normal operation and reliability. If the power cable receptacle does not provide a suitable ground, select a good earth ground for a grounding electrode. For example, use a cold water pipe, leach field, or copper rod, as specified by the National Electrical Code. If you use a water-pipe ground, make sure that expansion joint and water meter bonding straps are installed. Make sure the grounding conductor is insulated and isolated from any other incidental ground points. Properly dress this conductor, and keep the length as short as possible. Number 8 gauge copper grounding wire is preferred. If you select aluminum wire, install number 6 gauge.

### AC VOLTAGE

At the ac receptacle, check that the line voltage is 204-255 volts.

### INSTALLATION PROCEDURES

Each workstation is shipped with a Chassis Definition and Acceptance Record that gives configuration information. All strapping options and switch settings are factory set.

Host software installation can vary with equipment application. Consult the applicable software documentation for your particular installation.

The workstation is shipped with the table top removed, the display assembly in a forward position, and a horse-shoe-shaped plywood support bolted to the right and left table supports. Install the workstation as follows:

1. Move workstation to selected permanent location. Workstation rides on casters and can be pushed up a 15° ramp.
2. Open circuit breaker door (figure 2-5) to gain access to circuit breaker panel (figure 3-2), and check that all five circuit breakers are on.
3. Check that MAIN SWITCH is off.

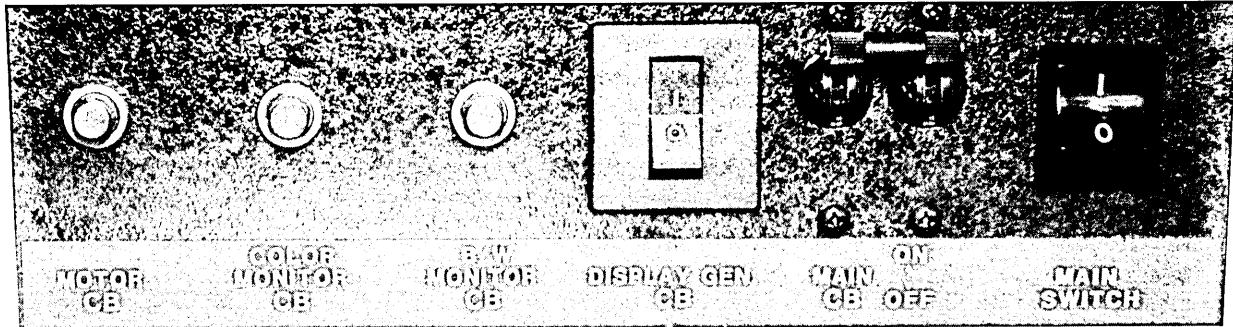


Figure 3-2. Circuit Breaker Panel

**CAUTION**

To prevent dangerous contact between table top and monitors, never press TABLE and DISPLAY switches simultaneously.

4. Plug ac power cable connector into a 208/220/240 V ac, 50/60 Hz outlet (NEMA 6-20R receptacle) that can deliver 11 amps.
5. Set MAIN SWITCH to on position.
6. Press DISPLAY switch (figure 3-3) on movement control panel to raise display assembly to maximum height.
7. Loosen three nuts holding inner housing and tilt actuator to three guide rails (figure 3-4) on display assembly underside.
8. Slide display assembly backward as far as rail slots permit.
9. Tighten three nuts to hold display assembly in new position, with lock washers positioned to prevent forward movement.
10. Loosen four screws holding plywood support and remove plywood support. Save plywood support and screws.
11. Loosen but do not remove screw holding cover plate (figure 3-5).

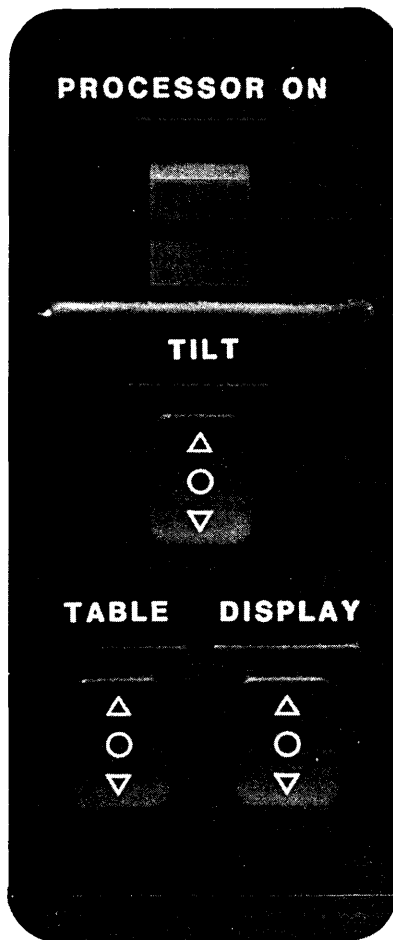


Figure 3-3. Movement Control Panel

12. Slide cover plate up as far as slot permits (figure 3-6).
13. Tighten holding screw to hold cover plate in raised position.

**WARNING**

To prevent injury to personnel and to meet UL requirements, make sure the cover plate is in the raised position before operating the workstation.



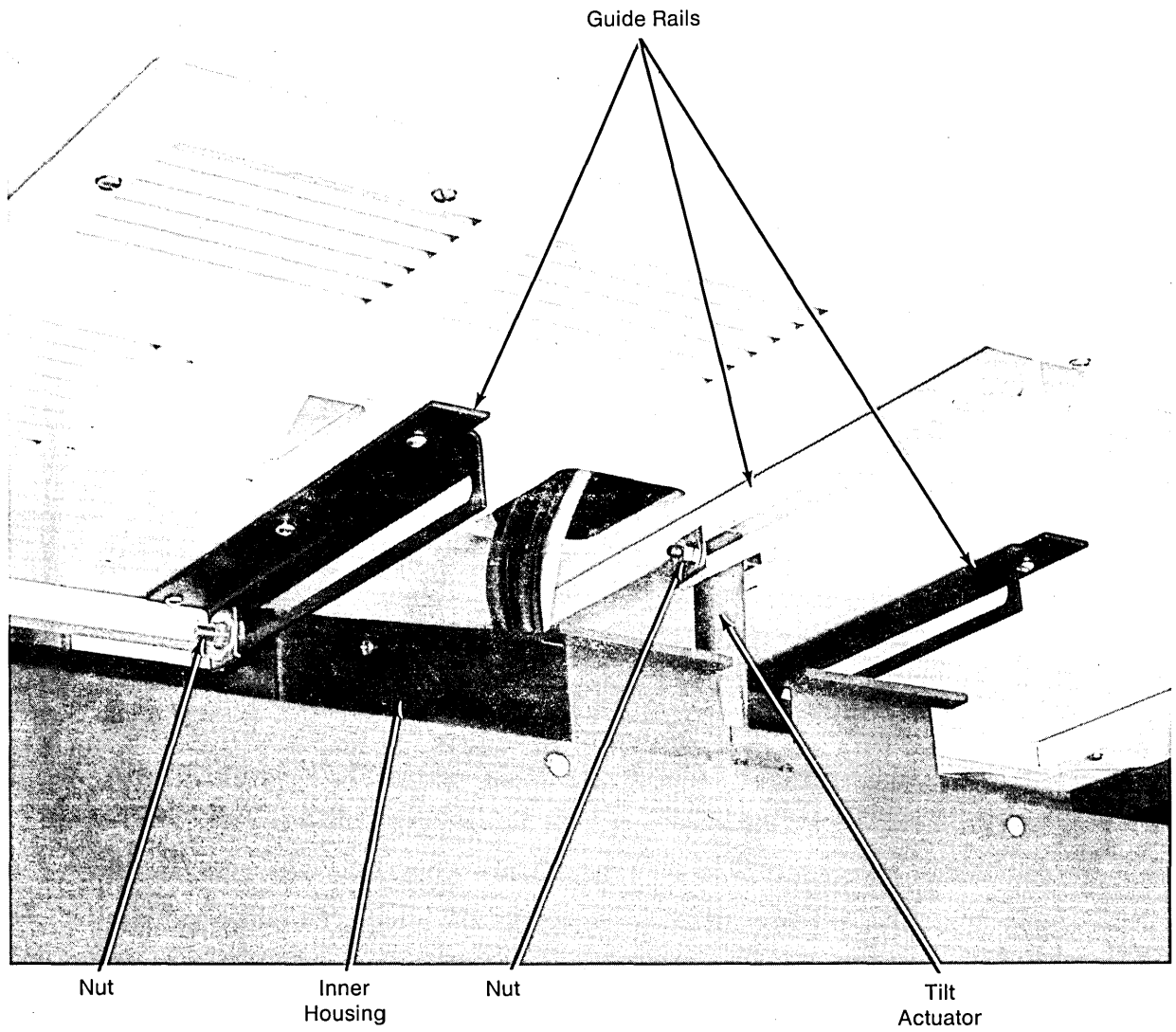


Figure 3-4. Guide Rails

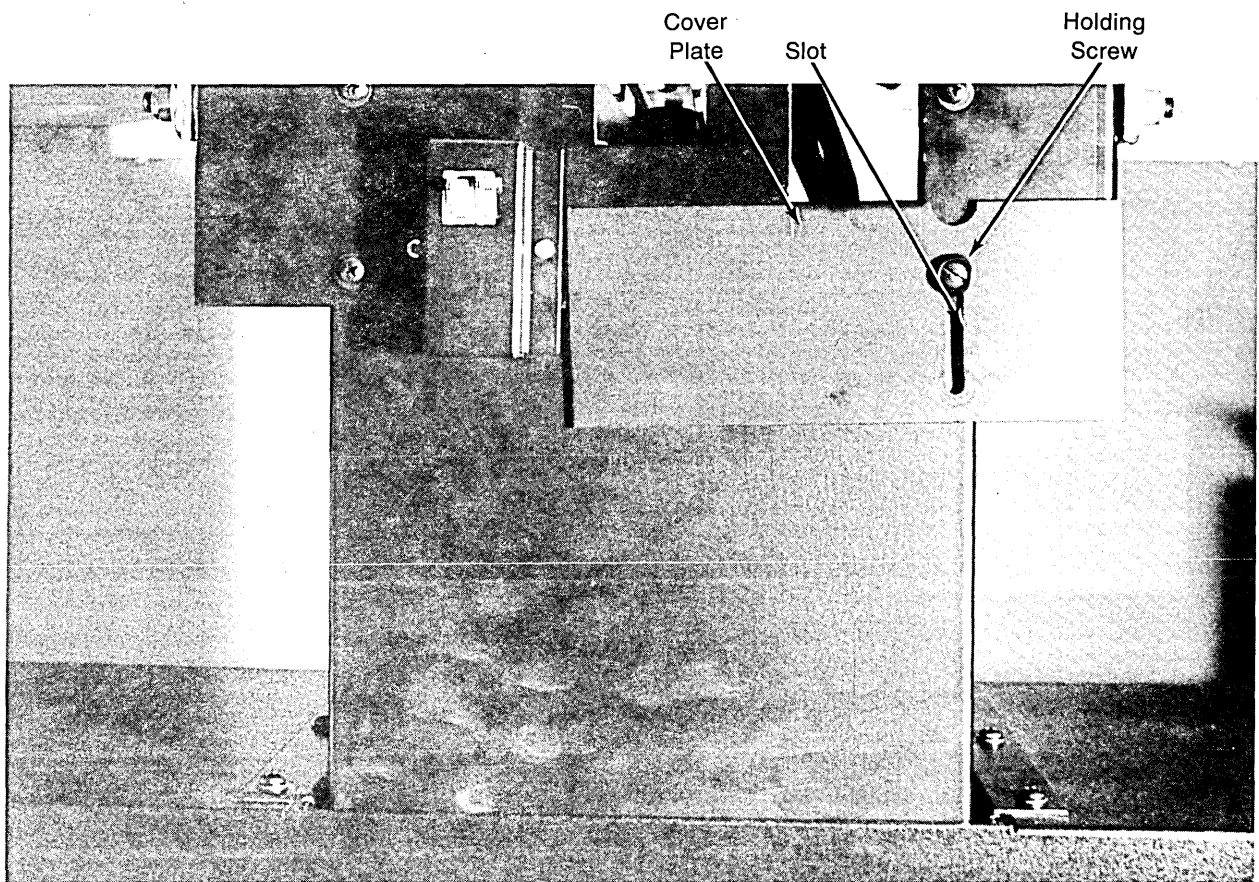


Figure 3-5. Cover Plate in Shipping Position

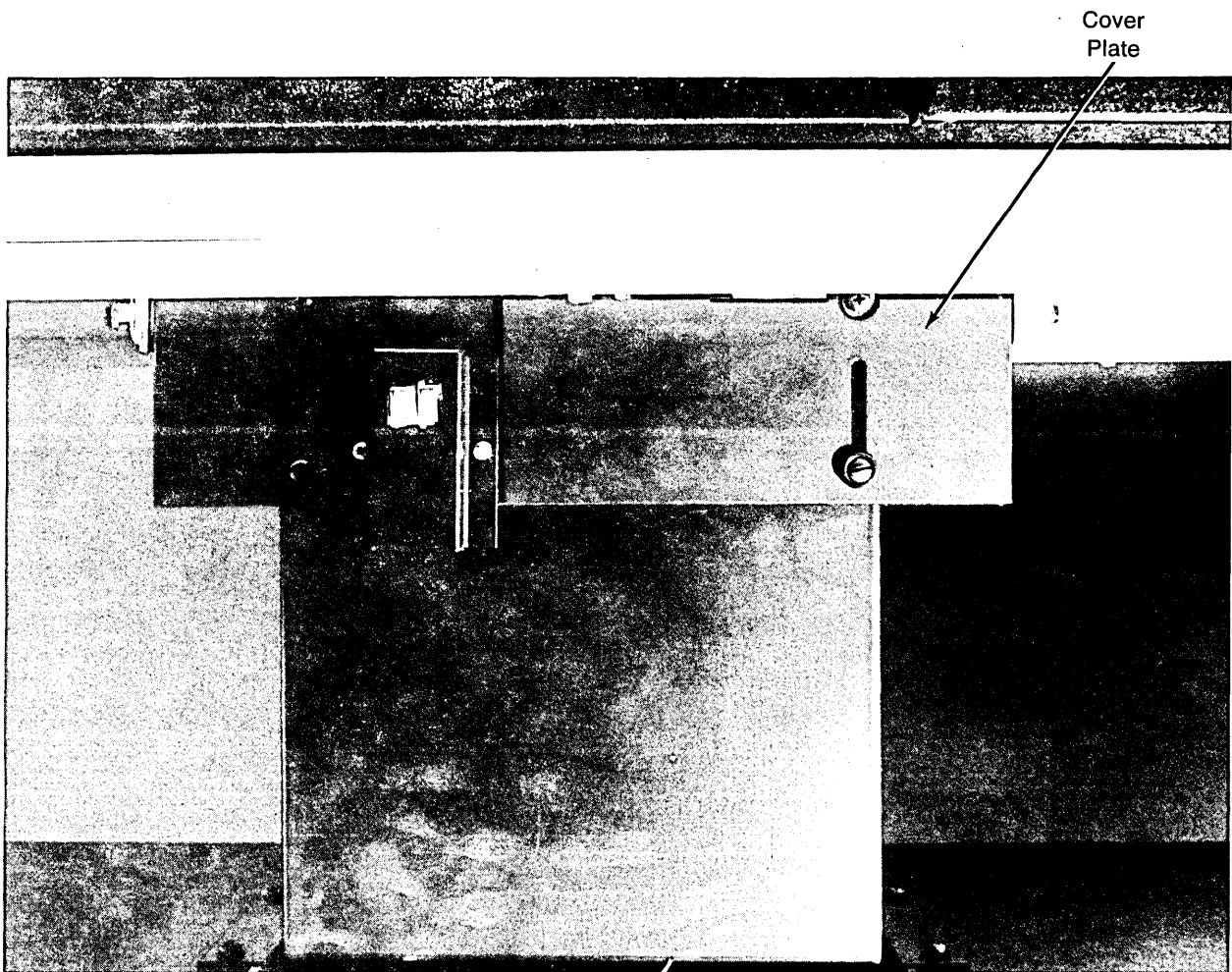


Figure 3-6. Cover Plate in Raised Position

## CAUTION

To prevent damage to equipment, do not operate the workstation until the actuator arm is installed.

14. Attach limit-switch actuator arm (figure 3-7) loosely to table top underside with two screws.
15. Lay table top across table supports.
16. Bolt table top to supports with 12 screws.
17. Press TABLE switch to raise table top just enough to gain access to actuator arm.
18. Adjust actuator arm to actuate limit switches (figure 3-8), and tighten screws. Move table and display assembly up and down several times to check limit switch operation.
19. Press TABLE switch to lower table top to minimum height.
20. Place keyboard and graphic tablet on table top.
21. Plug keyboard and graphic tablet connectors into mating connectors on underside of display base (figure 3-9).
22. Tighten connector holding screws carefully. Do not cross-thread screws.
23. Connect host computer to I/O panel (figure 3-10). For installation of RS232 and optional interfaces (DCSL and DG/GPIF), refer to ICEM Workstation Communication Interfaces On-Site Hardware Maintenance Manual 62950153.
24. Set PROCESSOR ON switch on movement control panel to on position and check that switch lights. Workstation is now ready for checkout.

## CONFIGURATION

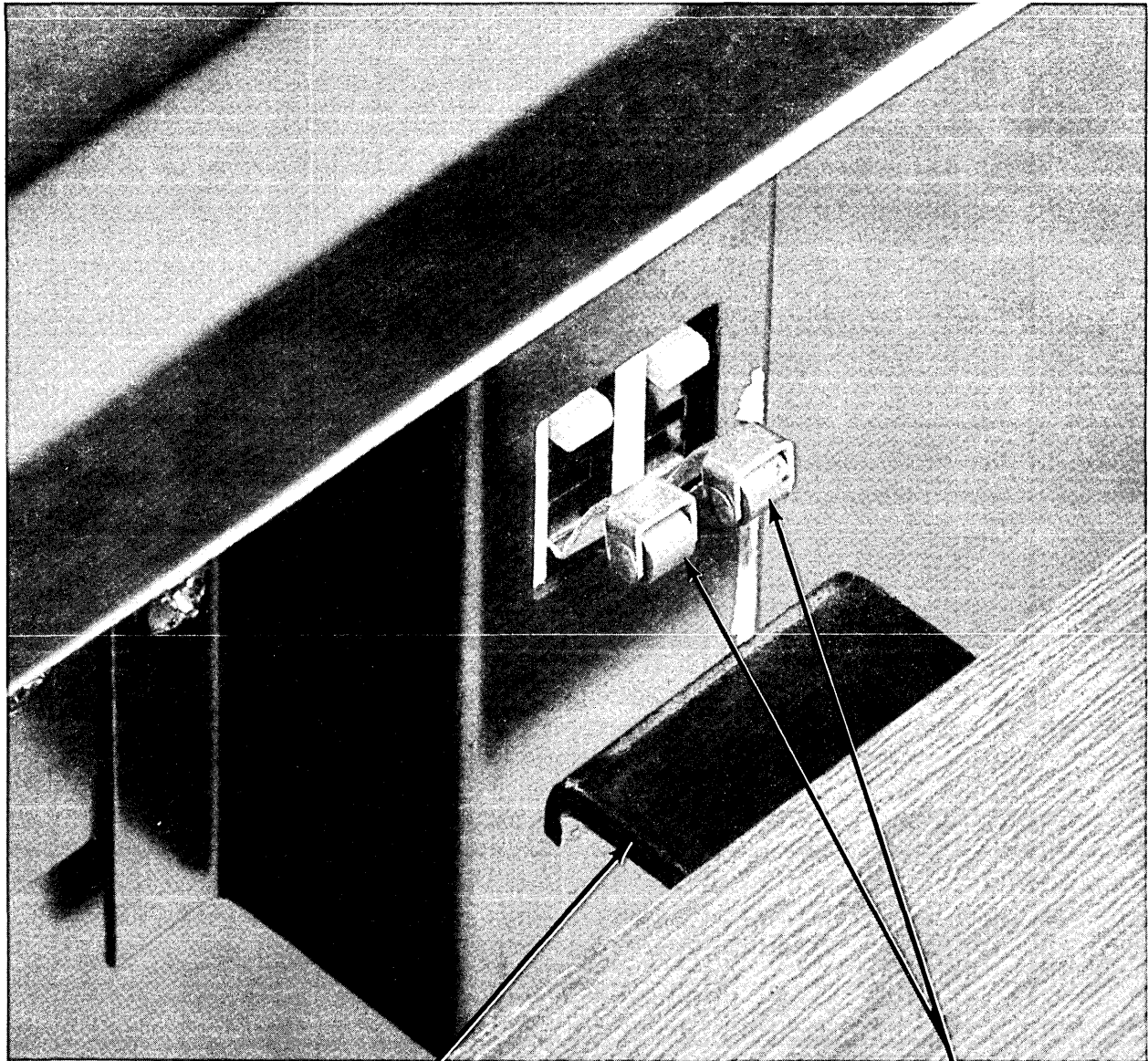
All internal cables are factory installed. Figure F07-1 is a cable interconnect diagram of the workstation. Configuration select SW1 and SW2 switches on the DLP PCB (slot A3) are factory set. Table 3-1 shows the switch settings for normal operation (figure 3-11).

## OPERATION

The following paragraphs describe controls and indicators available to the operator. Turn-on procedure, operating instructions, and turn-off procedures follow.



Figure 3-7. Actuator Arm

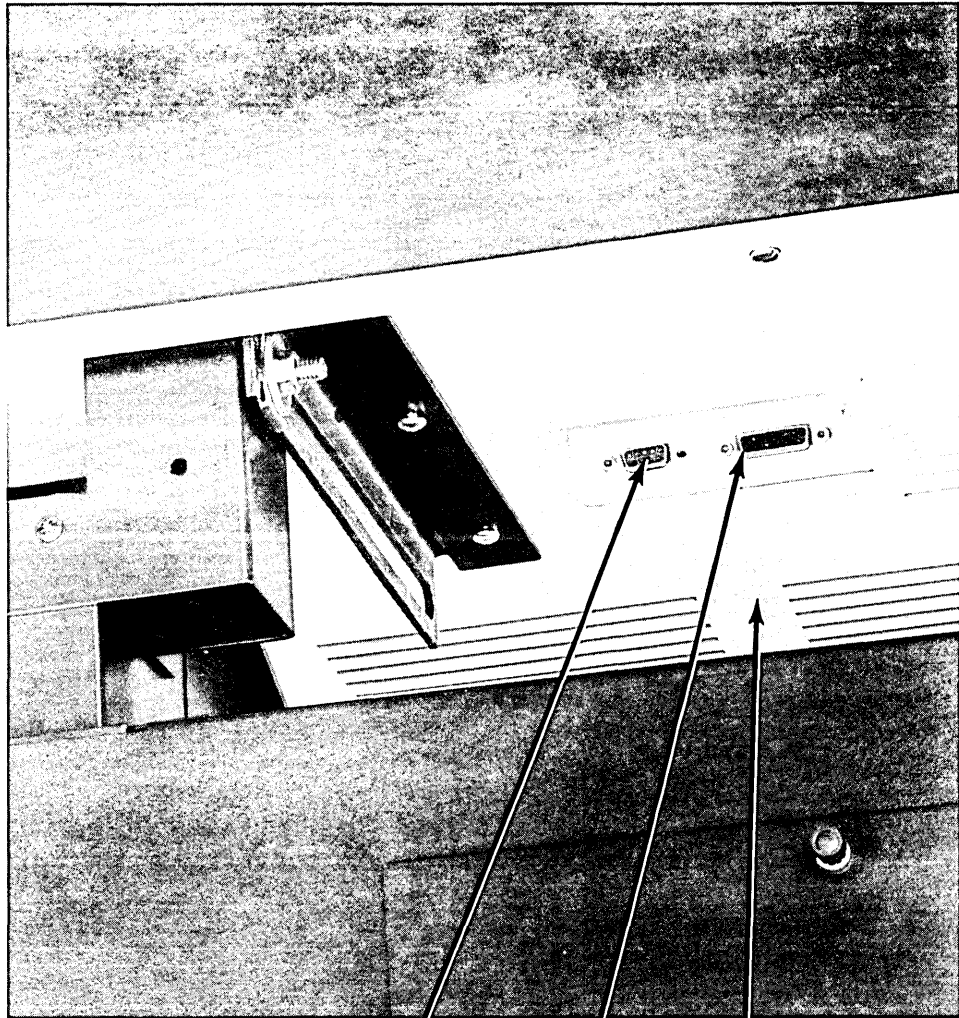


Actuator  
Arm

Limit Switches

Figure 3-8. Limit Switches





Keyboard  
Connector

Graphic  
Tablet  
Connector

Display  
Assembly  
Underside

Figure 3-9. Peripheral Connectors

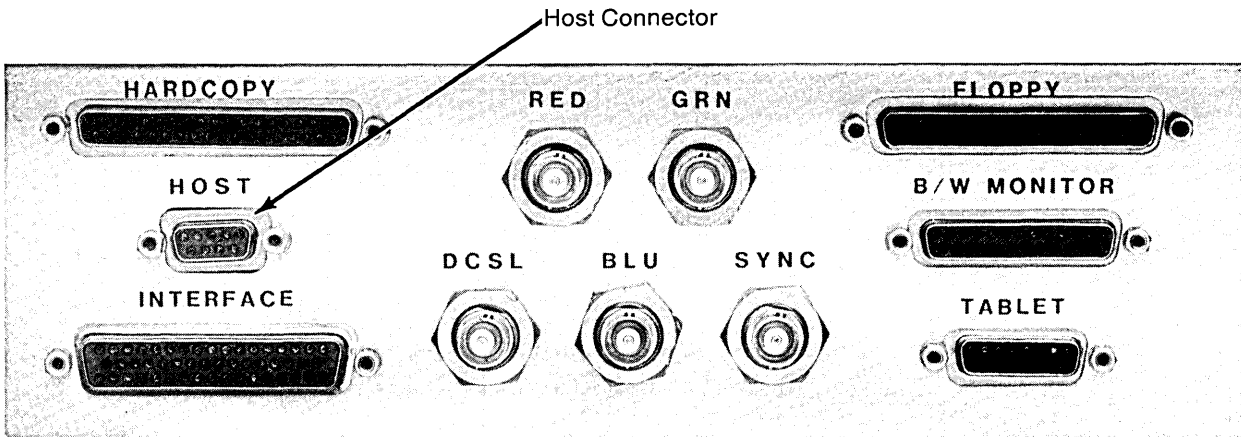


Figure 3-10. I/O Panel

Table 3-1. Configuration Select Switch Settings

Switches	Setting
SW1 switches 1-5, 7	OFF
SW1 switches 6, 8	ON
SW2 Switch 1	ON
SW2 switches 2-8	OFF

### Controls and Indicators

The following panels have controls or indicators available to the operator:

- ✕ Display control panel
- ✕ Movement control panel
- ✕ Circuit breaker panel
- ✕ Test panel

Table 3-2 lists display control panel controls and indicators (figure 3-12). Refer to CDC CC63X Display Terminal Hardware Maintenance Manual 62940034 for additional information on display control panel indicators. Table 3-3 lists movement control panel controls. Table 3-4 lists circuit breaker panel controls.

The test panel (figure 3-13) has an indicator and six test points (table 3-5). The test points are labeled with the nominal voltage levels that appear at the PCBs. For the actual voltage levels at the test panel, refer to VOLTAGE ADJUSTMENTS in chapter 5, Maintenance.



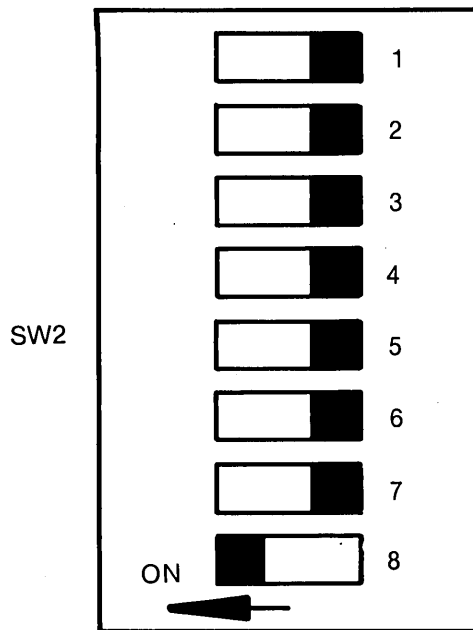
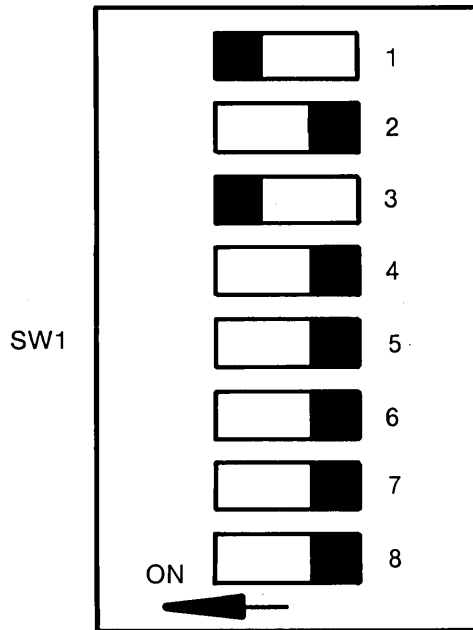


Figure 3-11. Configuration Select Switch Settings

Table 3-2. Display Control Panel Controls and Indicators

Name	Type	Function
CONTRAST	Rotary control	Adjusts monochrome monitor contrast
BRIGHTNESS	Rotary control	Adjusts monochrome monitor brightness
RESET B/W	Pushbutton switch	Resets monochrome monitor
BRIGHTNESS COLOR	Rotary control	Adjusts color monitor brightness
DEGAUSS COLOR	Momentary rocker switch	Degausses color monitor
RESET SYSTEM	Momentary paddle switch	Resets workstation
Eject pushbutton	Pushbutton switch	Ejects diskette from disk drive
Disk active	Red indicator	Lights to indicate disk drive is running
ERROR	Red indicator	Lights to indicate an error condition
ALERT	Red indicator	Lights to indicate an alarm condition
LOCK	Red indicator	Lights to indicate keyboard is locked
MESSAGE	Red indicator	Software defined function
PROGRAM 7, 2, 3	Red indicators	Software defined functions
DATA SET READY	Green indicator	Lights to indicate workstation has received a data set ready signal from host computer

### Turn-on

Turn on the workstation as follows:

1. Open circuit breaker cover.
2. Check that all five circuit breakers are on.
3. Set MAIN SWITCH to on position.

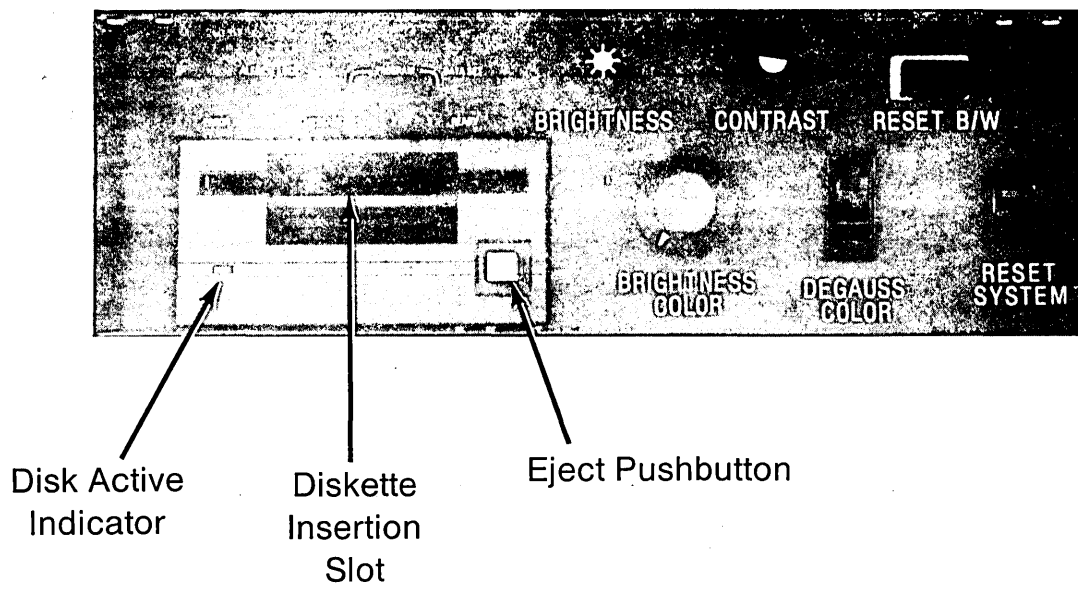


Figure 3-12. Display Control Panel

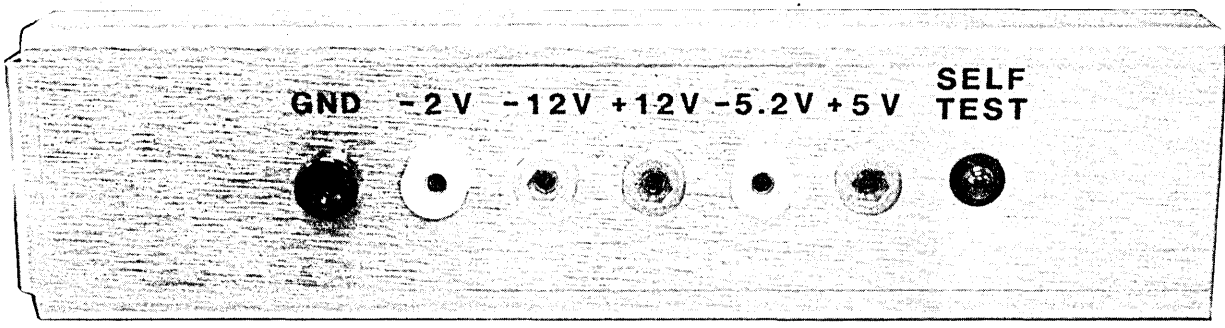


Figure 3-13. Test Panel

Table 3-3. Movement Control Panel Controls

Name	Type	Function
PROCESSOR ON	2-position rocker switch	Applies power to display generator and both monitors (lights red in on position)
TILT	Momentary 2-position rocker switch (center off)	Tilts display assembly forward or backward
TABLE	Momentary 2-position rocker switch (center off)	Moves table up or down
DISPLAY	Momentary 2-position rocker switch (center off)	Moves display assembly up or down

Table 3-4. Circuit Breaker Panel Controls

Name	Type	Function
MOTOR CB	Reset pushbutton	Restores power to motors after circuit breaker trips
COLOR MONITOR CB	Reset pushbutton	Restores power to color monitor after circuit breaker trips
B/W MONITOR CB	Reset pushbutton	Restores power to monochrome monitor after circuit breaker trips
DISPLAY GEN. CB	2-position rocker-switch circuit breaker	Applies power to display generator
MAIN CB	2-position toggle-switch circuit breaker	Applies power to workstation when MAIN SWITCH is on
MAIN SWITCH	2-position rocker switch	Applies power to workstation

Table 3-5. Test Panel Indicator and Test Points

Name	Type	Function
SELF TEST	Green Indicator	Lights during display generator self test
GND	Black socket	Ground
-2 V	White socket	Test point
-12 V	Blue socket	Test point
+12 V	Green socket	Test point
-5.2 V	Yellow socket	Test point
+5 V	Red socket	Test point

4. On movement control panel, set PROCESSOR ON switch to on position and check that switch lights.
5. Close circuit breaker cover.

### Operating Instructions

This paragraph gives instructions for the operator to follow under normal and emergency conditions. For additional operating information, refer to the manuals listed under Related Documents, chapter 1.

### CAUTION

To prevent dangerous contact between table top and monitors, never press TABLE and DISPLAY switches simultaneously.

Normal Operating Instructions. Adjust table height and display assembly height and tilt angle with TABLE, DISPLAY, and TILT controls for convenient monitor viewing. Manually adjust horizontal angle of each monitor for best viewing angle. Pull anti-glare hood forward, if necessary, to reduce glare.

Adjust BRIGHTNESS and CONTRAST controls for clear monitor displays.

To degauss the color monitor, press the DEGAUSS COLOR switch.

To reset the monochrome monitor, press the RESET B/W pushbutton.

To load the disk drive, insert a diskette into the slot on the disk drive.

Press the pushbutton on the disk drive to eject the diskette.

To reset the workstation, press the RESET SYSTEM switch.

Emergency Operating Instructions. Circuit breakers protect the workstation from overload conditions. If a circuit breaker trips, call a qualified technician. After the overload condition has been corrected, set the MAIN SWITCH to the off position, reset the circuit breaker, then set the MAIN SWITCH to the on position. If you need to turn off power during any emergency, set the MAIN SWITCH to the off position.

### **Turn-off**

To turn off the workstation, open the circuit breaker door and set the MAIN SWITCH to the off position.

### **CHECKOUT**

Checkout the workstation as follows:

1. Press DISPLAY switch to move display assembly up to maximum height.
2. Press TABLE switch to move table top up to maximum height, then down to minimum height.
3. Press DISPLAY switch to move display assembly to minimum height.
4. Press TILT switch to tilt display assembly backward and forward.
5. Check that monitors swivel individually in response to manual pressure.
6. Loosen front door twist screws and open front door.
7. Check that cooling fans are spinning normally.
8. Check monochrome monitor parameter settings using procedure given under MONOCHROME MONITOR PARAMETER SETTING CHECK.
9. Check dc voltages at test panel and adjust, if necessary, as described in chapter 5, Maintenance.
10. Run diagnostic tests described in chapter 5. Diagnostic test 2F(H) shows correct graphic tablet switch settings. Remove switch cover on back of tablet between INTERFACE and PEN/CURSOR connectors to check switch settings.
11. Run TEKEM test described in appendix C.

### **PACKING/RESHIPING**

If you need to ship the workstation to CDC because of shipping damage, or for any other reason, identify the owner and the requested service or repair on a tag and attach the tag to the equipment. Include the part number and the full serial number on the tag. Always identify the equipment by part number and serial number in any correspondence with CDC. To reship the workstation,

proceed as follows:

1. Raise display assembly to maximum height.
2. Set MAIN SWITCH to off position.
3. Disconnect keyboard, graphic tablet, and host computer cable.
4. Remove 12 screws and remove table top.
5. Loosen cover-plate holding screw and slide cover plate down as far as slot permits.
6. Tighten holding screw.
7. Bolt plywood support (foam-side up) saved from installation to table supports with four screws.
8. Loosen three nuts and slide display assembly forward on guide rails as far as rails permit.
9. Tighten three nuts to hold display assembly in forward position, with lock washers positioned to prevent backward movement.
10. Set MAIN SWITCH to on position.
11. Lower display assembly onto foam cushion on plywood support.
12. Set MAIN SWITCH to off position.
13. Disconnect ac power cable from ac outlet.
14. Close and fasten all doors.
15. Strap display assembly to plywood support in two places using strong tape or plastic banding.
16. Place workstation on shipping pallet and bolt down with four screws.
17. Strap table top to back side of workstation while resting on shipping pallet using strong tape or plastic banding.
18. Restore packing material saved from unpacking.
19. Encase workstation in wooden crate.
20. Secure crate with plastic banding.

#### **MONOCHROME MONITOR PARAMETER SETTING CHECK**

The following procedure describes how to check the Terminal and CYBER Mode parameters. Operator parameters do not need to be checked. They may be changed temporarily by the operator using the F keys. Proceed as follows:

1. On keyboard (upper left) press <SETUP> and note that monochrome monitor displays following Operator parameters (first group):

F	RETURN	F	LINE ON	F	PRINTER	F	MARGIN ON	F	ALERT SOFT	F	LOCK ALPHA	F	N-PAD SHIFT	F	SCREEN ROLL	F	CYBER LARGE	F	MORE SELECT
1		2		3		4		5		6		7		8		9		10	

2. Press F10 key and note that following (second) group of Operator parameters appears:

F	RETURN	F	BACKGD DARK	F	CURSOR BLOCK	F	CURSOR BLINK	F	BAUD 9600	F	DUPLEX FULL	F	CHR/LN 80	F	LINES 30	F	XPARENT OFF	F	Mode Select
1		2		3		4		5		6		7		8		9		10	

3. Press F10 key again and note that following Mode Selection display appears:

F	MODE 1	F	MODE 2	F	MODE 3	F	MODE 4	F	MODE 5	F	MODE 6	F	MODE 7	F	TERMINAL	F		F	
1	CYBER	2	PLATO	3	CP/M	4	DISK	5	C120	6		7	PACK	8	TEST	9		10	

4. Hold down <CTRL> and press <SETUP>.

5. Check that following Terminal parameters appear as shown. To change a parameter, first move cursor by using space bar, backspace (<-->) key, and F keys. Then type in correct number or letter. Press <COPY> to store changes.

F	RETURN	F	CONFIG	F	CONFIG	F	CONFIG	F	RETURN	F	AS X Y	F	L ID	F	PORT A	F	PORT B	F	instl
1		2	100000	3	000000	4	100000	5	000000	6	1 0 0	7	0 0000	8	C A	9	C A	10	mode n



6. Press F10 key and check that ENTER MODE n (1-6) appears.

7. Type <1> and check that following CYBER Mode parameters appear as shown. To change a parameter, use F keys. After making any changes be sure to press <COPY>.

F	RETURN	F	CONFIG	F	CONFIG	F	CONFIG	F	RETURN	F	OPR EF	F	A-DIAL	F	A-DIAL	F	DP T R	F	ACCESS
1		2	100000	3	001001	4	000000	5	010000	6	4625	7	000000	8	000000	9	00 A A	10	0000

8. After checking Terminal and CYBER Mode parameters, press F1 key twice to return to normal operation.



## Chapter 4

### FUNCTIONAL DESCRIPTION

#### INTRODUCTION

This chapter describes workstation operation as part of a computer graphics system. Functional descriptions of electronic and electromechanical components follow.

#### COMPUTER GRAPHICS SYSTEM

The workstation functions as part of a computer graphics system. Figure 4-1 is a functional block diagram of a representative system consisting of the following functional units:

- ✕ Host computer
- ✕ Workstation

The workstation consists of the following functional components:

- ✕ Display generator
- ✕ Color monitor
- ✕ Monochrome monitor
- ✕ Keyboard
- ✕ Graphic tablet
- ✕ Table assembly

The display generator sends video signals to the monitors for display in response to data from the host computer, keyboard, or graphic tablet. Keyboard data reaches the display generator via the monochrome monitor. The table assembly has three electric motors that control table and display assembly movement.

#### Host Computer

Host computer tasks typically include storing, processing, and communicating formatted image or graphics data to the workstation. Depending upon user requirements, some computing tasks are transferred to the workstation. These tasks might include display list processing, coordinate transformation, or pixel formatting.

#### Display Generator

In a typical application, the display generator accepts and interprets text, image or graphics instructions and data from the host computer, performs CRT memory storage and CRT write operations, and supports peripheral devices.

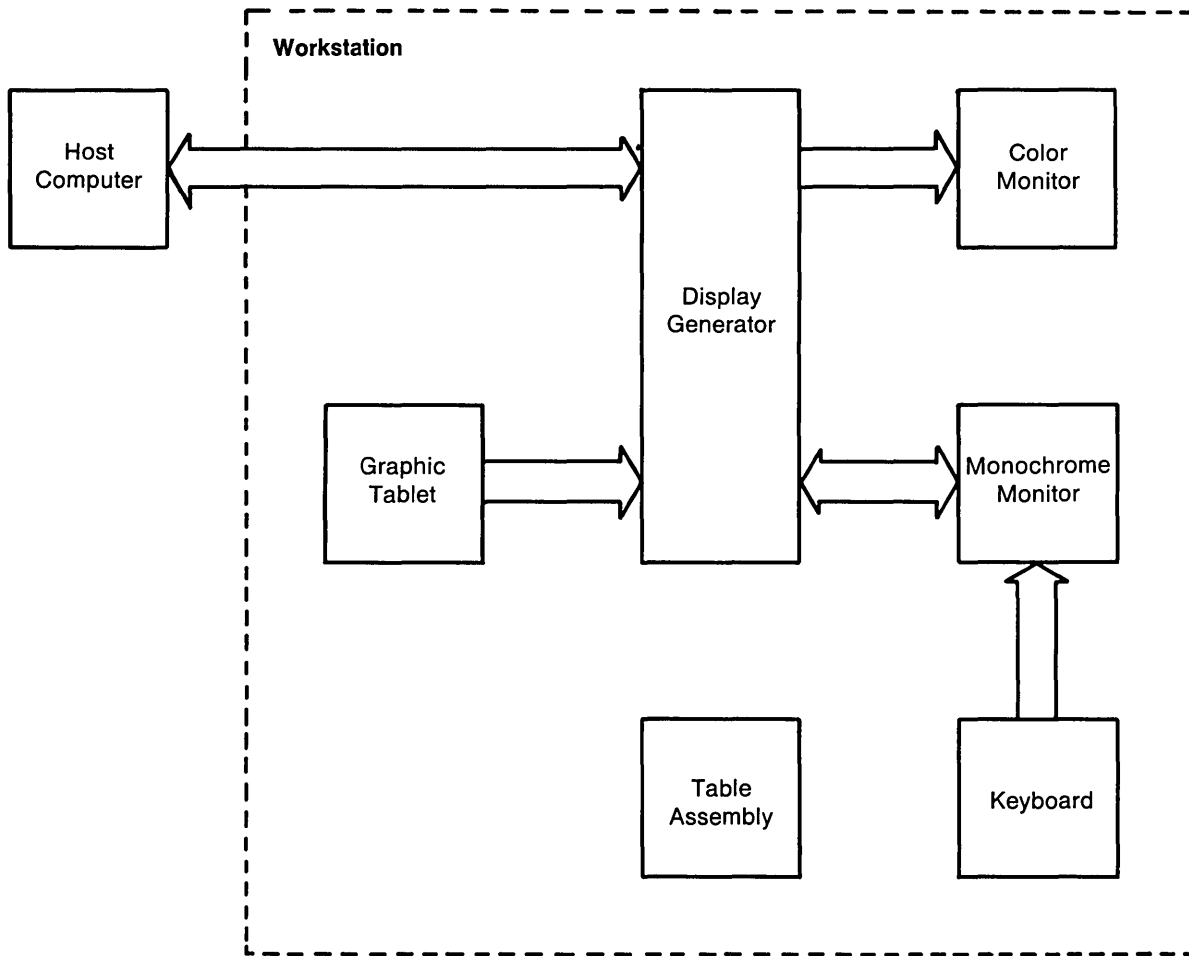


Figure 4-1. Computer Graphics System

### Peripherals

The display generator supports serial transmission devices that operate in differential or RS232 modes. Devices include:

- ✧ Keyboard
- ✧ Graphic tablet

The keyboard enables the user to interact via keystroke input. Keyboard characters are bidirectionally transmitted as eight-bit ASCII codes. Unique function codes extend the standard ASCII scheme.

The graphic tablet digitizes the position of a pointer placed in close proximity to the tablet working surface. The resulting x-y measurement is suitable for computer processing.

## **Color Monitor**

The color monitor receives red-green-blue (RGB) video signals from the display generator. The monitor amplifies and conditions these signals and applies the result to the respective RGB electron guns of a high-resolution color CRT, which displays color images.

## **Monochrome Monitor**

The monochrome monitor receives digital data from the display generator and converts the data to analog video signals. These signals drive a single electron gun, which displays monochrome images on a CRT. The monochrome monitor also routes keyboard data to the display generator.

## **SIGNAL AND DRAWING CONVENTIONS**

Functional descriptions are based on block diagrams showing data and address buses and selected control-signal lines. All other control-signal lines are omitted for clarity.

## **ELECTRONIC FUNCTIONAL DESCRIPTIONS**

The display generator (figure 4-2) consists of the following functional elements:

- ✕ Disk drive
- ✕ Disk Interface PCB
- ✕ Display list processor (DLP) PCB
- ✕ Raster Processor PCB
- ✕ Memory PCB
- ✕ Video C PCB
- ✕ Backplane PCB
- ✕ Power supply

Refer to the paragraph titled POWER DISTRIBUTION for a description of power supply operation.

### **Disk Drive**

In read mode, the disk drive reads a floppy diskette and sends serial output data to the disk interface PCB. In write mode, the disk drive receives serial data from the disk interface PCB and writes the data on the diskette.

### **Disk Interface PCB**

In read mode, this PCB converts serial data from the disk drive into parallel data, and sends the parallel data to the DLP PCB on the VME bus. In write mode, the PCB converts parallel data from the DLP into serial data for the disk drive.

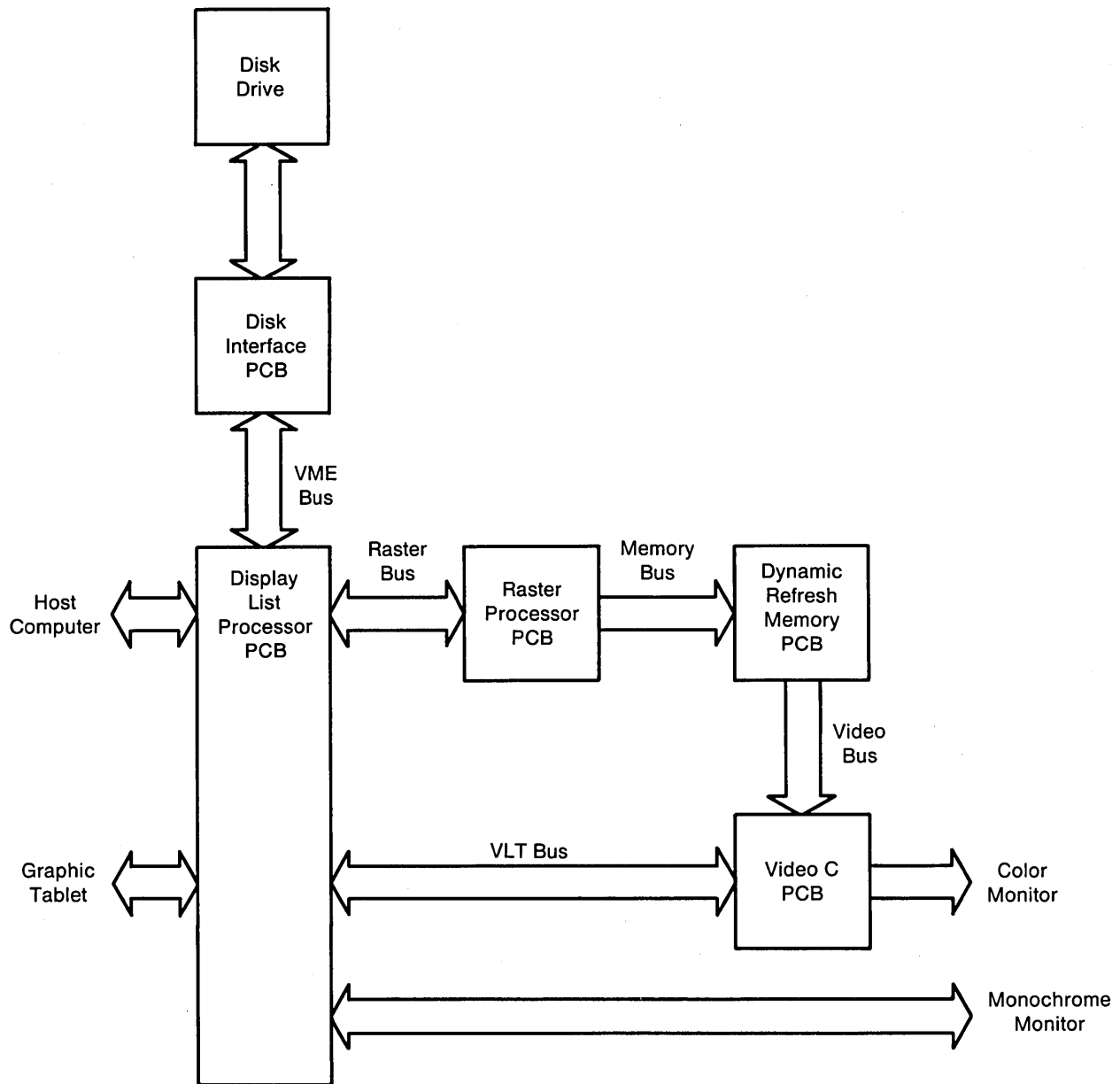


Figure 4-2. Display Generator Block Diagram

## Display List Processor (DLP) PCB

The DLP PCB (figure 4-3) consists of the following functional elements:

- ✕ VME address interface logic
- ✕ VME data interface logic
- ✕ DLP interface logic
- ✕ VME address decoder
- ✕ DLP address decoder
- ✕ CPU address decoder
- ✕ Processor memory
- ✕ DLP control logic

The VME address interface logic transfers address bits from the DLP address bus to the VME bus.

The VME data interface logic transfers data between the DLP data bus and the VME bus.

The DLP interface logic transfers data between the DLP data bus and six I/O ports. Address bits from the CPU go to the raster and VLT buses. Address bits also control DLP interface logic operation.

The VME address decoder derives control signals by decoding address inputs from the VME bus.

The DLP address decoder derives control signals by decoding DLP address inputs.

The CPU is a Motorola 68000 microprocessor. The CPU processes data from the host computer, graphic tablet, keyboard, and disk drive, and controls display generator operation.

Processor Memory. Processor memory (figure 4-4) consists of the following functional elements:

- ✕ Bootstrap PROM
- ✕ Program RAM
- ✕ Program RAM control logic
- ✕ Data multiplexer
- ✕ Display list memory
- ✕ Memory control logic
- ✕ Address multiplexer

The bootstrap PROM can store 8K 16-bit words of bootstrap data. At power on, the PROM sends data to the CPU on the DLP data bus when addressed via the DLP address bus.

The program RAM can store 128K 16-bit words of program data. The RAM receives data from the disk drive via the DLP data bus and sends data to the CPU under control of the program RAM logic.

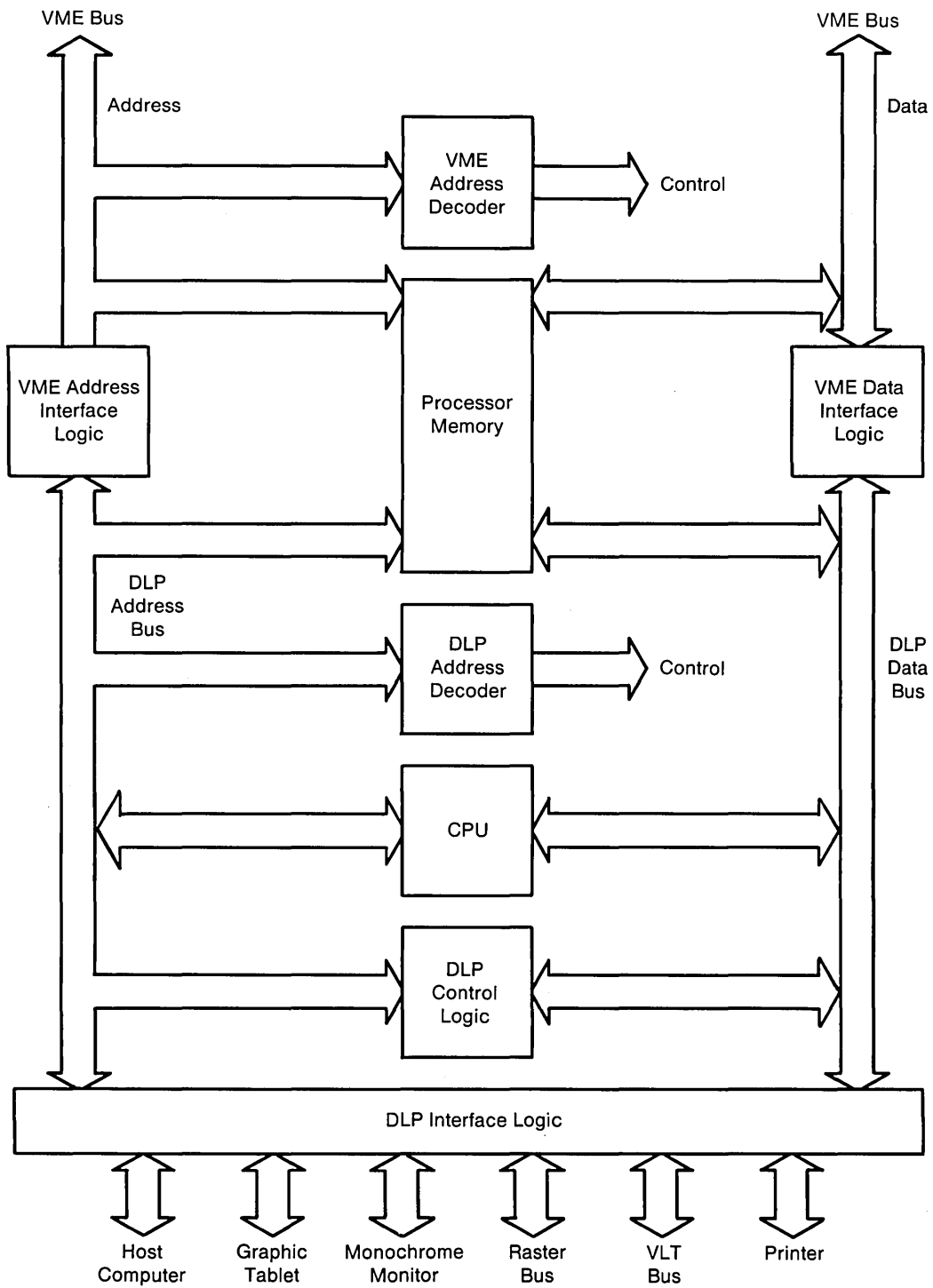


Figure 4-3. DLP PCB Block Diagram



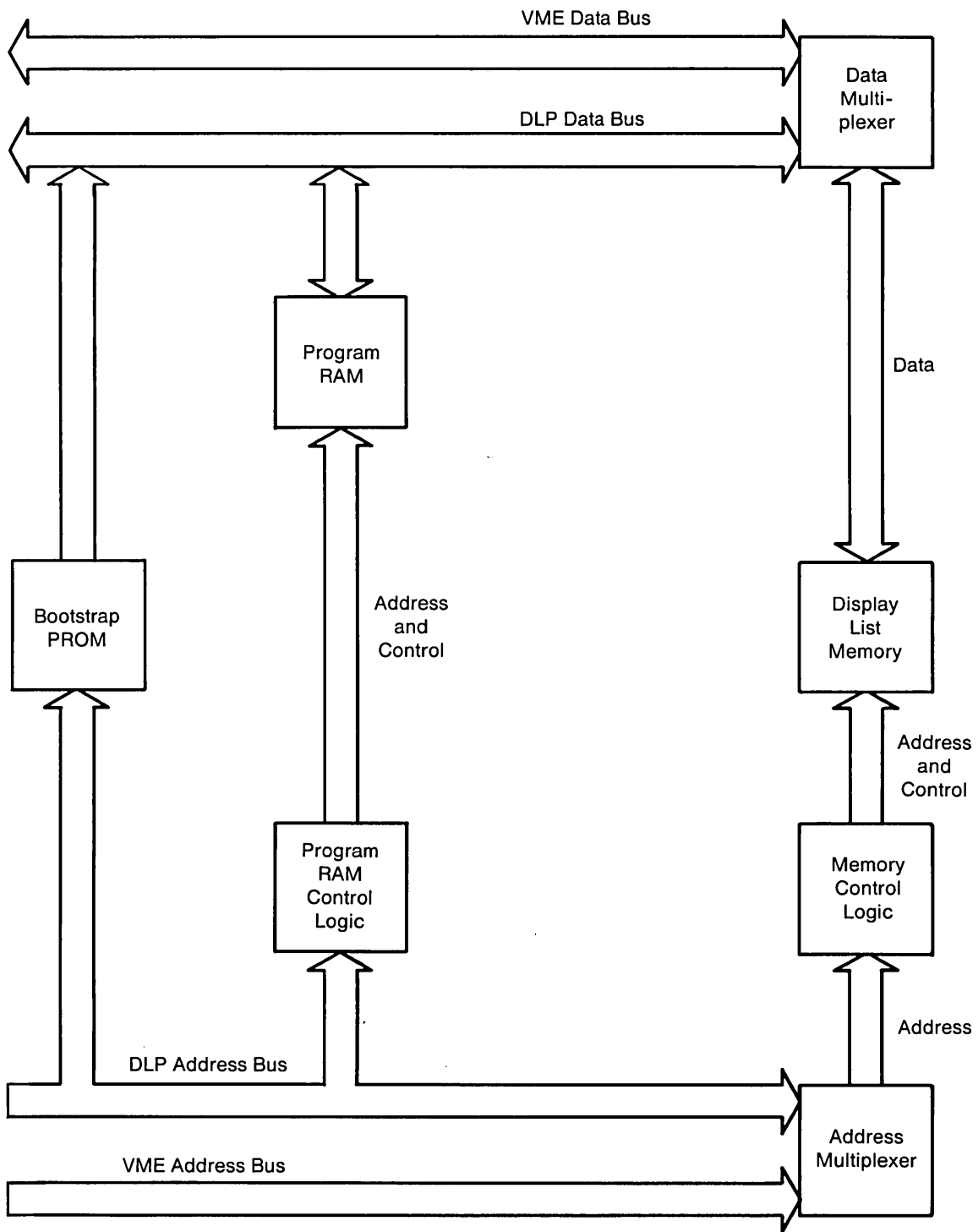


Figure 4-4. Processor Memory Block Diagram

The program RAM control logic decodes address bits received from the CPU on the DLP address bus to derive address and control signals. The logic controls program RAM operation with the derived signals.

The data multiplexer transfers data between either the VME or DLP data bus and the data lines that go to the display list memory.

The display list memory can store 196K 32-bit words of display list RAM data. The memory sends output data to the data multiplexer.

The memory control logic controls display list memory operation. The logic transfers address bits from the address multiplexer to the display list memory.

The address multiplexer transfers address bits from either the VME or DLP address bus to address lines that go to the memory control logic.

DLP Control Logic. The DLP control logic (figure 4-5) consists of the following functional elements:

- ✕ LED control logic
- ✕ Alphanumeric LED display
- ✕ Self-test logic and LED
- ✕ Configuration select logic

The LED control logic decodes address bits from the DLP address bus to derive LED control signals.

The alphanumeric LED display is an array of LEDs that display data from the DLP data bus. The display operates under the control of address bits from the DLP address bus and control signals from the LED control logic.

The self-test logic receives control signals from the LED control logic, and generates signals that light the self-test LED during self test.

The configuration logic contains switches that are set to a desired configuration. At power on, the CPU reads the logic, which sends back configuration data.

### **Raster Processor PCB**

The raster processor PCB (figure 4-6) has the following functional elements:

- ✕ Level translator
- ✕ Readback logic
- ✕ Raster RAM
- ✕ Address decoder
- ✕ Refresh counter
- ✕ Clock generator
- ✕ Sync generator
- ✕ Reset switch
- ✕ Reset logic
- ✕ Raster control logic

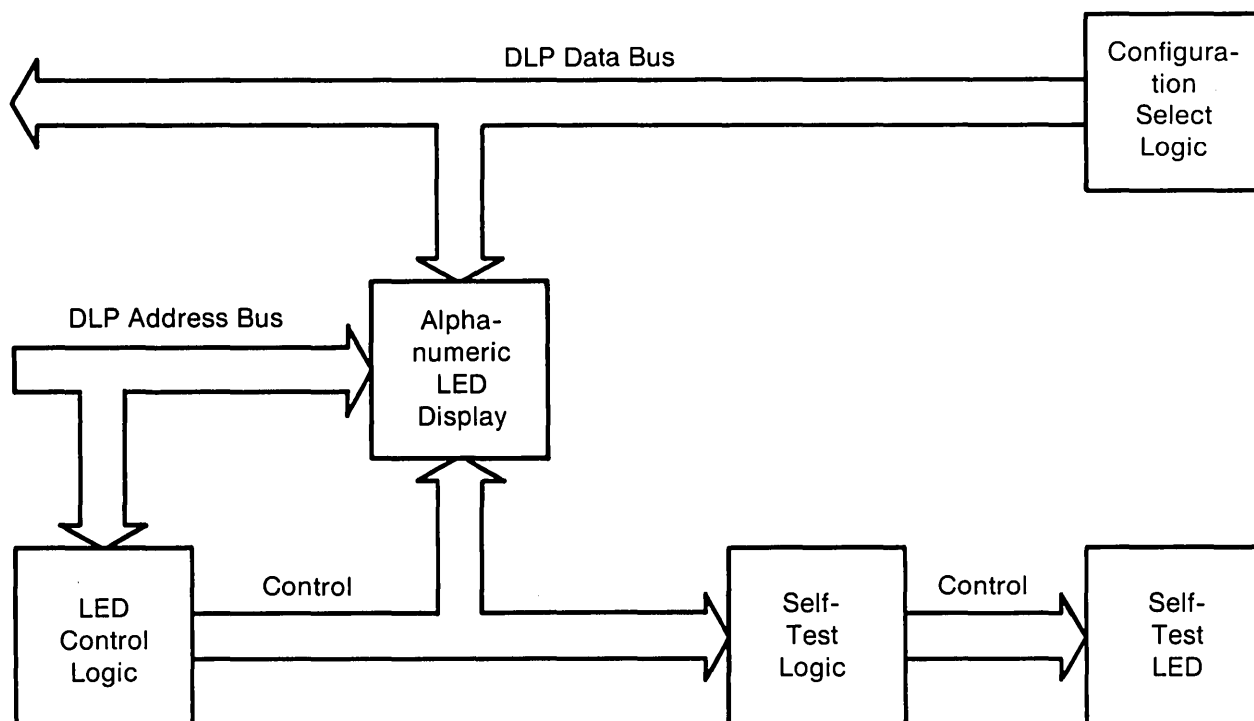


Figure 4-5. DLP Control Logic

The level translator transfers data between the raster bus and the ECL data bus, converting vector bus voltage levels to the ECL data bus levels.

The readback logic transfers readback data from the memory PCB to the vector bus for transmission to the DLP PCB.

Raster RAM is a 1024 x 32-bit high-speed Z-axis memory. Raster RAM enables the display generator to write image data as vectors at high speed, or to derive shaded vectors. In write mode, the RAM stores data from the ECL data bus. In output mode, the RAM sends stored data to the memory PCB. Address inputs come from the ECL data bus.

The address decoder derives control signals by decoding address inputs from the vector bus.

The refresh counter generates address bytes that go to refresh memory in the memory PCB. Y-origin data bits from the ECL data bus load the counter to the required starting count.

The clock generator supplies clock pulses to all other display generator PCBs.

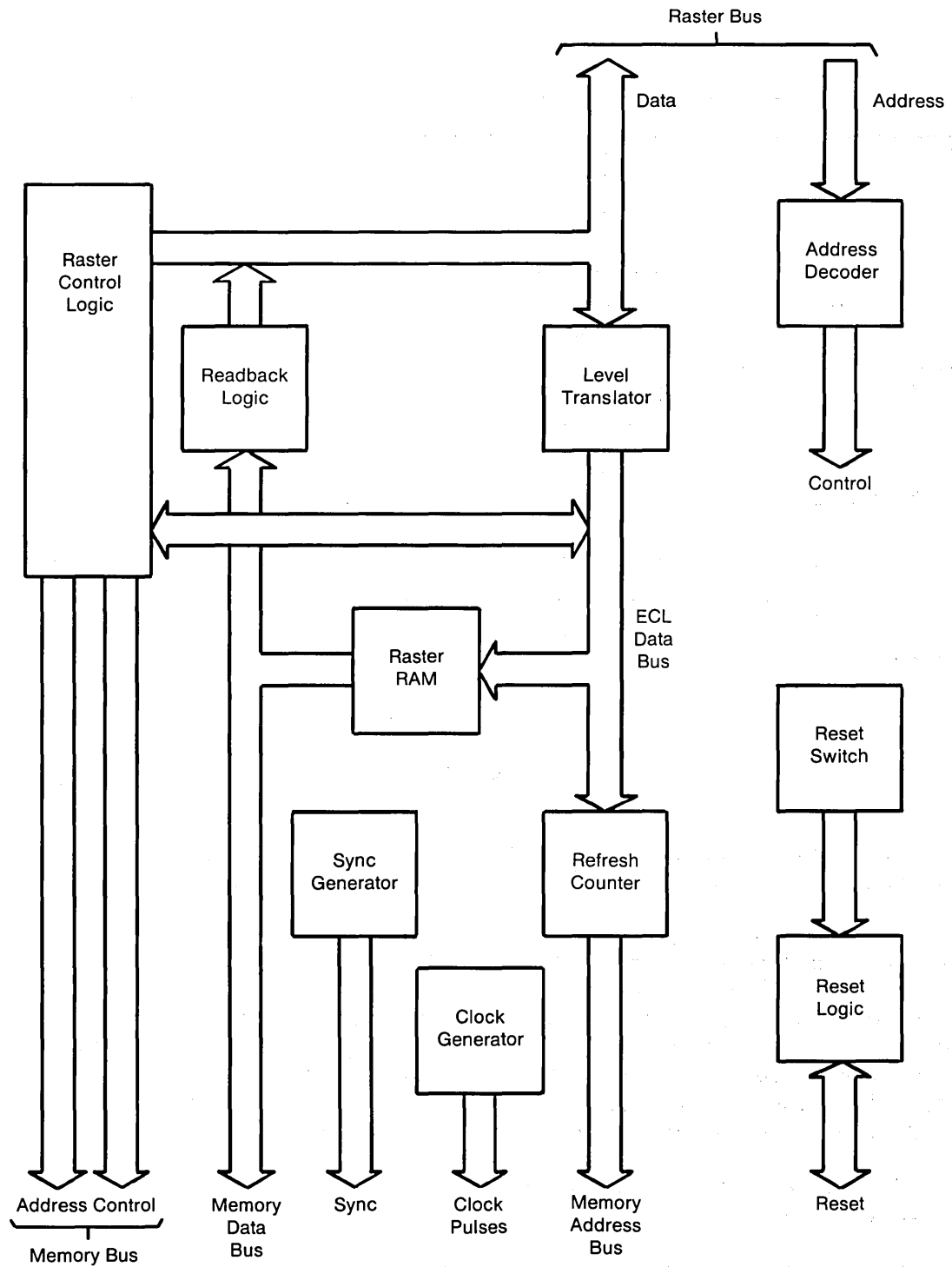


Figure 4-6. Raster Processor Block Diagram

The sync generator supplies the pulses that synchronize the CRT display and associated operations. The sync pulses go to the video and other PCBs.

The reset logic resets the PCB at power on or in response to a switch closure. An initiating signal can come from the local reset switch or the external test-panel reset switch. The logic also sends a reset signal to the other PCBs.

The raster control logic (figure 4-7) consists of the following functional elements:

- ✧ Slope calculator
- ✧ Vector generator
- ✧ Control sequencer
- ✧ Y COP counter
- ✧ Y window comparator
- ✧ COP multiplexer
- ✧ X COP counter
- ✧ X window comparator
- ✧ Refresh counter
- ✧ Memory timing sequencer

The slope calculator simplifies polygon-fill and shading endpoint calculations by signaling the DLP PCB each time a Y boundary is crossed. The calculator receives  $\Delta X$  and  $\Delta Y$  values on the ECL data bus, and sends display control signals to the X and Y COP counters.

The vector generator makes the calculations necessary for vector display. The generator receives  $\Delta X$  and  $\Delta Y$  values on the ECL data bus, and sends display control signals to the X and Y COP counters.

The control sequencer receives control data on the ECL data bus, and generates signals that control PCB operation. COP control signals go to the X and Y COP counters. Control signals also go to the dynamic refresh memory PCB.

The Y COP counter is an up/down counter that determines the Y coordinate of the current operating point (COP) on the CRT screen. The counter receives COP position data on the ECL data bus. Input control signals increment or decrement the counter. Output data bits go to the COP multiplexer. Readback data bits go out on the ECL data bus.

The Y window comparator inhibits any portion of any vector that goes outside a selected window on the CRT screen in the vertical direction. The comparator compares COP position values from the COP counter with window boundary values from the ECL data bus. When a position value is greater than a maximum window value, or less than a minimum window value, the comparator sends a signal to the control sequencer that prevents data from being written into refresh memory on the dynamic refresh memory PCB.

The COP multiplexer transfers COP data from either the X or Y COP counter to output lines that go to refresh memory on the dynamic refresh memory PCB. COP position data bits become address bits for refresh memory.

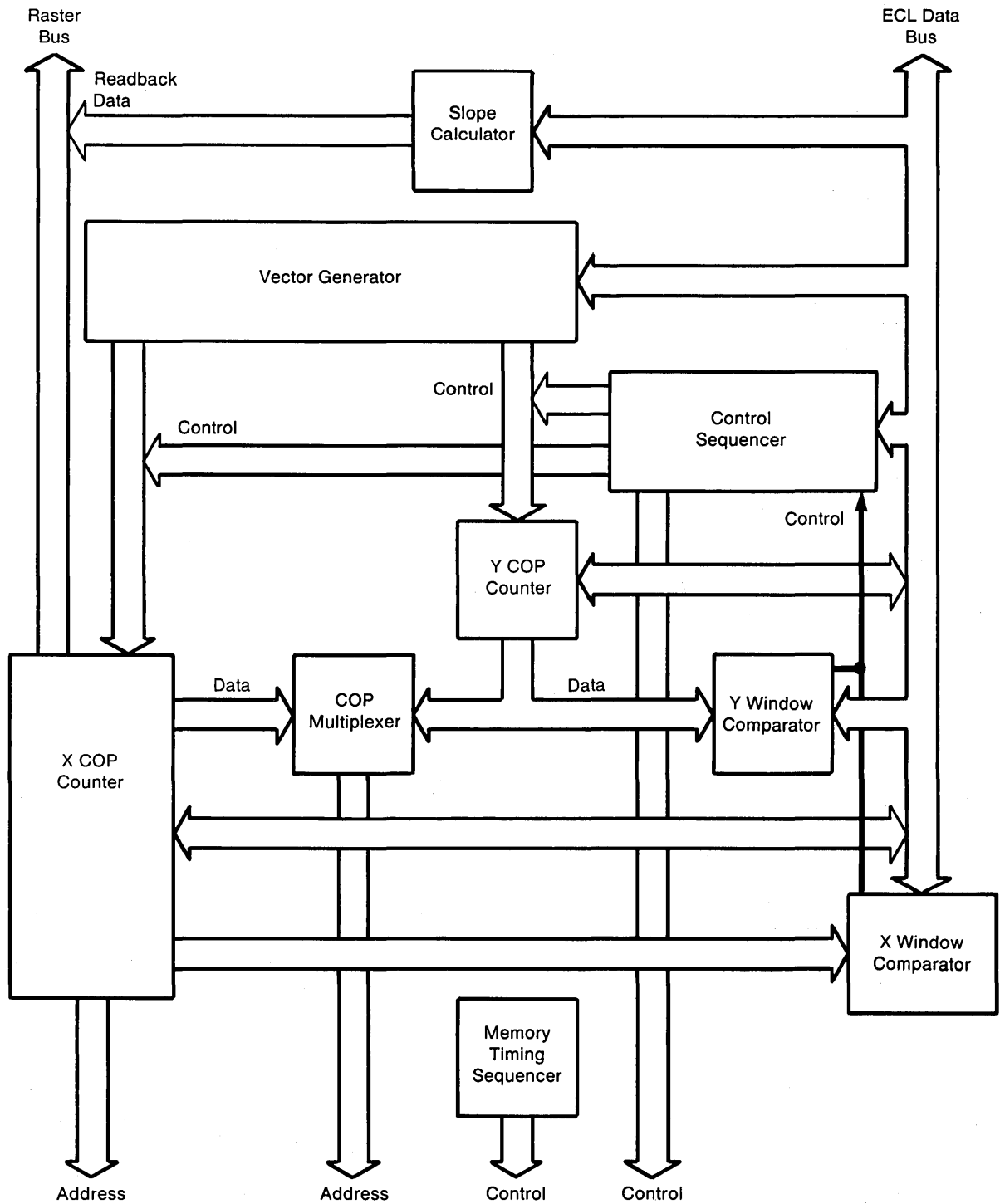


Figure 4-7. Raster Control Logic

The X COP counter is an up/down counter that determines the X COP coordinate. The counter receives COP position data on the ECL data bus. Input control signals increment or decrement the counter. Output data bits go to the COP multiplexer. Readback data bits go out on the ECL data bus.

The X window comparator inhibits any portion of any vector that goes outside a selected window on the CRT screen in the horizontal direction. The comparator compares COP position values from the X COP counter with window boundary values from the ECL data bus. When a position value is greater than a maximum window value, or less than a minimum window value, the comparator sends a signal to the control sequencer that prevents data from being written into refresh memory.

The memory timing sequencer generates control signals that go to the dynamic refresh memory PCB to control refresh memory operation.

### Dynamic Refresh Memory PCB

This PCB (figure 4-8) consists of the following functional elements:

- ✕ Memory address logic
- ✕ Data input logic
- ✕ Memory control logic
- ✕ Refresh memory
- ✕ Video output logic
- ✕ Data readback logic

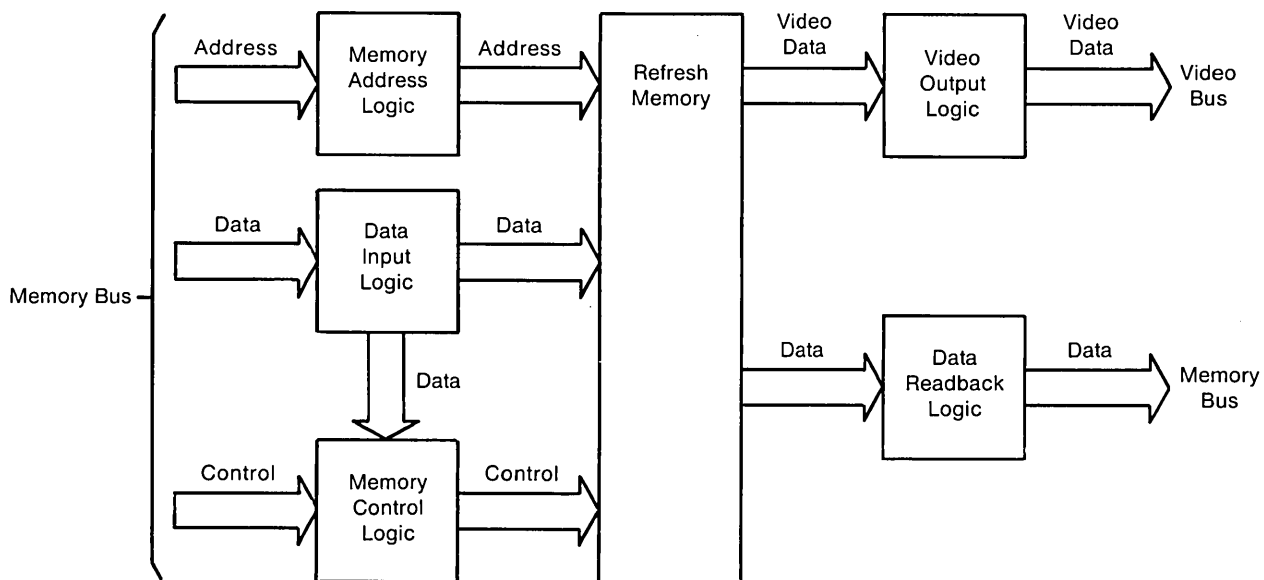


Figure 4-8. Dynamic Refresh Memory PCB Block Diagram

The memory address logic transfers address bits from the memory bus to address lines that go to refresh memory.

The data input logic transfers data from the memory bus to data lines that go to refresh memory and the memory control logic.

The memory control logic controls refresh memory operation. The logic generates control signals in response to data and control inputs.

The refresh memory stores the data needed to refresh the color monitor CRT display, and consists of eight planes. Each plane has 20 16K RAMs. The memory stores input data in addressed locations and sends output data to the video output logic and the data readback logic.

The video output logic transfers video data from refresh memory to the video bus.

The data readback logic transfers readback data from refresh memory to the memory bus.

#### **Video C PCB**

The video C PCB (figure 4-9) consists of the following functional elements:

- ✕ Level translator
- ✕ Cursor control logic
- ✕ Address decoder
- ✕ Video logic

The level translator transfers data from the VLT bus to the ECL1 and 2 and the TTL1 and 2 buses. The translator converts VLT bus voltage levels to levels required by the other buses.

The cursor control logic stores a selected cursor pattern, and generates cursor control signals in response to input data and address bits.

The address decoder derives signals that control PCB operation by decoding VLT bus address bits.

The video logic (figure 4-10) consists of the following functional elements:

- ✕ Input logic
- ✕ VLT
- ✕ Readback logic
- ✕ Video control logic

The video input logic transfers input data and address bits to address lines that go to the VLT.

In write mode, the VLT stores ECL1 bus data in addressed locations. In read mode, the VLT sends data stored in addressed locations to the video control logic and the readback logic.



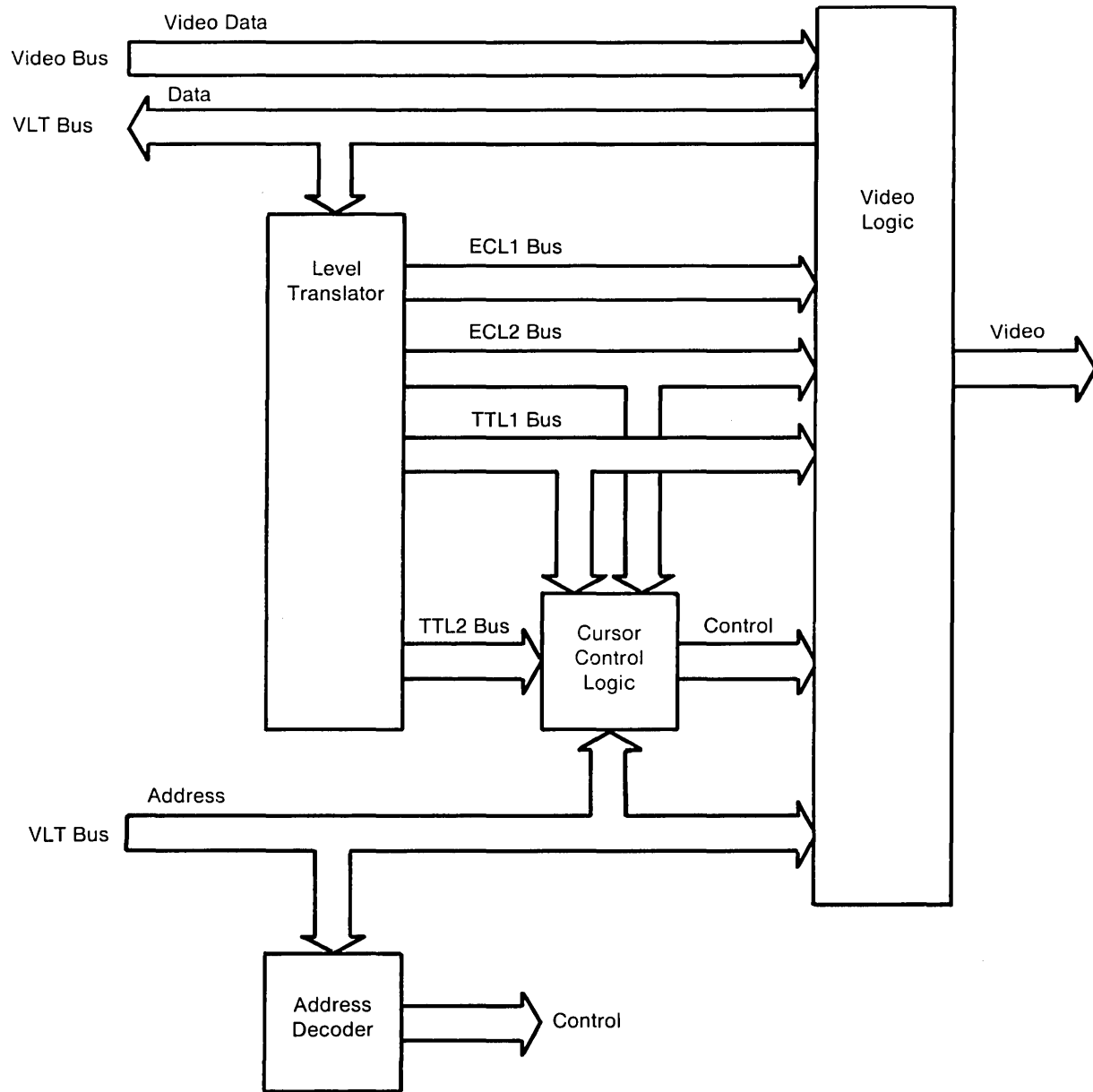


Figure 4-9. Video C PCB Block Diagram

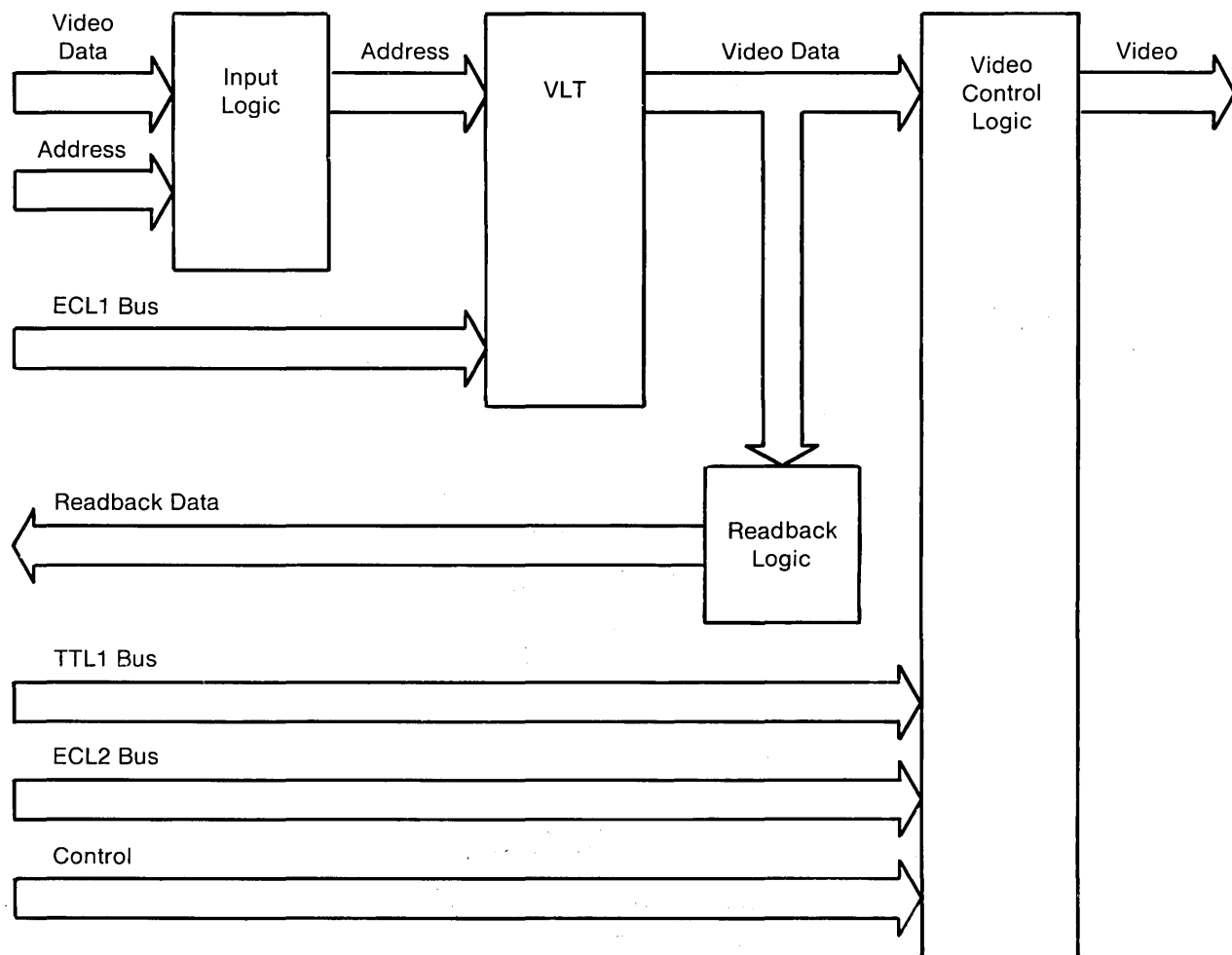


Figure 4-10. Video Logic

The readback logic transfers video data from the VLT to VLT bus data lines that go to the DLP PCB.

The video control logic (figure 4-11) consists of the following functional elements:

- ✘ Blink generator
- ✘ Pixel multiplexer
- ✘ Overlay multiplexer
- ✘ Cursor multiplexer
- ✘ DAC

The blink generator supplies blink control signals to the cursor multiplexer and the pixel multiplexer in response to data from the TTL1 bus.

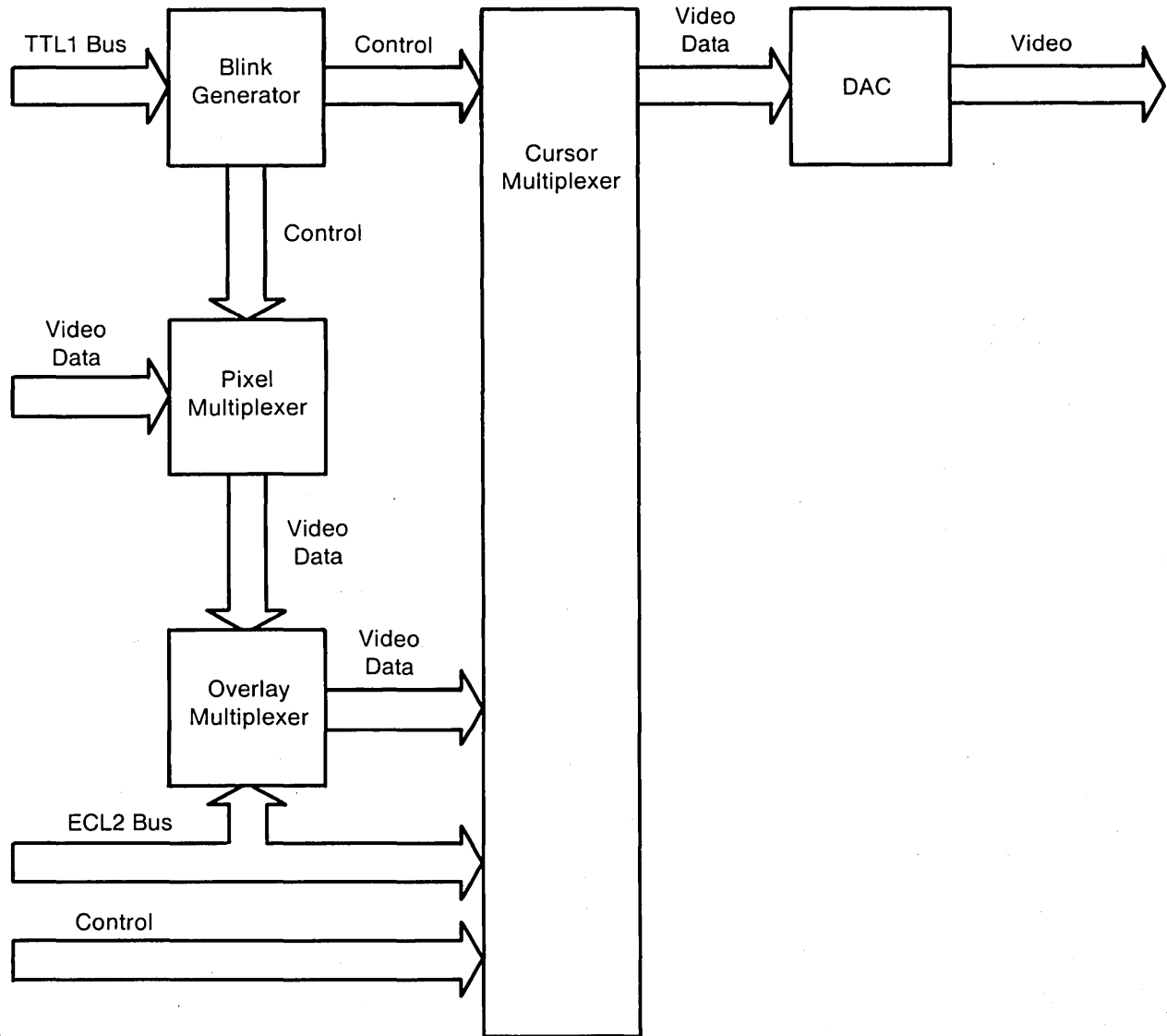


Figure 4-11. Video Control Logic

The pixel multiplexer transfers video data from the VLT to the overlay multiplexer.

The overlay multiplexer transfers video data from either the pixel multiplexer or the ECL2 bus to the cursor multiplexer.

The cursor multiplexer transfers video data from either the overlay multiplexer or the ECL2 bus to the DAC.

The DAC converts parallel digital video data to serial analog red, green, and blue signals.

### **Backplane PCB**

The backplane PCB interconnects the other display generator PCBs, and provides terminations for display generator signal lines.

### **POWER DISTRIBUTION**

The display generator, both monitors, and the three electric motors require ac power. The display generator power supply provides the dc power needed by display generator components.

#### **AC Power**

Figure F07-2 is a wiring diagram of workstation ac power distribution. Figure F07-3 is a wiring diagram of display generator ac power distribution. The electronic circuits (figure 4-12) receive ac power through two switches and a circuit breaker. The movement control circuits receive ac power through a switch and two circuit breakers. The electronic circuits consist of the display generator, rear door fans, two monitors and three circuit breakers. The movement control circuits consist of three motors, three manual switches, and three microswitches.

The display generator power supply and intake fan assembly (figure 4-13) receive ac power through a line filter and a circuit breaker. The thermal switch is closed at normal temperatures. If the temperature rises to a dangerous level, the switch opens to cut off power to the power supply. The switch remains open until the temperature returns to a normal level. The circuit breaker also supplies power to the rear door fans. The two monitors receive ac power through individual circuit breakers.

The table up/down switch (figure 4-14) applies power to the table up/down motor on the common line and either the up or down line to control motor direction and, therefore, table movement direction. Two normally-closed microswitches limit the extent of table movement. When the table reaches the upper limit, the table upper-limit microswitch opens to cut off power to the motor and stop table movement. Similarly, the table lower-limit microswitch stops the motor at the lower limit. The display up/down switch controls display assembly up/down movement in the same way. The microswitch in the down line opens at the lower limit of display assembly movement. Similarly, the display tilt switch controls display assembly tilt.

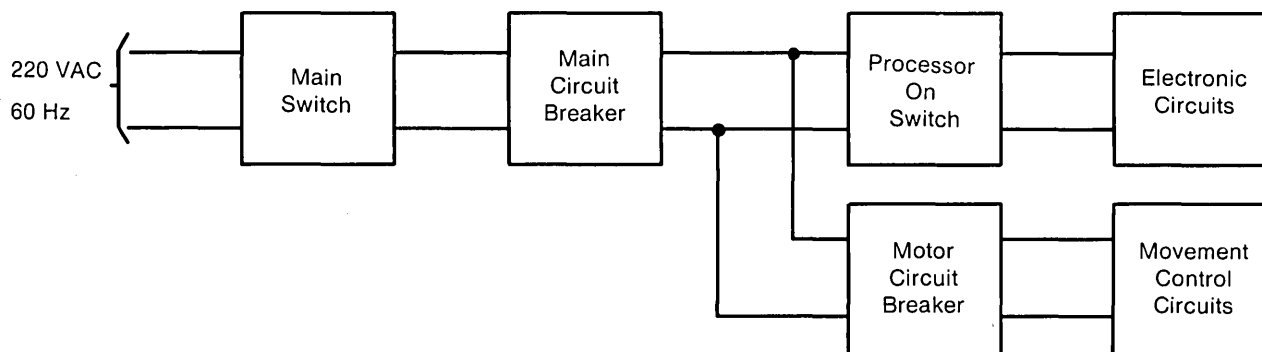


Figure 4-12. AC Power Distribution

#### DC Power

The display generator power supply provides five dc voltages (figure 4-15). The backplane PCB distributes the voltages to the test panel, disk drive, and other PCBs.

#### ELECTRO-MECHANICAL FUNCTIONAL DESCRIPTIONS

The left and right pedestal assemblies and the modesty assembly contain mechanisms that control table and display assembly movement.

#### Table Movement

The table up/down motor (figure 4-16) in the modesty assembly powers a tandem drive that moves the table top up and down, keeping it level, even when loaded with equipment. The tandem drive consists of the left and right actuators. The left actuator (figure 4-17) in the mechanism enclosure consists of an Acme right-hand threaded screw in an internally-threaded sleeve, and a gear box. The sleeve is fastened to the left table support (figure 4-18). The motor drives the gear box which drives the screw. As the screw turns, the sleeve moves up or down depending on the direction of rotation. The table support moves with the sleeve.

The right actuator in the display generator enclosure is identical to the left actuator except that the threaded screw and sleeve have left-hand threads. The motor drives the right gear box by means of a long drive shaft. Both table supports are bolted to the table top. When the motor is switched on, the table top moves up or down depending on motor direction.

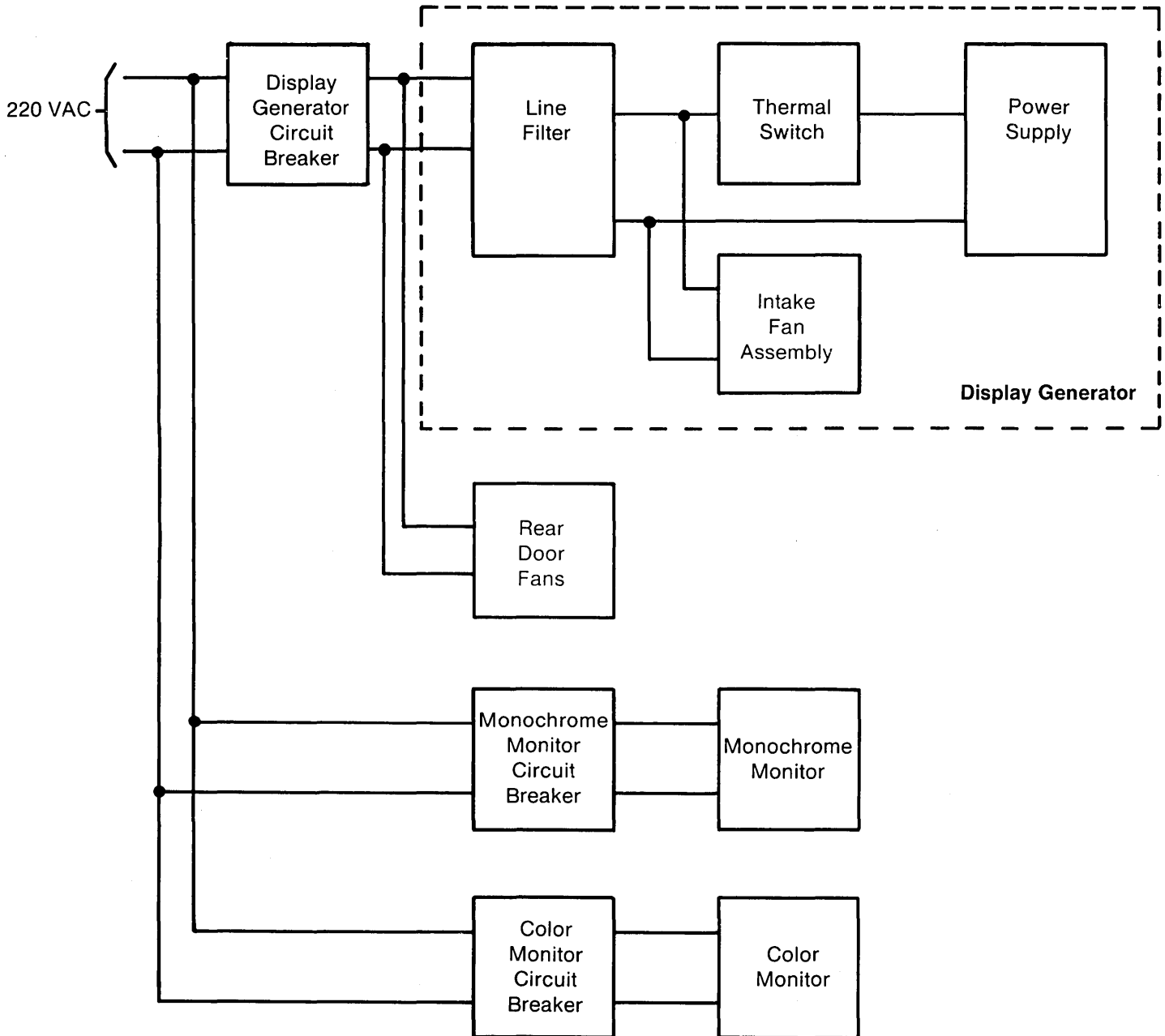


Figure 4-13. Electronic AC Distribution

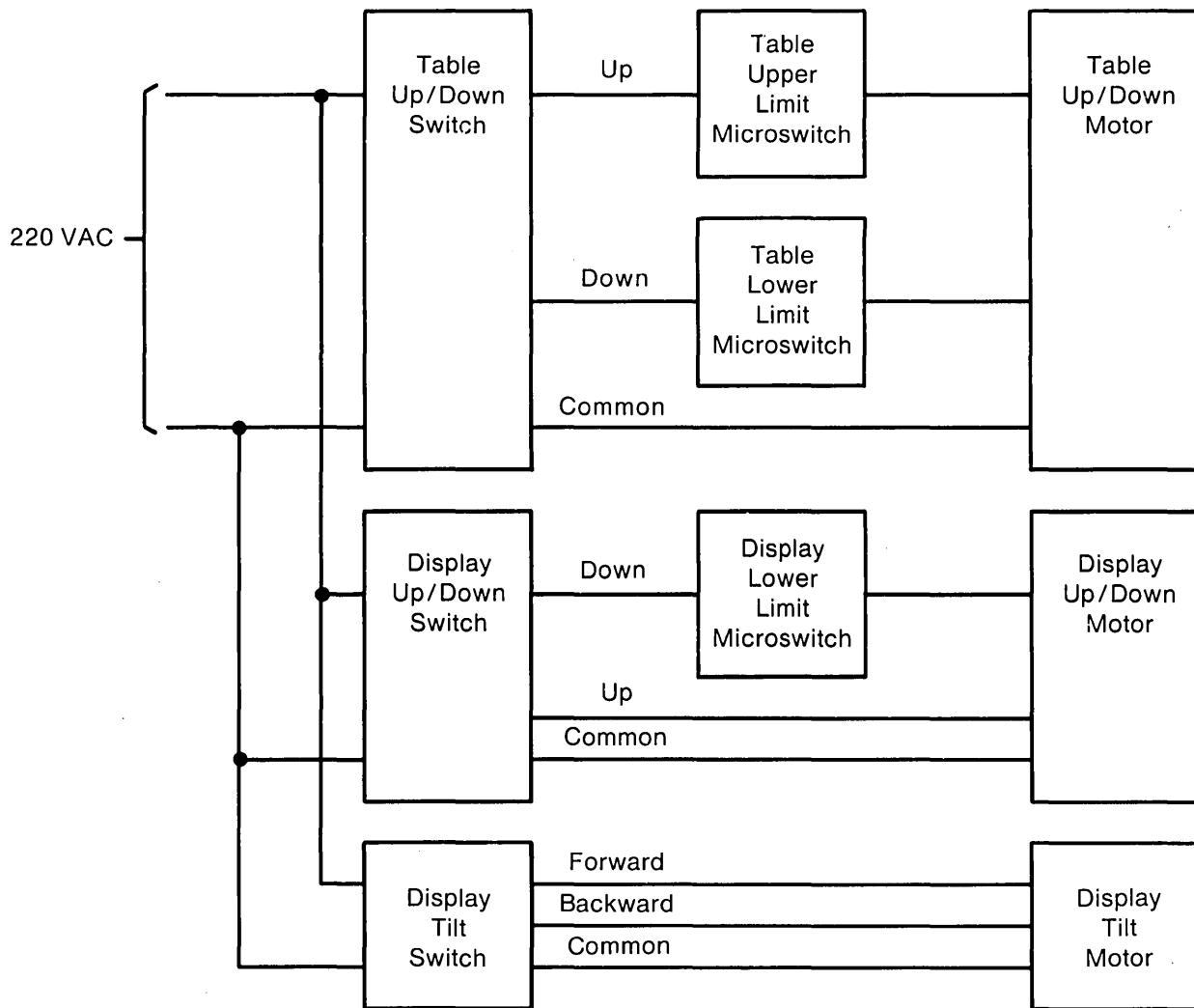


Figure 4-14. Movement Control

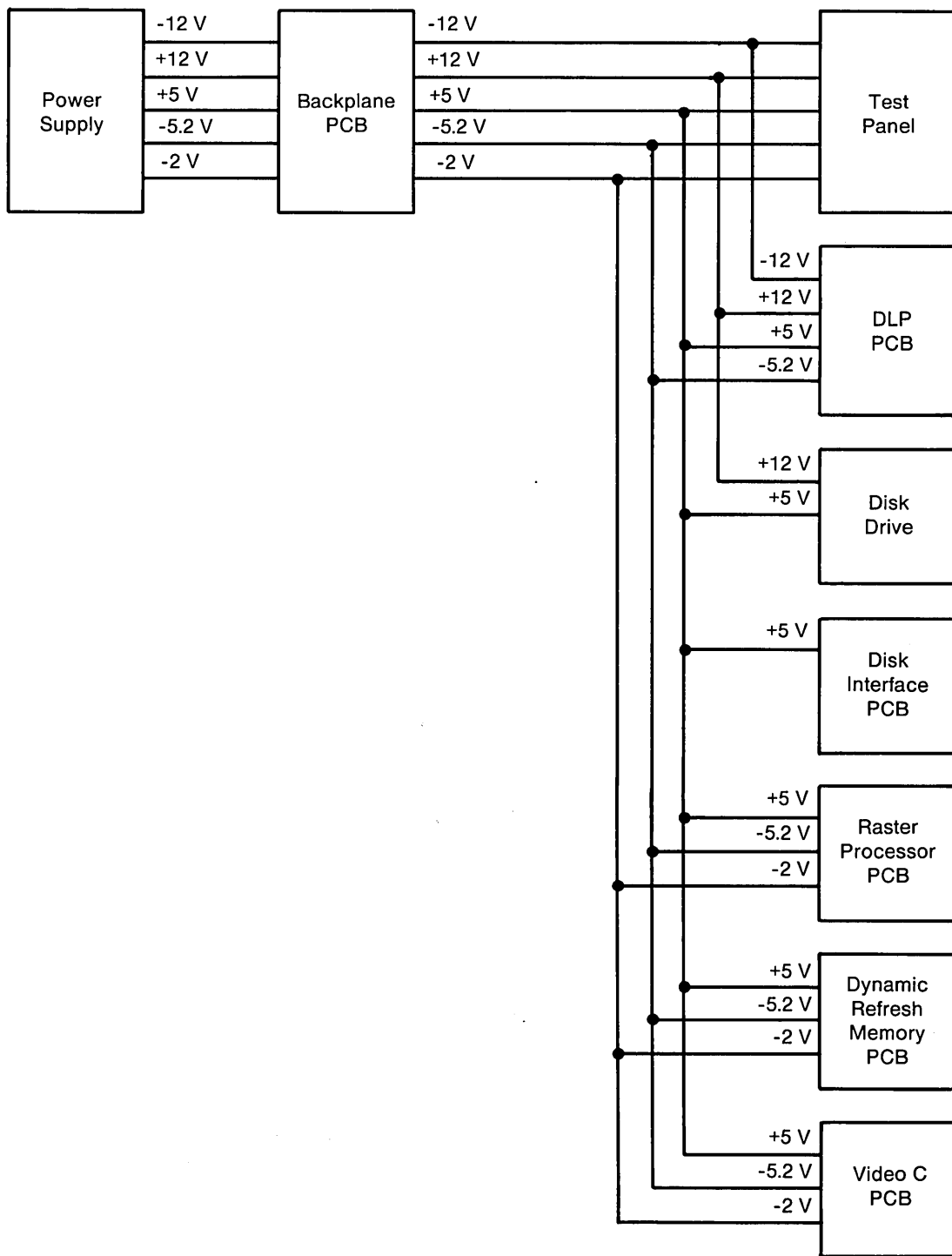


Figure 4-15. DC Power Distribution



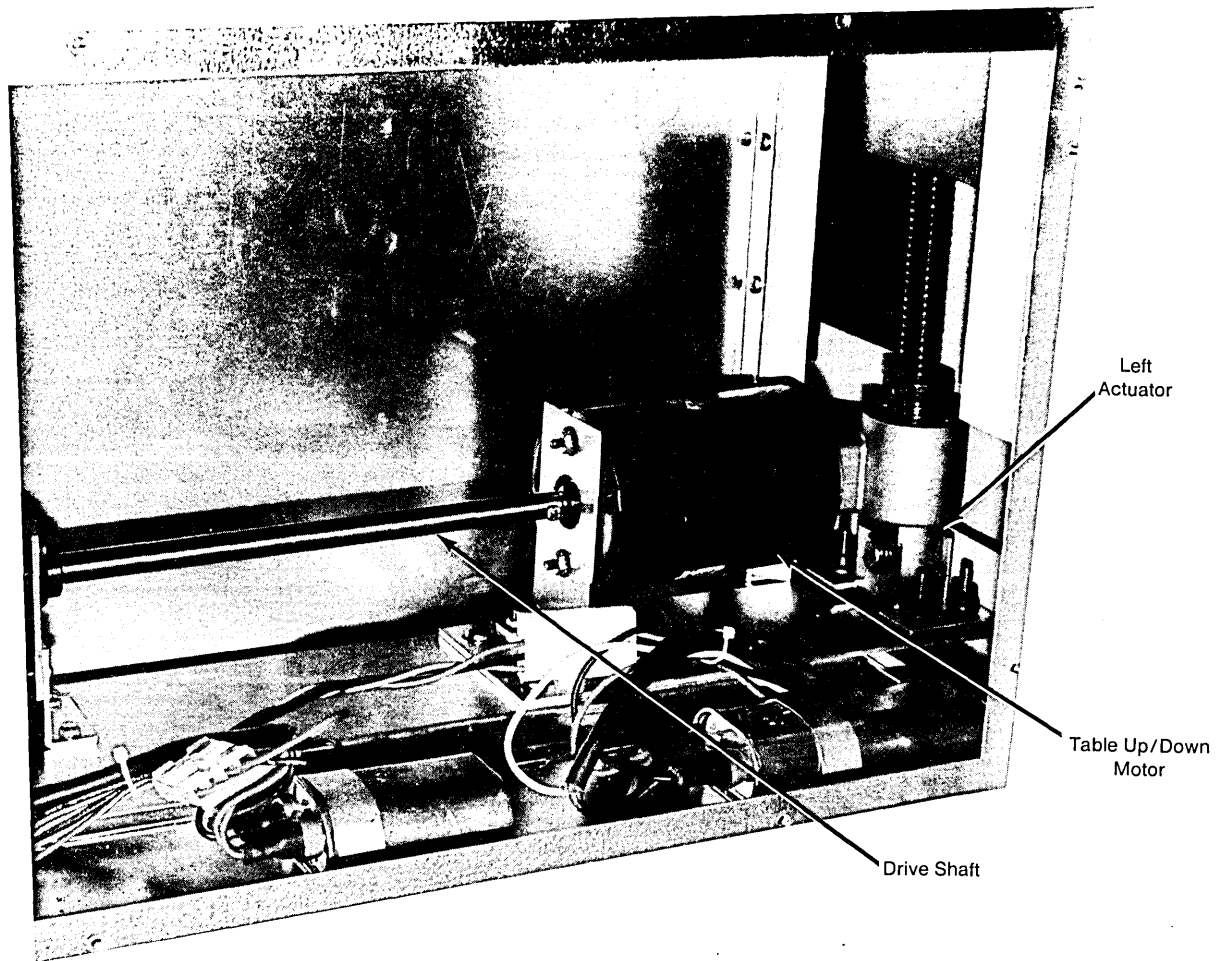


Figure 4-16. Tandem Drive Components

#### Display Assembly Up/Down Movement

The display up/down motor (figure 4-19) drives the display up/down actuator which is similar to the table actuators. The actuator sleeve is fastened to the up/down bracket which is fastened to the inner housing. The housing is attached to the two outer slotted guide rails (figure 4-20) that are bolted to the display base underside. The motor moves the sleeve, and therefore, the display assembly up or down depending on motor direction.

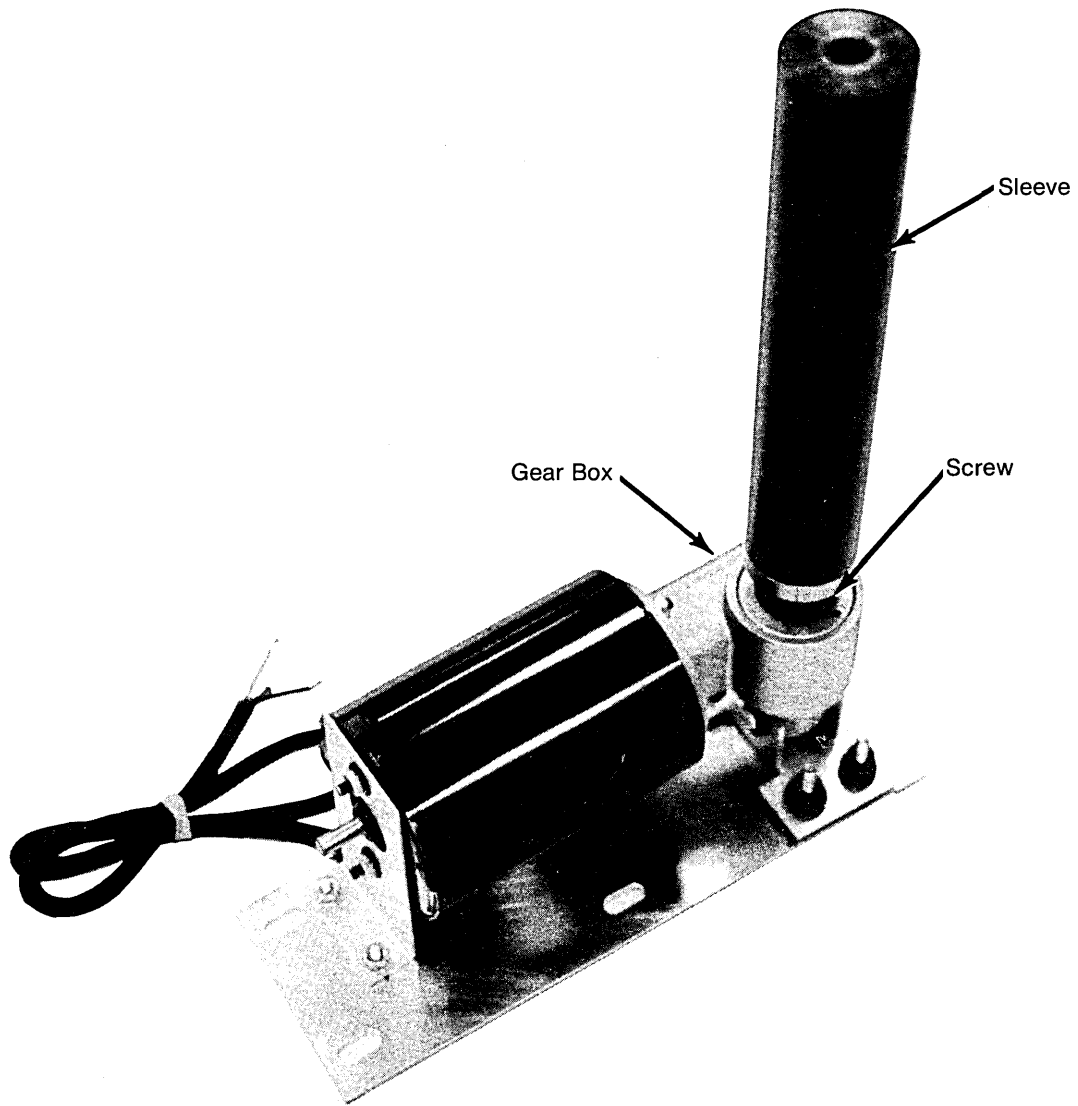


Figure 4-17. Left Actuator and Motor

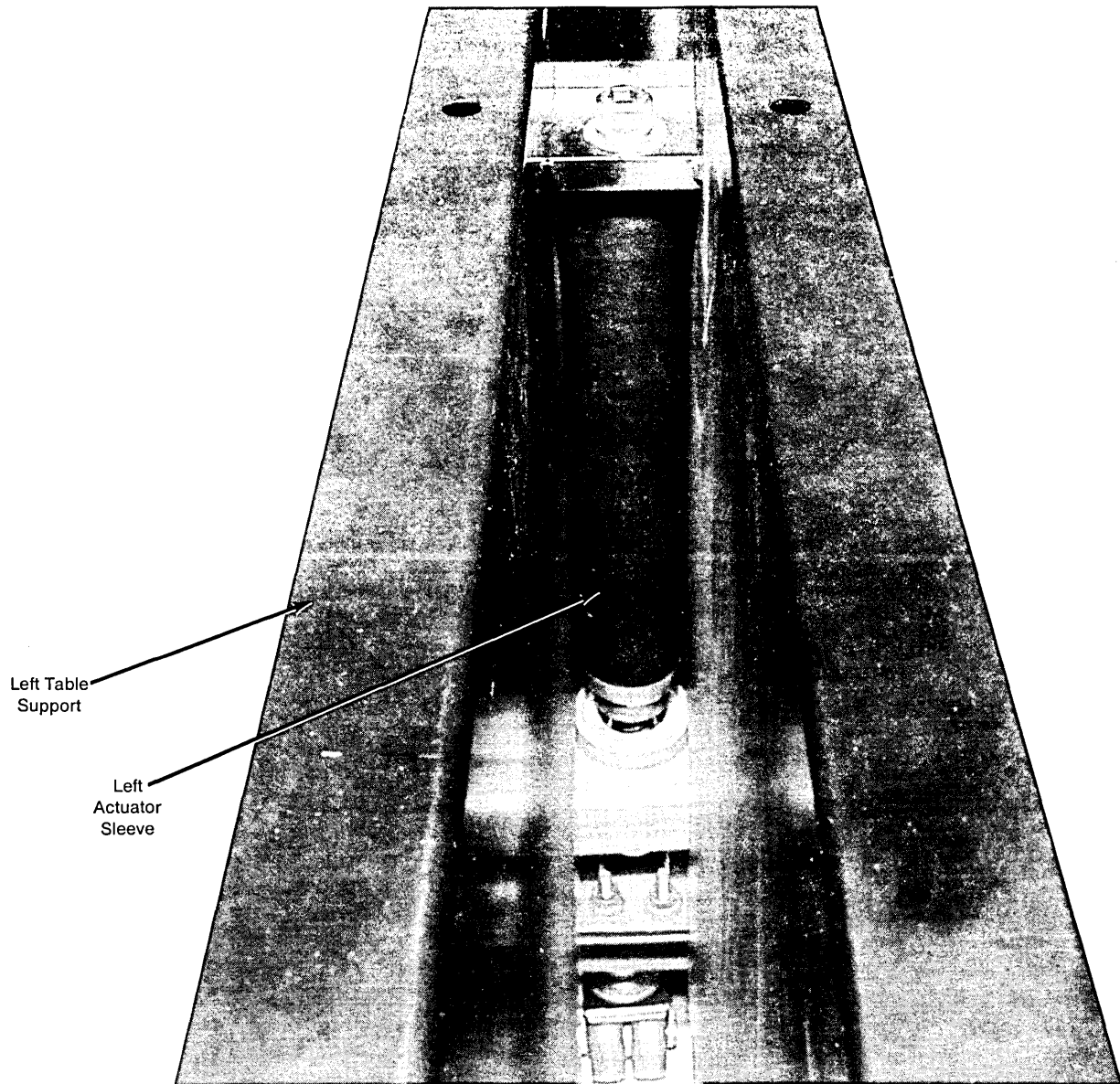


Figure 4-18. Left Table Support Interior

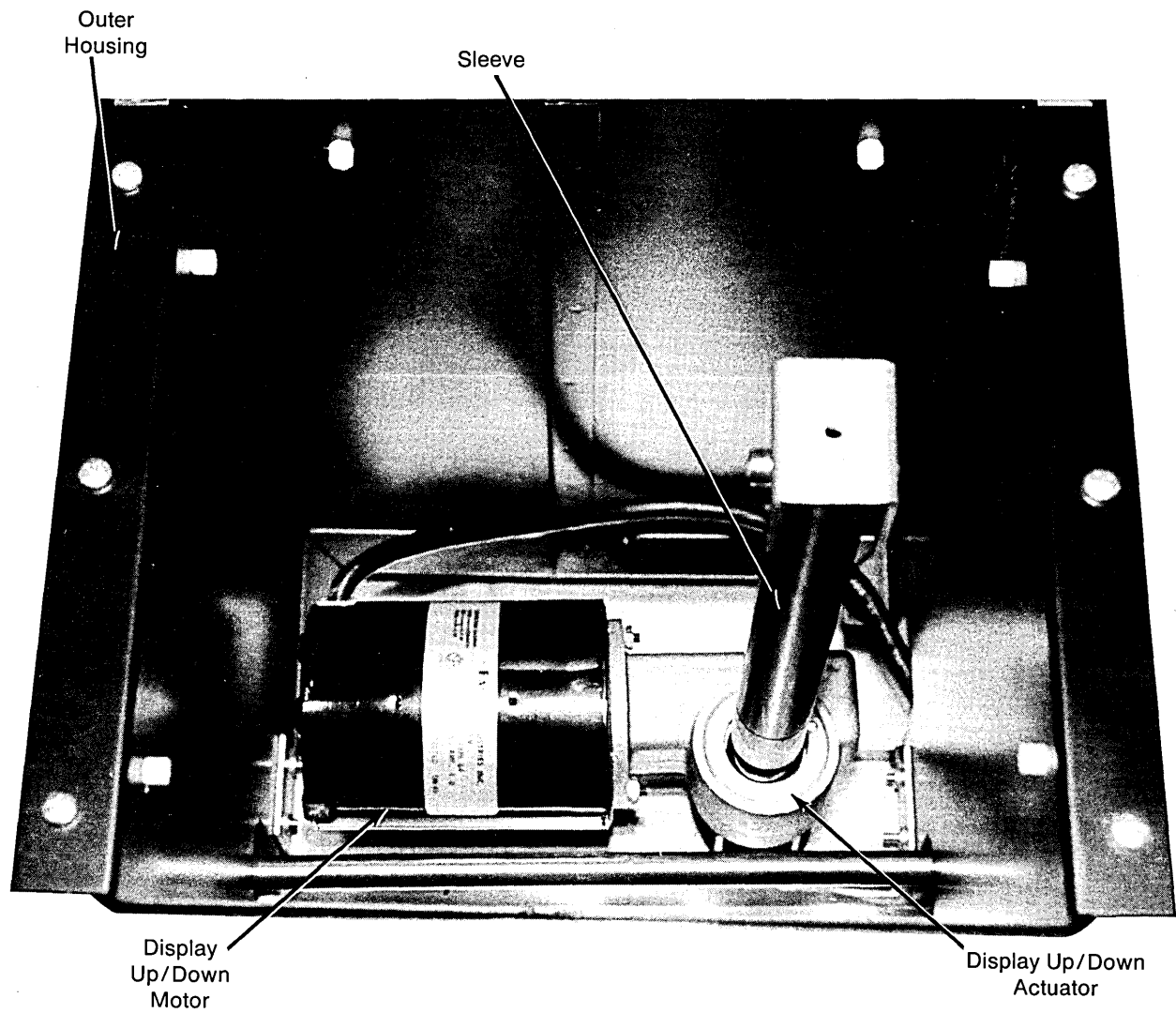


Figure 4-19. Outer Housing Interior with Inner Housing Removed

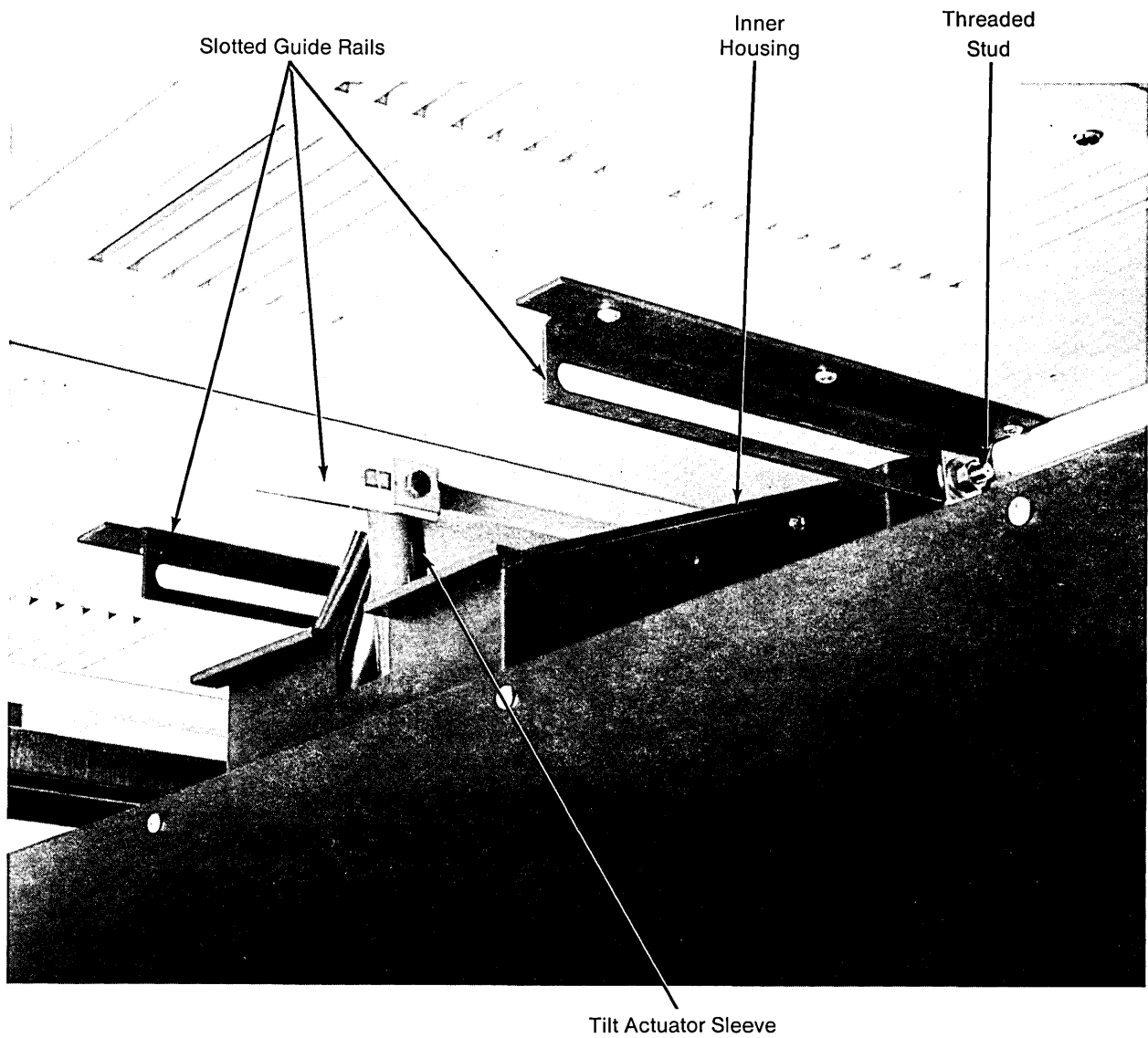


Figure 4-20. Slotted Guide Rails

## **Display Assembly Tilt**

The display assembly tilt actuator is similar to the up/down actuator. The tilt motor (figure 4-21) raises and lowers the actuator sleeve which is attached to the central slotted guide rail on the display base underside. When the sleeve is raised, it pushes upward against the central slotted rail. The two outer slotted rails bolted to the display base underside are attached to the inner housing with two threaded studs near the front of the display assembly. The tilt actuator is positioned farther to the rear of the display assembly. Therefore, when the sleeve pushes upward, the display assembly pivots about the studs, tilting forward. When the sleeve descends, the display assembly pivots back to its former position.

## **Limit Switches**

Three microswitches function as limit switches to prevent dangerous contact between the table top and the monitors or other components. Two limit switches (figure 4-22) are mounted on a bracket that is fastened to the front of the inner housing, which moves the display assembly up and down. One of the limit switches controls the table up/down motor. The other controls the display up/down motor. An actuator arm bolted to the underside of the table top trips the limit switches when the table top approaches the display assembly. The table limit switch opens to shut off the table up/down motor. When the table is stationary and the display assembly is descending, the limit switches also move down the trip when they contact the actuator arm. The display limit switch opens to shut off the display up/down motor. Similarly, when the table top reaches its lower limit, a plastic stud on the right table support trips the table lower-limit switch, which shuts off the table up/down motor. Refer to POWER DISTRIBUTION for electrical operation.

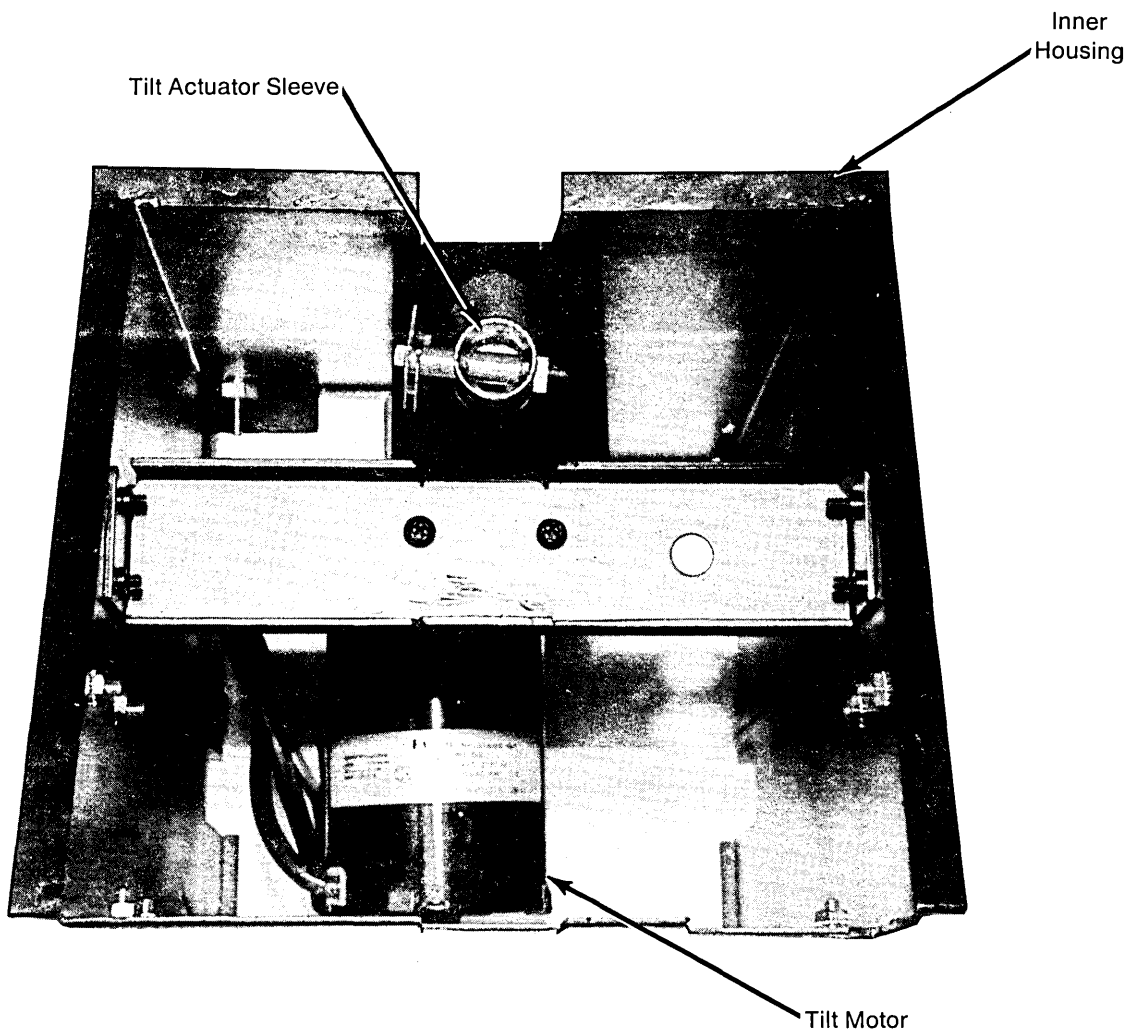


Figure 4-21. Inner Housing Interior

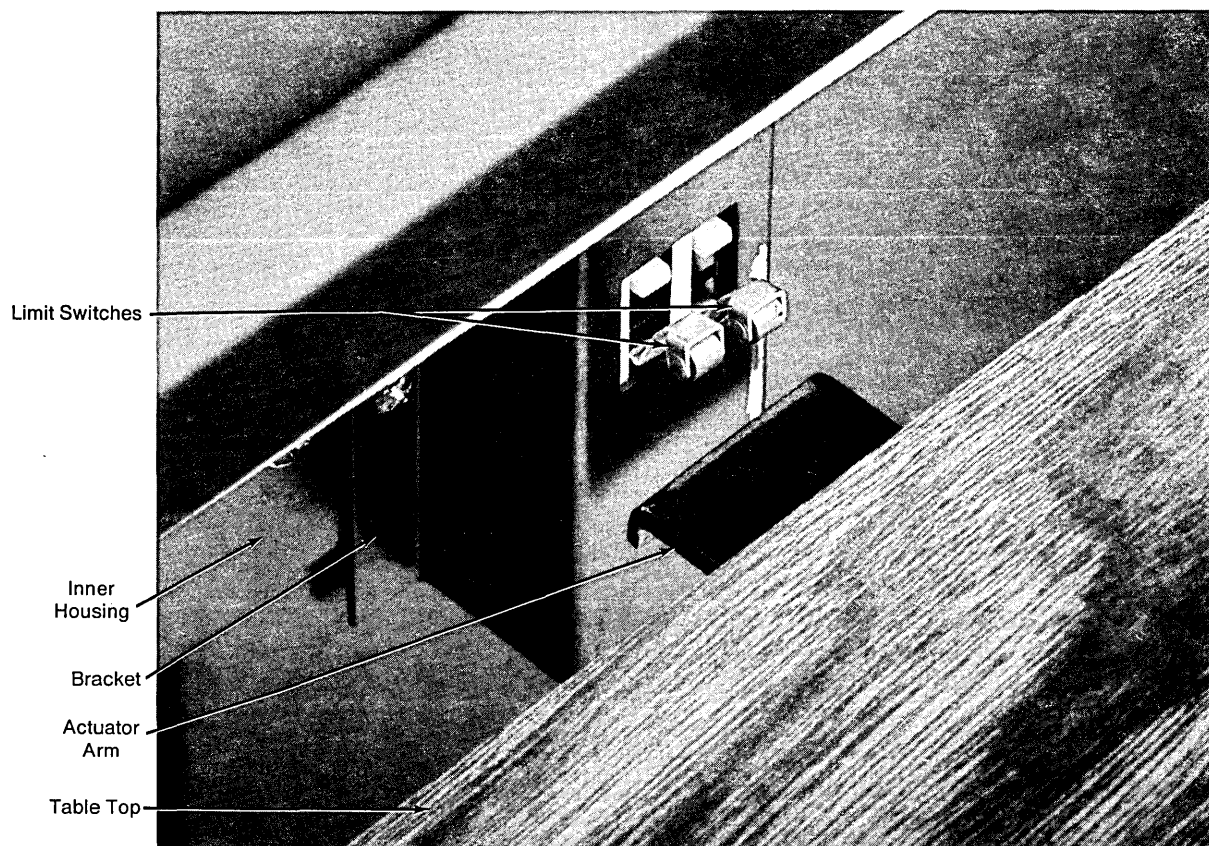


Figure 4-22. Two Limit Switches



## **Chapter 5**

### **MAINTENANCE**

#### **INTRODUCTION**

This chapter contains preventive and corrective maintenance and removal and replacement procedures. For monitor or peripheral maintenance, refer to the applicable manual listed under Related Documents in chapter 1. For problems with workstation motors or other problems not covered here, call support.

#### **TOOLS AND TEST EQUIPMENT**

A standard tool kit and a multi-range volt-ohmmeter are required for workstation maintenance.

#### **CAUTION**

Be careful not to cause a static discharge that may damage ICs when handling equipment. Always use an electrostatic protective wrist-strap before touching a PCB.

#### **PREVENTIVE MAINTENANCE**

Preventive maintenance consists of periodically inspecting and cleaning the workstation.

#### **WARNING**

To prevent personal injury or damage to equipment, disconnect the workstation from the ac power source before inspecting or cleaning.

Use a soft brush and vacuum cleaner to remove dust from cooling fans and other areas. While cleaning, inspect for problems such as bent or broken connectors or damaged insulation. Clean the air filter as follows:

1. Loosen rear door twist screws and open rear door.
2. Remove two screws holding cable entry panel (figure 5-1) and remove cable entry panel.
3. Pull air filter from mounting bracket.
4. Clean air filter with a vacuum cleaner.
5. Reinsert filter.
6. Remount cable entry panel.
7. Close and fasten rear door.

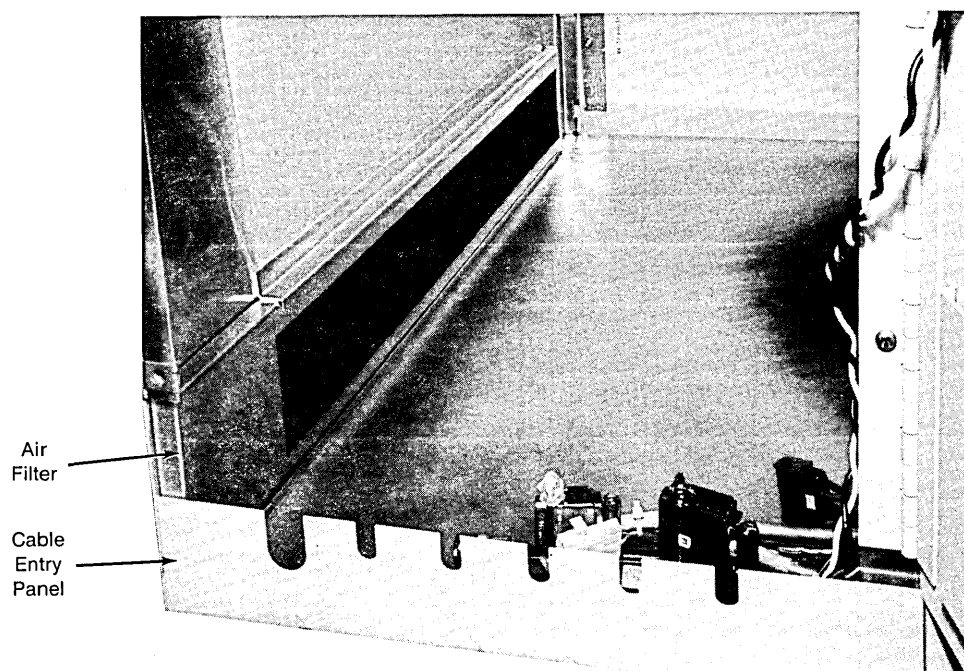


Figure 5-1. Air Filter

**CAUTION**

Careless voltage adjustment can cause serious equipment damage. Be careful not to turn adjustment controls too far. Only a qualified technician should attempt voltage adjustment.

## VOLTAGE ADJUSTMENT

To adjust display generator dc voltages, proceed as follows:

1. Loosen rear-door twist screws and open rear door.
2. Set PROCESSOR ON switch to off position.
3. Remove screws holding power supply top cover (figure 5-2), and remove top cover.
4. Remove two power-supply holding screws carefully as these are not captive screws.
5. Tilt power supply backward.
6. Loosen lock nut on 5V control (figure 5-3).
7. Set PROCESSOR ON switch to on position.
8. Adjust 5V control with a screwdriver for  $+5.1 \pm 0.1$  (+5.0 to +5.2) volts at test panel if voltage is outside this range.
9. Tighten locknut until finger tight.
10. Adjust following controls in same way if voltages are outside following ranges:

<u>Control</u>	<u>Voltage</u>
12 V	+12.0 $\pm 0.1$ (+11.9 to +12.1)
12 VM	-12.0 $\pm 0.1$ (-11.9 to -12.1)
2 V	-2.1 $\pm 0.1$ (-2.0 to -2.2)
-5 V	-5.3 $\pm 0.1$ (-5.2 to -5.4)

## CORRECTIVE MAINTENANCE

The diagnostic tests on diskette 510868-01 are designed to isolate a workstation electronic problem to a field replaceable unit (FRU). To initially check out the workstation, run all the diagnostic tests. To isolate a problem, it may not be necessary to run all diagnostic tests. Since running all the diagnostic tests takes about 30 minutes, you may be able to save time by running only those tests that are necessary. If you have a problem and suspect a particular FRU, you can select the tests that check out the suspected FRU with the aid of the Quick Reference Chart (table 5-1). Locate the suspected FRU on the chart and run the indicated tests. A circled X indicates the FRU most likely to be faulty for each test failure. An X without a circle indicates the next most likely FRU to be faulty.

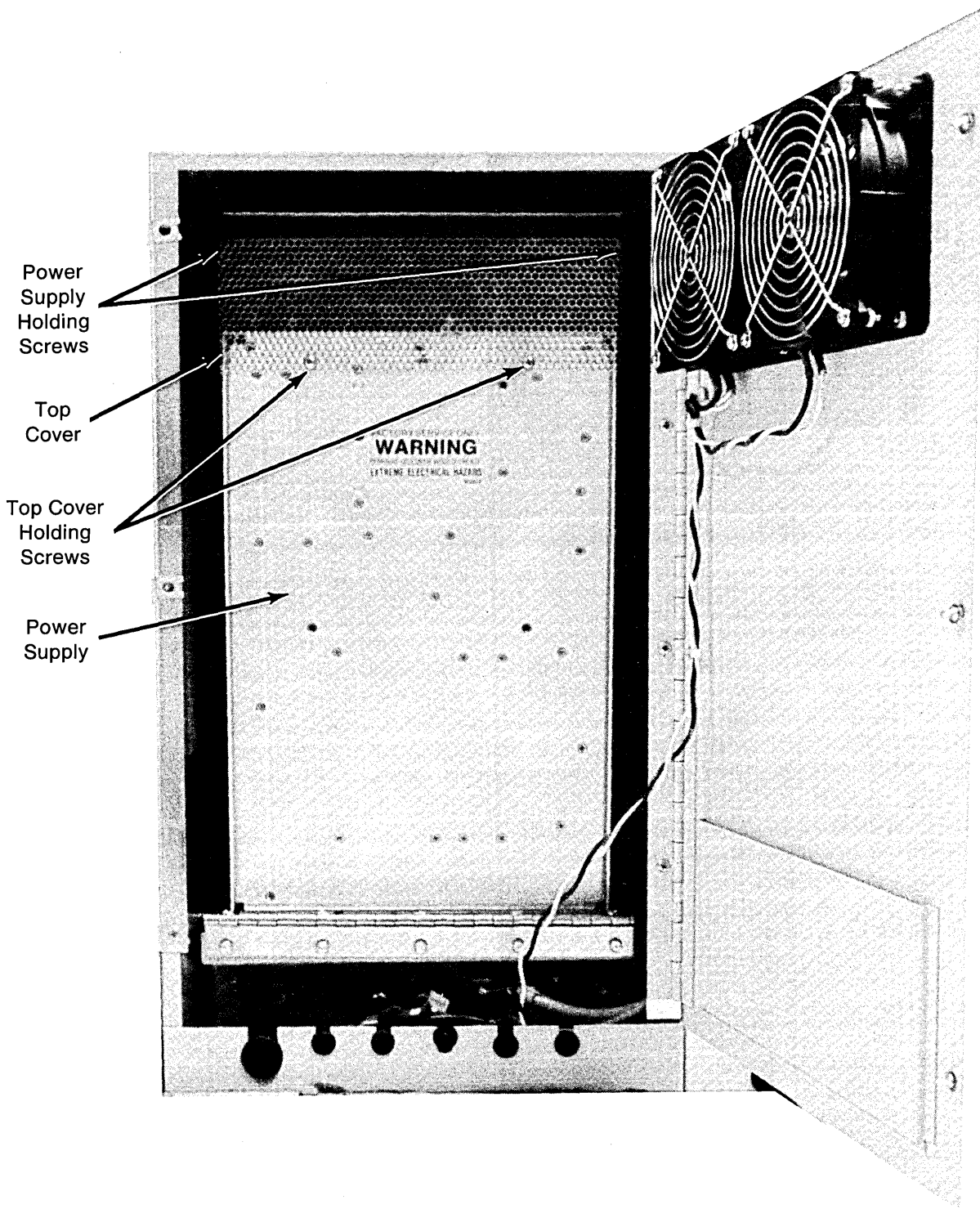


Figure 5-2. Power Supply Top Cover Removal

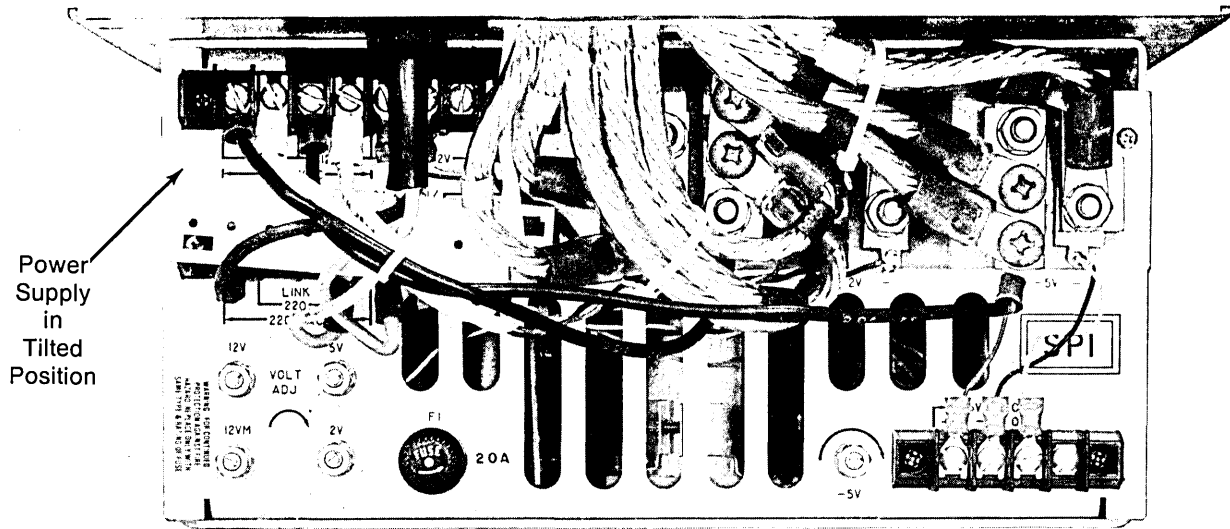


Figure 5-3. Voltage Adjustment Controls

Table 5-1. Quick Reference Chart

FRU*	Test Number in Hexadecimal															
	1	2	5	6	10	12	17	18	1B	1D	20	25	2B	2D	2F	38
DLP												(X)		(X)		
RP	X	X	(X)	(X)	X	(X)	(X)	(X)								
MEM	X	(X)	X	X	(X)	X	X	X	X							
VID				X		X			(X)	(X)	(X)					
CM	(X)															
KB													(X)			
GT															(X)	
VC																(X)

\*Abbreviations:

- |     |                            |     |                            |
|-----|----------------------------|-----|----------------------------|
| CM  | Color monitor              | MEM | Dynamic refresh memory PCB |
| DLP | Display list processor PCB | RP  | Raster processor PCB       |
| GT  | Graphic tablet             | VC  | Video cables               |
| KB  | Keyboard                   | VID | Video C PCB                |

Table 5-2 lists symptoms that occur during normal operation and indicates suspect FRUs. This may help you decide which diagnostic test to run first.

Table 5-2. Fault Isolation Guide

Symptom	Suspect FRUs
Random lines or dots	Raster processor PCB Dynamic refresh memory PCB
Broken lines	Dynamic refresh memory PCB Raster processor PCB
Color problem	Video C PCB Dynamic refresh memory PCB
Missing color	Color monitor Video C PCB
No picture	Color monitor

### Diagnostic Test Procedure

To run the diagnostic tests, proceed as follows:

1. Set PROCESSOR ON switch to on position.
2. Insert diagnostic diskette into disk drive (metal edge first, with name side up).
3. Press RESET SYSTEM switch to initialize system. Red disk active indicator comes on and goes off several times.
4. After about 65 seconds, monochrome monitor displays

DLP Diskette Based Diagnostics

Please type CTRL and A simultaneously followed by CR

5. Hold down <CTRL> and press <A>
6. Hold down one of the two shift keys and press <CR DEL>

Monitor then displays

Memory Mask (enter 8 HEX digits, 0 enables writing) =

If diskette does not load properly, check that DLP PCB configuration select switches are set correctly (figure 3-11), then press RESET SYSTEM switch again. If diskette still does not load properly, replace diskette, DLP PCB, disk interface PCB, or disk drive. If problem persists, call support.

7. If workstation has a standard four-plane refresh memory, type

ffffff0

If workstation has an optional eight-plane refresh memory, type

ffffff00

If you don't know how many planes refresh memory has, open the front door and look at the dynamic refresh memory PCB in slot A7. If the PCB is fully populated with RAM chips (ICs), you have an eight-plane memory. If several chip locations are empty, you have a four-plane memory.

8. Hold down a shift key and press <CR DEL>.

Monitor then displays a menu of the diagnostic tests followed by

TEST =

9. Type the number of the test you want to run.
10. Hold down a shift key and press <CR DEL>.

Monitor then displays the name of the test, and the test begins.

### CAUTION

To avoid damaging equipment, do not attempt to remove the display cover without first reading the display cover removal and replacement procedures.

### Diagnostic Tests

Table 5-3 lists the diagnostic tests. The first (left hand) column of the table shows the test number in hexadecimal. The second column gives the time required to complete the test in minutes or seconds. IMED in this column means the test is completed immediately. The third column shows the message displayed on the monochrome monitor when the test is completed. For test 2, the message is either "Test 2 passed" or "Test 2 failed." The fourth column describes the pattern that appears on the color monitor. The last column shows the FRUs most likely to be faulty if a failure message appears or if the test pattern is abnormal. Abbreviations are explained below the table. Replace the FRUs, one by one, in the order shown until the problem is corrected. If the problem persists, call support.

Most tests are similar to test 2. Tests 1, 5, 6, 1D, 20, and 38(H) are visual tests only and give no pass or failure message. After test 5 is complete, the

Table 5-3. Diagnostic Tests

No. (H)	Time	Monochrome Monitor Display	Color Monitor Display	FRU to Replace*
1	IMED	No message	White 64-square grid with a dot in middle of each square. If pattern is absent, turn BRIGHTNESS COLOR control fully clockwise. If raster is absent, remove display cover. If color monitor CRT filament is lit, replace color monitor. If filament is not lit, check color monitor fuse, then check ac input power. If raster is visible, but pattern is absent, replace color monitor, video C PCB, dynamic refresh memory PCB, or raster processor PCB. If pattern is abnormal, press DEGAUSS COLOR switch. If pattern contains random lines or dots or broken lines, replace raster processor PCB or dynamic refresh memory PCB.	CM RP MEM VID
2	10 min	Test 2 passed or failed	Screen fills with white then erases slowly	MEM RP
5	40 sec	Test 5 is done	Moving triangle. If triangle leaves behind dots or a white trail, replace FRUs listed.	RP MEM
6	75 sec	Test 6 is done	8 colored V-shaped scrolling bands. If bands are misshapen, replace raster processor PCB. If colors are repeated out of sequence, replace video C PCB or dynamic refresh memory PCB.	RP VID MEM



Table 5-3. Diagnostic Tests (continued)

No. (H)	Time	Monochrome Monitor Display	Color Monitor Display	FRU to Replace*
10	6 sec	Test 10 passed or failed	0 through 3 or 0 through 7 in a vertical column	MEM RP
12	IMED	Test 12 passed or failed	Magenta field	RP MEM VID
17	3 min	Test 17 passed or failed	Moving line in a box	RP MEM
18	1 min	Test 18 passed or failed	Moving line in a box	RP MEM
1B	2 sec	Test 1B passed or failed	Blue flash	VID MEM
1D	10 sec	Test 1D is done	Stationary horizontal line and moving vertical line changing color from red to green to blue. If colors are abnormal, replace video C PCB.	VID
20	1 min	Test 20 is done done	White moving wheel. If wheel is irregular or colored or if movement is jerky, replace video C PCB.	VID
25	45 sec	Test 25 passed or failed	None	DLP
2B	N/A	Displays char- acter typed	None	KB
2D	IMED	Test 2D passed or failed	None	DLP
2F	N/A	No message until you exit test	White 9-square grid	GT

Table 5-3. Diagnostic Tests (continued)

No. (H)	Time	Monochrome Monitor Display	Color Monitor Display	FRU to Replace*
38	IMED	Test 38 is done	Three pairs of horizontal colored bars: red (top), green (middle), and blue (bottom). If colors are not in correct positions, check that video cables are connected to correct sockets.	Video cables

\*Abbreviations:

CM - Color monitor	MEM - Dynamic refresh memory PCB
DLP - Display list processor PCB	N/A - Not applicable
GT - Graphic tablet	RP - Raster processor PCB
IMED - Immediate	VID - Video C PCB
KB - Keyboard	

monochrome monitor displays

Test 5 is done

Tests 6, 1D, 20, and 38(H) are similar to test 5. Test 2B(H) checks keyboard operation by displaying the characters you type. All standard letter, number and punctuation keys can be tested, but not special function keys. Test 2F(H) checks out the graphic tablet. The color monitor displays cursor movement in response to stylus movement on the tablet.

After each test is completed, hold down a shift key and press <CR DEL>. The monochrome monitor then displays the menu again followed by

Test =

You can then run another test.

You can attempt to exit any test at any time, but the test may have to run its course before you get out. To exit test 2F(H), hold down a shift key and press <CR DEL>, then touch the graphic tablet with the stylus. To exit any other test, just hold down a shift key and press <CR DEL>. When you exit test 2, the monochrome monitor displays

Test 2 was aborted

Most tests are similar to test 2. When you exit test 1, the monitor displays

Test 1 was exited

When you exit test 2B(H), the monitor displays

Test 2B is done

The test 2F(H) exit message is similar.

If you cannot exit a test, or if you encounter any other problem, press the RESET SYSTEM switch and repeat the diagnostic test procedure. If the problem persists, turn the PROCESSOR ON switch off and on again.

### **COLOR MONITOR COLOR ADJUSTMENTS**

The following adjustments are the only adjustments required for the color monitor. Proceed as follows:

#### **CAUTION**

To avoid damaging equipment, do not attempt to remove the display cover without first reading the display cover removal and replacement procedures.

1. Remove display cover by performing removal procedures given under REMOVAL AND REPLACEMENT.
2. Check that three TERM switches on color monitor rear (figure 5-4) are in down position.
3. Check that INT/EXT switch is set to EXT.
4. Load diagnostic diskette and run test 1.
5. Disconnect green and blue video cables from monitor.
6. Adjust RED BACKGROUND and RED GAIN controls with a screwdriver for dark background and bright grid, with a dot visible at the center of each square.
7. Disconnect red video cable.
8. Reconnect blue video cable.

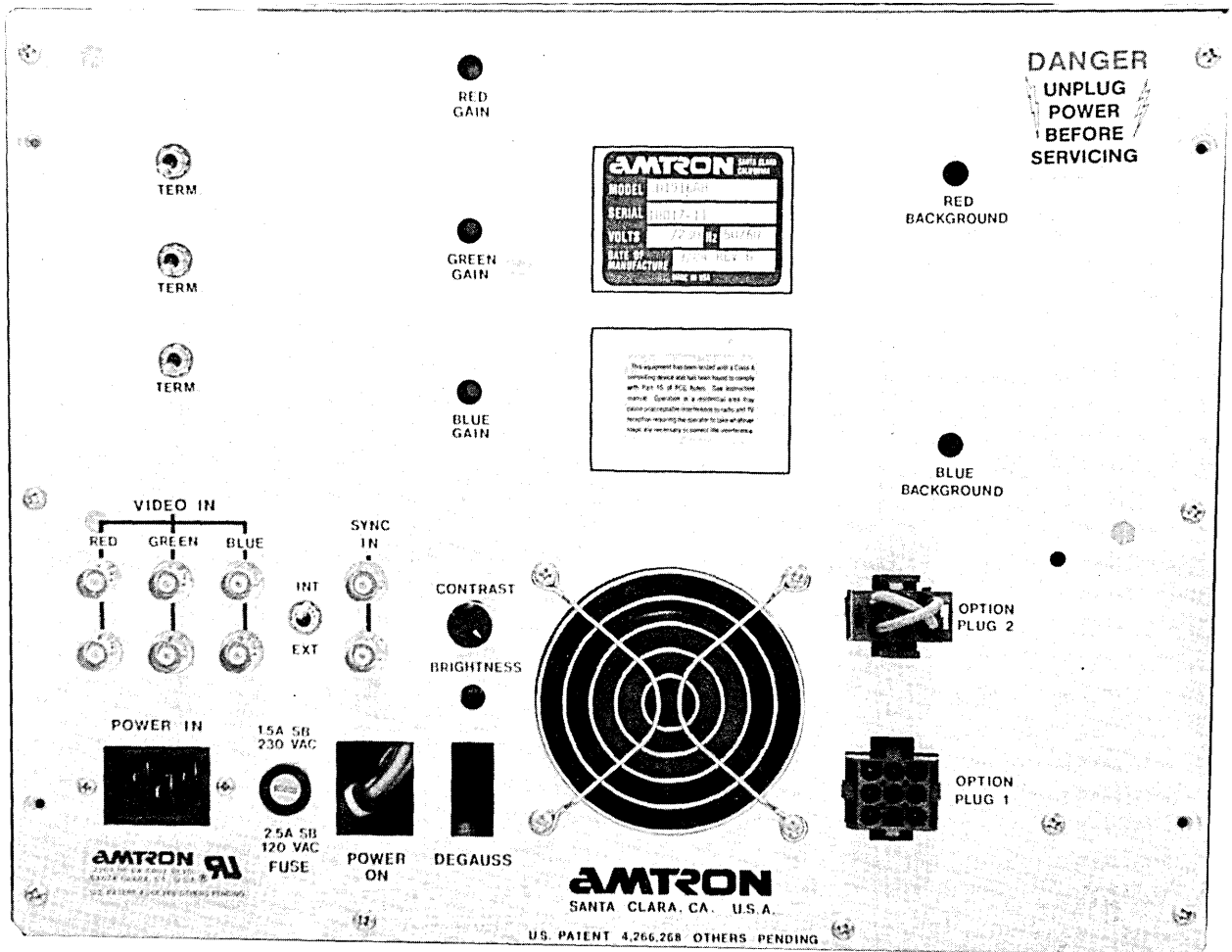


Figure 5-4. Color Monitor Rear

9. Adjust BLUE BACKGROUND and BLUE GAIN controls for display pattern described in step 6.
10. Disconnect blue video cable.
11. Reconnect green video cable.
12. Adjust GREEN GAIN control for display pattern described in step 6.
13. Reconnect red and blue video cables.
14. Check that grid lines and dots in test 1 pattern are white. If they are not, repeat steps 5 through 14.
15. Replace display cover by performing replacement procedures given under REMOVAL AND REPLACEMENT.

#### **REMOVAL AND REPLACEMENT**

The following paragraphs provide removal and replacement procedures for field-replaceable parts.

#### **WARNING**

To prevent personal injury or damage to equipment, disconnect the workstation from the AC power source before removing or replacing parts other than front-loaded PCBs.

#### **Front-Loaded PCBs**

Remove and replace a front-loaded PCB as follows:

1. Set PROCESSOR ON switch to off position.
2. Unlock extractors to release PCB.
3. Pull extractors to remove PCB from card slot.

#### **CAUTION**

To avoid serious damage to equipment, always observe the color code when inserting a PCB in a card slot.

4. Insert replacement PCB into correct card slot in agreement with color code.
5. Press extractors firmly to ensure that PCB is securely seated.
6. Lock extractors to hold PCB in place.

#### **Disk Interface PCB**

To remove the disk interface PCB, proceed as follows:

1. Set PROCESSOR ON switch to off position.
2. Loosen rear door twist screws and open rear door.
3. Remove two screws holding power supply upright.
4. Tilt power supply backward.
5. Disconnect cable from disk interface PCB.
6. Unplug PCB from backplane.

Replacement is the reverse of removal.

#### **Keyboard**

To replace the keyboard with a 721 Viking keyboard, part number 61409656, proceed as follows:

1. Disconnect keyboard cable from display assembly.
2. Remove four screws from old keyboard base.
3. Remove keyboard top cover.
4. Disconnect keyboard cable from keyboard.
5. Loosen cable clamp and remove cable.
6. Similarly, remove cable from new keyboard.
7. Connect cable removed from old keyboard to new keyboard.
8. Tighten cable clamp to hold cable in position.
9. Reassemble keyboard and fasten with four screws previously removed.
10. Plug cable into display assembly.

## Display Cover

To remove the display cover, proceed as follows:

1. Remove two holding screws from display cover rear.

### CAUTION

To avoid damaging equipment do not attempt to lift display cover up directly after removing holding screws.

2. Raise display cover rear about a half inch.
3. Slide cover back at least three inches.
4. Lift cover carefully from display assembly.

To replace the display cover, proceed as follows:

1. Lower display cover carefully onto display assembly with front edge of cover at least three inches behind front of display assembly.
2. Slide cover forward until front is flush with front of display assembly.
3. Replace two holding screws.

## Monochrome Monitor

Field replaceable modules of the monochrome monitor are listed in table 5-4 and shown in figure 5-5.

Removal and replacement of the three PCB's or the entire monitor should be done using the following procedures. All work on either of the monitors requires removal of the monitor assembly cover as shown in figure 5-6. Particular care should be taken to avoid impact to the front bottom corners of this moded part as they can be cracked, or broken off, if the cover is dropped.

### PCB Assembly - Main Logic Board P/N 90446597.

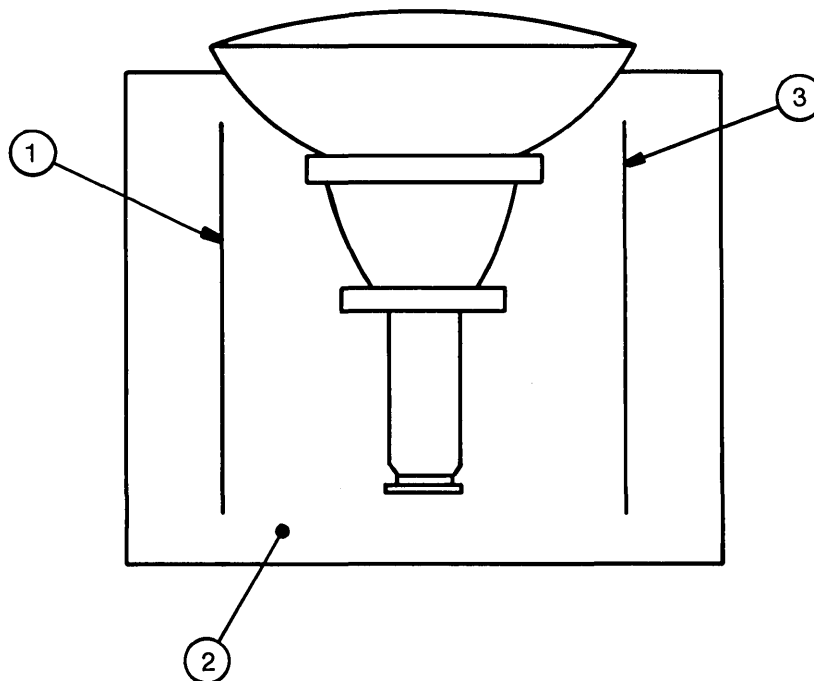
1. Remove the ac power plug of the workstation from the wall or other receptacle.

**WARNING**

To prevent personal injury or damage to the equipment, disconnect the workstation from the ac power source during any removal and replacement operations.

Table 5-4. Monochrome Monitor Field Replaceable Modules

Callout Item No.	VIKX Field Service Kit ZKCC634B P/N 66329384 Callout	CDC P/N	Reference in CDC Publication 62940034, CDC CC63X Display Terminal
1	PTD BO Assy 185107-00	66327973 Vendors No. 185107-00	Monitor Board, p.4-4 p. 6B-21, 35
2	CD Assy 1AJD-3 Logic BD	90446597	Main Logic Board, p.4-5 p. 6B-8
3	Power Supply PCA 81AHD-3	90446556	Power Supply, p.6B-8





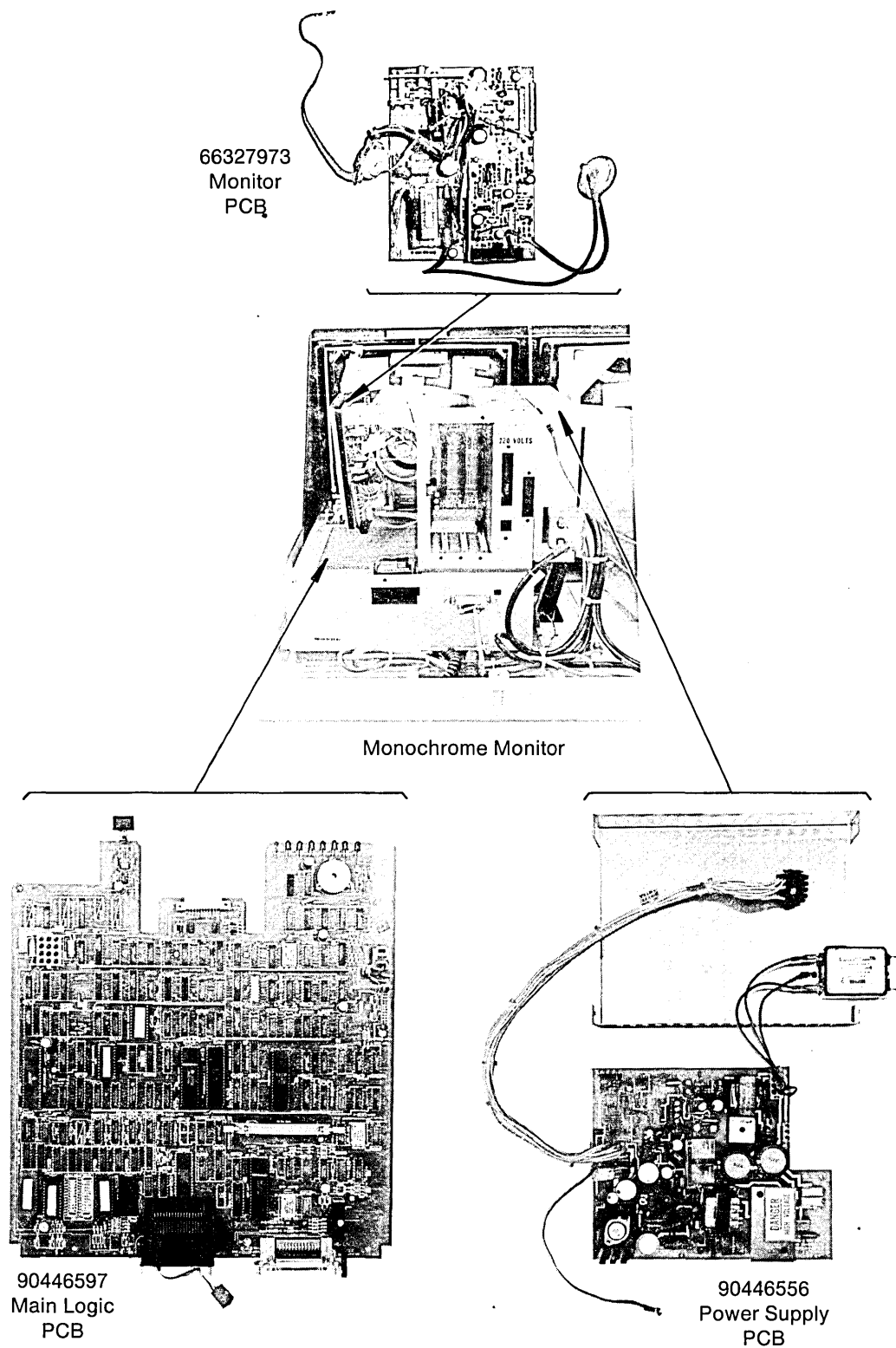


Figure 5-5. Field Replaceable Modules, Monochrome Monitor

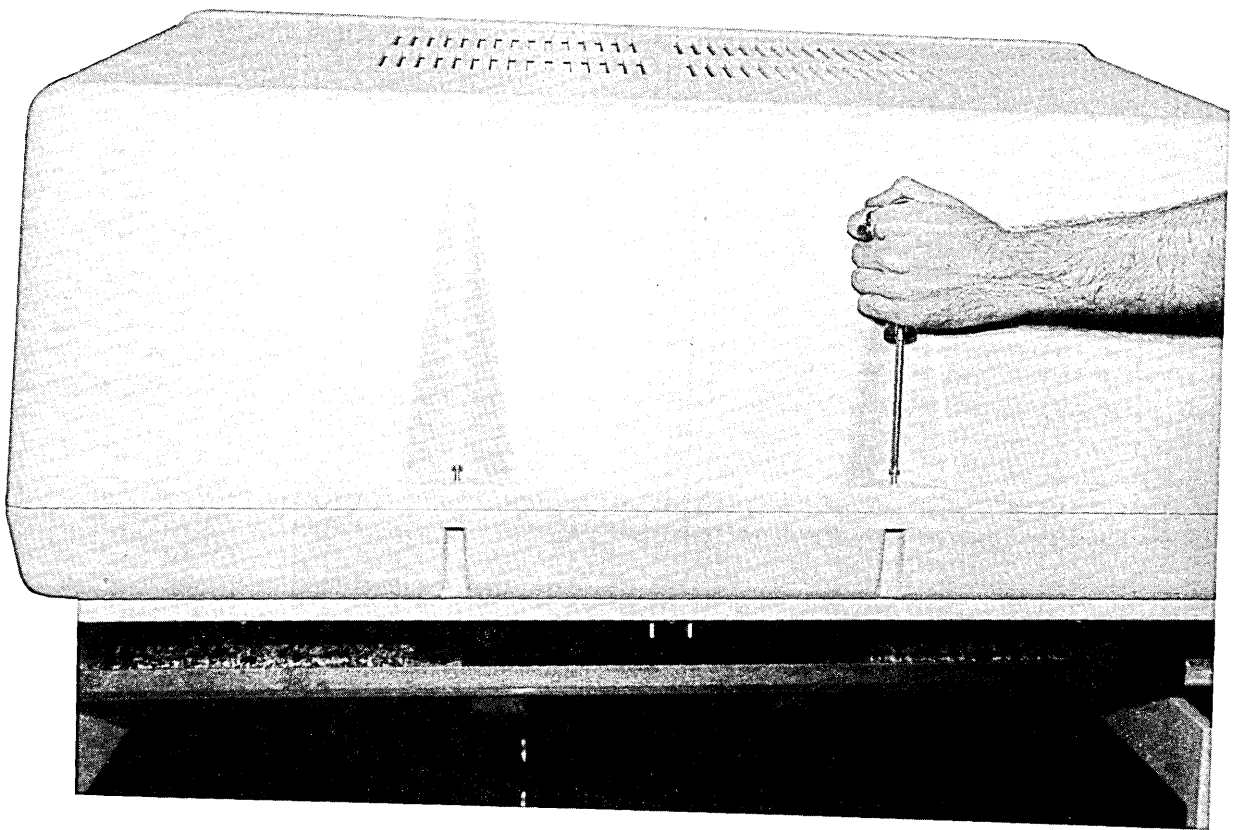


Figure 5-6. Removing Monitor Assembly Cover

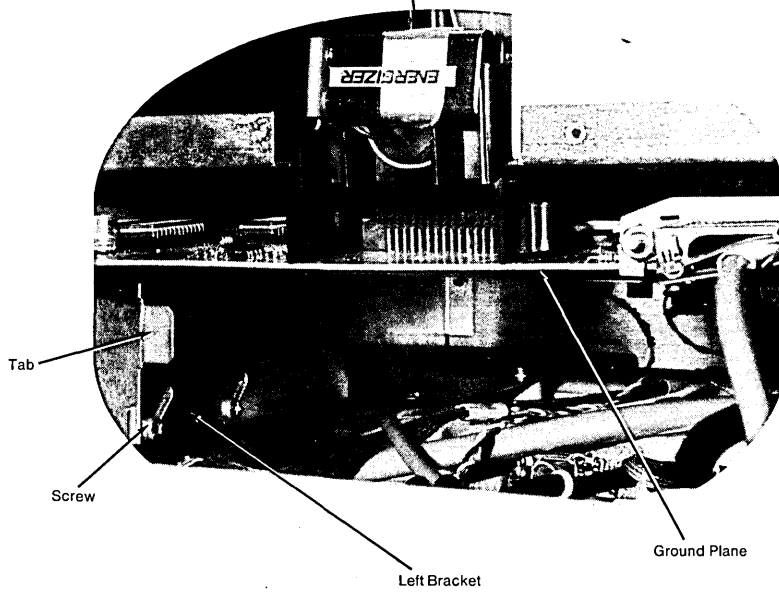
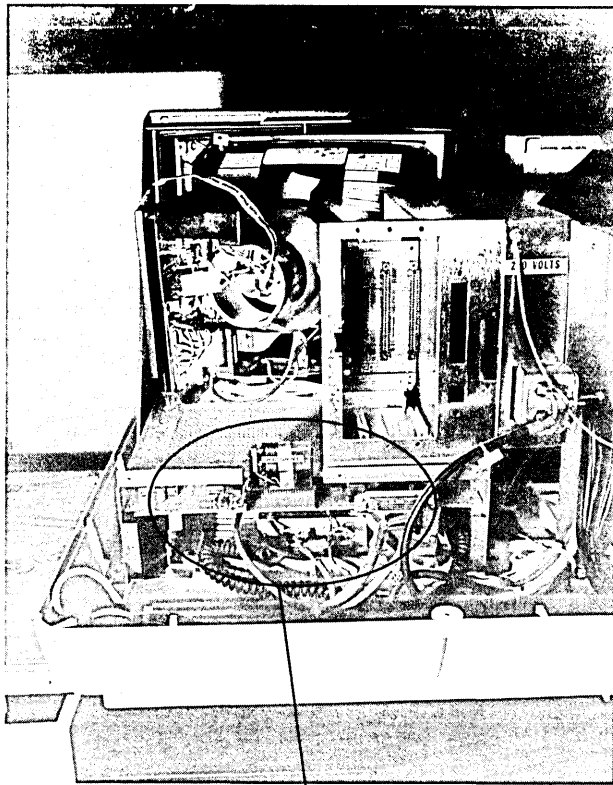


Figure 5-8. Ground Plane Contact Bracket

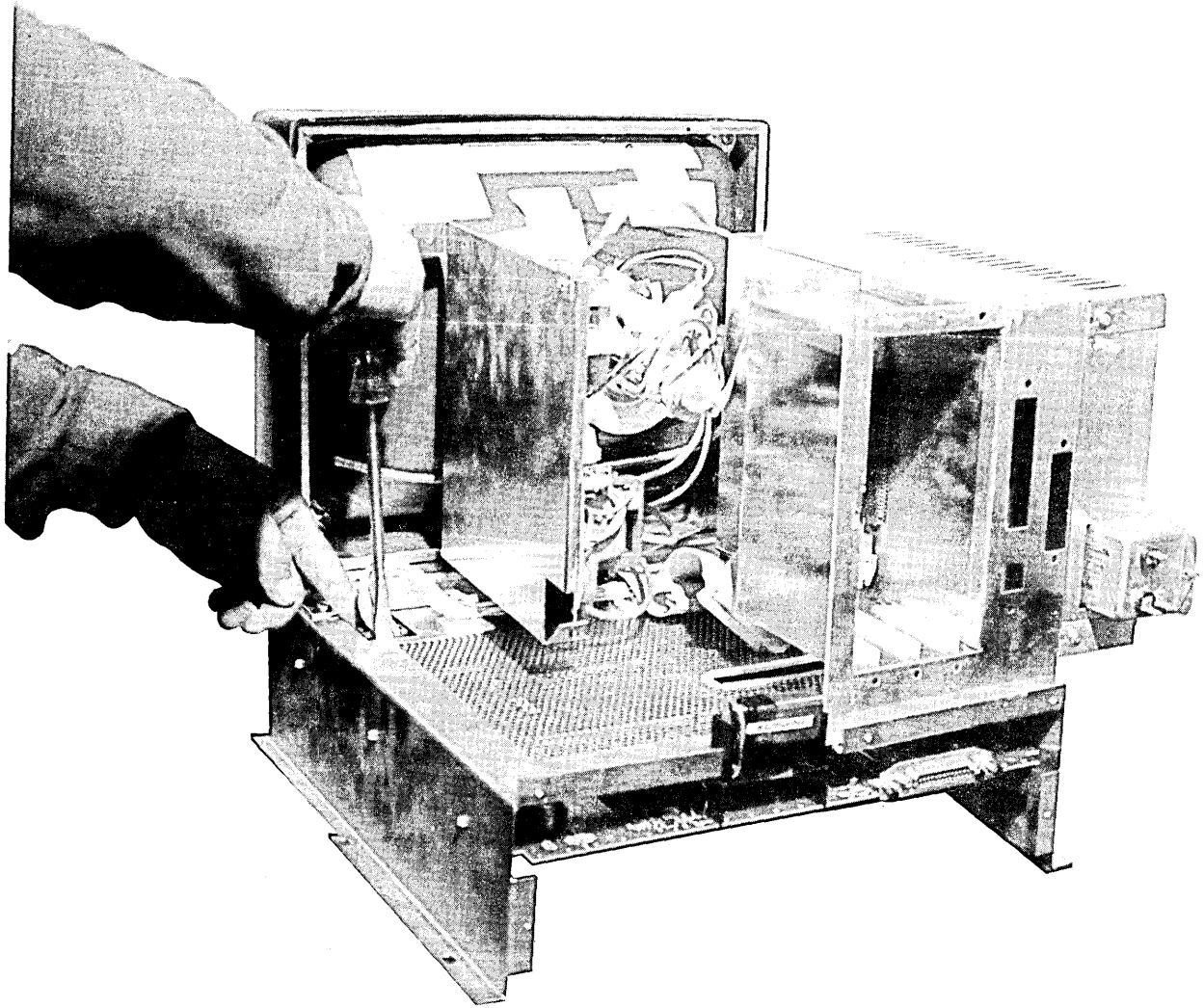


Figure 5-9. Removing Connector

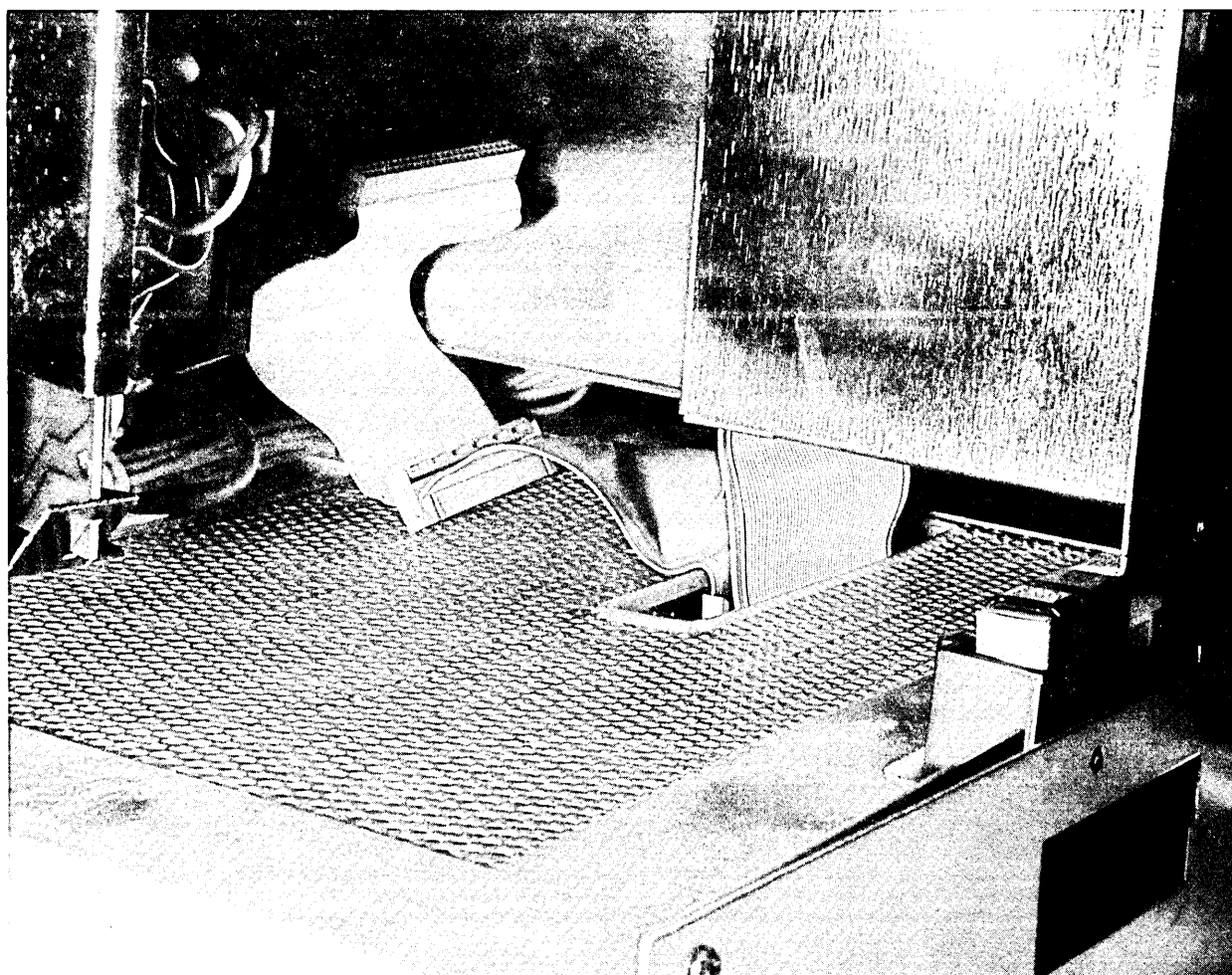


Figure 5-10. Options Motherboard Cable

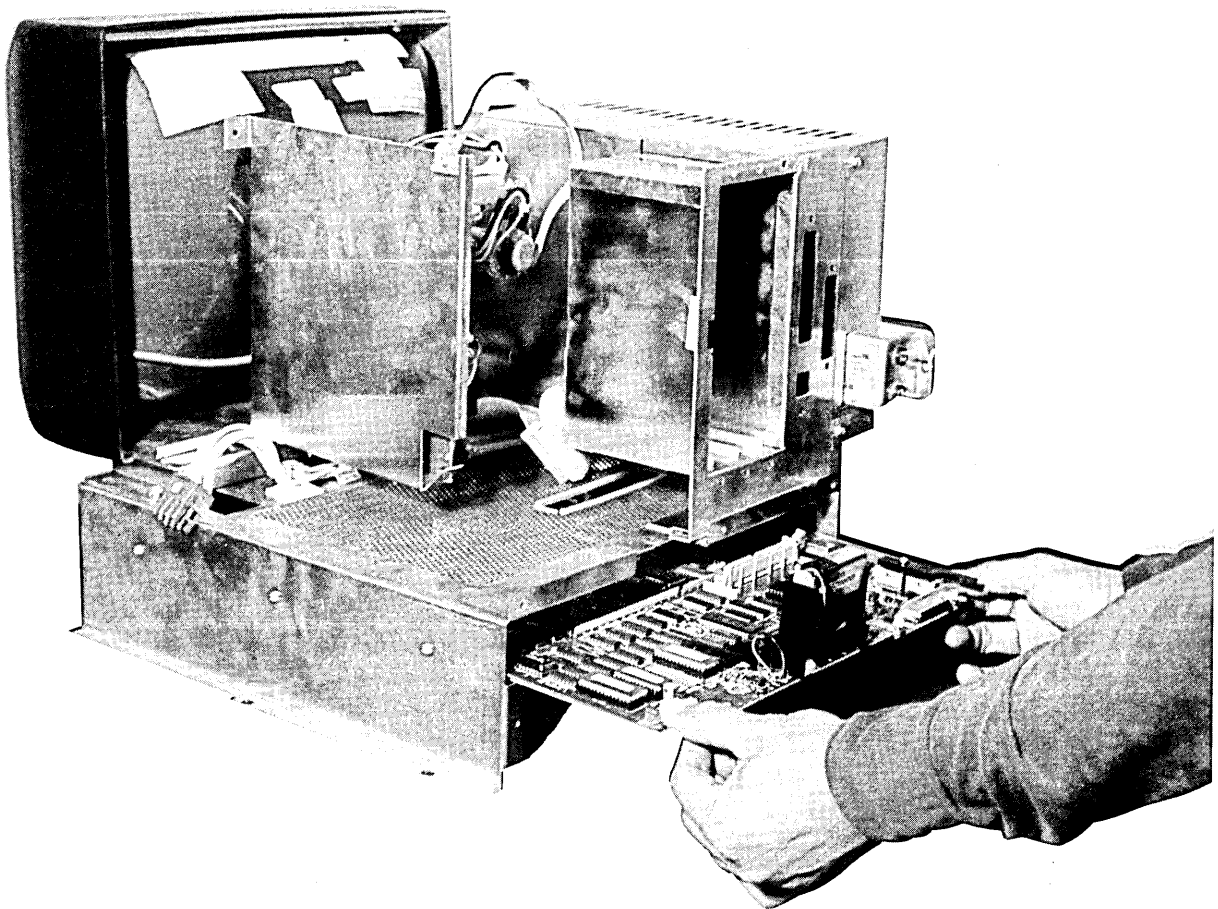


Figure 5-11. Removing the Main Logic PCB

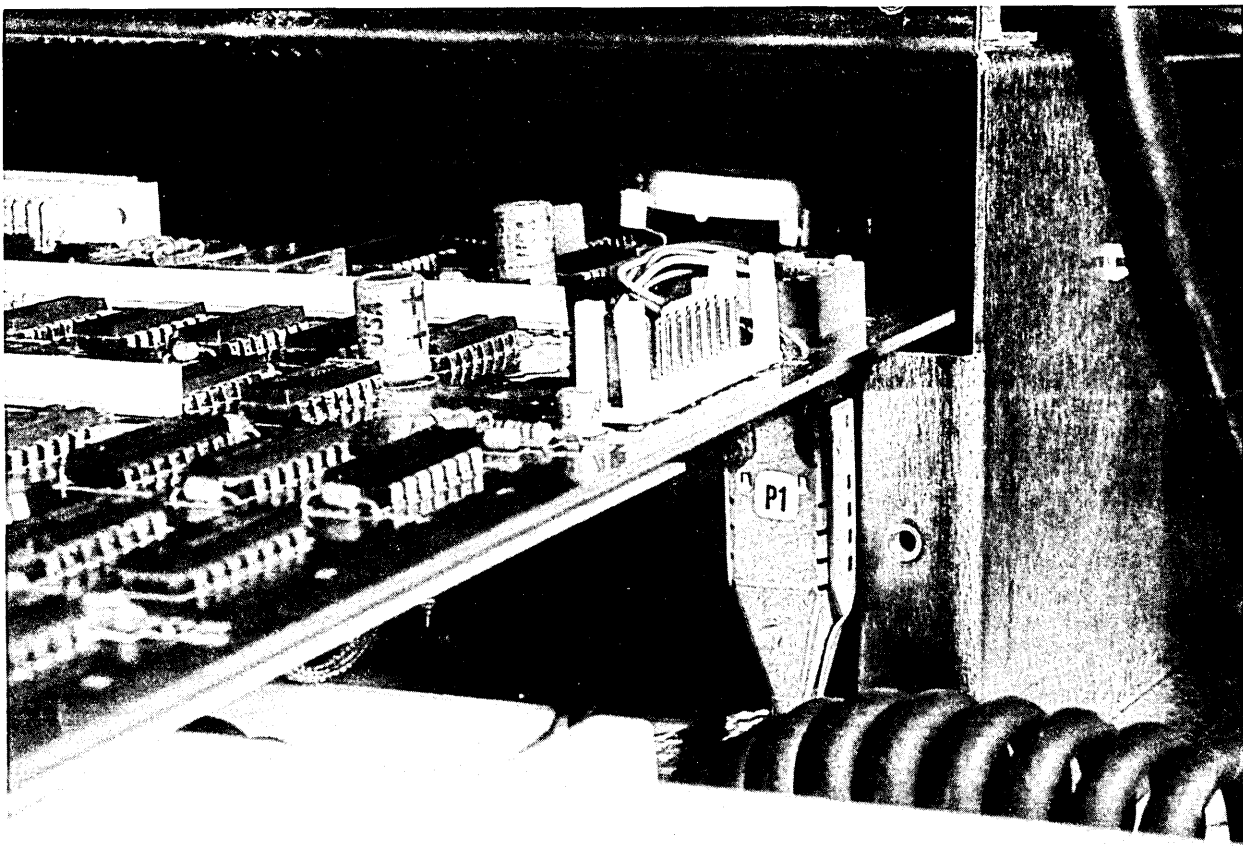


Figure 5-12. Connector P1 Mated to Main Logic PCB

PCB Assembly - Power Supply P/N 90446556.

1. Remove the ac power plug of the workstation from the wall or other receptacle.
2. See figure 5-13. Disengage the three snap-on connections to the ac line filter.
3. See figure 5-14. Remove the screws from the metal safety shield and place the shield on the worksurface.
4. See figure 5-15. Disengage the brown connector on the far end of the cable and pull the cable under the bottom edge of the PCB as shown. See figure 5-8.
5. See figure 5-16. Disengage the white connector and cable, with tag marking S10243-01A, at the lower left corner of the PCB.
6. Remove the three machine screws along the top edge of the PCB. Grasp the edge of the PCB and lift it vertically away from the monitor chassis. The removal of the Power Supply PCB is now complete.

To replace a Power Supply PCB, do the following.

1. Insure that the sheet of white insulating material is in place. Holding the PCB by its top edge, lower the PCB vertically until the two bottom corners slide into locating notches in the sheet metal and the three screw holes at the top align with mating holes.
2. Insert the three machine screws. See again figure 5-14.
3. Engage the white connector in a reversal of step 5.
4. Pass the brown connector and its cable under the PCB in a reversal of step 4. Engage the connector with its mate on the Main Logic PCB.
5. Replace the metal safety shield with attached line filter in a reversal of step 3.
6. Engage the three snap-on connections to the ac line filter.

The replacement of the Power Supply PCB is now complete.

PCB Assembly - Monitor Board P/N 66327973 (Vendor's P/N 185107-00).

1. Remove the ac power plug of the workstation from the wall or other receptacle.
2. See figure 5-17 showing the Monitor PCB and the location of the high voltage connection to the CRT (H-V Cap).



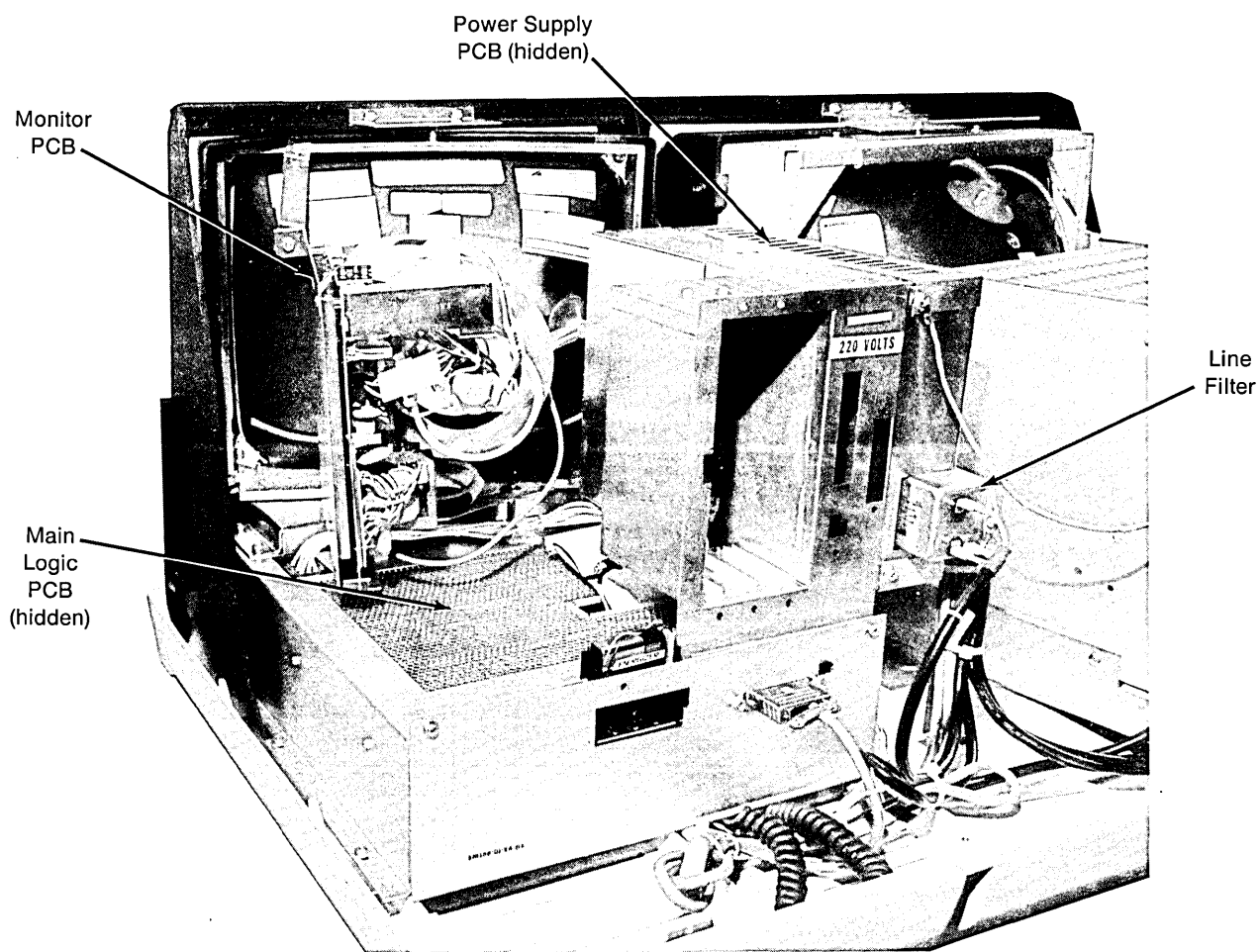


Figure 5-13. Rear of Monochrome Monitor Showing AC Line Filter and PCBs.

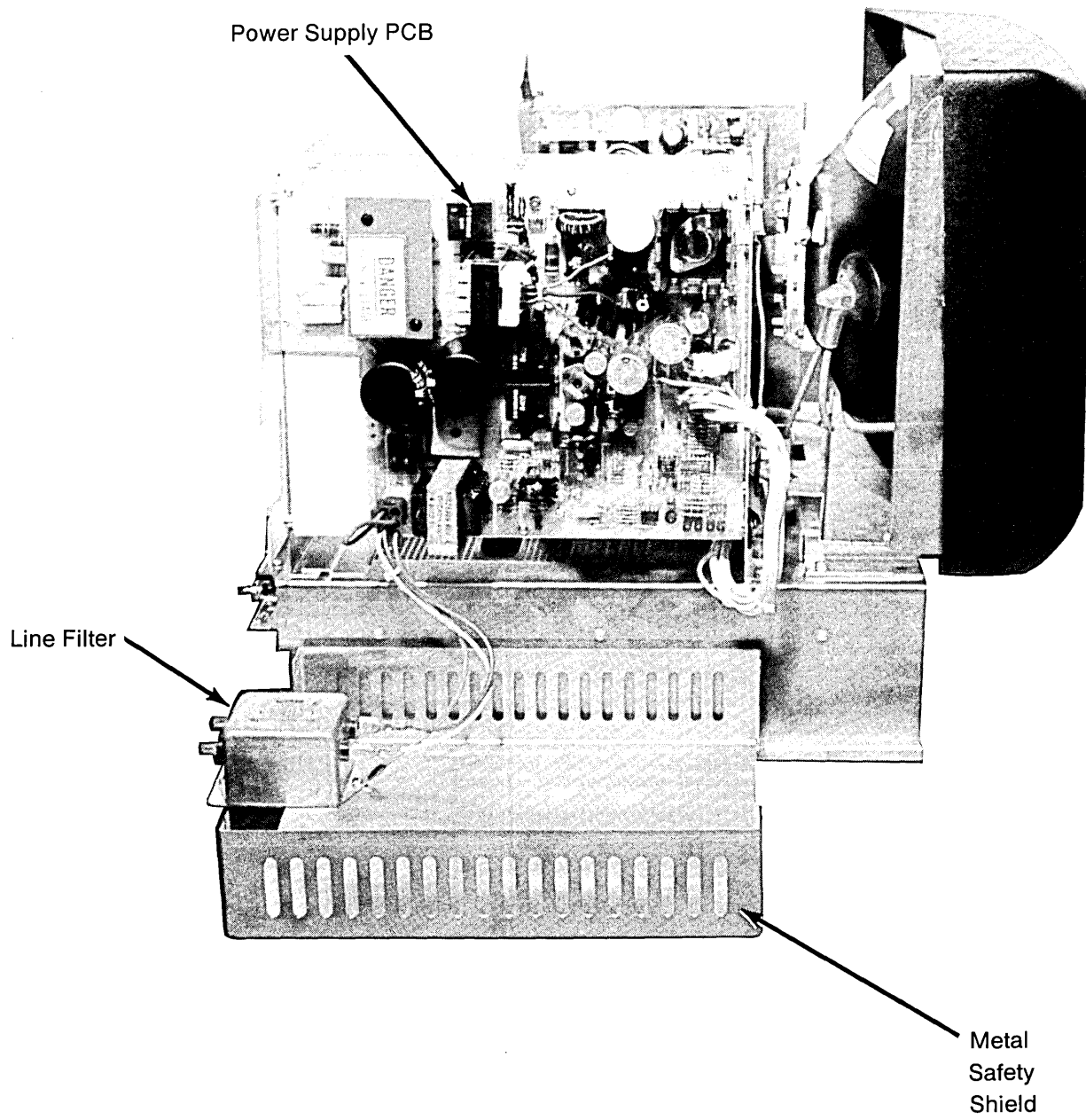


Figure 5-14. Shield Removed from Power Supply PCB

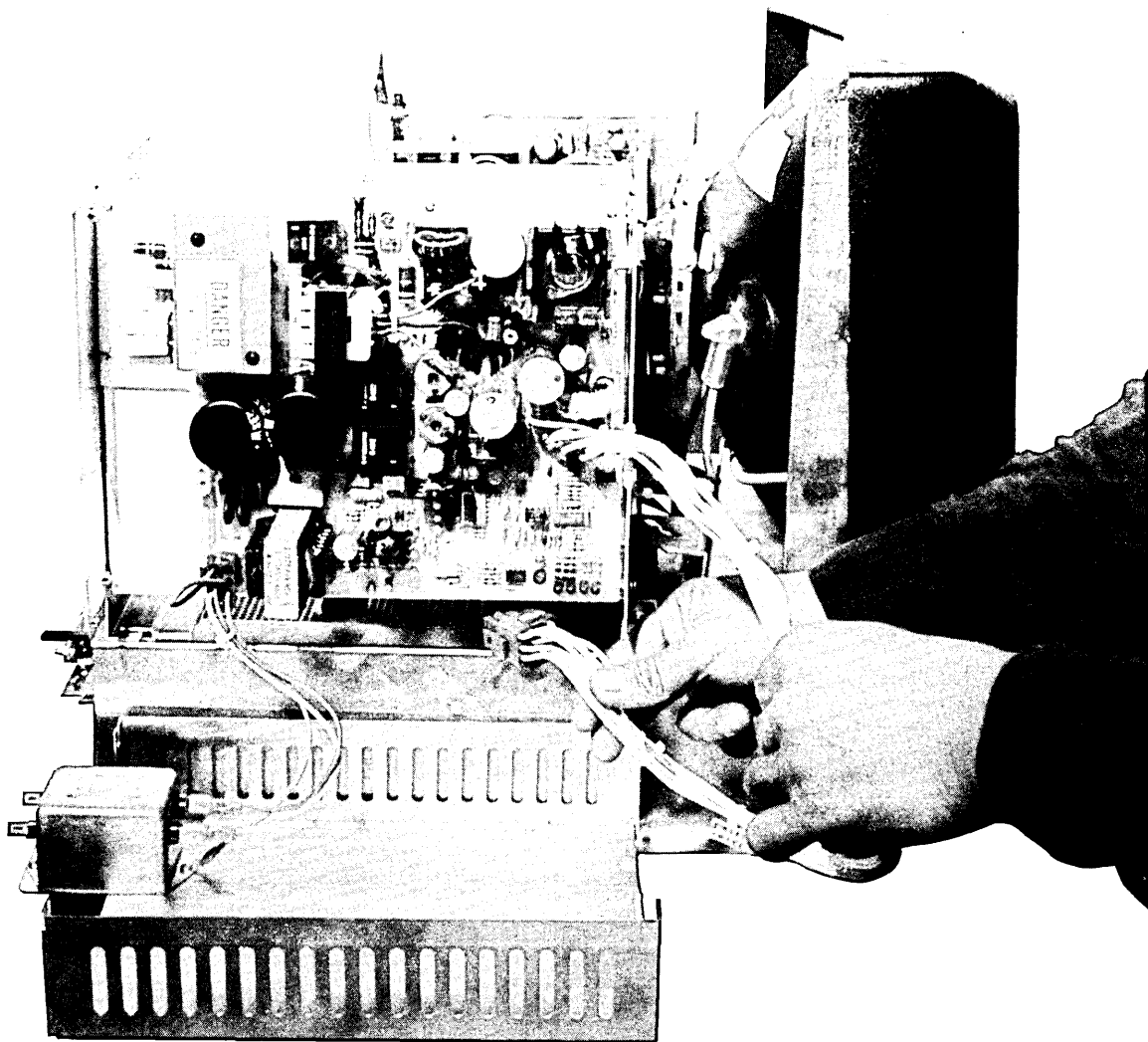
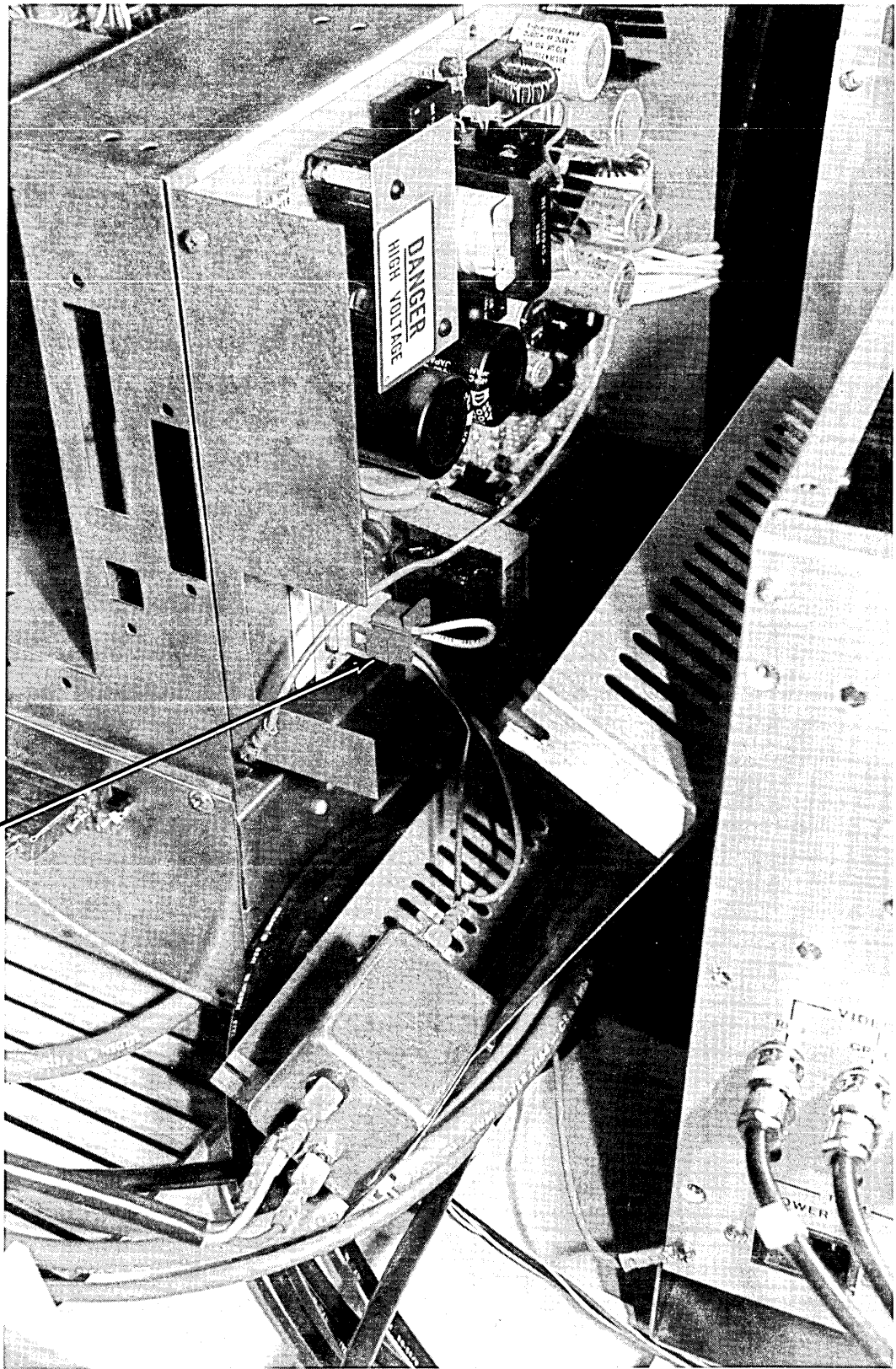


Figure 5-15. Pulling Cable and Connector Under Power Supply PCB



Connector

Figure 5-16. Line Power Connector

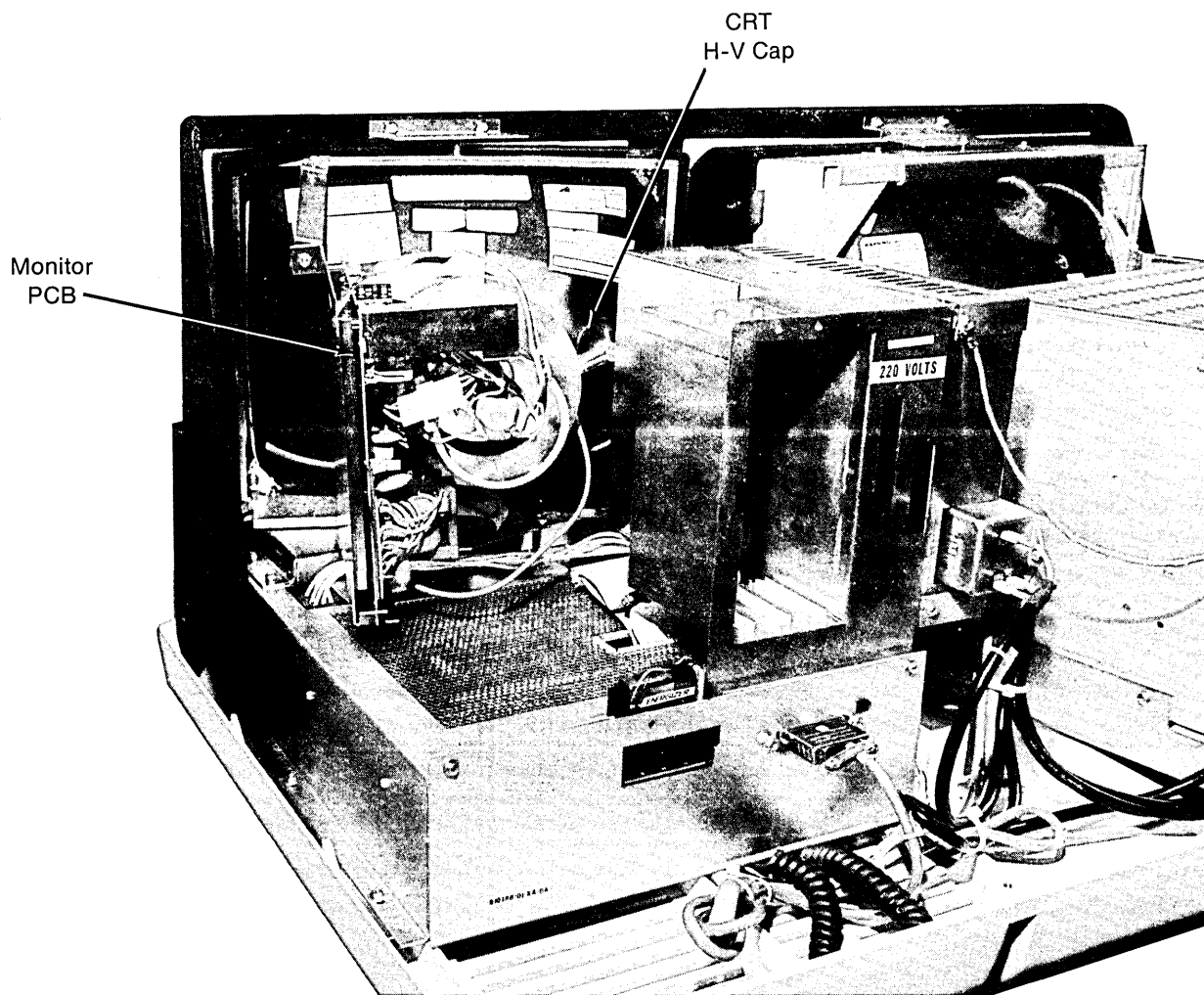


Figure 5-17. Monitor PCB, Component of the Monochrome Monitor

3. See figure 5-18. Using a screwdriver with an insulated handle, insert the blade under the H-V Cap from the CRT bulb and touch the screwdriver shaft to chassis ground. This procedure is redundant to the bleeder resistance in the monitor designed to prevent any high voltage being present when the power is disconnected.
4. See figure 5-19. Disengage the in-line connector as shown.
5. Pull the end of the yellow ground strap off the fastening tab attached to the upper rear corner of the ground/shield plane.
6. See figure 5-20. Remove the CRT socket from the pins at the rear of the bulb. Remove the connector plug from its socket at the lower right corner of the PCB.
7. The PCB is now electrically detached from surrounding components. Remove the two screws at the top corners of the PCB (this will loosen the mu-metal shield support bracket, but that's OK).
8. Lift the PCB upward from the two slots in which the bottom corners rest. The removal of the Monitor PCB is now complete.

To replace a Monitor PCB, proceed as follows.

1. Lower a PCB until the bottom corners rest in the bracket slots as shown in figure 5-20. Replace the two machine screws which fasten the PCB (as well as the mu-metal shield support bracket) in place.
2. Attach all the electrical connectors to the replacement PCB in a reversal of steps 6, 5, and 4.

The replacement of the Monitor PCB is now complete.

#### Entire Monochrome Monitor

1. See figure 5-21 for a rear view of the monochrome monitor with the display assembly cover removed.
2. Remove the ac power plug of the workstation from the wall or other receptacle.
3. Remove the three snap-on connections to the ac line filter. Remove the chassis ground wire connection.
4. Remove connector P2 and then the rear cover plate.
5. See figure 5-22. Remove the swivel pivot assembly, fastened by two screws.

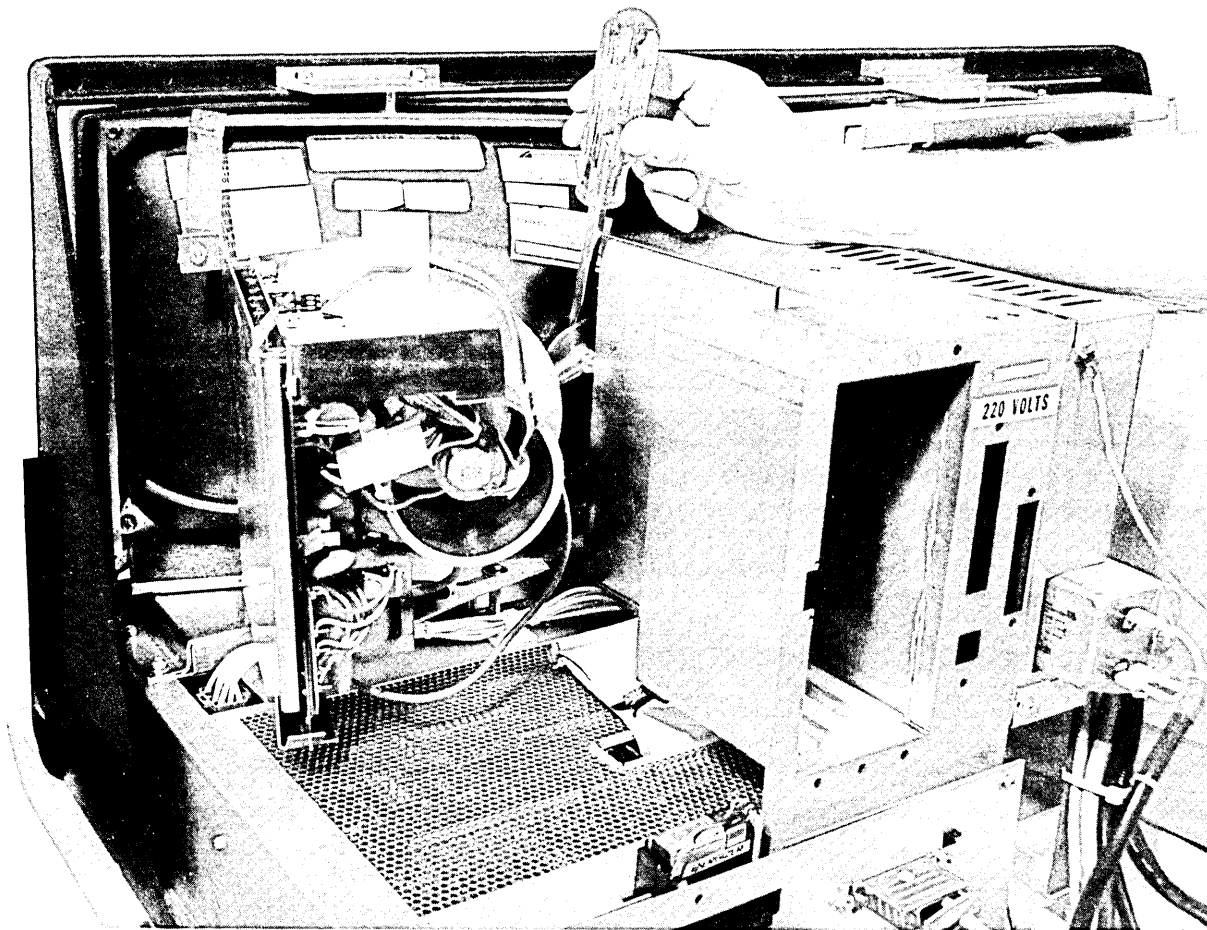


Figure 5-18. Grounding the H-V Cap for Safety

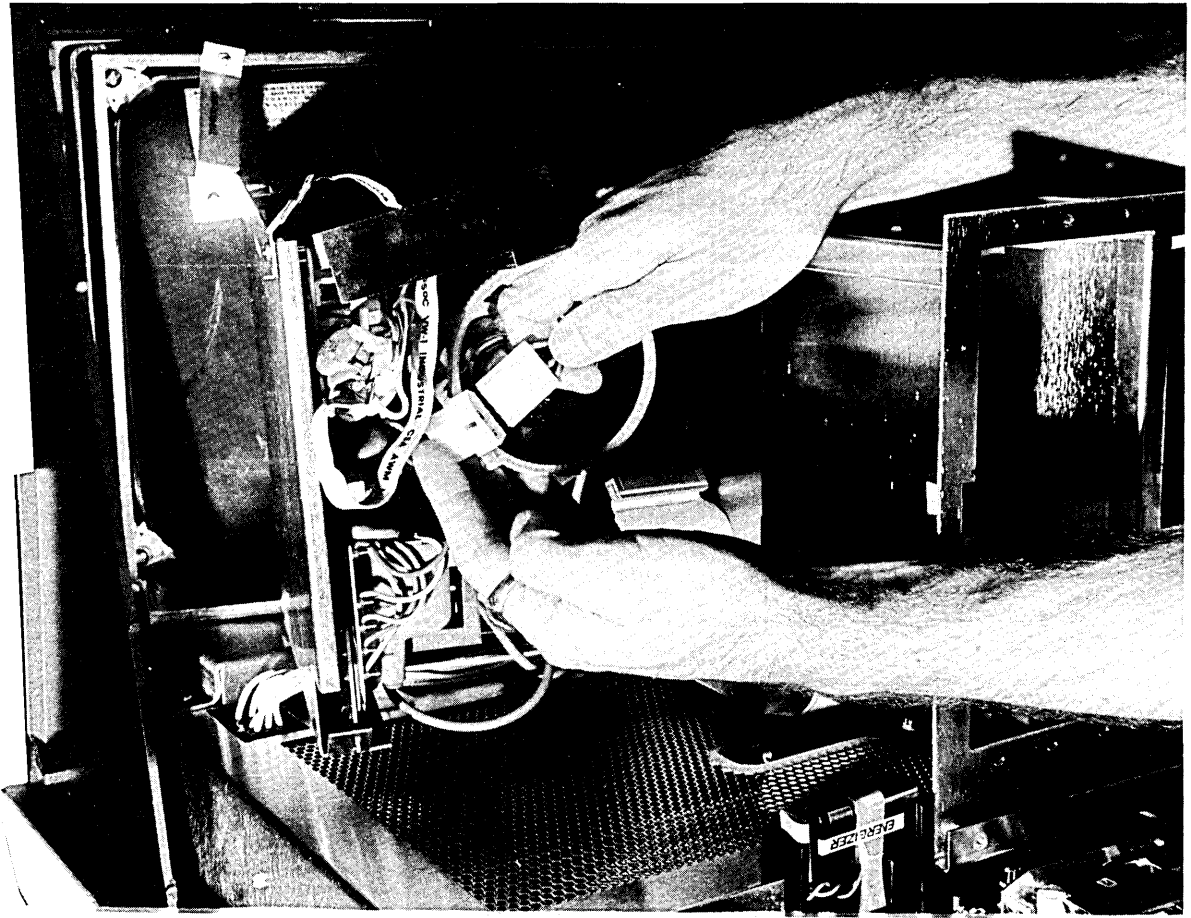


Figure 5-19. Disengaging the In-Line Connector



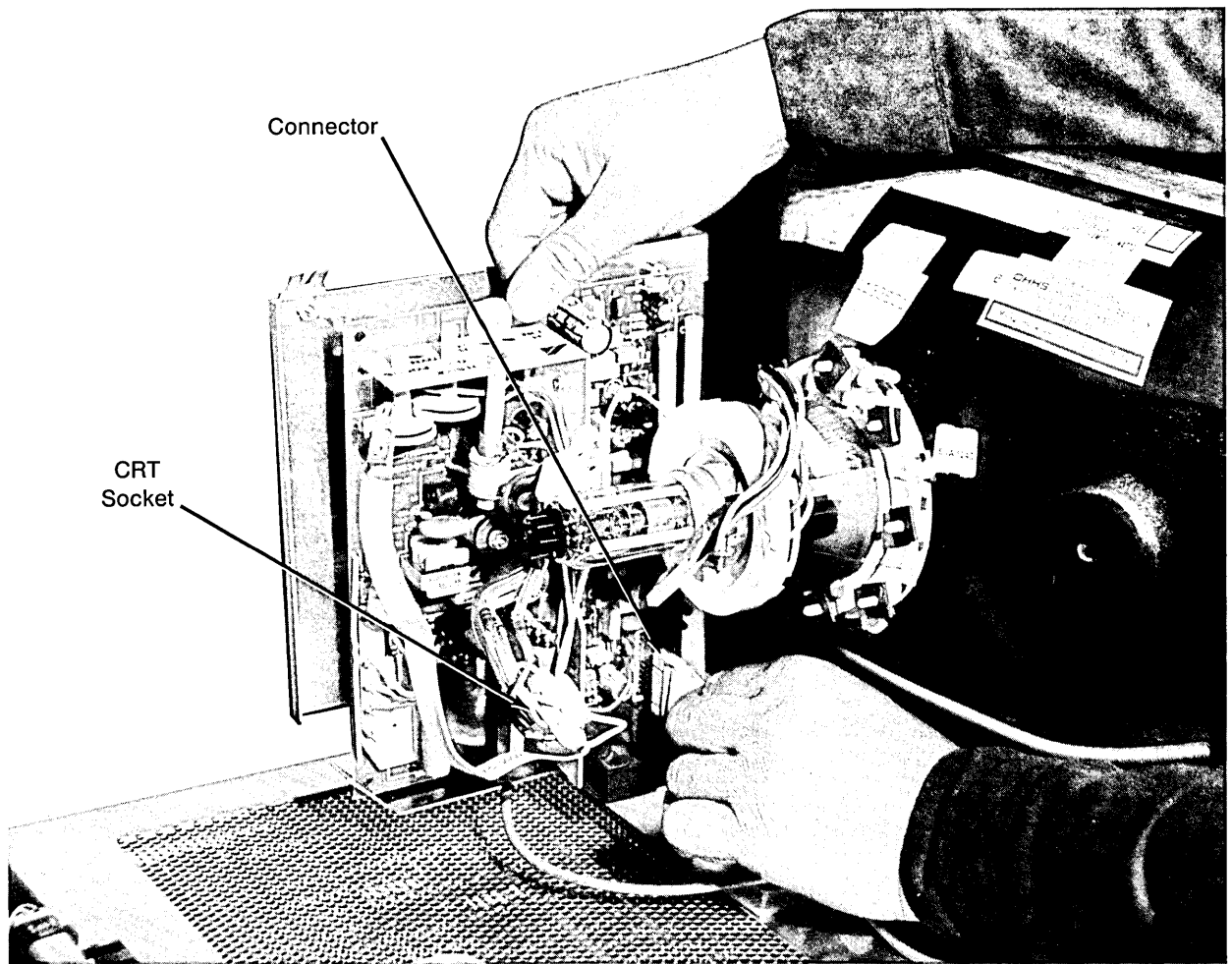


Figure 5-20. Disengaging Connector

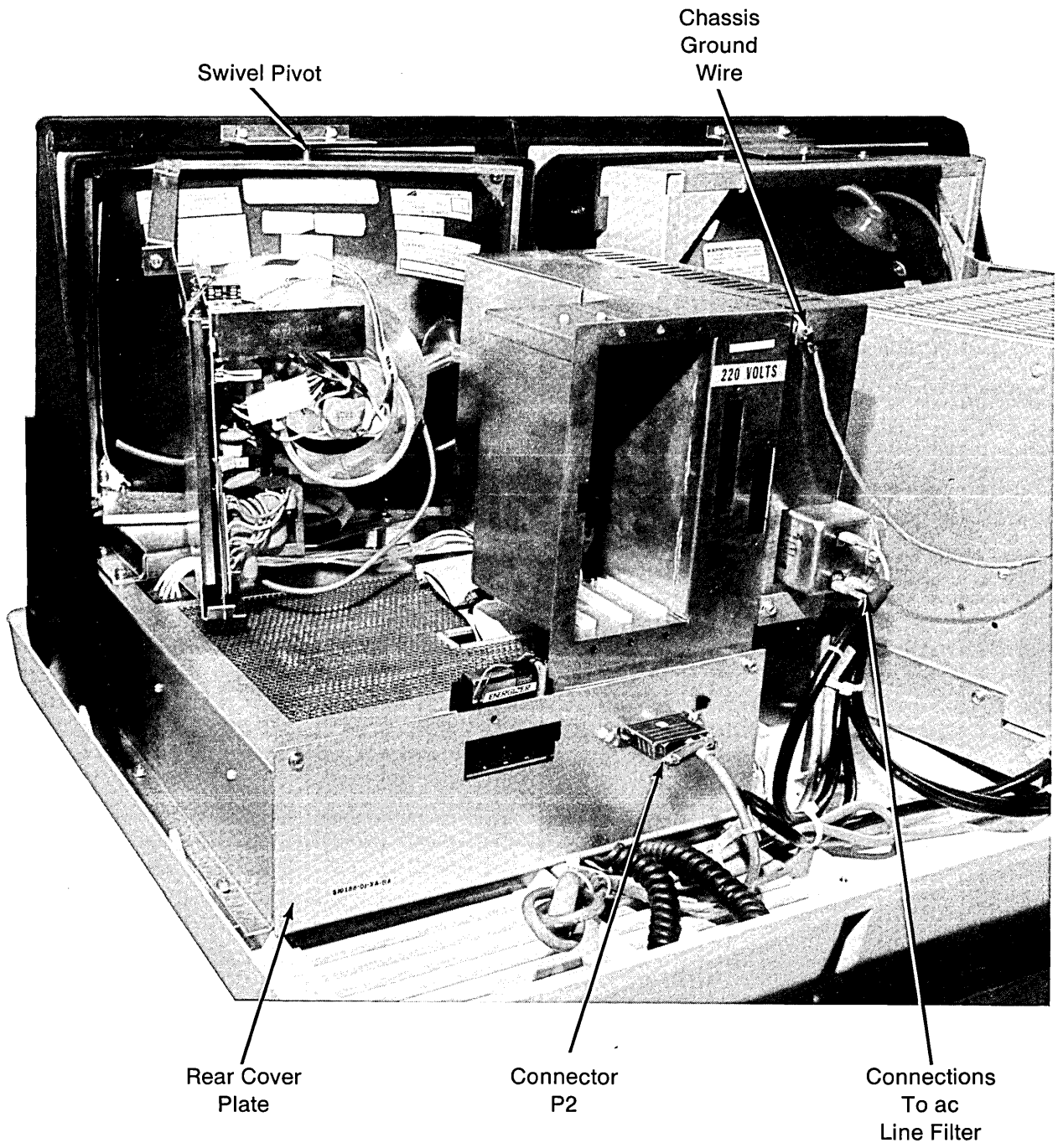


Figure 5-21. Monochrome Monitor with Display Assembly Cover Removed



Figure 5-22. Removing Swivel Pivot Assembly

6. See figure 5-23. Remove the four screws, two on each side, attaching the monitor chassis to the display assembly base.
7. See figure 5-24. Loosen two screws (shown) in the left spring support bracket. Complete removal of the comparable two screws in the right spring support bracket will allow removal of the upper bracket and its spring. This will be of help later.
8. Open the in-line, white nylon connector in the three conductor group (blue, black, and white) which goes to the rear of the RESET SYSTEM switch.
9. See figure 5-25. Pull the entire monitor chassis back so the CRT bezel clears the frame around it. The chassis may now be tilted up.
10. See figure 5-26. With the chassis tilted up, a) detach all connections to the back of the disk drive and b) detach the black, coiled cable terminating in connector P1 (see also figure 5-12).
11. The monochrome monitor may now be lifted out for replacement or for subsequent removal of the disk drive which is part of the assembly.

The replacement of the monochrome monitor requires a reverse ordering of the procedural steps given above.

#### **Disk Drive**

1. See figure 5-27. The removal of the disk drive requires access to the bottom of the disk drive housing; obtaining this access requires that the entire monochrome monitor chassis assembly be removed toward the rear of the workstation and then tilted upward as in the figure.
2. The procedure used to clear the disk drive of all connecting wires and to gain access to the drive for its removal begins by going through all the steps given at the manual heading "Entire Monochrome Monitor, just preceding. Refer back, and do these procedures.
3. The entire monitor assembly should be lifted off the workstation and placed on a work surface in such an orientation that the bottom of the disk drive is accessible.
4. See figure 5-28. Remove the four screws from the bottom of the disk drive housing. A pull on the front surface bezel will bring the disk drive out for test or replacement. The removal procedure is now completed.

The replacement of the disk drive and the necessary replacement of the entire monochrome monitor back into the display assembly requires a reversal of the procedures just given.

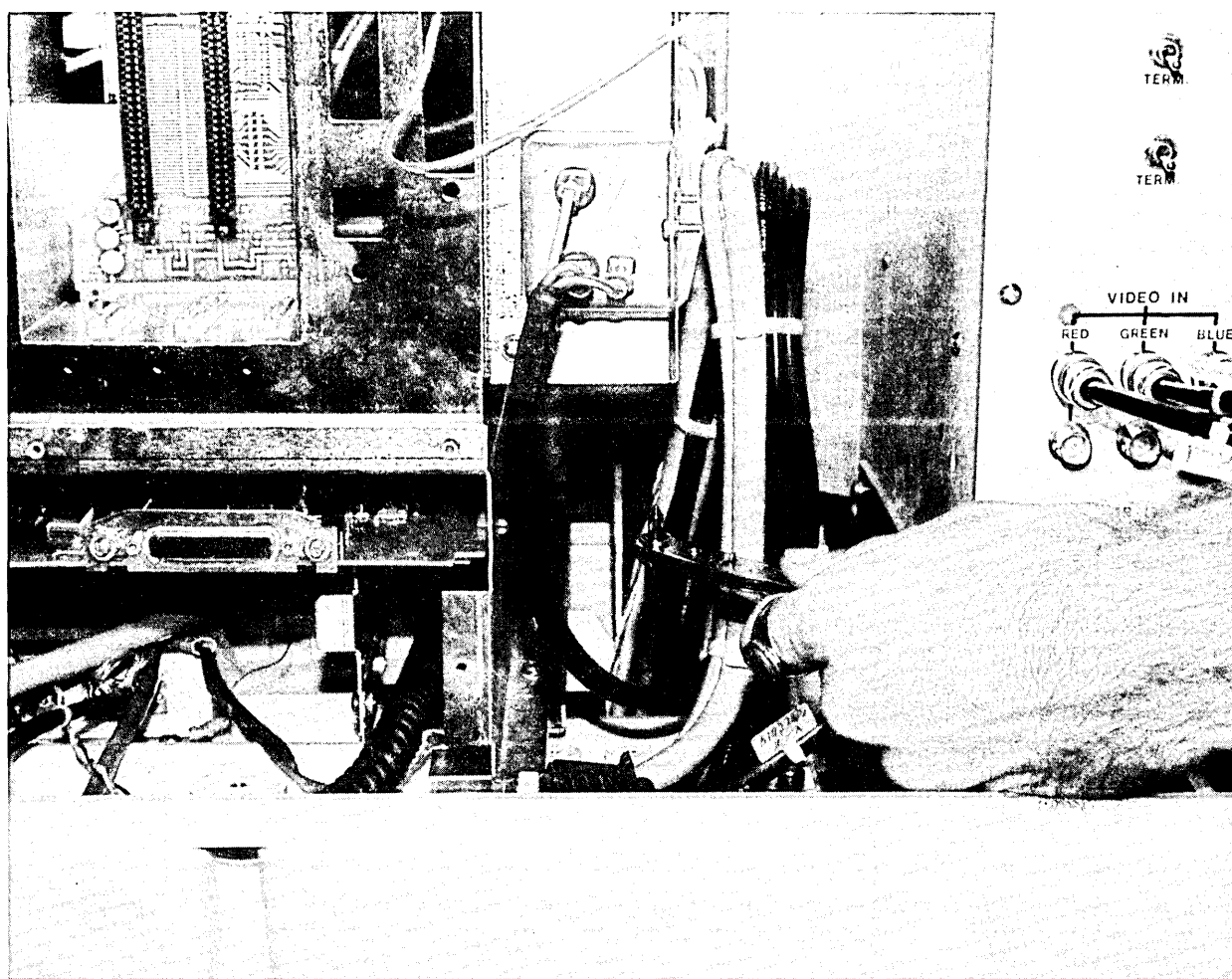


Figure 5-23. Detaching the Monochrome Monitor Chassis

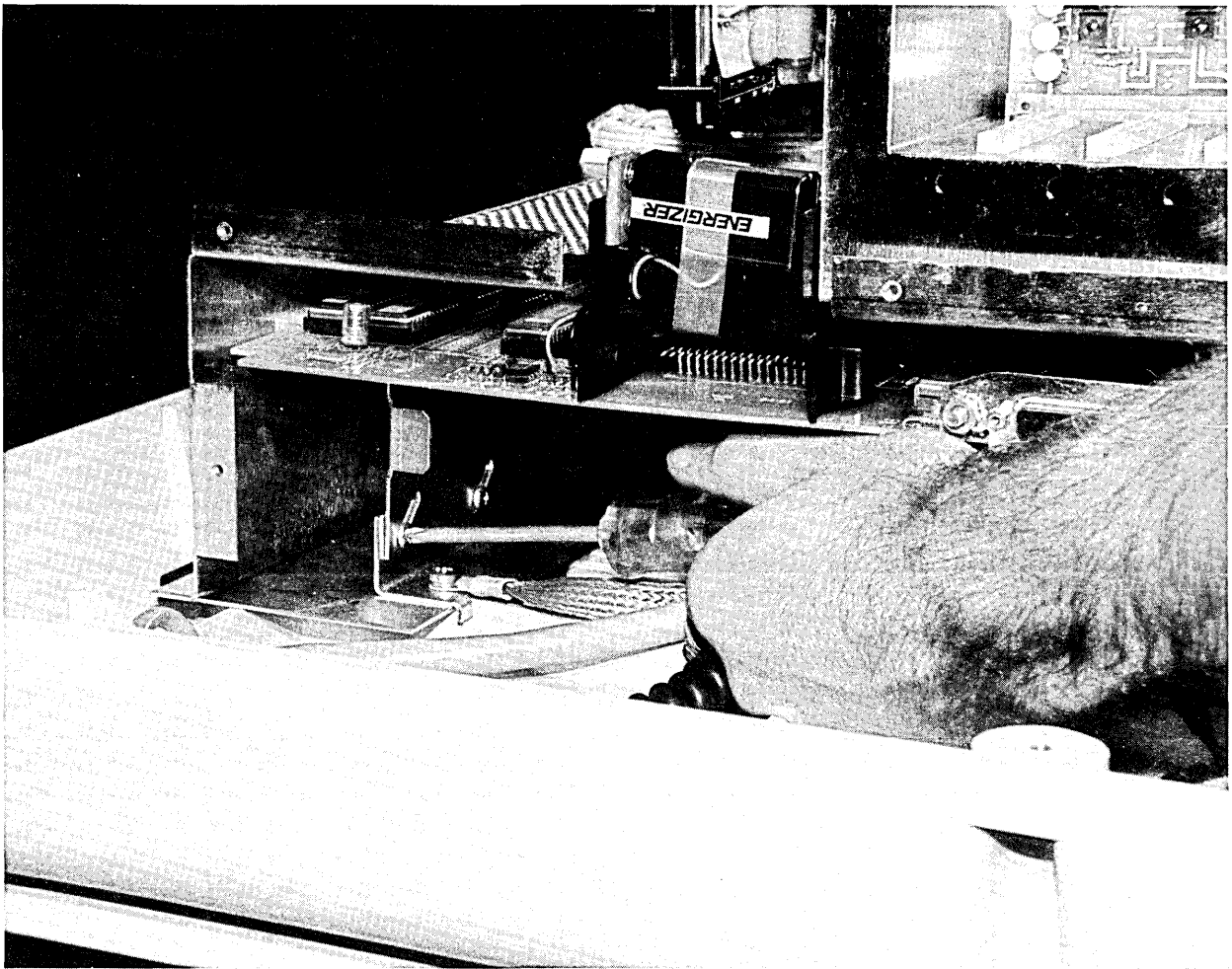


Figure 5-24. Loosening the Left Spring Support Bracket

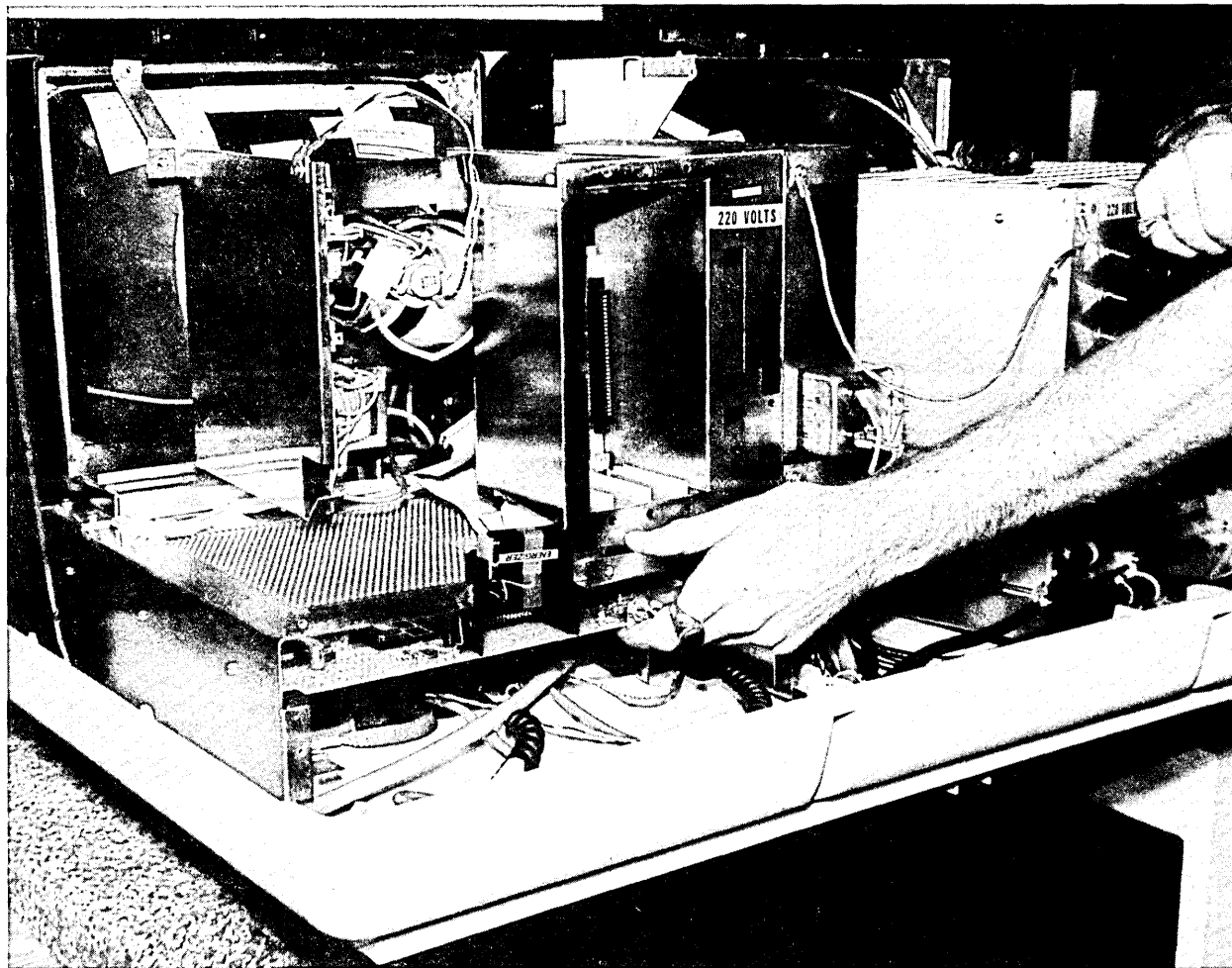


Figure 5-25. Lifting/Pulling the Monitor for Tilt-Up

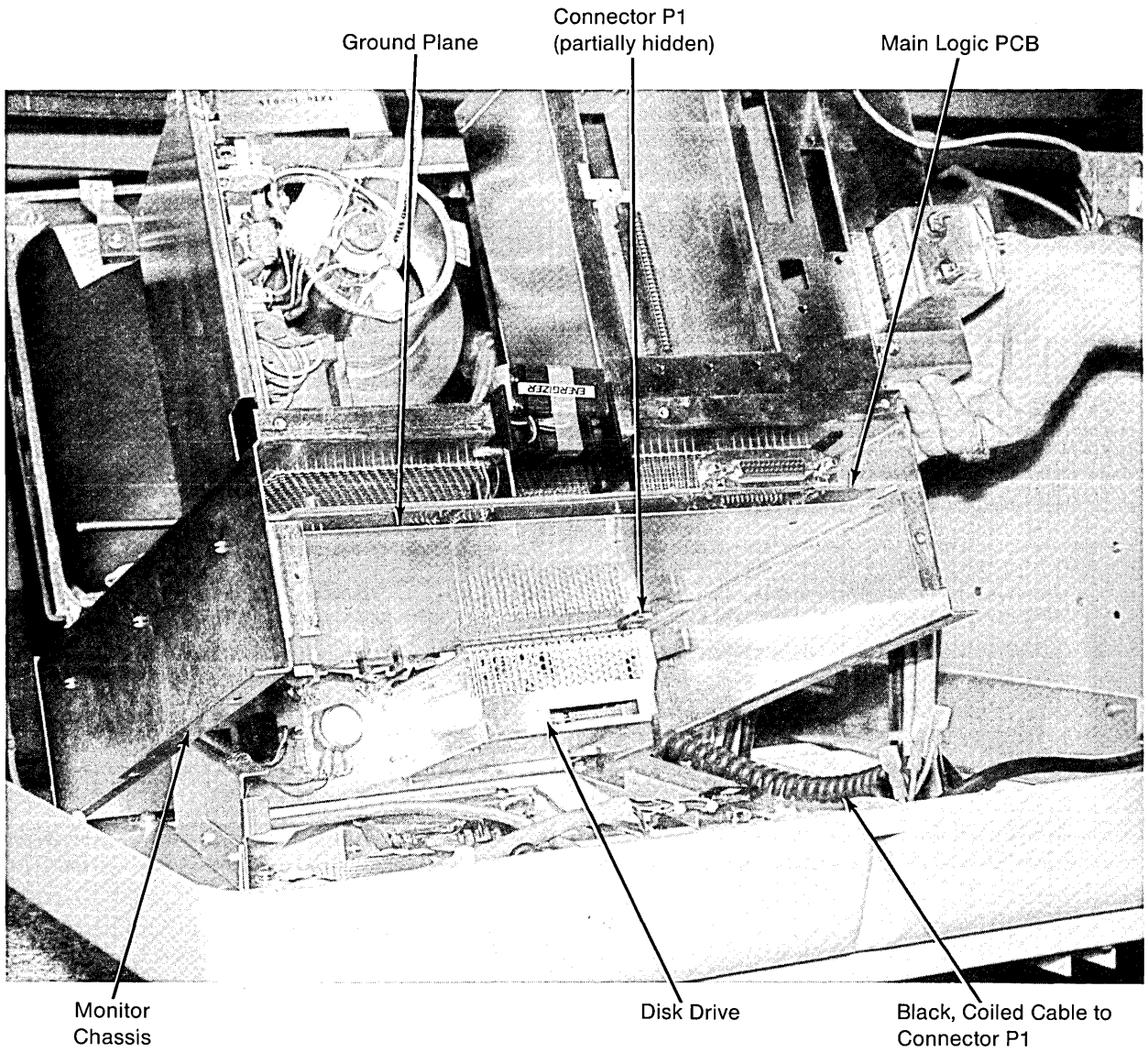


Figure 5-26. Monitor Tilted Up



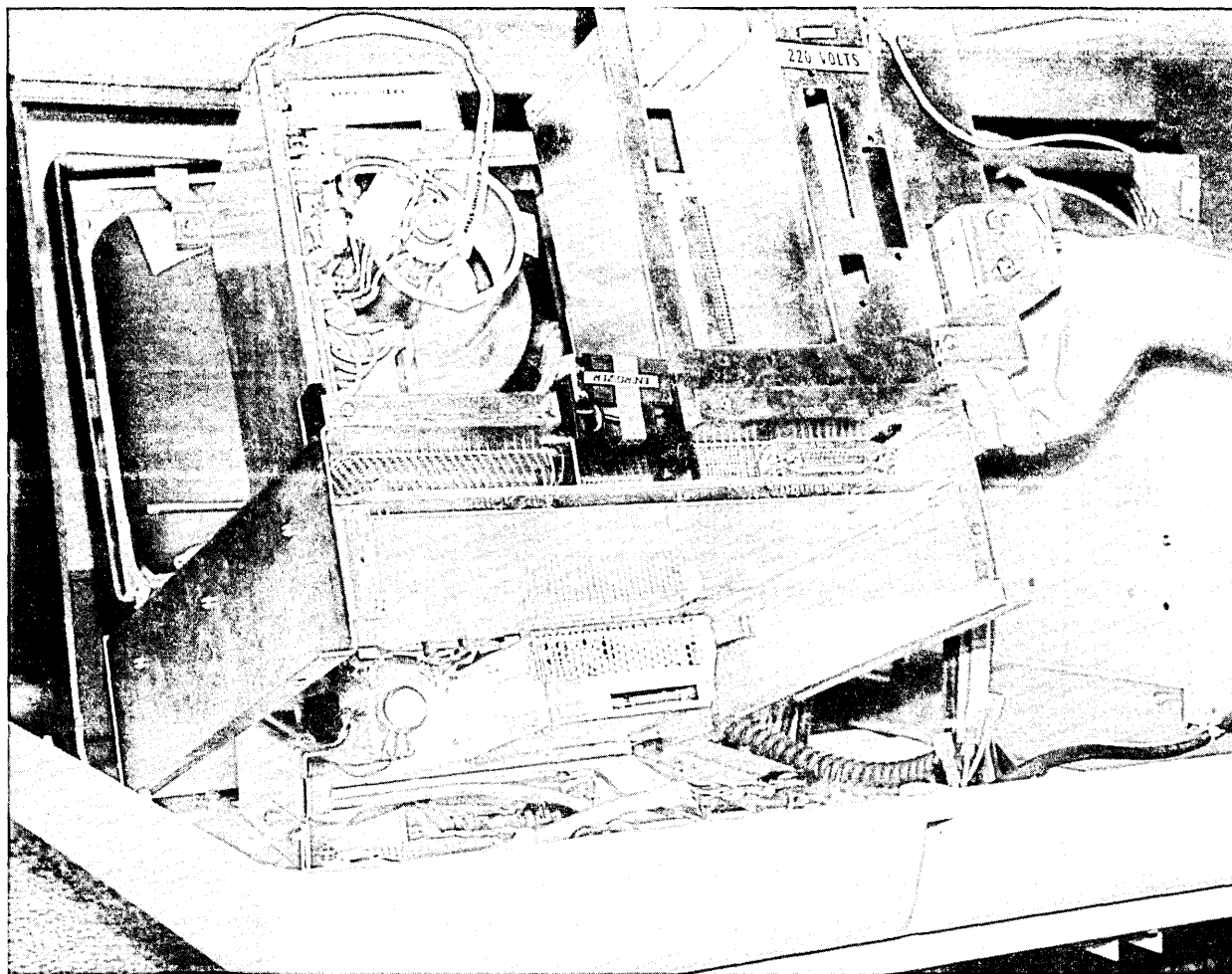


Figure 5-27. Bottom of Monitor Showing Disk Drive

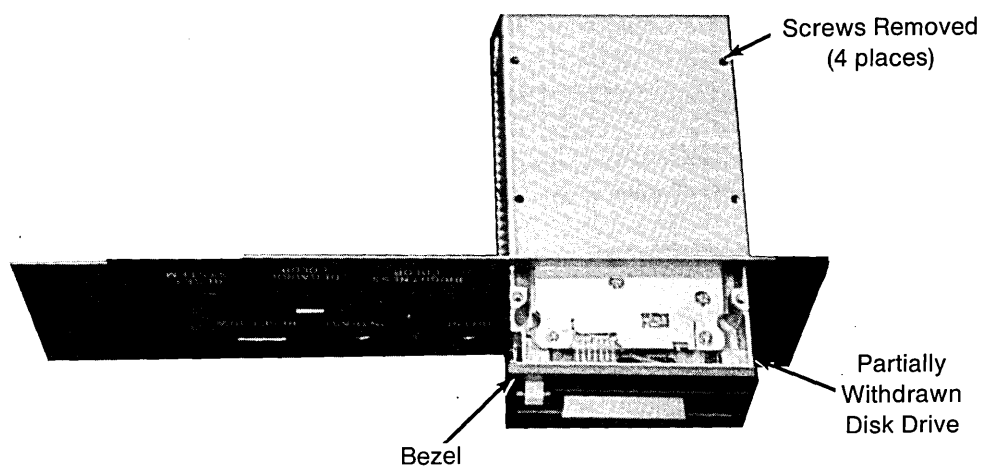
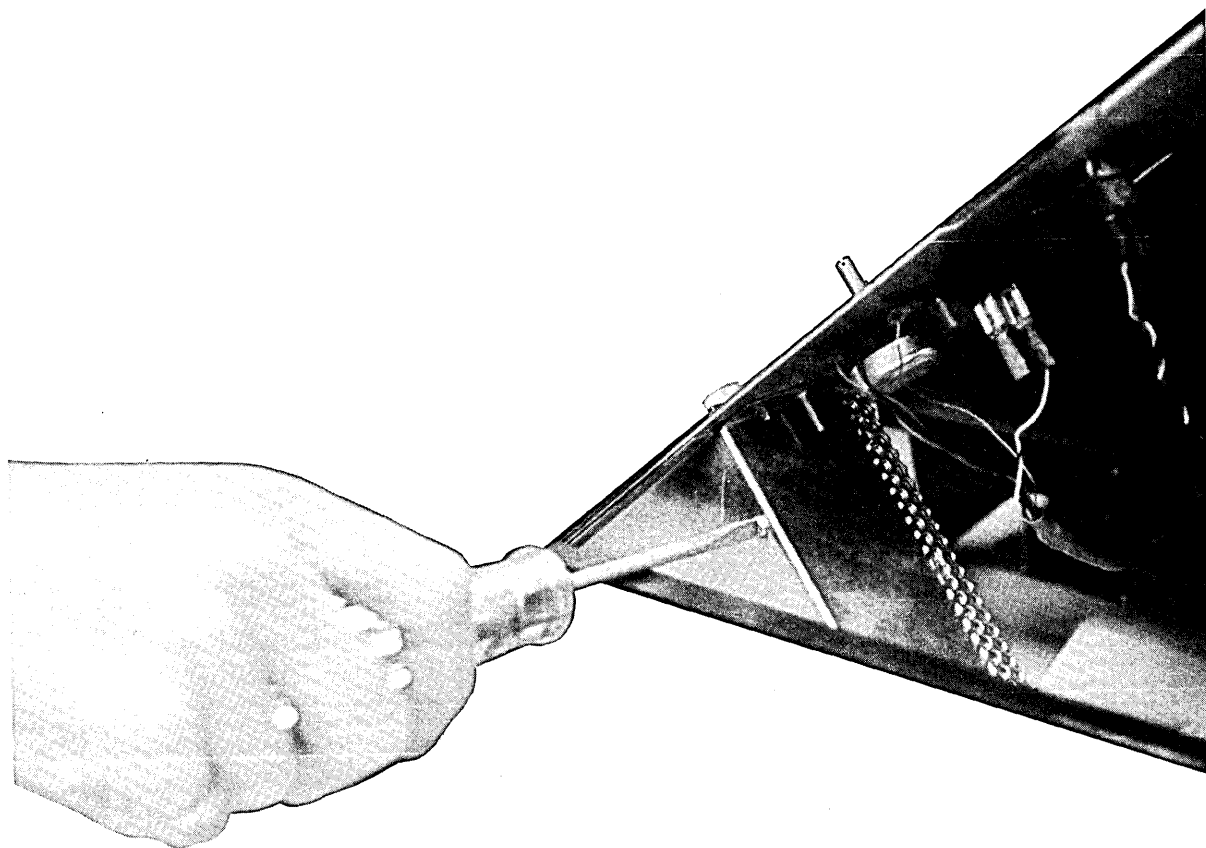


Figure 5-28. Removal of Disk Drive

## **Entire Color Monitor**

1. Remove the ac power plug of the workstation from the wall or other receptacle.
2. See figure 5-29. Remove all connections to the rear of the monitor, beginning with the connector labeled POWER IN. Remove the two ground wires fastened under screw heads.
3. See figure 5-30. Remove the cable tie anchors.
4. See figure 5-31. Remove the swivel pivot assembly (3 screws).
5. See figure 5-32. Remove the four screws (two on each side) as shown.
6. See figure 5-33. Lift and pull back on the chassis until it is clear of the base bracketry, on the bottom, and the outer frame surrounding the display faces, at the right in the figure.
7. Lift out the monitor. This completes the removal of the Color Monitor.

The replacement of the Color Monitor is done using the following procedures.

1. Lift the replacement monitor into place, using two persons, if possible.
2. Attach the monitor chassis to its base bracketry in a reversal of step 5, above.
3. Replace the swivel pivot assembly. See again figure 5-31.
4. Replace the cable tie anchors. See again figure 5-30.
5. Insert all the connectors in a reversal of step 2 of the removal procedure, ending with the connector labeled POWER IN. Attach the two ground wires by inserting screws through their terminating lugs.

The replacement of the Color Monitor is now complete.

## **Power Supply**

1. Remove the ac power plug of the workstation from the wall or other receptacle.
2. See figure 5-34. Open the rear door of the right pedestal assembly. Remove the connectors mating to the display generator chassis assembly.
3. See figure 5-35. Open the front door of the right pedestal assembly. Remove the four screws holding the chassis assembly; the chassis, with power supply at the rear, may then be pulled forward and out of the pedestal.

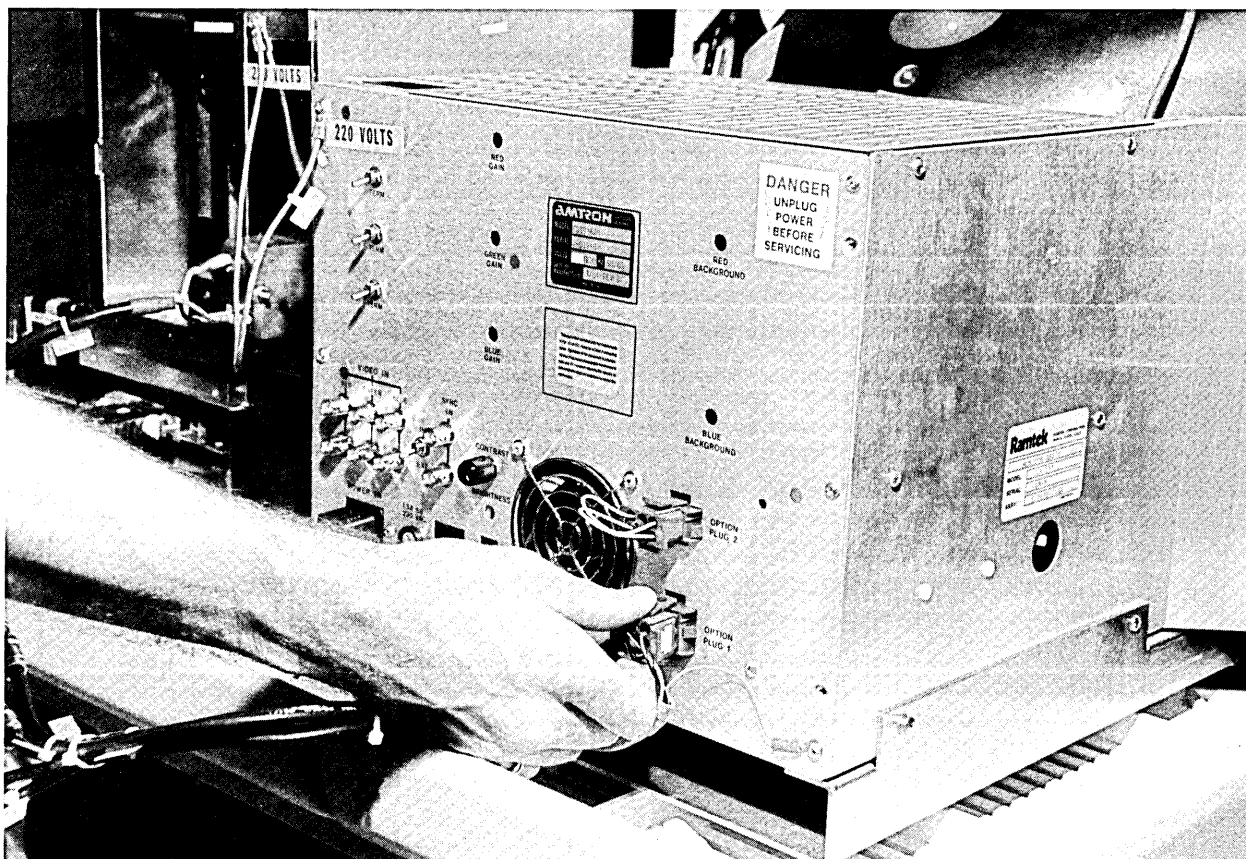


Figure 5-29. Removing Connections to Color Monitor

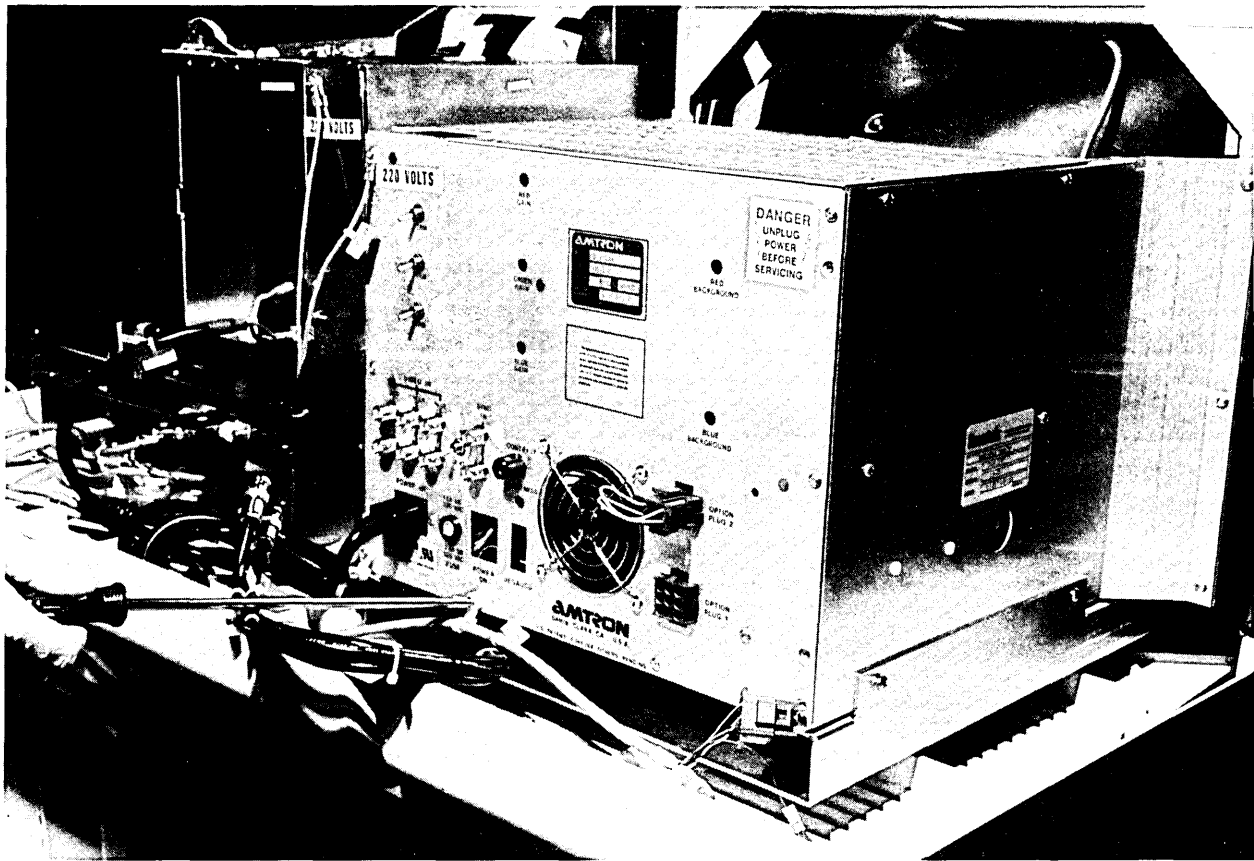


Figure 5-30. Removing Tie Anchors

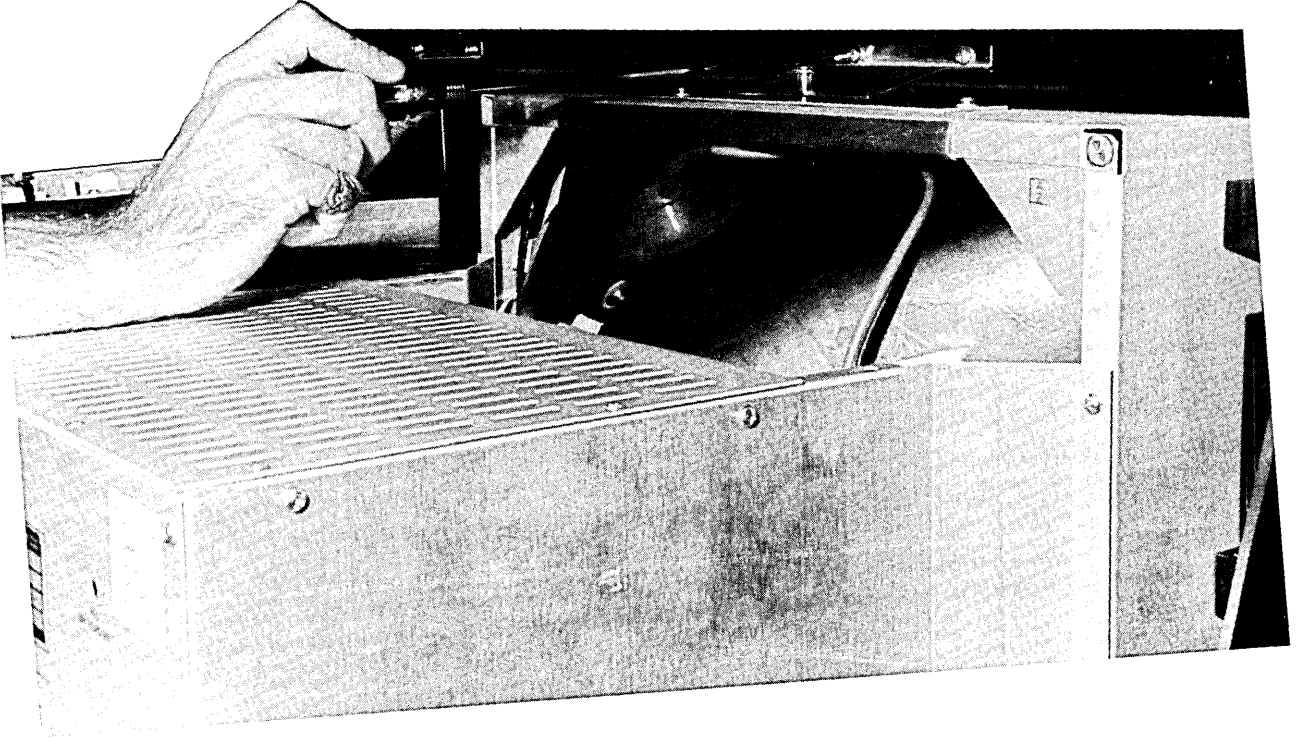


Figure 5-31. Removing Monitor Swivel Pivot Assembly

62950149

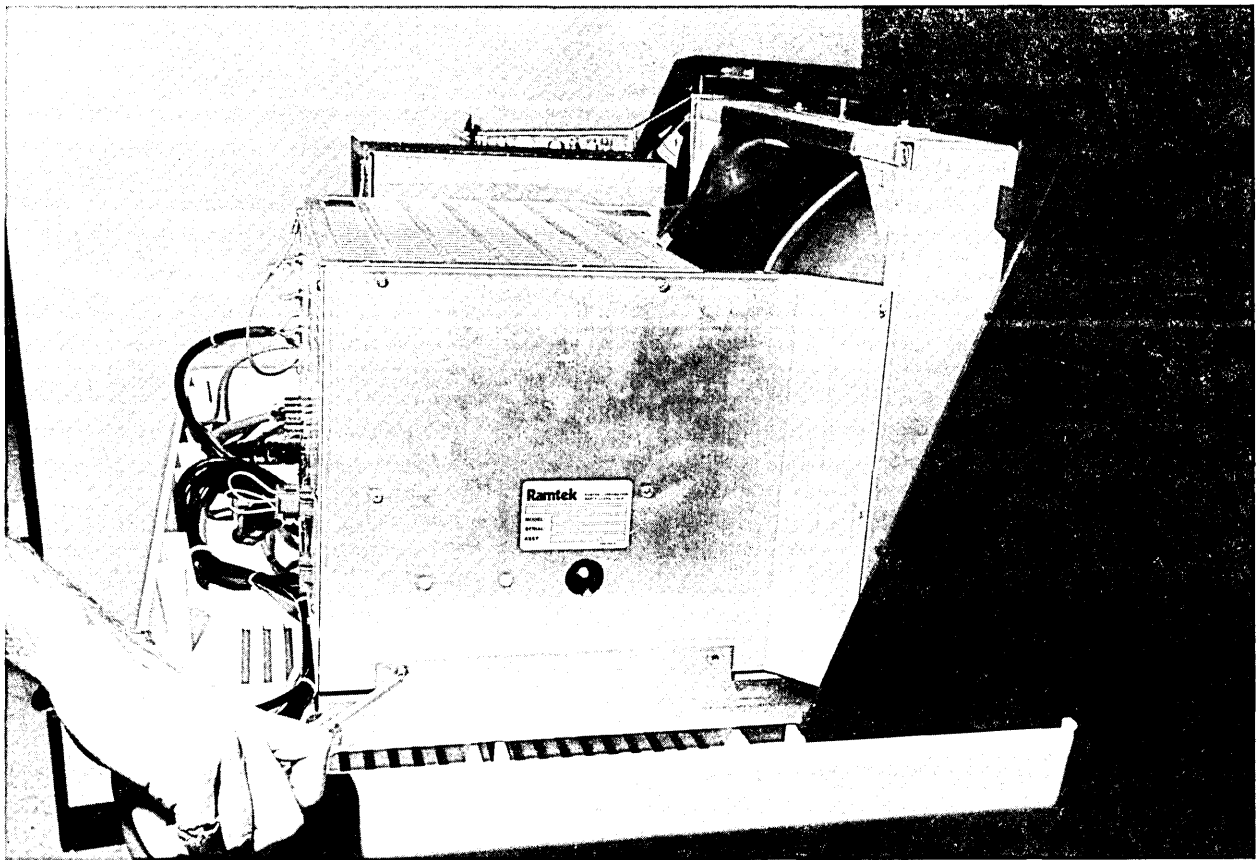


Figure 5-32. Detaching Monitor Housing from Base

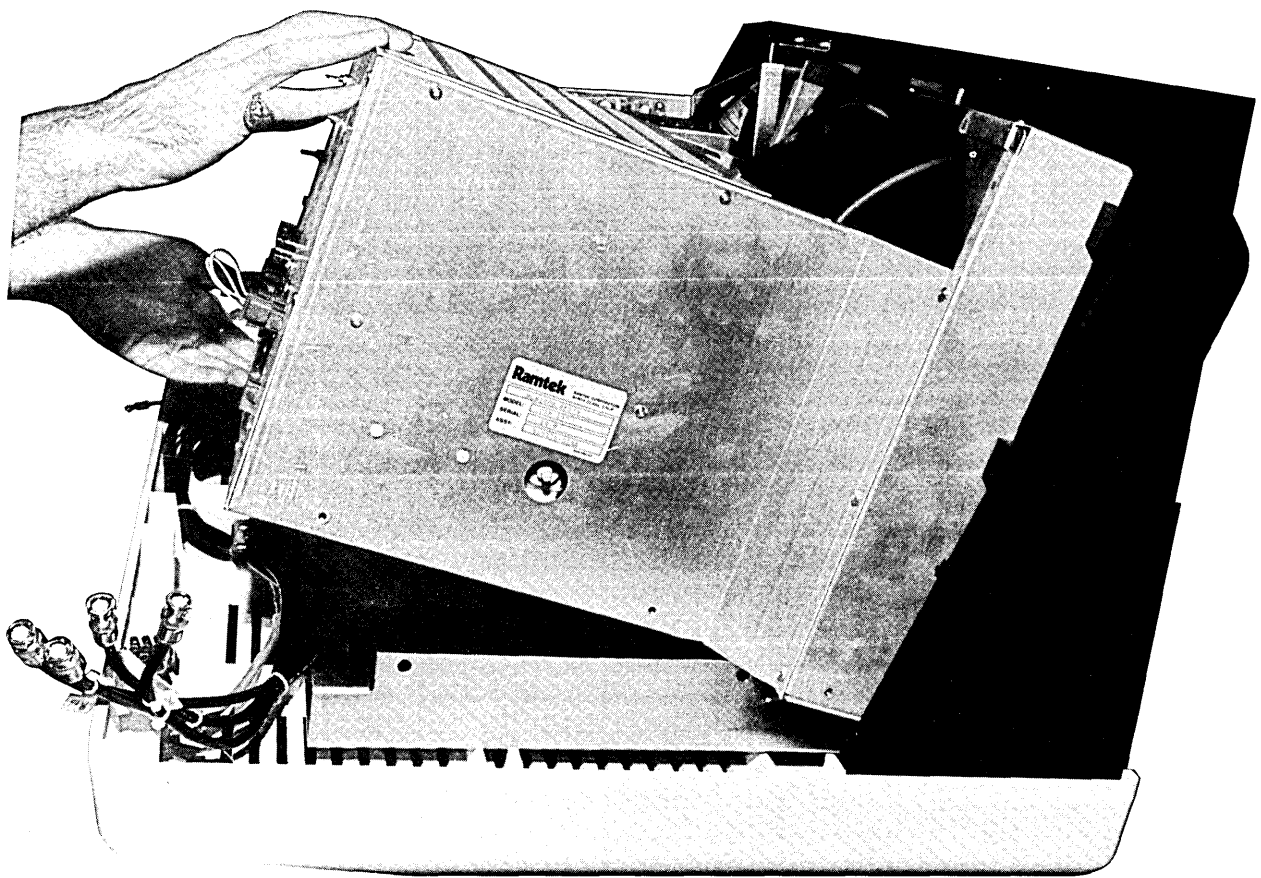


Figure 5-33. Removing the Monitor



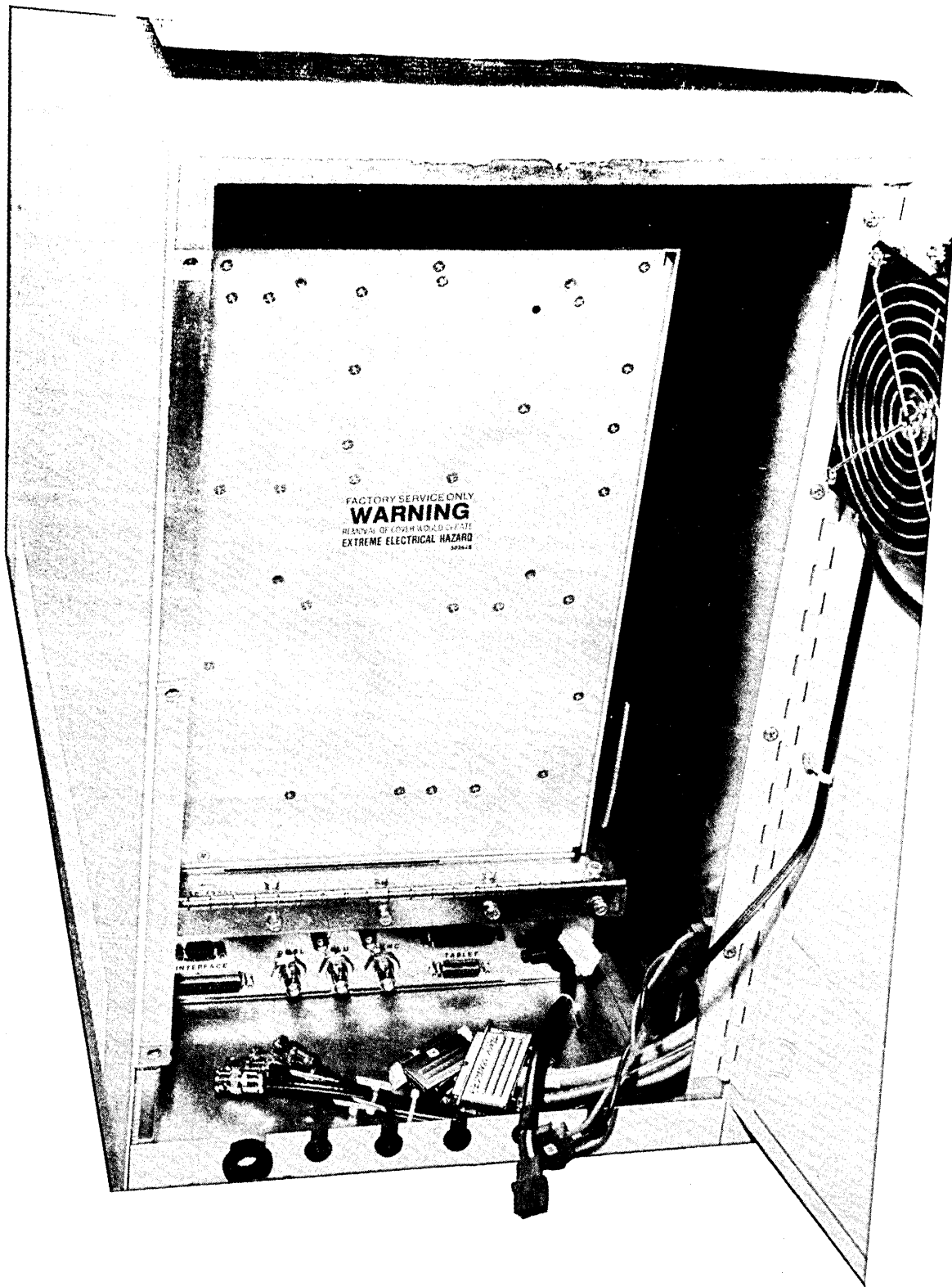


Figure 5-34. Rear of Power Supply Showing Cables Disconnected

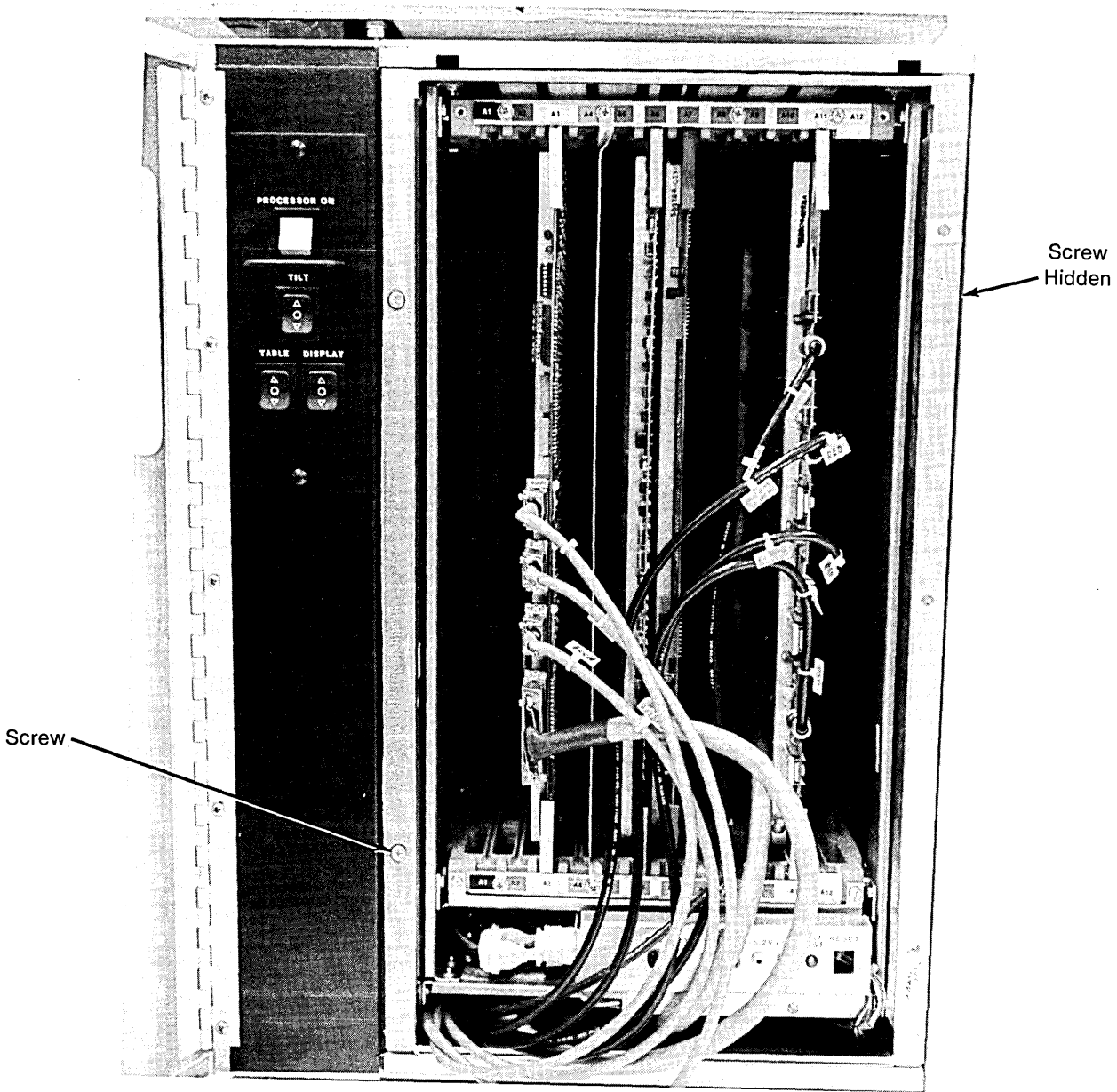


Figure 5-35. Front of Display Generator Chassis Assembly

### CAUTION

As the chassis is pulled forward, lower its front edge to the floor (approximately 2 inches or 5 centimeters). Keep feet and hands clear of injury. Take care to prevent the rear of the chassis (which contains the substantial weight of the power supply) from falling to the floor as the chassis is completely withdrawn from the pedestal housing.

4. See figure 5-36. Remove two screws holding the protective screen over the power supply terminals. Remove the screen.
5. See figure 5-37. Remove two screws holding the power supply mounting plate against the rear of the card cage housing. Note the hinge at the bottom of the supply.
6. See figure 5-38. To prevent hardware from accidentally falling into the power supply, apply tape to cover all openings in the top of the supply housing.
7. See figure 5-39. Using a nut driver and a Phillips head screwdriver, remove the connections to the terminal strips.
8. See figure 5-40. Snap off the plastic barrier as shown and remove the connections under it.
9. See figure 5-41. Remove any three of the four screws; these screws serve a double purpose, a) to fasten the brackets which restrain the heavy conductors and b) to hold the entire power supply against the L-shaped mounting plate on which the supply rests. The remaining screw holds the power supply against the plate during the next step.
10. See figure 5-42. Tilt the power supply down to expose the restraining cable which limits the motion. Raise the supply to remove tension from this cable and detach the cable fastening as shown.

### CAUTION

Provide support for the weight of the power supply when the restraint cable is detached.

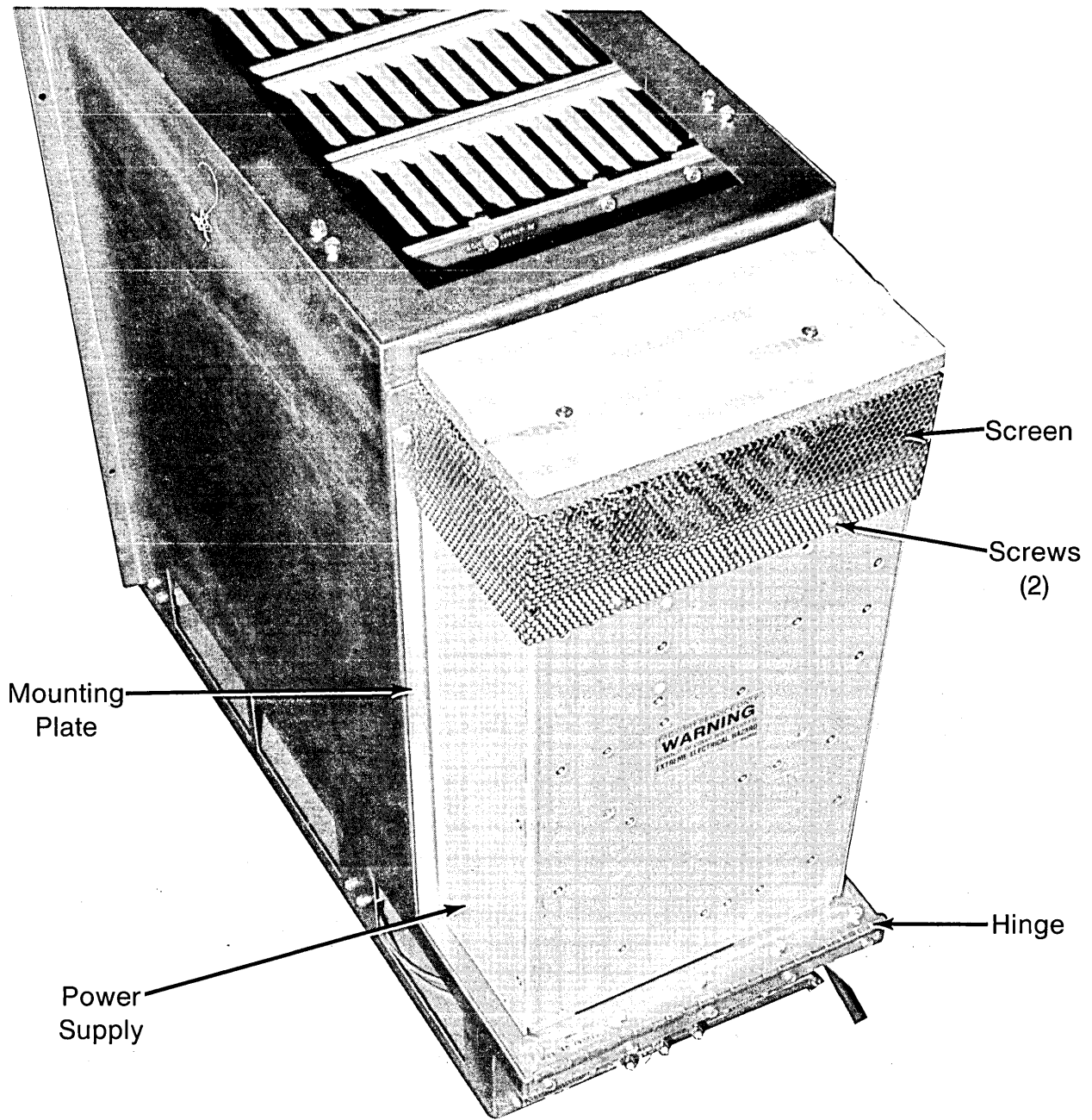


Figure 5-36. Power Supply on Rear of Display Generator Chassis

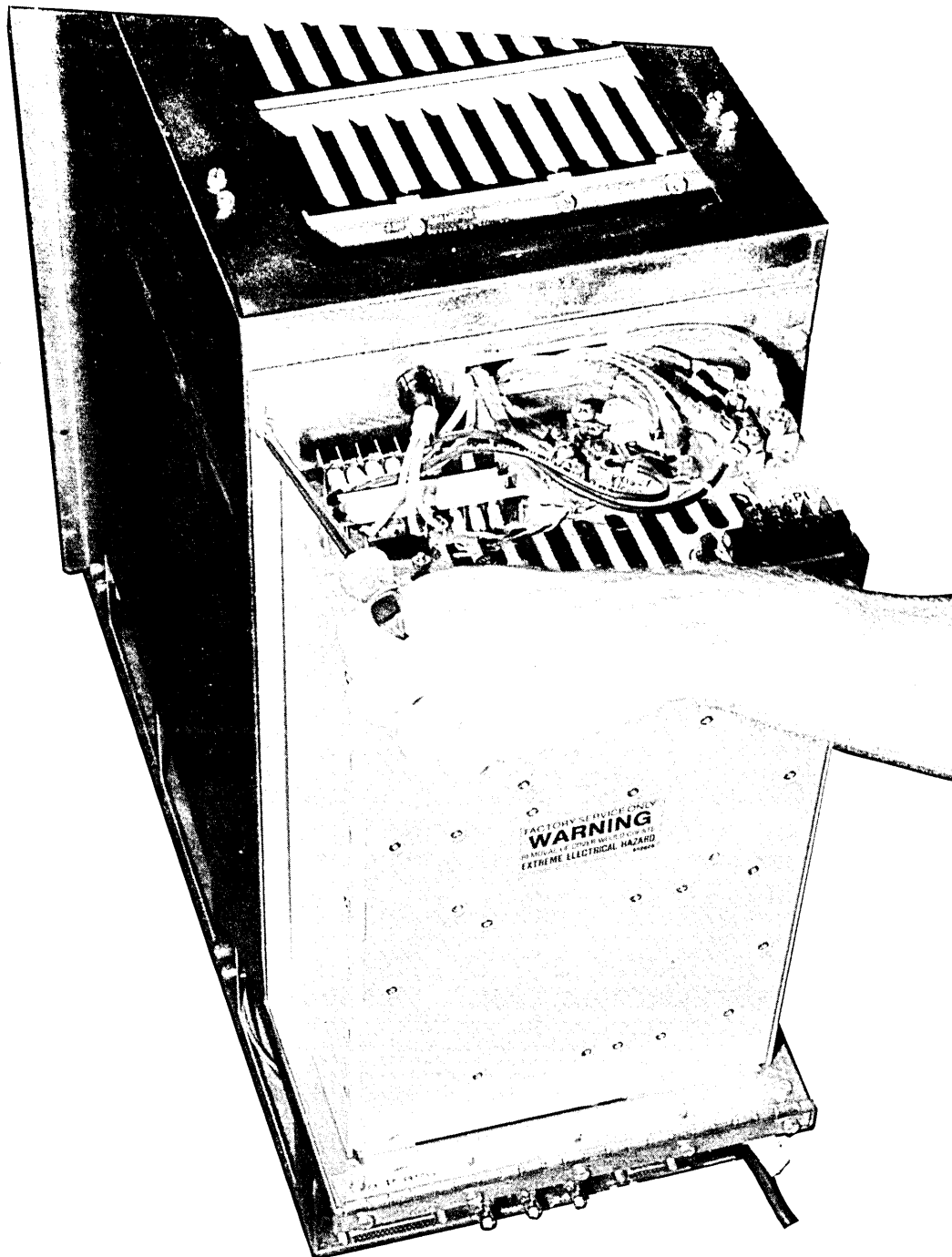


Figure 5-37. Detaching Power Supply Mounting Bracket from Display Generator Chassis Assembly

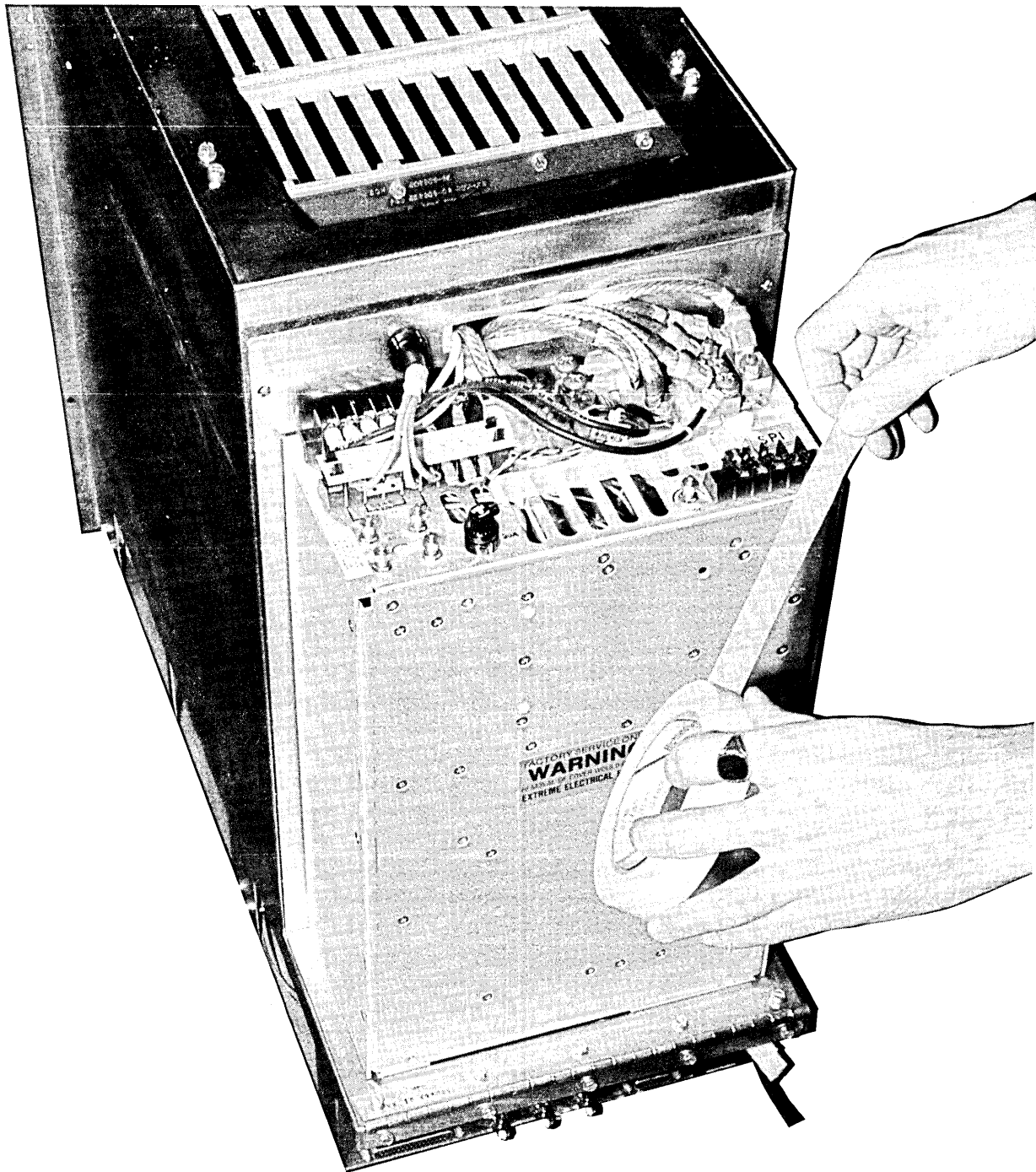


Figure 5-38. Taping Over Openings

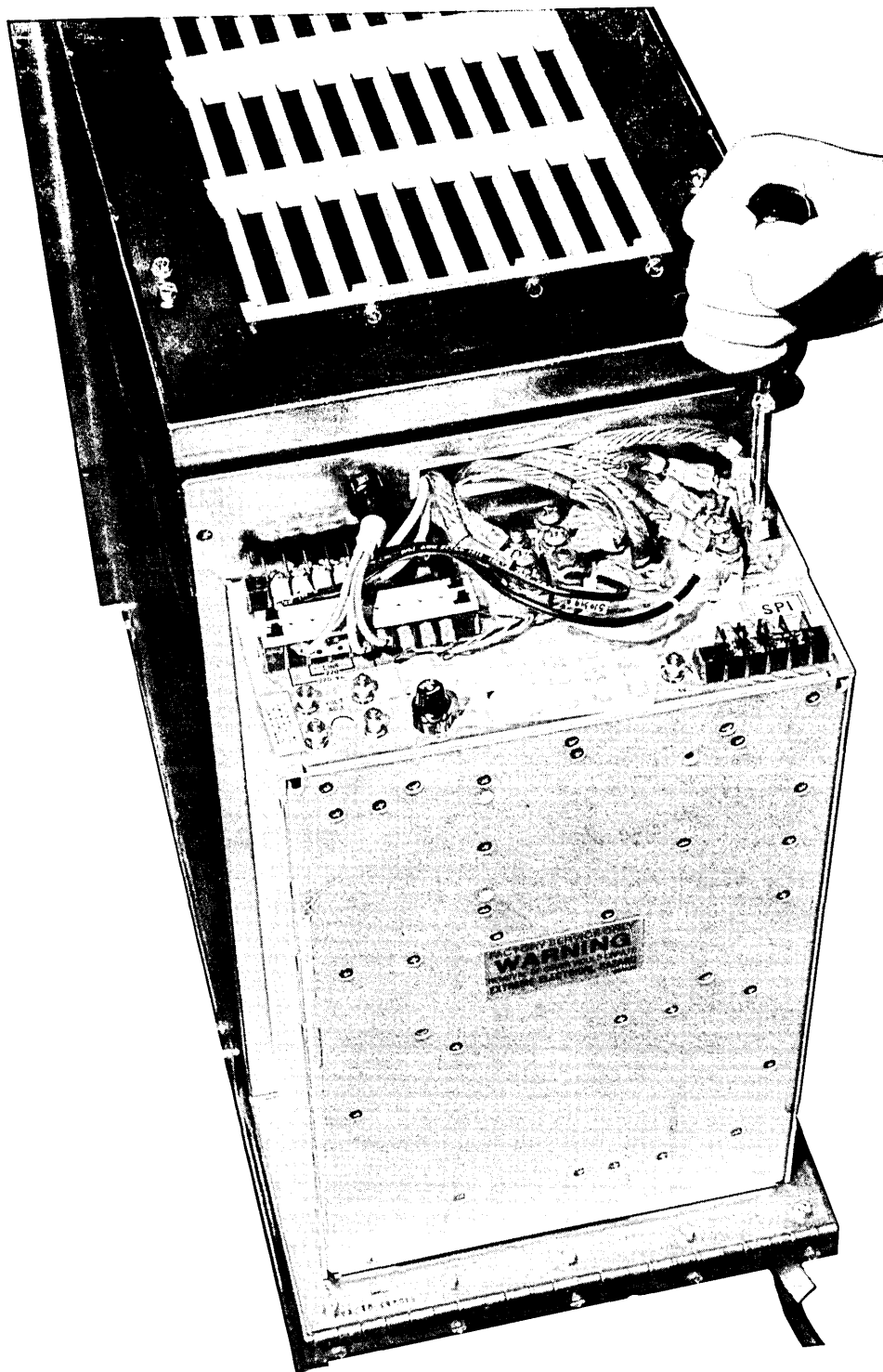


Figure 5-39. Removing Connections to Power Supply

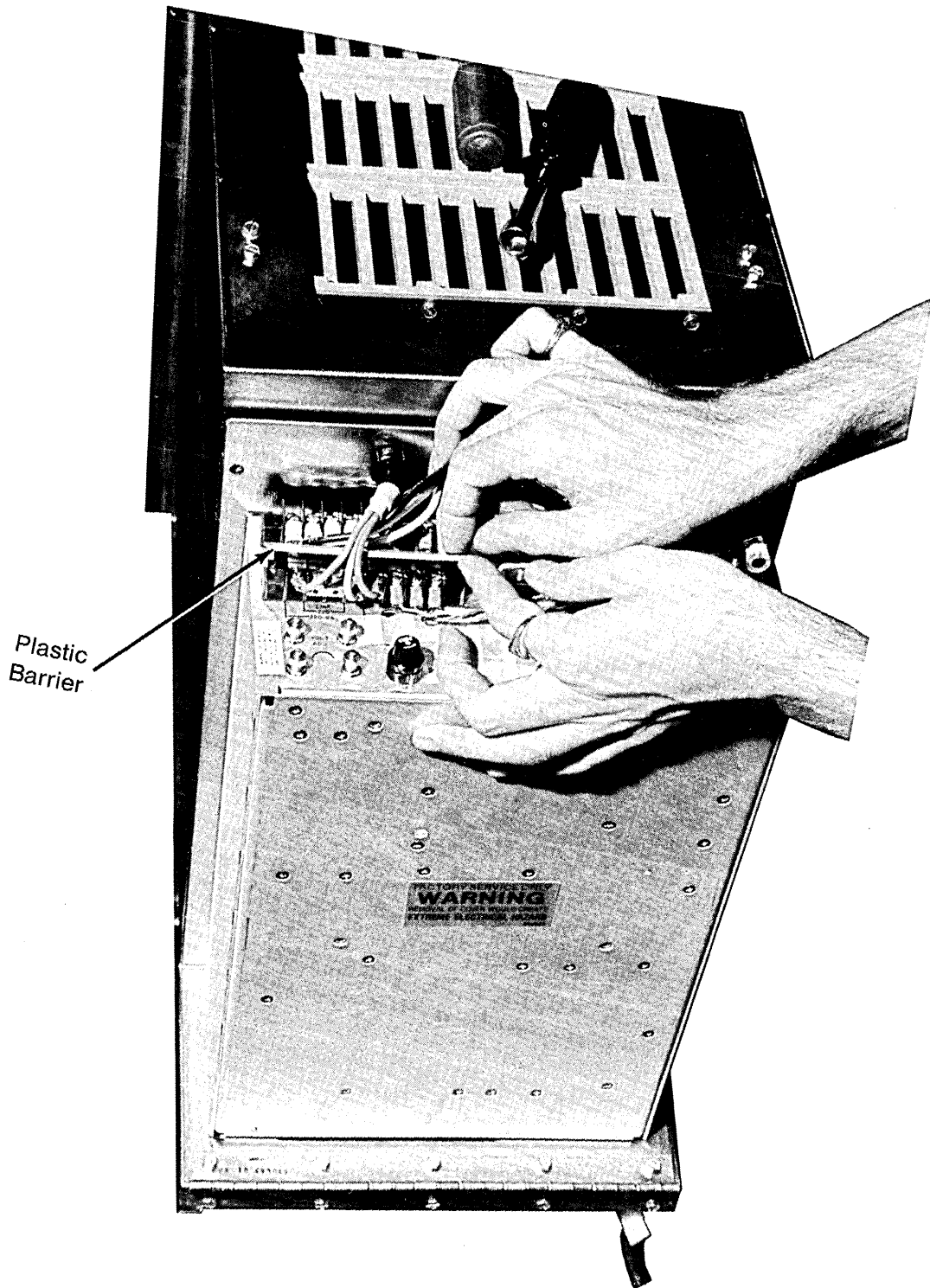


Figure 5-40. Removing Plastic Barrier Over Terminal Strip



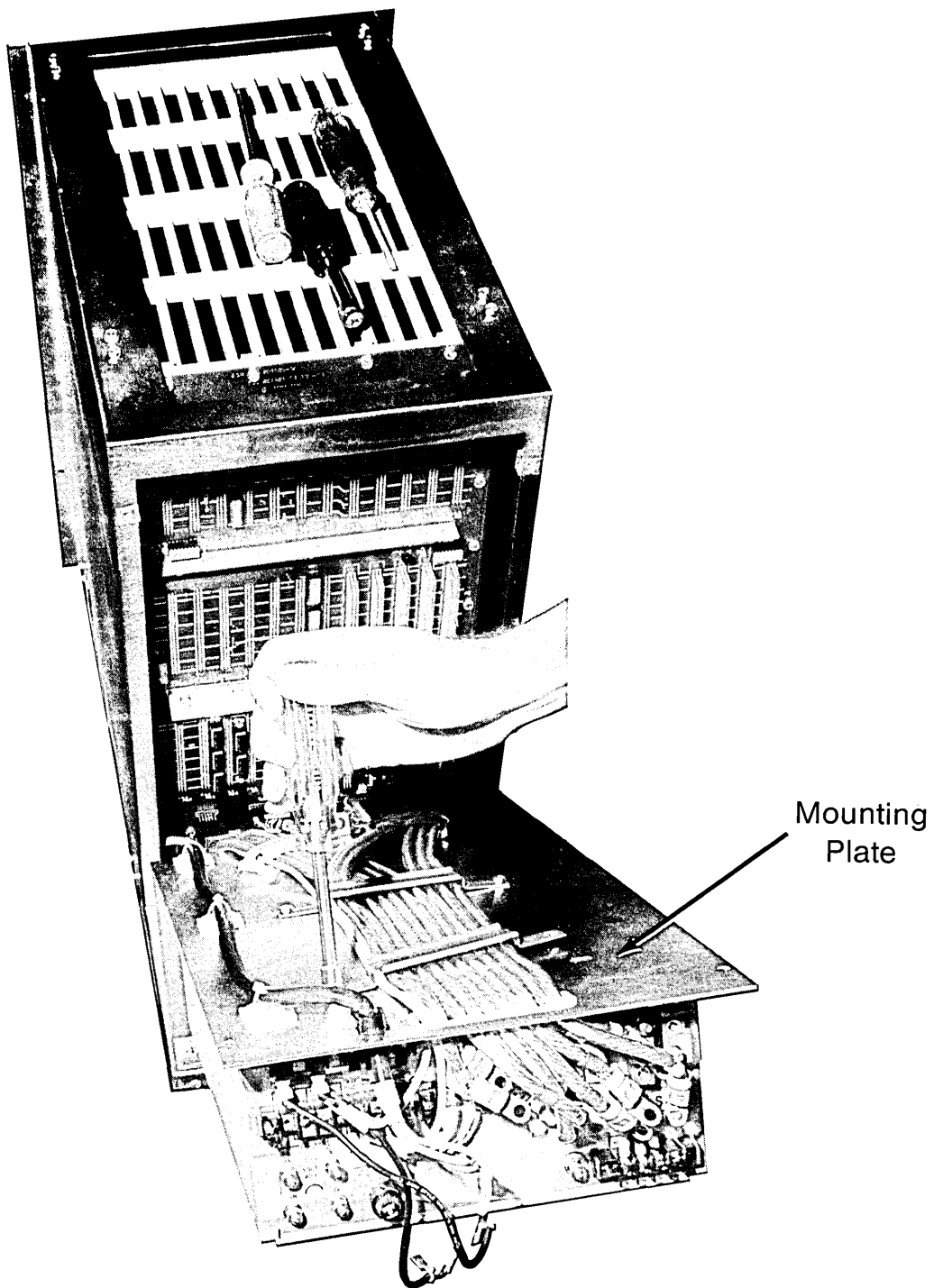


Figure 5-41. Removing Screws to Separate Power Supply

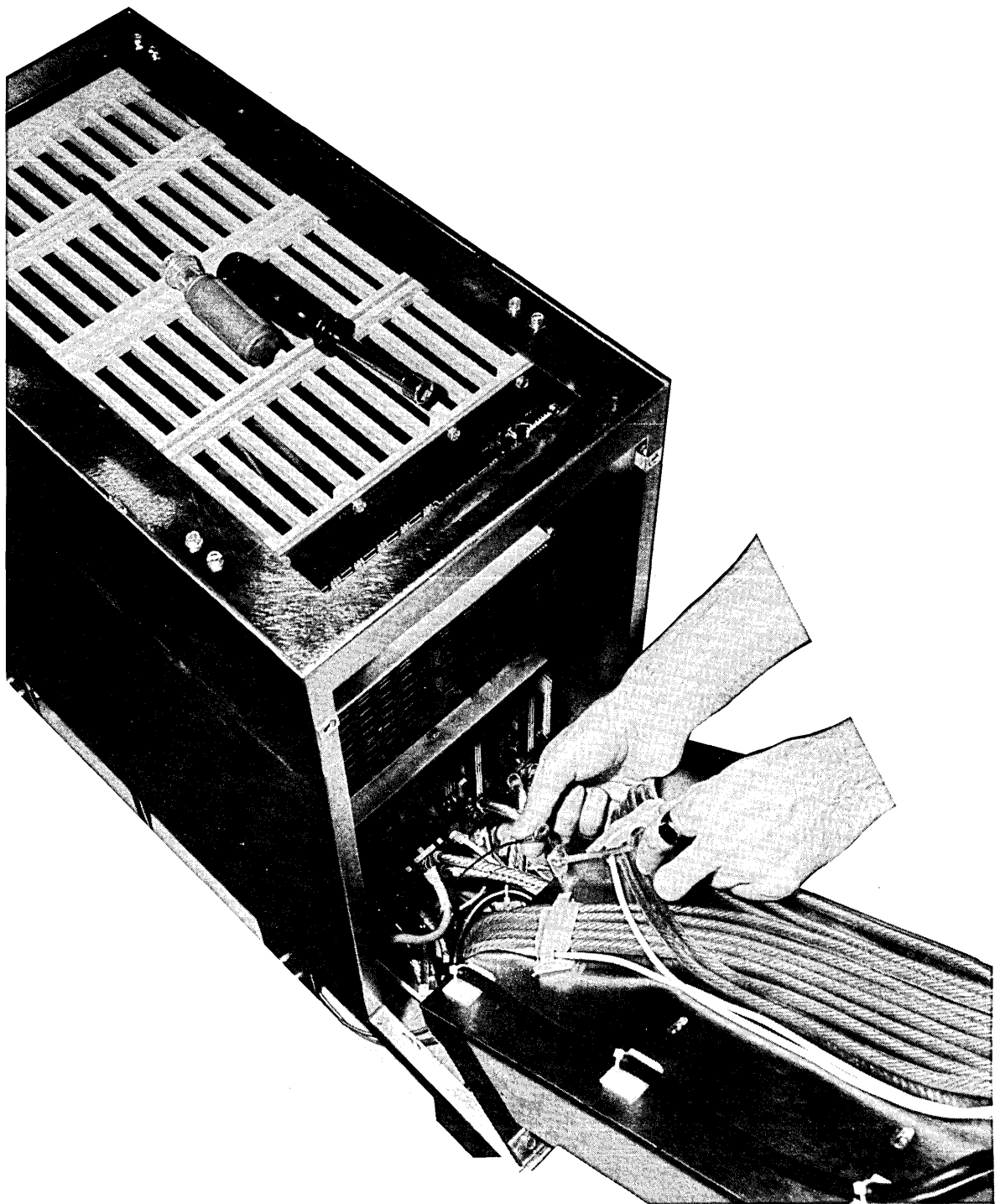


Figure 5-42. Detaching Restraint Cable

11. See figure 5-43. Cut the plastic cable ties (2), push each of the conductor groups aside, and pull out the non-reusable ties. This action reveals an additional screw which passes through the chassis mount of each cable tie and into a threaded hole in the power supply structure. To complete the task of removing the power supply, remove each of the two screws. The supply is now being held against the L-plate by just the one screw not removed in step 9.
12. While supporting the power supply against a fall to the floor, remove the one last holding screw and lower the supply to the floor. The situation will be as pictured in figure 5-44 where the L-shaped plate has been raised to show the supply now removed.

Replacement of the power supply requires the reversal of the removal sequence, with some care given to conductor placement to allow flexing as the power supply is moved about the hinged joint.

#### **CAUTION**

Slowly raise the power supply and observe carefully the flexing of the heavy conductors to assure that the conductors do not touch the backplane connection pins.

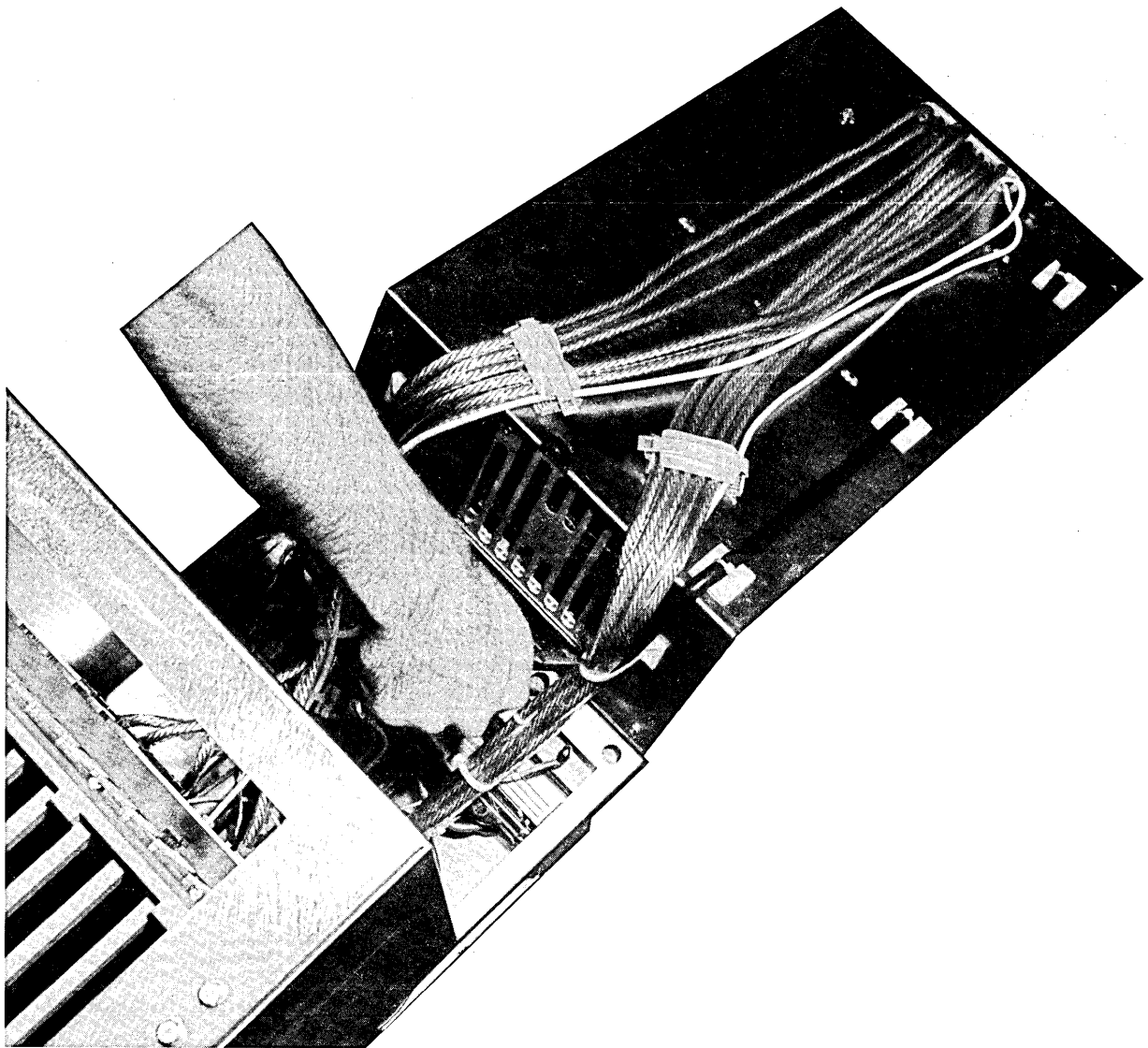


Figure 5-43. Cutting Cable Ties



Figure 5-44. Power Supply Separated From Its Mounting Plate



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## Chapter 6

### PARTS LIST

#### INTRODUCTION

This chapter contains spare parts kit lists and assembly-level parts lists.

#### SPARE PARTS LIST

The 790-20 workstation is a combination of a Ramtek graphics system and a CDC CC634B terminal. Ramtek part numbers are used for the graphics and CDC part numbers for the CC634B.

Two kits are required to maintain the 790-20 workstation. The ZKCC634B kit (CDC number 66329384) is required for the CC634B, and the ZKTN234 kit (Ramtek number 510553-02) is required for the rest of the workstation.

The CRT/yoke assembly and the keyboard assembly from the CC634B are changed by Ramtek and are assigned Ramtek part numbers. The face of the CRT is given an anti-glare coating. The keyboard is given a different cable and some new key captions.

The 790-20 kit (table 6-1) includes five basic PCBs plus two option PCBs. The rest of the option PCBs, color monitor, keyboard, and electro-mechanical parts, are stocked at WDC and FDCs. Customers with several workstations may find it practical to stock some items like the color monitor, power supply, and keyboard on site. The ZKCC634B kit (table 6-2) contains spares for the CC638B and some options. It may be more practical to spare selected parts such as the main logic board, the power supply, and the monitor board rather than a complete kit.

Table 6-1. Kit ZKTN234

Part Number	Description
	Inventory Sheet Kit DM-2
62940417	Manual, Hardware Maintenance
6350126-01	Case, Shipping
510070-01	PCB, Raster Processor
509964-01	PCB, Display List Processor
510074-02	PCB, Dynamic Ref. Memory (4 Bits)
510032-01	PCB, Video C
509069-02	PCB, Draw Processor
510080-00	PCB, Transform Processor
510092-01	PCB, Floppy Drive I/F
510601-01	Diagnostic Floppy Disc

Table 6-2. Kit ZKCC634B

Part Number	Description
51041404	Touch Panel, CRT Antiglare
61409556	Keyboard Assy
66312532	Cherry-MO -0001 Key Switch
66327973	PTD BO ASSY 185107-00
66315789	Cable ASSY Drawer Extender
90446556	PCA 81AHD-3 (Power Supply)
90446516	PCA 1ALD-1 (VX Graphic Logic)
90446597	CD ASSY 1AJD-3 Logic BD
75446270	Case
75446271	Foam Set

#### PARTS LISTS

Figures 6-1 through 6-4 are assembly-level parts lists for the workstation. Figures F07-3, F07-4, and F07-5 show the locations of parts listed in figures 6-2, 6-3, and 6-4 respectively.



PARENT PART: 510550-01  
 REV: XA  
 DATE: 27-Sep-84

FINAL ASSY, CDC WORKSTATION

ITEM NO.	COMPONENT PART NUMBER	DESCRIPTION REMARKS	QTY PER	UM
001	510205-01	PEDESTAL ASSY-CDC	1	EA
002	510250-01	FINAL ASSY, CHAS	1	EA
003	510206-01	DOOR, FRONT	1	EA
004	510269-01	BRACKET, DOOR	1	EA
005	510220-01	TABLE TOP ASSY	1	EA
006	510160-01	COVER ASSY	1	EA
007	510744-01	GRAPHICS TABLET ASSY	1	EA
008	510755-01	KEYBOARD ASSY, MOD-CDC	1	EA
009	0710086-01	SCREW, MACH, PPNHD, 1/4-20X.375, BRS	12	EA
010	0799312-00	WASHER, LK, #1/4, SPLIT	12	EA
011	0799707-00	SCREW, MACH, PPNHD, 8-32X.375	5	EA
012	0799805-00	SCREW, MACH, PPNHD, 10-32X.500	2	EA
013	0799991-00	SCREW, MACH, PFLHD, 10-32X.500	2	EA
014	0799803-00	SCREW, MACH, PPNHD, 10-32X.375	2	EA
015	0310070-01	FASTENER, POVHD, 1/4 TURN, Z ST, .180	3	EA
016	0710166-01	RING, RETAINING, PUSH-ON, .400X.215	3	EA
017	510402-01	CONTAINER, SHIPPING-CDC	1	EA
018	8000151-01	MANUAL, S/W, ICEM ERGNMC WKST-CDC	1	EA
019	8000153-01	MANUAL, H/W MAINT, 790 ICEM-CDC	1	EA
020	509964-01	PCB Assy, DLP DRAM	1	
021	510070-01	PCB Assy, Raster Proc DRAM	1	
022	510074-01	PCB Assy, Memory 10 x 12 DRAM	1	
023	510032-01	PCB Assy, Video C	1	

NOTES:

NO DWG EXISTS FOR THIS ASSY.  
 \*\*\*\*\*  
 1) ITEMS 009 & 010 ARE USED TO MOUNT ITEM 005.  
 \*\*\*\*\*  
 2) ITEM 011 IS USED TO MOUNT ITEM 003.  
 \*\*\*\*\*  
 3) ITEMS 012 & 013 ARE USED TO MOUNT ITEM 002 & ITEM 004.  
 \*\*\*\*\*  
 4) ITEM 014 IS USED TO MOUNT ITEM 006.  
 \*\*\*\*\*  
 5) ITEM 015 & 016 ARE USED IN ITEM 003.

Figure 6-1. Parts List, Final Assembly, CDC Workstation

PARENT PART: 510205-01  
 REV: XA  
 DATE: 27-Sep-84

PEDESTAL ASSY-CDC

ITEM NO.	COMPONENT PART NUMBER	DESCRIPTION REMARKS	QTY
001	510210-01	FILTER ASSY,AIR	1
002	510215-01	HOUSING ASSY,ACTUATOR SUPPORT	2
003	510245-01	PEDESTAL SUBASSY	1
004	510325-01	CABLE ASSY,AC PWR	1
005	510225-01	PANEL ASSY,CONTROL	1
006	510230-01	HOUSING ASSY,INNER	1
007	510240-01	CIRCUIT BREAKER ASSY	1
009	510277-01	COVER,REAR,MODESTY	1
010	510690-01	DOOR ASSY,REAR	1
011	510335-01	ACTUATOR ASSY,PRIMARY TANDEM DR-MOD	1
012	510227-01	ACTUATOR,SECONDARY,TANDEM DRIVE	1
013	510213-01	PLATE,MTG,TANDEM DRIVE.MOTOR	1
014	510214-01	PLATE,MTG,TANDEM DRIVE-GEAR HSG	1
015	510219-01	BRACKET,MTG,ACTUATOR	2
016	510228-01	SHAFT.PIVOT,ACTUATOR	2
017	510229-01	BRACKET,SUPPORT,TANDEM DRIVE.MTR	2
018	510249-01	SHAFT,DRIVE	1
019	510313-01	BRACKET,MTG,PILLOW BLOCK	2
020	510650-01	HOUSING ASSY,OUTER	1
021	510276-01	BRACKET,LOCATING,LIMIT SWITCH	1
022	510207-01	WASHER,RUBBER	3
023	510613-01	PLATE,PIVOT,MON	1
024	510242-01	DOOR,CIRCUIT BREAKER	1
025	9060051-01	SWITCH,ROLLER ACTUATOR,SPDT,5 AMPS	3
026	510314-01	PLATE,MTG,BEARING	2
027	510316-01	BRACKET,LOCK,TILT MECHANISM	1
028	510316-02	BRACKET,LOCK,TILT MECHANISM	1
029	510278-01	BUSHING,UP-DOWN	2
030	510279-01	WASHER,UP-DOWN	2
031	510616-01	BRACKET,LOCK,MONITOR HSG	2
032	510315-01	BUSHING,LOCK	1
033	510345-01	PANEL,REAR,CABLE I/O	1
034	510237-01	BRACKET,MTG,LIMIT SWITCH	1
035	510288-01	BRACKET,MTG,LIMIT SWITCH	1
036	510331-01	COVER,LIMIT SWITCH	1
037	510165-01	BASE ASSY	1
038	0310071-01	RING,RETAINING,E-STYLE,.500X.392	4
039	0310067-01	NUT,WELL,1/4-20	8
040	7110002-01	BEARING,THRUST	2
041	8640023-01	RECEPTACLE,CLIP-ON,.055-.090	3
042	0310053-01	NUT,SHEET METAL,10-32	4
043	0310069-01	LATCH,ADJUSTABLE GRIP	1
044	8606139-00	TERMINAL,SLIP ON,22-18AWG,-.250TAB,F	4
045	0710138-01	SCREW,CAP,SOC HD,1/2-20X1.00	2
046	510178-01	BRACKET,FORWARD	1
047	510178-02	BRACKET,FORWARD	1
048	0310068-01	SPRING,EXTENSION,.437OD,ZINC	8
049	1710005-01	GROMMET,RUBBER,.187	4
050	0710155-01	BRACKET,MTG,CAP,STRAP-TYPE	2

Figure 6-2. Parts List, Pedestal Assy - CDC, Sheet 1 of 2

PARENT PART: 510205-01  
 REV: XA  
 DATE: 27-Sep-84

PEDESTAL ASSY-CDC

ITEM NO.	COMPONENT PART NUMBER	DESCRIPTION REMARKS	QTY
051	510175-01	MONITOR ASSY, CLR, 19"	1
052	510706-01	FINAL ASSY, MON, ALPHANUM	1
055	510275-01	CABLE ASSY, INPUT PWR, MON, CLR	1
059	510289-01	CABLE ASSY, GND JUMPER	1
060	510291-01	CABLE ASSY, COAX-RED	1
061	510711-01	PLUG, JUMPER, MON, CLR	1
062	0710158-01	SCREW, MACH, PPNHD, 4-40X1.00	2
063	510294-01	CABLE ASSY, INPUT PWR, MON, ALPHANUM	1
064	510295-01	CABLE ASSY, I/F, DIS GEN/MON, ALPHANUM	1
065	510296-01	CABLE ASSY, DISK DRIVE	1
066	510297-01	CABLE ASSY, KEYBOARD	1
067	510298-01	CABLE ASSY, I/F, DIS GEN/TABLET	1
068	3854059-00	TUBING, SHRINK, .750, RED	
069	0710159-01	SCREW, CAP, HXHD, 1/4-20X2.00	1
070	510291-02	CABLE ASSY, COAX-GRN	1
071	510291-03	CABLE ASSY, COAX-BLU	1
072	510320-01	CABLE ASSY, MAIN SW/CKT BRKR	1
073	510291-04	CABLE ASSY, COAX-SYNC	1
074	510614-01	PLATE, PIVOT, 15" MON	1
076	510324-01	CABLE ASSY, PWR SW, DIS GEN	1
077	510328-01	CABLE ASSY, TABLE LIM	1
078	510329-01	CABLE ASSY, TABLE DIS LIM	1
079	510330-01	CABLE ASSY, EXT-TILT MOTOR	1
085	0710117-01	SCREW, MACH, PPNHD, 10-32X.375, BLKOX	18
086	0799803-00	SCREW, MACH, PPNHD, 10-32X.375	12
087	0799808-00	SCREW, MACH, PPNHD, 10-32X.625	2
088	0799414-00	NUT, KEP, 10-32	4
089	0799707-00	SCREW, MACH, PPNHD, 8-32X.375	11
090	0799410-00	NUT, KEP, 8-32	9
092	0799402-00	NUT, KEP, 4-40, W/LKWASHER	4
093	0799606-00	SCREW, MACH, PPNHD, 4-40X.625	4
094	0799641-00	SCREW, MACH, PPNHD, 1/4-20X.500	5
095	0799116-00	WASHER, FLT, #1/4	7
096	0799105-00	WASHER, LK, #1/4, INTL TOOTH	5
097	0799652-00	SCREW, MACH, PPNHD, 6-32X.375	22
098	0799406-00	NUT, KEP, 6-32	2
099	0799202-00	WASHER, FLT, #6	8
100	0799516-00	NUT, HEX, 1/4-20	1
101	0799682-01	SCREW, MACH, PTRHD, 8-32X.500, BLKOX	2
102	0710165-01	WASHER, FLAT, .500, COLD ROLL STEEL	2
103	0799618-00	SCREW, MACH, PPNHD, 1/4-20X1.25, BRS	8
104	0710105-01	WASHER, FLT, #5/16	2
105	0710163-01	NUT, HEX, 5/16-24, ELASTIC LOCK	2
106	9550562-00	TIE, CABLE, W/#6 SCREW HEAD	1
107	0799203-00	WASHER, FLT, #8	1
108	9550563-00	TIE, CABLE, 8.00 L	10
109	1710006-01	GROMMET, RUBBER, .500ID	1
110	1710007-01	GROMMET, RUBBER, .250	5
111	510775-01	LOGO, IDENT-CDC EMBLEM	1

Figure 6-2. Parts List, Pedestal Assy - CDC, Sheet 2 of 2

PARENT PART: 510250-01  
 REV: XA  
 DATE: 28-Aug-84

FINAL ASSY, CHAS

ITEM NO.	COMPONENT PART NUMBER	DESCRIPTION REMARKS	QTY
001	510251-01	CHASSIS, MAIN	1
002	510255-01	CARD CAGE ASSY	1
003	510265-01	PLATE ASSY, FAN	1
004	510260-01	PANEL ASSY, CTL	1
005	510258-01	BRACKET, PWR SUPPLY	1
006	510009-01	POWER SUPPLY, SWITCHING	1
007	510261-01	CLAMP, CABLE	2
008	510263-01	HINGE, PWR SUPPLY BRACKET	1
009	510262-01	COVER, POWER SUPPLY	1
011	6910068-01	LINE FILTER, 12 AMPS	1
012	8609126-00	BLOCK, TERMINAL, 18 POS	1
013	0310044-01	BUSHING, STRAIN RELIEF, N, BLK	1
014	8603100-00	STRAIN RELIEF, .750 MTG HOLE	1
015	0200050-01	SCREW, MACH, HXHD, 8-32X.375, W/LKWSH	34
016	0799203-00	WASHER, FLT, #8	26
017	510611-01	POWER DISTRIBUTION, CBL DIAG	0
019	0799703-00	SCREW, MACH, PPNHD, 8-32X.500	1
020	0799652-00	SCREW, MACH, PPNHD, 6-32X.375	2
021	0799410-00	NUT, KEP, 8-32	1
022	0799406-00	NUT, KEP, 6-32	9
023	502956-00	RESTRAINER, CABLE	1
024	1703116-00	STRIP, GROMMET	2
025	9550550-00	MOUNT, CABLE TIE, 1" SQ, ADHESIVE BACK	2
026	509778-01	CABLE ASSY, PWR SUPPLY TO TERM BLOCK	1
027	510317-01	CABLE ASSY	1
028	510334-01	CABLE ASSY	1
029	510333-02	CABLE ASSY, BRN, 16 AWG	1
030	510333-01	CABLE ASSY, BLU, 16 AWG	1
031	510319-01	CABLE ASSY, I/F	1
032	508389-01	CABLE ASSY, RS232, 9 PIN	1
033	510327-01	CABLE ASSY, HARDCOPY	1
034	508388-01	CABLE ASSY, VIDEO (4')	5
035	510303-01	CABLE ASSY, DISK DRIVE	1
036	510326-01	CABLE ASSY, MON, ALPHANUM	1
037	510318-01	CABLE ASSY, TABLET	1
038	8640201-01	CONN, LOCKING, PLUG, 2 POS	1
039	3854008-00	TUBING, SHRINK, .750, BLU	1
040	510332-01	CABLE ASSY	2
041	508673-01	CABLE ASSY, +5VDC, RED, 6 AWG	2
042	508676-01	CABLE ASSY, -5VDC, BLU, 6 AWG	2
043	509205-01	CABLE ASSY, -2VDC, WHT, 6 AWG	1
044	508677-01	CABLE ASSY, DC GND, BLK, 6 AWG	5
045	508667-01	CABLE ASSY, -12VDC, YEL, 12 AWG	1
046	508668-01	CABLE ASSY, +12VDC, WHT, 12 AWG	1
047	510349-01	CABLE ASSY, GND, 12 AWG, BLK	2
048	508730-01	CABLE ASSY, TERMINAL BLOCK JUMPER	1
049	0310053-01	NUT, SHEET METAL, 10-32	2
050	0799805-00	SCREW, MACH, PPNHD, 10-32X.500	8
051	0799204-00	WASHER, FLT, #10	8

Figure 6-3. Parts List, Final Assy, Chassis, Sheet 1 of 2

PARENT PART: 510250-01  
REV: XA  
DATE: 28-Aug-84

FINAL ASSY, CHAS

ITEM NO.	COMPONENT PART NUMBER	DESCRIPTION REMARKS	QTY
052	0799414-00	NUT, KEP, 10-32	8
053	510092-01	PCB ASSY, DISC I/F-BUS ARBITER	1
054	0710086-01	SCREW, MACH, PPNHD, 1/4-20X.375, BRS	7
055	507277-02	BLOCK, MOUNTING, POWER SUPPLY	4
056	0799436-00	SCREW, MACH, BNDHD, 6-32X.500, NYL	4
057	9560011-01	MOUNT, FLAT CABLE, 1.00X2.24	3
058	9550551-01	MOUNT, CABLE TIE, 3/4" SQ, ADHESIVE BK	8
059	9550560-00	TIE, CABLE, 3.875" L	8
060	9550563-00	TIE, CABLE, 8.00 L	6
061	9550565-00	CABLE TIE, 5.50"L	2
062	502628-00	LABEL, POWER SUPPLY WARNING	1
063	0799803-00	SCREW, MACH, PPNHD, 10-32X.375	2

Figure 6-3. Parts List, Final Assy, Chassis, Sheet 2 of 2

PARENT PART: 510706-01  
 REV: XA  
 DATE: 25-Sep-84

FINAL ASSY, MON, ALPHANUM

ITEM NO.	COMPONENT PART NUMBER	DESCRIPTION REMARKS	QTY
001	510180-01	BASE ASSY, MON	1
002	510185-01	POWER SUPPLY AND OPTION BD ASSY	1
003	510734-01	PCB ASSY, CTLR	1
004	510679-01	KNOB-CDC	1
005	510673-01	PANEL, FRONT, MON	1
006	510161-01	OVERLAY, CTL INDICATOR	1
007	510188-01	PANEL, REAR	1
008	0510041-01	DISK DRIVE-FLOPPY, MICRO	1
009	510196-01	SUPPORT, DRIVE	1
010	510739-01	TERMINAL, SLIP ON, .187/.250 TABS. M	1
011	510285-01	CABLE ASSY, COLOR CONTROL	1
012	9052111-00	KNOB, ROUND SKIRT, 1/4" SHAFT. BLACK	1
013	9060054-01	SWITCH, ROCKER, SPST, MOM ON-NONE-OFF	1
014	0799652-00	SCREW, MACH, PPNHD, 6-32X.375	4
015	0799901-00	SCREW, MACH, PFLHD, 6-32X.375	2
016	0799604-00	SCREW, MACH, PPNHD, 4-40X.375	4
017	0799676-01	SCREW, MACH, BNDHD, M3X0.5X6MM LONG	4
018	9550550-00	MOUNT, CABLE TIE, 1" SQ, ADHESIVE BACK	2
019	0799406-00	NUT, KEP, 6-32	2
020	0799202-00	WASHER, FLT, #6	4
021	9550565-00	CABLE TIE, 5.50"L	2
022	0799803-00	SCREW, MACH, PPNHD, 10-32X.375	2
023	0799304-00	WASHER, LK, #10, SPLIT	2
024	510740-01	CABLE ASSY, RESET SYS	1
025	8601173-00	CONN, FRIC LOCK, 3 POS, RCPT, W/O EARS	1

Figure 6-4. Parts List, Final Assy, Monitor, Monochrome

**Chapter 7**  
**FOLDOUT ILLUSTRATIONS**

This chapter contains illustrations larger than one page.





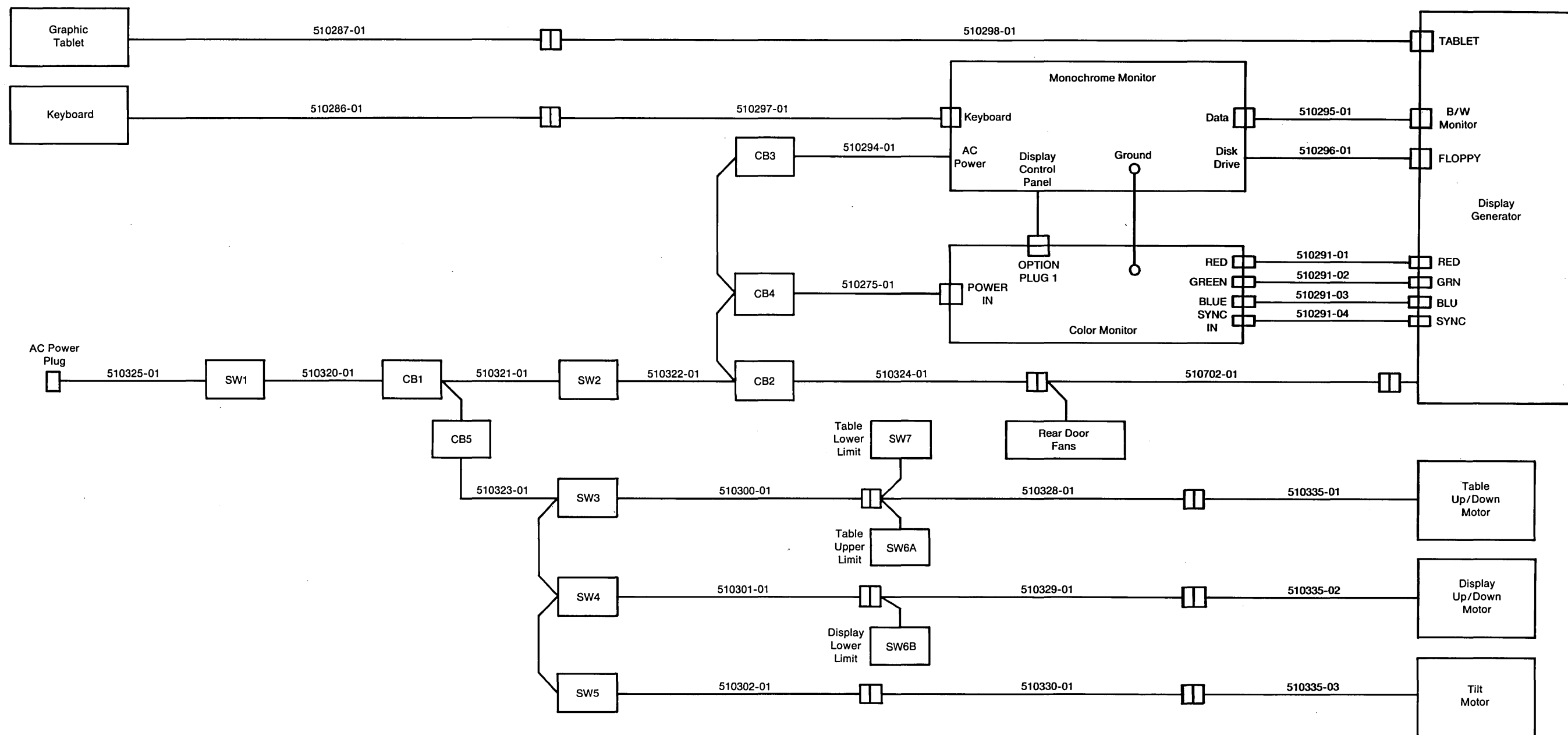


Figure F07-1. Cable Interconnect Diagram

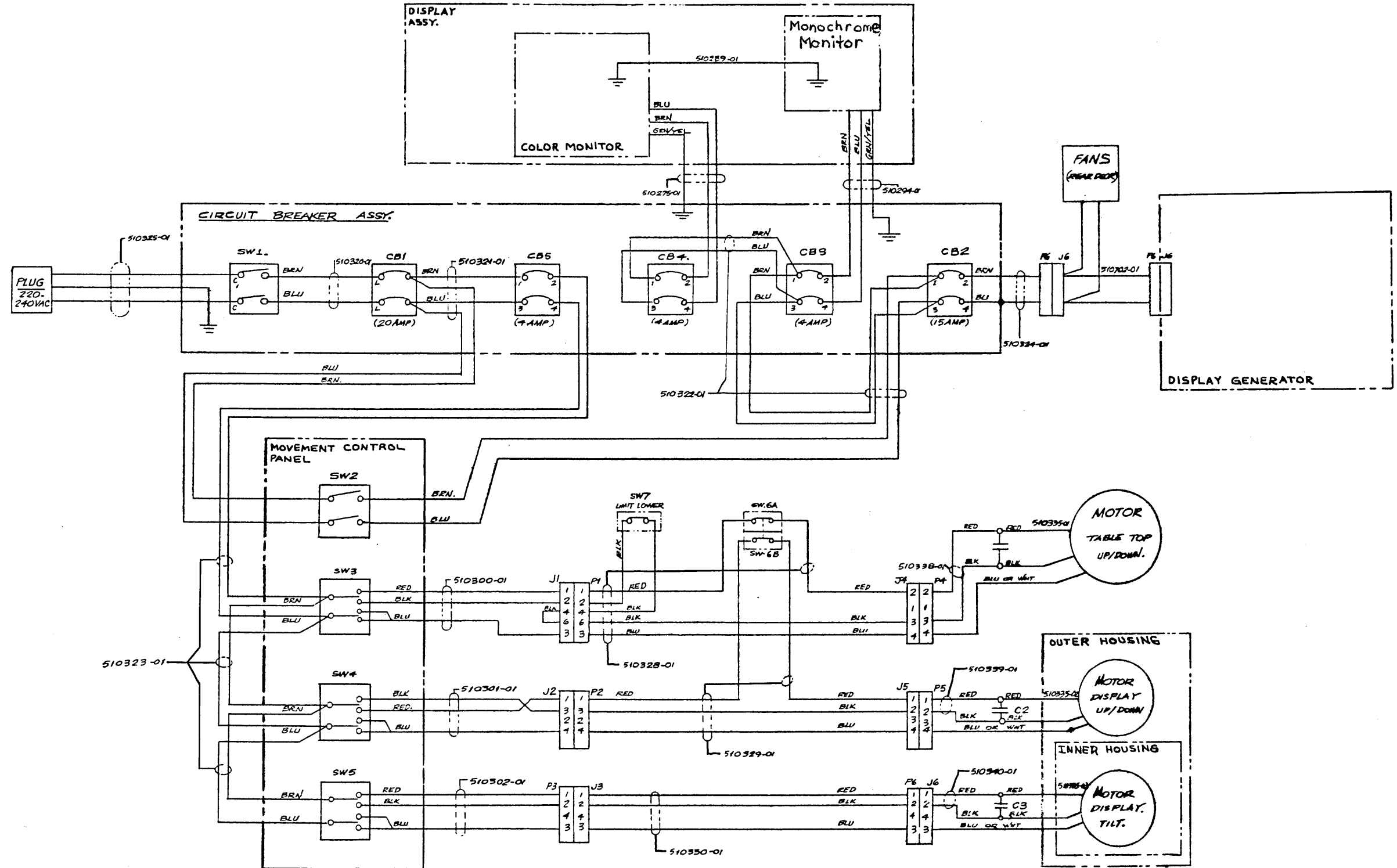


Figure F07-2. Workstation AC Power Wiring Diagram

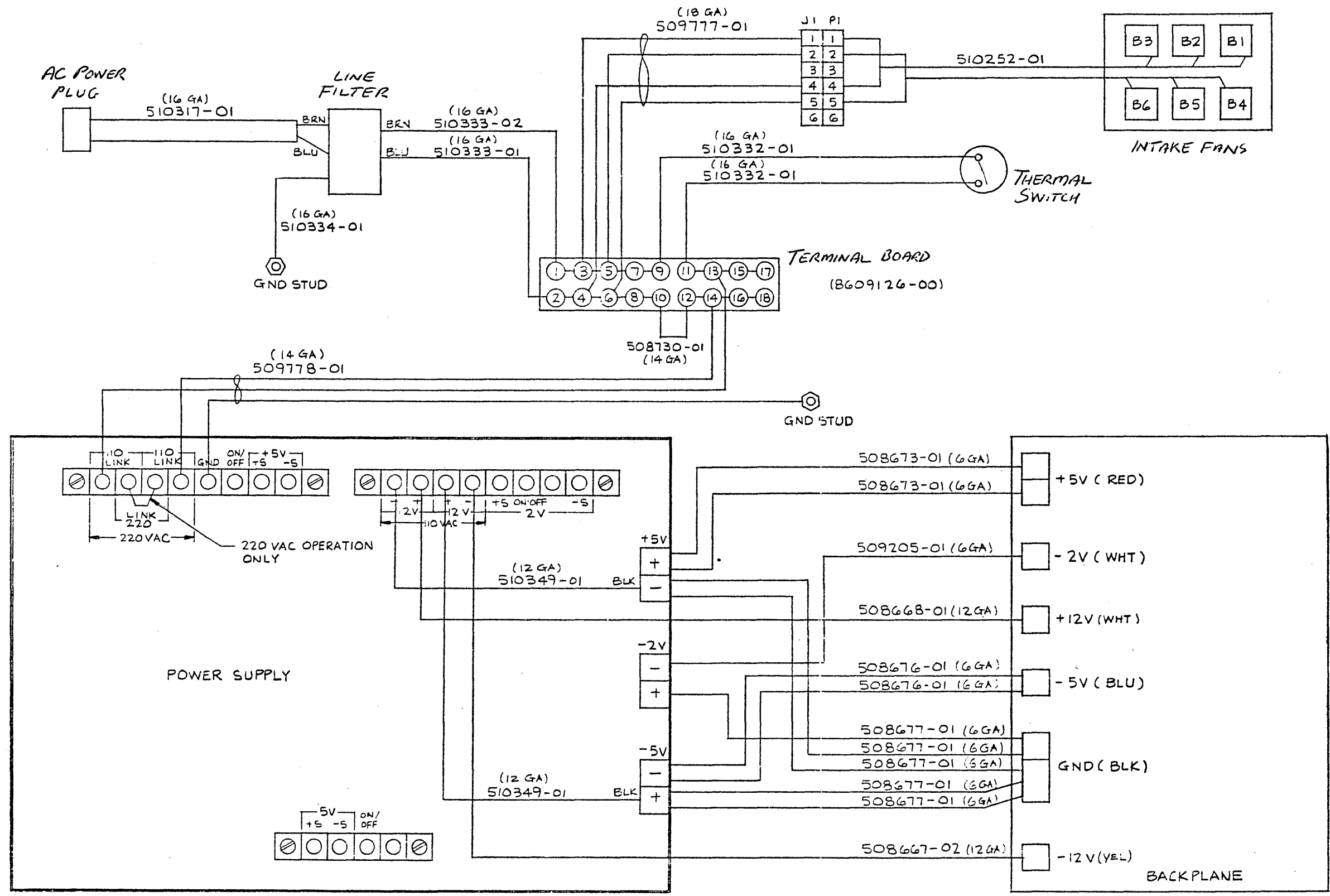


Figure F07-3. Display Generator Power Distribution Wiring Diagram

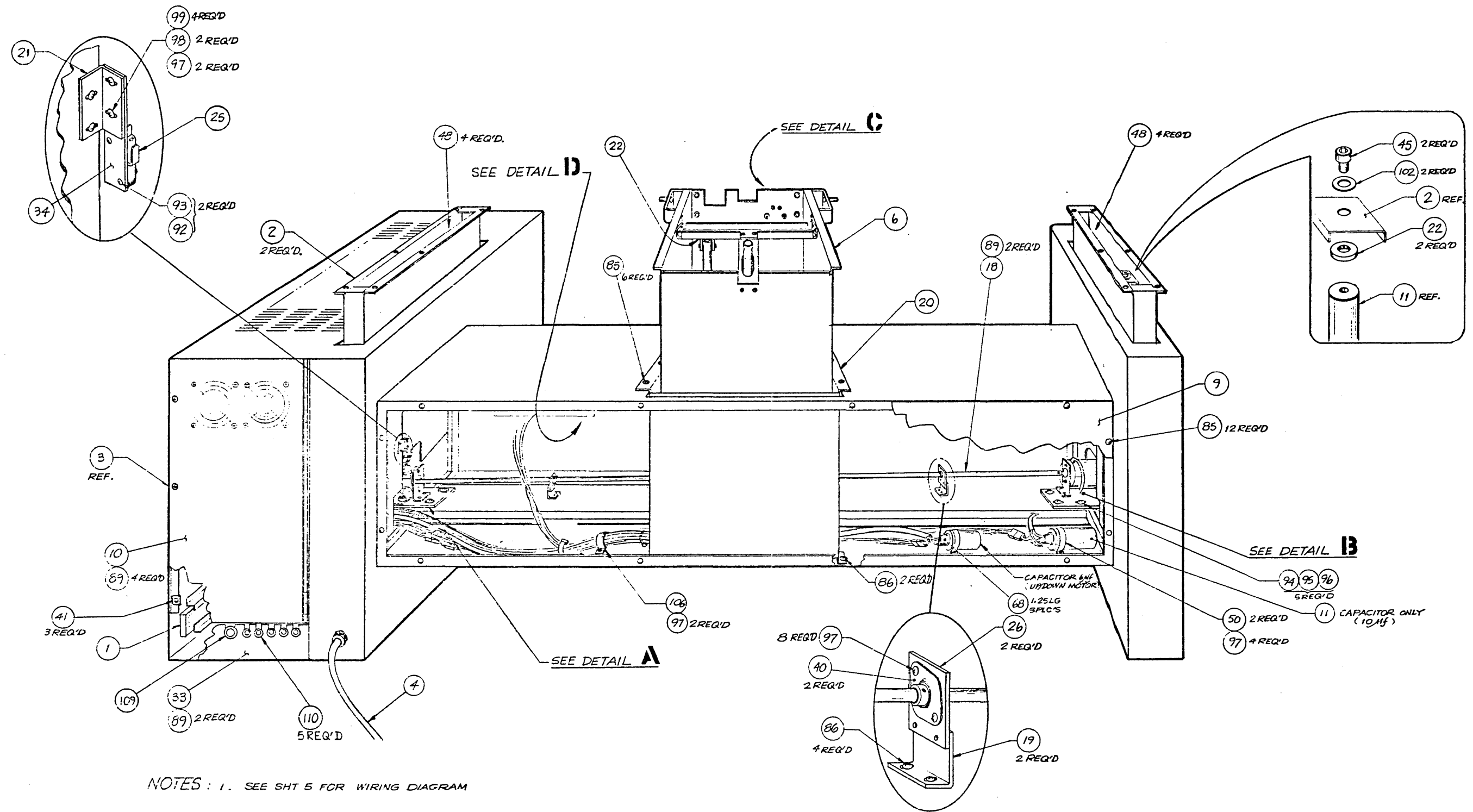


Figure F07-4. Pedestal Assembly -  
CDC, Sheet 1 of 4

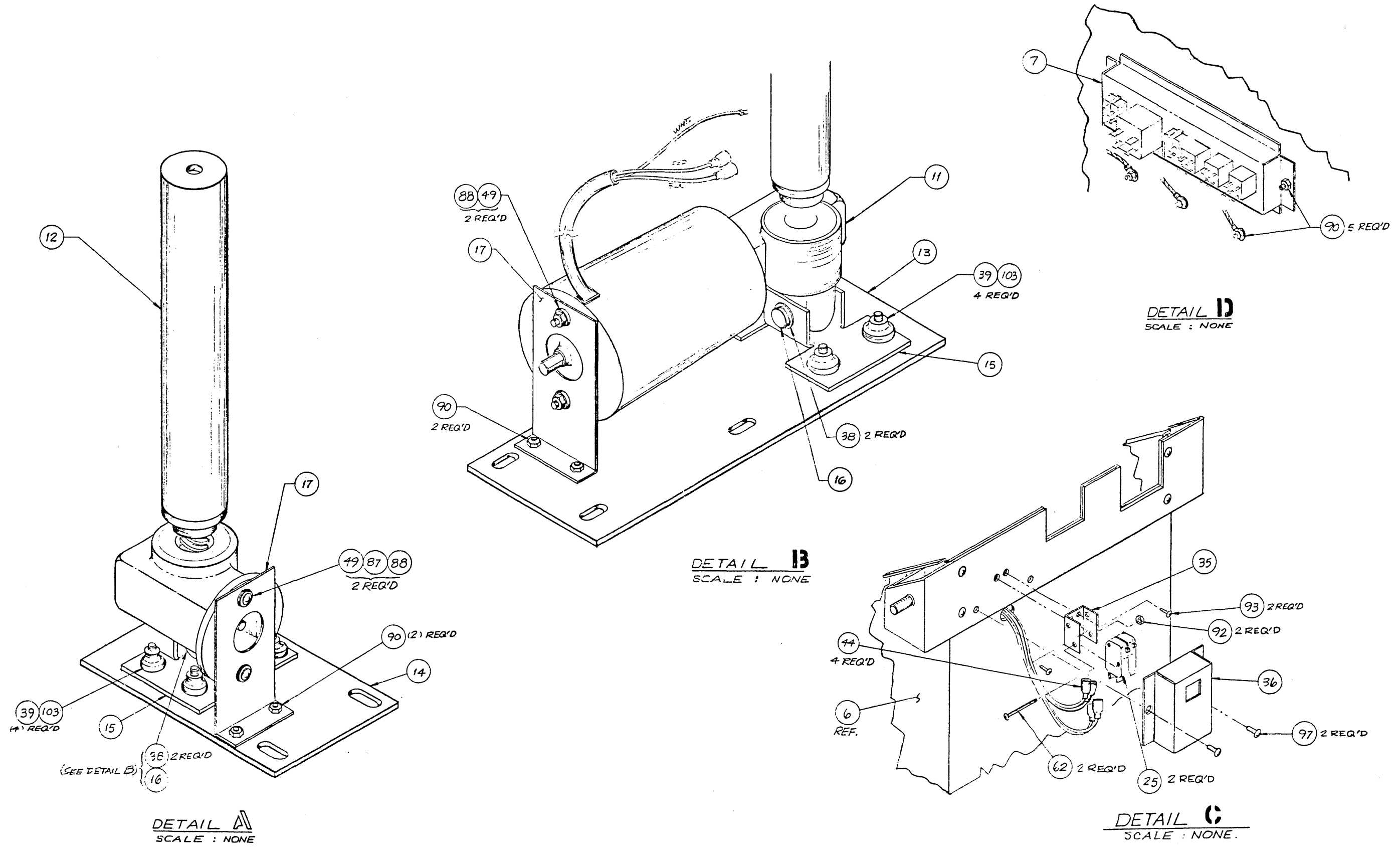


Figure F07-4. Pedestal Assembly -  
CDC, Sheet 2 of 4

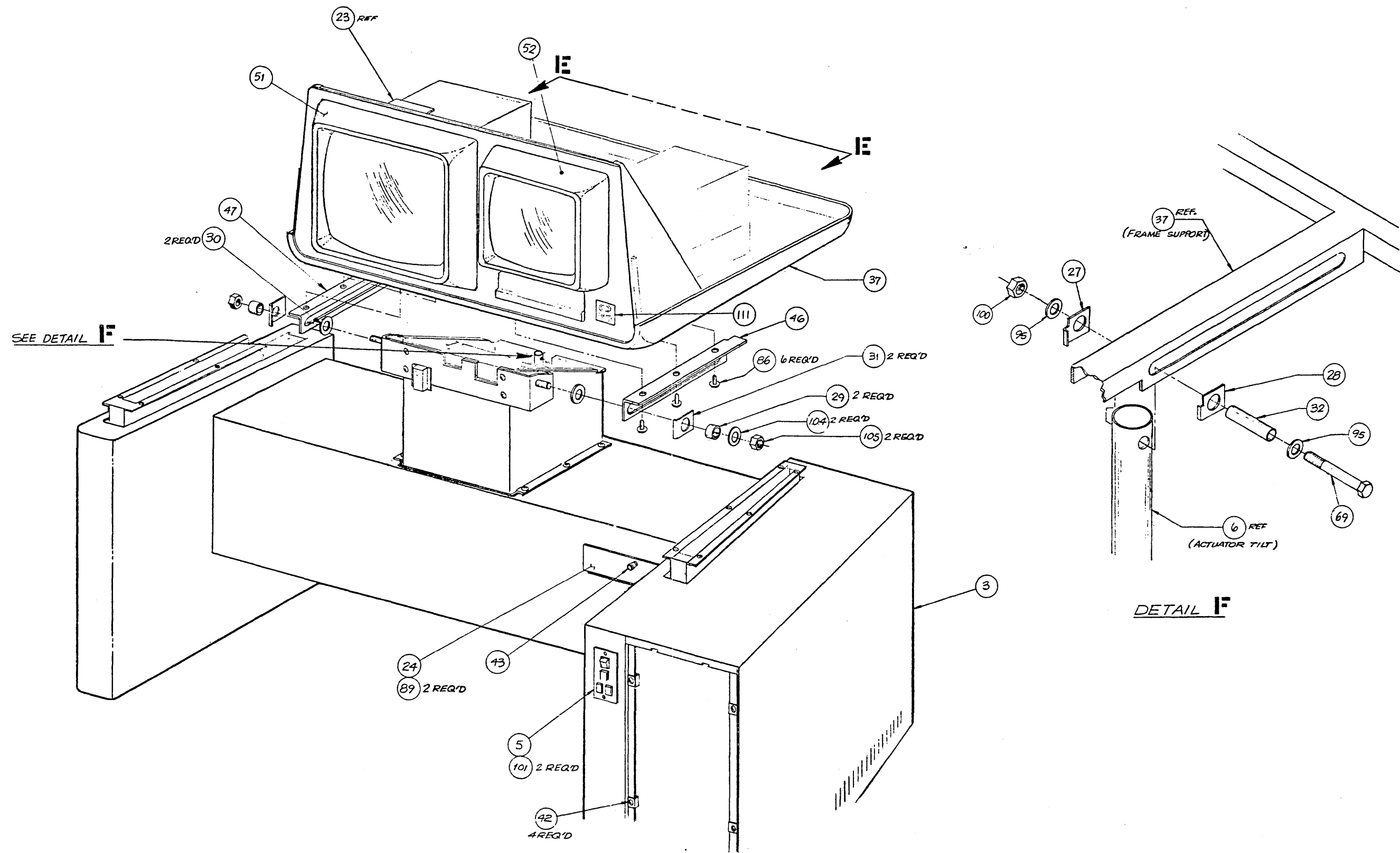
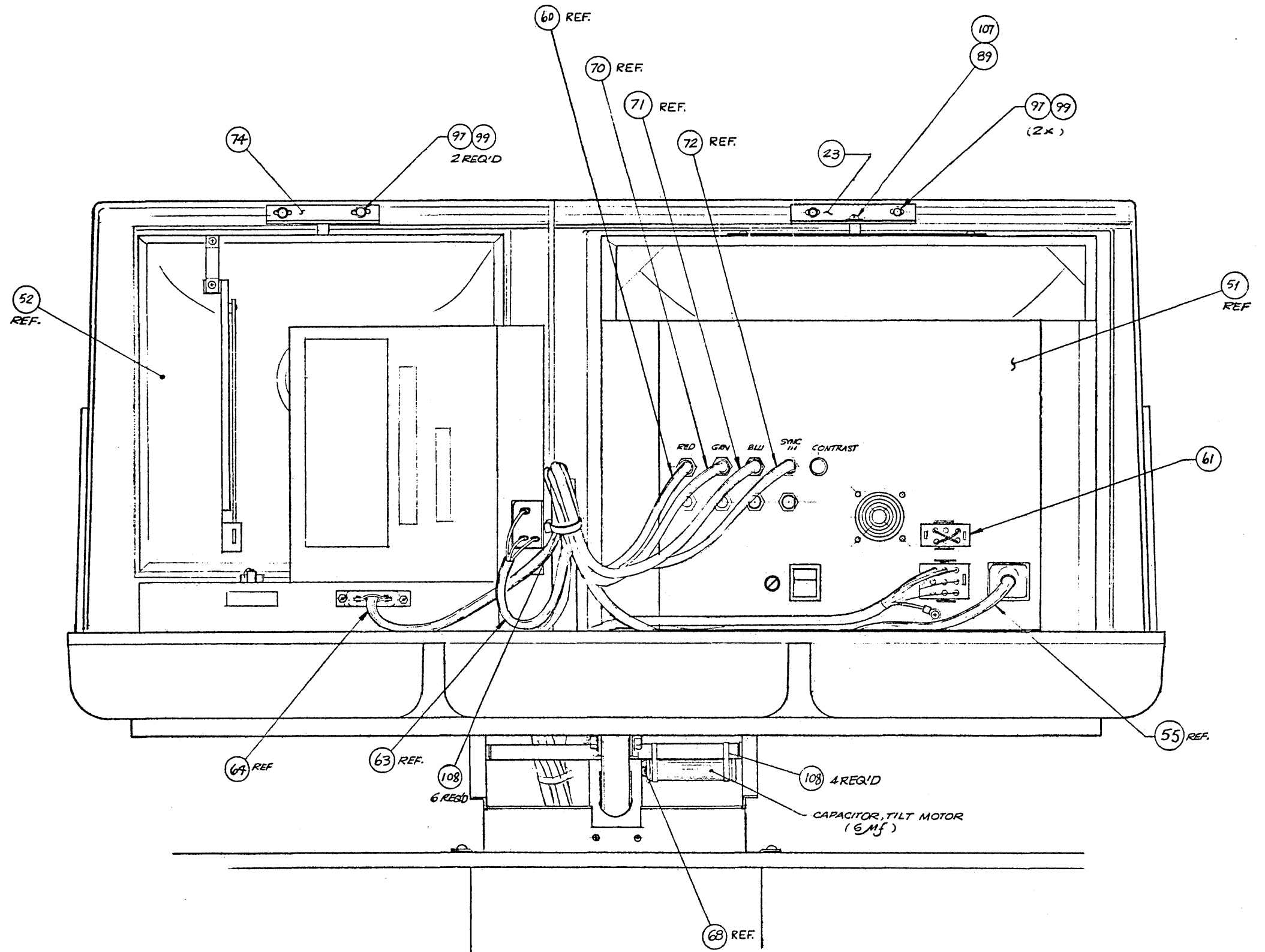


Figure F07-4. Pedestal Assembly -  
CDC, Sheet 3 of 4



VIEW I-I

Figure F07-4. Pedestal Assembly -  
CDC, Sheet 4 of 4

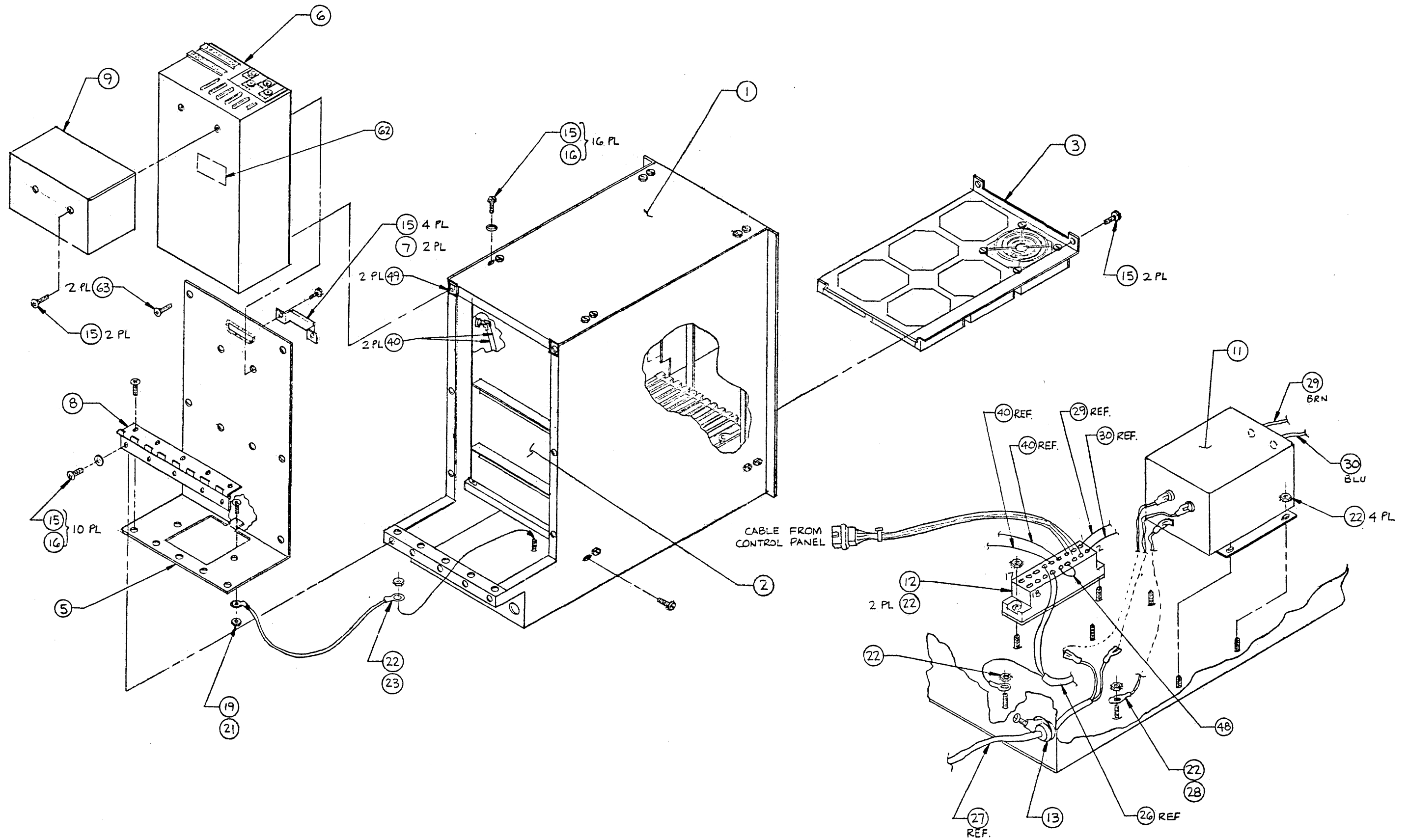


Figure F07-5. Final Assembly, Chassis, Sheet 1 of 3



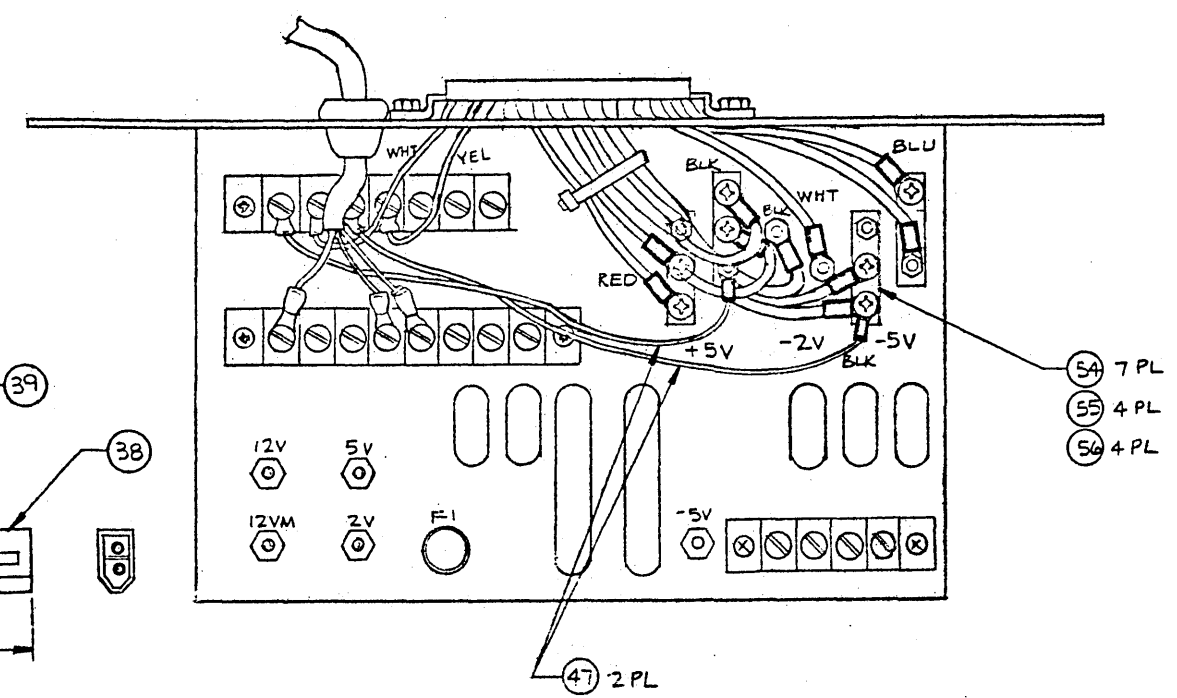
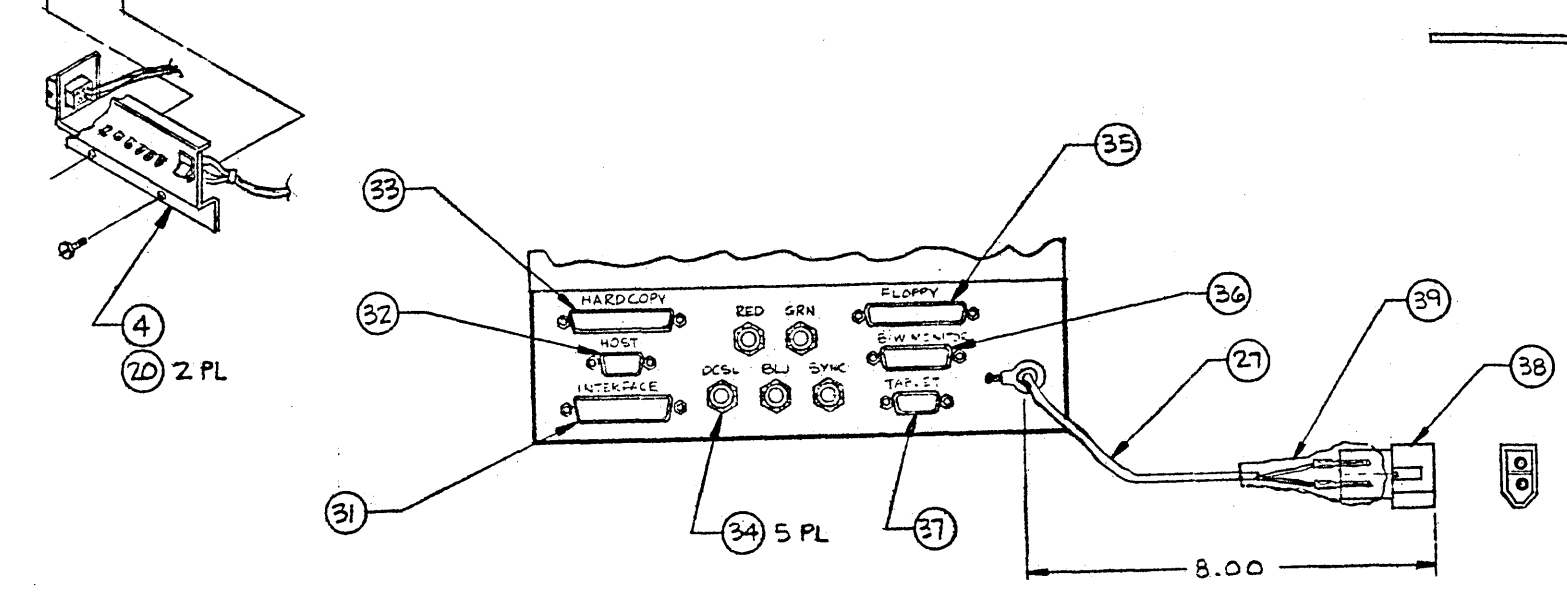
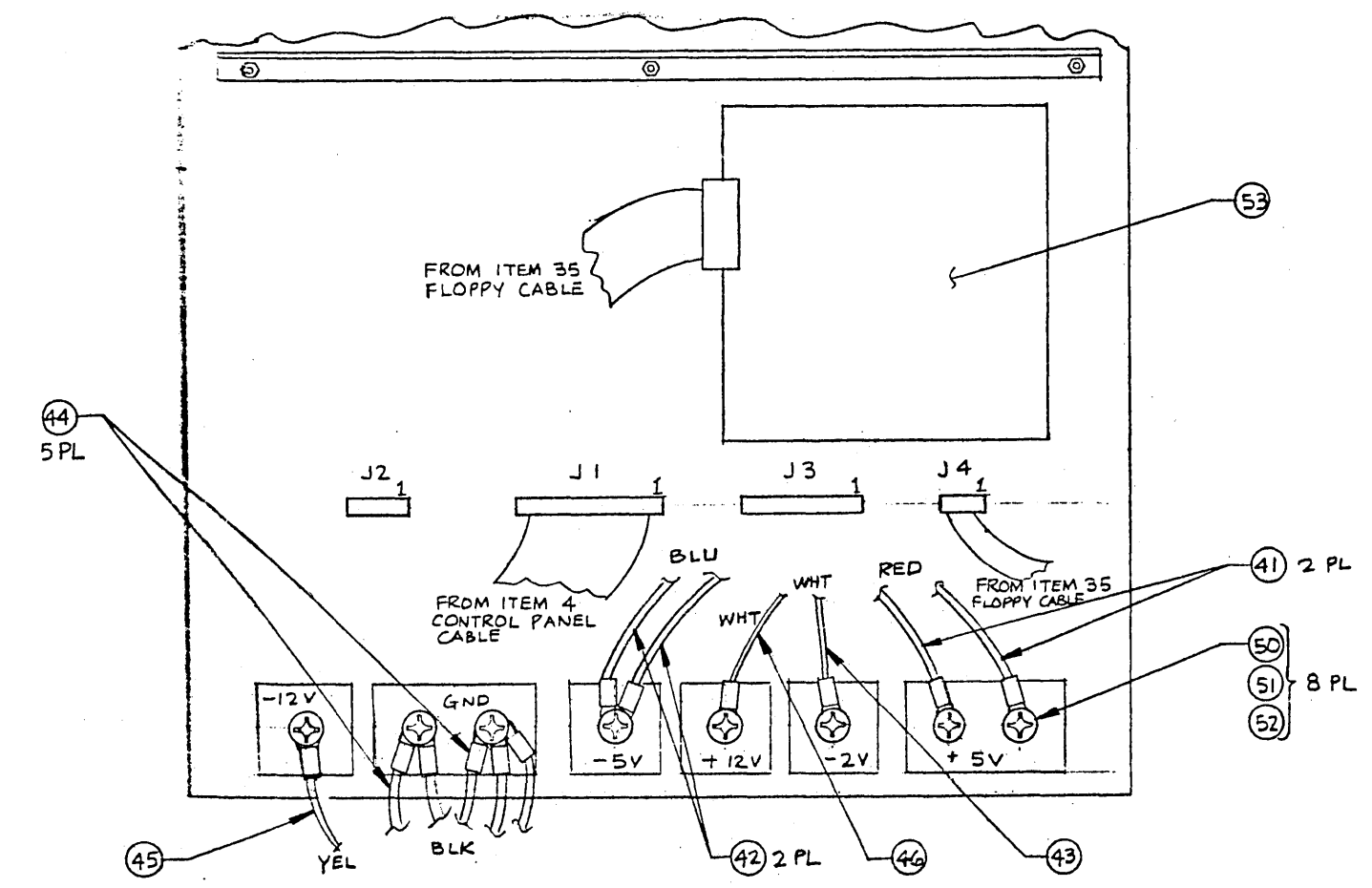
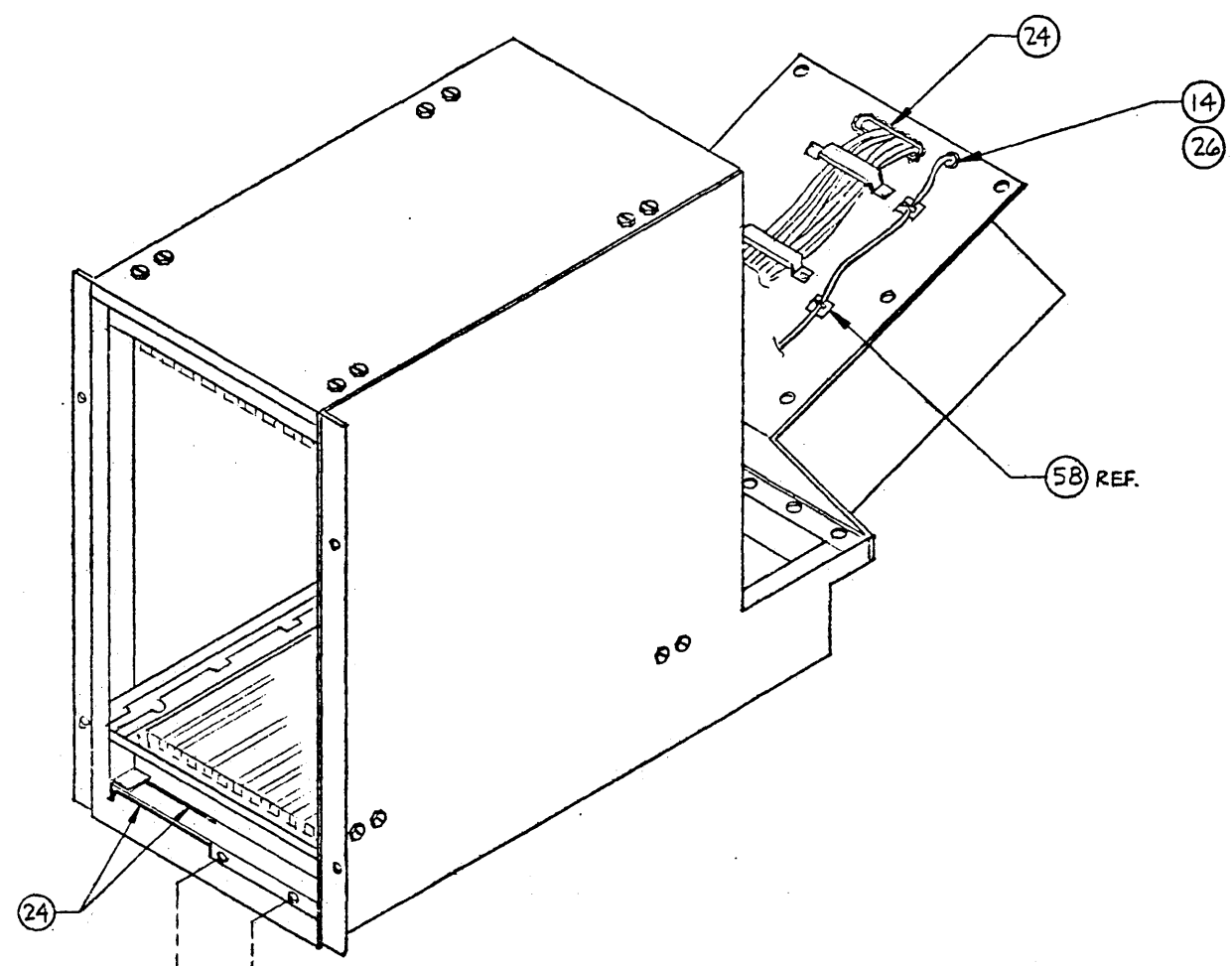
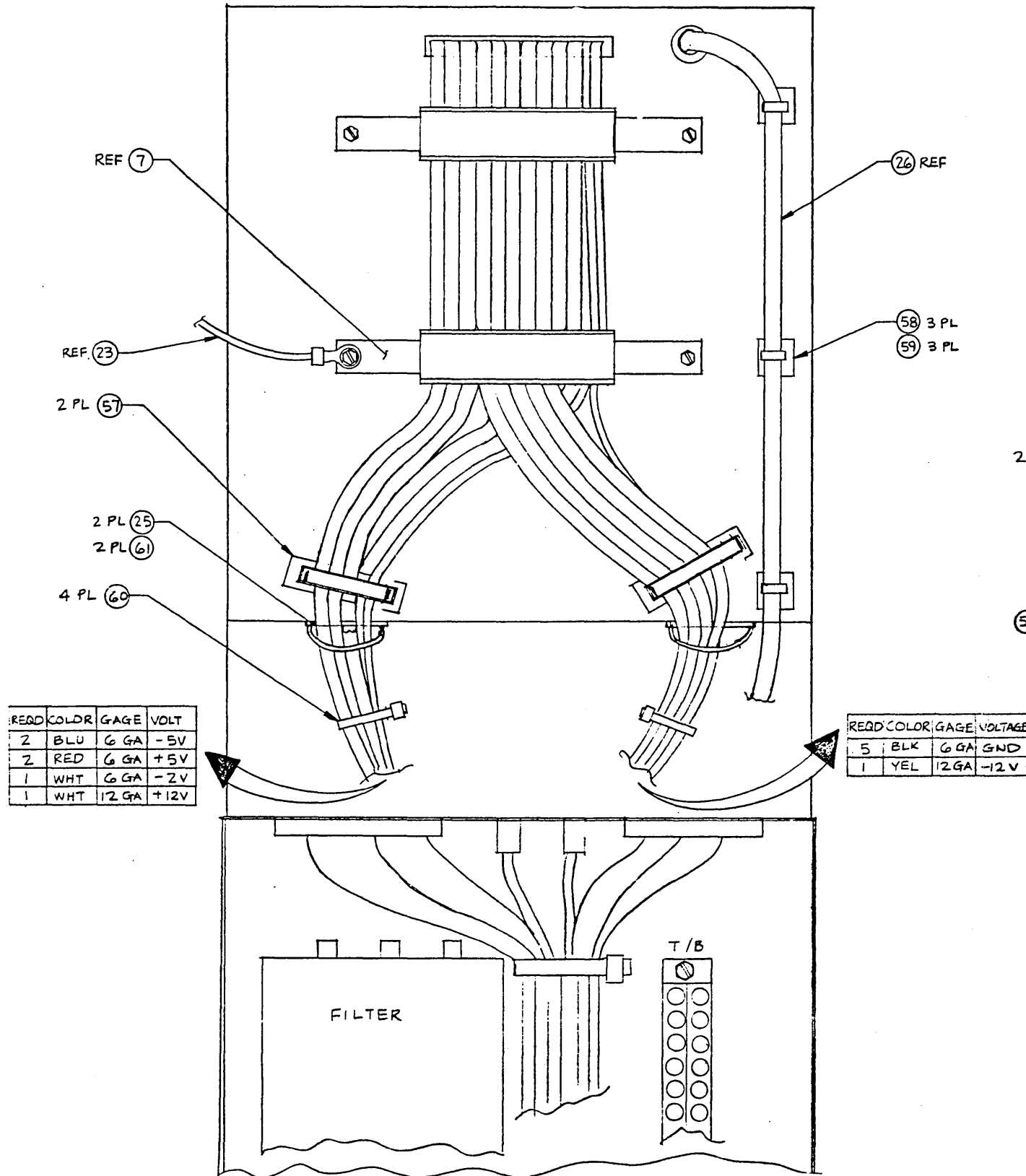


Figure F07-5. Final Assembly, Chassis, Sheet 2 of 3

VIEW OF POWER SUPPLY CABLING



BOTTOM VIEW OF CHASSIS CABLING

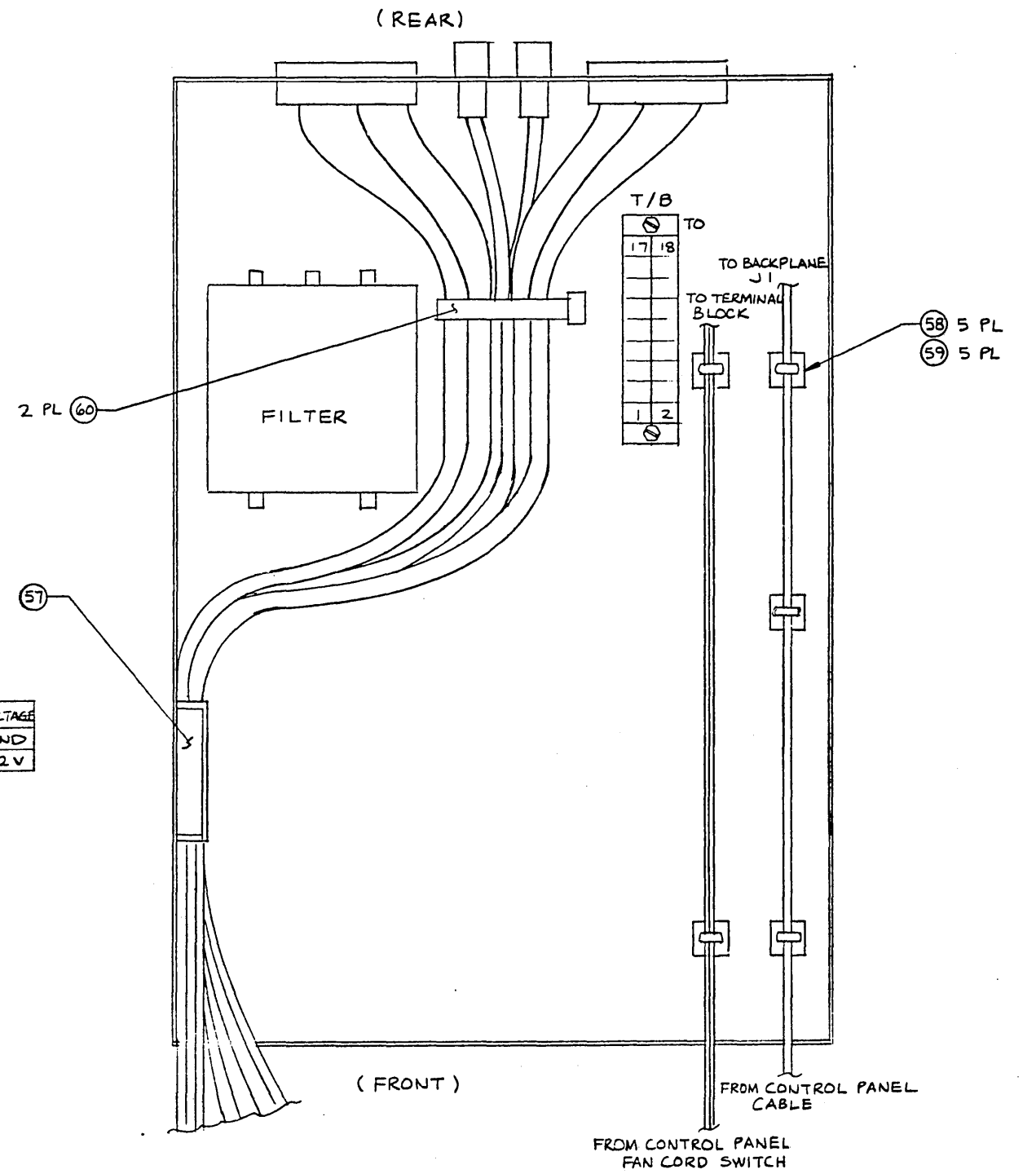


Figure F07-5. Final Assembly, Chassis, Sheet 3 of 3

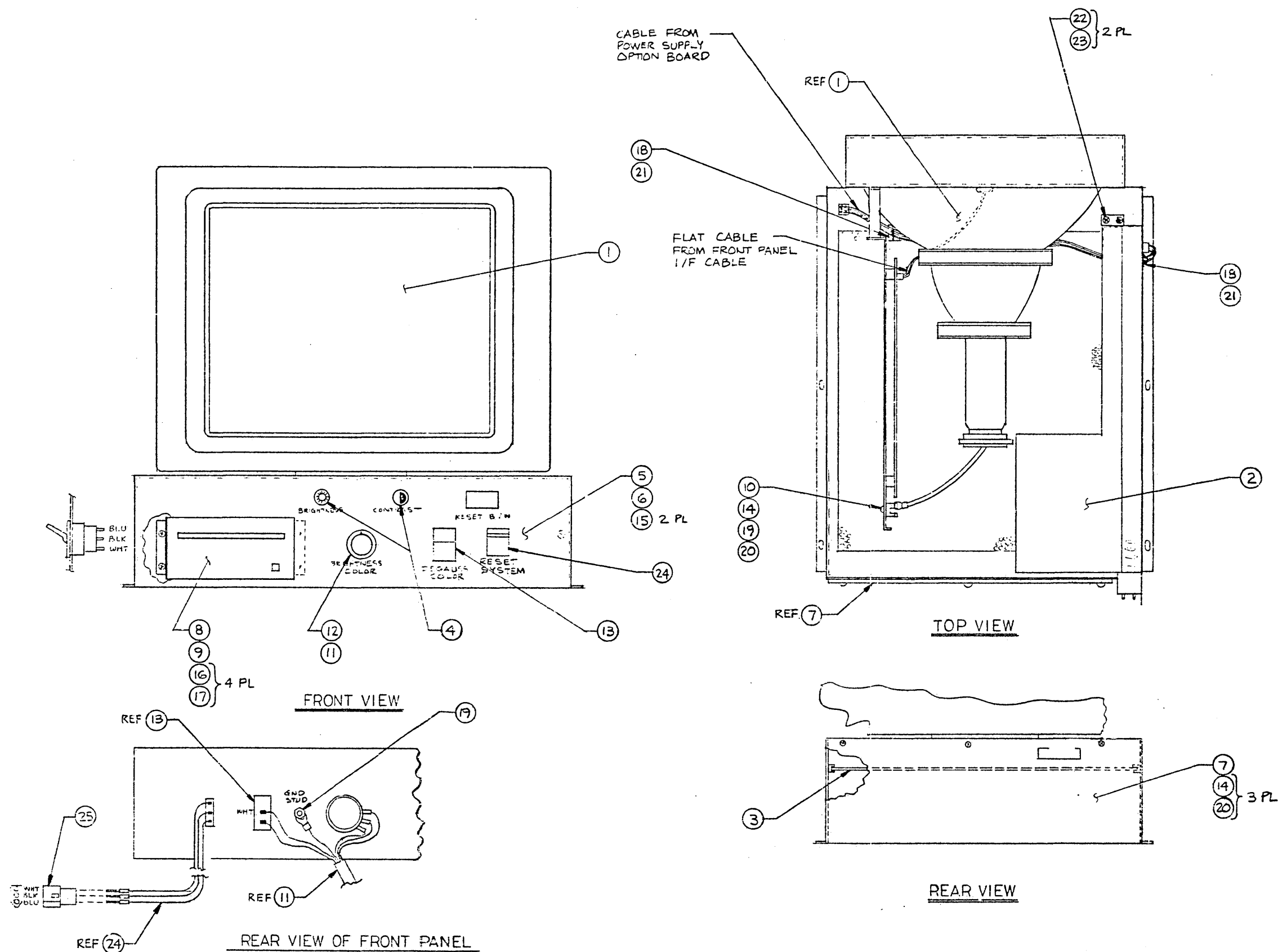


Figure F07-6. Final Assembly, Monitor, Monochrome

## Appendix A

### DESIGN CONCEPTS

#### INTRODUCTION

The following paragraphs explain design concepts embodied in graphics display systems.

#### RASTER SCAN

Raster scan is a method of displaying images on a CRT in broadcast television (TV) and TV monitors. The two types of monitor in use are monochrome and color.

In a monochrome monitor, a single CRT electron beam scans the CRT screen in a regular pattern, or raster. The beam sweeps across the screen to trace a series of horizontal lines, one below the other. After completing the last line at the bottom of the screen, the beam returns to the top and repeats the scan pattern. Each set of lines is a frame. After completing each line, the beam is turned off, or blanked, during the retrace period when the beam returns to begin the next line. Similarly, after completing the last line, the beam is blanked during the return to the top. Images are formed by varying beam intensity as the beam sweeps across the screen. With a sufficiently fast frame repetition rate, the viewer perceives a steady image.

Each horizontal line is divided into a number of picture elements (pixels), and each pixel is given an intensity value. Each image, therefore, consists of a matrix of pixels.

Interlacing is a raster-scan method that reduces image flicker. This result is achieved by replacing each frame with two interlaced fields. The beam first traces the odd-numbered lines to form the first field, then traces the even-numbered lines to form the second field.

In a color monitor three electron beams generate three rasters, one for each primary color (red, green, and blue). Each pixel is given three color values. The range of these values depends on refresh memory capacity and the digital-to-analog converters (DACs) installed. The three colors appear to the viewer as one blended color.

In color graphics applications, each color signal is transmitted to the monitor via an individual coaxial cable in contrast to color television broadcasting. This eliminates the need to encode color information for transmission on a single carrier.

#### REFRESH MEMORY

CRT screens have a short persistence and must be continually refreshed to produce a steady image. Refresh memory stores the data needed to refresh the

CRT. Refresh memory is a matrix of RAM cells. Digital data bits corresponding to CRT screen pixels are periodically loaded into refresh memory. Once loaded, refresh memory contents are not changed until modified by the program or by an operator acting through an interactive peripheral device.

The simplest data format that can describe an image is one refresh memory cell (or bit) for each CRT screen pixel. This is a two-dimensional refresh memory and there is a one-to-one correspondence between x and y coordinates in refresh memory and CRT screen x and y coordinates. The total number of memory cells required is simply horizontal scan lines multiplied by pixels per line. With only one bit per pixel, this memory can only control on or off states of the electron beam, thus shading is impossible.

In color graphics, refresh memory is three dimensional, consisting of x and y values and an added z value which defines the color. The simplest color graphics system has three memory planes corresponding to primary colors red, green, and blue. This system is limited to eight colors because only three bits are available per pixel. As memory planes are added, the z value range increases, thus the available number of displayable colors increases.

The output of refresh memory does not directly drive the CRT. Each z value is actually an address for a video lookup table, which provides the color data needed by the DACs to drive the CRT.

#### **VIDEO LOOKUP TABLE PRINCIPLES**

A VLT is a RAM that stores a color value for each pixel address in refresh memory. A VLT provides speed and flexibility by allowing the user to interactively change the color value assignments for the pixel values without changing the data in refresh memory.

Each pixel has the form  $x,y,z$ , where x and y represent the two-dimensional cartesian coordinates and z is the binary value of the bits at the x and y locations of each plane of refresh memory.

The z value thus obtained is loaded into the VLT address register and selects a particular VLT location. The contents of the VLT at this location provide the color value for the pixel at the x and y coordinates associated with the z value.

For example, VLT location 2 contains the color value for every pixel with a z value of 2. Every pixel in refresh memory with the same z value has the same color value. The number of VLT locations needed to color every pixel is always less than or equal to the largest possible z value. This maximum value in turn depends on the number of memory planes in the system. For instance, in a system with 8 memory planes, the largest z value possible is one less than 2 to the 8th or 255. Thus, a VLT with 256 locations (0-255) is sufficient to provide color values for every possible z value stored in refresh memory.

## Appendix B

### HEXADECIMAL CONVERSION CHART

The following chart gives decimal equivalents for all hexadecimal values from 1 through 38(H).

<u>Hexadecimal</u>	<u>Decimal</u>	<u>Hexadecimal</u>	<u>Decimal</u>
1	1	1D	29
2	2	1E	30
3	3	1F	31
4	4	20	32
5	5	21	33
6	6	22	34
7	7	23	35
8	8	24	36
9	9	25	37
A	10	26	38
B	11	27	39
C	12	28	40
D	13	29	41
E	14	2A	42
F	15	2B	43
10	16	2C	44
11	17	2D	45
12	18	2E	46
13	19	2F	47
14	20	30	48
15	21	31	49
16	22	32	50
17	23	33	51
18	24	34	52
19	25	35	53
1A	26	36	54
1B	27	37	55
1C	28	38	56



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## Appendix C

### TEKTRONICS EMULATION (TEKEM) VERIFICATION TEST

#### INTRODUCTION

With TEKEM diskette 66330350 loaded, 790 Workstation operation is similar to Tektronix 4115 workstation operation. The diskette contains the TEKEM test, which checks that the 790 workstation performs as follows:

- ✕ Displays the basic background colors
- ✕ Displays some primitives (basic drawing parts such as lines and text)
- ✕ Displays some attributes (qualities that change the appearance of a drawing such as color and shading)
- ✕ Displays a crosshair cursor (two intersecting lines that define a location on a CRT screen) and checks that the cursor can move vertically and horizontally
- ✕ Responds to input from graphic tablet

#### INITIAL PROCEDURE

1. Press PROCESSOR ON switch to turn on display generator
2. Insert TEKEM diskette 66330350 in disk drive, metal edge first and label up
3. Press RESET SYSTEM switch on display control panel

Monochrome monitor displays

READY FOR INPUT

4. Press <NEXT>

#### TEST PROCEDURES

There are four TEKEM tests:

- ✕ Background test
- ✕ Primitive/attribute test
- ✕ Crosshair cursor test
- ✕ Graphic tablet test

When running the following tests, type the instructions exactly as shown. All 0's are zeros. Note that the backward apostrophe (`) is used in the tests. The key for this symbol is between the backspace and the +/- keys. If you



make a mistake go back to the last <ESC> in the instructions, press <ESC> and continue with the test. If that does not allow you to continue, press the RESET SYSTEM switch, press <NEXT>, and repeat the test. After pressing <NEXT>, you may start with step 1 of any test.

### **Background Test**

1. Press <LOCAL> to put workstation in local mode
2. Type <ESC>TM111 (color monitor screen remains blank)
3. Type <ESC>TBF4F4F4
4. Check that color monitor screen turns white
5. Type <ESC>TBF400
6. Check that color monitor screen turns red
7. Type <ESC>TB0F40
8. Check that color monitor screen turns green
9. Type <ESC>TB00F4
10. Check that color monitor screen turns blue
11. Type <ESC>TB000
12. Check that color monitor screen turns black
13. Press <LOCAL> to return workstation to remote mode

### **Primitive/Attribute Test**

1. Press <LOCAL> to put workstation in local mode
2. Type <ESC>MT1<ESC>LF<space>@<space>``<space>@<ESC>LG9cs?S
3. Check that a diagonal white line appears across color monitor screen
4. Type <ESC>MT7<ESC>LF`w/W;<ESC>LT7CDC<space>790
5. Check that CDC 790 appears in yellow near center of color monitor screen
6. Type <ESC>TM111<ESC>TG148F400<ESC>MP(<ESC>UB0<ESC>UR2+`w/W;ck?K
7. Check that a red rectangle appears in upper right corner of color monitor screen
8. Press <PAGE>

9. Check that color monitor screen becomes black
10. Press <LOCAL> to return workstation to REMOTE mode

### **Crosshair Cursor Test**

1. Press <LOCAL> to put workstation in local mode
2. Type <ESC>MT1<ESC>LF+`w/W<ESC>LT4HERE
3. Check that HERE appears in white near center of color monitor screen
4. Type <ESC>IE01
5. Check that crosshair cursor appears somewhere on color monitor screen
6. Use arrow keys (2, 4, 6, and 8 keys on left side of keyboard) to move crosshair cursor
7. Check that you can move intersection of crosshair cursor lines over R in word HERE
8. Press <LOCAL> to return workstation to REMOTE mode
9. Type Z
10. Check that crosshair cursor disappears
11. Press <PAGE>
12. Check that color monitor screen becomes black

### **Tablet Test**

1. Press <LOCAL> to put workstation in local mode
2. Type <ESC>MT1<ESC>LF+`w/W<ESC>LT4HERE
3. Check that HERE appears in white near center of color monitor screen. If display is abnormal, press RESET pushbutton on graphic tablet and repeat step 2
4. Type <ESC>IE81
5. Check that crosshair cursor appears somewhere on color monitor screen
6. Pick up tablet stylus and lightly move tip of stylus across surface of tablet. (If you press too hard on stylus, crosshairs disappear)
7. Check that you can move crosshair cursor over R in word HERE
8. Press <LOCAL> to return workstation to REMOTE mode

9. Push down on stylus, then let up
10. Check that crosshair cursor disappears. If workstation is not connected to host computer, cursor does not disappear
11. Press <PAGE>
12. Check that color monitor screen turns black

# COMMENT SHEET

MANUAL TITLE: \_\_\_\_\_

PUBLICATION NO.: 62950149

REVISION: A

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

STREET: \_\_\_\_\_

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A	PROD RLSE PER ECN 6446	GPG	4-15-85

SHT NO.											
VERSION											
<b>APPROVALS</b>				<b>DATE</b>	<b>TITLE</b>						
ENT BY <i>L. J. [unclear]</i>				4-12-85	ERRATA SHEET, HDW MAINT MANUAL - CDC						
CHKD BY <i>Gmajet</i>				4-12-85	DWG NO. <u>511143-01</u>						
ENG. <i>[unclear]</i>				4-12-85							
MFG ENG <i>[unclear]</i>				4-12-85	REV A						
APVD <i>Gmajet</i>				4-12-85	SHEET <u>1</u> OF <u>6</u>						

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Errata Sheet,  
 To CDC Document Number 62950149 Rev B  
 CDC ICEM ERGONOMIC WORKSTATION  
 HARDWARE MAINTENANCE MANUAL  
 (ON-SITE INFORMATION)

Effective Date: 15 March 1985

Mark up your manual as indicated below. Then paste or tape the replacement figures 2-11 and 2-15 (included herein) over those figures in the manual. Finally, attach this errata sheet inside the rear cover of the manual.

Page	Text Lines Down	In Para. Starting With	Change	
			From	To
2-3	36	Display generator DLP PCB	509964-01	510571-03
2-12	--	--	Present photo, Fig. 2-11	New photo, attached
2-13	--	--	Figure 2-12 Display Generator, Front Front	Figure 2-12 Display Generator, Front See DLP in Figure 2-11
2-17	--		Present photo, Fig. 2-15	New photo, attached
2-18	2	The DLP PCB has...	..., and four connectors (J1 through J4).	...SW2). There are six 9-pin connectors and one 37-pin connector.
2-18	5	The DLP PCB has...	<ul style="list-style-type: none"> <li>✕ J1 Monochrome Mon</li> <li>✕ J2 Graphic Tablet</li> <li>✕ J3 Host Computer</li> <li>✕ J4 Printer</li> </ul>	Ident. Port Connects to <ul style="list-style-type: none"> <li>✕ J1 1 Monochrome Serial Terminal (RS232)</li> <li>✕ J2 2 Graphic Tablet (Special RS232)</li> <li>✕ J3 3 Host (RS232)</li> <li>✕ J4 3 Not used</li> <li>✕ J5 4 Option (RS232)</li> <li>✕ J6 4 Option (TTL, differential)</li> <li>✕ J7 Par. Centronix Compatible Device</li> <li>✕ DS1 --- Halt LED (red)</li> <li>✕ DS2 --- Self-test LED (green)</li> </ul>





Page	Text Lines Down	In Para. Starting With	Change	
			From	To
3-14	--	Table 3-1	SW1 switches 1-5,7 off SW1 switches 6,8 on	SW1 switches 1-5,7,8 off SW1 switch 6 on
3-15	--	Figure 3-11	Present illustration	New illustration, attached
4-5	20	The DLP interface..	...six I/O ports.	...six serial I/O ports and one parallel I/O port.*
4-5	67	In footnote space at bottom of page	(Blank space)	*Serial connectors numbered 1, RS232 - Terminal; 2, RS232 - Tablet (Note A) 3, RS232 - Host; 4, not used; 5, RS232 - Option (Note B) 6, differential - Option (Note B) NOTE A: special RS232 NOTE B: Use 5 or 6 but not both
4-8	8	The display list ...	196K	256K
5-3	37	The diagnostic tests ...	510868-01	510868-02
5-52	-	Figure 5-35		Add notation under figure title: PICTURE OBSOLETE, see revised Fig. 2-11.
6-1	-	Table 6-1	509964-01 PCB, Display List Processor 510601-01 Diagnostic Floppy Disc	510571-03 PCB, Display List Processor 510868-02 Diagnostic Floppy Disc
6-3	-	Item No.020	509964-01	510571-03



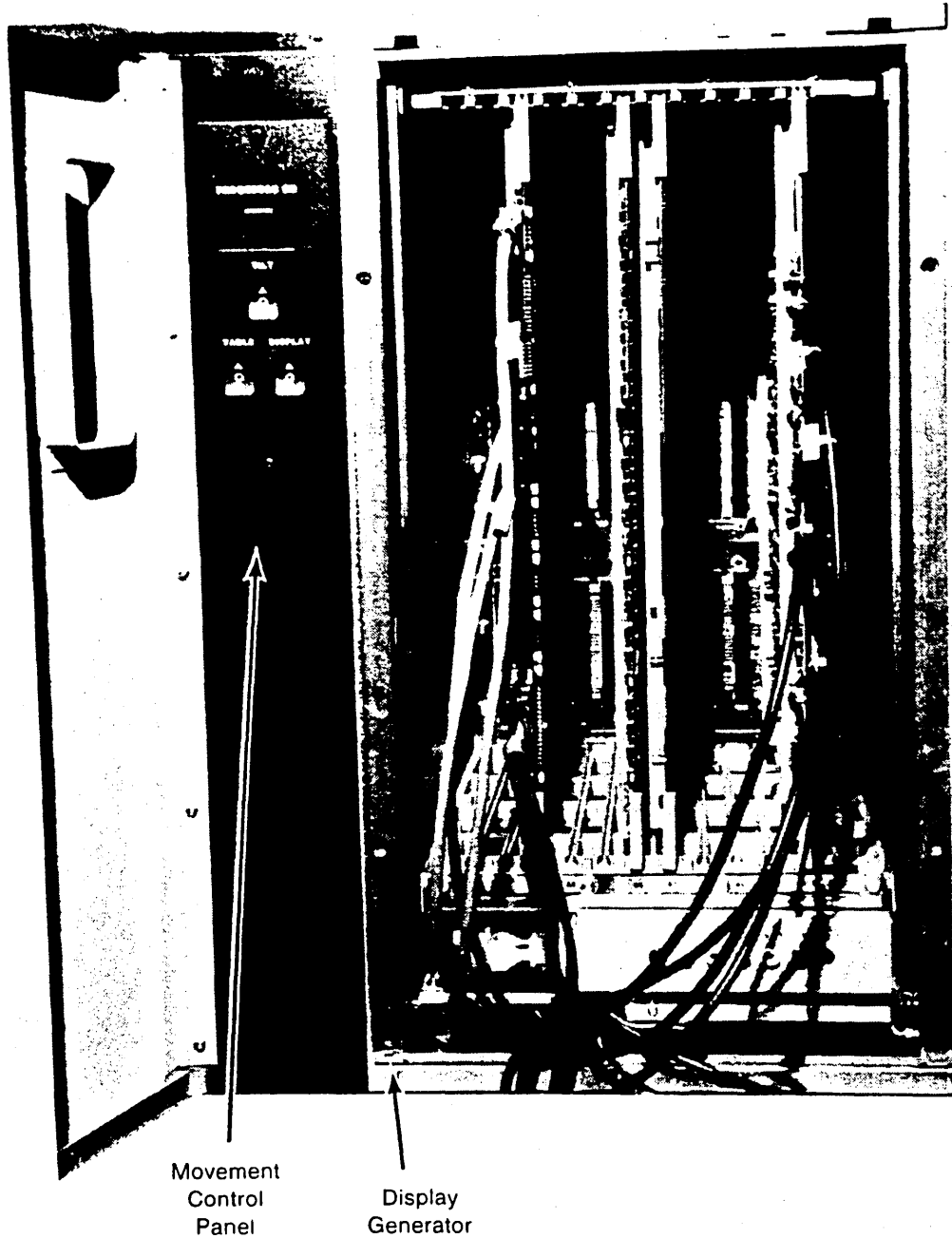
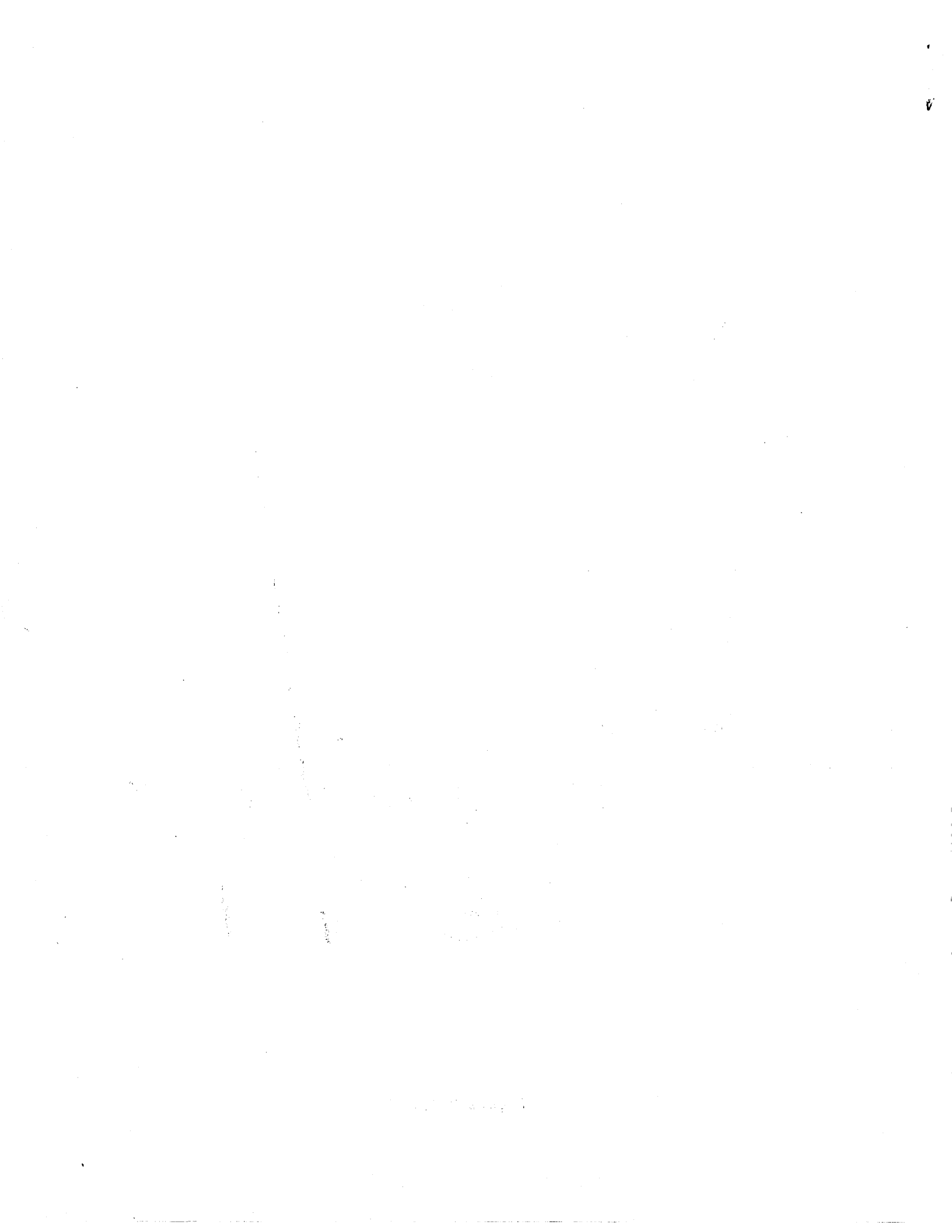


Figure 2-11. Right Pedestal Assembly, Front Door Open



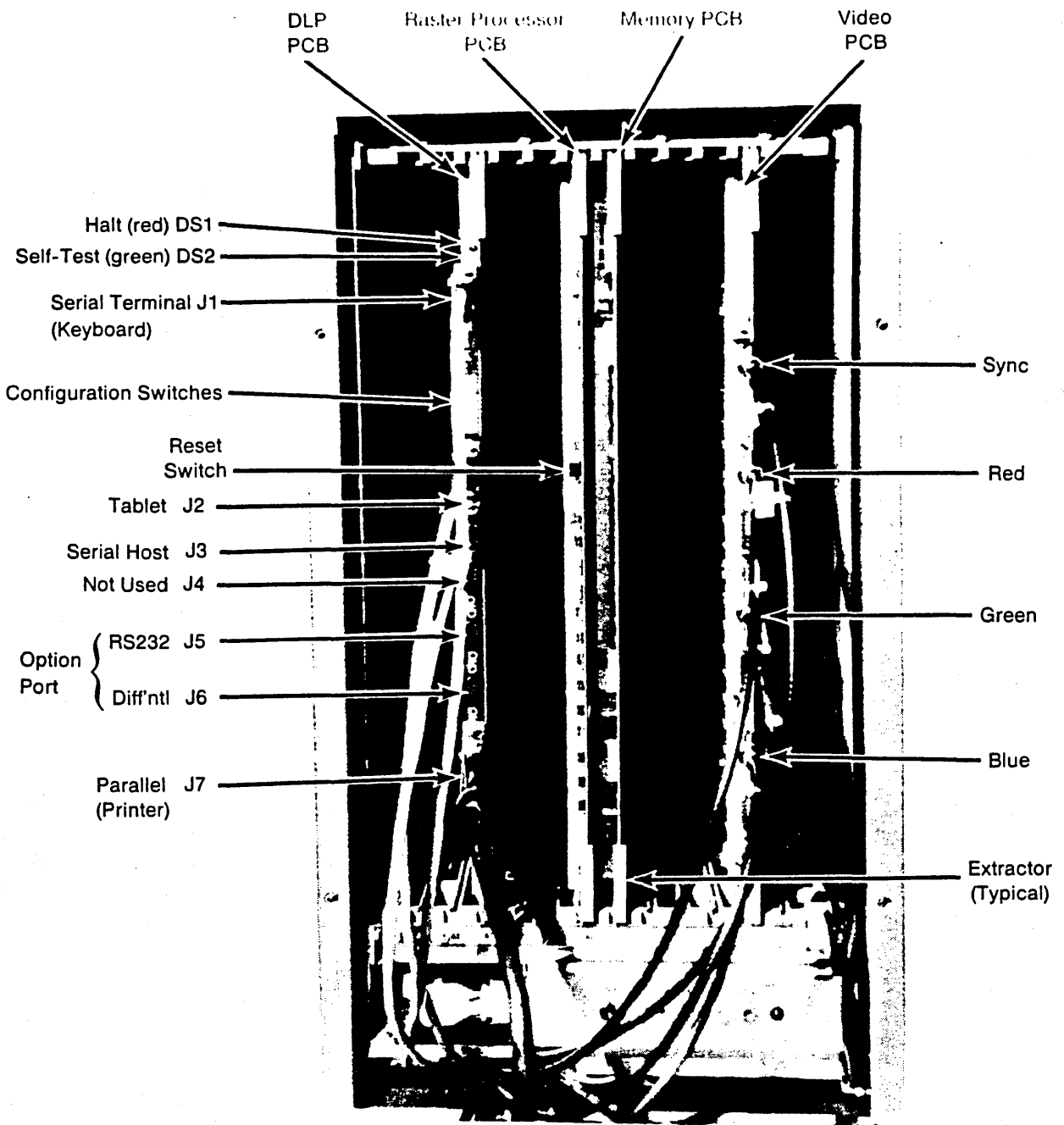


Figure 2-15. PCB Features

1950

1950

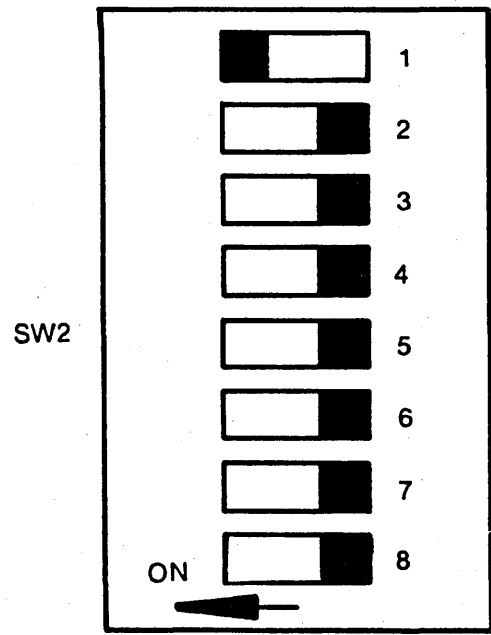
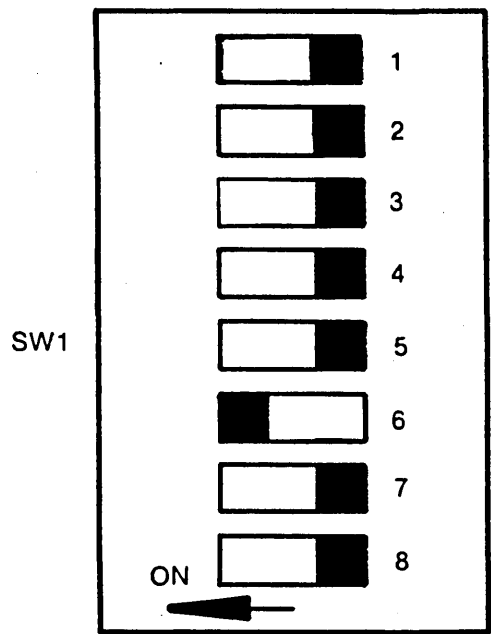
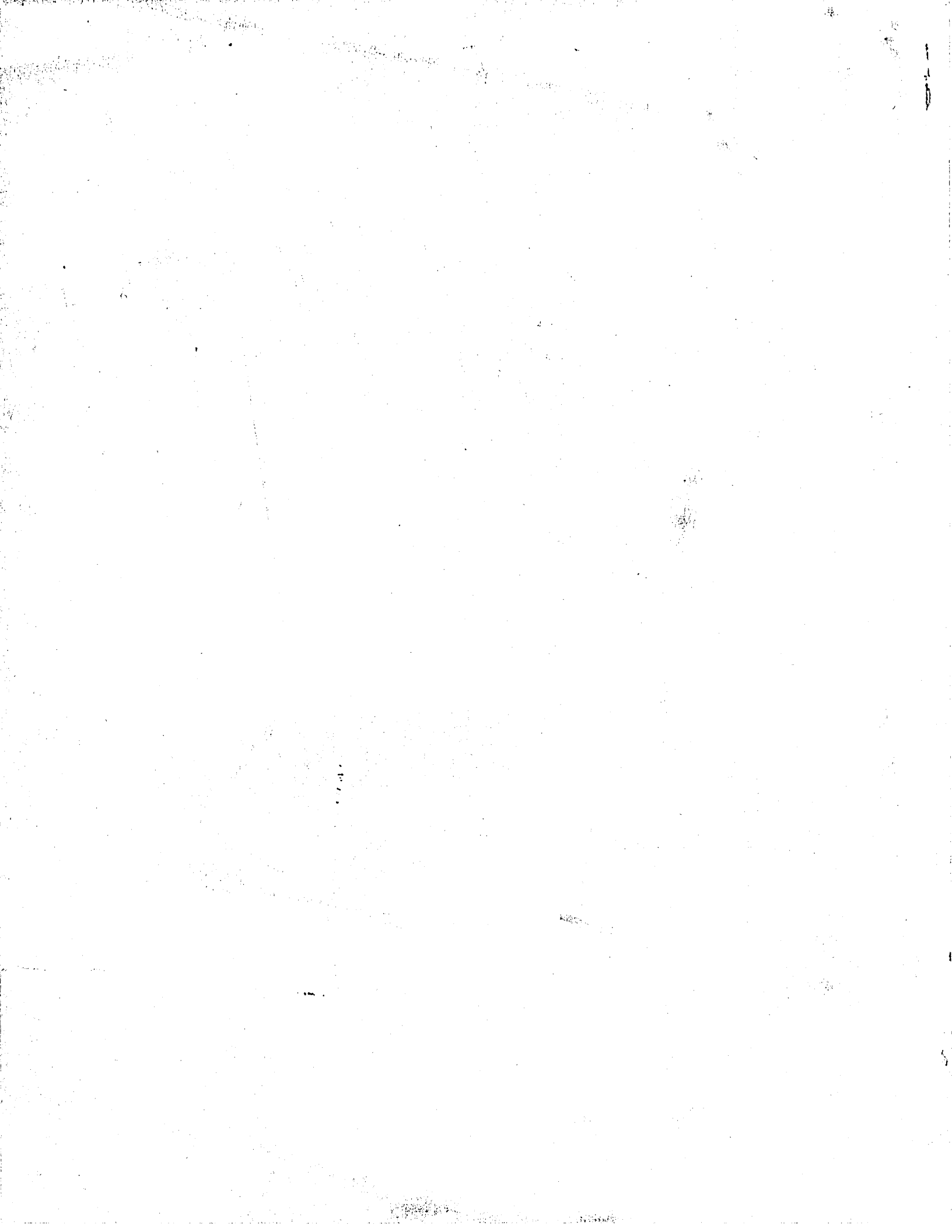


Figure 3-11. Configuration Select Switch Settings







1

2



3

4



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