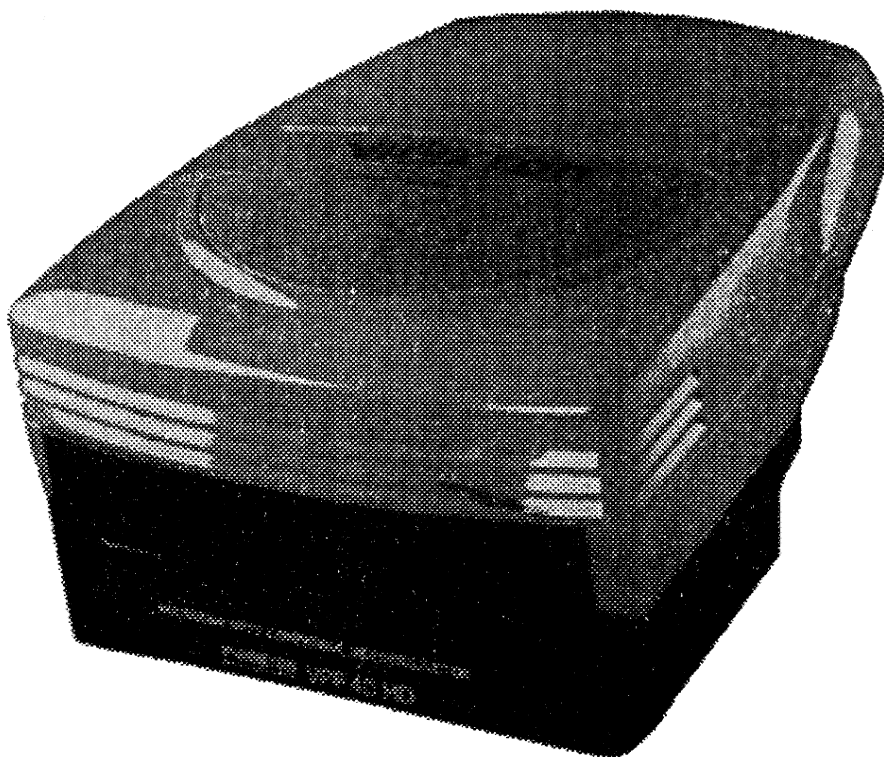


**COLORTREK**

# VPF40HD

VIDEOPROJECTOR



**SERVICE  
MANUAL**

## WARNING

THE VPF40HD® SERIES PROJECTOR GENERATES AND MAY RADIATE RADIO FREQUENCY ENERGY. IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE USER'S MANUAL, IT MAY CAUSE INTERFERENCE WITH RADIO COMMUNICATIONS.

THE VPF40HD® SERIES PROJECTOR IS TESTED TO AND COMPLIES WITH THE LIMITS FOR A CLASS A COMPUTING DEVICE PURSUANT TO SUBPART J OF PART 15 OF FCC RULES, WHICH ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST RADIO INTERFERENCE IN A COMMERCIAL ENVIRONMENT. WHEN THE VPF40HD® SERIES PROJECTOR IS OPERATED IN A RESIDENTIAL AREA IT MAY CAUSE RADIO INTERFERENCE. IN SUCH A CASE THE USER WILL BE REQUIRED, AT HIS OWN EXPENSE, TO TAKE MEASURES REQUIRED TO CORRECT THE INTERFERENCE.

## NOTICE

THIS DIGITAL APPARATUS IS TESTED TO AND COMPLIES WITH THE LIMITS FOR A CLASS A DIGITAL APPARATUS PURSUANT TO THE CANADIAN DEPARTMENT OF COMMUNICATIONS RADIO INTERFERENCE REGULATIONS. THE REGULATIONS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST SUCH INTERFERENCE FROM DEVICES OPERATED IN A COMMERCIAL ENVIRONMENT.

## AVIS

CET APPAREIL À AFFICHAGE NUMÉRIQUE A ÉTÉ CONTRÔLÉ. IL EST CONFORME AUX LIMITES DES RÉGLEMENTS DE LA CLASSE A D'APPAREILS À AFFICHAGE NUMÉRIQUE ÉTABLIS PAR LE MINISTÈRE DES COMMUNICATIONS DU CANADA EN CE QUI CONCERNE LES INTERFÉRENCES RADIO. CES RÉGLEMENTS ONT ÉTÉ MIS EN PLACE POUR ASSURER UNE PROTECTION RAISONNABLE CONTRE LES INTERFÉRENCES PRODUITS PAR DES APPAREILS UTILISÉS DANS UN ENVIRONNEMENT COMMERCIAL.

## WARNING

TO PREVENT FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE. DO NOT USE THE POWER CORD WITH EXTENSION CORDS, RECEPTACLES OR OTHER OUTLETS WHICH DO NOT HAVE A GROUND CONNECTION.

**WARNING:** DO NOT LIFT THE PROJECTOR BY THE TOP COVER.

**WARNING:** MAKE SURE THE LINE VOLTAGE IS PROPERLY SELECTED BEFORE CONNECTING THE POWER CORD.

**CAUTION:** DO NOT BLOCK AIR FLOW AROUND THE PROJECTOR. THERE MUST BE AT LEAST 1 INCH (2.54 cm) CLEARANCE BETWEEN THE BOTTOM OF THE PROJECTOR AND THE MOUNTING SURFACE.

**CAUTION:** KEEP OUT OF DIRECT SUNLIGHT. PROLONGED EXPOSURE TO SUNLIGHT MAY CAUSE PERMANENT DAMAGE.

**CAUTION:** NEVER TOUCH THE ACRYLIC LENS WITH FINGERS. CLEAN ONLY WHEN ABSOLUTELY NECESSARY WITH THE LENS CLEANING CLOTH PROVIDED. DO NOT MOISTEN THE CLOTH FOR CLEANING. RUB VERY GENTLY IN A CIRCULAR MOTION.

**CAUTION:** IF SHIPPED IN COLD WEATHER, UNPACK THE PROJECTOR AND ALLOW IT TO SIT AT ROOM TEMPERATURE FOR ONE HOUR BEFORE OPERATING. FAILURE TO DO SO MAY RESULT IN CRT BREAKAGE.

**CAUTION:** RETAIN AND USE THE ORIGINAL PACKING FOR SHIPPING THE PROJECTOR TO ANOTHER LOCATION. THE ORIGINAL PACKING IS CUSTOM DESIGNED FOR THE PROJECTOR.

**CAUTION:** THE FEET ON THE PROJECTOR MUST BE FULLY RETRACTED PRIOR TO PACKING THE PROJECTOR.

THIS PROJECTOR IS COVERED BY U.S. PATENTS 4414494, 4680555 AND 5065076. OTHER PATENTS PENDING.

## WARRANTY

Vidikron Projection Products are warranted to be free of defects in material and workmanship in normal use for the period listed below from the original date of purchase:

PRODUCT	PART	PICTURE TUBE	LABOR
Projection System	1 Year	1 Year	1 Year
Interface Devices	90 Day replacement warranty		
Wire Harness	90 Day replacement warranty		
Accessories	90 Day replacement warranty		

This warranty does not apply to units which have been subject to abuse, accident, improper installation or on which the serial number has been removed or damaged.

### I. LIMITATIONS

1. The labor warranty is valid only if the malfunctioning unit is repaired by an authorized service depot or selling dealer.
2. The warranty does not cover:
  - a) Problems caused by associated equipment such as antenna distribution systems, video tape recorders, cameras, etc.
  - b) Damage caused by accident, misuse, improper power source, fire, flood, lighting, other acts of God, repair or alteration by other than Vidikron Limited authorized service organization.
  - c) Transit damage.
  - d) Phosphor degradation of the picture tube: example, visible burns or patterns on phosphor screen during normal use.
3. Proof of purchase is necessary for verification of warranty.
4. Unit must be properly packaged (in original packaging if possible) when returned under warranty.
5. Vidikron Interface devices are designed to be used with Vidikron projection systems. Use of other interface devices with Vidikron projection systems could void the warranty. Interfaces used with other than Vidikron projection systems are void of all warranty.
6. Wire harness assemblies sold by Vidikron contain installation instructions. These instructions are current at the time of printing and updated as necessary. Although Vidikron strives to maintain our technical information as current as possible, we cannot be responsible for changes made by the terminal manufacturer to their specs and equipment as it applies to the installation of the wiring harness or its operation. Wire harness should be installed by qualified technical personnel.

### 2. DEALER'S OBLIGATION

1. The dealer is expected to evaluate the merchandise to insure that it is in working order, and is responsible for making any minor setup adjustments at no cost to Vidikron or the customer.
2. The dealer must advise the customer that the warranty registration card is to be filled out and mailed to Vidikron within 7 days of the date of purchase using the return envelope provided.
3. If assistance or guidance is required on technical problems, it is the dealer's responsibility to contact Vidikron Limited, or the nearest authorized service depot.
4. Where warranty service is required, it is the dealer's responsibility to insure that the unit is packed and shipped prepaid to an authorized Vidikron Limited service depot.
5. If a dealer elects to make warranty repairs through anyone other than an authorized Vidikron Service depot, the warranty becomes void, unless otherwise specified.
6. A current list of all authorized serviced organizations can be obtained from Vidikron Limited (see back cover).

7. When returning a unit for repair to an authorized service depot, documentation should be included with the following information.

#### In Warranty

- A. Customer's name and address.
- B. Date of Purchase.
- C. Specific complaint/failure (Notations such as "defective" or "repair under warranty" are not acceptable).

#### Out of Warranty

- A. Include terms A, B, C, of "In Warranty".
- B. A purchase Order to cover the cost of repairs.

#### Damaged Merchandise

See transit damage/loss below.

### 3. TRANSIT DAMAGE/LOSS

#### VISIBLE/HIDDEN DAMAGE

Vidikron Limited endeavours to use reliable and reputable carriers but occasionally damage or loss can occur. Resolving the problem of transit damage or loss depends on the co-operation of all parties. The following will outline the responsibilities of the various parties involved.

#### The consignee or buyer must:

- Inspect all shipments on arrival.
- If damage, suspected damage or loss is apparent upon delivery, an appropriate notation should be marked on all copies of the carrier's pro bill and the driver must sign all copies to acknowledge this notation.
- Ask the carrier to do a detailed inspection of the damages.
- File a claim with the carrier.
- Co-operate with the carrier to achieve damage repair where possible.
- Follow-up as necessary to secure final settlement.

#### The carrier should:

- Co-operate in every way with the buyer/claimant to achieve an amicable settlement.

#### Vidikron will:

- Assist our customers, through our Distribution Services Department, in freight claim matters.
- Drop Shipments: Vidikron does not promote the practice of drop shipments.
- Although Vidikron will provide every assistance, we cannot be responsible for the actual filing of claims on the carrier or accept liability for uncontrolled freight claims.

### 4. SERVICE DEALER

Dealers who maintain their own service facilities and would like to become an authorized depot may acquire application forms from Vidikron Limited (see back cover).

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## HOW THIS MANUAL IS ORGANISED

This manual is for use by a service technician to service and maintain an Vidikron VPF40HD® series projection system. Organization of the manual permits easy access to service related information for the system and its serviceable modules. Sections 1 to 7 include servicing information at the system level. All other sections are specific to the system's internal modules.

Individual sections of this manual may be updated or replaced as your projector hardware configuration changes. Appropriate sections will be provided with all new or upgraded components. Initial section titles include:

GENERAL SERVICING:	Section 1	Introduction
	Section 2	System Specifications
	Section 3	Theory of Operation
	Section 4	Servicing Guidelines
	Section 5	Hardware Layout and Disassembly
	Section 6	Troubleshooting
	Section 7	Alignment Procedures
MODULE SERVICING:	Section 8	Bias Module
	Section 9	Convergence Module
	Section 10	Horizontal Deflection Module
	Section 11	Keystone Module
	Section 12	Motherboard Assembly
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	Section 14	Power Entry Module
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	Section 16	RGB SYNC 2 INPUT Module
	Section 17	Remote Control Module
	Section 18	Remote Jack and Fan Assemblies
	Section 19	Vertical Deflection Module
	Section 20	Video Control Module
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Section 23	ACON (Automatic Convergence Option)	
APPENDICES:	Appendix A	Computer Communication
	Appendix B	Reverse Scan Installation
	Appendix C	Harness/Wiring Diagram
	Appendix D	Terms/Concepts/Abbreviations
	Appendix E	Service Replacement Modules and Assemblies
	Warranty	

NOTE: Prior to module servicing, review sections 1 to 7.

## SECTION I

### INTRODUCTION

#### 1.1 SCOPE

This service manual establishes procedures for a qualified service technician to service and maintain an Vidikron VPF40HD commercial projection system. Sections 1 to 7 include service information for the projection system. Sections 8 to 23 are specific to each internal module in the VPF40HD projector. Appendices A to F provide additional reference information.

#### 1.2 REFERENCES

Vidikron VPF40HD Series Projection System User's Manual #B-54-7597-01P.

#### 1.3 SYSTEM DESCRIPTION

The VPF40HD Series Projector is a three lens, high resolution, high brightness, video/data projector. Features of the projector include:

- automatic synchronization to a variety of video input sources in the frequency range of 15 kHz to 55 kHz horizontal and 45 Hz to 120 Hz vertical
- focusing on flat, curved or rear screens with allowable projector-to-screen distances from 5 to 30 feet
- projector control of a wide range of software functions from either a built-in, wired remote or infrared remote keypad
- microprocessor control of all major projector functions
- nonvolatile memory storage of all projector settings
- modular construction for easy accessibility to module components when servicing is required

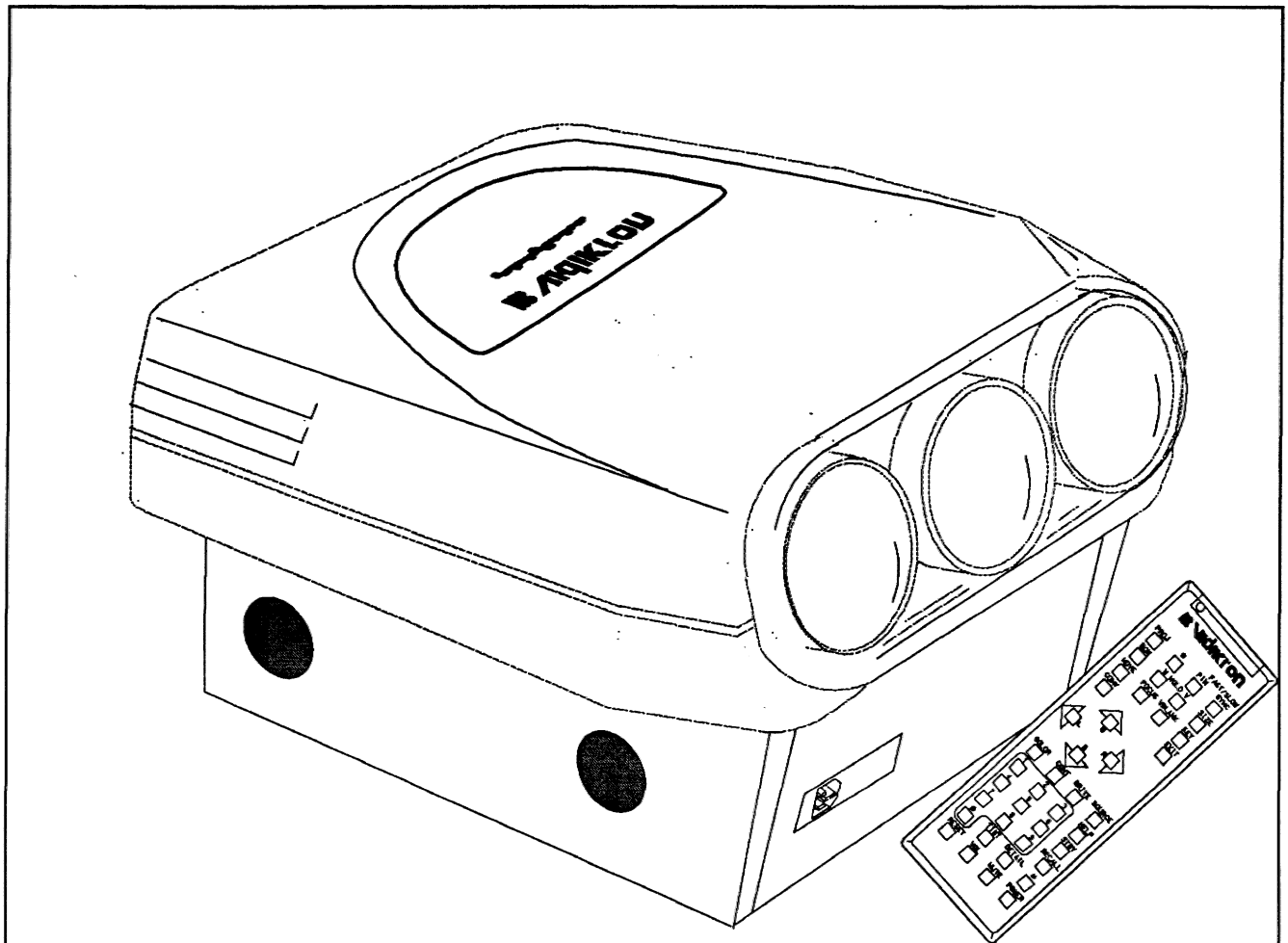


FIGURE I-1. The VPF40HD Projector

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**NOTES**

## SECTION 2

### SYSTEM SPECIFICATIONS

#### 2.1 SPECIFICATIONS

##### OPTICS

- High definition F1.0 hybrid lens
- 10 line pairs/mm

##### RESOLUTION

- Maximum resolution 1280 x 1024 pixels
- 1000 TV lines

##### BRIGHTNESS

- 650 lumens peak light output
- 370 foot lamberts on a 6' diagonal 10 gain screen total light output

##### FOCUSED DATA

- 480 lumens peak light output
- 280 foot lamberts on a 6' diagonal 10 gain screen total light output

##### DISPLAY

- Functional 3 lens design allows simple adjustment for flat, curved or rear screens from 5 to 25 feet diagonal
- Electronic pincushion circuitry separately corrects top, bottom and sides for flat, curved or rear screen applications
- Keystone circuitry corrects pictures for angles up to  $\pm 15^\circ$  vertically from screen axis

##### VIDEO CIRCUITS

###### Input

- Input level 0.5 to 2.0 volt p-p, 75 ohms  $\pm 1\%$  terminated
- Automatically switches to separate sync or sync on green
- Separate sync is automatically accepted in either polarity

###### Frequency Response

- 60 MHz bandwidth  $\pm 3$  dB
- Linear non-differential video amplifier accommodates 8 nano-second pixels and digital clock rates over 130 MHz

##### D.C. Restoration

- Keyed clamp

##### Gain

- Minimum video gain 40 dB or 100X
- Maximum video output 120 volts p-p drive

##### DEFLECTION CIRCUITS

###### Vertical Deflection

- Size: automatically regulated over frequency range and adjustable from 20% underscan to 10% overscan
- Frequency Range: 45 Hz to 120 Hz auto-locking
- Retrace Time: less than 300 microseconds

###### Horizontal Deflection

- Size: regulated over frequency range and adjustable from 10% underscan to 10% overscan
- Frequency Range: 15 kHz to 55 kHz auto-locking
- Retrace Time: 3.5 $\mu$ s

##### GEOMETRY DISTORTION

- Horizontal - less than 2%
- Vertical - less than 2%

##### SOFTWARE VERSION

- V3.1

##### OPERATING AND SERVICE CONTROLS

###### Keypad

- |                |                  |
|----------------|------------------|
| <b>Primary</b> | <b>Secondary</b> |
| • Power        | • Converge       |
| • Contrast     | • Pincushion     |
| • Bright       | • Bow            |
| • Color        | • Size           |
| • Tint         | • Focus          |
| • Detail       | • Keystone       |
| • Volume       | • Move           |
| • Mute         | • Vert. Blank    |
| • Standby      | • Horz. Hold     |
| • Reset        | • Vert. Hold     |
| • Recall       | • Fast/Slow Sync |
| • Help         | • Projector #    |
| • Source #     | • Exit           |

- Optional remote infrared receiver can be connected for rear screen applications
- On screen menus with step-by-step setup instructions and graphic focus aids

###### Screwdriver Adjust

- RGB Drive Levels
- RGB Screen Controls
- RGB Cut-off Switches
- RGB Electronic Focus
- Vertical Linearity

###### Indicators

- |   |                   |
|---|-------------------|
| • Power On                                | • Error           |
| • Ready                                   | • Vertical Scan   |
| • Vert. Hold Manual                       | • Fail            |
| • Horz. Hold Manual                       | • Horz. Scan Fail |
| • 200V, 150V, -24V, +24V, -12V, +12V, +5V |                   |

##### High Voltage

- 34.0 kV regulated to better than  $\pm 1\%$

##### Power Requirements

- 90 VAC to 132 VAC can be externally reconnected for 180 VAC to 264 VAC
- Line frequency 50 to 60 Hz nominal
- Power 450 watts maximum

##### OTHER FEATURES

###### Inputs

- The projector comes with a RGB SYNC 2 INPUT module installed

###### Optional Source Selection

- The Electrohome IR Remote Video/Data Switcher allows the use of 6 additional input modules
- Up to 3 Switchers may be used for up to 36 inputs

###### Mounting

- The projector can be ceiling mounted on its optional fixture or mounted on table or castered cart

##### WEIGHT

- 99 lbs (45 kg)
- Shipping Weight 124 lbs (57 kg)

##### ACCESSORIES INCLUDED

- IR remote control keypad
- Tool Kit, Ball Nose Driver
- Lens Cleaning Cloth
- User's Manual

##### ENVIRONMENT

###### Maximum Operating Range

- Temperature: 0 to 35°C (32 to 95°F)
- Storage: -30 to 65°C (-22 to 149 °F)
- Humidity: 0 to 90% non-condensing
- Altitude: 0 to 3000m (0-10,000 ft.)

###### Heat Dissipation

- 17,000 Btu/hr (approx.)

##### REGULATORY APPROVALS

- FCC Class A, DHHS and HWC
- CSA certified

##### One year parts and labor WARRANTY

Due to constant research, specifications are subject to change without notice. VPF40HD is a registered trademark of Vidikron Limited.

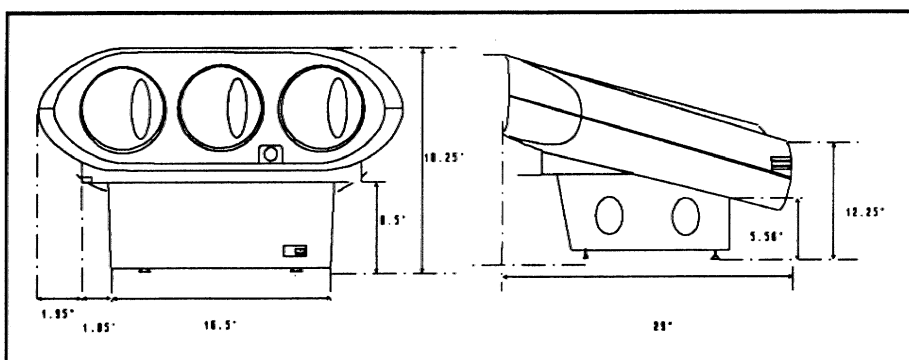


FIGURE 2-1. Projector Dimensions





## SECTION 3

### THEORY OF OPERATION

#### 3.1 OPTICAL

The projector uses F1.0, color corrected, hybrid optics. The optics are formed from glass and acrylic aspheric elements. Two stage focusing allows independent focusing of the image center and corners. It also enables the projector to be used with a variety of screen types, e.g., curved, flat, or rear screens.

Each CRT/lens assembly can be mechanically adjusted to accommodate screen sizes ranging from 5 to 25 feet diagonal. Each CRT can be mechanically tilted side to side and top to bottom, with respect to the lens, to optimize screen focus at various projector-to-screen angles.

#### 3.2 MECHANICAL

The chassis of the projector is a wire-frame type with detachable metal side, front, back and bottom panels. The top cover is sturdy moulded plastic, which is also detachable. Accessibility to the internal modules is made easy by removal of these panels and the top cover.

The projector is designed to accept a variety of electronic modules. A series of card racks (slots) are provided for this purpose at the rear of the projector. The plug-in nature of the modules eliminates time consuming de-soldering and eases serviceability. Most modules plug directly into the Mother PCB, minimizing both harnessing and noise within the projector.

#### 3.3 ELECTRONIC

The projector takes video input signals and processes them through video, sync/deflection, and correction circuits to produce a projected video image. To do this, many individual system modules work together. These modules and their basic functions are explained in the following paragraphs. For more details for any specific module, refer to the appropriate Module Servicing section in this manual. Also refer to Figure 3-1, *Function Block Diagram*.

##### 3.3.1 Power Supply Modules

The power supply circuitry contains the following modules:

- a) Power Entry (PEM),
- b) Low Voltage Switch Mode Power Supply (SMPS),
- c) High Voltage Power Supply,
- d) Bias.

Power Entry Module (PEM). The Power Entry Module (PEM) accepts 120V or 240V AC input power for distribution to the projector power supplies. A 120V/240V switch on the Power Entry Module is set to the input voltage in use.

Low Voltage Switch Mode Power Supply (SMPS). The Low Voltage SMPS provides +5, +6.3,  $\pm 12$ ,  $\pm 24$ , +150 and +200 VDC for the logic and control circuitry.

High Voltage Power Supply. The High Voltage Power Supply provides 34 KV to each CRT anode, 11 KV to the focus circuitry and 800 VDC for G2 cut-off.

Bias Module. The Bias module controls electronic and dynamic focus, G2 cut-off, beam limit and blanking. It also includes High Voltage Power Supply shut off circuitry in the event of a scan failure and/or a beam over-current condition.

##### 3.3.2 Remote Control Module

The Remote Control module is the main control center for the projector. It consists of a microprocessor, read only memory, random access memory, input/output expanders and a number of digital-to-analog converters. The module receives user input from the projector's built-in or external keypads, and monitors status and control inputs from the other system modules.

Microprocessor address and data bus lines as well as numerous analog and digital control voltages are distributed from the Remote Control module to control projector functions.

### 3.3.3 Video Modules

The video circuitry includes the following modules:

- a) Input
- b) Waveform
- c) Video Control
- d) Video Output

Video Input Module(s). Video input modules receive input signals from a video source and condition them for use by the projector. The projector comes with a standard RGB SYNC 2 INPUT module. Other input modules may also be installed.

The input module directs the video component of the input signal to the Video Control module, and the sync component to the Horizontal Deflection module. Input modules also perform decision making routines such as determining whether or not a signal should be connected to the Mother Board.

Waveform Module. The waveform module provides gain control voltages for the Video Control module. It also provides waveform signals for the Keystone, Power Deflection and Bias modules for geometry correction. (See section 3.3.5, *Correction Circuits*).

Video Control Module. The Video Control module performs two primary functions. It amplifies video input signals by multiplying them by the gain signal from the Waveform module. It provides crosshatch and text generation.

Outputs of the Video Control module are fed to the Video Output module.

Video Output Module. The Video Output module amplifies incoming video signals from the Video Control module and directs these signals to the cathode of each CRT. There is one Video Output module per CRT.

### 3.3.4 Sync/Deflection Circuits

The composite sync signal from each input module is fed to the Horizontal Deflection module for processing. Output from the Horizontal Deflection module is used by the Power Deflection and Vertical Deflection modules.

Horizontal Deflection Module. The Horizontal Deflection module splits the combined sync signal into horizontal and vertical components. The vertical sync pulse is fed to the Vertical Deflection module. The horizontal sync pulse is used by the auto-frequency lock, bandswitch and horizontal processor circuitry to form a horizontal drive pulse.

The Horizontal Deflection module also produces a regenerated sync pulse which is controlled by the keypad MOVE key to shift the projected image up, down, left and right.

Vertical Deflection Module. This module uses a vertical processor to derive the vertical drive pulse for use by the Power Deflection modules. The horizontal regulator (or buck convertor) supplies power to the horizontal deflection circuitry. The Vertical Deflection module also contains vertical auto-lock circuits and an EHT INHIBIT circuit.

Power Deflection Module. Vertical and horizontal deflection amplifiers on the Power Deflection modules control the flow of current through the deflection yokes (and the arising magnetic fields) on each CRT. This control permits movement or scanning of the electron beam and horizontal and vertical centering of the projected image.

### 3.3.5 Correction Circuits

The correction circuitry provides convergence, geometry, color, and focus correction.

Convergence Module. The Convergence module corrects and compensates for errors in registration between the red, green and blue CRT images. The module uses digital-to-analog converters to continuously generate correction values which are memory-mapped to the CRT raster.

The Convergence module contains the following circuitry:

- a) horizontal phase locked loop (HPLL)
- b) vertical phase-locked loop (VPLL)
- c) alpha generation
- d) RAM bank switching
- e) band switch
- d) address generation and multiplexing
- f) waveform channel

Waveform Module. The Waveform module provides geometry correction waveforms to the Keystone, Power Deflection and Bias modules.

Other functions provided are: address/data de-multiplexing, address decoding, programmable blanking generation and drive level control.

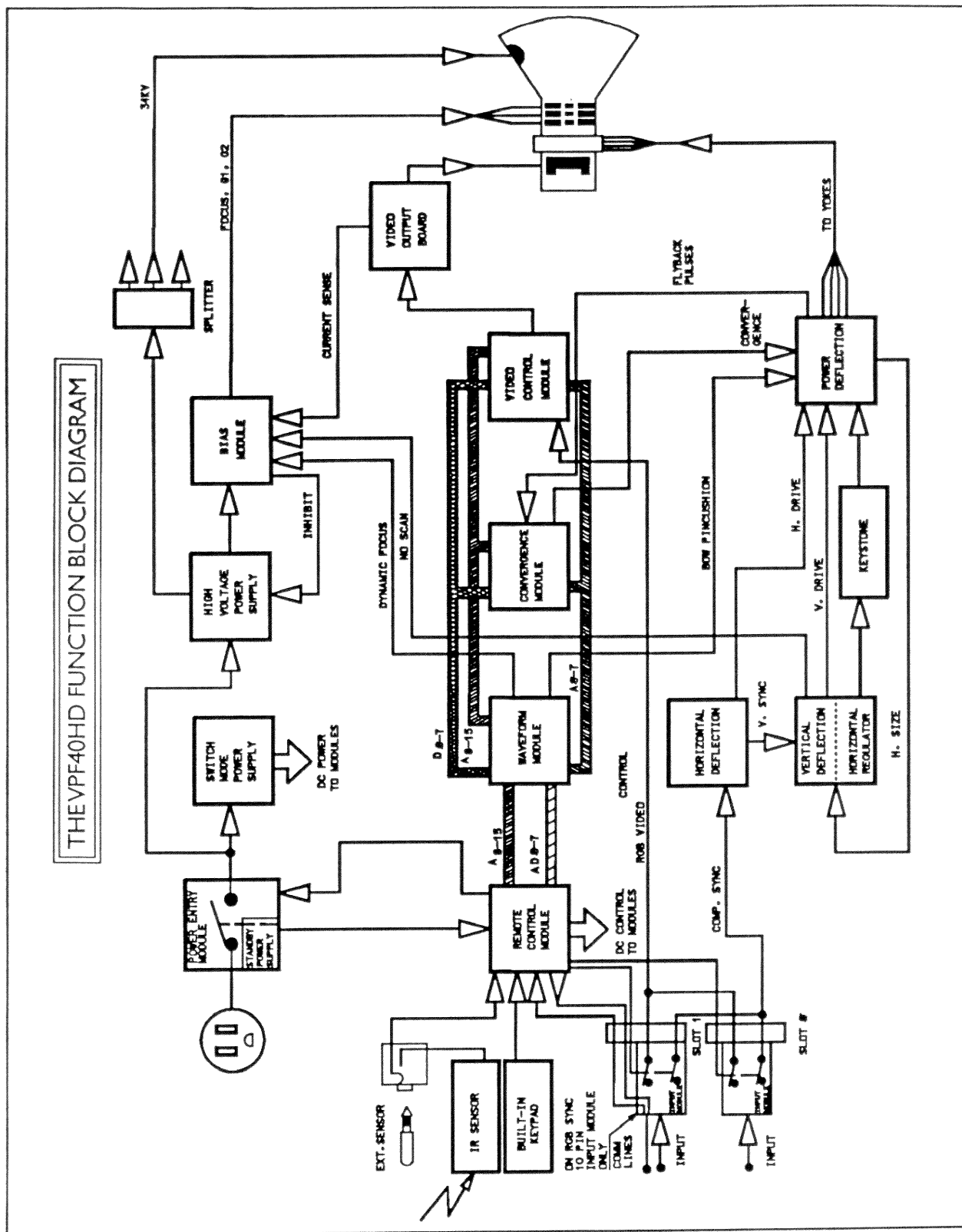


FIGURE 3-1. Function Block Diagram

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**NOTES**

## SECTION 4

### SERVICING GUIDELINES

#### WARNING

**PERFORM SERVICING ONLY AFTER BECOMING THOROUGHLY FAMILIAR WITH THE FOLLOWING SERVICING GUIDELINES. NONCOMPLIANCE INCREASES THE RISK OF HAZARDS AND INJURY TO THE USER.**

**DO NOT MODIFY ANY CIRCUIT.**

#### 4.1 SAFETY PRECAUTIONS AND WARNINGS

##### 4.1.1 High Voltage

High voltages capable of causing DEATH are used in this projector. Observe all precautions necessary for working on HIGH VOLTAGE equipment before servicing either the power supplies or their load components.

To prevent damage to solid state devices, do not arc the picture tube anode lead to chassis or earth ground.

#### WARNING

**This projector employs high voltage picture tubes.**

##### 4.1.2 X-RAY Radiation

This projector can produce soft x-ray radiation. The HIGH VOLTAGE has been factory set to prevent exposure to soft x-ray radiation.

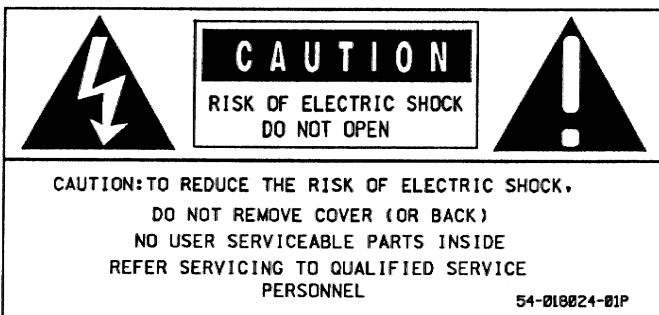


FIGURE 4-1. Caution Label

##### 4.1.3 High Voltage Power Supply

Due to critical safety circuitry to prevent x-ray radiation, the High Voltage Power Supply must be serviced at the factory. If the module needs repair, replace it.

##### 4.1.4 CRT Handling

#### WARNING

Each picture tube encloses a high vacuum. Bumping or scratching a picture tube may cause it to implode, resulting in personal injury and property damage. Wear shatter-proof goggles while handling a CRT. Handle a CRT by the neck.

##### 4.1.5 Video Output Module

Do not adjust or repair critical safety circuitry within the Video Output Module. It has been designed to prevent x-ray radiation. If components in this circuitry need repair, replace the Video Output module.

Controls R43 and R47 are sealed in epoxy. They **MUST NOT** be adjusted, replaced or defeated.

##### 4.1.6 Ventilation Slots

Do not block any of the projector ventilation slots during operation or servicing. Ventilation slots are located on the top cover, side panels and bottom plate.

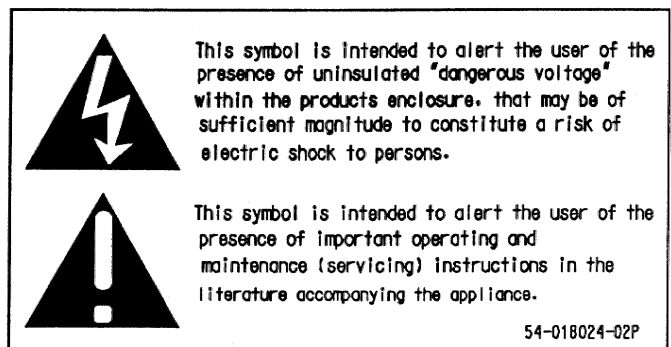


FIGURE 4-2. Alert Label



#### 4.1.7 CRT Coolant Safety Data

The face of each CRT is liquid cooled by an ethylene glycol mixture sealed within the CRT assembly. The ethylene glycol mixture, while sealed in the assembly, is not dangerous or harmful. However, if the seal becomes broken, appropriate measures must be taken. Read the following safety data pertaining to the coolant mixture.

##### Coolant Manufacturer

KANTO CHEMICAL COMPANY INC.  
3-2-8, Honcho-Nihonbashi Chuo-ko  
Tokyo, JAPAN 103  
Emergency Phone Number: 03-279-1587

##### Coolant Supplier

SONY CORPORATION  
4-10-18, Takanawa Minato-ku  
Tokyo, JAPAN 108  
Emergency Phone Number: 03-448-3759

##### Ingredient Details

Coolant Main Ingredient: Ethylene Glycol  
Percentage: greater than 95%  
Gas Number: 107-21-1  
LD<sub>50</sub>: 5 to 15g/kg (rat, guinea pig, mouse)

##### Physical Data

Physical State: Liquid  
Odor and Appearance: colorless, slight odor  
Air Pressure: 760 mmHg  
Boiling Point: 197.85 °C (760 mmHg)  
Freezing Point: 8.6 °F = 13 °C = 260 °K  
Specific Gravity: 1.115 at 20 °C

##### Fire and Explosion Data

Flashpoint: 111.1 °C  
Lower Flammable Limit: 3.2 % by volume  
Autoignition temperature: 775 °F  
Means of Extinction: water fog, alcohol foam, carbon dioxide or dry chemical

##### Reactivity Data

Incompatibility with: strong oxidizing agents and strong bases  
Hazardous: carbon monoxide, carbon  
Decomposition Products: dioxide

##### Toxicological Properties

Route of Entry: skin contact, skin absorption, eye contact, inhalation, ingestion  
Effects of Acute Exposure: ingestion causes stupor or coma, sometimes leading to fetal kidney injury  
Exposure Limits: 10 mg/m<sup>3</sup>  
Irritancy: irritant

##### Preventive Measures

Personal Protective: safety goggles, shower  
Equipment: with eye bath  
Respiratory: approved respirator  
Eye: safety goggles  
Clothing: protective clothing  
Handling Procedures: avoid contact with eyes, skin and clothing  
avoid prolonged or repeated exposure  
Storage: keep tightly closed  
hygroscopic  
protect from moisture  
Spillage, Clean-up: wear suitable protective equipment  
and disposal: small spills should be flushed with large quantities of water  
larger spills should be collected for disposal

##### First Aid Measures

Specific Measures: If ingested, consult with physician.  
In case of skin contact, wash off with water (water soluble).

## 4.2 SERVICING AND REPAIR GUIDELINES

**WARNING**

THE PROJECTION SYSTEM CONTAINS MANY STATIC SENSITIVE COMPONENTS. ALL SERVICING MUST BE PERFORMED AT A STATIC CONTROLLED WORK STATION.

**IMPORTANT:** When ordering service replacement components, quote the projector model number, the serial number and the date of manufacture. This information is available from the licence label located on the front bezel.

**4.2.1** Before servicing, observe the original lead dress. Take extra precaution to maintain the original lead dress, especially in the high voltage circuitry areas. Replace any wire that has damaged insulation.

**4.4.2** Replace all components that show signs of overheating. Always use the manufacturer's replacement component.

**4.2.3** Check that the high voltage is at its correct value. Use a accurate, calibrated, high voltage meter.

**4.2.4** When troubleshooting a projector with a high voltage problem, **DO NOT** operate the projector longer than is necessary to locate the cause of the problem.

**WARNING**

**DO NOT** make any adjustments to the High Voltage Power Supply. X-ray radiation may be emitted when excessive high voltage exists.

**4.2.5 AC Leakage Test.** Perform an AC leakage test on exposed metallic parts after each servicing. This will ensure that the projector is safe to operate without danger of electric shock. Perform the test as follows:

a) Temporarily disable the ground connection of the line cord using a suitable adaptor. **DO NOT** use a line isolation transformer.

b) Connect a 1500  $\Omega$ , 10 watt resistor in parallel with a 150nF AC capacitor between a known good earth ground and each exposed metallic part, one at a time. With an AC voltmeter having a minimum sensitivity of 1000  $\Omega/V$ , measure the voltage across the 1500  $\Omega$  resistor. See Figure 4-3. The rms voltage measured **MUST NOT EXCEED** 0.3V rms (this is equivalent to 0.5mA rms current). Values exceeding this limit are potential shock hazards. Correct immediately!

**4.2.6 Component Removal.** If a component is defective and must be replaced, cut the leads near the body of the component as shown in Figure 4-4.

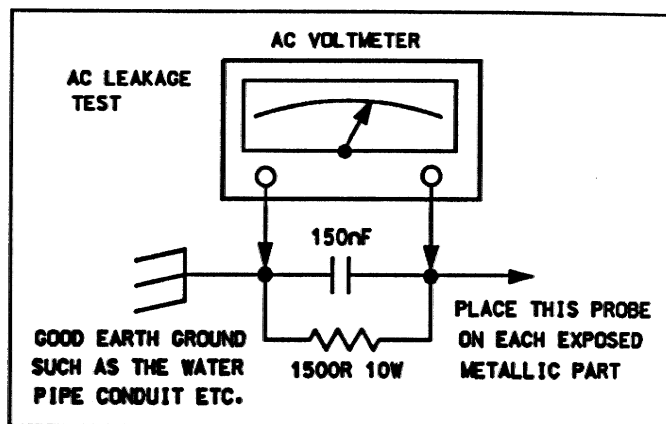


FIGURE 4-3. AC Leakage Test

02060307

Grip the lead with needle-nose pliers. Use a soldering iron to melt the solder, securing the lead, on the back of the PCB. Pull gently to remove the lead.

If a component is to be removed for testing, grip the lead with needle-nose pliers. Use a soldering iron to melt the solder while securing the lead on the back of the PCB. Pull gently to remove the lead.

Avoid excessive heating of the component. If a transistor is to be removed, attach an alligator clip or soldering heat sink to the transistor case to provide a temporary heat sink. Clean out all holes. Use a solder sucker, solder brush or solder wick.

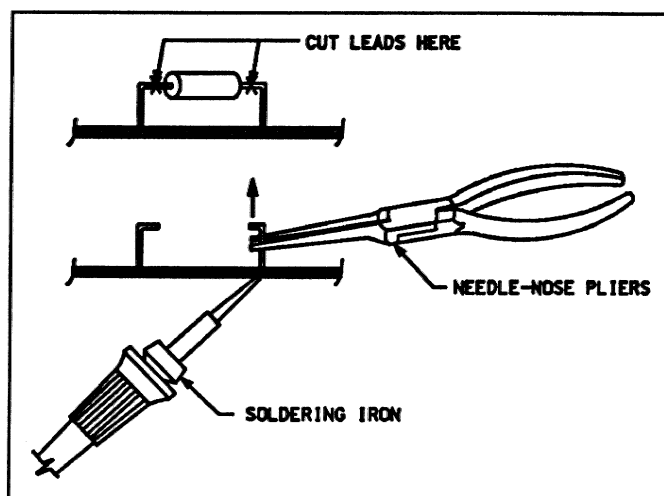


FIGURE 4-4. Component Removal

02060309

Check component markings **AND** the parts list to determine the correct replacement component. **NOTE:** If the component is highlighted in the parts list with a  $\Delta$  symbol, it is a critical safety component. The component **MUST** be replaced with an identical part.

**4.2.7 Repair Cautions.**

**DO NOT** short transistors or ICs during circuit checks.

**DO NOT** short IC pins.

**DO NOT** short transistor emitter or collector pins while the projector is operating.

**DO NOT** short or remove bias resistors while the projector is operating.

**DO NOT** operate power transistors with heat sinks removed.

**DO NOT** overload transistors or ICs. Make sure the projector is disconnected from its AC power source before testing, removing, or installing transistors or ICs.

**DO NOT** operate the projector with parts removed (except covers and track-mounted modules).

**DO NOT** over-tighten the CRT tilt screws (below front top cover. Severe CRT damage may result.

**4.3 CLEANING**

Perform cleaning as required after each servicing.

Disconnect AC power from the projector. Remove (blow or wipe) foreign material, e.g., dust, from the projector.

Clean the case with a soft dampened cloth. Use a mild commercial cleaner. **DO NOT** use liquid or aerosol cleaners.

Clean the lenses only when necessary using the lens cleaning cloth. **DO NOT** moisten the cloth. Rub very gently in a circular motion.

## SECTION 5

### HARDWARE LAYOUT AND DISASSEMBLY

#### 5.1 HARDWARE LAYOUT

The projector system consists of several modules and components, each located in one of three main serviceable areas:

- 1) Rear Panel Rack
- 2) Front Slide-out Rack
- 3) Projection Head

Modules within each of the serviceable areas are interconnected via cabling and/or the centrally located Mother Board. Refer to Appendix C, *Harness/Wiring Diagram*.

**Rear Panel Card Rack.** The Rear Panel Card Rack contains the projector's plug-in card type modules, accessible by removing the rear panel. These include:

- ▶ Vertical Deflection Module
- ▶ Horizontal Deflection Module
- ▶ Remote Control Module
- ▶ Waveform Module
- ▶ Convergence Module
- ▶ Video Control Module
- ▶ Auto-Convergence Module (optional)
- ▶ Input Module
- ▶ Remote Jack Assembly

**Front Slide-out Rack.** The Front Slide-out Rack is a wire frame module rack which can be temporarily slid away from the front projector base for module servicing. The rack is accessible by removing the projector's lower front panel. Modules contained within the rack include:

- ▶ High Voltage Power Supply
- ▶ Low Voltage Switch Mode Power Supply (SMPS)
- ▶ Power Entry Module
- ▶ Fan Filter Assembly
- ▶ Standby Power Transformer
- ▶ Line Filter
- ▶ Keystone Module

**Projection Head.** The Projection Head includes the system's optical and electro-mechanical components. Accessibility is provided by removing the top cover. Modules and assemblies within the Projection Head area include:

- ▶ Lens/CRT Assemblies (3)
- ▶ Power Deflection Modules (3)
- ▶ Bias Module
- ▶ Splitter
- ▶ Keypad
- ▶ IR Sensor Assembly

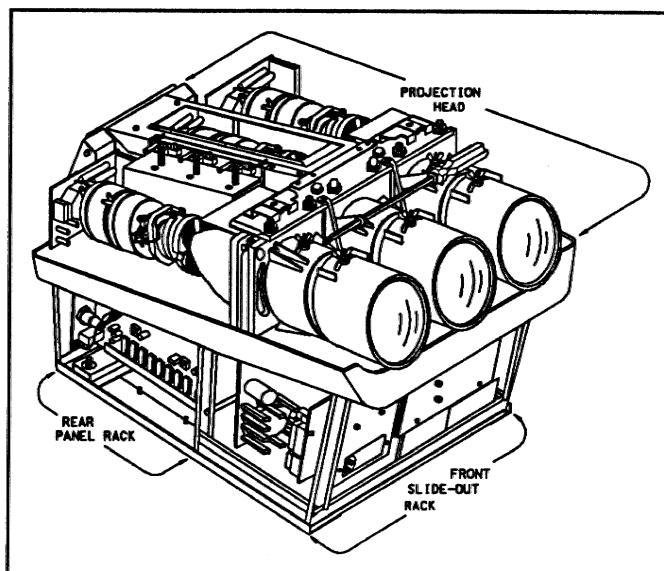


FIGURE 5-1. Projector Module and Component Areas

## 5.2 DISASSEMBLY AND REPLACEMENT

This section includes disassembly and replacement procedures for many of the projector's hardware and electrical components. For modules and components not covered in this section, refer to the appropriate **Module Servicing** section in this manual.

Disassembly/Replacement Procedures included in this section are:

- ▶ Top Cover Removal (5.2.1)
- ▶ Side Panel Removal (5.2.2)
- ▶ Front Panel Removal/Front Slide-out Rack Mounted Module Access (5.2.3)
- ▶ Lower Case Removal (5.2.4)
- ▶ Back Panel and Card Rack Module Removal (5.2.5)
- ▶ Keypad Removal (5.2.6)
- ▶ Keypad Installation (5.2.7)
- ▶ Standby Power Transformer Removal (5.2.8)
- ▶ Line Filter Removal (5.2.9)
- ▶ Lens Removal (5.2.10)
- ▶ CRT Removal (5.2.11)
- ▶ Lens/CRT Assembly Installation (5.2.12)
- ▶ CRT Deflection Assembly Replacement (5.2.13)

### Tools & Equipment Required:

- ▶ 1/4" hex head socket driver
- ▶ Phillips screwdriver

## WARNING

### IMPORTANT NOTES:

- 1) READ SECTION 4, SERVICING GUIDELINES, PRIOR TO THE DISASSEMBLY OR REPLACEMENT OF ANY MODULE OR COMPONENT.
- 2) REMOVE ALL POWER TO THE PROJECTOR PRIOR TO THE DISASSEMBLY OR REPLACEMENT OF PROJECTOR MODULES OR COMPONENTS.
- 3) MANY OF THE PROJECTOR MODULES CONTAIN STATIC SENSITIVE COMPONENTS. SERVICING MUST BE PERFORMED AT A STATIC CONTROLLED WORK STATION.

### 5.2.1 Top Cover Removal

- a) Remove the line cord.
- b) Locate the two 15/16 head fasteners on the bottom sides of the projector's top cover. Using a 15/16 allen head type screw driver, turn the head of each fastener approximately 5 turns counter-clockwise. See Figure 5-2.

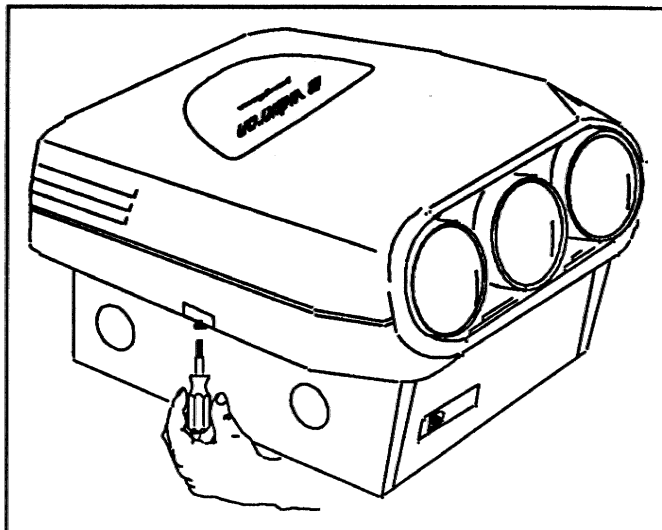


FIGURE 5-2. Top Cover Removal (A)

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Grasp adjacent sides of the projector top cover and gently lift it away from the projector as shown in Figure 5-3.

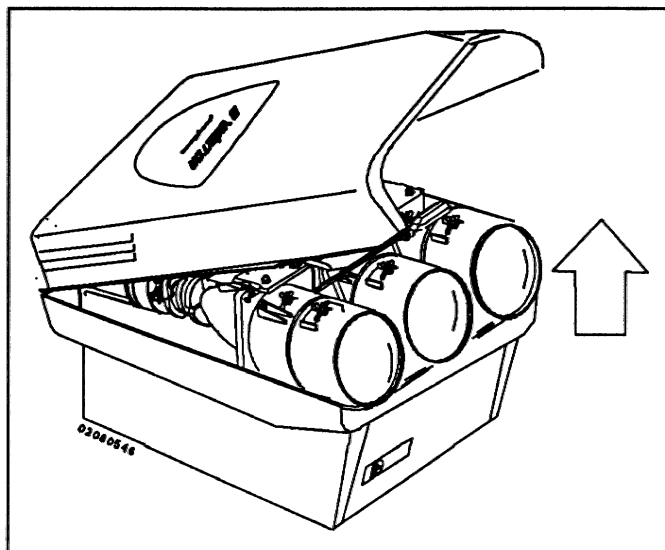


FIGURE 5-3. Top Cover Removal (B)

02080546



### 5.2.2 Side Panel Removal

- a) Remove the 2 screws securing each side panel to the projector frame as shown in Figure 5-4.
- b) Pull each side panel down and away from the projector body.

### 5.2.3 Front Panel Removal/Front Slide-out Rack Mounted Module Access

The following projector modules are mounted in a slide-out rack located in the lower front portion of the projector:

- ▶ High Voltage Power Supply
- ▶ Low Voltage Switch Mode Power Supply (SMPS)
- ▶ Power Entry Module
- ▶ Fan Filter Assembly
- ▶ LVPS Power Transformer
- ▶ Line Filter
- ▶ Keystone Module

To access any of the above modules, the projector lower front panel must be removed and the front slide-out rack slid away from the projector body.

Access the front slide-out rack as follows:

- a) Remove the side panels per section 5.2.2.
- b) Remove the 3 hex head screws securing the front panel to the projector frame as shown in Figure 5-5. Pull the front panel down and away from the projector body.

Access the Front rack modules as follows:

- c) The front rack is positioned behind the front panel and secured by two hex head screws to the projector frame. Remove the screws as shown in Figure 5-6.
- d) Notice how the front rack frame rests within guides located on each side of the projector frame. Grip the front rack and gently slide it (approximately 4") from the projector frame. Closely watch all cables connected to the front rack modules to assure no restrictions or unnecessary strain occurs.

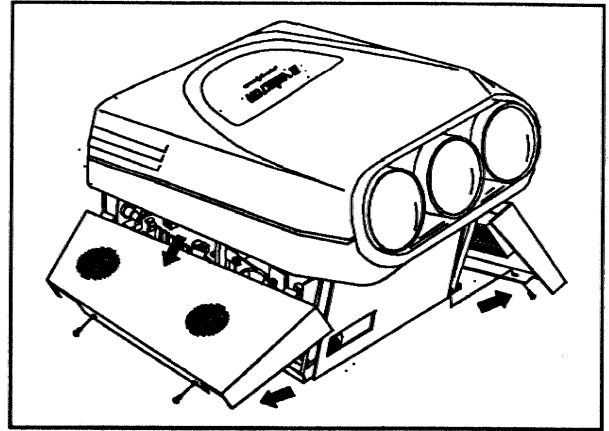


FIGURE 5-4. Side Panel Removal 02080837

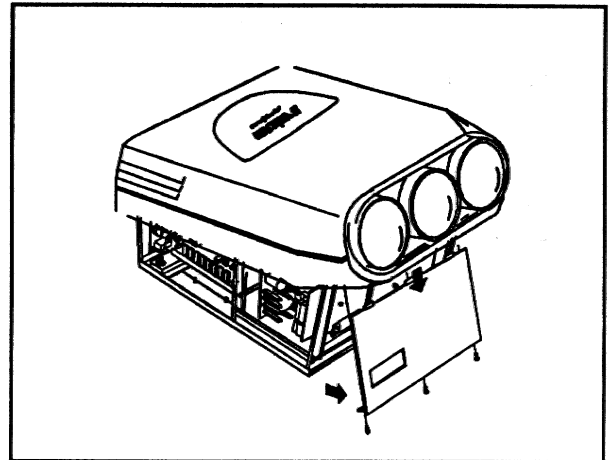


FIGURE 5-5. Front Panel Removal 02080838

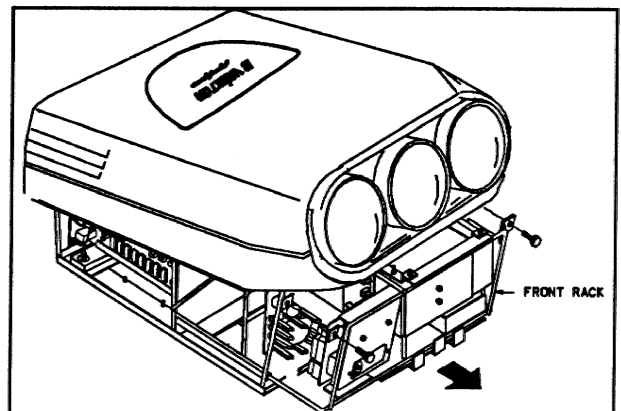


FIGURE 5-6. Slide-out Rack Access 02080805

### 5.2.4 Lower Case Removal

- a) Remove the top, side and front panels as described in sections 5.2.1 to 5.2.3. Do not remove the front slide-out rack from the projector.
- b) Remove the 16 Phillips head screws securing the lower case to the chassis. See Figure 5-7.
- c) Lower the case away from the chassis.

### 5.2.5 Back Panel and Card Rack Module Removal

The following projector modules are card-rack mounted in the rear panel card rack in the projector:

- ▶ Vertical Deflection Module
- ▶ Horizontal Deflection
- ▶ Remote Control Module
- ▶ Waveform Module
- ▶ Convergence Module
- ▶ Video Control Module
- ▶ Auto-convergence Module (optional)
- ▶ Video Input Module

See Figure 5-8.

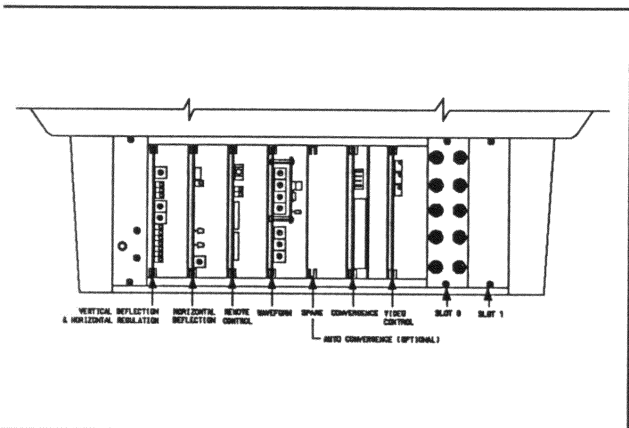


FIGURE 5-8. Card Rack Modules

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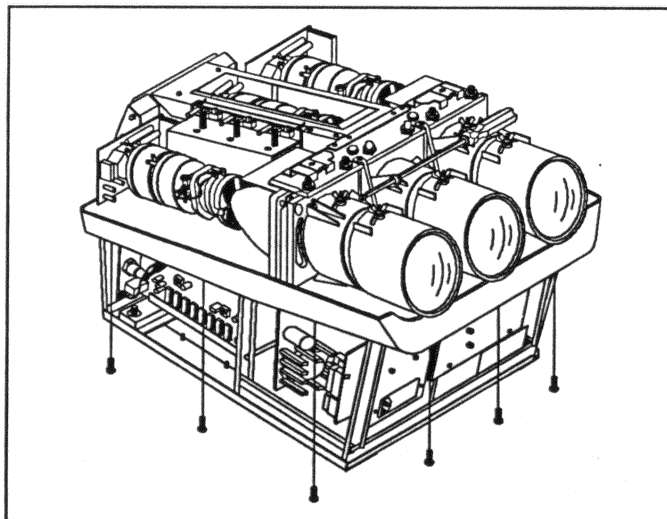


FIGURE 5-7. Lower Case Removal

02080806

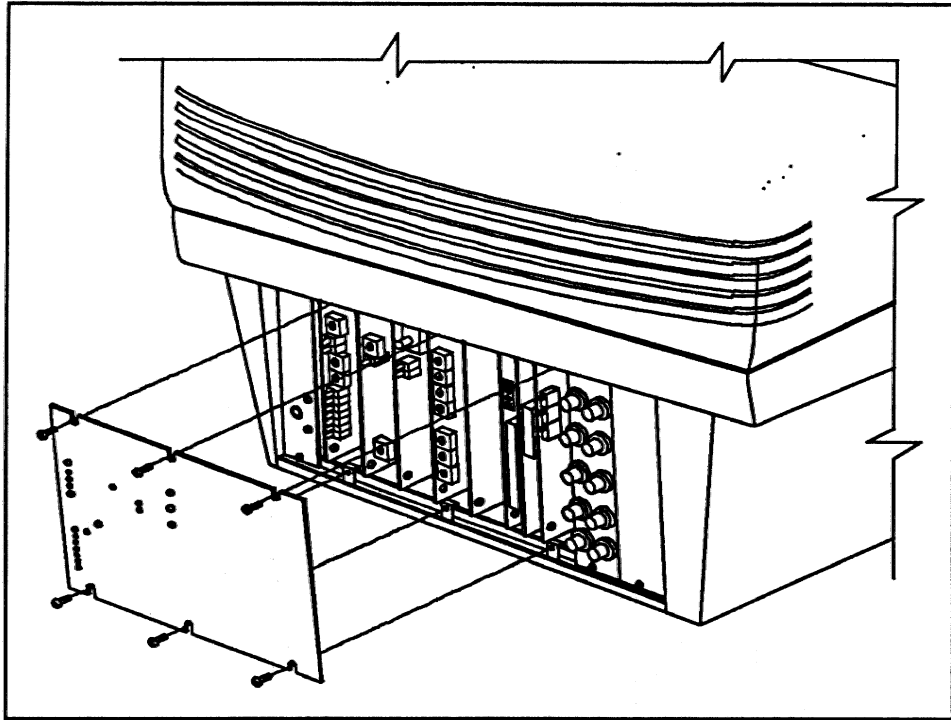
## CAUTION

REMOVE AC POWER PRIOR TO MODULE REMOVAL.

## WARNING

STATIC SENSITIVE COMPONENTS. PRINTED CIRCUIT BOARD REMOVAL OR REPAIR MUST BE PERFORMED AT A STATIC CONTROLLED WORK STATION.

- a) Remove the top cover. See section 5.2.1.
- b) Remove the printed circuit board extractor from the tool pouch.
- c) Remove the 6 Phillips head screws securing the back panel to the projector chassis.
- d) Remove the back panel as shown in Figure 5-9.



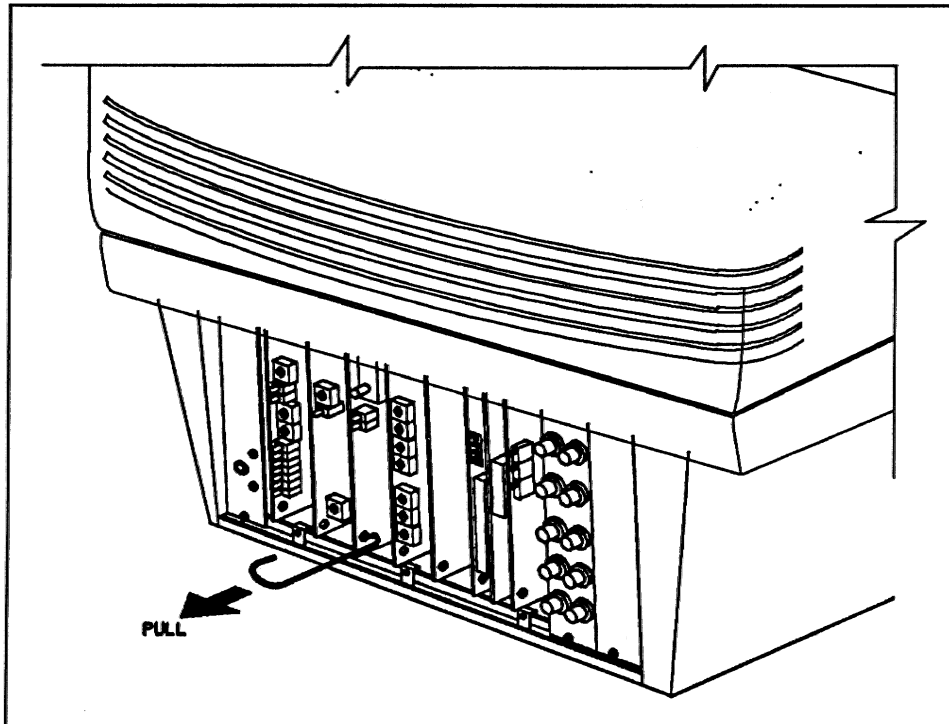
**FIGURE 5-9. Back Panel Removal**

02080808

e) Each card rack mounted module has a hole located in its outer top and/or bottom corners. Remove the printed circuit board extractor from the tool pouch supplied with the projector. Insert the hook of the extractor into one

of the holes of the module to be removed. Refer to Figure 5-10.

f) Pull the module out of the projector.



**FIGURE 5-10. Card Rack Module Removal**

02080810

### 5.2.6 Keypad Removal

- a) Remove the top cover. See section 5.2.1.
- b) Remove the side panel located next to the remote sensor plug-in at the rear of the projector. Refer to section 5.2.2.
- c) With the side panel removed, unplug the keypad cable leading to the keypad input on the Mother Board. Feed the cable away from the Mother Board, back to the Keypad. Refer to Appendix C, *Harness/Wiring Diagram*.
- d) Remove the 4 hex head screws which secure the keypad holder to the side brackets. See Figure 5-11, item 1.

- e) Remove the top 2 hex head screws which secure the keypad holder to the top bracket as shown (item 2).
- f) Remove the keypad assembly from the projector body.
- g) If the keypad side brackets must also be removed for ease in accessibility to other modules, remove the 2 side bracket mounting screws (item 3).

**NOTE:** Item 3 in Figure 5-11 does not require removal if only the keypad is to be removed.

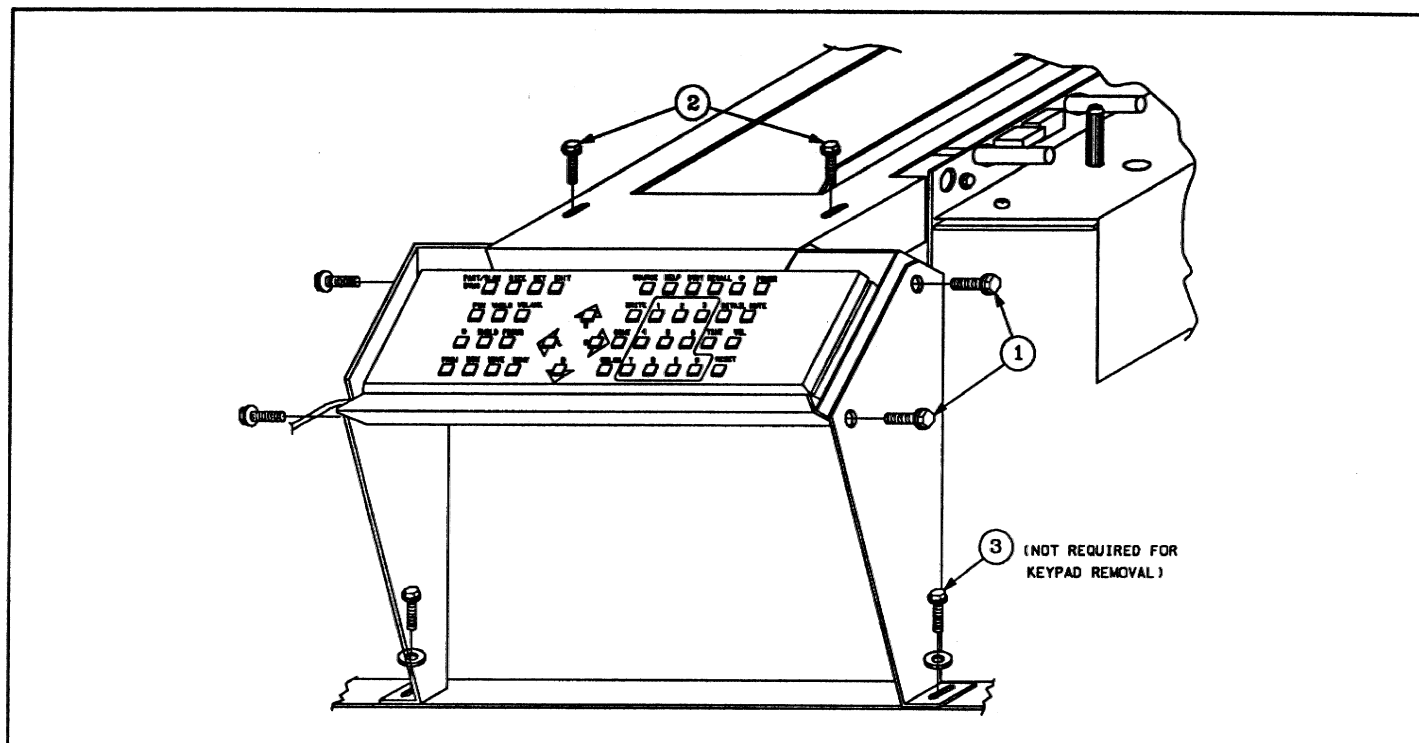


FIGURE 5-11. Keypad Removal

02060331

### 5.2.7 Keypad Installation

- a) Ensure that the tabs of all brackets are positioned in the grooves of the keypad.
- b) Tighten the keypad holder to the top bracket with the 2 screws removed in step e) above.

- c) Attach the keypad holder to the side brackets. Use the screws removed in step d) above. **NOTE:** Adjust the angle of the keypad such that it will penetrate the rear top cover and enable the rear top cover to be secured to the projector.

### 5.2.8 Standby Power Transformer Removal

The Standby Power Transformer is mounted within the front slide-out rack.

a) Remove the projector front and side panels and slide the front rack out per section 5.2.3.

b) Unplug connector M18-P5 from the Power Entry module as shown in Figure 5-12 below.

c) Unscrew the two hex head screws which secure the power transformer bracket to the front slide-out rack (item 2 in diagram). Feed the transformer assembly out through the bottom of the rack.

d) Remove the two hex head screws securing the transformer to the bracket.

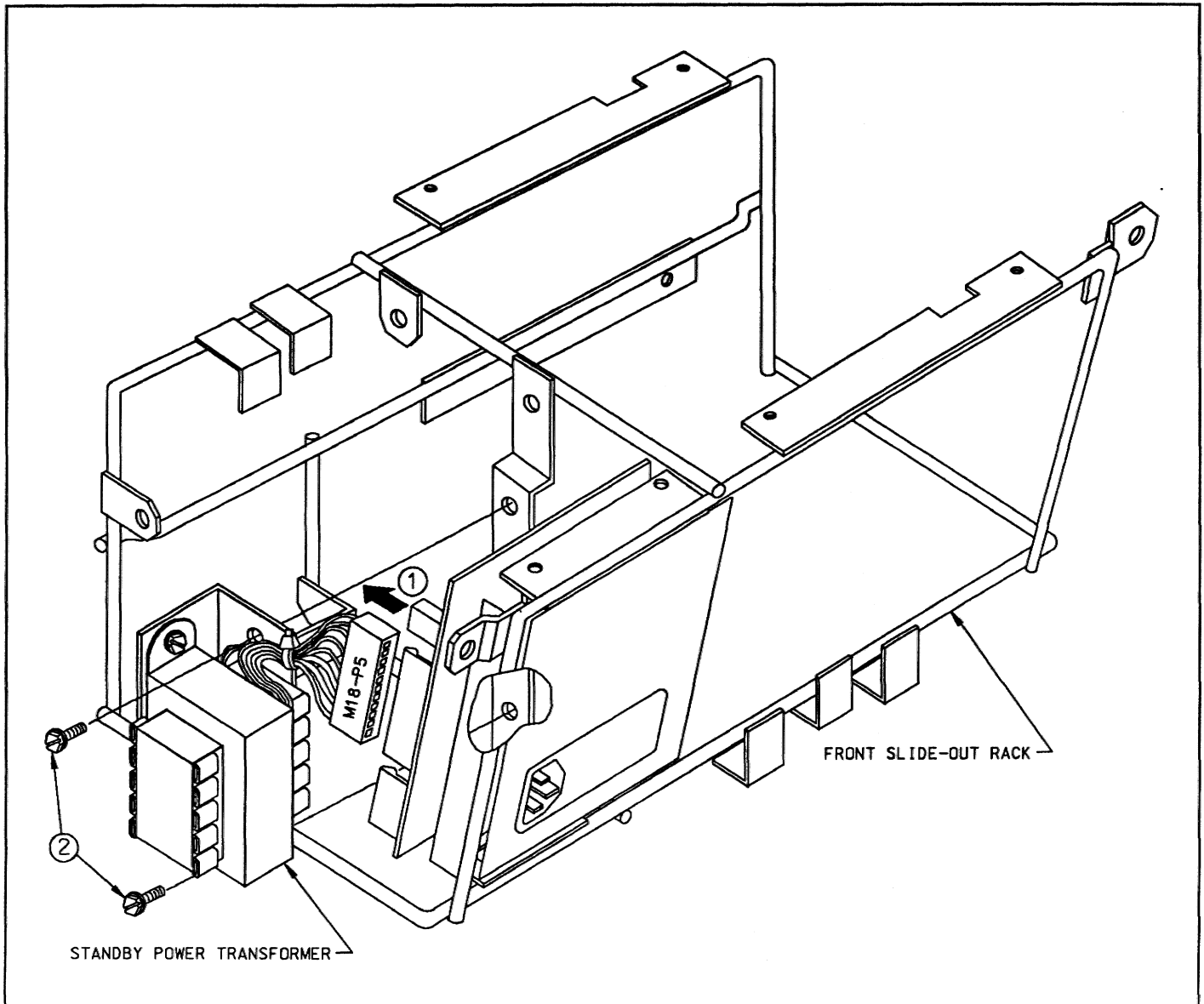


FIGURE 5-12. Standby Power Transformer Removal

02060353



### 5.2.9 Line Filter Removal

The Line Filter is mounted within the front slide-out rack.

a) Remove the projector front and side panels and slide the front rack out per section 5.2.3.

b) Unplug connector M18-P4 from the Power Entry module as shown below (item 1).

c) Follow the yellow/green earth grounding wire from the line filter to the grounding point located on the projector frame (item 2 below). Disconnect the ground lead at the grounding point.

d) Remove the two hex head screws (item 3 below) which secure the line filter to the front slide-out rack. Feed the line filter out through the top of the rack.

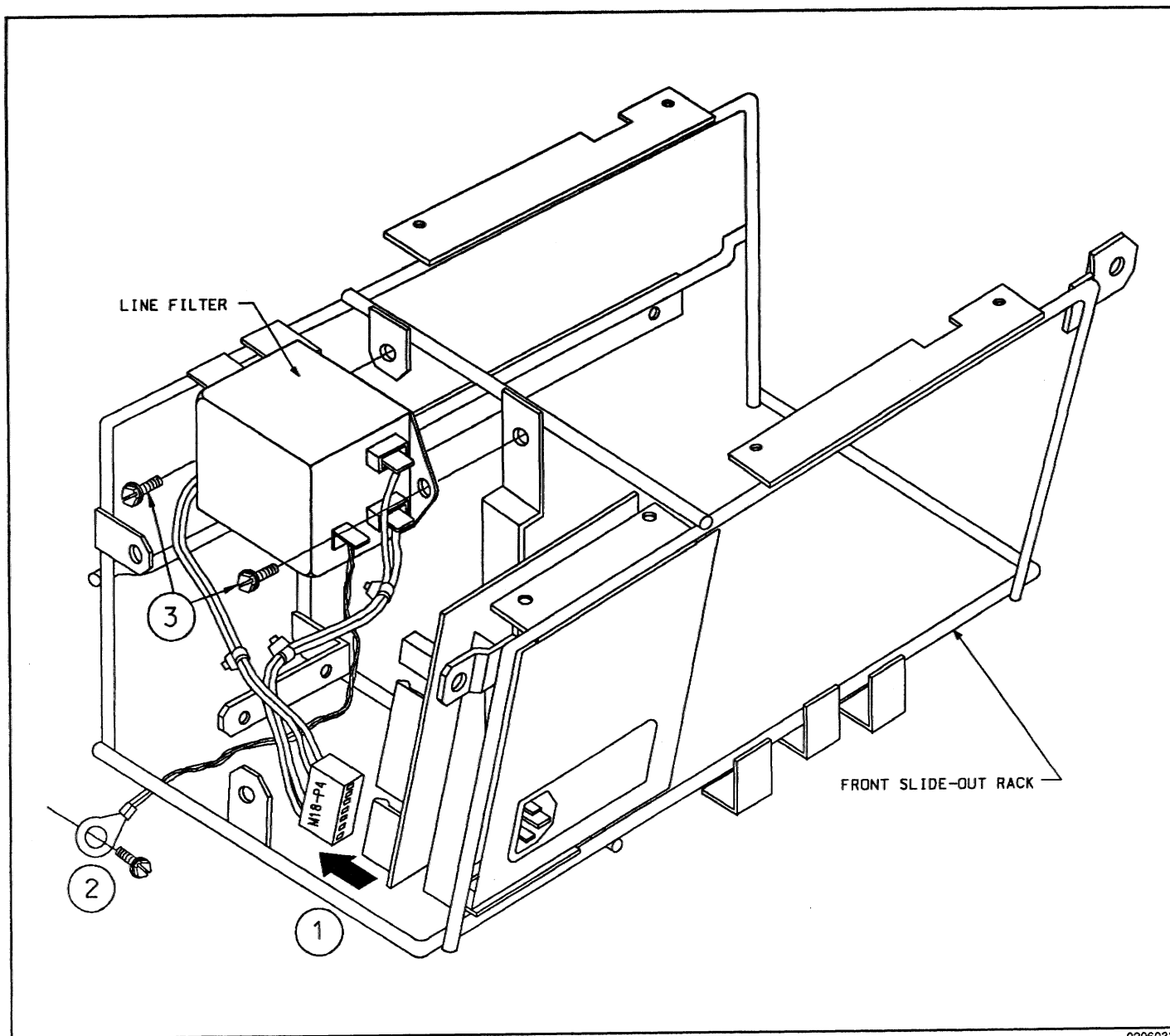
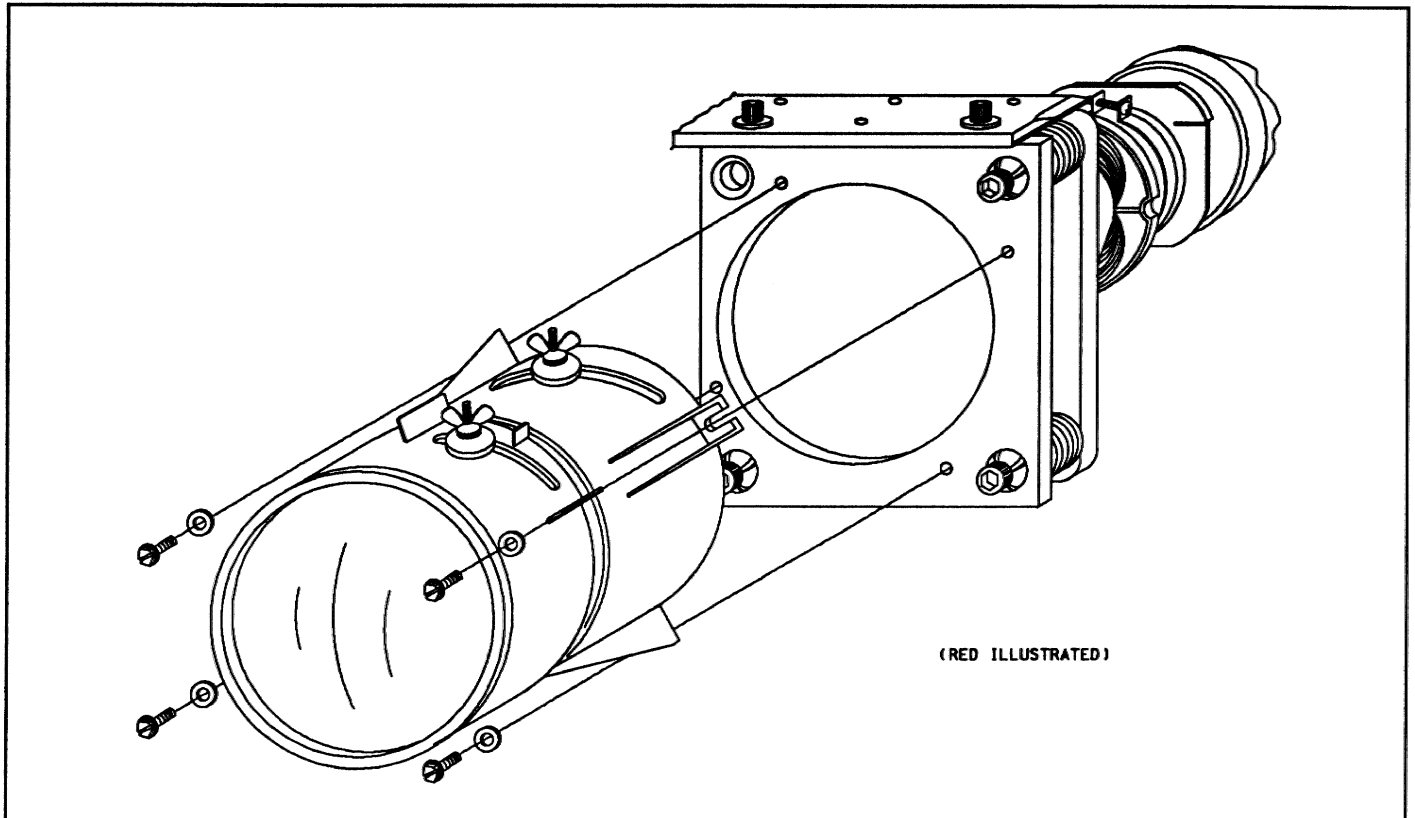


FIGURE 5-13. Line filter Removal

02060337

#### **5.2.10 Lens Removal**

- a) Remove the projector top cover per section 5.2.1.
- b) Remove the foam shield from around the lens.
- c) Remove the 4 hex head screws (and washers) securing the lens to the lens mounting plate. See Figure 5-14.
- d) Remove the lens from the projector.



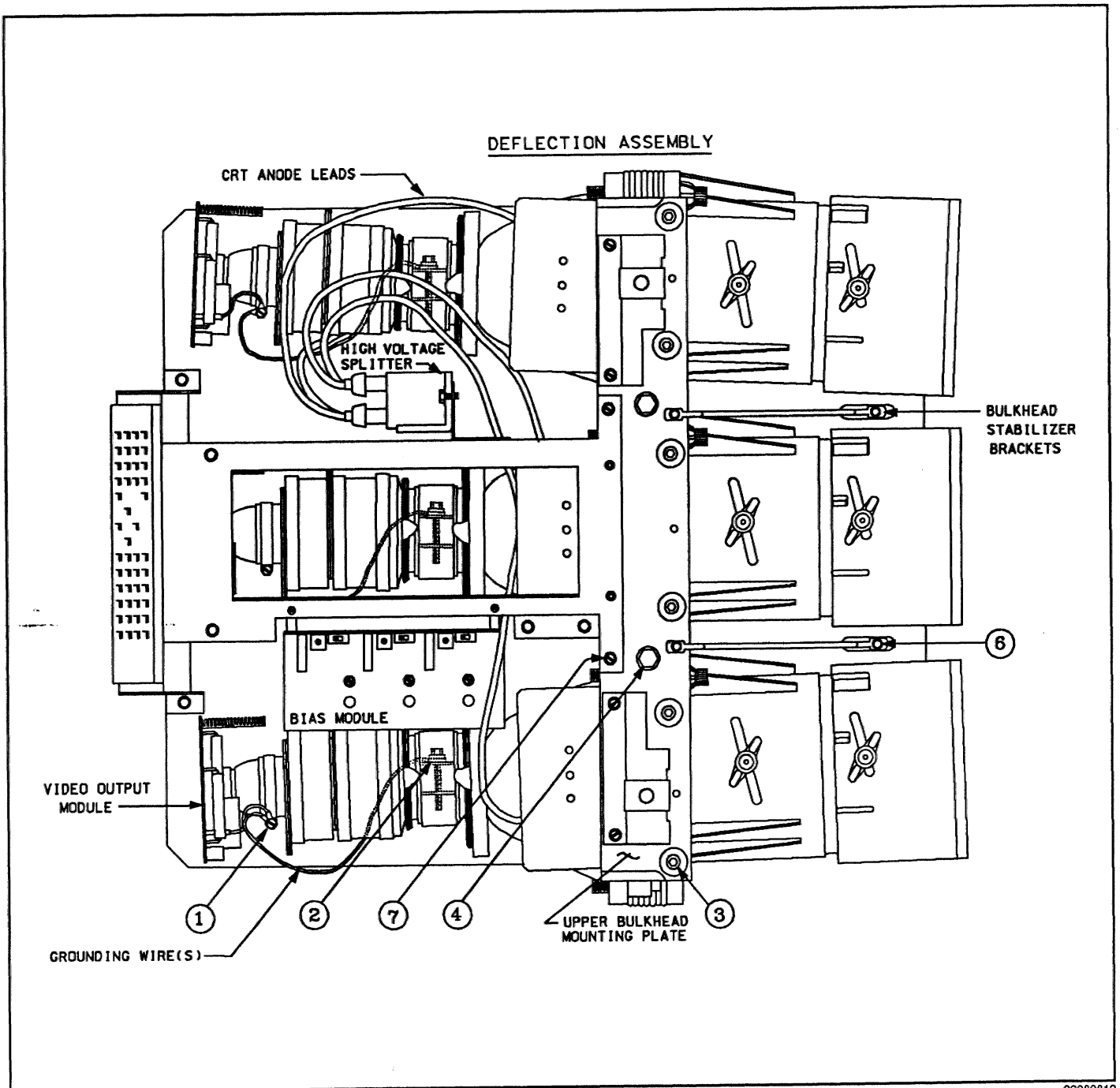


FIGURE 5-15 CRT Removal (A)

02080812

### 5.2.11 CRT Removal

Follow this procedure if one or more CRTs require removal.

## WARNING

Do not remove or handle the CRTs in any manner unless shatter-proof goggles are worn. People not wearing shatter-proof goggles must be kept away while the CRTs are handled. Keep the CRTs away from the body while handling.

a) Remove the top cover from the projector. See section 5.2.1.

b) If the green (center) CRT is to be removed, remove the keypad assembly per section 5.2.6.

NOTE: disconnection of the keypad cable from the Mother Board is not required.

c) Disconnect the CRT anode lead from the high voltage splitter. Turn the locking ring counter-clockwise to release the plug.

## CAUTION

**Beware of high voltage discharge from the anode lead. Discharge lead voltage to the chassis ground upon removal.**

d) Unplug the ground leads connected to P3 and P10 on the Video Output module.

e) Gently pull the Video Output module away from the CRT. Note: The Video Output module is secured to the CRT by a small amount of hot-melt glue. The joint between the glue and the CRT should break without difficulty. Pull the Video Output module from the CRT.

f) Disconnect the P6, P7 and P8 connectors from the Power Deflection module (located below the Video Output module).

g) Loosen the main Deflection assembly clamp which secures the Deflection assembly to the CRT neck. The Deflection assembly is shown in Figure 5-15. Slide the Deflection assembly off the neck of the CRT.

h) Remove the 6 CRT alignment screws (item 3).

i) Remove the 2 bulkhead securing bolts (item 4).

j) Remove the 4 bulkhead stabilizer bracket screws (item 5) for the two stabilizer brackets (item 6).

k) Remove the 2 bulkhead Bias module mounting bracket screws (item 7).

l) Remove the upper bulkhead mounting plate.

m) Remove the CRT bulkhead/lens assembly from the projector.

n) Remove the lens assembly per section 5.2.10.

o) With the hex head ball-nose driver supplied in the tool pouch, remove the 3 CRT tilt bolts, swivel bushings and tilt springs (items 8,9 and 10 in Figure 5-16).

p) Remove the 6 CRT mount screws (item 11 in Figure 5-16) from the CRT heat sink (item 12 in Figure 5-16).

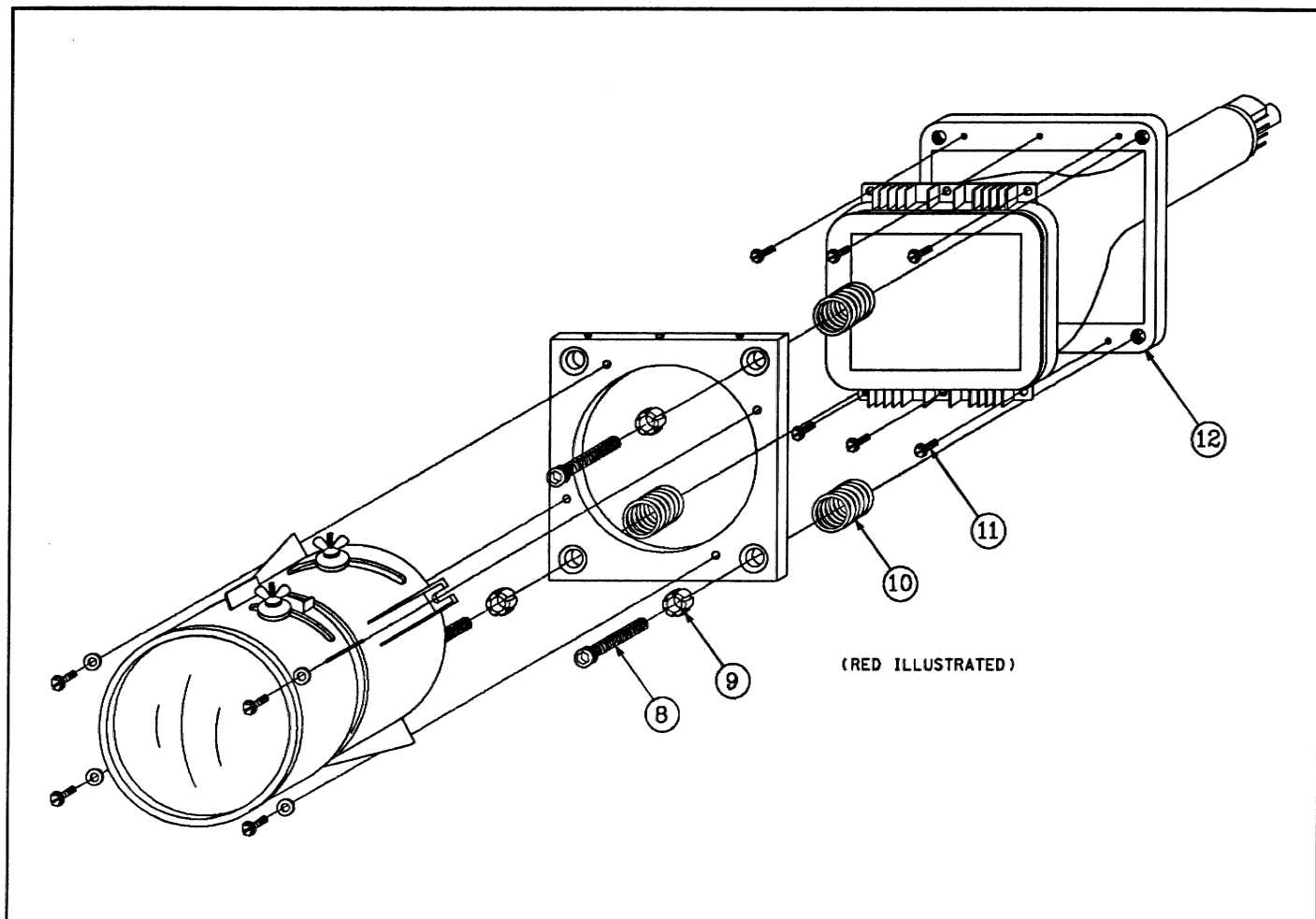


FIGURE 5-16 CRT Removal (B)

02060344

### 5.2.12 Lens/CRT Assembly Installation

Follow this procedure if a lens/CRT assembly has previously been removed and a new assembly is to be installed.

#### **WARNING**

Shatter-proof goggles **MUST** be worn when handling CRTs. Keep the CRTs away from the body while handling. People not wearing shatter-proof goggles must be kept away while the CRTs are handled.

a) Mount the CRT heat sink (item 12 in Figure 5-16) to the CRT with the 6 CRT mount screws (item 11).

b) Secure the CRT/bulkhead to the lens mounting plate with the 3 CRT tilt bolts, swivel bushings and tilt springs previously removed (items 8,9 and 10 respectively in Figure 5-16).

**NOTE:** The tilt springs must not protrude beyond the top or bottom of the bulkhead. The distance from the face of the CRT to the outside of the lens mounting plate must be 0.600"  $\pm$  0.002" (15.2mm  $\pm$  0.05mm).

c) Secure the lens to the lens mounting plate with the 4 hex head screws and washers previously removed. See Figure 5-13.

d) Add the foam shield around the lens.

e) Install the CRT bulkhead/lens assembly in the projector. Position the pin on the lower mounting plate in the hole of the lens mounting plate bottom.

f) Add the upper bulkhead mounting plate. Position the pin on mounting plate in the hole of the lens mounting plate top.

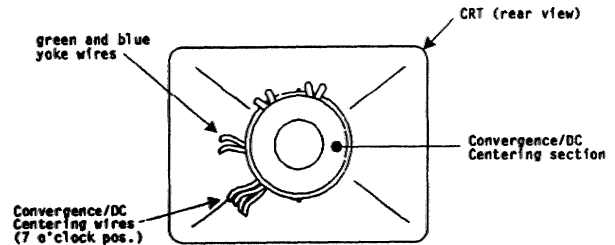
g) Mount the Bias module mounting bracket with the 2 screws previously removed (item 7 in Figure 5-15).

h) Secure each bulkhead stabilizer bracket with the 4 screws previously removed (item 5 in Figure 5-15).

i) Install the 2 bulkhead securing bolts (item 4 in Figure 5-15)

j) Screw in the 6 CRT alignment screws (item 3 in Figure 5-15). Do not tighten fully.

k) Slide the Deflection assembly as far as possible up the CRT neck. The convergence/DC centering wires from the Convergence/DC Centering section of the assembly should be at the 7 o'clock position when viewing the CRT from behind. Refer to the illustration below.



Tighten the main assembly clamp. Ensure the previously removed grounding wires connected between the Video Output module and the two assembly clamps are in place.

l) Reconnect the P6, P7 and P8 connectors from the Convergence/DC Centering and Yoke assemblies to the Power Deflection module.

m) Remove the old hot melt glue from the CRT connector on the Video Output module. Connect the Video Output module to the CRT. The CRT connector on the Video Output module is keyed to assure correct hook-up. Apply a small amount of hot melt glue between the CRT connector and the CRT.

n) Connect the braided ground lead from the CRT clamps to the P3 connector on the Video Output Module.

o) Connect the braided ground lead from the CRT grounding spring to the P10 connector on the Video Output Module.

p) Connect the CRT anode lead to the high voltage splitter. Turn the locking ring clockwise to secure the lead to the splitter.

q) Reinstall the keypad assembly if previously removed. Refer to sections 5.2.6 and 5.2.7.

r) Align the CRT/projector using the CRT alignment and spot size adjustment procedures in Sections 7.4 and 7.5.

### 5.2.13 CRT Deflection Assembly Replacement

Follow this procedure for replacement of the CRT deflection assemblies.

**a)** Remove the top cover from the projector. See section 5.2.1.

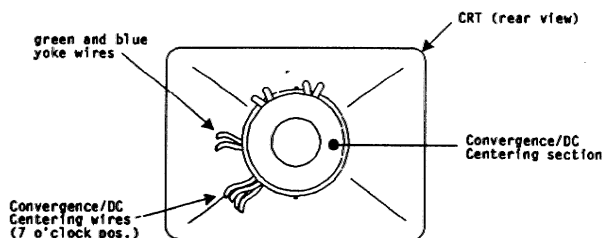
**b)** If the green (center) CRT is to be removed, remove the keypad assembly per section 5.2.6. Disconnection of the keypad cable from the Mother Board is not required.

**c)** Gently pull the Video Output module away from the CRT. Note: the Video Output module is secured to the CRT by a small amount of hot-melt glue. The joint between the glue and the CRT should break without difficulty. Pull the Video Output module from the CRT.

**d)** Disconnect the P6, P7 and P8 connectors from the Power Deflection module (located below the Video Output module).

**e)** Remove the Deflection assembly clamp screw to release the grounding wire to the P3 connector on the Video Output Module. See Figure 5-15.

Slide the Deflection assembly away from the CRT. Slide the new Deflection assembly as far as possible up the CRT neck. The convergence/DC centering wires from the Convergence/DC Centering section of the assembly should be at the 7 o'clock position as illustrated.



Tighten the main assembly clamp. Ensure the previously removed grounding wires connected between the Video Output module and the two assembly clamps are in place.

**f)** Reconnect the P6, P7 and P8 connectors from the Convergence/DC Centering and Yoke assemblies to the Power Deflection module.

**g)** Remove the old hot melt glue from the CRT connector on the Video Output module. Connect the Video Output module to the CRT. The CRT connector on the Video Output module is keyed to assure correct hook-up. Apply a small amount of hot melt glue between the CRT connector and the CRT.

**h)** Reinstall the keypad assembly if previously removed. Refer to sections 5.2.6 and 5.2.7.

**i)** Align the CRT/projector following the CRT alignment and spot size adjustment procedures in Section 7.4 and 7.5.

**NOTES**

## SECTION 6

### TROUBLESHOOTING

#### 6.1 TROUBLESHOOTING GUIDE

This section is to assist the service repair technician when a problem has occurred and troubleshooting is required. Once the full symptoms of the problem have been noted, refer to the diagrams and charts listed below to help locate the defective module. Attempt to locate the defective module directly or by elimination of good modules. For suspect modules, refer to the appropriate module servicing section(s) in this manual. These sections provide technical data (including schematics and component layouts) as well as alignment procedures.

The following diagrams and charts may be useful when trying to pinpoint defective modules or circuits:

- ① *Function Block Diagram* (Figure 3-1 in Section 3)
- ② *Troubleshooting Flow Charts* (Figures 6-1 to 6-5)
- ③ *Video Path Block Diagram* (Figure 6-6)

To assist in troubleshooting at the module/circuit board level, try the following:

- a) Check all wiring for defects.
- b) Visually check resistors, capacitors and other components for defects or abnormalities.

- c) For an apparently defective circuit, measure appropriate voltages and waveforms such as:
  - ① collector voltages and waveforms of transistors,
  - ① base to emitter voltages of transistors (0.3 to 1.0V),
  - ① terminal voltages and waveforms of ICs.
- d) If an intermittent problem exists, try tapping individual components, e.g., resistors, diodes, transistors, etc. Should this method fail, rapidly heat and cool in-circuit components. Use a portable hair dryer and spray-type circuit coolant.

**NOTE: If a component is defective and must be replaced, refer to the component removal instructions in Section 4.2.**

#### 6.2 FLOW CHARTS

The following pages contain troubleshooting flow charts which may be used as a guide when troubleshooting. The flow charts help you to isolate problems at the module level.

**NOTE: Make sure all projector modules are properly installed before troubleshooting.**



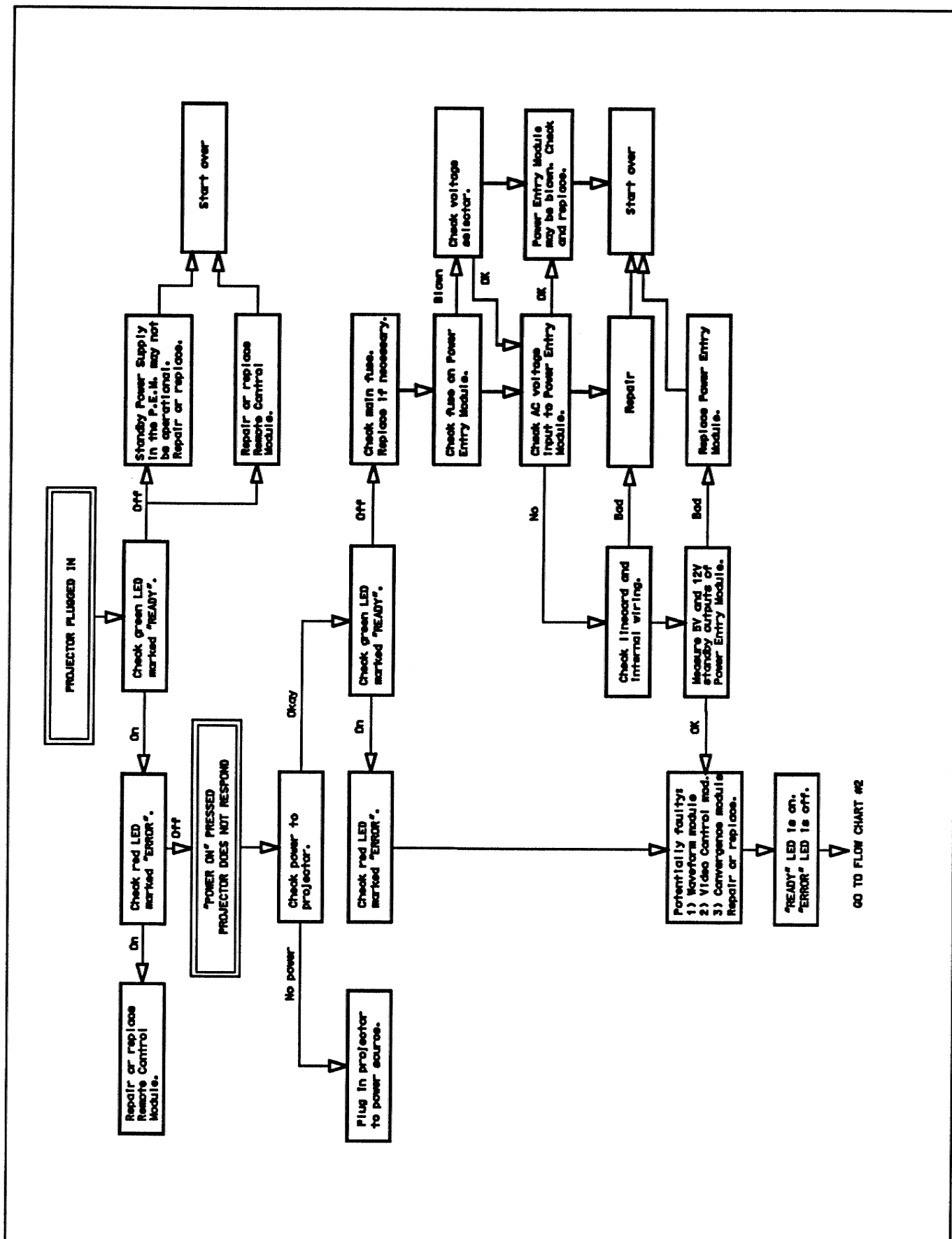


FIGURE 6-1. Flow Chart #1

02081111

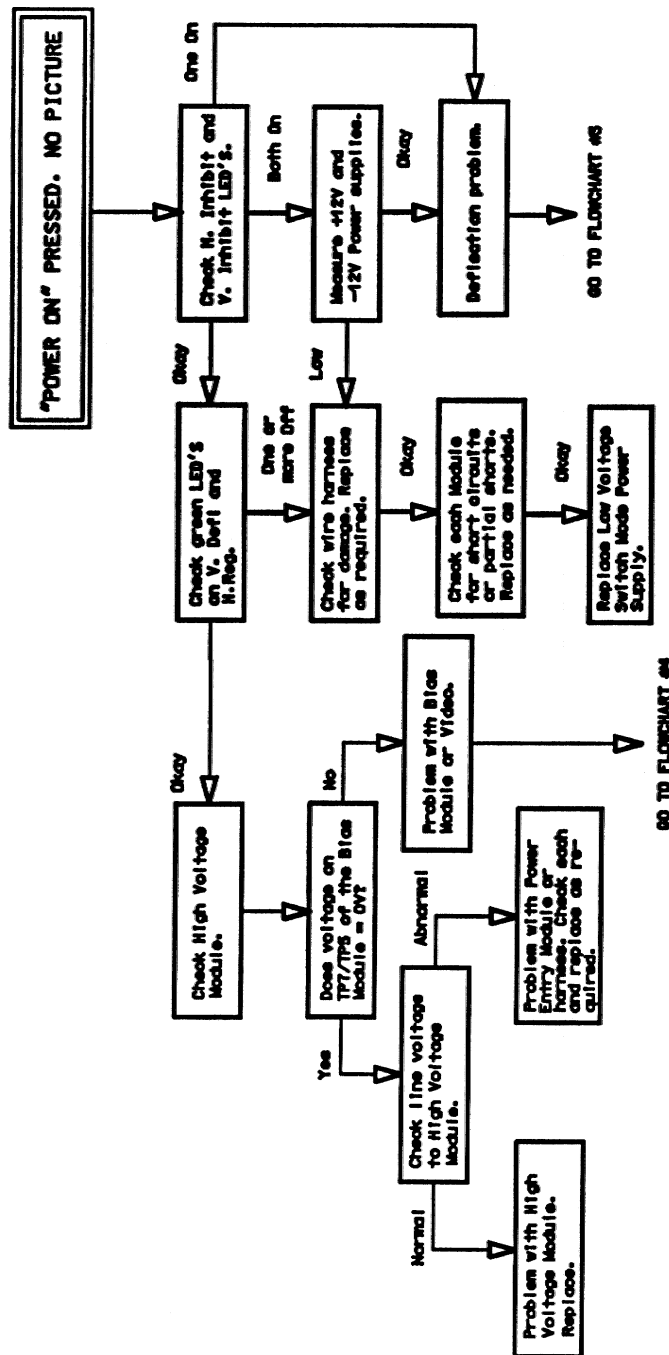


FIGURE 6-2. Flow Chart #2

02081112

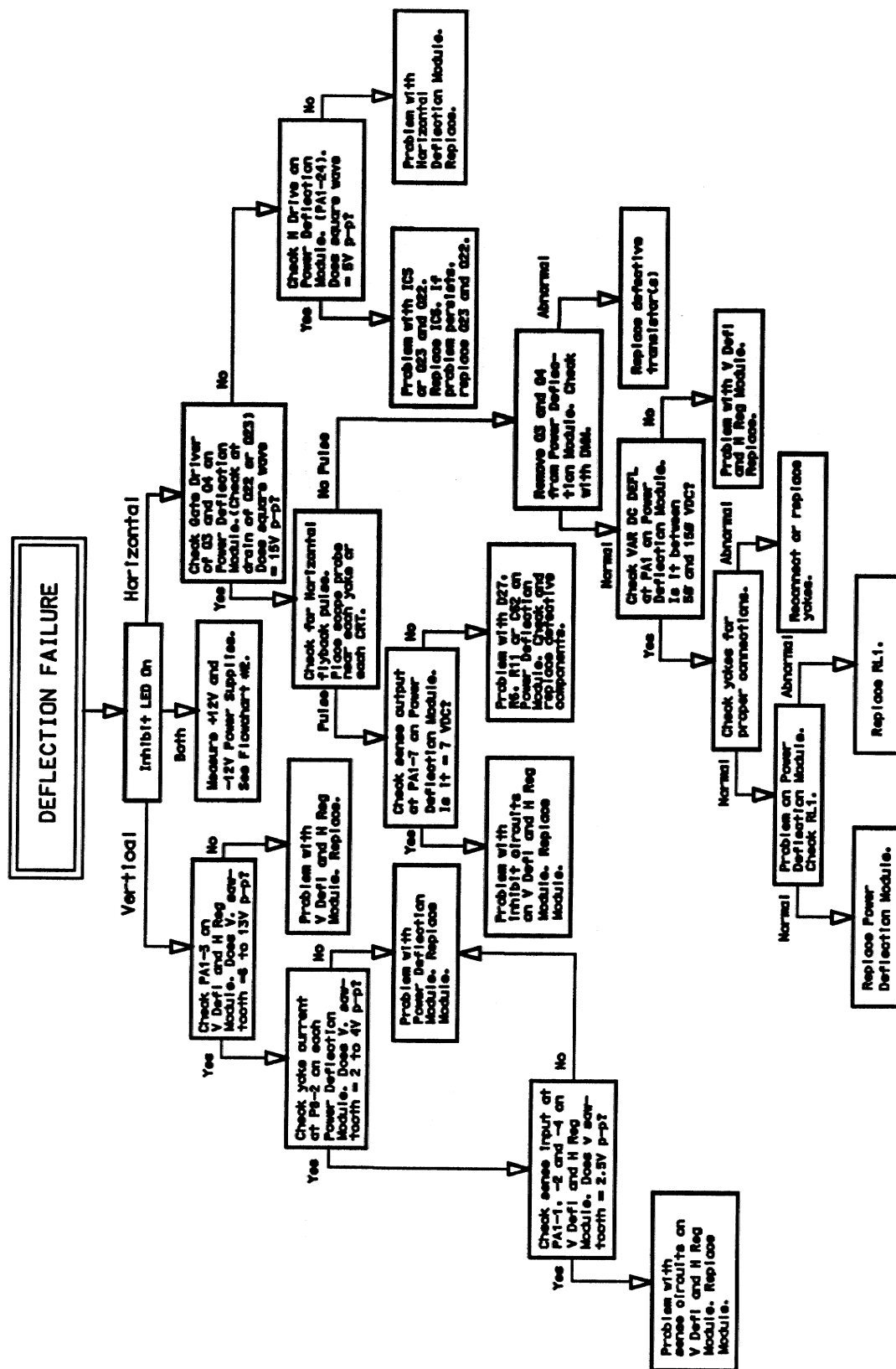


FIGURE 6-3. Flow Chart #3

02081113

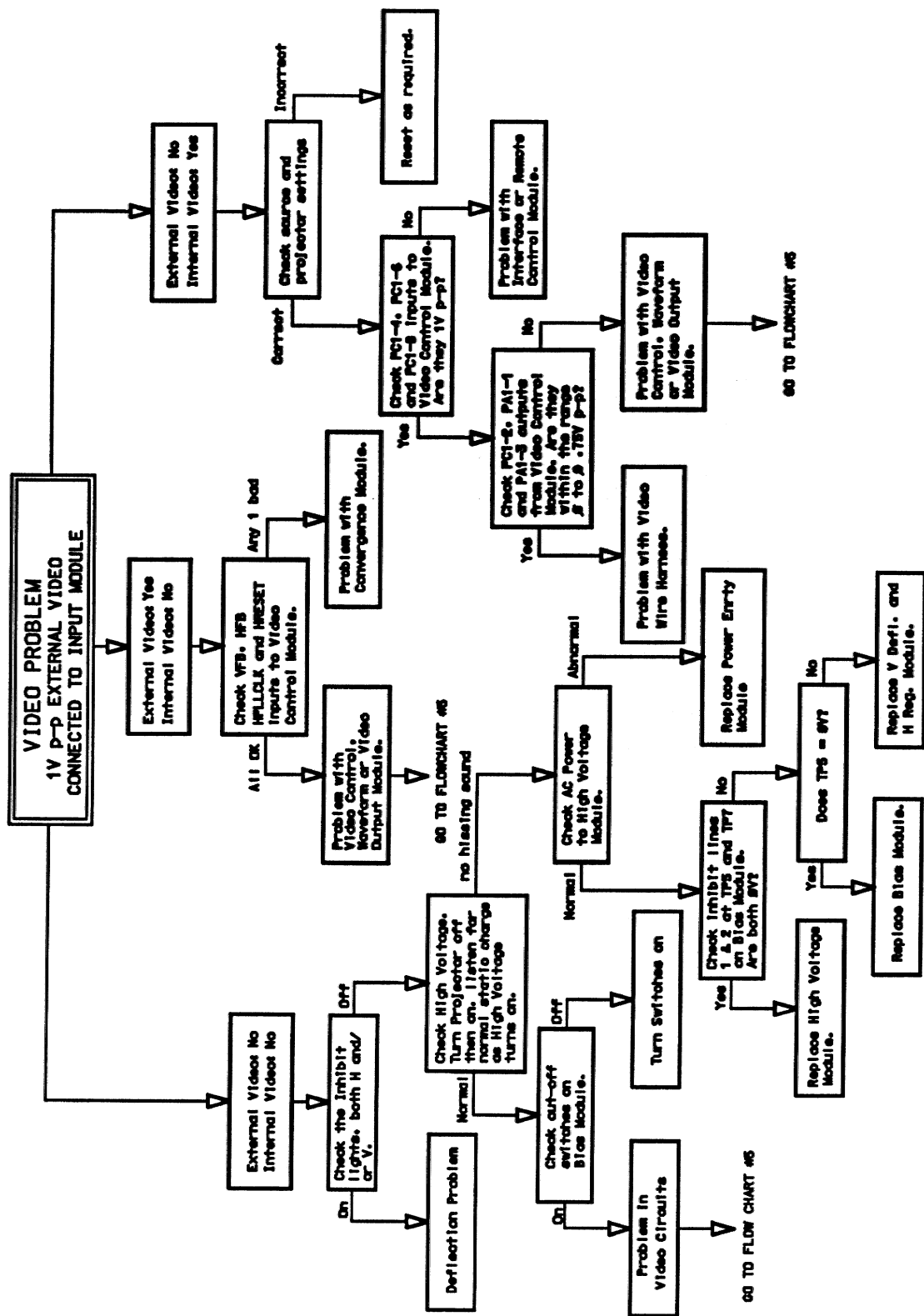
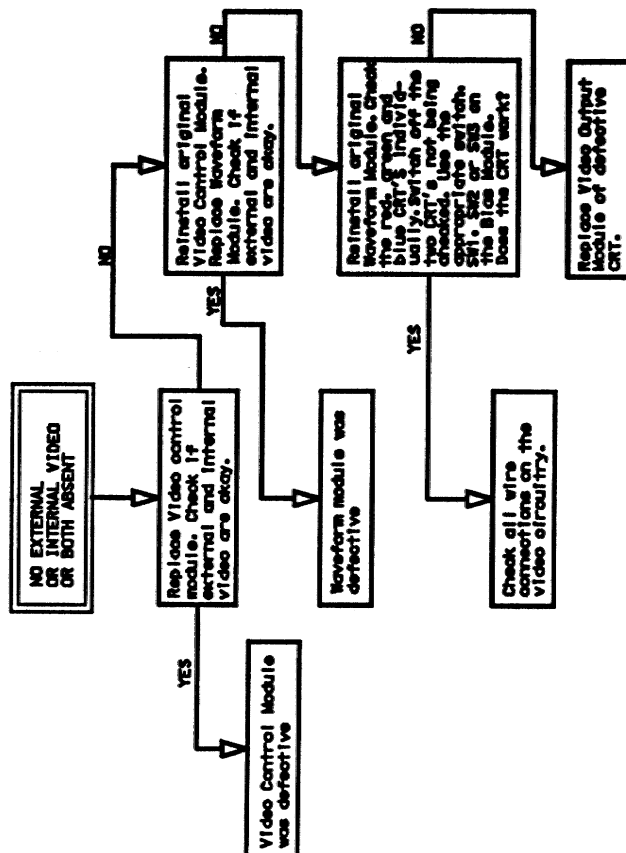


FIGURE 6-4. Flow Chart #4

02081114



NOTES:

FIGURE 6-5. Flow Chart #5

02081115

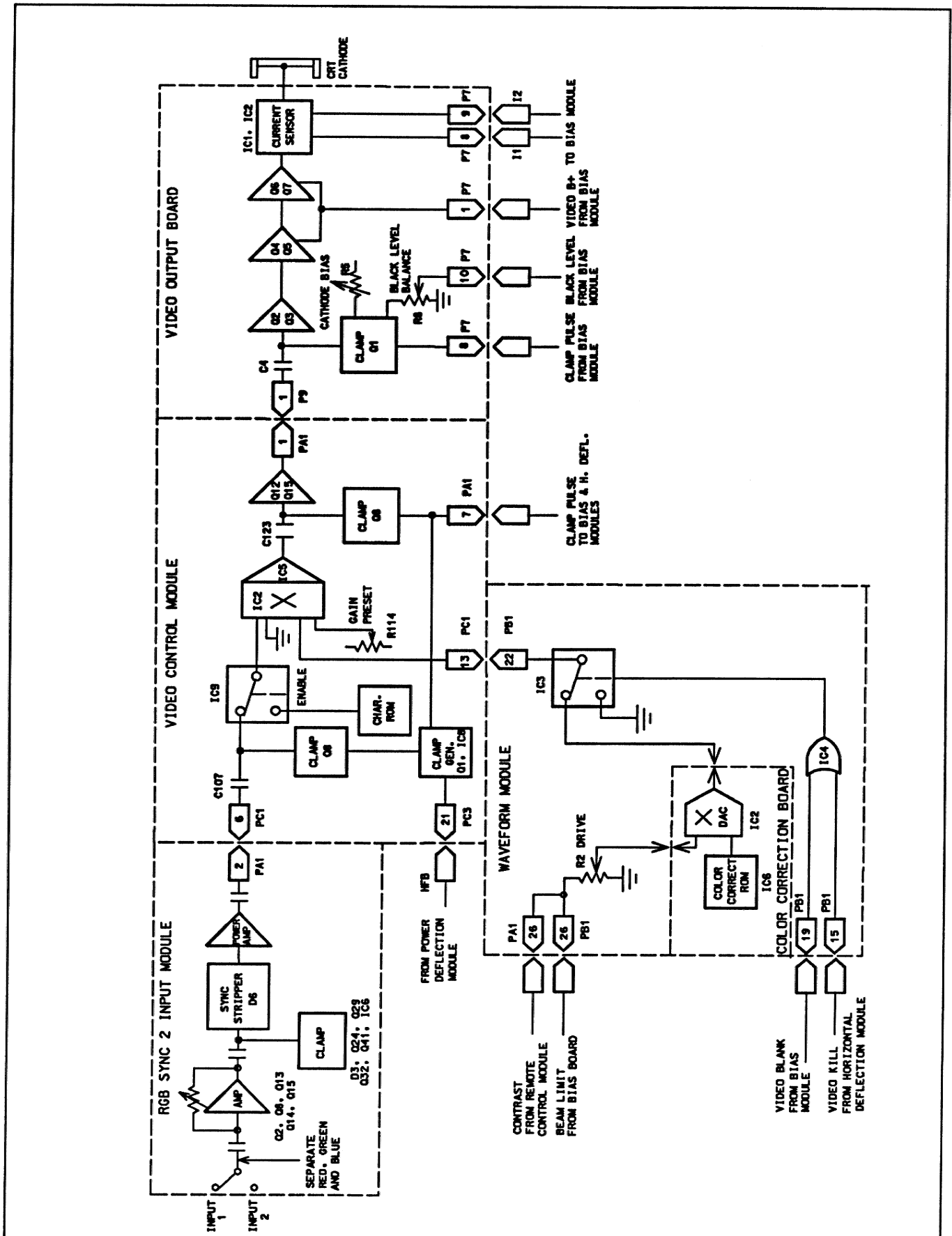


FIGURE 6-6. Video Path Block Diagram

02080114

**NOTES**

## SECTION 7

### ALIGNMENT PROCEDURES

This section provides projector alignment procedures for use by a service/repair technician. Refer to Table 7-1 for a list of procedures which may be performed. Alignment procedures involving only a single module may be found in the MODULE SERVICING section of this manual.

**TABLE 7-1. Service Alignment List**

Alignment/Setup	Modules affected	Section
Raster Centering	Power Deflection Module Remote Control Module	7.1
Color Balance	Bias Module Video Control Module Waveform Module	7.2
Video Amplifier & Color Balance	Bias Module Video Control Module Video Output Module	7.3
CRT/Lens Assembly Alignment	CRT/Lens Assembly Bias Module Deflection Yoke Converge/DC Centering Assembly	7.4
Spot Size Adjustment	Converge/DC Centering Assembly	7.5
Electronic Focus	Bias Module	8.2
Convergence (manual)	Convergence Module	9.2
Horizontal Deflection	Horizontal Deflection Module	10.2
Power Deflection	Power Deflection Module	13.2
Vertical Deflection and Horizontal Regulation	Vertical Deflection & Horizontal Regulation Module	19.2
Waveform	Waveform Module	22.2

### WARNING

**DO NOT ATTEMPT ANY SERVICING UNTIL ALL SERVICE WARNINGS IN SECTION 4, SERVICING GUIDELINES, ARE UNDERSTOOD.**

#### 7.1 RASTER CENTERING

##### Tools & Equipment Required:

- extender board, Vidikron Part # A-03-230330-01P
- printed circuit board extractor
- long shafted, fine tip, insulated slot screwdriver
- dc voltmeter or oscilloscope

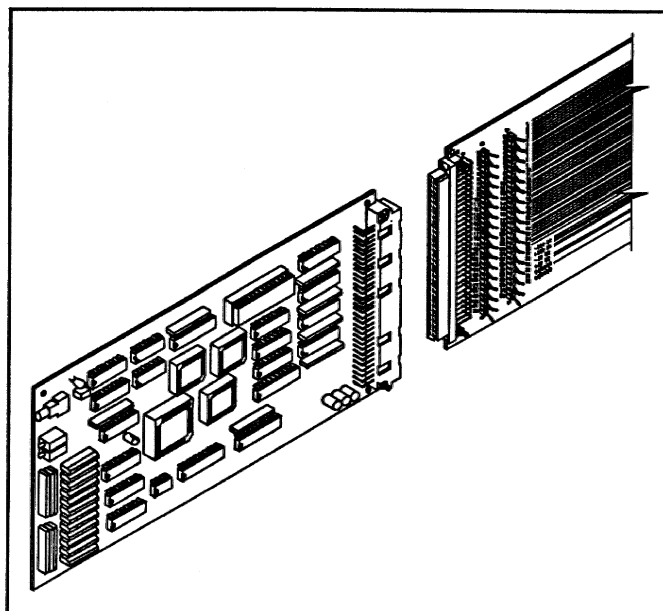
##### Modules affected:

- Power Deflection Module
- Remote Control Module

#### STEP 1 - Remote Control Module Removal

a) Remove the back panel as described in Section 5.2.

b) Locate the Remote Control module in the rear panel card rack. Using the printed circuit board extractor from the tool pouch, pull the module from the card rack (as described in Section 5.2).



**FIGURE 7-1. Extender Board Use**

02060340

#### STEP 2 - Check DC Voltage on Remote Control Module

a) Insert the extender board into the Remote Control module slot.

b) Plug the Remote Control module into the extender board. See Figure 7-1.

c) Locate row A, pin 8 on the extender board. Connect the dc voltmeter or oscilloscope to this pin. Connect the ground lead of the test instrument to pin 31 or 32 on any row.



d) Turn on the projector. Press CONVERGE, 5, 2, EXIT then ▲, EXIT on the keypad.

e) Press CONVERGE, 5,2 again then press and hold the L or R arrow key until the voltage on row A, pin 8, is zero.

f) Press EXIT, ▲, EXIT. Measure the dc voltage. If it is not zero repeat step e).

**NOTE: The above 2 steps eliminate all correction voltages.**

g) Press CONVERGE, 5, 1, 1.

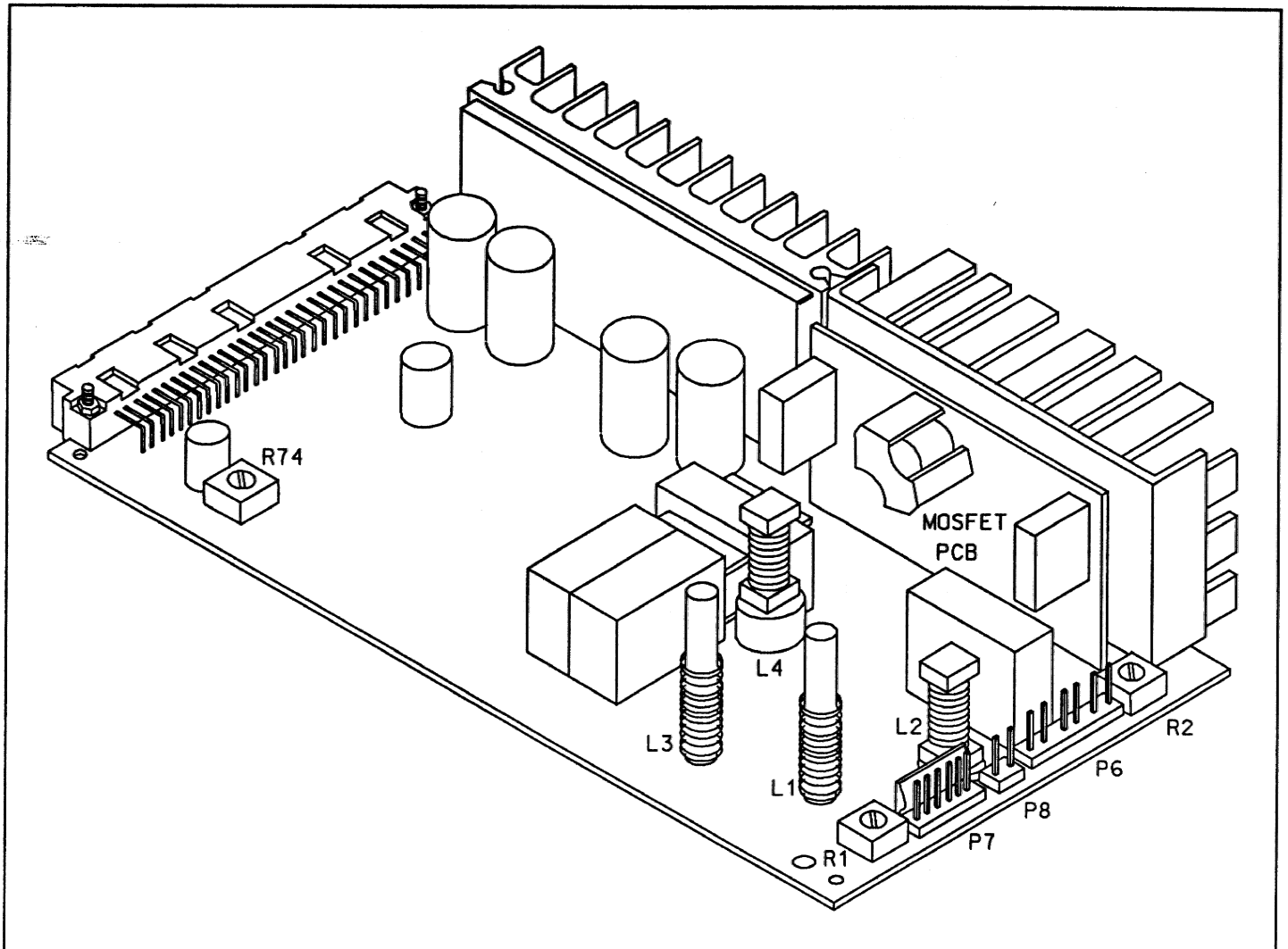
### STEP 3 - Alignment

a) Locate trimpot R2 on each Power Deflection module. See Figure 7-2.

b> Press the # button for the internal test pattern.

c) Use the slot screwdriver to adjust the trimpot. Look into each CRT lens, one at a time, and adjust the trimpot until the internal crosshatch is centered on the raster as close as possible.

d) Press EXIT, then converge the projector (see User's Manual).



**FIGURE 7-2. The Power Deflection Module**

02080815

## 7.2 Color Balance Set-up

### Tools & Equipment Required:

- white field signal generator
- fine tip slot screwdriver
- Phillips screwdriver

### Modules affected:

- Bias Module
- Video Control Module
- Waveform Module

- Remove the top cover and back panel from the projector. (See Section 5.2.)
- Connect a 1V p-p, 1% matched, white video signal to the 75  $\Omega$  input on the Interface module (3,4,5 wire family).
- Turn room lights off. Project an image on the screen.
- Adjust BRIGHTNESS to 5 on the function bar graph. Adjust CONTRAST to 0. Switch to the internal crosshatch.
- Adjust the three G2 trim potentiometers (R20, R45, R19) on the Bias module until the raster of each color is visible (see Figure 7-5).
- Turn OFF two of switches SW1, SW2 and SW3 on the Bias module. Adjust the G2 trimpot of the color still ON until the image just disappears. Repeat for the other colors.
- Increase BRIGHTNESS to 10. Turn on the red CRT

only. Adjust R113 on the Video Control module until the red crosshatch bars disappear. Repeat, for the green and blue CRTs, adjusting R114 and R115 respectively. See Figure 7-3.

**NOTE:** Observe closely. It is easy to miss the null position and turn through it to positive video.

h) Turn all switches on (SW1, SW2 and SW3). Adjust BRIGHTNESS to 5. Increase CONTRAST to 3. Connect the white field generator. Turn the three trimpot drive controls (red R1, green R2, blue R3) on the Waveform module fully clockwise. Refer to Figure 7-3.

i) Adjust the drive controls until a white image is produced. Reduce R1 if the image appears red. Reduce R2 if the image appears green. Reduce R3 if the image appears blue. Reduce R1 and R2 if the image appears yellow. Reduce R1 and R3 if the image appears reddish-purple. Reduce R2 and R3 if the image appears cyan or light blue.

j) Check step g) and repeat if necessary.

k) Gradually decrease contrast and observe the color on the screen. At low levels the color should be grey, if it is not, adjust one or two of the G2 trimpots on the Bias module until it is.

l) Repeat steps h) through k) until an optimum white is obtained. **NOTE:** If all three trimpots were adjusted in step k), repeat steps d) through k).

m) Proceed to section 7.3 if performance needs further improvement.

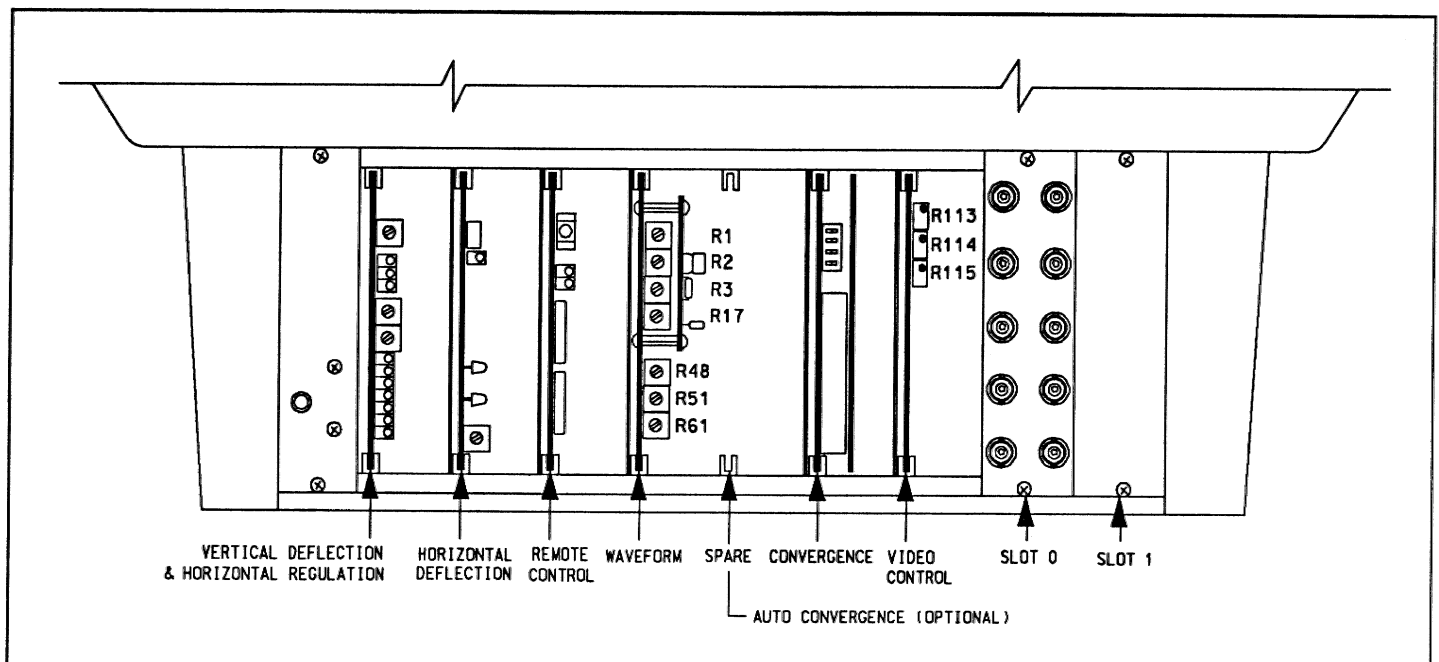


FIGURE 7-3. Video Control and Waveform Module Controls

02080816

### 7.3 Video Amplifier Alignment with Color Balance Set-up

**Note:** Perform this procedure only after Color Balance Set-up per Section 7.2.

#### Tools & Equipment Required:

- white field signal generator
- fine tip slot screwdriver
- extender board, Vidikron part #A-03-230330-01P
- Phillips screwdriver

#### Modules affected:

- Bias Module
- Video Control Module
- Video Output Module

a) Remove the top cover and back panel from the projector. (See Section 5.2)

b) Connect a 1V p-p, 1% matched, white video signal to the 75  $\Omega$  input on the interface module (3,4,5 wire family).

c) Adjust controls R116, R117 and R115 (red, green, blue) on the interface module until the outputs at C2, C4 and C6 (red, green, blue) are 1V p-p and within 1%.

d) Adjust CONTRAST to 0 on the function bar graph. Switch to the internal crosshatch.

e) Increase BRIGHTNESS to 10. Turn OFF two of switches SW1, SW2 and SW3 on the Bias module.

f) Adjust the appropriate video null trim pot (R113=red, R114=green, R115=blue) on the Video Control module until the crosshatch bars disappear from the image. Repeat for the two remaining CRT's.

g) Turn OFF two of switches SW1, SW2, and SW3. Adjust R8 on the Video Output module of the CRT which is on until maximum brightness is reached. Repeat for the other two CRT's.

h) Turn all switches on (SW1, SW2 and SW3). Set BRIGHTNESS to 5.

i) Connect the digital voltmeter between the cathode (pin K on the Video Output module) and ground.

**NOTE:** If the raster changes in brightness when the voltmeter is connected, insert a 20K resistor in series with the voltmeter. Keep the body of the resistor close to the cathode pin. See Figure 7-4.

j) Adjust R5 on the Video Output module until the voltmeter reading is 140 VDC  $\pm$  0.3V.

k) Adjust the three G2 trim potentiometers (R20, R45, R19) on the Bias module until the raster of each color is just visible.

l) Turn OFF two of switches SW1, SW2 and SW3 and adjust the G2 trim pot of the color still ON until the raster just disappears. Repeat for the other two CRT's.

m) Increase BRIGHTNESS to 10. Decrease CONTRAST to 0. The image should be grey. If it is not, adjust R8 on two of the Video Output modules. Repeat steps h) to m) as needed.

n) Turn all switches ON (SW1, SW2 and SW3). Adjust BRIGHTNESS to 5. Increase CONTRAST to 3. Connect the white field generator. Turn all three trimpot drive controls (red R1, green R2, blue R3) on the Waveform module fully clockwise. Decrease two of the colors until the best white image is produced. Check steps e) and f) and repeat if necessary.

o) Gradually decrease contrast and observe the color on the screen. At low levels the color should be grey; if it is not, adjust one or two of the G2 trimpots on the Bias module until it is.

p) Repeat steps n) through o) until an optimum white is obtained. **NOTE:** If all three trimpots were adjusted in step k), repeat steps n) and o).

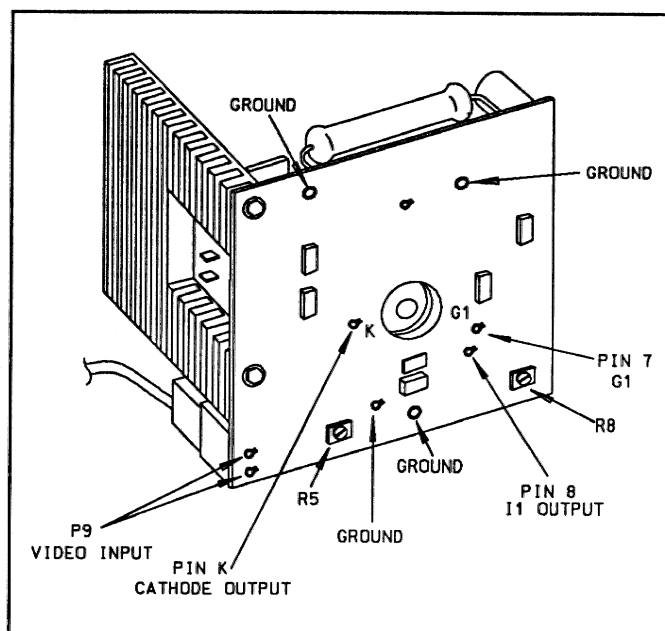


FIGURE 7-4. Video Output Module

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## 7.4 CRT/Lens Assembly Alignment

The following procedure is to be performed after replacement or reassembly of a CRT/Lens assembly. For general focusing and geometry alignment instructions, refer to the **Optical Alignment and Setup** section in the User's Manual.

### WARNING

The power supplies in the projector are capable of delivering **LETHAL** quantities of energy. Follow normal **HIGH VOLTAGE** precautions when working near them.

#### Tools & Equipment Required:

- hex head ball-nose driver (in tool pouch)
- allen key (in tool pouch)
- combination wrench (in tool pouch)
- adjusting tool (in tool pouch)
- Phillips screwdriver
- fine tip slot screw driver

#### Modules affected:

- CRT/Lens Assembly
- Bias Module
- Deflection Yoke
- Converge/DC Centering Assembly

a) Remove the top covers as described in Section 5.2.

b) For the newly installed or reassembled CRT, turn on the corresponding CRT switch on the Bias module. Refer to Figure 7-5. With the internal cross hatch selected from the keypad, look into the CRT lens and adjust the G2 and focus controls on the Bias module. Set the controls to roughly match that seen when looking into the other two CRT's (while turned on). Note: If the CRT is exhibiting an extremely bright image (high beam current), reduce with the G2 control.

c) Turn off the newly installed CRT and turn on one of the original CRTs, preferably the green or red. Use the appropriate switch on the Bias module. See Figure 7-5.

d) Press HELP, 1, 2, to enter the set-up routine.

e) Focus the picture optically and mechanically to produce optimum top, center, bottom and corner focus. Refer to the **PROJECTOR ALIGNMENT** section in the User's Manual for focusing instructions.

f) Switch ON the newly installed lens/CRT assembly. Ideally, the two colors should be converged and in focus.

g) Loosen both yoke clamps. Rotate the yoke clockwise or counter-clockwise until the image best lines up with the image from the reference CRT. Tighten the leading yoke clamp, i.e., the clamp which is nearest to the lens.

h) Follow the spot size adjustment instructions in section 7.5 for the affected CRT.

i) Check the top to bottom focus referring to the **PROJECTOR ALIGNMENT** section in the User's Manual.

j) Converge the projector referring to the **CONVERGENCE ALIGNMENT** section in the User's Manual.

k) If color balance is not correct, refer to section 7.2 - *Color Balance Set-up*.

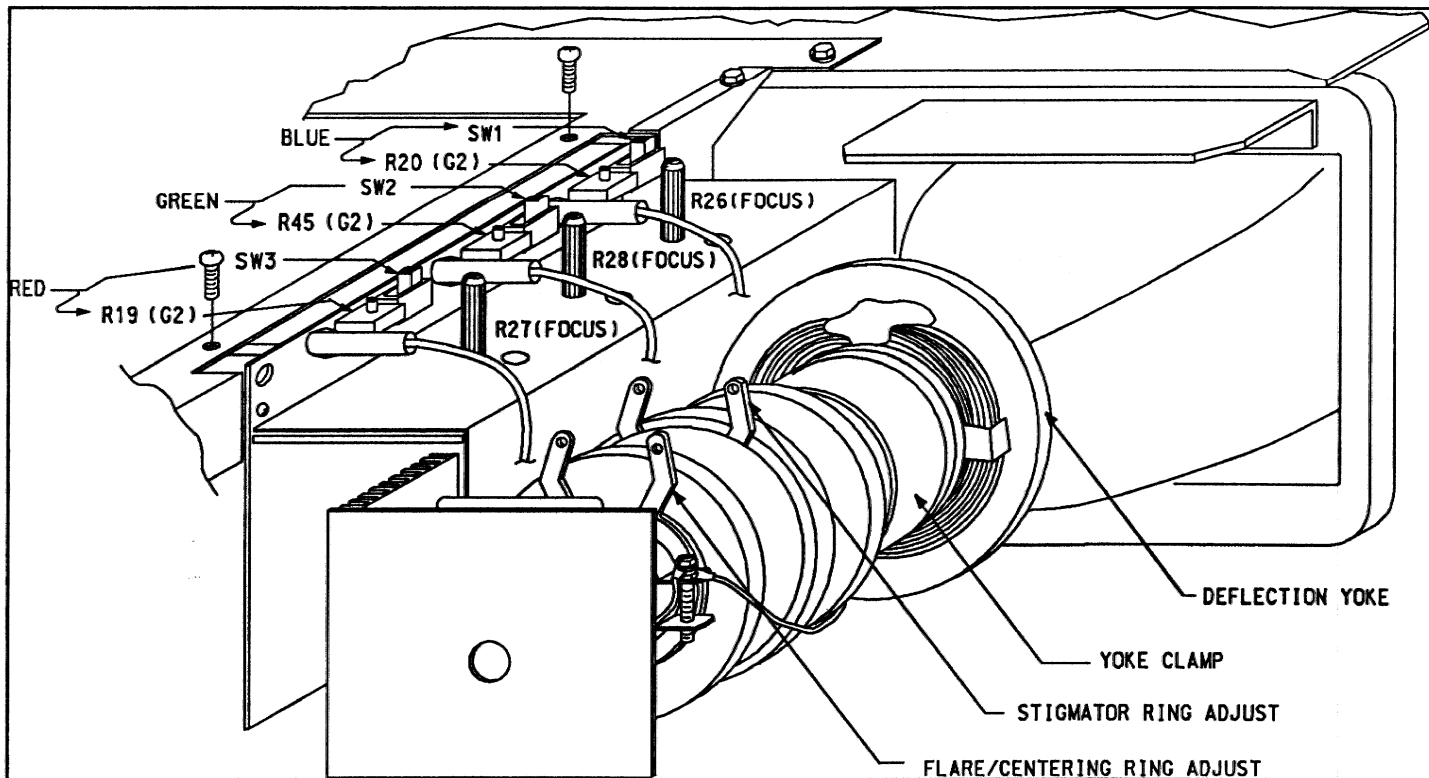


FIGURE 7-5. Bias Module and CRT Controls

02080819

## 7.5 Spot Size Adjustment

### Tools & Equipment Required:

- Phillips screwdriver
- fine tip slot screwdriver

### Modules affected:

- Converge/DC Centering Assembly

- Remove the projector top covers per section 5.2.
- Power up the projector.
- Check optical focus. Re-focus if necessary.
- Set FOCUS to 5 on the function bar graph.
- Press CONV, 4 to produce a dot pattern.

**NOTE: Do not use Interlace signals for these adjustments.**

- Turn OFF the green and blue CRTs using slide switches SW2 and SW3 on the Bias module. Darken the room.
- Turn the RED focus pot (R26) on the Bias module fully clockwise to produce large, well-defined spots on the screen.
- View the screen center. Rotate the stigmator rings until the spot becomes round. Refer to Figure 7-5.

## WARNING

### HIGH VOLTAGE

Follow normal HIGH VOLTAGE precautions.

**NOTE: Rotating the rings in opposite directions produces a different effect than does rotating the rings together.**

- Turn the red electronic focus pot fully counter-clockwise to produce small, bright dots surrounded by dim halos on the screen.
- Rotate the flare rings until the bright spot is in the center of the halo. Refer to Figure 7-5.
- Repeat steps h) to j) several times until spot/flare geometry looks best. Turn the focus pot until the spot is focused.
- Turn OFF the red CRT. Turn ON the blue CRT. Use slide switches SW1 and SW3 on the Bias module.
- Repeat steps h) to k) for the blue CRT. The blue electronic focus pot is R27.
- Turn OFF the blue CRT. Turn ON the green CRT. Use slide switches SW3 and SW2 on the Bias module.
- Repeat steps h) to k) for the green CRT. The green electronic focus pot is R28.
- Turn ON all CRTs.
- Set CONTRAST to 3. Check focus and adjust the appropriate pot on the Bias module as necessary.
- Install the projector cover.

**NOTES**