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SERVICE MANUAL

Model 230 Projector

HUGHES JVC TECHNOLOGY

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Carlsbad, California 92009

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DECLARATION OF CONFORMITY

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PER ISO/IEC GUIDE 22 AND EN 45014

Manufacturer: Hughes JVC
2310 Camino Vida Roble
Carlsbad, Ca 92009
USA

Hughes-JVC declares that this product conforms to the following Product Specifications (Directive/Standard):

Safety: EN 60950
IEC 950 (1992)

EMC: EN 55022 (1988) / CISPR-22 (1986) Class "A"
EN 50082-1 (1992) / IEC 801-2(1991)
EN 50082-1 (1992) / IEC 801-3(1984)
EN 50082-1 (1992) / IEC 801-4(1988)

ANSI C63.4-1992, FCC, Part 15, Class A

In addition, the above product complies with the requirements of the Low Voltage Directive 73/23 EEC and the EMC Directive 89/336/EEC.

104809 First Edition March 1998

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Safety Information

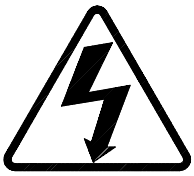
Introduction

Read entire Safety Chapter thoroughly before performing any maintenance or service on the projector. Only qualified service personnel should perform procedures and adjustments.

Safety Equipment: Use safety equipment specified in the projector's maintenance training and certification program.

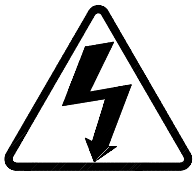
WARNINGS AND CAUTIONS!

Warnings and Cautions in this manual should be read thoroughly and strictly adhered to. Warning and Caution definitions and symbols are as follows:

WARNING SYMBOL  Warns user of a potential electric shock hazard in a procedure or situation that could result in personal injury if improperly performed.

CAUTION SYMBOL  Warns user of a potential safety hazard or potential light hazard from ultraviolet, infrared or bright light that could cause severe eye injury or a situation that could result in damage to the equipment if improperly used.

Installation Safeguards

 **WARNING!!!** Procedures in this service manual require removing the projector's covers to access internal component to remove, replace, service and adjust the projector. Only Hughes-JVC Certified Technicians are qualified to perform these procedures. Before removing or replacing any internal components or subassemblies, verify that the circuit breaker on the back panel is in the Off position **and** remove the power plug. Any adjustments performed that require covers

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off and power on should be performed with extreme care. Be especially aware of all hazardous areas indicated by warning and caution labels.



CAUTION! Do not use a forklift to lift the projector without using a safe shipping pallet. Lifting the projector without supporting the weight at the foot locations can cause severe damage to the projector.

If there is any visible damage to the power cable, disconnect power to the projector until the damaged cable is replaced. Install the projector on a smooth, vibration-resistant level surface, or ceiling mount, in an area free from dust and moisture. Do not place the equipment in direct sunlight or near heat-radiating appliances. Smoke, steam and exposure to direct sunlight could adversely affect the internal components.

If mounting the projector, use hardware that can handle a minimum of three (3) times the projector weight.

Heat Safeguards

Fans and Ventilation: The projector has multiple fans to cool the system. **Do not block the intake or outflow of any fans.** Heat is emitted within the system and must be properly dissipated to keep the system running correctly. Blocking air intake or exhaust ports can lead to projector overheating. Do not enclose the unit in a restricted space (refer to the physical access and thermal clearance illustration guidelines).

CAUTION! Do not unplug the power cord until after the arc lamp fan has stopped running. This fan protects the arc lamp from overheating. Disconnecting power before the cooling fans have stopped running can shorten Arc Lamp life.

Light Safeguards

Dangerous high voltage, bright light, ultraviolet, and infrared radiation can be hazardous to personnel. Access must remain restricted to Hughes-JVC certified engineers and technicians.

Ultra Violet and Infrared Light

Protect eyes and face from ultra violet light and infrared light by using the following protective eyewear:

1. X3 (up to 375 nanometers), ANSI approved, shade goggles must be worn by anyone near the projector when it is lit and the cover is off.
2. X5 (375 to 700 nanometers), ANSI approved, shade goggles when actually working on the projector near the arc lamp source.

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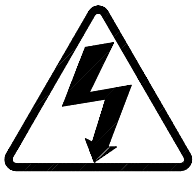


WARNING, BRIGHT LIGHT!!!

Never look directly at the Arc Lamp, the lighted Projection Lens or into the lamp housing, from any distance, when the projector is on. Direct exposure to light of this brightness can cause severe eye injury.

Dangerous levels of ultraviolet and infrared radiation, dangerous glare, very high temperatures (180°C to 300°C) and high internal gas pressure are present at the Xenon Arc Lamp. The lamp is contained in a protective reflector housing module and should not be operated outside this housing or outside of the projector. When replacement is needed, the arc lamp must be replaced as an entire module, as shown in this manual. Do not open the lamp housing or attempt to replace the Arc Lamp inside its module! Do not touch the Arc Lamp, or any connections, when the lamp is ignited or is arcing. Any servicing of the Arc Lamp must remain restricted to Hughes-JVC certified maintenance personnel.

Electrical Safeguards



High voltage access. Front and rear covers contain safety interlocks. Defeat restricted to Hughes-JVC certified service personnel!

WARNING!!! High Voltage points up to 40,000 volts are exposed inside the covers. Allow at least one minute for the high voltage to bleed off, even after power is turned off.

Due to high voltage danger, **DO NOT TOUCH**

- CRT cables. These cables can cause severe shock from a tiny, invisible crack or hole and should never be touched while projector power is on.
- CRT anodes.
- Main power ± supply posts.
- Arc Lamp main power ± posts
- CRT yoke assemblies and other proximity electrical assemblies, components and wiring. If performing the **ILA**® Back Focus, CRT Mechanical Focus, CRT rotation, width adjustment, or **ILA**® Overlap adjustment, always use an

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ANSI/ASTM 10,000 volt rated glove. Periodically check the condition of the gloves for cracks.

Power Supply

The projector operates from a 220V - 240V, 20 Amp, single-phase, 50/60 Hz AC power source. Ensure local power source matches these requirements before operating!

For continued safe and reliable operation, only use cables supplied by the manufacturer for power and signal connections.

Fluid Safeguards

Certain components of the projector contain fluid. If any fluid from the projector contacts the skin, wash off with soap and water. If any fluid from the projector splashes into the eyes, rinse with cool running water.

Ventilation and Foreign Object Retrieval

CAUTION! Ensure the projector's multiple fans are free from obstructions and operating properly. Air filters are located at vent ports on the cover. Air filters require periodic cleaning to ensure adequate cooling of the projector (*Section 4.3*). Ensure that all vent ports are clear of obstructions.

Keep the inside of the projector free from foreign objects, such as hairpins, nails, paper, etc. Do not attempt to retrieve any object or insert metal objects such as wire and screwdrivers inside the unit. If an object falls inside the projector, immediately unplug the projector and call a Hughes-JVC certified technician to remove object.

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1.0 Introduction

This Service Manual is designed to be used with the Model 230 User's Guide. This Service Manual provides information on the:

- Projector functional description;
- Service adjustments
- Removal and replacement of subassemblies;
- Troubleshooting.

The User's Guide covers the projector's installation, operation, setup adjustments, and specifications. Together the Service Manual and User's Guide provide a qualified service person with information to operate and maintain the projector.

1.1 Safety

This projector contains high voltages and high intensity light sources in its internal system and power supplies. Read the entire Safety Chapter at the front of this manual before performing any adjustments or maintenance.

When performing procedures that call for the projector's power to be on, always wear high voltage gloves (ANSI/ASTM 10,000 volt rated) when working around the CRTs, Arc Lamp or power supplies. Wear safety goggles (rated X5) when working anywhere near the light path from the Arc Lamp or the projection lens at all times.

1.2 Updates

Hughes-JVC will periodically provide bulletin and /or manual supplements to ensure the accuracy of this service manual.

1.3 Tool List

The following tools are required to perform service adjustments:

All Purpose Tools=Diagonal Sidecutters, Wirestrippers, Slot Adjustment Screwdriver (Tweeker), Mirror/Magnet Pick-Up Tool, Flashlight, 6" Crescent Wrench, Needlenose pliers, 6" Vise Grips
Balldriver, 1.5mm
Balldriver, 3mm
Balldriver, 3mm, Long
Balldriver, 4mm
Balldriver, 5mm, Long, T-handle
Balldriver, 6mm
Balldriver, 8mm

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Ballpoint L-Wrench Set, 1.5-5mm
Delrin .100 Hex Alignment Tool
Gloves, ANSI/ASTM 10,000 volt rated, Safety
Goggles, Safety, x3(covers on) and x5(covers off)
Hex Ballpoint Driver, 3mm
Hex Ballpoint Driver, 5mm
Nutdriver, 10mm
Nutdriver, 11mm (or 7/16")
Nutdriver, 5mm
Nutdriver, 7mm
Nutdriver, 8mm
Screwdriver, Phillips, #1
Screwdriver, Phillips, #2
Screwdriver, Pozidrive, #1
Screwdriver, Pozidrive, #2
Screwdriver, Slot ¼"
Screwdriver, Slot, ½"
Screwdriver, Slot, 3/16"
Socket, ¼" drive, 7mm-deep

1.4 Acronyms Used in this Manual

ALPS	Arc Lamp Power Supply
CDB	Convergence/Deflection Board
CH	Channel
CPU	Central Processing Unit
CRT	Cathode Ray Tube
EMI	Electromagnetic Interference
EPROM	Erasable Programmable Read-Only Memory
FPGA	Field Programmable Gate Array
F to V	Frequency to Voltage
G2	CRT Grid 2
HVDB	Horizontal/Vertical Deflection Board
HDTV	High Definition Television
Hz	Hertz
HSYNC	Horizontal Sync
HVDB	Horizontal/Vertical Deflection Board
HVPS	High Voltage Power Supply
IIC	Inter-Integrated Circuit
ILA®	Image Light Amplifier
I/O	Input/Output
I/R	Infrared
kHz	Kilohertz
LED	Light Emitting Diode
LVPS	Low Voltage Power Supply
NTSC	National Television Standards Committee
PAL	Phase Alternating Line
PCB	Printed Circuit Board
PLL	Phase Lock Loop
PLUGE	Picture Line-Up Generating Equipment

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RAM	Random Access Memory
RGB	Red, Green and Blue
RGBHV	Red, Green, Blue, Horizontal, Vertical
ROM	Read Only Memory
RTG	Raster Timing Generator
SCB	System Controller Board
SECAM	Sequential couleur a memoire (sequencial color with memory
SRB	Scan Reversal Board
SYNC	Synchronization
TTL	Transistor-Transistor Logic
UL	Underwriter Laboratories
UV	Ultraviolet
VAB	Video Amplifier Board
VCO	Voltage Controlled Oscillator
VIC	Video Input Card
VIN	Video Input
VPB	Video Processor Board
VSYNC	Vertical Sync
VTR	Video Tape Recorder
YC	Luminance/Chrominance

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2.0 System Description

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2.1 Introduction

The assemblies and components in the Model 230 projector are contained mainly in the five sections below (refer to Figures 4-1 and 4-13 for physical locations of assemblies and components:

- The Optics Assembly Section is located at the front area of the projector. The Optics Assembly Section includes the Cold Mirror/IR Filter, (**CAUTION!**: The term "cold mirror" is used because the mirror passes infrared light and its reflection contains only "cold' light that does not transmit appreciable heat. As a result of the absorption of infrared heat radiation, "cold" mirrors can get very hot.), Second Condensing Lens Ultraviolet Filter, Dichroic Mirror Assembly, Prisms, Combining Prism, Image Mirrors, and the Zoom Projection Lens.
- The Arc Lamp Assembly section is located in the right front area of the unit. It contains the Xenon Arc Lamp, First Condensing Lens, and Blower.
- The Power Supply Section is located at the right front area of the projector below and to the rear of the Arc Lamp. It contains the Low Voltage Power Supply, the High Voltage Power Supply, and the Arc Lamp Power Supply.
- The Projector Electronics Section is located mainly in the back half of the projector. It consists of the Electronics Module that houses 6 of the electronics printed circuit boards used in the projector, and their associated

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cabling. It also contains the Backplane board which is used to electrically interconnect the printed circuit boards, power supplies and other units in the projector, and the Video Input Cards that interface with different kinds of input signals.

- The CRT Section is located beneath the electronics card cage and contains the 3 CRTs, 3 Relay Lenses, 3 ILA®s and the Video Amplifier Board.

2.2 Optical System

Introduction: The Model 230 Optics Assembly divides white light from the Arc Lamp into its three color components, Red, Green and Blue. This light is then modulated with the image signal to form three single color images. The light is then recombined at the 4P (combining) prism and transmitted through the projection lens to the projector screen. The explanation below is divided into two sections. The first section follows the image path from the CRT to the projector screen. The second section follows the high intensity light path from the Arc Lamp Ignitor to the **ILA®** assemblies, where it combines with the image. The Red, Green, and Blue image and light paths are identical. *Refer to Figure 2-1*.



CAUTION! The alignment of system optical components is critical. Replacement of individual mirrors or prisms requires removing the projector cover and must be performed only by Hughes-JVC Certified technicians. Consult the factory before removing or aligning any mirrors or prisms.

2.2.1 Image Path

CRT Assemblies: The three CRT/Yoke assemblies are located beneath the Electronics Module card cage. Two exhaust fans at the rear help cool the CRT assemblies. Each CRT is sent a red, green, or blue signal, but they do not emit a red, green, or blue color, as in traditional projectors. The CRTs are not used as a primary light source. The light output to the screen is the function of the Arc Lamp. The purpose of the CRTs is to generate an image and to control the amount of modulation the ILA® assemblies introduce on the light coming from the Arc Lamp. The Red, Green, and Blue image signals are routed to the CRTs from the Video Amplifier Board through the CRT socket connectors.

Relay Lens: The relay lens picks up the image from the face of the CRT and focuses the image to the ILA® assembly.

Image Light Amplifier (ILA®) Assembly: The CRT image is received from the relay lens onto the input side of the ILA® assembly. The input and output sides of the ILA® assembly are isolated from each other electrically and optically but are coupled electrostatically.

At the same time as the image is received at the input side of the ILA® assembly, the output side of the ILA® assembly is receiving high intensity light from the arc lamp through the prism. This high intensity light is modulated

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(changing its polarization) by the signal on the input side of the ILA® assembly. The light is then reflected back from the output side of the ILA® assembly, then travels through the prism to be picked up by the projection lens.

NOTE: The prism reflects horizontally polarized light and passes vertically polarized light. Light from the arc lamp is polarized horizontally and reflects from the prism into the ILA® assembly then back out again, after being modulated by the image signal into vertically polarized light. The vertically polarized light then passes through the prism to the projector lens. In this manner the ILA® assembly combines the image from the CRT with the high intensity light from the arc lamp. Thus, the maximum brightness of the screen image is not dependent on the brightness of the CRT, but on the light from the arc lamp.

Polarizing Prism: The polarizing prism receives the high intensity light from the xenon arc lamp and polarizes the light horizontally. The prism reflects virtually all of this light toward the ILA® assembly. This light is then modulated (altered) into a vertical plane by the image on the input side of the ILA® assembly and then reflected back into the same prism. Since the prism reflects only horizontal light and passes vertical light, this high intensity, vertically polarized image goes straight through the prism toward the Combining Prism. Light that is not completely polarized horizontally or vertically passes through the prism in varying degrees of brightness, according to how polarized it is (fully polarized light resulting in maximum brightness on the screen).

Image Mirror: The Image Mirrors direct the blue and red images toward the Combining Prism.

Combining (4P) Prism: The combining prism consists of separate prisms that polarize each of the three high intensity signals and direct them toward the projection lens.

Projection Lens: The Projection Lens picks up the high intensity image from the Combining Prism and transmits it to the projector screen.

2.2.2 Arc Lamp Light Path

The Arc Lamp assembly produces the high intensity light used to transmit bright images to the screen. It consists of a Xenon Arc Lamp containing xenon gas under pressure, a Condensing Lens, an Ignitor assembly that provides the spark to light the arc lamp, a Laser Power Supply to provide the boost voltage to the Ignitor. An exhaust fan and blower help keep the arc lamp cool. The description below follows the sequence of the light path. (See Figure 2-1).

Ignitor and Laser Power Supply: The Laser Power Supply provides a boost voltage through a spark gap to the Ignitor circuit which then provides a momentary High Voltage, (about 32 KV), to excite the xenon gases inside the Xenon Arc Lamp. After the arc lamp ignites, it is maintained ON by high current and low-voltage (55-70 amps and +20-23 volts).



WARNING!!! The Xenon Arc Lamp produces high intensity white, ultraviolet and infrared light capable of severe eye injury. **Never look**

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directly at or touch the Xenon Arc Lamp. Service should be performed by Hughes-JVC certified technicians only.

Xenon Arc Lamp/Condensing Lens: High pressure, ionized xenon gas supports a high-current electrical arc to produce the intense, white light used in the Model 230 projector.

First Condensing Lens: The high intensity light output from the Xenon Arc Lamp goes through the First Condensing Lens (attached to the rear of the Arc Lamp housing) where the light beam is condensed and directed toward the Cold Mirror/IR Filter.

Cold Mirror/IR Filter: The Cold Mirror/IR Filter removes most of the IR light and directs the light beam toward the Second Condensing Lens.

Second Condensing Lens/UV Filter: Final condensing for the light beam is provided by the Second Condensing Lens. Ultraviolet light is filtered out by the UV Filter.

The high intensity light beam continues toward the Dichroic Mirror Assembly. Thus, most of the IR and UV light is filtered out before the light beam enters the more sensitive portions of the optics, leaving only the visible portion.

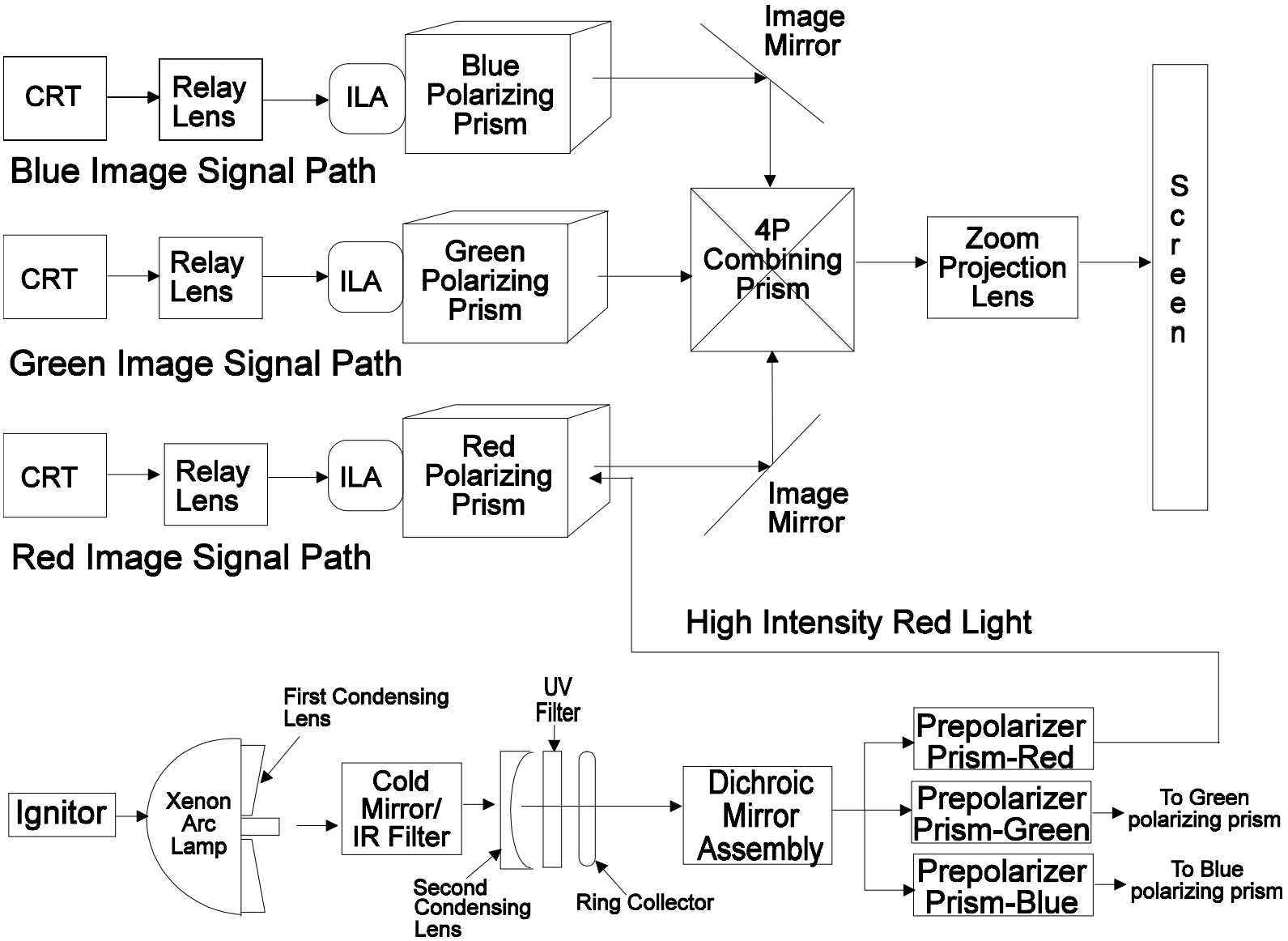
Dichroic Mirror Assembly: The condensed and filtered white light beam enters the Dichroic Mirror Assembly which separates (dichroic mirrors reflect only one color and pass all others) the light into its Red, Green and Blue components.

Prepolarizers and Polarizing Prisms: Each individual light beam is polarized (directed) toward its own Polarizing Prism where it is directed toward the output side of its **ILA®** Assembly and combined with the signal from the input side of the **ILA®** Assembly.

Each of these three light beams independently combine with the image in their own (Red, Green or Blue) color systems at the **ILA®** assemblies as described in Section 2.2.1, Image Path.

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Figure 2-1. Optical System Block Diagram



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2.3 Electronics System

2.3.1 General Description

The Model 230 Electronics System includes nine printed circuit assemblies. They provide all the controlling voltages and signals to adjust and correct picture settings, geometry, convergence, and shading (*see Chapter 4 of the User's Guide*). The Electronics System also controls video and sync input signals, LED displays on PCBs at the rear and side of the projector, two RS-232 communications ports, and two IR receivers for remote control of the projector.

The descriptions in this portion of the manual are based on an overall Electronics System block diagram and simplified block diagrams for each of the nine printed circuit assemblies. The diagrams and descriptions serve two purposes; first, to provide the technician with an overall grasp of how the system works and how each assembly works with other assemblies in the system, second, to provide the technician with enough information to troubleshoot to the assembly level, if needed.

Figure 2-2 provides an overall System Block Diagram to show how the Optical System, Arc Lamp, and Electronics System combine to provide the bright screen image.

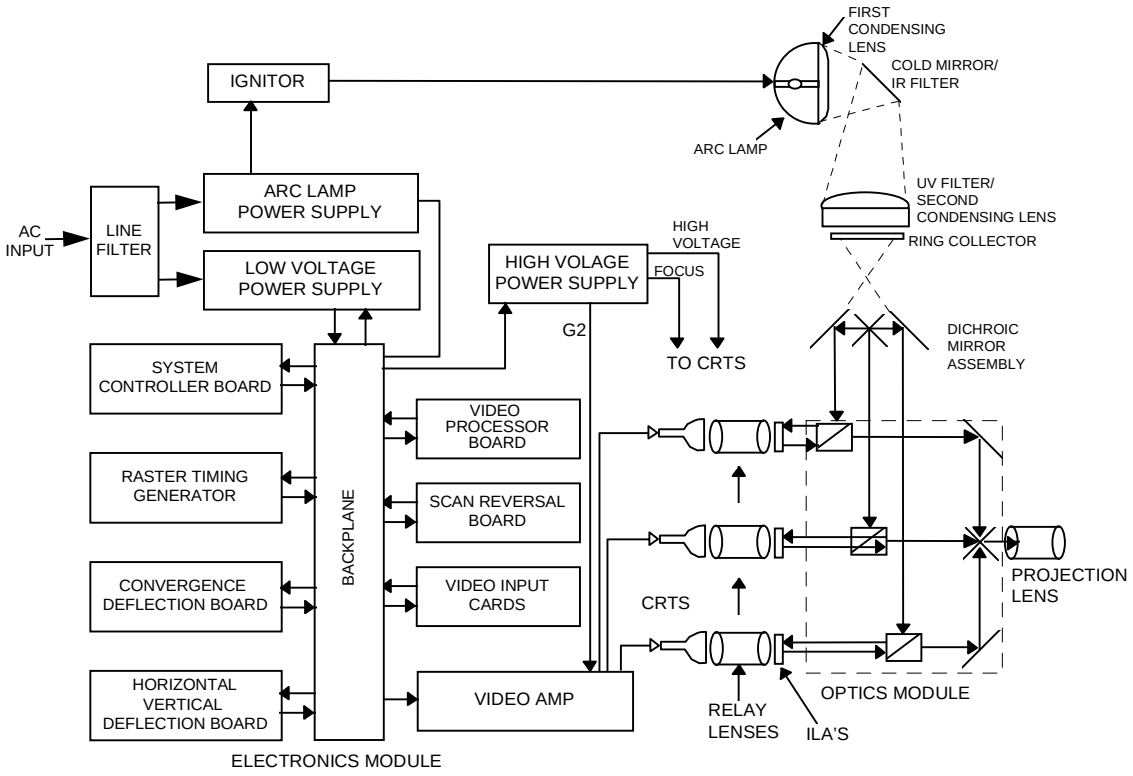


Figure 2-2. Model **230** System Block Diagram

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2.3.2 Power Supplies

The Model 230 includes three power supply assemblies.

- Low Voltage Power Supply
- Arc Lamp Power Supply
- High Voltage Power Supply

Low Voltage Power Supply (LVPS)

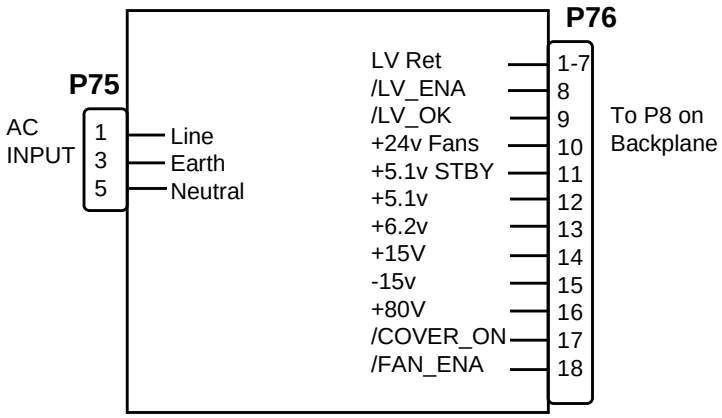


Figure 2-3. LVPS Input/Output Diagram

Main Functions:

- Provide all the low voltages needed by the projector.
- Provide standby power when the projector is OFF.
- Provide power for all cooling fans.

Inputs:

The Low Voltage Power Supply receives AC input power directly from the power source. The input range is from 220 VAC to 240 VAC, at 50 or 60 Hz.

/LV_ENA: Enabling signal from the System Controller Enables the LVPS when the System Controller receives a Power On command.

/FAN_ENA: From System Controller. Enables the +24v standby voltage for the projector fans.

/COVER_ON: Cover interlock signal. Indicates both covers in place. Enables the non-standby outputs.

Outputs:

+ 5.1VDC Main

+ 5.1VDC Standby

+ 6.2VDC

± 15VDC

+ 24VDC

+ 80VDC

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/LV_OK: When /LV-ENA is enabled, this diagnostic signal indicates to the System Controller the status of the non-standby supply (all outputs working or not working).

Operation:

The main power is filtered via the input filter to prevent radiation from escaping back to the power line. From the line filter, AC power is fed into the Low Voltage Power Supply module where AC is rectified, filtered, and compensated for power factor correction.

The +5.1V Standby is on whenever AC power is connected to the projector and the circuit breaker on the rear panel is in the On position. The +24V standby power for the fans turns on when the /FAN_ENA signal is received from the System Controller (this turns off in 5-8 minutes if power is not turned on by the remote control or a PC). All other voltages supplied by the LVPS are activated when power is turned on at the remote or PC. These include +5.1V for digital components, +6.2V for CRT filaments, ±15V for analog circuits, and the +80V supply which is used by the High Voltage Power Supply, Video Amplifier PCB, and the Horizontal/Vertical Deflection PCB.

Arc Lamp Power Supply (ALPS)

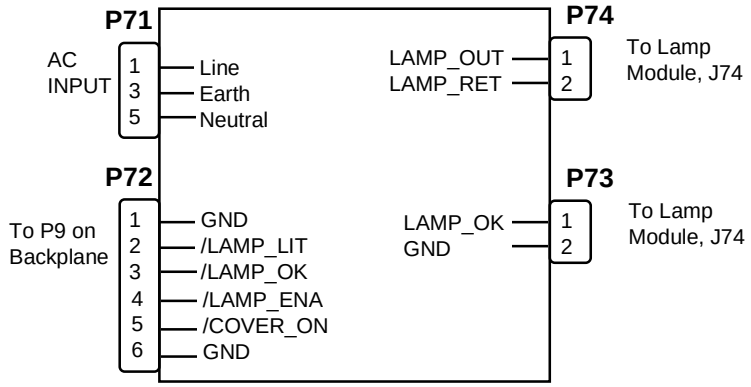


Figure 2-4. Arc Lamp Power Supply, Block Diagram

Main Functions:

- Provides ignition power to turn the Xenon Arc Lamp ON.
- Provides steady state power to maintain the lamp ON.

Inputs:

The Arc Lamp Power Supply receives AC input power directly from the power source. The input range is from 220-240 VAC, at 50 or 60 Hz.

/LAMP_ENA: From System Controller. Turns on the ALPS.

/COVER_ON: Cover interlock signal. Indicates both covers are in place.

/LAMP_OK: Tells the ALPS that the lamp is installed, the temperature is within limits, and the lamp cooling blower is working.

Outputs:

+140 VDC boost voltage to the Laser Power Supply.

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Voltage: 20 to 23 VDC to maintain the arc lamp ON.

Current: 55 to 70 amps to maintain the arc lamp ON.

LAMP_OUT: Lamp output voltage, positive.

LAMP_RTN: Lamp return.

/LAMP_LIT: Signal to SCB that the lamp is lit.

Operation:

Two signals (/COVER_ON and /LAMP_OK) are required in order for the arc lamp to light. /COVER_ON from the cover interlock switches tells the Arc Lamp Power Supply that the covers are in place and the interlock switches are pressed down. /LAMP_OK informs the System Controller that the lamp is installed (a mechanical switch activates when the lamp is installed) The System Controller then sends the /LAMP_ENA signal to the ALPS. The /LAMP_ENA signal turns on the ALPS.

The Arc Lamp Power Supply then provides the +140 VDC boost voltage to a spark gap and high voltage transformer which steps up the voltage to approximately 32KV and ignites the Xenon Arc Lamp. After the Arc Lamp is lit, it is maintained on by the ALPS at a constant 20-23 volts and 55-70 amps. The /LAMP_LIT signal output informs the System Controller if the lamp is lit or not.

The Arc Lamp Power Supply is electrically and magnetically shielded to prevent noise or disturbances in the CRTs or other circuitry.

High Voltage Power Supply (HVPS)

The High Voltage Power Supply (HVPS) is located on top of the LVPS on the right side of projector (as viewed from rear). This supply provides the anode, focus, and screen voltages required for the three CRTs in the Model 230 projector.

The following functions are provided by HVPS:

- Phase locked loop circuit for synchronization to the horizontal sync
- Generation of anode voltages (25 KV) for all three CRTs (RGB)
- Generation of focus voltage (G3) for all three CRTs (RGB)
- Generation of screen (G2 supply-Black Level) voltage for all three CRTs
- Generation of G1 supply (Blanking) voltage
- Dynamic focus amplifier using H and V parabolas
- External ON/OFF and generation of /HV_OK signal

The High Voltage Power Supply I/O diagram (Figure 2-5) and the list of inputs and outputs (Table 2-1), provide an understanding of the operation of the HVPS to allow the technician to perform module level troubleshooting.

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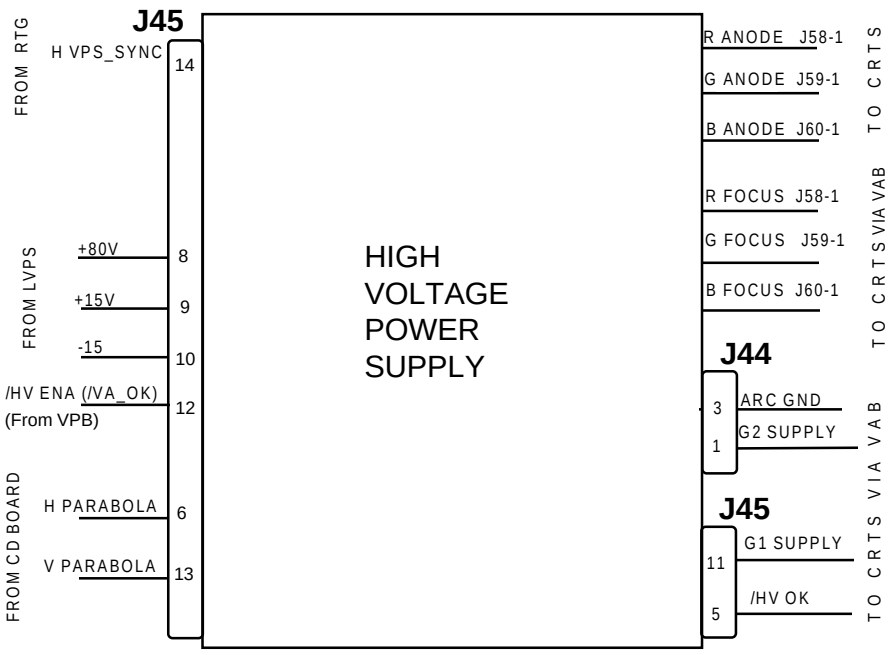


Figure 2-5. High Voltage Power Supply, I/O Diagram

The HVPS Input/Output

This section provides a comprehensive description of the inputs to and outputs from the HVPS. The I/O descriptions are arranged by the source/destination of the signal. The format used is such that the assembly communicated with is used as the primary heading of each output. Input refers to an input to the HVPS. Output refers to an output from the HVPS. In each case the signals direction is noted.

Table 2-1. High Voltage Power Supply I/O signals

RASTER TIMING GENERATOR PCB	
INPUT	**DESCRIPTION**
HVPS_SYNC	Square wave HCT level with 50 or 33% duty cycle synchronized to horizontal sync.
VIDEO PROCESSOR PCB	
INPUT	**DESCRIPTION**
/HV_ENA	The HVPS enable line. A low enable the HVPS (VA_OK from VPB).
VIDEO AMPLIFIER PCB	
OUTPUTS	**DESCRIPTION**
G1_SUPPLY	DC supply about -150 V for driving the G1 of CRTs
G2_SUPPLY	DC supply about 1.3 KV for driving the G2 of CRTs

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ARC_GND	Return (ground) line for the CRT anodes
CONVERGENCE/DEFLECTION PCB	
INPUTS	**DESCRIPTION**
H_ PARABOLA	Horizontal parabola for use by the dynamic focus amplifier
V_ PARABOLA	Vertical parabola for use by the dynamic focus amplifier
SYSTEM CONTROLLER PCB	
OUTPUT	**DESCRIPTION**
/HV_OK	The high voltage status line. Low = operational HVPS
LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
+ 15V	+ 15 V for use by the HVPS
+ 80V	+ 80 V for use by the HVPS
- 15V	- 15V for use by the HVPS
CRTS	
OUTPUTS	**DESCRIPTION**
RED_ANODE GRN_ANODE BLU_ANODE	Anode supply for the three CRTs. About 25 KV
RED_FOCUS GRN_FOCUS BLU_FOCUS	Focus voltage for the three CRTs. About 7 KV

Interlocks and protection:

This section describes the interactions between boards where one board may cause others to perform protection functions.

Input

A high signal at /HV_ENA shuts off the HVPS.

2.3.3 Video Input Cards

The four types of Video Input Cards that can be used with the Model 230 Projector are:

- Graphics Enhancer RGB Video Input Card, which is supplied with each projector and is used for RGB standard formats
- Optional Four Input RGB VIC used in a similar manner as a switcher.

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- Optional HDTV VIC used for High Definition Television.
- Optional Quad Standard Decoder VIC used for NTSC, PAL SECAM and other composite sources.

Graphics Enhancer RGB Video Input Card

The Graphics Enhancer RGB VIC is located at the rear of the projector. It has five BNC inputs. It provides the RGB and sync interface for the projector.

The following functions are provided by the RGB VIC:

- Video and sync interface for red, green and blue
- LED indication
- IIC serial bus interface

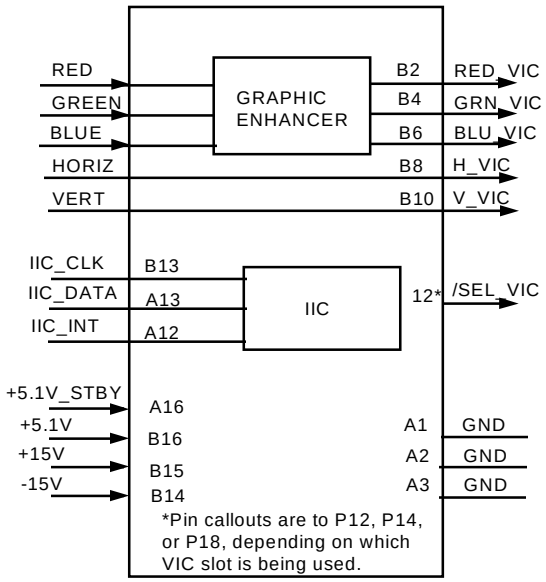


Figure 2-6. Graphics Enhancer RGB VIC I/O

Video and sync interface for red, green and blue

This RGB VIC provides a high bandwidth interface for the three color video signals. The video signals are routed to the Backplane Board without any distortion or modification. The sync signals (horizontal and vertical) are also directly connected to the Backplane Board.

LED indication

The RGB VIC includes an LED which glows when the board is selected (i.e. when the /SEL_CH line is low) as the input for the Model 230 Projector.

IIC serial bus interface section

The Graphics Enhancer RGB VIC is controlled by the serial bus interface. The IIC bus comes from the System Controller Board through the Backplane Board. The information transferred over the IIC bus is indicated below (I = input to the RGB VIC, and O = output from the RGB VIC). The RGB VIC does not use the interrupt line of the IIC bus interface:

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Table 2-2. Graphics Enhancer RGB VIC IIC communication

I/O	Bits	Information	Description
I	1	/SEL_CH	Select line for the Graphics Enhancer RGB VIC. Low = Selected RGB VIC.
O	4	VIC_ID	VIC identification lines. 0000 for RGB_VIC.
O	1	VIC_MODEL	Revision of the RGB VIC.
O	1	/VIC_OK	RGB VIC status line. Low = operational RGB VIC.

The Graphics Enhancer RGB_VIC I/O

This section provides a description of the inputs to and outputs from the RGB_VIC. The I/O descriptions are arranged by the source/destination of the signal. The format used is such that the assembly communicated with is used as the primary heading of each group of signals. Those signals are further subdivided into inputs and outputs. Input refers to an Input to the RGB_VIC, output refers to an output from the RGB_VIC.

Table 2-3. Graphics Enhancer RGB VIC I/O signals

PROJECTOR INPUTS	
INPUTS	**DESCRIPTION**
RED GREEN BLUE	Video input signals. about 0.7 to 1 VPP
HORIZ.	Horizontal or composite sync signal
VERTICAL	Vertical sync signal
VIDEO PROCESSOR BOARD	
OUTPUTS	**DESCRIPTION**
/SEL_VIC	Select line for VIC. A low indicates the RGB_VIC is selected.
RED_VIC GRN_VIC BLU_VIC	Video signals. about 0.7 to 1 VPP
H_VIC	Horizontal or composite sync signals
V_VIC	Vertical sync signals

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SYSTEM CONTROLLER BOARD	
INPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between system control board and the RGB_VIC.
OUTPUTS	**DESCRIPTION**
/IIC_INT	IIC interrupt line. RGB_VIC does not initiate an interrupt.
LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
+5.1 V	+5.1 V supply for use by RGB_VIC.
+15 V	+ 15 V supply for use by RGB_VIC.
-15 V	-15 V supply for use by RGB_VIC.
+ 5.1 V_stby	+ 5.1 V stand by supply for use by RGB_VIC.

Interlocks and protection

Input: None

Outputs: None

Quad Input RGB VIC

The Quad Input RGB VIC consists of four sets of RGBHV inputs and operates in a manner similar to a switcher. The four inputs are multiplexed so that only one is enabled at a specific time. Software selects the desired input channel through the IIC bus and ensures that only one RGB VIC is enabled. When one of the channels assigned to the Quad RGB VIC is selected, the /SEL_VIC line to the Video Processor is enabled.

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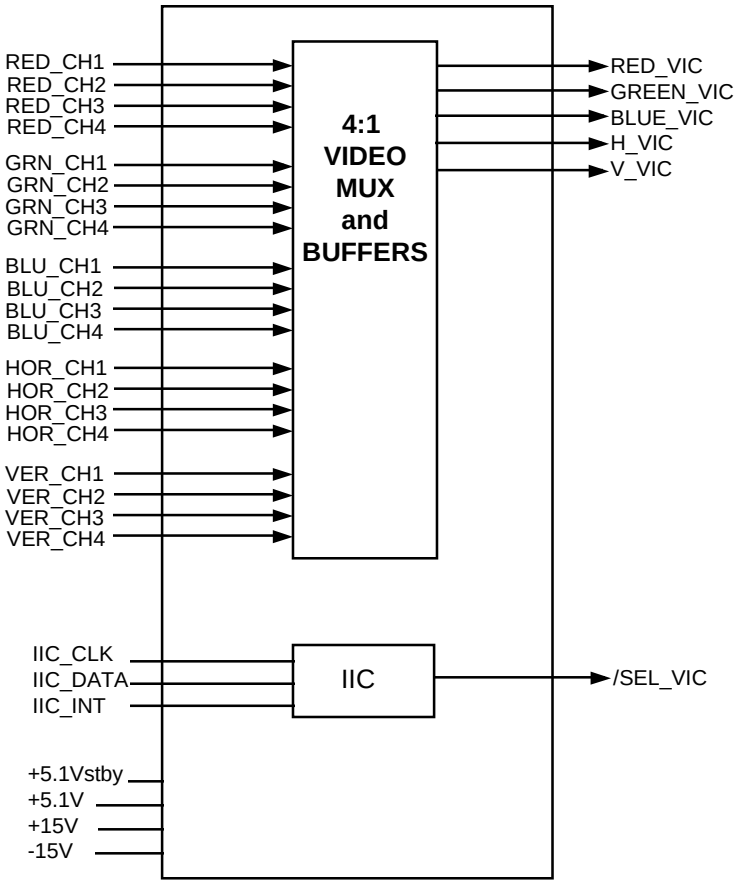


Figure 2-7. Quad Input RGB VIC

The same functions performed by the Graphics Enhancer RGB VIC are performed by the Quad Input RGB VIC. The description of operation and pinouts are the same as the Graphics Enhancer RGB VIC. One of four LEDs indicates which of the four RGB inputs is currently active.

HDTV YPbPr VIC

This color decoder video input card (YPbPr_VIC) is located on the back side of the projector and contains three BNC input connectors which can be used for two different inputs, YPbPr or GBR. This board converts these color component signals to RGB type video signals.

The following functions are provided by YPbPr_VIC:

- Video input and output buffers
- Conversion of color components signals to RGB video signals
- Separation of syncs from the Y/G input signal
- Hue, sharpness, gamma, and color adjustment
- Selection of RGB input or color component input
- LED indication

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- IIC serial bus interface

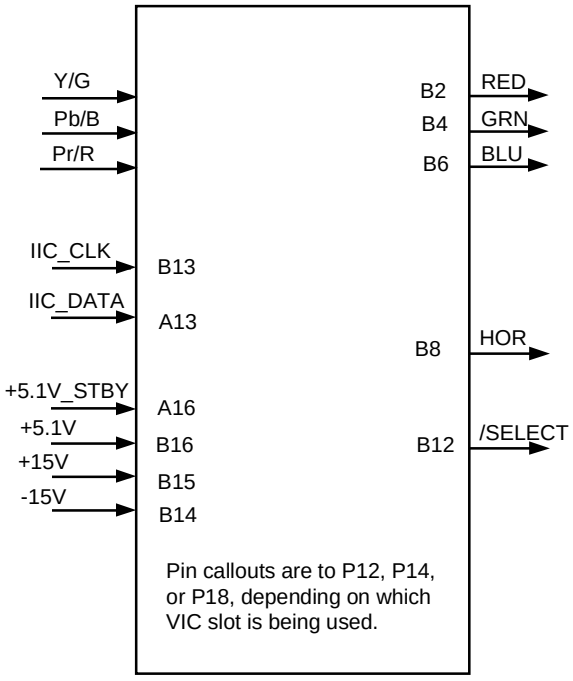


Figure 2-8. HDTV YPbPr VIC Input/Output Diagram.

This VIC accepts two types of video signals, color components (YPbPr) and RGB signals. In either case the output of this VIC is RGB type signals. If the inputs are color components they will be converted to RGB type signals.

The selection between color component input mode and RGB input mode is controlled by an input. This input is controlled by the System Controller Board via the IIC serial bus interface.

LED indication

There are two LEDs on this VIC. The RGB LED glows when the YPbPr_VIC is selected and is in RGB input mode. The YPbPr LED glows when the YPbPr_VIC is selected and is in YPbPr input mode. Both LEDs are off when the YPbPr_VIC is not selected as the input to projector. Only one LED can be on at one time.

IIC Interface

The YPbPr_VIC is controlled by the serial bus interface. The IIC bus comes from the System Controller Board through the Backplane Board. All required adjustments for this board are provided via the IIC serial bus interface. The information transferred over the IIC bus is indicated below (I = input to YPbPr_VIC, and O = output of YPbPr_VIC). The selection of this VIC is accomplished through the IIC control bus which provides the /SEL_VIC signal.

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Table 2-4. HDTV VIC IIC Interface

I/O	BITS	INFORMATION	DESCRIPTION
I	1	/SEL_YPbPr	Selects YPbPr input mode for the YPbPr_VIC. Low = Selected YPbPr input mode.
I	1	/SEL_RGB	Selects RGB input mode for the YPbPr_VIC. Low = Selected RGB input mode.
I	8	GAMMA	Data for adjustment of Gamma correction
I	8	COLOR	Data for adjustment of color
I	8	HUE	Data for adjustment of hue
I	8	SHARPNESS	Data for adjustment of sharpness
O	4	VIC_ID	VIC identification lines. 0001 for YPbPr_VIC
O	1	VIC_MODEL	Revision of the YPbPr_VIC.
O	1	/YPbPr_OK	YPbPr_VIC status line. Low = operational YPbPr_VIC

The HDTV YPbPr_VIC I/O

This section provides a comprehensive description of the inputs to and outputs from the YPbPr_VIC. The I/O descriptions are arranged by the source/destination of the signal. The format used is such that the assembly communicated with is used as the primary heading of each group of signals. Those signals are further subdivided into inputs and outputs. Input refers to an Input to the YPbPr_VIC, output refers to an output from the YPbPr_VIC.

Table 2-5. HDTV VIC Signals

PROJECTOR INPUTS	
INPUT	**DESCRIPTION**
Y/G Pb/B Pr/R	Video input signals-about 0.7 to 1 VPP
VIDEO PROCESSOR BOARD	
OUTPUT	**DESCRIPTION**
/SELECT	Selection indicator for VIC. Low indicates the selected YPbPr_VIC.
RED GRN BLU	Video signals. about 0.7 to 1 VPP

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HOR	Composite horizontal / vertical sync signal
SYSTEM CONTROLLER BOARD	
INPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between system control board and the YPbPr_VIC.
OUTPUTS	**DESCRIPTION**
/IIC_INT	IIC interrupt line. YPbPr_VIC does not initiate any interrupt
LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
+5.1 V	+5.1 V supply for use by YPbPr_VIC.
+15 V	+ 15 V supply for use by YPbPr_VIC.
-15 V	-15 V supply for use by YPbPr_VIC.

Interlocks and protection

Inputs:

None

Outputs:

None

Quad Standard Decoder VIC

The Quad Standard Decoder VIC is composite and S-Video interface. It contains three BNC input connectors for Composite Video and S-Video (luminance and chrominance). This decoder VIC converts these color component signals to RGBHV type video signals.

The following functions are provided by the Quad Standard Decoder VIC:

- Select input source-Composite or S-video
- Select standard-AUTO/NTSC/PAL/SECAM/4.43NTSC
- Conversion of composite and S-video signals to RGB video signals
- Separation of syncs from the input signal
- Tint, sharpness, and color adjustment
- LED indication of Composite or S-video
- IIC serial bus interface

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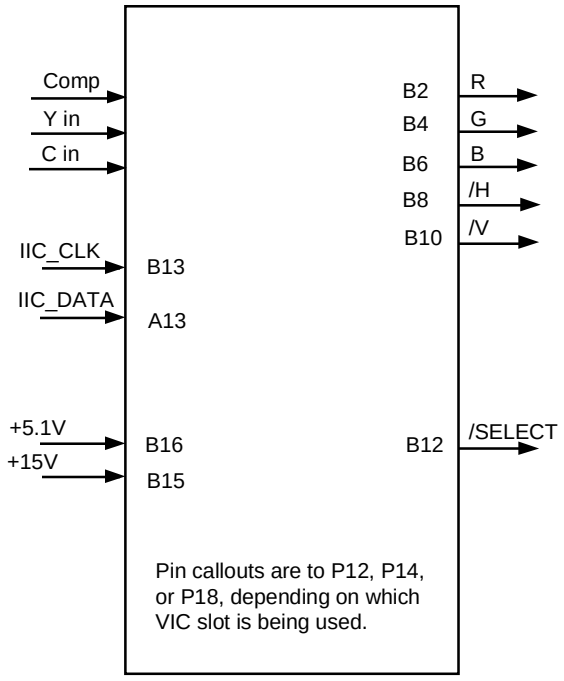


Figure 2-9. Quad Standard Decoder I/O Diagram.

LED Indication

There are two LEDs on this VIC. The LED on the right side of the board glows when Composite Video is selected and the LED on the left glows when S-Video is selected. Only one LED can light at one time.

IIC Interface

The Quad Standard Decoder VIC is controlled by the serial bus interface. The IIC bus comes from the System Controller Board through the Backplane Board. All required adjustments for this board are provided via the IIC serial bus interface. The information transferred over the IIC bus is indicated below (I = input to YPbPr_VIC, and O = output of YPbPr_VIC). The selection of this VIC is accomplished through the IIC control bus which provides the /SEL_VIC signal.

Table 2-6. Quad Standard Decoder VIC IIC Interface

I/O	INFORMATION	DESCRIPTION
I	SOURCE	Selects input source (Composite Video or S-Video)
I	STANDARD	Selects signal standard (AUTO/NTSC/PAL/SECAM/4.43NTSC)

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I	TINT	Data for adjustment of Hue
I	COLOR	Data for adjustment of color
I	SHARP	Data for adjustment of Sharpness
I	VTR	Selection of VTR mode
O	VNR	Selection of Video Noise Reduction mode

Quad Standard Decoder VIC I/O

This section provides a description of the inputs to and outputs from the Quad Standard Decoder VIC. The I/O descriptions are arranged by the source/destination of the signal. The format used is such that the assembly communicated with is used as the primary heading of each group of signals. Those signals are further subdivided into inputs and outputs. Input refers to an Input to the VIC, output refers to an output from the VIC.

Table 2-7. Quad Standard Decoder VIC Signals

PROJECTOR INPUTS	
INPUT	**DESCRIPTION**
Composite V S-Video	Video input signals-about 0.7 to 1 VPP Video input signal-about 0.7 to 1 VPP for Luminance and about .3-.6 VPP for Chrominance (Burst)
VIDEO PROCESSOR BOARD	
OUTPUT	**DESCRIPTION**
/SELECT	Selection indicator for VIC. Low indicates the Quad VIC is selected.
RED GRN BLU	Video signals. about 0.7 to 1 VPP
H, V	Horizontal/vertical sync signals, about 1-1.25 VPP
SYSTEM CONTROLLER BOARD	
INPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between System Control Board and the VIC.

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LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
+5.1 V	+5.1 V supply for use by The Quad Decoder VIC.
+15 V	+ 15 V supply for use by the Quad Decoder VIC.

Interlocks and protection

None

2.3.4 Video Processor PCB

The Video Processor Board (VPB) is the bottom-most card (see Figure 5-1) in the card cage. It is connected directly to the Backplane board through 2 connectors. When an external signal is being received, the VPB provides Horizontal Sync, Vertical Sync, and Green Sync signals to the Raster Timing Generator (RTG) board. It also provides three primary color signals, and G2, G1 bias and DC RESTORE control signals to the Video Amplifier Board (VAB).

The following functions are provided by the VPB:

- Video signal input and multiplexing
- Sync signal stripping
- Overlay signal multiplexing
- Brightness and Contrast control, and DC RESTORE
- Video signal gamma correction
- Sensitivity and Threshold signal input and control
- Automatic limiting for Contrast, G2, and internal video

The Video Processor I/O diagram and the list of inputs and outputs provide information to allow the technician to perform module-level troubleshooting.

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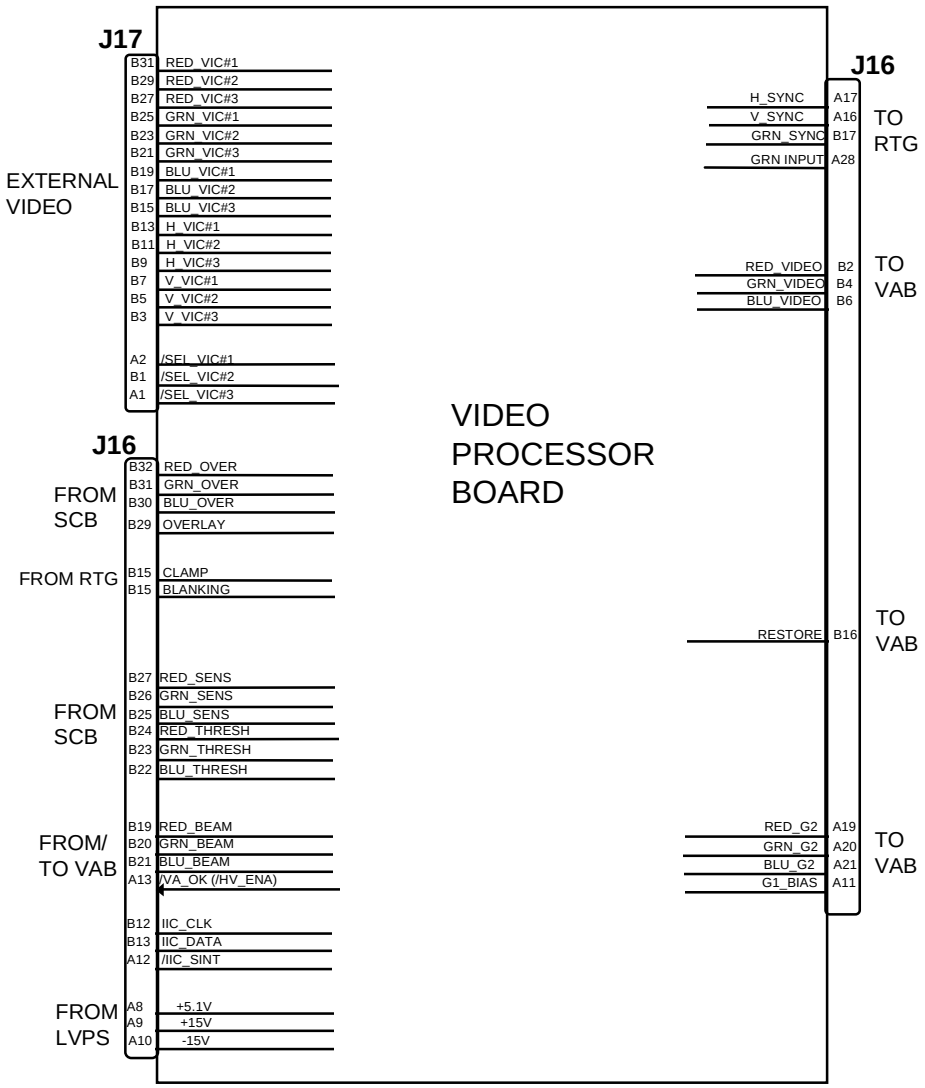


Figure 2-10. Video Processor I/O Diagram

IIC Interface

The VPB communicates with the SCB via the IIC bus. The information transferred over the bus (as shown in Table 2-8) is indicated as follows (I = Input to the VPB, O = Output from the VPB):

Table 2-8. Video Processor IIC communication

I/O	INFORMATION	DESCRIPTION
I	RED_CONT	Red Contrast level
I	GRN_CONT	Green Contrast level
I	BLU_CONT	Blue Contrast level
I	BRIGHTNESS	Brightness level
I	BEAM CURRENT	Beam Current

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I	RED_G2	Red G2 Control
I	GRN_G2	Green G2 Control
I	BLU_G2	Blue G2 Control
I	WHT_BOOST	Gamma correction
I	BLK_BOOST	Gamma correction
I	G1_BIAS	G1 bias level
O	/VA_OK	Issues to SCB that Video Amplifier is OK
O	BEAM_CURRENT	Beam current control
O	OK_DETECT	Issues to SCB that VPB is OK

Video Processor I/O

This section provides a comprehensive description of the inputs to and outputs from the VPB. The I/O descriptions in Table 2-9 are arranged by the source/destination of the signal. The format used is such that the assembly communicated with is used as the primary heading of each group of signals. Those signals are further subdivided into inputs and outputs. Inputs refers to an input to the VPB, while output refers to an output from the VPB.

Table 2-9. Video Processor I/O signals

SYSTEM CONTROLLER BOARD	
INPUT	**DESCRIPTION**
RED_OVER	Red signal of on-screen menu and/or internal test pattern
GRN_OVER	Similar to RED_OVER
BLU_OVER	Similar to RED_OVER
OVERLAY	Overlay control signal
RED_SENS	Sensitivity correction information for red. Real time data at 0 volt to 1 volt.
GRN_SENS	Similar to RED_SENS

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BLU_SENS	Similar to RED_SENS
RED_THRES	Threshold correction information for red. Real time data at 0 Volt to 1 Volt
GRN_THRES	Similar to RED_THRES
BLU_THRES	Similar to RED_THRES
I/O	**DESCRIPTION**
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between SCB and other circuit boards. See detailed description for list of signals transferred and data direction
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over IIC bus.
IIC_INT	Interrupt output to SCB
RASTER TIMING GENERATOR	
INPUT	**DESCRIPTION**
CLAMP	Pulse signal input from the RTG board. Indicates the commanded timing and duration of the DC restore.
BLANKING	Pulse signal input from the RTG board. Indicates the commanded blanking interval during the scan.
OUTPUT	**DESCRIPTION**
H_SYNC	Horizontal sync signal to RTG board
V_SYNC	Vertical sync signal to RTG board
GRN_SYNC	Green sync signal to RTG board
GRN_INPUT	Green video signal to RTG board
VIDEO AMPLIFIER	
INPUT	**DESCRIPTION**
RED_BEAM	Voltage signal proportional to cathode current averaged over several horizontal lines in the red CRT. Voltage level is + mV/mA

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GRN_BEA	Similar to RED_BEAM
BLU_BEA	Similar to RED_BEAM
/VA_OK	Issued from the VAB to indicate VAB working properly
OUTPUT	**DESCRIPTION**
RED_VID	Red video output. 0 Volt to 1 Volt.
GRN_VID	Similar to RED_VIDEO
BLU_VIDE	Similar to RED_VIDEO
RESTOR	DC RESTORE control signal. When this signal is asserted, DC level of the video signal is clamped at the proper value on the VAB.
RED_G2	Red CRT G2 voltage adjust control signal.
GRN_G2	Similar to RED_G2
BLU_G2	Similar to RED_G2
G1_BIAS	Control the adjustment of G1 voltage for all three CRTs
EXTERNAL VIDEO	
INPUT	**DESCRIPTION**
RED_VIC	Red video input from video input card #1
GRN_VIC	Similar to RED_VIC #1
BLU_VIC	Similar to RED_VIC #1
RED_VIC	Similar to RED_VIC #1
GRN_VIC	Similar to RED_VIC #1
BLU_VIC	Similar to RED_VIC #1
RED_VIC	Similar to RED_VIC #1
GRN_VIC	Similar to RED_VIC #1
BLU_VIC	Similar to RED_VIC #1
H_VIC #1	Horizontal sync signal input from video input card #1
H_VIC #2	Similar to H_VIC #1
H_VIC #3	Similar to H_VIC #1
V_VIC #1	Vertical sync signal input from video input card #1

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V_VIC #2	Similar to V_VIC #1
V_VIC #3	Similar to V_VIC #1
/SEL_VIC	Input signal from RGB VIC board which is used to select input video source from VIC #1.
/SEL_VIC	Similar to /SEL_VIC #1
/SEL_VIC	Similar to /SEL_VIC #1

LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
+ 5.1 volts	Power supply to digital components
+ 15 Volts	Power supply to analog components
- 15 Volts	Power supply to analog components

2.3.5 Video Amplifier

The Video Amplifier Board (VAB) is located at the back side of the projector under the necks of the three CRTs. It contains three separate video amplifiers, one each for red, green, and blue. The outputs from these video amplifiers connect directly to the CRTs and provide all electrical connections to the CRTS except for the anode voltages.

The following functions are provided by VAB:

- Amplification of video signals and driving the cathode of all three CRTs
- Sensing the cathode beam current for all three CRTs
- G1 regulator for all three CRTs
- Blanking drive section
- Phosphor protection for all three CRTs
- G2 regulator and adjustment of black level (screen) for all CRTs
- DC restoration for the video signals
- CRT interface for focus, heater voltage and ARC ground

The Video Amplifier Board I/O diagram (Figure 2-11) and the list of Inputs and Outputs (Table 2-10) provide information for the technician to perform module level troubleshooting.

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G1 Regulator for three CRTs

The input supply for the G1 grid of the CRTs is G1_SUPPLY and is about -200V. The VAB regulates this supply to about -80V to -30V. This supply can be adjusted by the G1_BIAS line. This adjustment provides the brightness control function. The G1_BIAS signal is an input of the VAB and is generated by the Video Processor Board. In the event of a failure, such as lack of deflection (a high on the /SWEEP_OK line), this output goes to the most negative value of the input supply (about -200V).

G2 Regulator and black level adjustment for CRTs

The VAB also regulates the G2 grid of the CRTs. The supply for the G2 grids (about 1200V) is generated by the HVPS. This G2_SUPPLY is an input to the VAB. There are also three control inputs (RED_G2, GRN_G2, and BLU_G2). The G2 voltage of each CRT is adjusted individually by using these control lines. This adjustment provides black level control. The G2 output voltages are pulled down during shutdown mode.

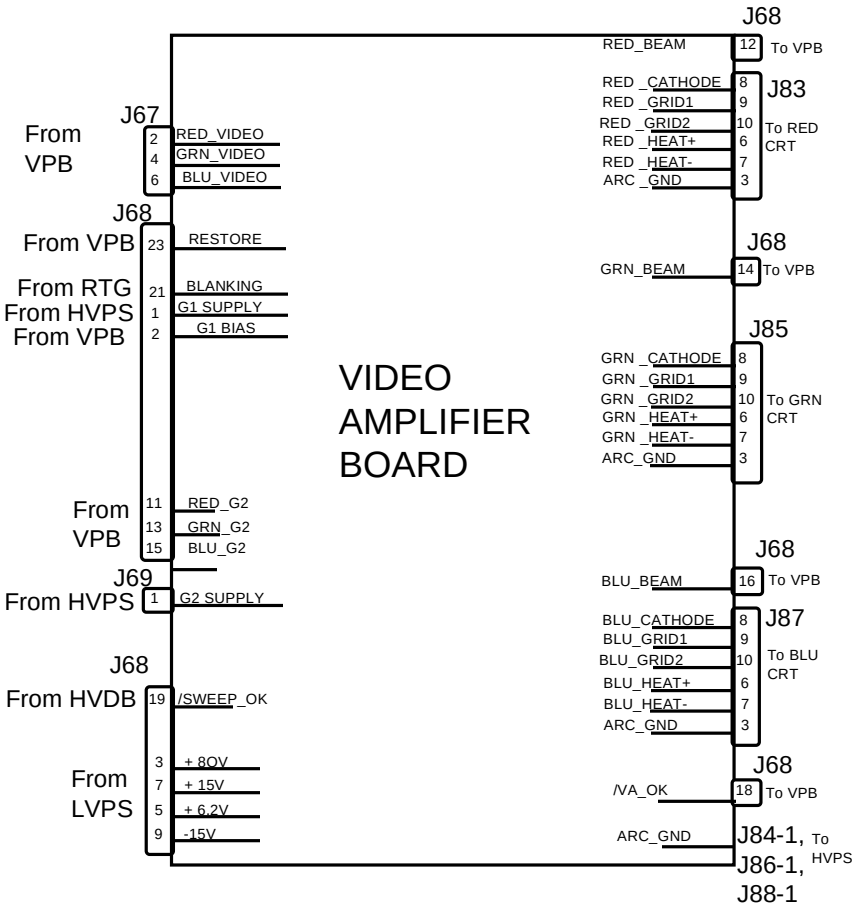


Figure 2-11. Video Amplifier PCB, Block Diagram.

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CRT interface for Focus, heater voltages and ARC ground

The three CRT sockets are part of the VAB. They provide the necessary interface for the input of the three CRTs. The Focus voltage for each color is connected directly to the socket of each CRT.

The VAB provides ARC grounds for each CRT which are used to protect against arcing of the CRT anode supply.

IIC Interface

The VAB does not use the IIC interface. All adjustments are accomplished by the control lines coming from the Video Processor Board.

The Video Amplifier Board I/O

This section provides a description of the inputs to and outputs from the VAB. The I/O descriptions are arranged by the source/destination of the signal. The assembly communicated with is used as the primary heading of each group of signals. Those signals are subdivided into inputs and outputs. Input refers to an Input to the VAB, output refers to an output from the VAB.

Table 2-10. Video Amplifier I/O signals

VIDEO PROCESSOR BOARD	
INPUTS	**DESCRIPTION**
RED_VIDEO GRN_VIDEO BLU_VIDEO	Video preamp signals. About 0.5 VPP
G1_BIAS	Brightness control line. 0 to 5 V DC
RED_G2 GRN_G2 BLU_G2	Black level (G2) control lines 0 to 3.1 V
RESTORE	Video DC restoration pulse. logic HC positive going 4% duty cycle
OUTPUTS	**DESCRIPTION**
/VA_OK	VAB status line. Low = good VAB. High = Bad VAB (This signal is called /HV_ENABLE at the HVPS).
RED_BEAM GRN_BEAM BLU_BEAM	Cathode beam current lines. about 1 volt per 100 UA

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HIGH VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
G1_SUPPLY	Supply for G1 grid of CRTs. About -200 V
G2_SUPPLY	Supply for G2 (screen) grid of CRTs. About 1200 V
RED_FOCUS GRN_FOCUS BLU_FOCUS	Focus supply for CRTs. about 7 KV
OUTPUTS	**DESCRIPTION**
ARC_GND	CRT ground (anode supply return line)
HORIZONTAL/VERTICAL DEFLECTION BOARD	
INPUTS	**DESCRIPTION**
/SWEEP_OK	Deflection detection line. open collector, low = good deflection
RASTER TIMING GENERATOR BOARD	
INPUTS	**DESCRIPTION**
BLANKING	Blanking signal. logic F type
CRTS	
OUTPUTS	**DESCRIPTION**
RED_FOCUS GRN_FOCUS BLU_FOCUS	Focus supply of CRTs. about 7 KV.
RED_GRID1 GRN_GRID1 BLU_GRID1	Grid 1 (G1) signal of CRTs.
RED_HEAT+ GRN_HEAT+ BLU_HEAT+	Positive side of the heater voltage for CRTs. About 6.2 V.

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RED_HEAT- GRN_HEAT- BLU_HEAT-	Negative side (return line) of the heater voltage for CRTs. Ground level.
RED_ CATHODE GRN_ CATHODE BLU_ CATHODE	Video output signals of the VAB. about 40 VPP with peak voltage of about 70 V.
RED_GRID2 GRN_GRID2 BLU_GRID2	G2 (screen) supply of CRTs. about 600 to 800 V
OUTPUTS	**DESCRIPTION**
ARC_GRD	Ground of CRTs (anode supply return line).
SYSTEM POWER SUPPLY	
INPUTS	**DESCRIPTION**
+6.2 V	+6.2 V supply line (heater voltage).
+15 V	+15 V supply for use by Video Amplifier Board.
-15 V	-15 V supply for use by Video Amplifier Board.
+80 V	+80 V supply for use by Video Amplifier Board.

Interlocks and protection:

None

2.3.6 System Controller PCB

The System Controller Board (SCB) is located in the electronic card cage (Figure 5-1).

The Electronics System is controlled by the SCB. The SCB uses digital and analog circuits to direct the operation of image and raster generation circuits and to control the input/output of power supply operation.

The SCB sets the operating parameters of the image, such as brightness and contrast. It also produces internal test patterns and generates on-screen display overlays. The SCB sets the timing for the raster generation to adjust phase, geometric corrections, shading corrections, and convergence. The program memory and the memory for all convergence and shading maps are located on the SCB.

The following functions are performed or controlled by the System Controller:

- Enables control for the Low Voltage Power Supply, Arc Lamp and cooling fans.

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- Fault monitors the HVPS, LVPS, Arc Lamp, and fans.
- Provides interboard communication via the IIC serial bus.
- Controls Zoom and Focus of the Projection Lens.
- IIC Interface control
- Provides Video Overlays
- X and Y convergence control
- Threshold and Sensitivity for shading
- I/O control
- Two RS-232 serial interface ports
- Infrared (IR) remote control interface. Accepts input from front or rear IR detectors.
- A 5-wire JTAG interface port for CPU emulation support.
- External 3 color system status LEDs. Green indicates normal, yellow is standby and red indicates a fault condition.
- External Service Mode switch (*see Figure 5-1*). Pressing this switch during a power-up sequence brings the system up in a diagnostic mode (for maintenance) rather than a normal operating mode.

The SCB I/O diagram (*Figure 2-12*) and the list of Inputs and Outputs (*Table 2-11*) provide information for the technician to perform module-level troubleshooting.

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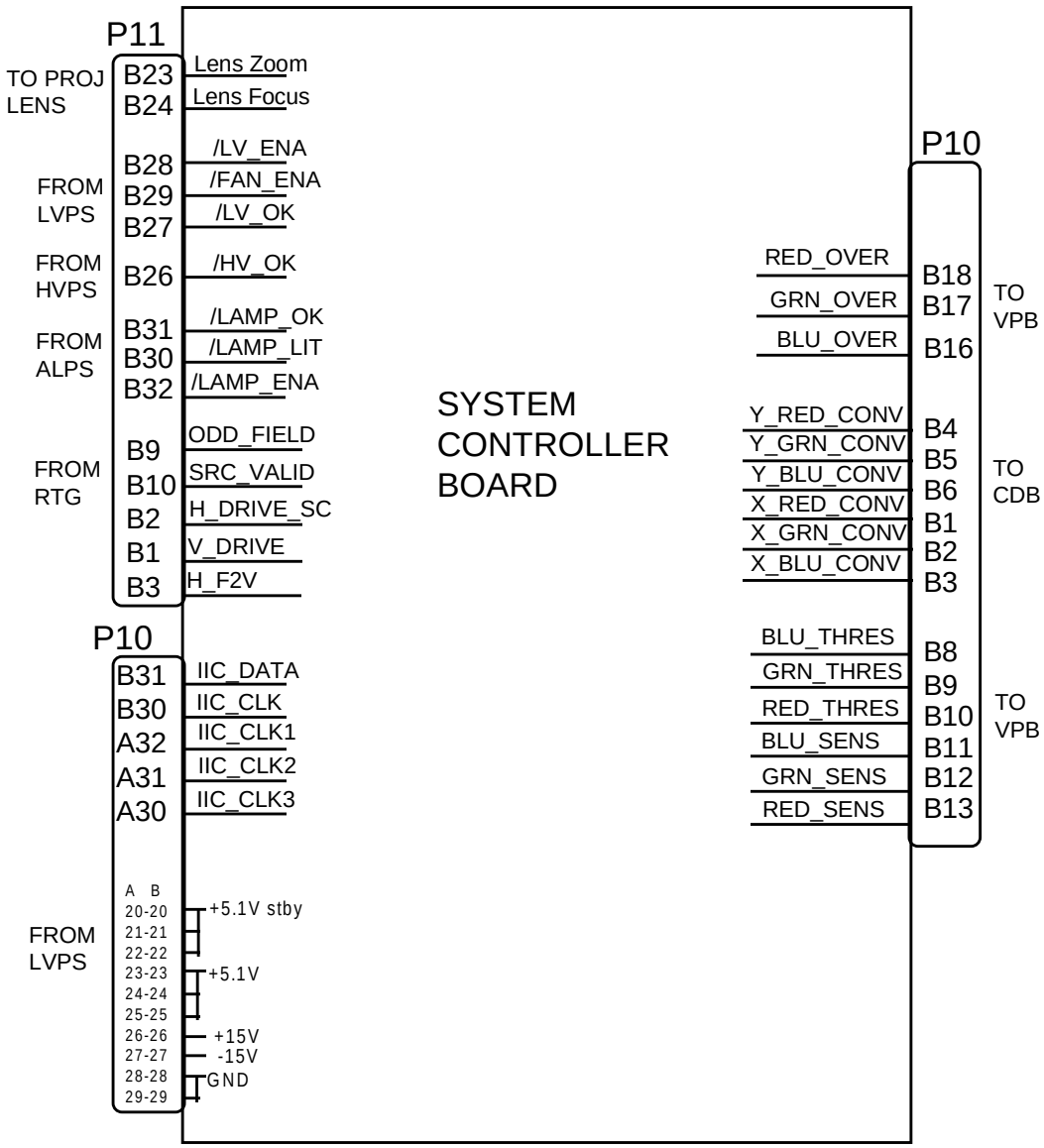


Figure 2-12. System Controller Board, Block Diagram.

IIC Interface

Communications are performed through the IIC bus to the other PCBs in the system.This three wire bus interface consists of clock line, data line and interrupt line. Data transferred over the IIC bus is listed in Table 2-9 (I/O signals).

System Controller Board Input/Output

This section provides a description of the inputs to and outputs from the SCB. The I/O descriptions are arranged by the source/destination of the signal. The format used is such that the assembly communicated with is used as the primary heading of each output. Input refers to an input to the SCB, output refers to an output from the SCB.

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Table 2-11. System Controller Board I/O signals

VIDEO PROCESSOR BOARD	
I/O	**DESCRIPTION**
IIC_CLK	IIC clock line. Clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Serial line for synchronous data transfer of the following data between Video Processor Board and SCB board. I=Input, O=Output. I BEAM CURRENT I OK DETECT O RED_CONT O GRN_CONT O BLU_CONT O BRIGHTNESS O RED_G2 O BLU_G2 O GRN_G2 O WHT_BOOST O BLK_BOOST
OUTPUTS	**DESCRIPTION**
OVERLAY	Overlay control signal
/IIC_INT	IIC interrupt line.
RED_OVER	Red signal of on-screen menu and/or internal test pattern
GRN_OVER	Similar to RED_OVER
BLU_OVER	Similar to RED_OVER
BLU_THRES	Threshold correction information for blue. Real time data at 0 volt to 1 volt.
GRN_THRES	Similar to BLU_THRES
RED_THRES	Similar to BLU_THRES

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BLU_SENS	Sensitivity correction information for BLU. Real time data at O volt to 1 volt.
GRN_SENS	Similar to BLU_SENS
RED_SENS	Similar to BLU_SENS
RASTER TIMING GENERATOR	
INPUTS	**DESCRIPTION**
SOURCE_ VALID	This signal indicates a new source (or valid). A high indicates a valid stable signal and low indicates change in input signal.
ODD_FIELD	Square wave with 50 % duty cycle which is low during the odd field of an interlace signal. This signal is high for noninterlaced signals.
280_CLK	Square wave signal, 50 % duty cycle, 280 times the frequency of horizontal sync. This clock is synchronized to the horizontal sync.
H_DRIVE	Square wave 50% duty cycle synchronized to selected horiz sync
V_DRIVE	Square wave negative going pulse synchronized to selected vertical sync with pulse width of about 4 horiz lines
H_F2V	DC voltage proportional to horiz frequency
OUTPUTS	**DESCRIPTION**
ISYNC_CLK	5 mHz clock used to generate the internal sync signals
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between System Controller and RTG.
CONVERGENCE/DEFLECTION BOARD	
OUTPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between the SCB and the Convergence/Deflection board.
X_RED_ CONV	Red X convergence waveform. The amplitude for full scale correction is about 1 VPP.
X_GRN_ CONV	Grn X convergence waveform. The amplitude for full scale correction is about 1 VPP.

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X_BLU_ CONV	Blu X convergence waveform. The amplitude for full scale correction is about 1 VPP.
Y_RED_ CONV	Red Y convergence waveform. The amplitude for full scale correction is about 1 VPP.
Y_GRN_ CONV	Grn Y convergence waveform. The amplitude for full scale correction is about 1 VPP.
Y_BLU_ CONV	Blu Y convergence waveform. The amplitude for full scale correction is about 1 VPP.
CORR_ SYNC	Square wave HCT level synchronous signal for horiz axis.
HORIZONTAL/VERTICAL DEFLECTION BOARD	
OUTPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.

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IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between the SCB and the Horizontal/Vertical Deflection board. I=Input, O=Output. O V_RED_LIN_CONTROL O V_GRN_LIN_CONTROL O V_BLU_LIN_CONTROL O V_RED_EDGE_CONTROL O V_GRN_EDGE_CONTROL O V_BLU_EDGE_CONTROL O L/R_KEY_CONTROL O L/R_PIN_CONTROL O WIDTH_CONTROL O H_RED_CENT_CONTROL O H_GRN_CENT_CONTROL O H_BLU_CENT_CONTROL O V_RED_CENT_CONTROL O V_GRN_CENT_CONTROL O V_BLU_CENT_CONTROL O FRONT/REAR O FLOOR/CEIL

HIGH VOLTAGE POWER SUPPLY

INPUT	**DESCRIPTION**
/HV_OK	The high voltage status line. Low = operational HVPS.

LOW VOLTAGE POWER SUPPLY

INPUTS	**DESCRIPTION**
+ 5.1V	Power for digital portion of SCB
+15V	Power for the analog portions of the SCB
-15V	Power for the analog portions of the SCB
+5.1V_Stby	Standby power to the CPU and peripherals.
/LV_OK	Tells SCB status of non-standby supply (all outputs working or not)

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OUTPUTS	DESCRIPTION
FAN_ENA	Signal to enable the 24V standby power
LV_ENA	Signal to enable the LVPS
ARC LAMP POWER SUPPLY	
INPUTS	**DESCRIPTION**
/LAMP_OK	Informs SCB that the Arc Lamp is installed, temperature is within limits, and lamp cooling blower is working
/LAMP_LIT	Informs the SCB that the Arc Lamp is lit or not lit
OUTPUTS	**DESCRIPTION**
/LAMP_ENA	Enables ALPS power
PROJECTION LENS	
OUTPUTS	**DESCRIPTION**
LENS_FOCUS	Signal to lens focus motor
LENS_ZOOM	Signal to lens zoom motor
FRONT IR	
INPUTS	**DESCRIPTION**
/FRONT_IR	Input from front infrared receiver
/REAR_IR	Input from rear infrared receiver

2.3.7 Raster Timing Generator PCB

The Raster Timing Generator (RTG) is located in the electronic card cage (Figure 5-1). The RTG I/O diagram (Figure 2-13) and the list of inputs and outputs (Tables 2-10 and 2-11) provide information to allow the technician to perform module level troubleshooting.

The following functions are provided by RTG board:

- Internal sync generation
- Sync detection and selection
- Serration and equalization pulse removal
- Phase locked loop
- Blanking pulse generation

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- Horizontal and vertical phase adjustments
- Interlace detection and odd field pulse generation
- Horizontal frequency band selection
- Horizontal line count and vertical count generation
- IIC interface
- Video clamp pulse generation
- Source change detection
- HVPS sync generation
- Horizontal deflection enable circuitry

The RTG I/O Diagram (Figure 2-13) and the list of inputs and outputs (Tables 2-12 and 2-13) provide information for the technician to perform module level troubleshooting.

Horizontal frequency band selection and LED logic.

The RTG produces a voltage that is proportional to the horizontal frequency which is used by the Horiz/Vert Deflection board, System Controller Board, and the phase locked loop (PLL) section of the RTG board. This DC voltage is used to create the following frequency bands:

Band A: from 15 KHZ to 24.5 kHZ.

Band B: from 24 KHZ to 29.5 kHZ

Band C: from 29 KHZ to 56 kHZ

Band D: from 55.5 KHZ to 90 kHZ.

These bands are outputted through the IIC interface to be used by the System Controller Board. These lines are also outputs of the RTG board through the Backplane Board. The Horizontal/Vertical Deflection Board uses these lines for proper selection of retrace times.

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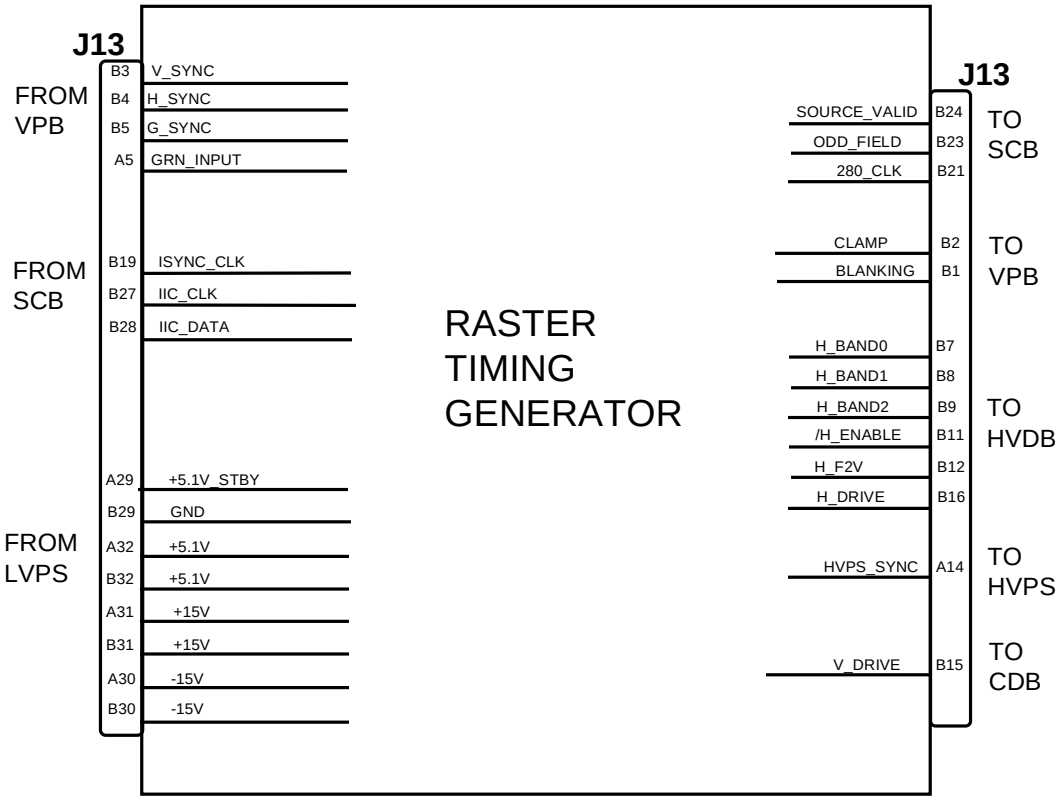


Figure 2-13. Raster Timing Generator, Input/Output Diagram.

There are 9 LEDs on the RTG board (*see Figure 5-2*) that indicate frequency bands, input modes and lock mode of the phase locked loop.

IIC Interface

The RTG board uses the IIC bus interface for serial communication with the System Controller Board. The information transferred over the IIC bus is indicated below (I = input to RTG, O = output from RTG). The RTG board does not use the interrupt line of IIC bus interface:

Table 2-12. Raster Timing Generator IIC communication

INPUT / OUTPUT	NO. OF BITS	INFORMATION	DESCRIPTION
I	1	FORCE_INTERNAL	Selects internal syncs
I	1	TRI_LEVEL	Selects the tri level mode for the video clamp signal (for HDTV)
I	1	SYNC_TIP	Selects the Sync tip option of video clamp signal
I	1	VTR_MODE	Selects VTR mode of operation

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I	9	Right blanking	Data for adjustment of right blanking
I	9	Left blanking	Data for adjustment of left blanking
I	12	Top blanking	Data for adjustment of top blanking
I	12	Bottom blanking	Data for adjustment of bottom blanking
I	8	Horz. phase	Data for adjustment of horizontal phase
I	12	Vert. phase	Data for adjustment of vertical phase
O	3	Frequency bands	The frequency band associated with the current signal
O	1	/RTG_OK	A low on this line indicates an operational RTG board
O	2	RTG_MODEL	The revision of the RTG board
O	12	H_COUNT	The number of horizontal lines associated with the current signal
O	12	V_COUNT	Data for V_COUNT
O	3	INPUT_MODE	Data indicating the selected sync signals
O	1	INTERLACE	High indicates interlace pattern

Raster Timing Generator Input/Output

This section describes the inputs to and outputs from the RTG board. The I/O descriptions are arranged by the source and destination of the signal. The assembly communicated with is used as the primary heading of each output. Input refers to an input to the RTG, output refers to an output from the RTG.

Table 2-13. Raster Timing Generator I/O signals

SYSTEM CONTROLLER BOARD	
INPUTS	**DESCRIPTION**
ISYNC_CLK	5 mHz clock used to generate the internal sync signals
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface
IIC_DATA	IIC data line. Bi directional serial line for synchronous data transfer between system control board and RTG board
OUTPUTS	**DESCRIPTION**
/IIC_INT	IIC interrupt line. This is not used by the RTG board.

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SOURCE_ VALID	This signal indicates a new source (or valid). A high indicates a valid stable signal and low indicates change in input signal
ODD_FIELD	Square wave with 50 % duty cycle which is low during the odd field of an interlace signal. This signal is high for noninterlaced signals
280_CLK	Square wave signal, 50 % duty cycle, 280 times the frequency of horizontal sync. This clock is synchronized to the horizontal sync.
VIDEO PROCESSOR BOARD	
INPUTS	**DESCRIPTION**
V_SYNC	Input vertical sync
H_SYNC	Input horizontal or composite sync
G_SYNC	Sync on green signal which is stripped for the green video
GRN_INPUT	Buffered version of green video
OUTPUTS	**DESCRIPTION**
Clamp	A negative going video clamp signal with about 3 % duty cycle
Blanking	Blanking signal composed of right, left, top and bottom blanking
HORIZONTAL/VERTICAL DEFLECTION BOARD	
INPUTS	**DESCRIPTION**
/H_ FLYBACK	Not used by the RTG board
OUTPUTS	**DESCRIPTION**
H_BAND0 H_BAND1	Horizontal frequency band lines Band A = 000, Band B = 001, Band C = 011 and band D = 111
/H_ENABLE	Low = enabled deflection and high = disabled deflection
H_F2V	A DC voltage proportional to horizontal frequency
H_DRIVE	Square wave 50 % duty cycle synchronized to the selected horizontal sync.
HIGH VOLTAGE POWER SUPPLY	
OUTPUT	**DESCRIPTION**
HVPS_ SYNC	Synchronization pulse for HVPS, synchronized with the selected horiz. sync at either same, half or one third the frequency

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CONVERGENCEDEFLECTION BOARD	
OUTPUT	**DESCRIPTION**
V_DRIVE	Square wave negative going pulse synchronized to the selected vertical sync with pulse width of about 4 horizontal periods
LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**
+5V	Power for digital portion of RTG board
+15V	Power for the phase locked loop and the supporting circuitry of RTG board
-15V	Power for the phase locked loop and the supporting circuitry of RTG board
+5.1V_STBY	Stand by + 5.1 V. Not used by RTG board.

Interlock and protection:

Input

None

Output

The RTG will disable the Horizontal Deflection Board by placing a high on the /H_ENABLE line during any of following events:

A. During and about 2 seconds after the programming period of the FPGA.

B. During frequency band change period.

C. During the period that the phase locked loop is out of lock.

2.3.8 Horizontal/Vertical Deflection PCB

The HVD board is located on the top side of the deflection cage in front of the electronic card cage.

The Horizontal/Vertical Deflection Board I/O diagram (Figure 2-14) and the list of inputs and outputs (Tables 2-14 and 2-15) provide information for the technician to perform module level troubleshooting.

The following functions are provided by the HVD board:

- Horizontal raster centering for all three colors
- Horizontal gate drive
- Switch mode power supply generating the required proportional DC supply
- Horizontal width adjustment

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- Horizontal retrace switch network
- Left/right pincushion and keystone correction
- Drive main deflection coils to provide horizontal raster scan for all three CRTs
- Drive main vertical coils to provide vertical raster scan for all three CRTs
- Vertical linearity adjustments individually for all three colors.
- Vertical raster centering for all three colors
- IIC interface

IIC Interface

All adjustments for the HVD board are performed by the System Controller via the IIC serial bus interface. This three wire bus interface consists of a clock line, a data line, and an interrupt line. The HVD board does not create any interrupt and the interrupt line is not used for this application. Table 2-14 lists the adjustments executed via the IIC bus interface (I = Input to HVD board , O = Output from HVD board):

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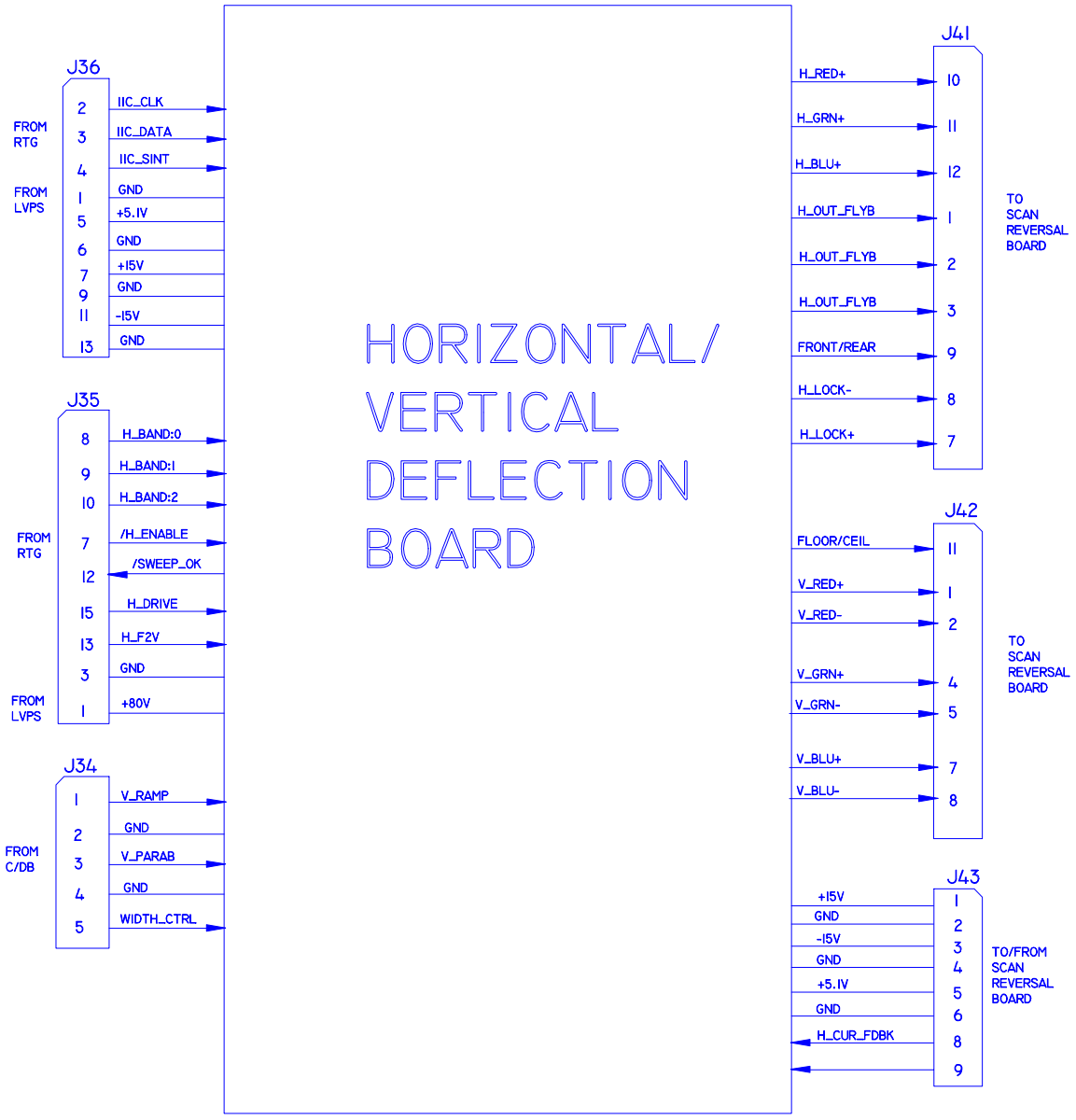


Figure 2-14. Horizontal/Vertical Deflection PCB I/O Diagram.

Table 2-14. Horizontal/Vertical Deflection IIC Data Interface

INPUT / OUTPUT	NO. OF BITS	INFORMATION	DESCRIPTION
I	8	V_RED_LIN_CONTROL	Data for adjustment of red vertical linearity
I	8	V_GRN_LIN_CONTROL	Data for adjustment of green vertical linearity

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I	8	V_BLU_LIN_CONTROL	Data for adjustment of blue vertical linearity
I	8	V_RED_EDGE_CONTROL	Data for adjustment of red vertical edge linearity
I	8	V_GRN_EDGE_CONTROL	Data for adjustment of green vertical edge linearity
I	8	V_BLU_EDGE_CONTROL	Data for adjustment of blue vertical edge linearity
I	8	L/R_KEY_CONTROL	Data for adjustment of left / right keystone correction
I	8	L/R_PIN_CONTROL	Data for adjustment of left / right pincushion correction
I	8	WIDTH_CONTROL	Data for adjustment of screen width
I	8	H_RED_CENT_CONTROL	Data for adjustment of red horizontal centering
I	8	H_GRN_CENT_CONTROL	Data for adjustment of green horizontal centering
I	8	H_BLU_CENT_CONTROL	Data for adjustment of blue horizontal centering
I	8	V_RED_CENT_CONTROL	The data for adjustment of red vertical centering
I	8	V_GRN_CENT_CONTROL	The data for adjustment of green vertical centering
I	8	V_BLU_CENT_CONTROL	The data for adjustment of blue centering
O	1	FRONT/REAR	Front or rear projection status line front = low and rear = high
O	1	FLOOR/CEIL	Floor or ceiling projection status line floor = low and ceiling = high
O	1	/DEFL_OK	Deflection status. Low = operational HVD board, High = Nonoperational HVD board.
O	2	HVD_MODEL	Revision of HVD board

Horizontal/Vertical Deflection Board I/O

This section provides a description of the inputs to and outputs from the HVD Board. The I/O descriptions are arranged by the source/destination of the signal. The assembly communicated with is used as the primary heading of each group of signals. Those signals are subdivided into inputs and outputs. Input refers to an Input to the HVD Board, output refers to an output from the HVD Board.

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Table 2-15. Horizontal/Vertical Deflection I/O signals

SYSTEM CONTROLLER BOARD	
INPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.
IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between the System Controller Board and the HVD Board.
OUTPUTS	**DESCRIPTION**
/IIC_SINT	IIC interrupt line. This is not used by HVD Board.
VIDEO PROCESSOR BOARD	
OUTPUTS	**DESCRIPTION**
/SWEEPOK	Low = good scan. High = no scan. Signal is dependent on two inputs; DEFL_OK (from SRB) and /H_ENABLE (from RTG).
SCAN REVERSAL BOARD	
INPUTS	**DESCRIPTION**
FRONT/REAR	Front or rear projection status line. Front = low. Rear = high.
FLOOR/CEIL	Floor or ceiling projection status line. Floor = low. Ceiling = high.
DEFL_OK	Deflection OK signal. High = good (about 2 v). Low = no scan.
H_CUR_ FDBK	Horizontal current feed back. A DC voltage proportional to the output current.
H_LOCK-	Horizontal interlock for yoke connectors. It should be 5 V when closed or 0V when open.
V_RED-	Current feedback of red vertical amplifier
V_GRN-	Current feedback of green vertical amplifier
V_BLU-	Current feedback of blue vertical amplifier

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OUTPUTS	DESCRIPTION
H_OUT_ FLYBACK	Horizontal output flyback pulse, about 800 VPP
H_LOCK+	Horizontal interlock for yoke connectors. This should be about 5 V when closed or 15 V when open.
H_RED+	Output of horiz. red centering (also top of the red horiz. yoke). About + 5 VDC.
H_GRN+	Output of horz. green centering (top of green horz. yoke). About + 5 VDC
H_BLU+	Output of horiz. blue centering (top of blue horiz. yoke). About + 5 VDC.
V_RED+	Output of red vertical amplifier. About 40 VPP.
V_GRN+	Output of green vertical amplifier. About 40 VPP.
V_BLU+	Output of blue vertical amplifier. About 40 VPP.
+15 V	+15 V supply for use by Scan Reversal Board
-15 V	-15 V supply for use by Scan Reversal Board
+5 V	+5 V supply for use by Scan Reversal Board
CONVERGENCE/DEFLECTION BOARD	
INPUTS	**DESCRIPTION**
V_RAMP	Vertical ramp waveform. About 4 VPP.
V_PARAB	Vertical parabola waveform. About 4 VPP.
OUTPUTS	**DESCRIPTION**
WIDTH_CTRL	A DC waveform for controlling width of picture. About 4 V max.
RASTER TIMING GENERATOR (RTG BOARD)	
INPUTS	**DESCRIPTION**
/H_ENABLE	A low on this line enables horizontal deflection. A high disables the horizontal amplifier.
H_BAND:0 H_BAND:1	Horizontal frequency band line. 000 = band A, 001 = band B, 011 = band C and 111 = band D.

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HF_2V	Horizontal frequency to voltage converter. a DC signal proportional to horiz. frequency. About 4.2 V at 90 kHz.
H_DRIVE	Horiz. drive pulse, 50 % duty cycle HCT level signal

SYSTEM POWER SUPPLY	
INPUTS	**DESCRIPTION**
+5 V	+ 5 V supply for use by HVD and Scan Reversal Boards
+15 V	+ 15 V supply for use by HVD and Scan Reversal Boards
-15 V	- 15 V supply for use by HVD and Scan Reversal Board
+80 V	+ 80 V supply for use by the switching supply of horizontal deflection amplifier

Interlocks and protection:

Input

None

Outputs

H_LOCK + and H_LOCK-: Used to shut down the switching power supply of the horizontal deflection amplifier in the event of a loose yoke or loose scan reverse connector. This prevents the power supply section of the Horizontal/Vertical Deflection Board from operating when 1 or more yoke connectors are disconnected.

/SWEEP_OK: Shuts down the video amplifiers in the event of deflection failure (if DEFL_OK or /H_ENABLE are not present).

2.3.9 Convergence/Deflection PCB

The Convergence/Deflection Board is located on the bottom side of the card cage under the Horizontal/Vertical Deflection Board. This board drives the convergence coils of the projectors.

The following functions are provided by C/D Board:

- Generation of various waveforms for the horizontal and vertical axes
- Height control
- Generation of waveforms for dynamic focus
- Various geometry correction functions for the horizontal and vertical axes
- Convergence output amplifiers for all colors and both horizontal and vertical axes
- Convergence enable and raster fill function

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- **ILA®** assembly driver circuitry with temperature compensation
- Phase locked loop for **ILA®** assembly drivers
- IIC serial bus interface

The Convergence/Deflection Input/Output diagram (Figure 2-15) and the list of inputs and outputs (Tables 2-16 and 2-17) provide information for the technician to perform module level troubleshooting.

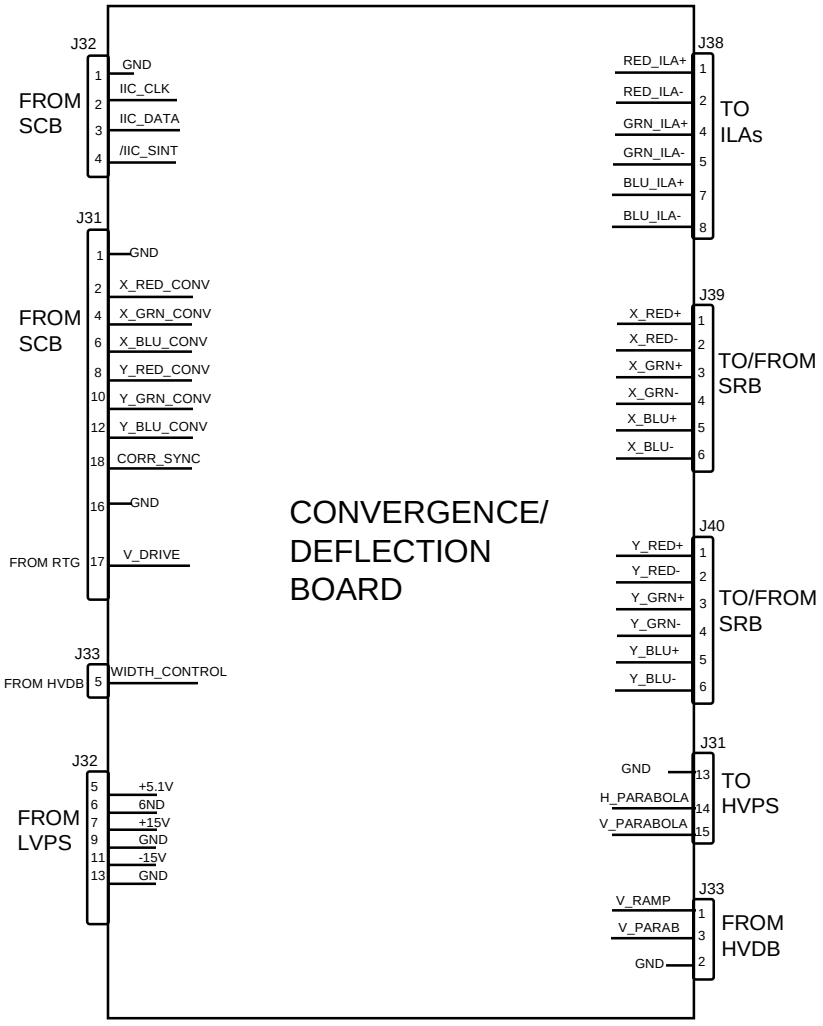


Figure 2-15. Convergence/Deflection Board I/O diagram.

IIC interface

Adjustments for this board are performed by the System Controller via the IIC serial bus interface. This three wire bus interface consists of a clock line, a data line and an interrupt line. The C/D Board does not create any IIC interrupt. The following table lists all adjustments performed via the IIC bus interface (I = Input to C/D Board, O = Output from C/D Board):

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Table 2-16. Convergence/Deflection IIC communication

INPUT/ OUTPUT	NO. OF BITS	INFORMATION	DESCRIPTION
I	1	ILA_FREQ_N1	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N2	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N3	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N4	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N5	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N6	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N7	Data for selection of frequency of ILA bias circuit
I	1	ILA_FREQ_N8	Data for selection of frequency of ILA bias circuit
I	8	ILA_RED_BIAS	Data for adjustment of red ILA bias
I	8	ILA_GRN_BIAS	Data for adjustment of green ILA bias
I	8	ILA_BLU_BIAS	Data for adjustment of blue ILA bias
I	1	ILA_FREQ_M1	Data for selection of frequency of ILA bias circuit (pre-scale counter)
I	1	ILA_FREQ_M2	Data for selection of frequency of ILA bias circuit (pre-scale counter)
I	8	LR_RED_SKEW	Data for adjustment of red left/right skew
I	8	LR_GRN_SKEW	Data for adjustment of green left/right skew
I	8	LR_BLU_SKEW	Data for adjustment of blue left/right skew
I	8	LR_BOW	Data for adjustment of left/right bow
I	8	HEIGHT	Data for adjustment of height for all colors
I	8	LR_KEY_BAL	Data for adjustment of left/right keystone balance
I	8	LR_PIN_BAL	Data for adjustment of left/right pincushion balance
I	8	H_RED_LIN	Data for red horizontal overall linearity correction
I	8	H_GRN_LIN	Data for green horizontal overall linearity correction
I	8	H_BLU_LIN	Data for blue horizontal overall linearity correction

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I	8	H_RED_ EDGE_LIN	Data for red horizontal edge linearity correction
I	8	H_GRN _EDGE_LIN	Data for green horizontal edge linearity correction
I	8	H_BLU _EDGE_LIN	Data for blue horizontal edge linearity correction
I	8	TP_RED_SKEW	Data for adjustment of red top/bottom skew
I	8	TP_GRN_SKEW	Data for adjustment of green top/bottom skew
I	8	TP_BLU_SKEW	Data for adjustment of blue top/bottom skew
I	8	TP_BOW	Data for adjustment of top/bottom bow
I	8	TP_PIN	Data for adjustment of top/bottom pincushion
I	8	TP_PIN_BAL	Data for adjustment of top/bottom pincushion balance
I	8	TP_KEY	Data for adjustment of top/bottom keystone
I	8	TP_KEY_BAL	Data for adjustment of top/bottom keystone balance
I	1	/RASTER_FIL	Control line for the raster fill option, low = raster fill is active
I	1	/CONV_ENABLE	Convergence enable line low = enabled convergence
O	1	ILA_LOCKED	Status line for the lock indication of the PLL of the ILA section with high = locked PLL
O	1	/CD_OK	Convergence board status line. Low = operational C/D Board, High = Nonoperational C/D Board.
O	2	CD_MODEL	Revision of C/D Board

The Convergence/Deflection Board I/O

This section describes the inputs to and outputs from the C/D Board. The I/O descriptions are arranged by the source and destination of the signal. The assembly communicated with is the primary heading of each group of signals. Those signals are subdivided into inputs and outputs. Input refers to an Input to the C/D Board, output refers to an output from the C/D Board.

Table 2-17. Convergence Deflection I/O signals

SYSTEM CONTROLLER BOARD	
INPUTS	**DESCRIPTION**
IIC_CLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over the IIC bus interface.

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IIC_DATA	IIC data line. Bidirectional serial line for synchronous data transfer between the System Controller Board and the C/D Board.
X_RED_ CONV	Red X convergence waveform. The amplitude for full scale correction is about 1 VPP.
X_GRN_ CONV	Green X convergence waveform. The amplitude for full scale correction is about 1 VPP.
X_BLU_ CONV	Blue X convergence waveform. The amplitude for full scale correction is about 1 VPP.
Y_RED_ CONV	Red Y convergence waveform. The amplitude for full scale correction is about 1 VPP.
Y_GRN_ CONV	Green Y convergence waveform. The amplitude for full scale correction is about 1 VPP.
Y_BLU_ CONV	Blue Y convergence waveform. The amplitude for full scale correction is about 1 VPP.
CORR_ SYNC	Square wave HCT level synchronization signal for horizontal axis
OUTPUTS	**DESCRIPTION**
/IIC_SINT	IIC interrupt line. Convergence board does not initiate any IIC interrupt.
ILAS	
OUTPUTS	**DESCRIPTION**
RED_ILA+	The positive output of red ILA driver circuitry, about ± 12 VPP
RED_ILA-	The negative output of red ILA driver circuitry, about ± 12 VPP
GRN_ILA+	The positive output of green ILA driver circuitry, about ± 12 VPP
GRN_ILA-	The negative output of green ILA driver circuitry, about ± 12 VPP
BLU_ILA+	The positive output of blue ILA driver circuitry, about ± 12 VPP
BLU_ILA-	The negative output of blue ILA driver circuitry, about ± 12 VPP
ILA_THERM+	The positive side of the ILA temperature sense line
ILA_THERM-	The negative side of the ILA temperature sense line
SCAN REVERSAL BOARD	
INPUTS	**DESCRIPTION**
X_RED-	Current feedback of red horizontal (X) convergence amplifier
X_GRN-	Current feedback of green horizontal (X) convergence amplifier

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X_BLU-	Current feedback of blue horizontal (X) convergence amplifier
Y_RED-	Current feedback of red vertical (Y) convergence amplifier
Y_GRN-	Current feedback of green vertical (Y) convergence amplifier
Y_BLU-	Current feedback of blue vertical (Y) convergence amplifier
OUTPUTS	**DESCRIPTION**
X_RED+	Output of red horizontal (X) convergence amplifier
X_GRN+	Output of green horizontal (X) convergence amplifier
X_BLU+	Output of blue horizontal (X) convergence amplifier
Y_RED+	Output of red vertical (Y) convergence amplifier
Y_GRN+	Output of green vertical (Y) convergence amplifier
Y_BLU+	Output of blue vertical (Y) convergence amplifier
HORIZONTAL/VERTICAL DEFLECTION BOARD	
INPUTS	**DESCRIPTION**
WIDTH_ CONTROL	A DC wave form for controlling width of picture. About 4 V max.
OUTPUTS	**DESCRIPTION**
V_PARAB	Vertical parabola wave form. About 4 VPP.
V_RAMP	Vertical ramp wave form. About 4 VPP.
RASTER TIMING GENERATOR BOARD	
INPUTS	**DESCRIPTION**
V_DRIVE	Square wave HCT level synchronized to vertical sync with 4H duty cycle.
HIGH VOLTAGE POWER SUPPLY	
OUTPUTS	**DESCRIPTION**
H_ PARABOLA	Horizontal parabola for dynamic focus section of High Voltage Power Supply
V_ PARABOLA	Vertical parabola for dynamic focus section of High v\Voltage Power Supply
LOW VOLTAGE POWER SUPPLY	
INPUTS	**DESCRIPTION**

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+5.1 V	+ 5 V supply for use by convergence board.
+15 V	+ 15 V supply for use by convergence board.
-15 V	- 15 V supply for use by convergence board.

Interlocks and protection

None

2.3.10 Scan Reversal Board

The Scan Reversal Board (SRB) is mounted vertically on the right side of the card cage.

The following functions are provided by the SRB:

- Reversal of scan in both horizontal and vertical axes
- Horizontal width adjustment for each color (R, G &B)
- Horizontal current feedback
- Scan failure detection for all six main (horizontal and vertical) deflection amplifiers

The Scan Reversal Board Input/Output diagram (Figure 2-16) and the list of inputs and outputs (Table 2-19) provide information for the technician to perform module level troubleshooting. Table 2-18 shows the signal states for modes of projector operation.

The SRB does not require any IIC bus interface.

Table 2-18. Scanning signal states

MODE OF OPERATION	FRONT/REAR LINE	FLOOR/CEIL LINE
Front and floor projection	Low	Low
Front and ceiling projection	Low	High
Rear and floor projection	High	Low
Rear and ceiling	High	High

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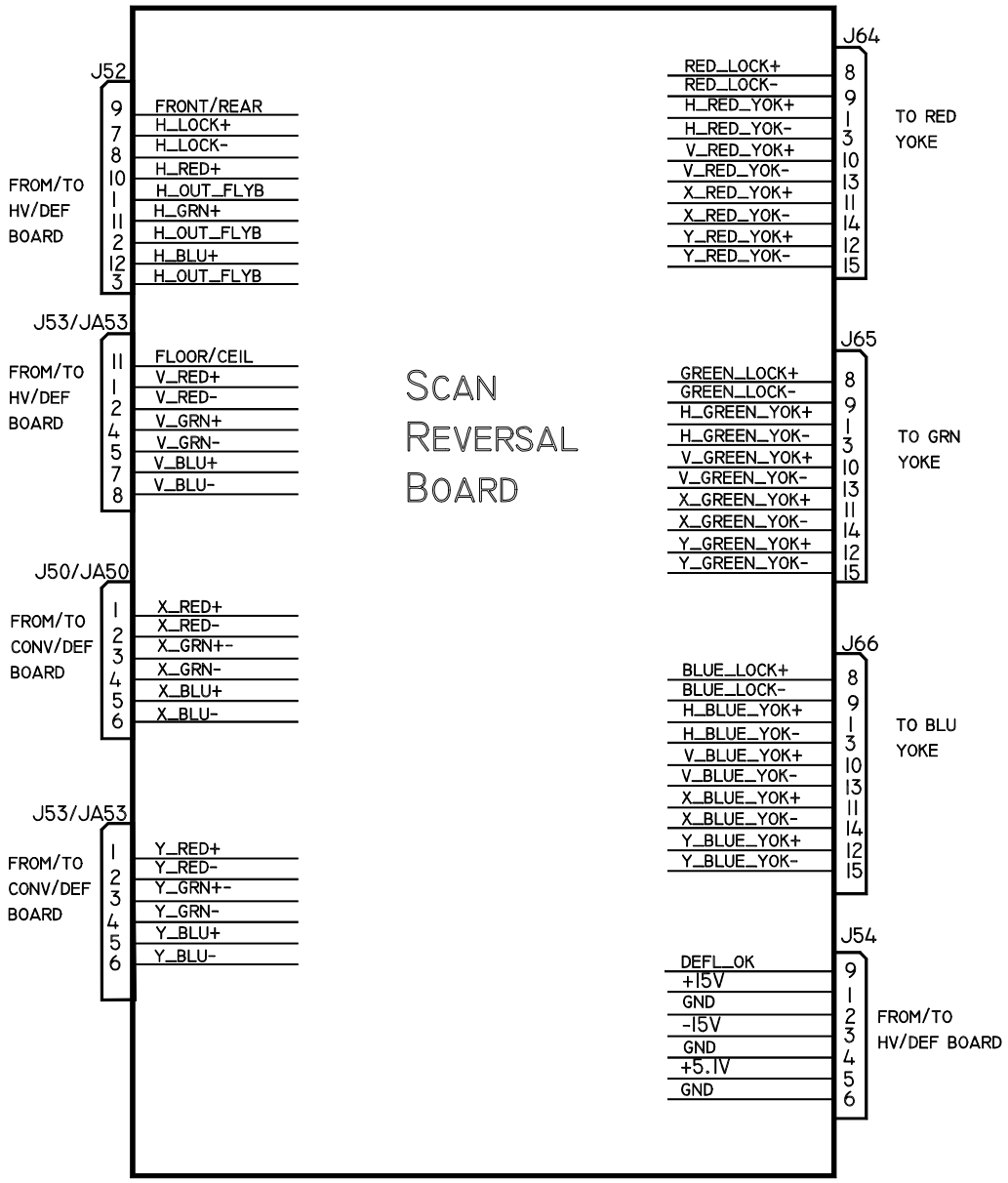


Figure 2-16. Scan Reversal Board, Input/Output Diagram.

Scan Reversal Board I /O

This section describes the inputs to and outputs from the SRB. The I/O descriptions are arranged by the source/destination of the signal. The assembly communicated with is the primary heading of each group of signals. Those signals are subdivided into inputs and outputs. Input refers to an Input to the Scan Reversal Board. Output refers to an output from the Scan Reversal Board.

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Table 2-19. Scan Reversal Board I/O signals

HORIZONTAL / VERTICAL DEFLECTION BOARD	
INPUTS	**DESCRIPTION**
H_OUT_ FLYBACK	Horizontal output flyback pulse, about 800 VPP
H_LOCK+	Horizontal interlock for yoke connectors. This should be about 5 V when closed or 15 V when open.
H_RED+	Output of horizontal red centering (also top of the red horiz yoke). About ± 5 Vdc.
H_GRN+	Output of horizontal green centering (also top of the green horiz yoke). About ± 5 Vdc.
H_BLU+	Output of horiz. blue centering (also top of the blue horiz yoke). About ± 5 Vdc.
V_RED+	Output of red vertical amplifier. about 40 VPP
V_GRN+	Output of green vertical amplifier. about 40 VPP
V_BLU+	Output of blue vertical amplifier. about 40 VPP
+15 V	+15 volt supply for use by SRB
+5 V	+5 volt supply for use by SRB
-15 V	-15 V supply for use by SRB
OUTPUTS	**DESCRIPTION**
H_LOCK-	Horizontal interlock for yoke connectors. It should be 5 V when closed or 0 V when open.
V_RED- V_RED_SENS	Current feedback of red vertical amplifier
V_GRN- V_GRN_SENS	Current feedback of green vertical amplifier
V_BLU- V_BLU_SENS	Current feedback of blue vertical amplifier
FRONT/REAR	Front or rear projection status line. Front = low and rear = high
FLOOR/CEIL	Floor or ceiling status line. Floor = low and ceiling = high
H_CUR_FDBK	Horizontal current feed back, a DC signal proportional to horz. output current
DEFL_OK	Deflection status line high (about 2 V) = good low = no scan

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CONVERGENCE/DEFLECTION BOARD	
INPUTS	**DESCRIPTION**
X_RED+	Output of horizontal red convergence amplifier
X_GRN+	Output of horizontal green convergence amplifier
X_BLU+	Output of horizontal blue convergence amplifier
Y_RED+	Output of vertical red convergence amplifier
Y_GRN+	Output of vertical green convergence amplifier
Y_BLU+	Output of vertical blue convergence amplifier
OUTPUTS	**DESCRIPTION**
X_RED-	Current feedback of horizontal red convergence amplifier
X_GRN-	Current feedback of horizontal green convergence amplifier
X_BLU-	Current feedback of horizontal blue convergence amplifier
Y_RED-	Current feedback of vertical red convergence amplifier
Y_GRN-	Current feedback of vertical green convergence amplifier
Y_BLU-	Current feedback of vertical blue convergence amplifier

RED YOKE CONNECTOR	
NAME	**DESCRIPTION**
H_RED_YOK+	Top of red horizontal yoke
H_RED_YOK-	Bottom of red horizontal yoke
RED_LOCK+	Interlock for red yoke. 5 V when closed or 15 V when open.
RED_LOCK-	Interlock for red yoke. 5 V when closed or 0 V when open.
V_RED_YOK+	Top of red vertical yoke
V_RED_YOK-	Bottom of red vertical yoke
X_RED_YOK+	Top of red horizontal convergence yoke
X_RED_YOK-	Bottom of red horizontal convergence yoke
Y_RED_YOK+	Top of red vertical convergence yoke
Y_RED_YOK-	Bottom of red vertical convergence yoke

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GREEN YOKE CONNECTOR	
NAME	**DESCRIPTION**
H_GRN_YOK+	Top of green horizontal yoke
H_GRN_YOK-	Bottom of green horizontal yoke
GRN_LOCK+	Interlock for green yoke. 5 V when closed or 15 V when open.
GRN_LOCK-	Interlock for green yoke . 5 V when closed or 0 V when open.
V_GRN_YOK+	Top of green vertical yoke
V_GRN_YOK-	Bottom of green vertical yoke
X_GRN_YOK+	Top of green horizontal convergence yoke
X_GRN_YOK-	Bottom of green horizontal convergence yoke
Y_GRN_YOK+	Top of green vertical convergence yoke
Y_GRN_YOK-	Bottom of green vertical convergence yoke-
BLUE YOKE CONNECTOR	
NAME	**DESCRIPTION**
H_BLU_YOK+	Top of blue horizontal yoke
H_BLU_YOK-	Bottom of blue horizontal yoke
BLU_LOCK+	Interlock for blue yoke. 5 V when closed or 15 V when open.
BLU_LOCK-	Interlock for blue yoke . 5 V when closed or 0 V when open.
V_BLU_YOK+	Top of blue vertical yoke
V_BLU_YOK-	Bottom of blue vertical yoke
X_BLU_YOK+	Top of blue horizontal convergence yoke
X_BLU_YOK-	Bottom of blue horizontal convergence yoke
Y_BLU_YOK+	Top of blue vertical convergence yoke
Y_BLU_YOK-	Bottom of blue vertical convergence yoke-

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2.3.11 Backplane PCB

The Backplane PCB is the interface that connects the Power Supplies, VICs, PCBs, and other components together, either through a direct connection to a connector on the Backplane or through cables to connectors on the Backplane PCB. Signals are not modified in any way by the Backplane. It serves only as an interconnecting point. Refer to Figure 2-17 for a general idea of how the projector wiring is interconnected through the Backplane PCB.

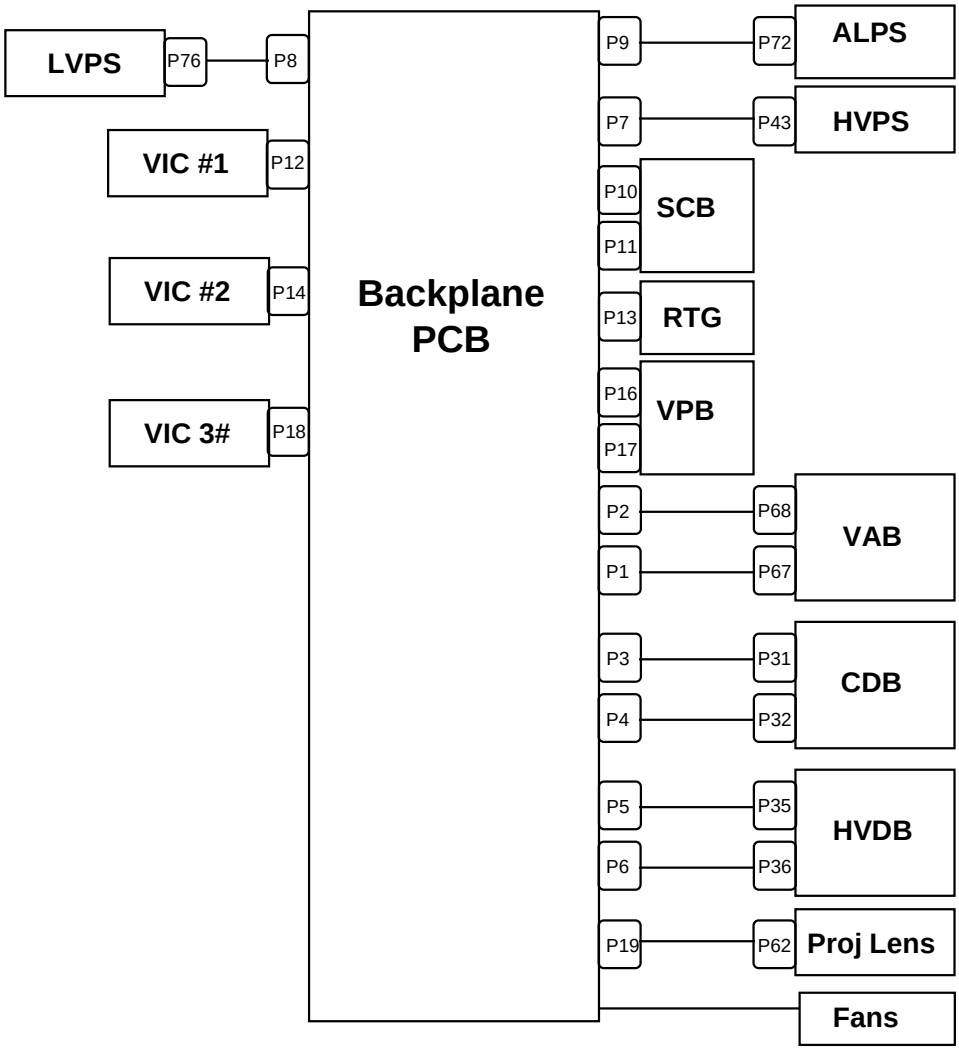


Figure 2-17. Backplane Board Interface Block Diagram.

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3.0 Service Adjustments

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This chapter details adjustment procedures required to maintain the Model 230. Refer to Figures 3-1 and 3-2 to locate assemblies and components. A tool list, required to perform adjustments, is in Chapter 1.

CAUTION! Before performing procedures in this chapter, review the chapter on Safety at the beginning of this manual.



WARNING!!! When performing procedures in this chapter that require projector covers to be off, wear high voltage gloves (ANSI/ASTM 10,000 volt rated) when working near the CRTs, Arc Lamp, or power supplies. Wear safety goggles (rated X5) when working **anywhere** near the light path from the arc lamp or the projection lens.

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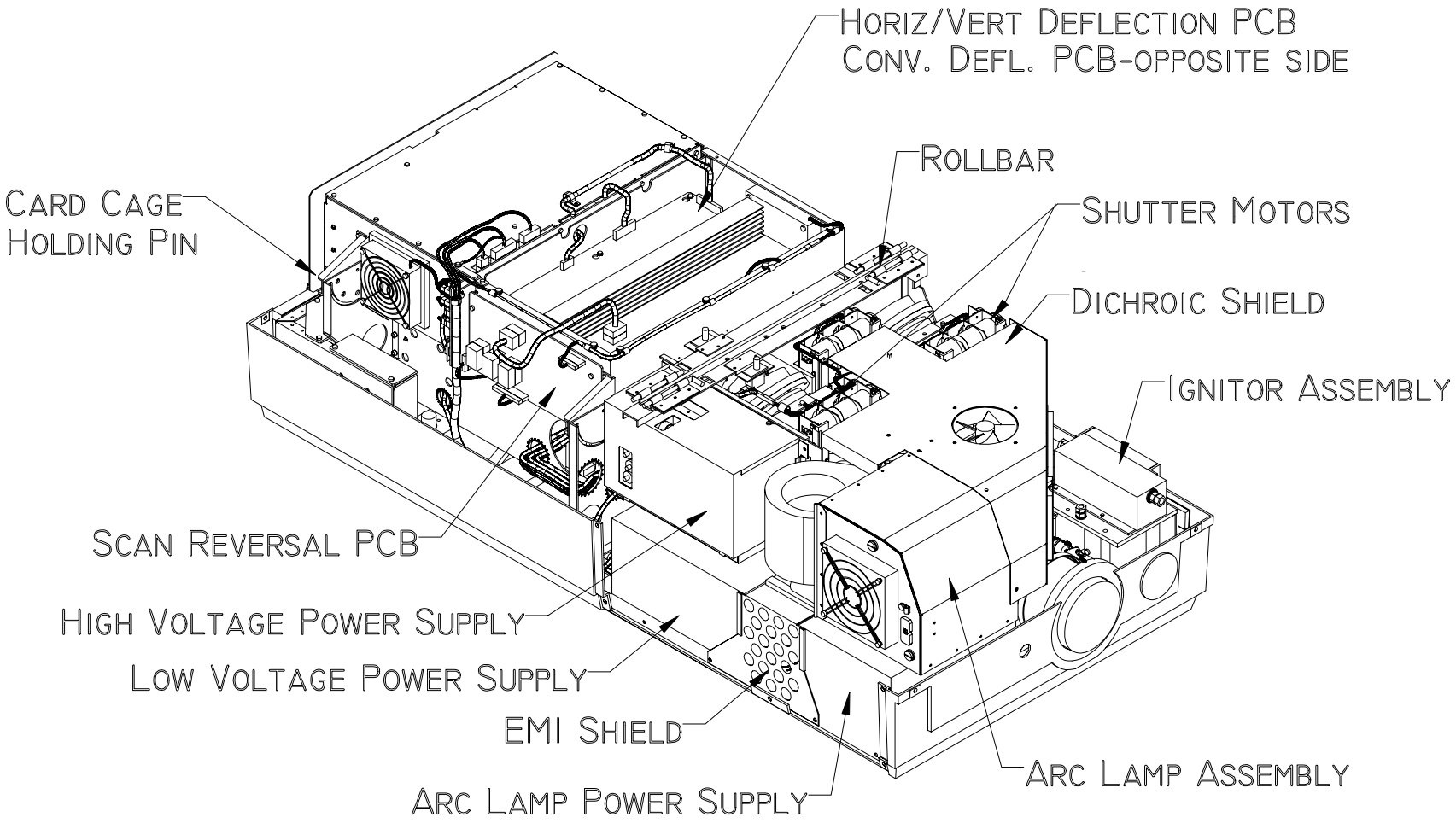


Figure 3-1. Major components of the Model 230 Projector.

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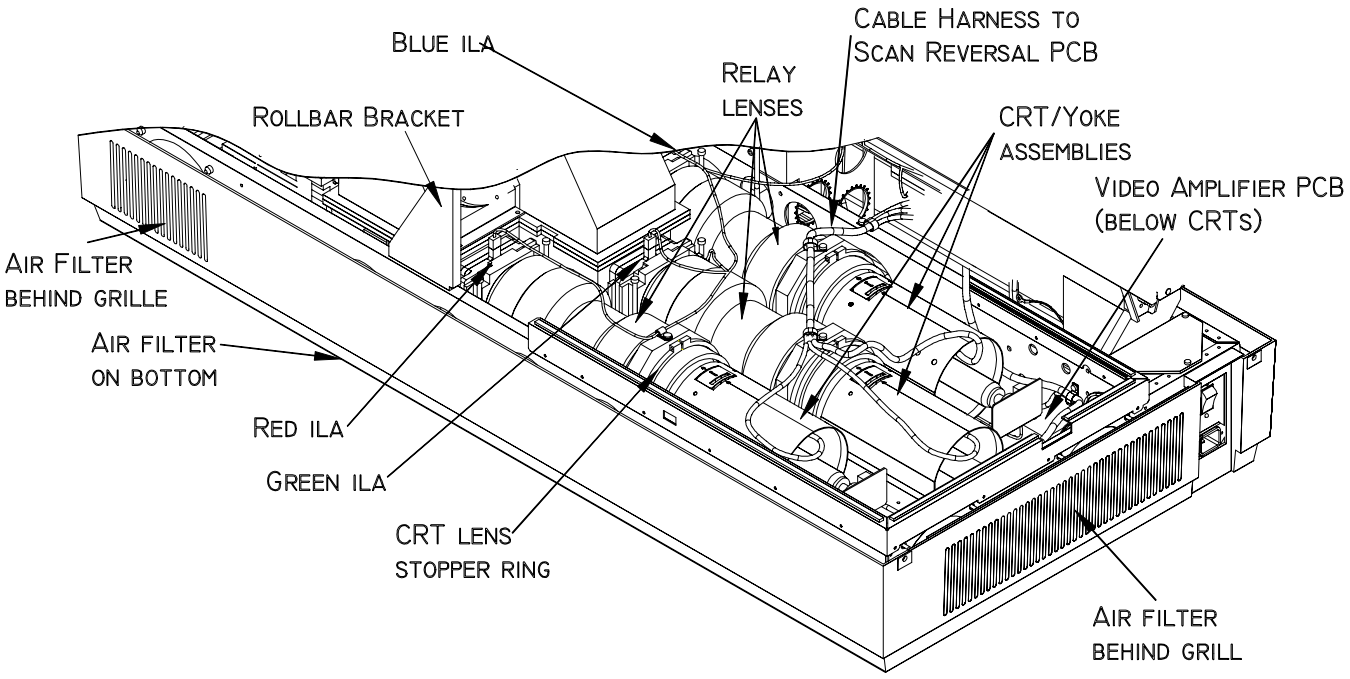


Figure 3-2. View of CRTs, Relay lenses and **ILA®** Assemblies.

3.1 Arc Lamp Adjustment

An Arc Lamp adjustment must be performed whenever an Arc Lamp is replaced and *may* be needed if the projector is heavily jarred during shipment. The Arc Lamp Adjustment consists of 3 separate adjustment procedures; Arc Lamp Current adjustment, Arc Lamp Alignment, and Condensing Lens X/Y positioning adjustment. The Condensing Lens adjustment is not normally needed, even when replacing an Arc Lamp. In rare instances, when the hot spot cannot be centered by the Arc Lamp alignment procedure, it may be necessary to perform the Condensing Lens adjustment. Do not perform the Condensing Lens adjustment unless absolutely necessary.

3.1.1 Arc Lamp Current Adjustment

1. Remove the front cover and the lower-right side panel.
2. Apply power to the projector and allow it to operate for a minimum of 15 minutes.
3. Use a DVM and measure the voltage across the Arc Lamp Ignitor ± terminals (see Figure 3-3).

   Caution: Always wear 10 kV rated rubber electrical gloves when performing the preceding operation. Also, **Do Not** place DVM leads across Igniter Terminals **±** during projector power up because there is a 32 kV pulse that lights the Arc Lamp that is present across these leads during power up.

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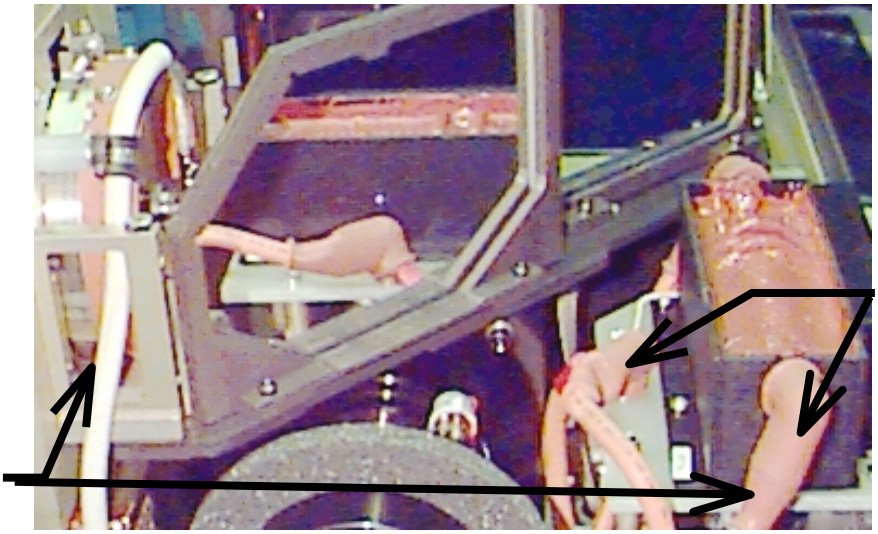


Figure 3-3. Arc Lamp current and voltage measurements.

4. Use a clamp-on type ammeter such as AMPROBE Model AC/DC 1000, or equivalent, and measure the Arc Lamp current around the Ignitor cable. Place the clamp-on current meter around either end of the white cable that goes from the Ignitor to the Arc Lamp and measure the current going to the lamp (Figure 3-3). If the current exceeds 70 amps, lower the current to 70 amps by adjusting the trimmer pot that is accessible through the small aperture in the Arc Lamp Power Supply cover (see Figure 3-4). **CAUTION!** The current should not exceed 75 amps or damage to the equipment could result.

   NOTE: If a clamp-on meter is not available, an alternate method of measuring Arc Lamp current may be used as follows:
   A. Using a DVM with the range set to a minimum of 100 millivolts, measure the Arc Lamp current by measuring the voltage across the two terminals, next to the trimmer pot from Step 5 above (Figure 3-4). This test point reads millivolts across a shunt that has been selected so that a 1 millivolt reading on the DVM is equal to 1 amp of Arc Lamp current.

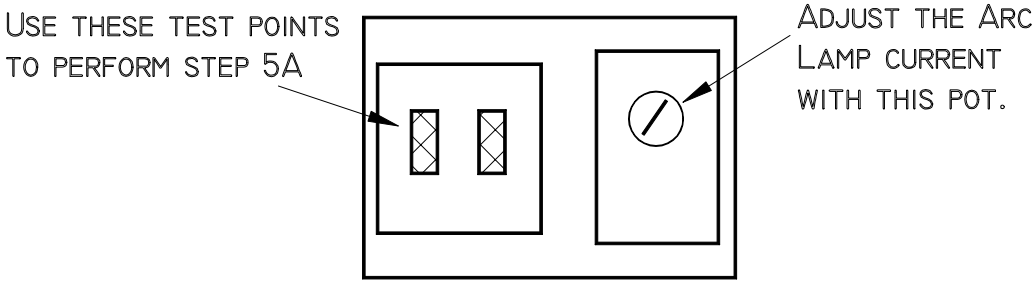


Figure 3-4. Zoom view of aperture on Arc Lamp Power Supply cover

   B. Multiply the voltage reading from Step 4 by the current measured in Step 5A (bear in mind that the millivolt reading from Step 5A should be interpreted as amps, i.e. 1 millivolt=1 amp.
   C. This result should be 1600 ±30 watts. If the result is not 1600 ±30watts,

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adjust the trimmer pot (Figure 3-4) until the result is 1600 ±30 watts. If increasing, observe that the voltage from Step 4 may decrease slightly. **CAUTION!** Make adjustments in small increments and do not adjust beyond 1630 watts or damage to the equipment may result.

5. Wait approximately 10 minutes, then recheck the current and voltage and make final adjustments, if necessary. Leave the front cover and lower-right side panel off to perform the Arc Lamp Alignment procedure.

3.1.2 Arc Lamp Alignment

1. Verify that the "Shutters on Hide" box is checked in the System-Preferences menu, then use the RGB key and the HIDE key to hide Red and Blue. This prevents light coming from the Red and Blue **ILA®**s.
2. Open the fan door of the Arc Lamp Enclosure housing to gain access to the three Arc Lamp alignment screws. The Arc Lamp fan disconnects when this door is opened. **CAUTION!** This fan disconnection is acceptable for short periods of time only (preferably <20 minutes--maximum 45 minutes).
3. Access the "Shutters on Hide" box again from the System-Preferences menu and uncheck the box, then use the RGB and HIDE keys to hide Green. This mutes video from the Green CRT but leaves the Green shutter open to allow Arc Lamp light from the Green **ILA®** on the screen.
4. Select **ILA®** Bias from the System-Factory Adjustments menu. Record this current **ILA®** bias level. This bias level will be returned to when this adjustment is complete. The Green value only need be recorded because Red and Blue will return to their original levels when Green is reset.
5. Use the up arrow key and adjust the **ILA®** bias for Green for maximum light output.
6. Next the Arc Lamp alignment screws (Figure 3-5) are adjusted to center the "hot spot" (brightest area). Figure 3-7 illustrates a "hot spot" on the screen.
7. Use a light meter and measure the brightness from the screen center to the screen corners to determine where the hot spot is located.
8. Use Figures 3-5 and 3-6 as guides to determine which alignment screw(s) to adjust. Figure 3-6 illustrates the direction the hotspot will move when turning the alignment screws clockwise. Turning the alignment screws counterclockwise moves the hotspot in the opposite direction from what is shown in Figure 3-6.

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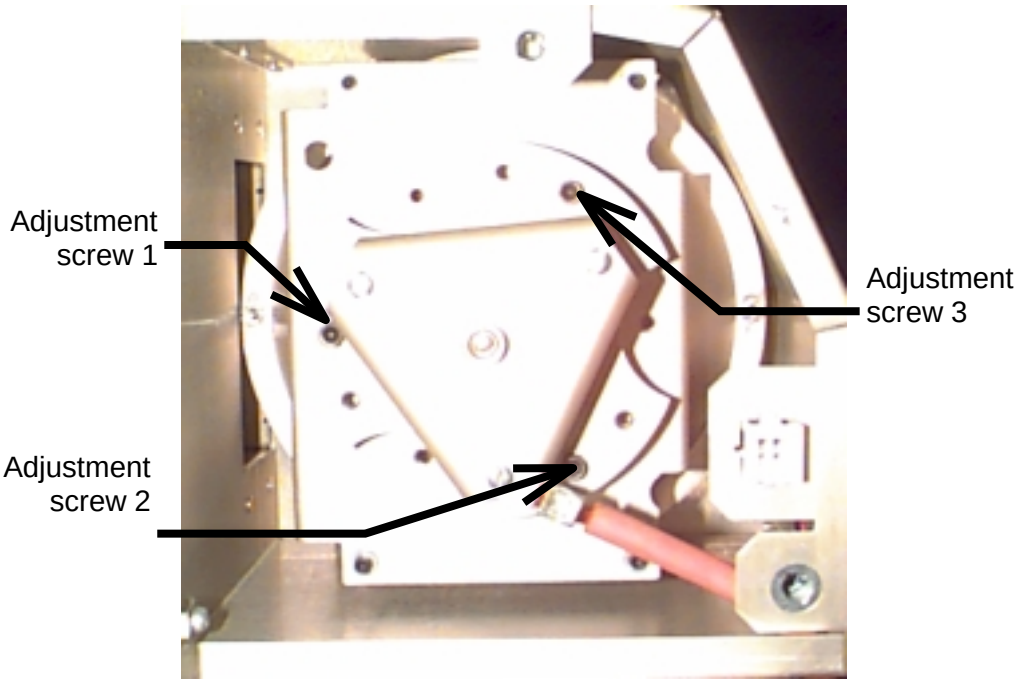


Figure 3-5. Arc Lamp alignment screws.

9. Once the hotspot is centered, use the same 3 alignment screws to obtain proper rolloff from center to corners (rolloff is the gradual decrease in brightness from the screen center to the screen corners). The goal now is to decrease the brightness at the center and increase the brightness at the corners. Rolloff should be no more than 4:1 from center to corners. Each corner should be balanced evenly so that no corner is excessively brighter or darker than any other corner. Be sure to adjust each of the 3 screws by the same amount, whether clockwise or counterclockwise, (adjusting any one screw more than the others will decenter the hotspot again).
10. After adjusting the 3 screws equally, recheck rolloff with the light meter again to determine if the screws need to be turned more in the same direction or in the opposite direction. Readjust, recheck, and readjust until a rolloff of 4:1 from screen center to screen corners is obtained.
11. When proper rolloff is obtained, return the **ILA®** bias adjustment to the level from Step 4, replace the fan door on the Arc Lamp Power Supply, retighten the fan door screws and recheck the "Shutters on Hide" box. If not performing a Condensing Lens Adjustment, replace the lower-right side panel and front cover.

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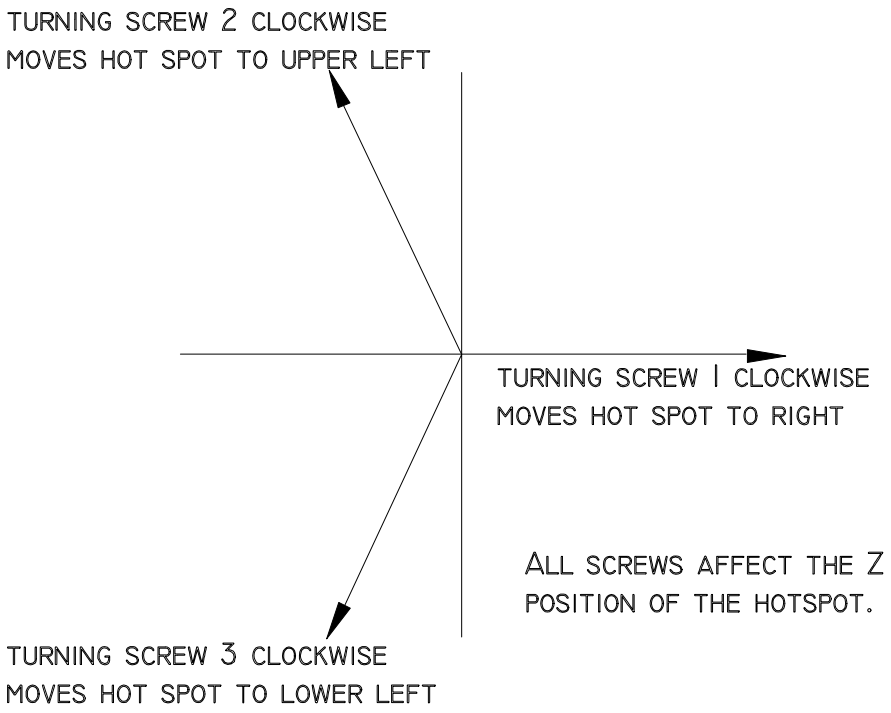


Figure 3-6. Graphical representation of hotspot movement on screen.

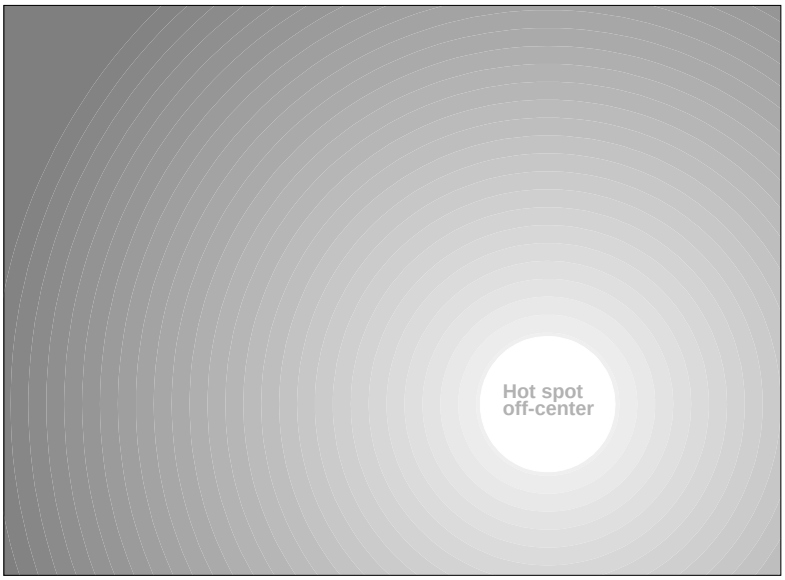


Figure 3-7. Arc Lamp “Hot Spot” (brightest area) is off-center vertically and horizontally. Adjust to center the “hot spot”.

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3.1.3 Condensing Lens Adjustment

NOTE: The Condensing Lens will not normally need adjustment and should not be adjusted unless the "hot spot" is still significantly off-center and cannot be centered using the Arc Lamp alignment screws. The first few steps of this procedure are to prepare the Condensing Lens for adjustment and are performed with power off. Then power is applied and the adjustments are performed.

1. Turn off power to the projector at the circuit breaker. Allow the projector to cool down for at least 5 minutes before proceeding.
2. Remove the front cover and lower-right side panel, if not already removed from above.
3. Remove the Dichroic Shield cover (first read the WARNING below)



WARNING!!! Some components under the Dichroic Shield cover, especially the Condensing Lens and nearby components, are still hot! Before removing the Dichroic Shield cover wait at least 10 minutes for these components to cool down.

4. Loosen the two X-translation screws that hold down the Condensing Lens (see Figure 3-8). This allows the X (horizontal) alignment of the condensing lens.

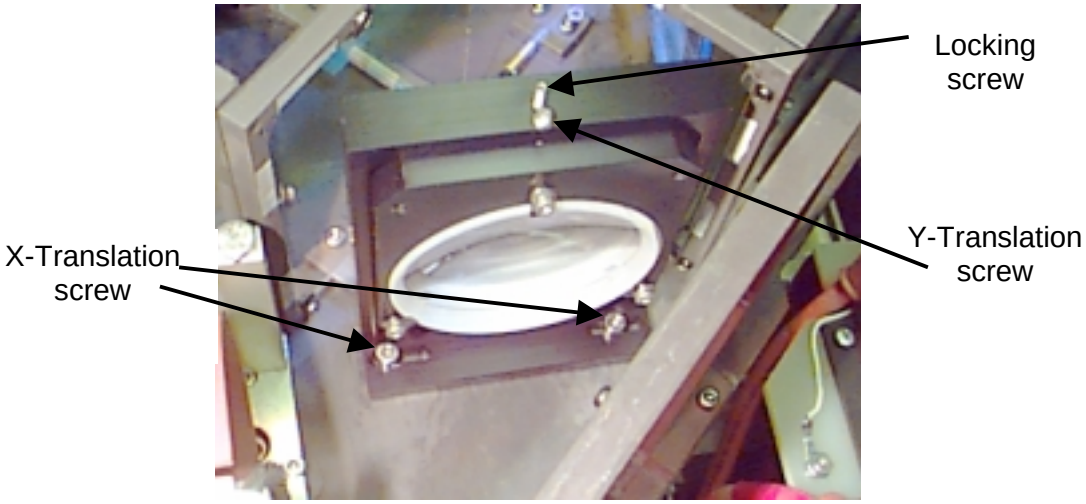


Figure 3-8. Condensing Lens, front view.

5. Loosen the hex Locking Screw (Figure 3-8) very slightly. This allows the Y (vertical) alignment of the condensing lens.
6. Turning the Y translation screw, located next to the locking screw (Figure 3-8) raises or lowers the lens. Rotating the screw clockwise raises the lens, rotating counterclockwise allow the lens to be pushed down manually. If the lens does not move freely, the four back screws may be too tight. To loosen

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the four back screws (Figure 3-9), first remove the Condensing Lens by removing the two X translation screws (Figure 3-8), then very slightly loosen the four back screws until the lens can move freely in the up or down direction by turning the Y translation screw. Then replace the Condensing Lens.

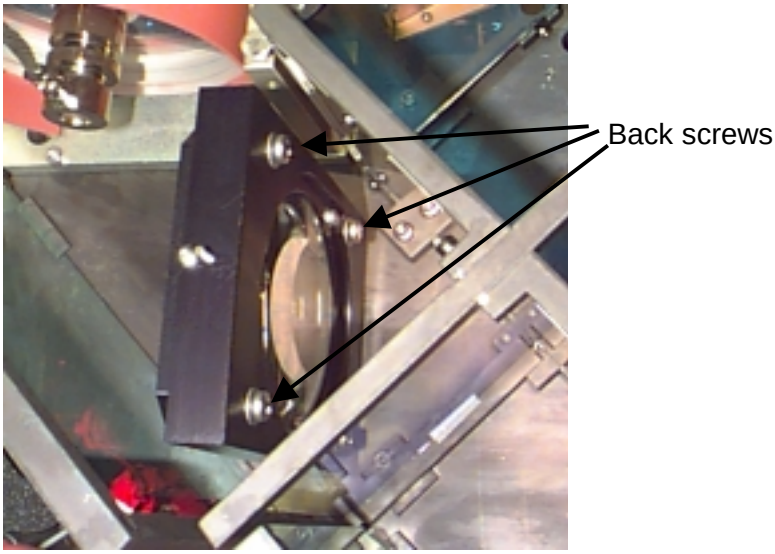


Figure 3-9. Condensing Lens, rear view.

7. Remove the fan from the Dichroic Shield cover to provide access to the Condensing Lens adjustments, then replace the Dichroic Shield cover but do not secure it with the screws until the Condensing Lens adjustment is completed later in this procedure.



WARNING!!! The next step reapplies power to the projector. Dangerous light exists in the mirror area where the Dichroic Shield cover was removed. It is crucial that hands and other parts of the body be kept away from the Arc Lamp light beam. Severe burns can result from even short exposures to the light beam. Do not allow anyone near the projector unless they are wearing safety goggles of at least X5 strength. Do not look directly at the light beam even with safety goggles! PUT ON SAFETY GLASSES NOW!

8. Apply power to the projector.
9. Adjust the X (horizontal) position of the Condensing Lens to center the hot spot horizontally. Do this by physically moving the lens horizontally until the "hot spot" is centered horizontally on the screen.
10. Adjust the Y (vertical) position of the Condensing Lens to center the hot spot vertically. Do this by adjusting the Y translation screw (Figure 3-8) until the "hot spot" is centered vertically on the screen.

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11. Repeat Steps 9 and 10 until no further increase in center brightness can be achieved and the "hot spot" is centered as much as possible.
12. When the hot spot is centered as much as possible, turn off power at the circuit breaker. Wait 10 minutes for the components to cool down, then carefully tighten the Condensing Lens locking screw, back screws, and X-translatlon screws, replace the fan in the Dichroic Shield cover and replace the Dichroic Shield cover in the projector.
13. Recheck rolloff with a light meter and readjust, if necessary, the Arc Lamp alignment screws for a 4:1 rolloff from screen center to screen corners.
14. Close the fan door of the Arc Lamp Enclosure, replace the lower-right side panel and front cover.

3.2 Electronic Module Tilt-up

1. Remove the rear cover (Section 4.2).
2. Release the clasp on the left side of the electronic module (turn CCW and pull out).
3. Pull out the release pin on the rear-right side of the electronic module to tilt it up. Tilt the electronic module up to a vertical position.
4. Ensure the holding pin locks the electronic module in place.

3.3 ILA® Back Focus

The **ILA®** Back Focus adjustment moves the **ILA®**/Relay Lens/CRT assemblies together to adjust the focal length. When using a zoom lens this adjustment allows the zoom lens' tracking to remain focused throughout the entire range. Use the focus test pattern to perform this adjustment one color at a time. The procedures below perform the **ILA®** Back Focus for the Green lens. The first procedure is for a zoom lens. The second procedure is for a fixed lens.

For best results, perform **ILA®** Back Focus procedure with 2 people. One person to watch the screen close-up and the other to move the **ILA®**/Relay Lens/CRT assemblies back and forth. The adjustment is factory-set but may need some touch-up in the field.

To adjust the **ILA®** Back Focus for a Zoom Lens:

1. Remove the rear cover (Section 4.2).
2. Tilt up the Electronic Module (Section 3.3).
3. View Green. Hide Red and Blue.
4. Select the Focus test pattern.
5. Select Projection Lens from the menu.
6. Use the up/down arrow keys to zoom the Projection Lens to full telephoto position (smallest image).
7. Use left and right arrows to focus the projection lens to get sharply focused spacer balls. **NOTE:** Spacer balls are used inside the ILA® Assembly to

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separate the layers. They are tiny, random, irregularly-shaped spots that are visible throughout the image. Look directly in front of the screen in the lighter areas of the image to view. From throw distances shorter than 4 meters, spacer balls are difficult to see.

8. Zoom the lens to a wide angle position (largest image).
9. Put on safety gloves (see Safety section for gloves type) then loosen the wing nut on the Green Relay Lens (or whichever lens is being focused). **NOTE:** If the **ILA®**/Relay Lens/CRT assembly cannot be moved close enough to get a good spacer ball focus, loosen the CRT Lens Stopper Ring in front of the CRT Holder Ring (Figure 3-10). Move the CRT snug against the collar to get additional range, and then, retighten the collar.
10. Loosen the 2 hex bolts (shown in Figure 3-12) on the **ILA®** assembly in front of the Relay Lens.
11. Slide the Relay Lens/CRT/**ILA®** assembly forward or backward until the sharpest spacer ball focus is achieved. **NOTE:** Do not use the zoom lens focus while performing this step.
12. Repeat Steps 6-11 until the spacer balls stay in focus through the entire zoom range. The spacer balls may go slightly out of focus in spots while zooming up or down, but they should be in focus at the smallest and largest images.
13. Tighten the hex bolts on the Green **ILA®** Assembly and the wing nut on the Green Relay Lens.
14. Repeat Steps 9-13 above for other colors that need **ILA®** Back Focusing. Be sure to hide the other 2 colors.

To adjust the **ILA®** Back Focus for a Fixed Lens:

1. Remove the rear cover (Section 4.2).
2. Tilt up the Electronic Module (Section 3.3).
3. View Green. Hide Red and Blue.
4. Select the Focus test pattern.
5. Select Projection Lens from the menu.
6. Use left and right arrows to focus the projection lens to get sharply focused spacer balls. **NOTE:** Spacer balls are used inside the **ILA®** Assembly to separate the layers. They are tiny, random, irregularly-shaped spots that are visible throughout the image. Look directly in front of the screen in the lighter areas of the image to view. From throw distances shorter than 4 meters, spacer balls are difficult to see.
7. Put on safety gloves (see Safety section for gloves type) then loosen the wing nut on the Green Relay Lens (or whichever lens is being focused). **NOTE:** If the **ILA®**/Relay Lens/CRT assembly cannot be moved close enough to get a good spacer ball focus, loosen the CRT Lens Stopper Ring in front of the CRT Holder Ring (Figure 3-10). Move the CRT snug against the collar to get additional range,then retighten the collar.

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8. Loosen the 2 hex bolts (shown in Figure 3-12) on the **ILA®** assembly in front of the Relay Lens.
9. Slide the Relay Lens/CRT/ILA® assembly forward or backward until the sharpest spacer ball focus is achieved. **NOTE:** Do not use the lens focus while performing this step.
10. Tighten the hex bolts on the Green **ILA®** Assembly and the wing nut on the Green Relay Lens.
11. Repeat Steps 7-10 above for other colors that need **ILA®** Back Focusing. Be sure to hide the other 2 colors.

    NOTE: The CRT Mechanical Focus procedure (*Section 3.4*) is often performed sequentially with the CRT Rotation procedure (*Section 3.5*). The same two set screws (*Figure 3-10*) are loosened when doing either of these procedures. When performing the procedures in sequence, ensure the two set screws are secured when either the focus lock screw *or* the CRT thumbscrew is tightened after finishing each adjustment. **Do not** leave the set screws loose when securing either the focus lock screw or the CRT thumbscrew. **Adjusting either of these while the set** screws are loose may cause the CRT to go out of focus or rotate.

3.4 CRT Mechanical Focus

The CRT Mechanical focus is factory-set and will not normally require adjustment. When a CRT is replaced, the CRT mechanical focus must be reset. Adjust colors individually. After completing, recheck other colors for additional adjustment. Replacing the CRT could cause other colors to become misadjusted. Use the Focus test pattern (an external signal or other test patterns can also be used) for adjustment.

To adjust the CRT Mechanical Focus:

1. Remove the rear cover (Section 4.2)
2. Tilt the Electronic Module to the full up position (Section 3.2).
3. Select the Focus test pattern.
4. Zoom the Projection Lens to the widest angle (largest image) and adjust the Projection Lens focus for the sharpest image of the Focus test pattern.
5. Loosen the two set screws (Figure 3-10) near the top of the CRT sleeve.
6. Loosen the CRT focus lock screw located on the Guide Plate at the top of the CRT shield (Figure 3-10). The CRT is now free to slide.
7. Grasp the CRT thumbscrew (Figure 3-10) and slide the CRT back and forth until the image is focused as sharply as possible (be careful not to loosen the CRT thumbscrew which could cause the CRT to rotate).
8. Tighten the set screws first, then the CRT focus lock screw. NOTE: Tighten set screws before focus lock screw. The focus lock screw can slightly defocus or rotate the CRT as it is being tightened if the set screws are loose.
9. Repeat the above steps for the Red and Blue CRTs.

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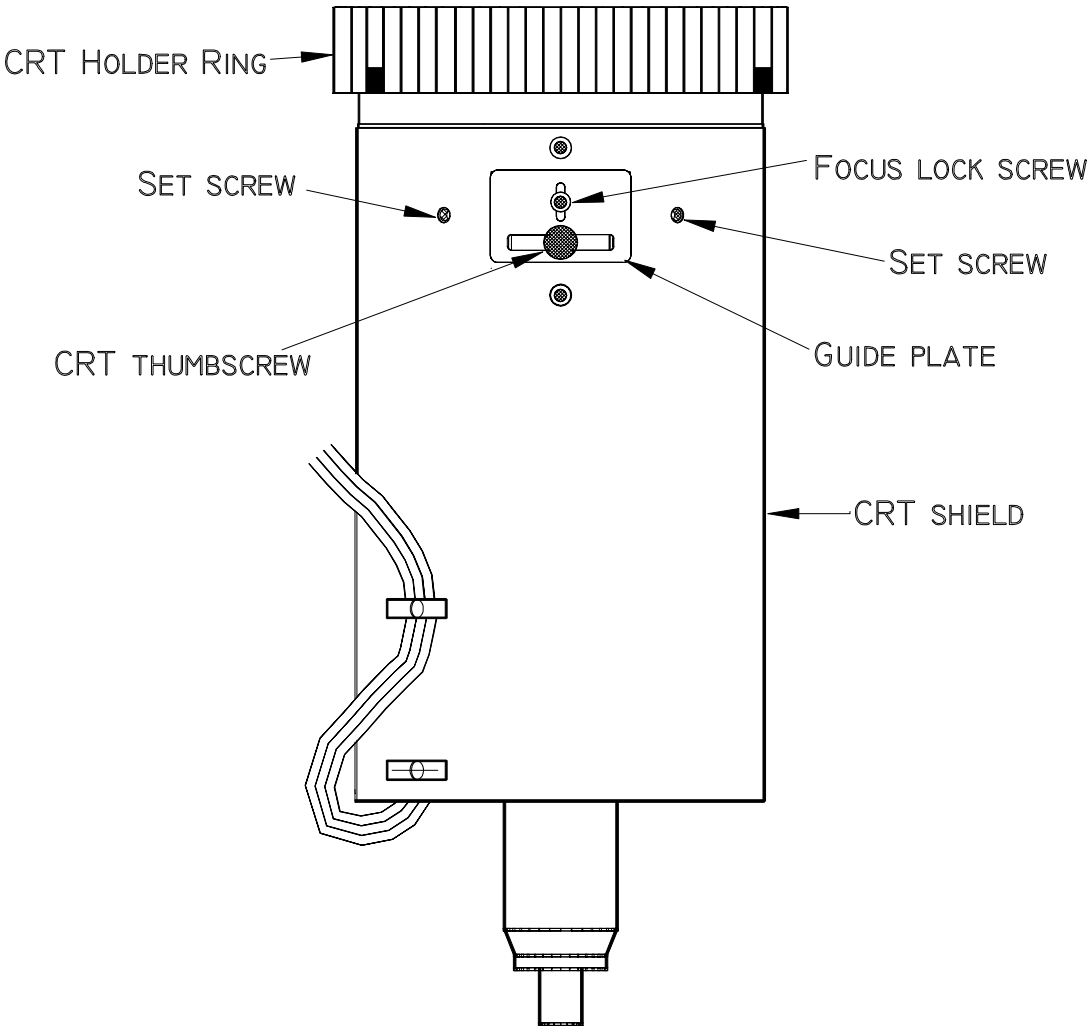


Figure 3-10. CRT Mechanical Focus adjustments.

3.5 CRT Rotation

The CRT tilt adjustment aligns the CRT level with the screen. This is a factory-set adjustment and should not need adjusting unless the CRT or yoke is moved.

Remove the rear cover (Section 4.2) and tilt the electronic module up (Section 3.2).

1. Select Test Pattern 8, Center/Lin.
2. View the color for the CRT that requires rotation. Hide the other 2 colors.
3. In the Geometry menu, set “Reg Enable” to off by unchecking the box. Unchecking the Reg Enable box temporarily disables any convergence corrections that have been performed with a different CRT/Yoke assembly and sets these values to the default levels so that CRT Rotation can be accomplished correctly.
4. In the Geometry menu, access Bow, Skew, Pincushion, and Keystone. Note the values for each setting. After recording values, set each to the default

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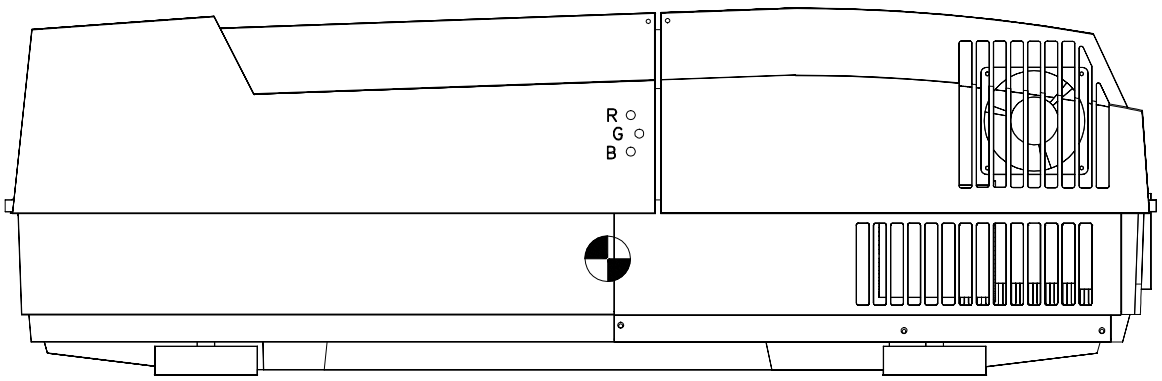
level of 128 (For Skew, select the color of the CRT that is to be rotated-the other functions are not color-selectable). This is done so that the CRT Rotation can be properly performed without the influence of any previous corrections made for these adjustments.

5. Loosen the 2 set screws (Figure 3-10) near the top of the CRT sleeve.
6. Loosen the CRT Thumbscrew (Figure 3-10) on the top of the CRT Assembly.
7. Tilt the yoke by grasping the Thumbscrew and moving it in whichever direction it takes to make the CRT raster square.
8. When the CRT raster is square on the screen, tighten the 2 set screws first, then the CRT thumbscrew.
9. In the Geometry menu, toggle the Reg Enable box back to On.
10. Reset Bow, Pincushion, Keystone, and Skew (select proper color for Skew) to the values noted previously in Step 4.
11. Recheck Bow, Pincushion, Keystone, and Skew and readjust if necessary. Also recheck Convergence (refer to the Model 230 User's Guide).
12. Repeat the above procedure for any other CRT that is not level.

3.6 CRT Electronic Focus

The Electronic Focus is factory-set and will not normally need to be adjusted except after component replacement, maintenance, or if wide temperature variations exist between the factory and the field location. View one color at a time.

1. Select the Focus test pattern.
2. Zoom the Projection Lens to the widest angle and adjust the Projection Lens focus for the sharpest image.
3. View Green. Hide Red and Blue.
4. Adjust the Green Electronic Focus (Figure 3-11) for a sharp focus of the H pattern at the center of the screen.
5. Repeat the above steps for Red and Blue.



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Figure 3-11. RGB Electronic Focus adjustments.

3.7 ILA® Overlap

This adjustment positions the **ILA®** assemblies in their sockets. Adjustment should only be made once or whenever an **ILA®** is replaced.

To determine if this adjustment is necessary:

1. Note the value of the **ILA®** bias for red, green and blue so they can be returned to these levels when this procedure is complete.
2. Hide red, green, and blue.
3. Increase the **ILA®** biases to maximum for all 3 colors. With all colors at maximum, the image on the screen should be a white screen with some colors at the edges.
4. Observe the right, left, top, and bottom of the screen. Normally, green is the reference to which blue and red will be matched. (**NOTE:** If the green **ILA®** was replaced, the blue or red image should be used as the reference to which green is matched.) If a red or blue border is present on either side or at the top or bottom the **ILA®** overlap needs adjustment. If both red and blue overlap, the border will be yellow. In either case, proceed with the adjustment below. If there is no overlap, reset the **ILA®** biases to their previous levels from Step 2.

To perform an **ILA®** Overlap adjustment:

Remove the rear cover (*Section 4.2)* and tilt the electronic module up (*Sections 3.2*).

1. Continue with all three colors hidden.
2. Loosen the 2 wing nuts at the top of the **ILA®** assembly to be adjusted (Figure 3-12).
3. If the overlap is at the left or right, grasp the **ILA®** assembly and slide it to the right or left so that the edges coincide with the edges of the other two **ILA®** assemblies. **CAUTION!** To avoid damaging the connector, grasp the **ILA®** assembly itself, **not** the connector at the top.

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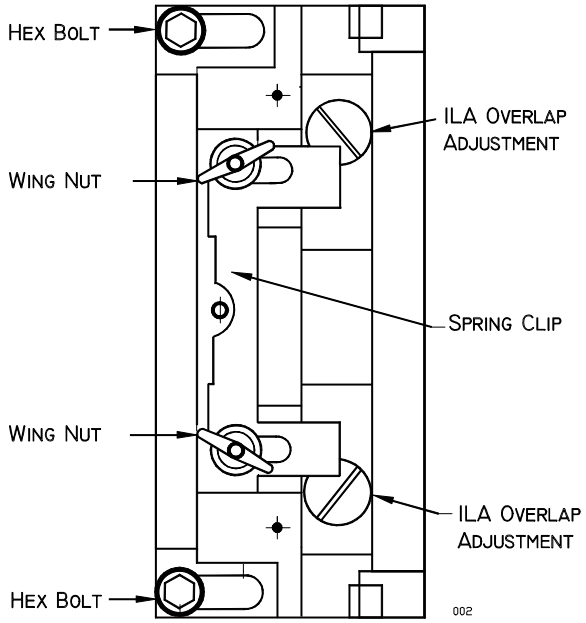


Figure 3-12. ILA® Assembly top view. The overlap screws shown are visible after the ILA® assembly is removed.

4. If the overlap is at the top or bottom, be sure the projector is level, then slide the spring clip (Figure 3-12) at the top of the **ILA®** assembly backward and remove the **ILA®** assembly (it will slide out with some resistance). Observe there are two adjustment screws at the bottom of the **ILA®** assembly which allow for up and down movement. Turn these screws in or out very slightly to allow the ILA® to seat lower or higher, whichever is needed.
5. Reinstall the **ILA®** assembly and replace the spring clip.
6. Repeat Step 4 if adjustment is still needed.
7. Retighten the 2 wing nuts.
8. Reset the **ILA®** biases to their previous levels from Step 2.

3.8 Front/Rear or Inverted Projection Jumper Settings

NOTE: In the procedures below each of the jumpers mentioned have a specific purpose: J100 and J101 are the horizontal scanning jumpers, J 53 and J53A are the vertical scanning jumpers, and J50 and J50A are the convergence jumpers.

3.8.1 Front/Rear Jumper Setting (Horizontal Reverse)

1. The Horizontal Scan Reversal Jumper reverses the image projection for front or rear projection. Figure 3-13 illustrates the jumpers' location on the Scan Reversal Board.
2. The Model 230 Projector is shipped with the jumper plugs inserted in J50 and J100 for front/upright projection. For other orientations refer to Table 3-1.

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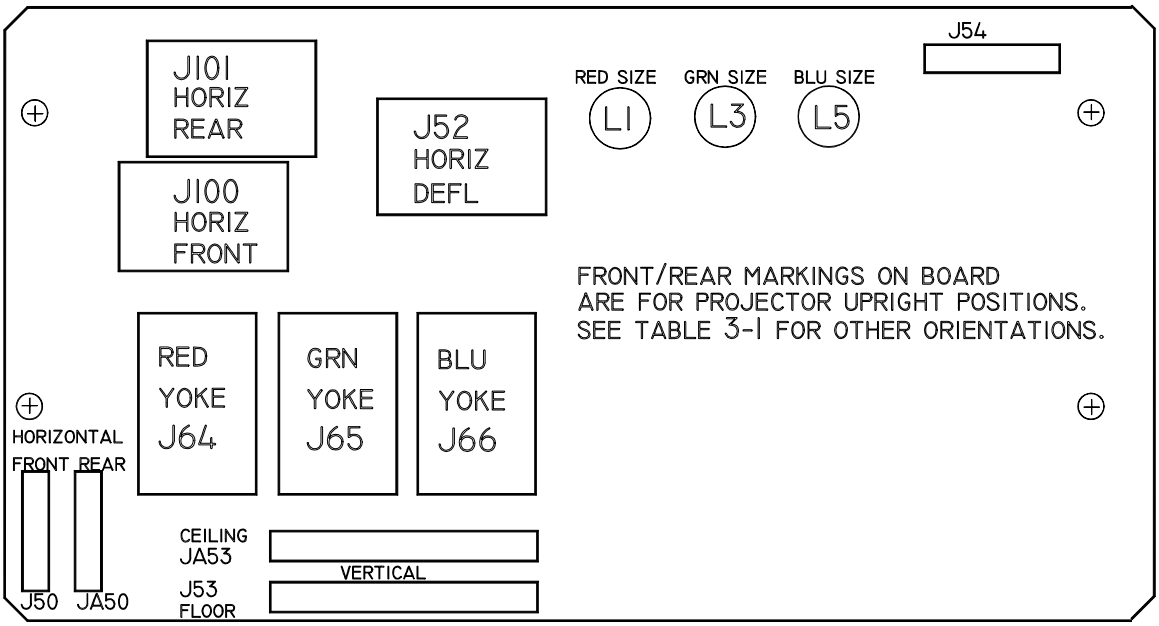


Figure 3-13. Scan Reversal Board.

To set the Horizontal Scan Jumper:

1. Turn power off at the projector and wait 10 minutes for the arc lamp to cool.
2. Remove the projector rear cover (Section 4.2).
3. Verify that the jumper is plugged into JA50 and J101 for rear/upright projection or J50 and J100 for front/upright projection (See Figure 3-13). Refer to Table 3-1 for other orientations. Change jumpers if necessary.
4. Replace the projector cover.
5. When changing jumpers for front or rear screen projection, Centering, convergence and shading must be rechecked.

TABLE 3-1. PROJECTION ORIENTATION JUMPER SETTINGS.

ORIENTATION	CONVERGENCE. P50 GOES TO:	VERTICAL. P53 GOES TO:	HORIZONTAL. P100 GOES TO:
FRONT/FLOOR UPRIGHT	J50	J53	J100
FRONT/CEILING UPSIDE DOWN	JA50	JA53	J101
REAR/FLOOR UPRIGHT	JA50	J53	J101
REAR/CEILING UPSIDE DOWN	J50	JA53	J100

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3.8.2 Inverted Vertical Jumper Setting

The Ceiling/Floor jumpers invert the image vertically for use in some situations that use mirrors or ceiling projections. Figure 3-13 illustrates the location of the jumpers on the Scan Reversal Board. The Model 230 Projector is shipped in the normal vertical projection position with the jumper plug inserted into J53. For an inverted vertical setup this jumper plug must be inserted into JA53. (Refer to Table 3-1 for other orientations).

To invert the vertical image:

1. Turn power off at the projector and wait for the arc lamp to cool.
2. Remove the projector rear cover (Section 4.2).
3. Tilt the electronic module up (Section 3.2).
4. Verify that the vertical jumper is inserted in the correct jacks for appropriate application, (refer to Figure 3-13 and Table 3-1). Change jumpers if necessary.
5. Replace the electronic module and rear cover.
6. When changing jumpers for floor or ceiling screen projection, Centering, Convergence and Shading must be rechecked.

3.9 Vertical and Horizontal Size Settings

Adjust the vertical height pots and horizontal size coils when replacing the Horizontal/Vertical Deflection board, Scan Reversal board, or CRT/Yoke assembly. These adjustments may also be needed when the convergence adjustment procedures fail to bring the colors into convergence.

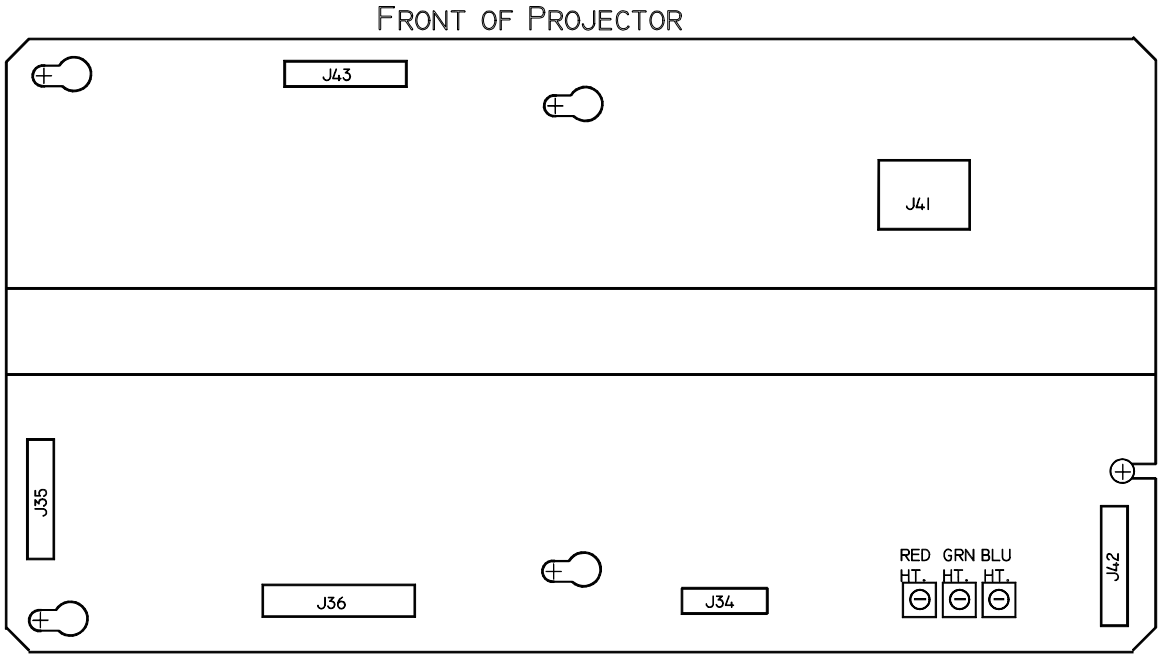


Figure 3-14. Horizontal/Vertical Deflection Board.

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To adjust the Vertical height (*see Figure 3-14*):

1. Remove the rear cover (Section 4.2).
2. Select the X-hatch test pattern.

   NOTE: Green is the master to which Red and Blue will be matched. The Green height pot should not need adjustment except when the Green CRT assembly has been replaced.
3. Hide Blue and view Red and Green.
4. If Red is higher than Green at the top ***and*** lower than Green at the bottom of the X-hatch image, *or* If lower than Green at the top ***and*** higher at the bottom, adjust Red vertical pot to correct the error.

   If Red is higher than Green at the top ***and*** bottom, *or* lower than Green at the top ***and*** bottom, this is most likely caused by Red not being centered correctly and can be corrected with the centering adjustment (User's Guide, Chapter 5).

   If the Red height pot does not completely eliminate the difference in height between Red and Green, balance the error at the top and bottom. Too much of an error at the top or bottom makes convergence procedures harder to accomplish.
5. Repeat Steps 2 and 3 above for Blue while hiding Red.
6. Recheck all Geometry and Convergence settings (*see User's Guide*) and readjust wherever necessary.

To adjust the horizontal size coils (*see Figure 3-15*):

1. Continue to use the X-hatch test pattern.
2. Hide Blue. View Red and Green.
3. If Red is outside of Green on both sides, or inside of Green on both sides, use a Delrin .100 hex alignment tool to adjust the Red horizontal size coil to correct the error. If Red is outside of Green on one side and inside of Green on the other side, this is most likely caused by Red not being centered correctly and can be corrected with the centering adjustment (*User's Guide, Chapter 5*).
   If the Red horizontal size coil does not completely eliminate the size error between Red and Green, balance the error on both sides to allow for easier convergence.
4. Repeat Steps 2 and 3 above for Blue while hiding Red.
5. Recheck all Geometry and Convergence settings and readjust wherever necessary.
6. Replace the electronic module and rear cover.

3.10 Software Updating

The Model 230 software resides in Flash Memory and is updated via the projector's serial Port A. To perform an update, a disk containing the updated

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Boot Software (boot.hex) and/or System Software (zsys.hex) and a PC with Windows 3.1 is required to perform update.

Boot Manager Software and System Software are separate products. Each may be updated independently. The System Software will depend on a specific version of the Boot Manager. Refer to the System Software release bulletin for Boot Manager version dependencies.

To perform software upgrade:

1. Verify that the projector circuit breaker is off. Use a Null Modem cable to connect a PC to the projector's Serial Port A.
2. Start Windows 3.1.
3. Click on the terminal icon from the Accessories Directory.
4. From the Terminal menu, select Settings-Terminal Emulation and click on DEC-VT-100(ANSI).
   Select OK.
5. Under Settings choose Terminal Preferences.
6. Under Terminal Preferences the following selections are appropriate; Terminal Modes=Sound, CR->CR/LF=Both off, Columns=80, Cursor=Block & Blink, Terminal Font=Fixedsys 15, Translation=None, Show Scroll Bars=On, Buffer Lines=100, Use Function Arrow & Control Keys for Windows=Off. Select OK.
7. Under Settings select Text Transfer=Standard Flow Control. Select OK.
8. Under Settings select Communications and choose; Connector=select the PC port being used, Baud Rate=9600 or 19200 (depending on the System Controller Switch block Pos 4-see note below this step), Data Bits=8, Stop Bits=1, Parity=None, Parity Check=Off, Carrier Detect=Off, Flow Control=XON/XOFF. Select OK.

   NOTE: Switch position 4 on the switch block at the card edge of the System Controller (*Figure 5-1*) controls the baud rate for Serial Port A for the Boot Manager and System Software. Down=9600, Up=19200. Ensure the other SCB switches (1, 2, and 3) are in the Down position.
9. Turn the projector circuit breaker on while depressing and holding down the service mode switch on the SCB (Figure 5-1). Verify that "Boot Manager" appears on the terminal monitor. The Power On LED stays Red.
   Alternate for Step 9: In "Power Off" Standby mode, Press "Control, Shift + _ (underscore), hex "IF (international keyboard may vary in key placement).
10. The following should be displayed on the Windows Terminal screen (where x.x.0 is the currently loaded Boot Manager version (e.g. 0.9.0 or 1.1.0).

```
–Boot Manager Ver x.x.0 (Service Mode Startup)
–Copyright (c) 1994 Hughes JVC Technology

–Command: _
```

11. Verify that the Boot Manager version is correct. If it is necessary to update the Boot Manager, perform the following steps. If the Boot Manager is already up to date, skip to Step 12 to update the System Software.

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11A. Enter the command "loadboot" at the prompt. You should see the following output:

```
Command: loadboot

Boot Manager software update procedure

***WARNING: IMPROPER USE MAY MAKE THIS SYSTEM
UNBOOTABLE*** (This warning relates to the Flash Memory
updating that occurs in Step 11D. Do not turn projector
power off while the Flash Memory is updating)

Memory buffer reset to 0xff

Begin your S-Record upload now (Esc to abort).
```

11B. From the Windows Terminal Menu (normally in Accessories window), select "Transfers/Send Text File", then select "List Files of Type:All Files", and select the disk and/or directory with the Model 230 software. You should see a file named "boot.hex". Select this file and press the OK button to begin the upload.

11C. During upload, a progress indicator updates the number of records received. At the completion of the upload, the system will display the following (numerical values are for example only and depend on the Boot Manager version):

```
S-Records processed: 823

Upload Successful

Address Range: 0x00000000-0x00006687

Bytes Loaded:  26248

***WARNING: FLASH WILL NOW BE UPDATED***

Press Enter to continue, Esc to abort.
```

11D. The system has verified that the load module is correct and is ready to update the Flash. Press Enter to perform the update (press Esc now to abort the update with no changes). While the Flash memory is being updated (15-30 seconds), DO NOT turn off the projector circuit breaker or the machine could be made unbootable, requiring a new set of flash chips to be installed. When the update is complete, the system will display the following:

```
Reprogramming Flash Sector 0 1
Boot Manager software update successful

Command: _
```

The Boot software has been successfully updated. To restart the projector under control of the updated boot manager, enter the "reboot" command while depressing the service mode switch (Figure 5-1). The projector will now restart with the updated boot manager software. (**NOTE:** If normal software starts, see Step 9 to reenter Boot Manager.) You should see the following displayed, where y.y.0 is the updated Boot Manager's version.

```
Boot Manager Ver y.y.0 (Service Mode Startup)
Copyright (c) 1994-1996 Hughes-JVC Technology

Command: _
```


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12. To update the System Software from the Boot Manager prompt:

12A. Type in the command “loadsys” at the prompt. The following should be displayed:

```
Command: loadsys

System software update procedure
***WARNING: IMPROPER USE MAY MAKE THIS SYSTEM
UNBOOTABLE*** (NOTE: This warning relates to the Flash
Memory updating that occurs in Step 12D below. Do not
turn projector power off while the Flash Memory is
updating.)

Memory buffer reset to Oxff

Begin your S-Record upload now (Esc to abort)
```

12B. Select “Transfers/Send Text File” from the Windows Terminal Menu (normally in Accessories window). In the “Send Text File Dialog” box, select “List Files of Type: All Files” and select the disk and/or directory with the Model 230 software. Select file named “zsys.hex”. Press OK to start upload.

12C. During upload, a progress indicator updates the number of records received. When the upload is complete, the system will display the following (numerical values are for example only and depend on the System Software version):

```
S-Records processed:11282
Upload Successful
Address Range: 0x00020000-0x000781cf
Bytes Loaded:360912

***WARNING: FLASH WILL NOW BE UPDATED***

Press Enter to continue, Esc to abort
```

12D. At this point the system has verified that the load module is correct and is ready to update the Flash memory. Press Enter to perform the update (Esc will abort the update process with no changes). While the Flash is being updated (approx 15-30 seconds), DO NOT turn off the projector circuit breaker, this may make the machine unbootable, requiring a new set of flash chips to be installed. When the update is complete, the system will display the following:

```
Reprogramming Flash Sector 2 3 4 5 6 7 8 9

System software update successful

Command: _
```

The software update is complete. To restart the projector, type in the “sys” command and press Enter. The projector will now restart with the updated System Software.

3.11 Gamma Tracking

Gamma Tracking is used mainly during factory-setup. It may be necessary when **ILA**®s are replaced or when the projector has been in use for a long time. To check if Gamma Tracking is needed, access the Grey Scale test pattern. After all

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setup procedures are complete the Grey Scale test pattern should be grey throughout. If the edges of the Grey Scale appear grey but the middle appears color-tinged, this indicates that Gamma Tracking may need adjustment.

NOTE: Overall Gamma Tracking is usually best if no color is too near the extreme (0 or 255). For example, if the middle gray level looks green and the Gamma Tracking settings are; Red=128, Green=200, Blue=128, it is better to adjust Red and Blue down instead of Green up.

To adjust Gamma Tracking:

1. Select the Grey Scale test pattern.
2. Observe the center of the Grey Scale. If the center of the test pattern shows a red, blue or green tinge, Gamma Tracking may need to be adjusted for that color.

   NOTE: It is also possible that two colors are dominant at the center. If the center of the test pattern appears magenta, then red and blue are both dominant. If the center appears cyan-tinged, green and blue are dominant. If the center appears yellow, red and green are dominant.
3. Select the color to adjust
4. Make a note of the data value of the color(s) to be adjusted before making any adjustments to gamma so that it can be returned to if adjusting gamma does not improve the grey scale image on the screen .
5. Use the arrow keys to decrease gamma in the selected color so that the Grey Scale looks grey throughout the pattern. Use the UP arrow key to i*ncrease the data value for gamma in the selected color to make it less dominant*!

3.12 Graphic Enhancement Adjustment

The optional Graphic Enhancer RGBHV VIC has a very small adjustable pot (see Figure 3-15) that was designed primarily to improve the visibility of computer black text on white background (such as spreadsheets). This pot is factory-set at mid-range to provide an appreciable enhancement of small black text on white background. HJT recommends this pot be left at the factory mid-range setting.

If it is absolutely necessary to adjust this pot to optimize a specific type of graphic image, be sure to check that other sources viewed from the Graphic Enhancer VIC are not adversely affected. This enhancement adjustment only affects computer graphics and does not appreciably affect images from VCRs, DVDs etc.

Increasing (clockwise) sharpens the appearance of black on white text but overadjustment will adversely affect other types of graphics. This is a fixed adjustment and a compromise setting may be needed for best overall performance.

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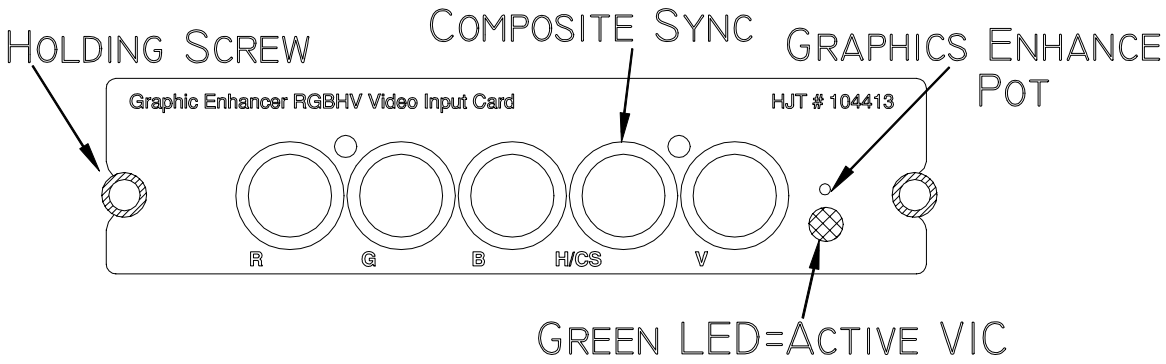


Figure 3-15. Graphic Enhancer Video Input Card.

3.13 Cleaning Lenses, ILA® Assemblies and Mirrors

The projection lens is the only item that requires periodic cleaning. Other assemblies are covered to prevent dust entering or finger smudging. Cleaning may be needed for special circumstances such as replacing an assembly. Cleaning should only require removing excessive dust (use canned air such as “Office Duster” or "Aero Duster") or removing fingerprint smudges (use “Kodak Lens paper”, or equivalent) from the projection lens. As much as possible, clean the optics only when absolutely necessary.

Projection Lens: Use lens paper and wipe the lens clean in a vertical motion from top to bottom. Use compressed air to blow excess dust from the lens. An optical lens cleaning solution can also be used to remove finger smudges.

ILA® Assembly: Clean the ILA® assembly faces with compressed air only. Do not wipe the ILA assembly faces.

CRT Faces: Use compressed air to blow dust off and lens paper to clean face.

Relay Lens: Same as Projection Lens.

Mirrors and Polarizing Beam Splitter Windows: The Optical Shield covers the Dichroic Mirror Assembly and Polarizing Beam Splitter windows. Normally cleaning is not needed. Clean only if absolutely necessary using compressed air. Do not wipe mirrors.

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4.0 Maintenance (Remove/Replace)

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4.1 Introduction

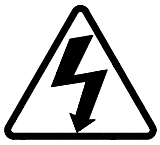
NOTE: Before removing the front or rear cover or replacing any components or subassemblies, please review the Safety Chapter at the front of this manual. Removal and replacement procedures in this chapter must be performed by Hughes-JVC certified technicians and engineers only.

When performing any maintenance, protect yourself and the equipment by following these guidelines:

- Turn the projector off with the remote.
- After the cooling fans have automatically stopped running, turn off the circuit breaker.
- Allow a discharge time of at least one minute for the high voltage to bleed off, then unplug the power cord from the AC wall outlet.
- Observe all Cautions and Warnings

Tools required to perform removal and replacement of projector components and subassemblies are listed in Chapter 1, Introduction.

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WARNING!!! Various procedures in this chapter involve the removal and replacement of system subassemblies. Ensure that the projector circuit breaker is turned off *and* the AC power plug is removed from the AC outlet PRIOR to attempting any of these procedures.

When performing any maintenance procedures in this chapter, follow the guidelines below:

Left/Right Orientation: When left and right is mentioned in this chapter, it is with reference to standing at the rear of the projector, facing the screen.

Connectors on subassemblies and PCBs have tabs that must be released first before pulling on the connector. The proper procedure is to push slightly *IN* on the connector, then squeeze the tab, then pull the connector out.

NOTE: While performing any maintenance procedures, check the prism diaphragm for dryness, crazing, cracking, or possible leaking. If any problems are observed, call HJT.

When references are made in this chapter to assemblies and components, refer to Figures 4-1 and 4-14 for their locations.

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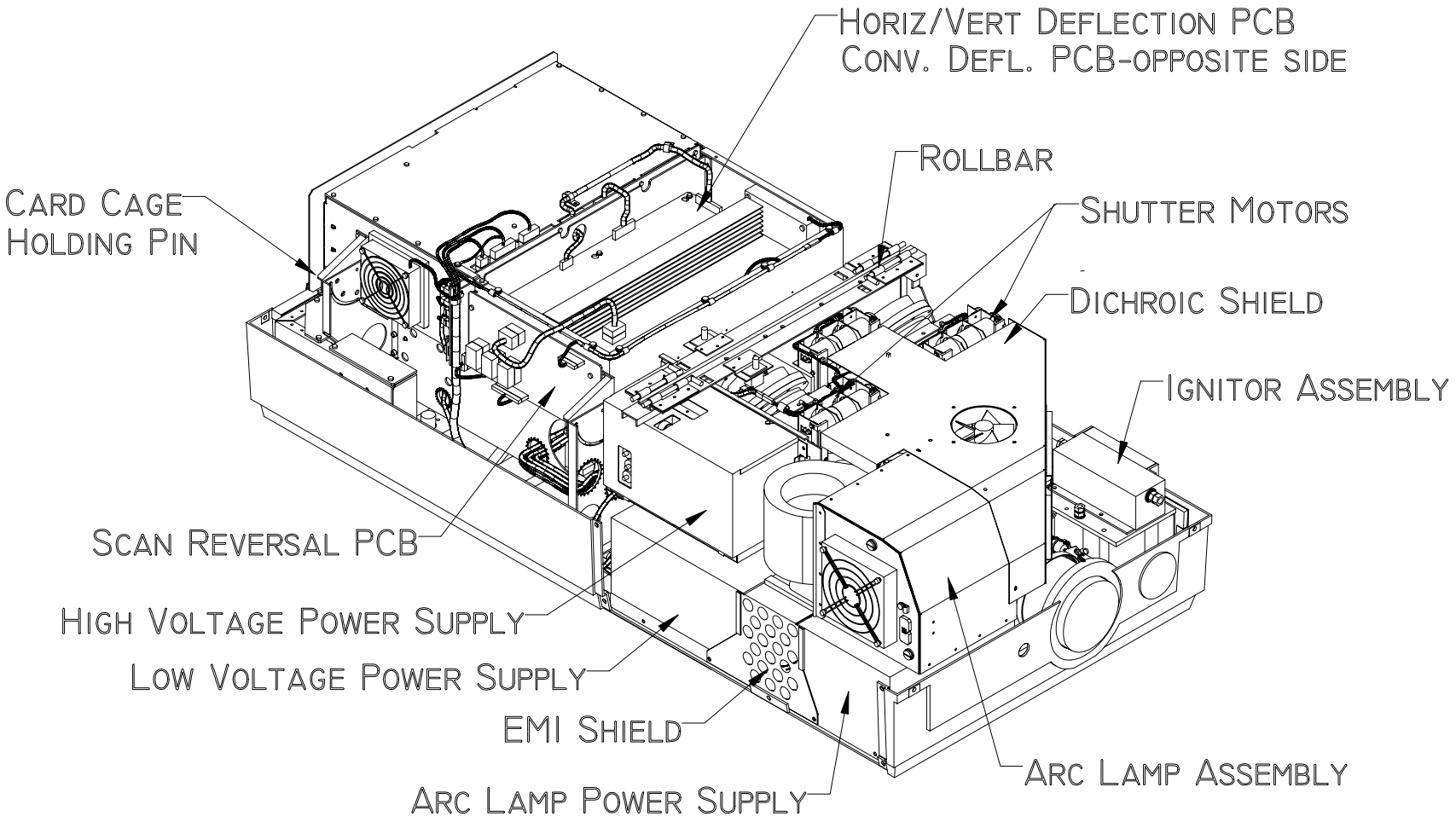


Figure 4-1. Major components of the Model 230 Projector.

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4.2 Projector Covers

Prior to removing either cover, review the chapter on Safety and adhere to all warnings and cautions.

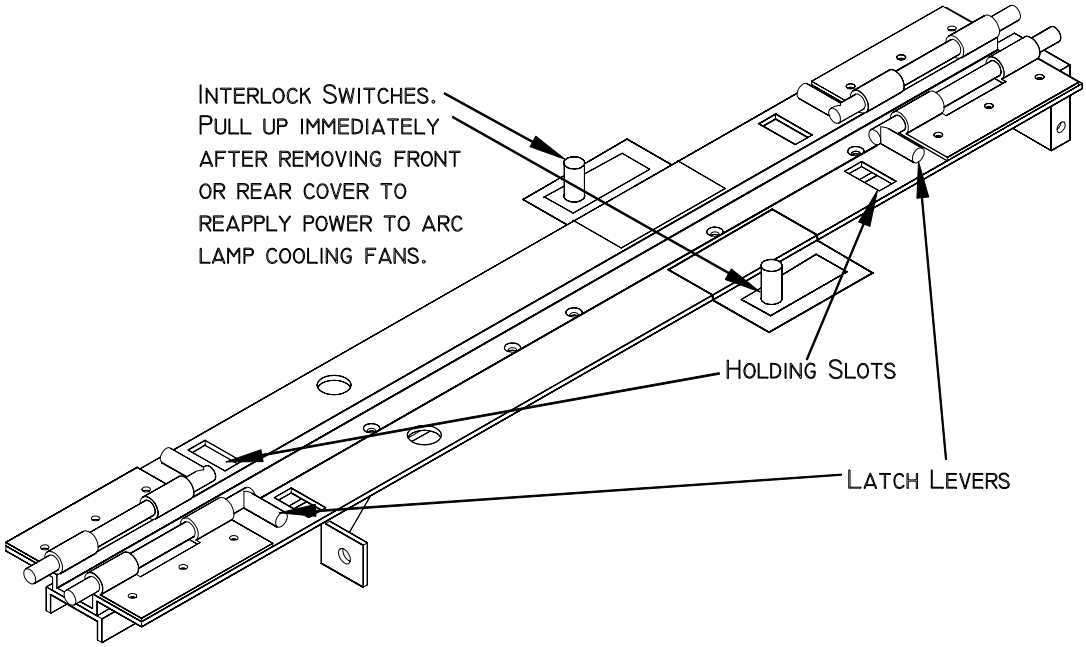


Figure 4-2 Rollbar Assembly.

To remove the front or rear covers (*refer to Figure 4-2*):

1. Disconnect the projector power plug.
2. Loosen the two pozidrive spring screws at the front of the front cover or the rear of the rear cover.
3. Tilt up the front or rear cover.

CAUTION! Do not leave either cover in the tilted up position! The covers can fall from this tilted up position and possibly damage projector components. Remove the cover and set it aside when servicing the projector.

4. Release the two Latch Levers on the Rollbar assembly that hold the cover in place. Place the ends of the Latch Levers into the holding slots.

CAUTION! Immediately after removing the front or rear cover, pull up the power interlock switch. This allows power to be reapplied to

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the fans to cool the Arc Lamp. The power interlock switches for both covers are attached to each cover hinge.

5. When the Latch Levers are inserted into the holding slots, lift the cover off. Be careful not to brush against any of the internal components of the projector when removing the cover. If any undue resistance is felt, stop to locate the source before proceeding.
6. Replace the covers in reverse order from above. When replacing either cover, make sure the slot in the cover fits over the bottom of the projector case or the cover will not close correctly.

4.3 Air Filters

Air filters should be cleaned whenever necessary. In extremely dusty or dirty conditions, the filters should be cleaned more frequently. Remove the filters and vacuum them or blow them clean with compressed air. They may also be washed with soap and water.

There are 3 polyurethane air filters in the Model 230 that require periodic cleaning. They are located as follows:

- 1 metal-framed filter in the rear of the projector in the bottom cover-accessible when the rear cover is off.
- 1 filter on the bottom of the projector-slides out from the middle-left side of the projector (grasp the hole in the filter frame). The filter can be peeled off the Velcro on the frame, if necessary.
- 1 metal-framed filter in the front-left-bottom cover accessible with the front cover off.

4.4 Arc Lamp Assembly

The Arc Lamp Enclosure Assembly consists of a the Xenon Arc Lamp module and blower. The blower is removed and replaced together with the Arc Lamp Module.

Caution: It is strongly recommended that the Arc Lamp current be turned down (see Section 3.1) before installing a new Arc Lamp to help prevent possible damage that could reduce the life of the new lamp.



WARNING!!! Dangerous light exists in this area of the projector. Before proceeding with the removal of any subassemblies below, verify that the circuit breaker at the rear of the projector is turned off and the power plug is removed from the AC outlet.

To remove the Arc Lamp Enclosure Assembly:

1. Remove the front cover (*Section 4.2*).
2. **CAUTION!** Ensure all fans have stopped running.

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3. Remove the lower-right-front-side panel (*5 screws*).
4. Remove the Dichroic Shield (*1 screw on top-connects to Arc Lamp enclosure, 1 screw in front-connects to Arc Lamp enclosure, 1 screw on bottom-right-connects to Ignitor board*).

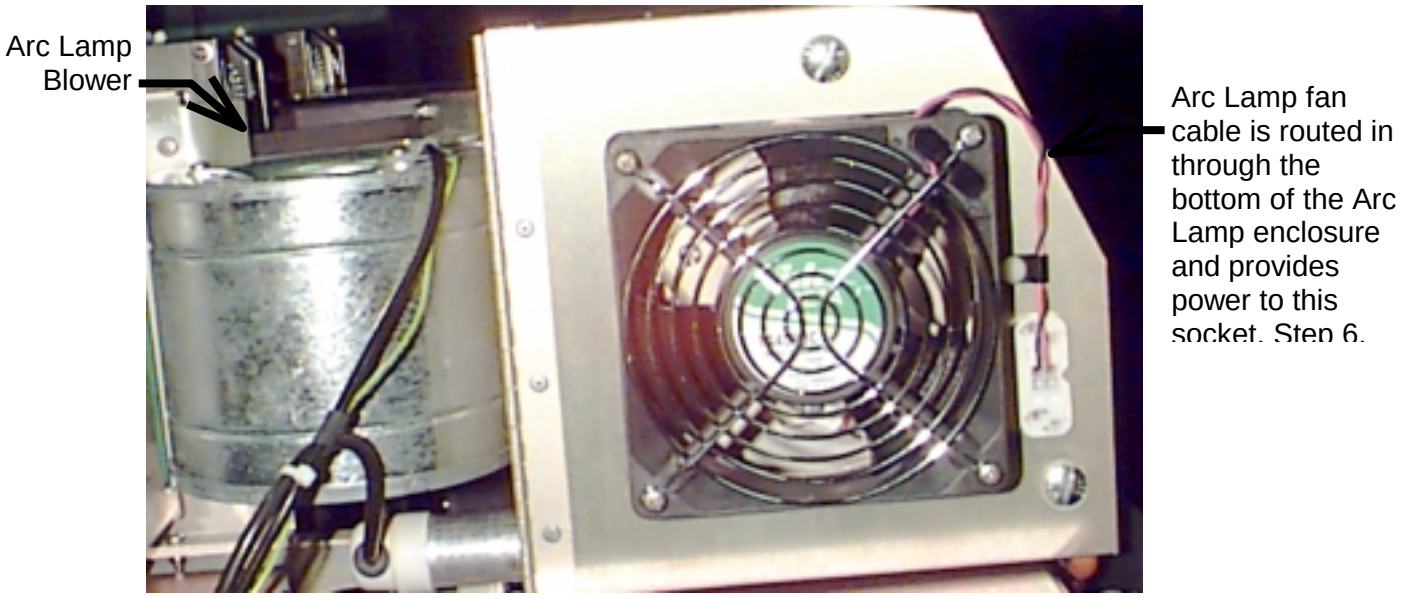


Figure 4-3. Arc Lamp Assembly

5. Disconnect the Arc Lamp blower cable.
6. Disconnect the Arc Lamp fan cable. This cable is routed through the bottom of the Arc Lamp assembly enclosure (below the right side in Figure 4-3) and provides power to the Arc Lamp door fan through the white socket shown to the right of the Arc Lamp fan in Figure 4-3. Disconnect the cable at the socket connection below the Arc Lamp enclosure.

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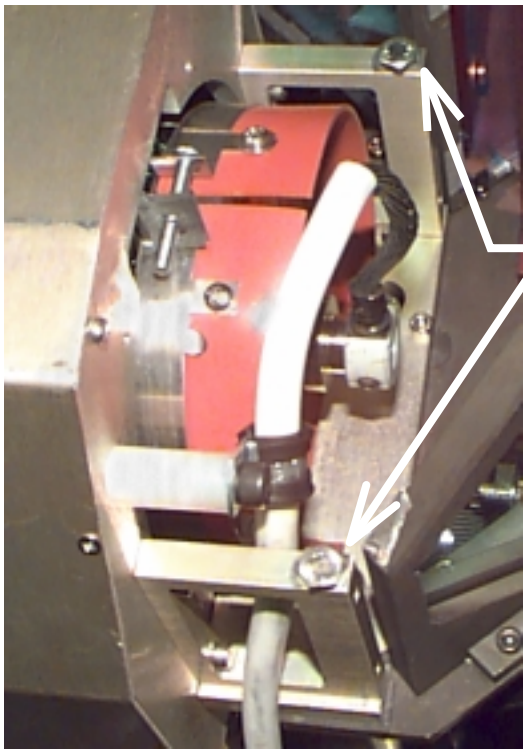


Figure 4-4. Arc Lamp cable and clamp.

7. Label and disconnect both Arc Lamp cables from the Ignitor board (Figure 4-5). These are called out as "Positive Common" and "Negative Output" in Figure 4-5. Return these cables with the Arc Lamp assembly
8. Remove the two holding bolts that secure the Arc Lamp Enclosure to the projector (Figure 4-4).
9. Carefully slide the Arc Lamp assembly out.
9. Reinstall the Arc Lamp in reverse order from above.
10. After reinstalling the Arc Lamp, perform the Arc Lamp adjustment procedure as shown in Chapter 3.

4.5 Ignitor Assembly

The Ignitor Assembly includes the Ignitor and the Laser Power Supply. When either of these two components require replacing, the Ignitor Assembly is returned and replaced as a unit.

To remove the Ignitor Assembly:

1. Remove the front cover (Section 4.2).
2. Disconnect and label the cables attached to the Ignitor (see Figure 4-5).
3. Remove the 3 screws securing the Ignitor Assembly (refer to Figure 4-5).
4. Replace the Ignitor Assembly in reverse order.

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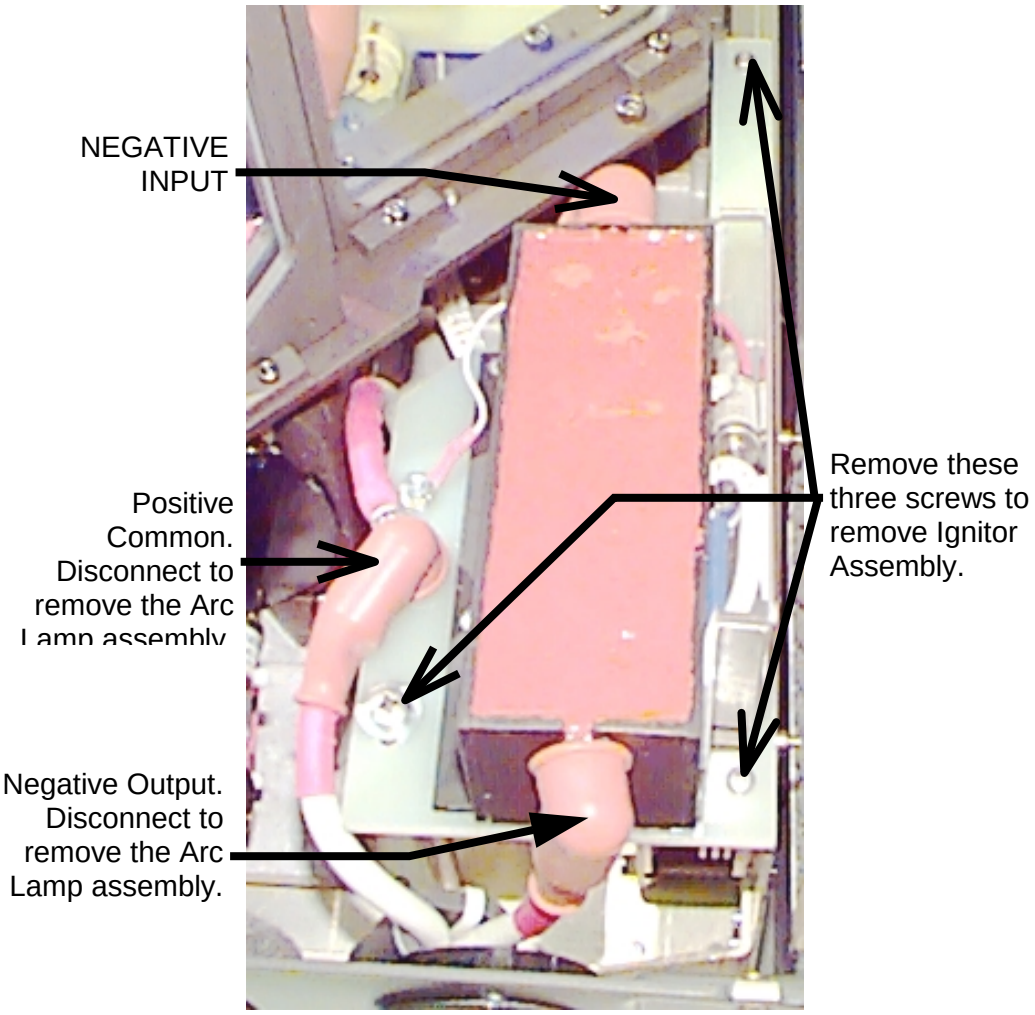


Figure 4-5. Ignitor Assembly.

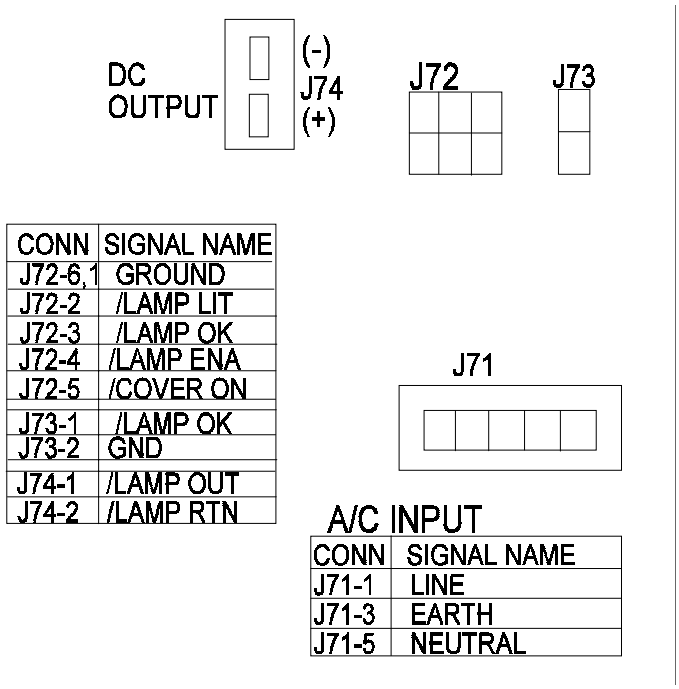
4.6 Arc Lamp Power Supply

To remove the Arc Lamp Power Supply:

CAUTION! It is strongly recommended that the Arc Lamp current be turned down (see Section 3.1) before installing a new Arc Lamp to help prevent possible damage that could reduce the life of the new lamp.

1. Remove the front cover (*Section 4.2*).
2. Remove the lower-right-front-side panel by removing the 5 pozidrive screws securing it.
3. Remove the 2 pozidrive screws from the bottom of the EMI shield and slide it out of the way to the left.

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CONN	SIGNAL NAME
J72-6,1	GROUND
J72-2	/LAMP LIT
J72-3	/LAMP OK
J72-4	/LAMP ENA
J72-5	/COVER ON
J73-1	/LAMP OK
J73-2	GND
J74-1	/LAMP OUT
J74-2	/LAMP RTN

CONN	SIGNAL NAME
J71-1	LINE
J71-3	EARTH
J71-5	NEUTRAL

Figure 4-6. Arc Lamp Power Supply connections.

4. Label and remove the cables from the DC OUTPUT terminal, J74 (see *Figure 4-6 for cable connections)*. Retain the .47µfd capacitor, connected across the terminals, to be reinstalled on the replacement power supply.
5. Disconnect J71 (AC Input).
6. Disconnect J72 (SIGNAL CABLE).
7. Disconnect J73.
8. Remove the 2 screws at the bottom of the ALPS and carefully slide it out of the projector.
9. Replace the Arc Lamp Power Supply in reverse order from above. **NOTE:** When replacing the cables on the ± terminals on J74, a mechanical pickup tool is very useful to start the screws.
10. Perform the Arc Lamp Adjustment procedure as shown in Section 3.1.

4.7 Low Voltage Power Supply

To remove the Low Voltage Power Supply:

1. Remove the front cover.
2. Remove the lower-right-side panel by removing the 5 pozidrive screws securing it.
3. Remove the 2 pozidrive screws securing the EMI Shield. Slide the shield to the left and remove it.
4. Remove J76 (DC Output) and J75 (AC Input) from the left side of the Low Voltage Power Supply. **NOTE:** These connectors could be a little difficult to

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remove and it may be necessary to angle the LVPS partly out of the chassis in order to get a firmer grip on the connectors.

5. Remove the 2 screws on the bottom side of the LVPS and carefully slide it out of the projector.
6. Reinstall the LVPS in reverse order. After the LVPS is installed, recheck Timing, Geometry, Electronic Focus, **ILA®** Bias/Sensitivity, Convergence, G2, and Shading.

4.8 High Voltage Power Supply

To remove the High Voltage Power Supply:

1. Remove the front and rear covers (*Section 4.2*).
2. Remove the High Voltage Power Supply cover (*Figure 4-7*) by removing the pozidrive screw that secures the HVPS at the bottom of the cover and loosening the 2 pozidrive screws at the top of the front flap.

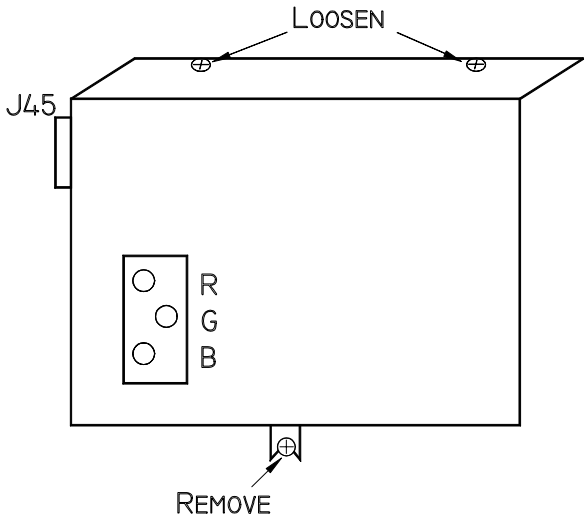


Figure 4-7. High Voltage Power Supply cover.

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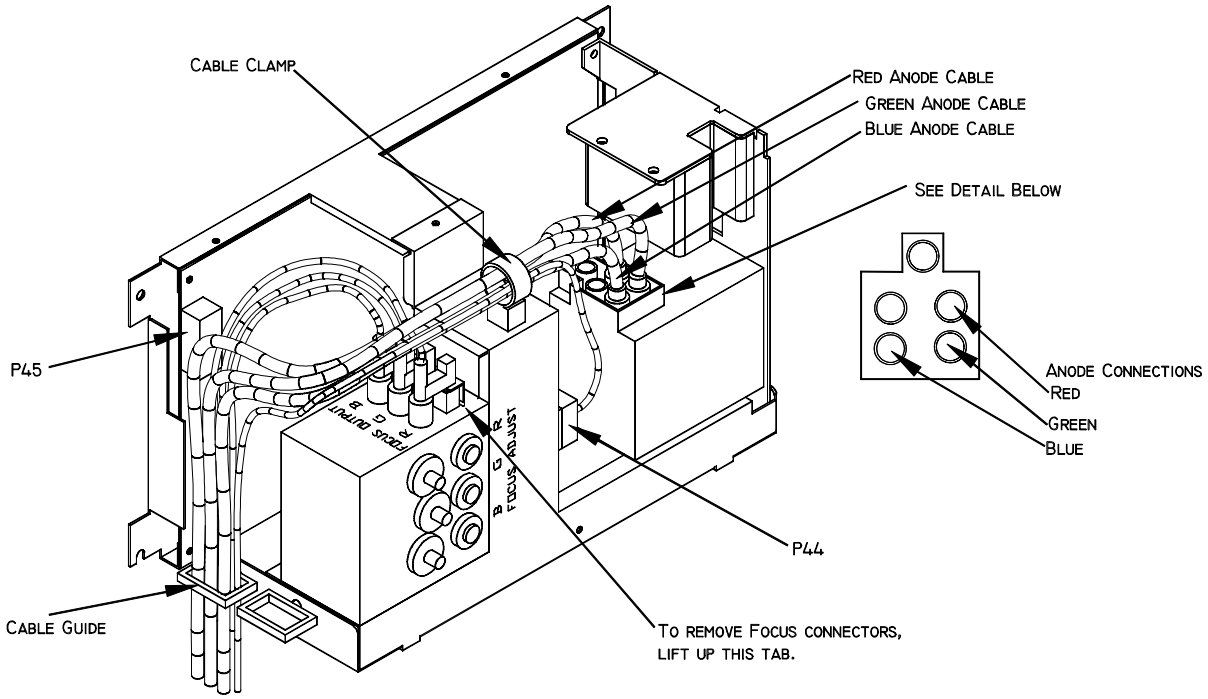


Figure 4-8 High Voltage Power Supply.

3. Carefully slide the cover upward and outward to remove it.

NOTE: For the remainder of this procedure refer to Figure 4-8 above.

4. Disconnect the 3 CRT anode cables.
5. Disconnect P44-G2 Out (at the middle-front of the HVPS).
6. Unsnap the cable clamp at the top of the HVPS.
7. Remove the anode cables and the P44 cable from the cable clamp.
8. Disconnect P45 (“Control”) at upper left of HVPS.
9. Disconnect and label the 3 Focus cables. The square tabs on these cables (see Figure 4-8) may have to be lifted up by gently prying with a flathead screwdriver.
10. Remove all cables from the slot in the cable guide at the left side of the HVPS.
11. Verify that all plugs and cables are removed and out of the way so the HVPS is free to be removed.
12. Loosen (do not remove) the 2 pozidrive screws (at the bottom of the HVPS) that secure the HVPS metal housing to the projector.
13. Remove the 2 pozidrive screws that hold the top of the HVPS metal housing to the projector frame.
14. Grasp the HVPS at the bottom and lift upward and outward so that it slides away from the bottom screws.
15. Reinstall the HVPS in the reverse order from above. When reinstalling, be sure that the HVPS slides over the bottom screws *and* the lip at the top of the

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projector frame. Make sure each anode cable “snaps” back into its receptacle. The receptacles are about 2” inside the hole where the cable fits into. Also, be sure the rear flap on each focus cable connector snaps over the square socket securely-wiggle the connector a little to make it fit over.

16. Replace the HVPS cover. After the HVPS is replaced, recheck CRT Mech Focus, Yoke Alignment, G2, and Electronic Focus.
17. Replace the projector covers.

4.9 Raster Timing, System Controller, Video Processor PCBs

All electrical connections to the Raster Timing Generator, System Controller, and Video Processor boards are routed through the backplane board. There are no connectors to remove.

To remove the Raster Timing Generator, Video Processor, or System Controller PCBs (for these PCB locations, refer to Figure 4-9):

1. Turn off power at the remote control and at the circuit breaker on the projector rear panel.
2. Remove the projector rear cover.
3. For the Raster Timing Generator and Video Processor PCBs, grasp the card extractor tabs at both ends of the boards and pull out. To remove the System Controller Board, use a small, screwdriver and remove the screw in the bracket in the center of the System Controller Board (this bracket holds the SCB to the card cage). Grasp the bracket and pull out the SCB.
4. When replacing boards, verify that power is off at the circuit breaker, the power plug is disconnected and there are no bent pins on any connectors. Make sure the board is properly and securely seated before reapplying power.

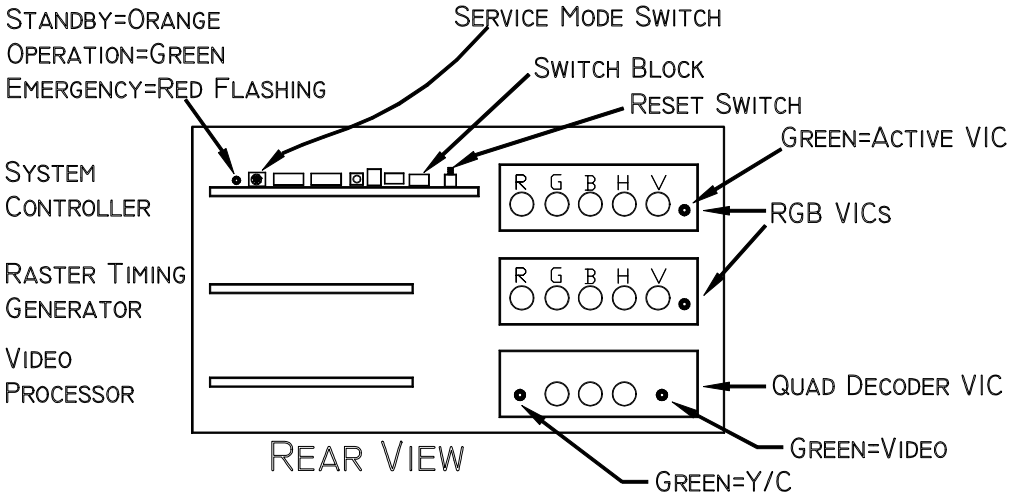


Figure 4-9. Projector rear with cover and rear panel off.

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NOTE: To remove connectors on the printed circuit boards in the sections below, push the connector in slightly, then squeeze the tab and pull the connector out.

4.10 Convergence/Deflection PCB.

The Convergence/Deflection PCB is located on the bottom side of the Electronic Module card cage.

To remove the Convergence/Deflection PCB:

1. Remove the rear cover (*Section 4.2*).
2. Tilt the Electronic Module up. (*Section 3.3*).
3. Disconnect 6 connectors; J31, J32, J33, J38, J39, and J40 from the Convergence/Deflection PCB (*Figure 4-10).* Move the cables out of the way.

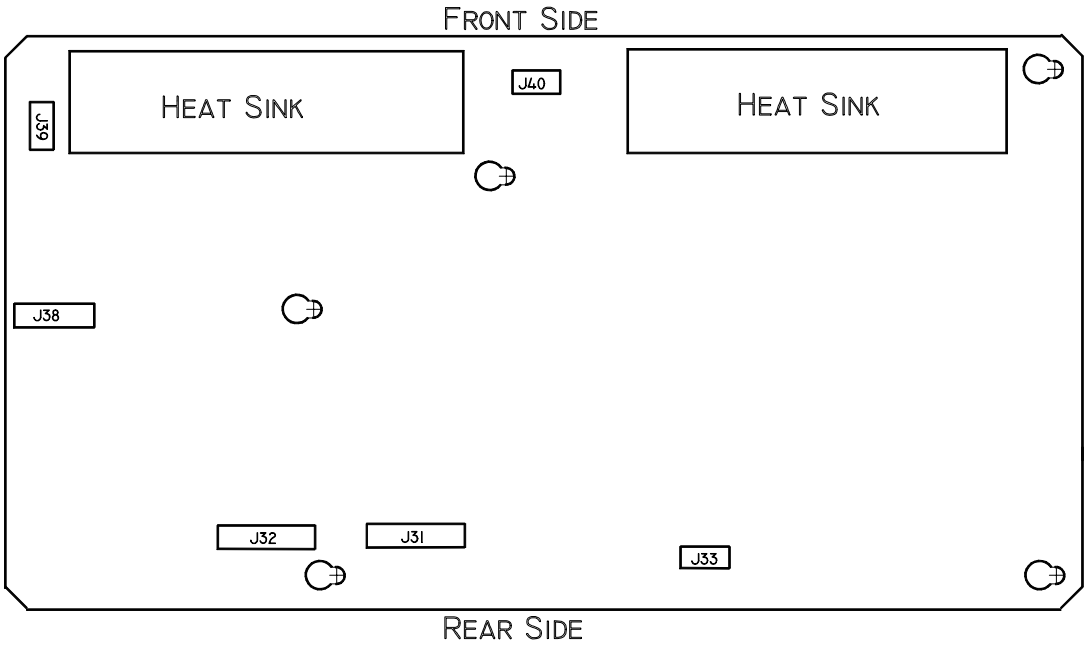


Figure 4-10. Convergence/Deflection PCB.

4. Loosen (not necessary to remove) the 5 screws that secure the Convergence Deflection PCB to the electronic module card cage (Figure 4-10).
5. Remove the Convergence Deflection PCB by sliding it upward so the mounting screws will clear the access holes, then angle the right side outward. **NOTE:** In order to get the right side out, it may be necessary to first move the board out enough to clear the access holes, *then* angle the left side out just enough for the top 2 fins of the heat sync to fit over the electronic module frame lip (this will allow a little more clearance for the right side to be removed), *then* maneuver the right side out.
6. Reinstall the Convergence/Deflection PCB by lowering the right side in first until it clears the electronic module edge, then lowering the left side in.

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NOTE: it may be necessary to fit the top 2 fins of the heat sync over the electronic module frame lip at the left to get enough clearance for the right side to be installed. Carefully fit the board over the mounting screws and slide the board into position. Tighten the screws and reconnect the connectors.

4.11 Horizontal/Vertical Deflection PCB

The Horizontal/Vertical (H/V) Deflection PCB is located in the upper portion of the Electronic Module card cage.

To remove the Horizontal/Vertical (H/V) Deflection PCB:

1. Remove the rear cover (*Section 4.2*).
2. Disconnect 6 connectors; J34, J35, J36, J41, J42, and J43. (*Figure 4-11).* Move the cables out of the way.
3. Loosen (not necessary to remove) the 5 pozidrive screws that secure the H/V Deflection Board to the electronic module cage.
4. Remove the H/V Deflection PCB by sliding it toward the left side of the projector (this is the upward direction if the electronic module is raised up) so that the mounting screws clear the access holes. Then lift the side of the board that is nearest the front of the projector first and angle it upward so that the side closest to the rear clears the lip of the electronic module frame. Be careful when removing or reinstalling the board to avoid gouging it on the fan screws or cable clamps.
5. Reinstall the HV Deflection PCB by lowering the side that is nearest to the rear of the projector in first until it clears the electronic module edge, then lowering the other side. Carefully fit the board over the mounting screws and slide the board into position. Tighten the screws and reconnect the connectors.

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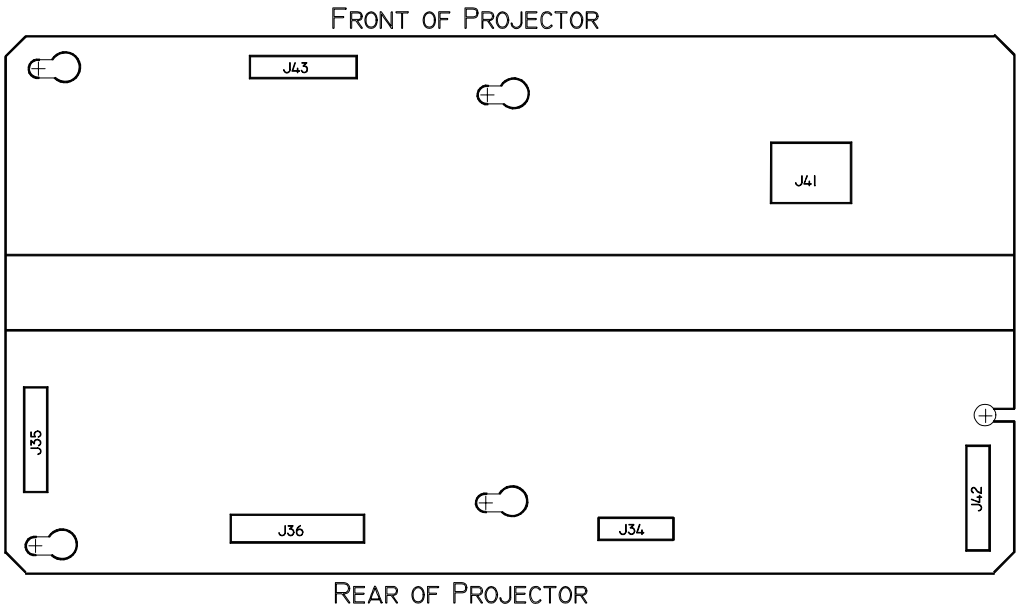


Figure 4-11. Horizontal/Vertical Deflection PCB.

4.12 Video Input Cards (VICs)

Instructions for installing, removing, editing and VIC Settings are covered in Chapter 5 of the Model 230 User's Guide.

4.13 Video Amplifier PCB

The Video Amplifier PCB for the 3 CRTs is located under the Electronic Module, on the bottom frame of the projector behind and under the CRT assemblies.

To remove a Video Amplifier PCB:

1. Remove the front and rear covers (*Section 4.2*).
2. Tilt the Electronic Module up (*Section 3.2*).
3. Loosen the Green CRT Holder Ring (*knurled knob-see Figure 3-8*). *Read the Caution below this step before removing the CRT Holder Ring completely.* **NOTE:** The holder ring should only be hand-tight. If it cannot be removed by hand, a flathead screwdriver can be used in the slots on the CRT Holder Ring (*Figure 3-8*) to help loosen it. Be careful not to let the flathead screwdriver slip out of the slot and possibly damage components. **Do not** use a screwdriver or any other tool to tighten this ring-it should be hand-tight only.

CAUTION! This step is performed with the CRT Socket Connector still connected to the Green CRT and the ground wire still connected from the CRT/Yoke Assembly to the CRT Socket Connector. This is because the Green CRT Socket Connector is close to the rear of the projector and is easier to disconnect from the CRT after the CRT/Yoke Assembly is loose and is moved

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away from the rear of the projector. Use extreme care not to break any of these connections when removing the CRT/Yoke Assembly.

4. Carefully remove the Green CRT/Yoke Assembly by sliding it backward and upward as far as possible before disconnecting the Green CRT Socket Connector from the CRT neck. Use care to avoid bumping the CRT as it is being removed and to avoid breaking any of the wires that connect from the CRT Socket Connector to the Video Amplifier.
5. Move the Green CRT/Yoke Assembly away from the rear of the projector, then disconnect the Green CRT Socket Connector and the ground wire between the CRT/Yoke Assembly and the CRT Socket Connector. **NOTE:** It may be helpful to perform this step with a partner-one person to hold the CRT/Yoke Assembly firmly and the other to remove the CRT Socket Connector and the ground wire.
6. Gently lay the Green CRT Socket Connector on the top of the Video Amplifier PCB.
7. Place the Green CRT Assembly in a safe location on or against one of the other CRT Assemblies.
8. Disconnect the Red and Blue CRT Socket Connectors and gently lay them on the top of the Video Amplifier Board.
9. Disconnect the 3 connectors (push in slightly, squeeze the tabs, and pull out), J67, J68, and J69 from the Video Amplifier PCB)Figure 4-12). Move the cables out of the way.

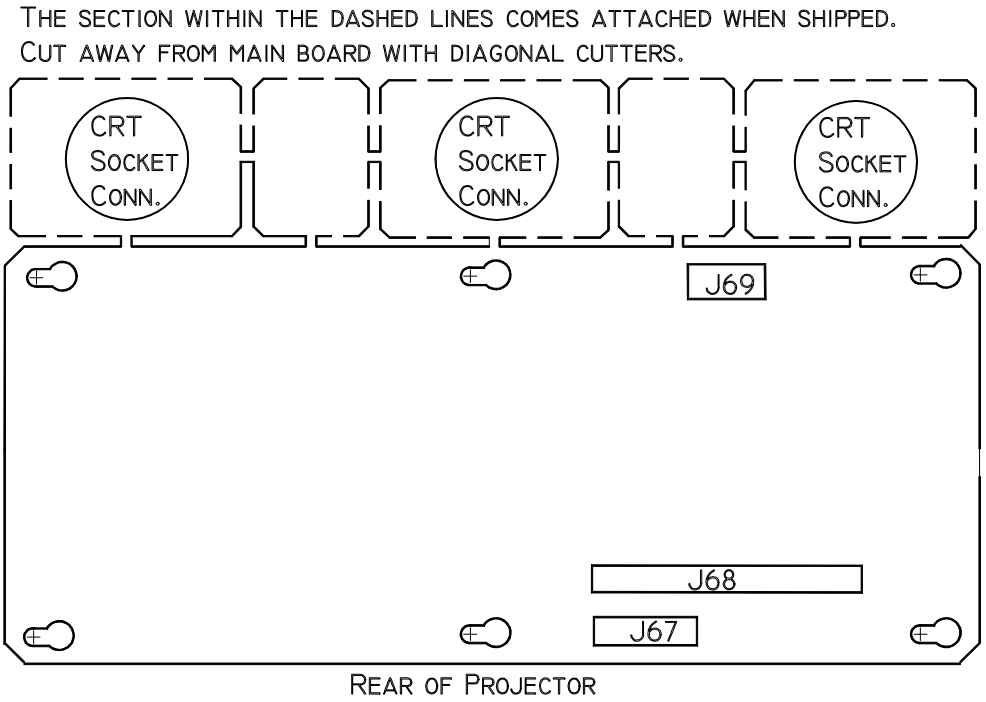


Figure 4-12. Video Amplifier PCB showing breakaway CRT Socket Connectors.

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10. Disconnect the 3 Focus cables that run from the CRT Socket Connectors to the Focus connectors on the HVPS. **NOTE:** Observe that each of the 3 Focus cables (large, red wires that run from each CRT Socket Connector to the Focus connectors on the HVPS) is joined near the CRT by a coupler plug and jack. Disconnect (and label) the focus cables at these couplers.
11. Loosen the 6 pozidrive screws that secure the Video Amplifier PCB to the projector frame.
12. Make sure everything is out of the way, then slide the Video Amplifier PCB toward the left so the mounting screws will clear the access holes and remove the board from the projector.
13. Reinstall in the reverse order from above. **NOTE:** The Video Amplifier PCB is shipped with the 3 CRT Socket Connectors attached at the end in a "breakaway" arrangement (Figure 4-12). Use a pair of diagonal cutters and carefully cut the socket connectors away from the Video Amplifier PCB. The spacers between the CRT Socket Connectors can be discarded.

4.14 Scan Reversal PCB

The Scan Reversal PCB is located on the right side of the Electronic Module.

To remove the Scan Reversal PCB:

1. Remove the projector rear cover.

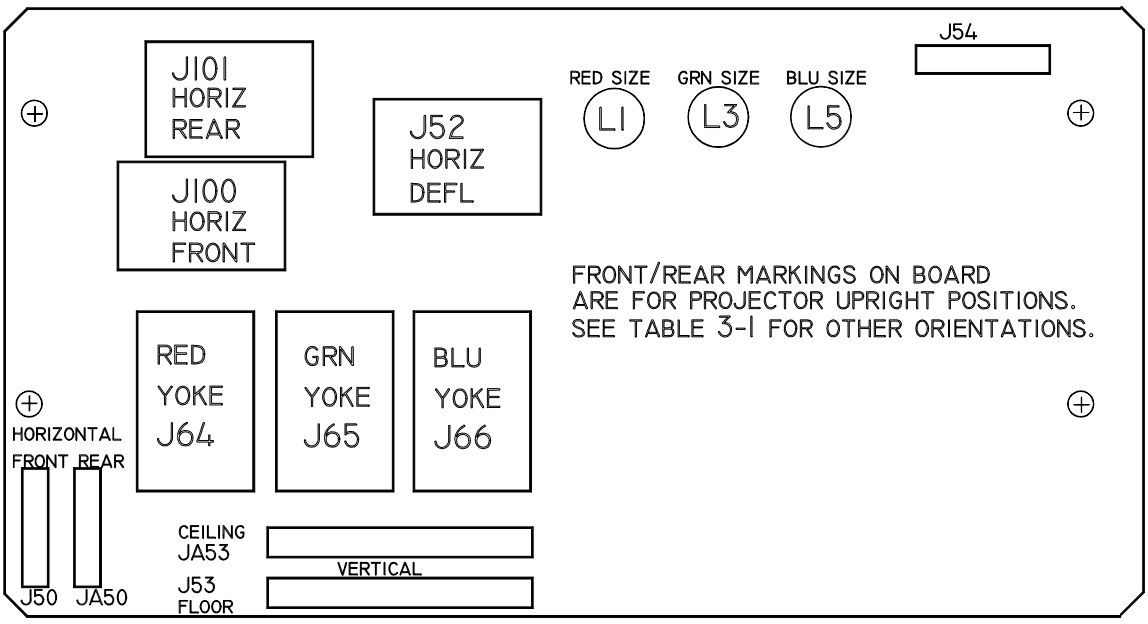


Figure 4-13. Scan Reversal PCB.

2. Disconnect 7 connectors (Figure 4-13); J52, J54, J64, J65, J66, J50 (or J50A), and J100 (or J101). To remove, push in slightly, squeeze the tabs, then pull connector out.
3. Move all cables out of the way.

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4. Remove the 4 pozidrive screws (*Figure 4-13*) and lift the board out.
5. Reinstall in the reverse order from above.

4.15 CRT/Yoke Assembly

WARNING!!! The CRT/Yoke Assemblies should be handled with extreme caution. If dropped they can implode and flying glass can cause severe injury to personnel. Be careful not to bump or drop the CRT. Place in a safe area immediately after removal.

Three CRT/Yoke Assemblies are located in the CRT Assembly area below the card cage. To remove a CRT/Yoke Assembly (refer to Figure 4-14):

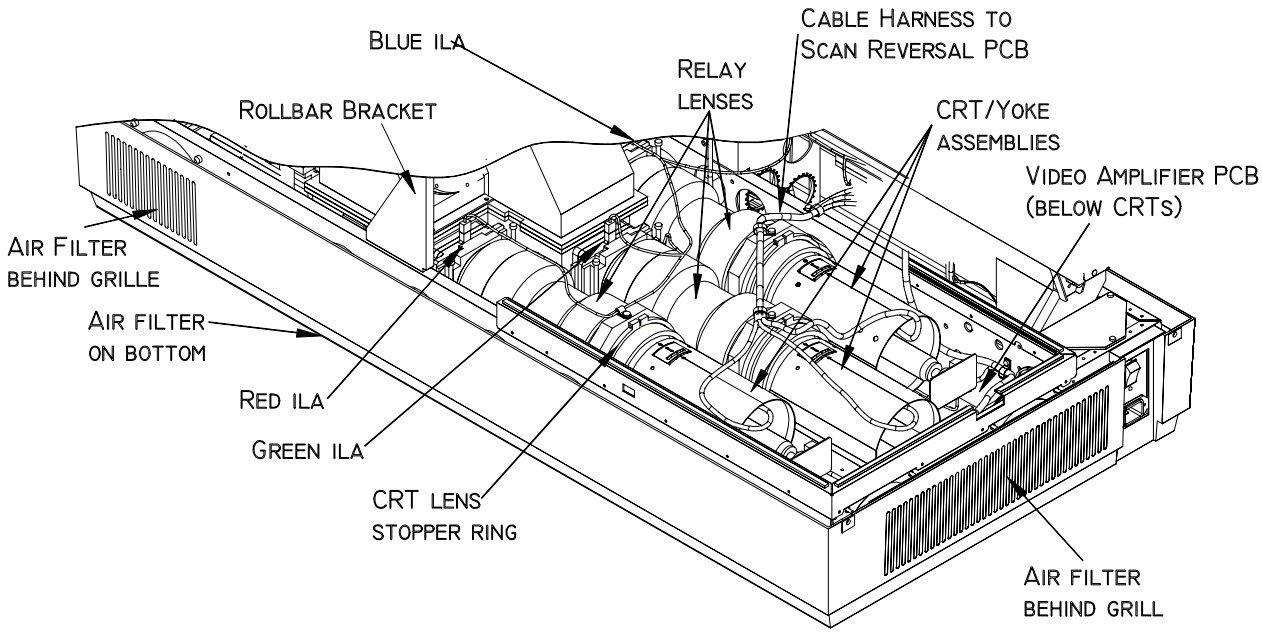


Figure 4-14. View of CRTs, Relay lenses and **ILA®** Assemblies.

1. Remove front and rear covers (*Section 4.2*).
2. Tilt the Electronic Module up and lock it in place (*Section 3-2*).
3. Remove the two pozidrive screws from the top of the High Voltage Power Supply (HVPS) cover (*Figure 4-7)* and remove the one screw at the bottom of the cover and loosen the two screws at the top of the cover.
4. Remove the CRT anode cable (for the CRT that is to be replaced) from the HVPS.
5. Disconnect the Yoke plug and cable harness from the Scan Reversal PCB for the appropriate CRT (*see Figure 4-13*).

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6. Remove the wires from the cable clamp for the CRT/Yoke Assembly that is being removed.
7. Loosen the CRT Holder Ring (*knurled knob in Figure 3-8*). **NOTE:** The CRT Holder Ring should be only hand-tight. If it cannot be removed by hand only, a flathead screwdriver can be used in the slots on the CRT Holder Ring to help loosen it. **Do not** use a tool of any kind to tighten this ring-it should be hand tight only.
8. **CAUTION!** *For the Green CRT/Yoke Assembly only, this step is best performed with the Green CRT still connected to the CRT socket connector and the ground wire still connected from the CRT to the socket connector. This is because the Green socket connector is close to the rear of the projector and is easier to disconnect from the CRT after the CRT/Yoke Assembly is loose and is moved away from the rear. Be careful not to break any of these connections.*

   Gently remove the CRT/Yoke Assembly by sliding it backward and upward as far as possible before unplugging the CRT socket connector from the neck. Use caution to avoid bumping the CRT/Yoke Assembly as it is being removed.
9. After removing the CRT/Yoke Assembly, carefully unplug the CRT socket connector and the ground wire that connects the CRT to the socket connector. **NOTE:** It may be helpful to have another person assisting for step 9. One person can unplug the CRT socket connector and ground wire, while the other person holds the CRT/Yoke Assembly firmly.
10. After verifying that all cables are out of the way, remove the CRT/Yoke Assembly from the projector.
11. Reinstall the CRT/Yoke Assembly in the reverse order. **NOTE:** When reinstalling the CRT/Yoke Assembly, plug the CRT ground wire into the CRT Socket Connector first, then partially plug in the Green socket connector into the CRT. When the CRT is completely installed it will be easier to fully insert the CRT into the socket connector.
12. Perform a CRT Mechanical focus adjustment (*Section 3.4*) and CRT Rotation (*Section 3.5*) after replacing the CRT/Yoke Assembly. Check the CRT Mechanical Focus on the other two colors to verify that they are still correct. It is possible the other focus adjustments could have been disturbed by the removal and replacement of the CRT/Yoke Assembly.

4.16 ILA® Assembly

To remove an **ILA®** Assembly:

1. Remove the rear cover (*Section 4.2*).
2. Tilt up the Electronic Module (*Section 3-2).*

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3. Disconnect the connector on the top of the appropriate **ILA®** assembly. (*Figure 4-14*).

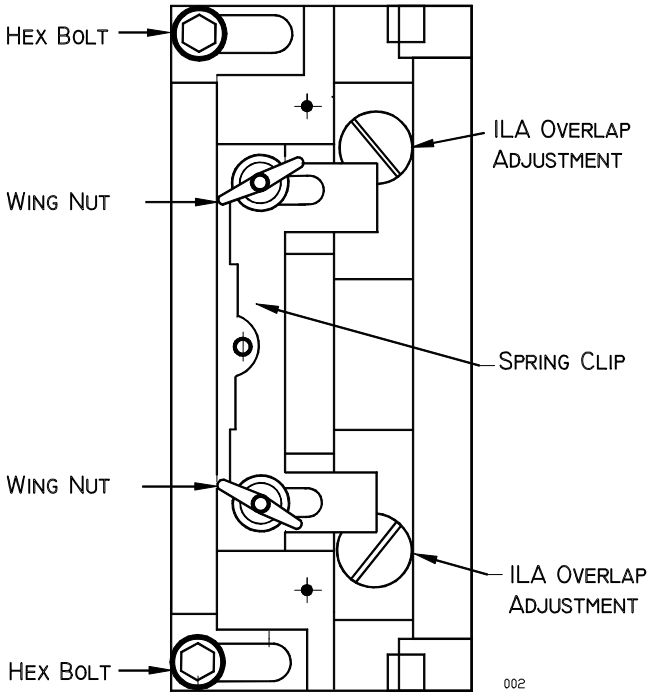


Figure 4-15. ILA® Assembly top view. The overlap screws shown are visible after the ILA® assembly is removed.

4. Loosen the two wingnuts at the top of the appropriate **ILA®** assembly (*Figure 4-15*).
5. Slide the spring clip at the top of the **ILA®** assembly backward (*Figure 4-15*). This will free the **ILA®** assembly.
6. Grasp the **ILA®** assembly by its housing and slide it out.
7. Replace the **ILA®** in the reverse order from above.
8. Recheck the **ILA®** Back Focus (*Section 3.3*) and the **ILA®** Overlap adjustment (*Section 3.7*).
9. Recheck convergence, shading, **ILA®** bias and G2 and readjust, if necessary (*User's Guide, Chapter 5*).

4.17 Relay Lens

To remove a Relay Lens (*refer to Figure 4-14*):

1. Remove the rear cover (*Section 4.2*).
2. Tilt up the Electronic Module (*Section 3.2*)
3. Remove the corresponding CRT Assembly behind the Relay Lens that is to be removed (*refer to Section 4.15*).

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4. Loosen the CRT Lens Stopper Ring (the thin collar just in front of the CRT Holder knurled ring-Figure 4-14) and slide it off the back of the Relay Lens.
5. Loosen the wing nut on top of the Relay Lens mount (the bracket at the rear of the Relay Lens).
6. Remove the 2 long hex bolts at the front of the Relay Lens (*shown in Figure 4-15*).
7. Remove the 2 hex bolts at the rear of the Relay Lens (these bolts are level with the *bottom* of the Relay Lens and hold the bracket in place).
8. Remove the Relay Lens. Leave the Relay Lens Bracket and the CRT Lens Stopper Ring in the projector-do not send them back with the Relay Lens.
9. Replace the Relay Lens in reverse order from above.

4.18 Projection Lens

To remove the Projection Lens:

1. Remove the sponge cover from around the front of the Projection Lens.
2. Disconnect and label the Projection Lens Focus and Zoom motor cables (The Focus motor is at the top of the Projection Lens. The Zoom motor is at the bottom.)
3. Loosen (do not remove) the Lens holding screw at the right side (*Figure 4-16*) of the Projection Lens.
4. Rotate the Projection Lens left or right so that the notch on the lens clears the holding screw on the lens holder (Figure 4-16). **CAUTION!** The lens can fall out now! Carefully slide the lens out.

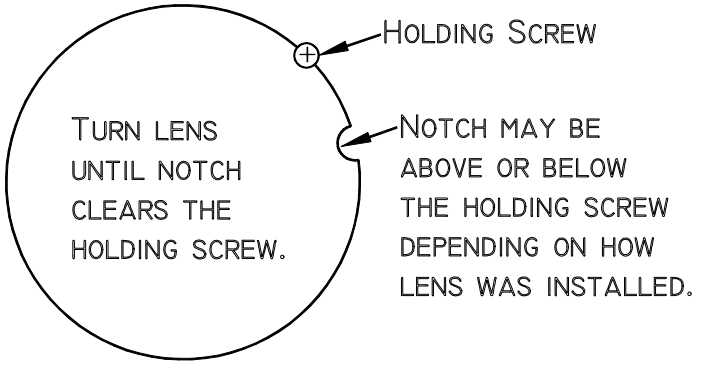


Figure 4-16. Projection Lens holding screw and removal notch.

5. Replace the Projection Lens in reverse order. **NOTE:** The same basic procedure above is used to install or remove optional fixed lenses.

NOTE: When changing from a zoom to a fixed lens, or vice versa, the **ILA®** Back Focus (*Section 3.3*) may need readjustment.

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4.19 Prism Assembly



CAUTION! The removal of the Prism Assembly requires removing the Dichroic Mirror Assembly (X-Plate). In most cases this necessitates an optical realignment. **HJT does not recommend performing this replacement in the field.** Optical alignment is critical and requires projector power to be on. This results in an additional safety hazard due to the high intensity light beam emanating from the optical area with the optical cover off. If removal and replacement is absolutely necessary, proceed with extreme caution and wear proper safety glasses as outlined in the section on safety at the front of this manual.

The Prism Assembly requires removing more components and assemblies than any other assembly. Be sure to have storage cabinets or tables to house the items as they are removed to provide access to the Prism Assembly. Allow 2-4 hours to perform the removal and replacement of the Prism Assembly. *Refer to Figures 4-1 and 4-14 for assemblies referenced in this procedure.*

To remove the Prism Assembly:

1. Remove front and rear covers (*Section 4.2*).
2. Remove the Dichroic Shield (3 screws).
3. Remove the lower right side panel (5 screws).
4. Remove the Arc Lamp Assembly (Section 4.4).
5. Remove the Ignitor Assembly (Section 4.5).
5. Remove the Dichroic Mirror assembly by removing the remaining hex bolts (Figure 4-17). Use care when lifting the mirror assembly. Place it in a safe, level storage area.
6. Remove the 2 hex bolts from the front of the Prism assembly (*Figure 4-17*).
7. Remove the Rollbar assembly (2 pozidrive bolts/nuts on left side and two nuts on right side). Disconnect and label the 2 connectors on the hinge assembly for the shutter motors (1 in front and 1 in rear). Remove and label the jumper that connects the front interlock switch to the rear interlock switch.
8. Remove the Rollbar Bracket that was holding up the left side of the Rollbar assembly.
9. Remove the 3 **ILA®** asssemblies (*Section 4.16*).

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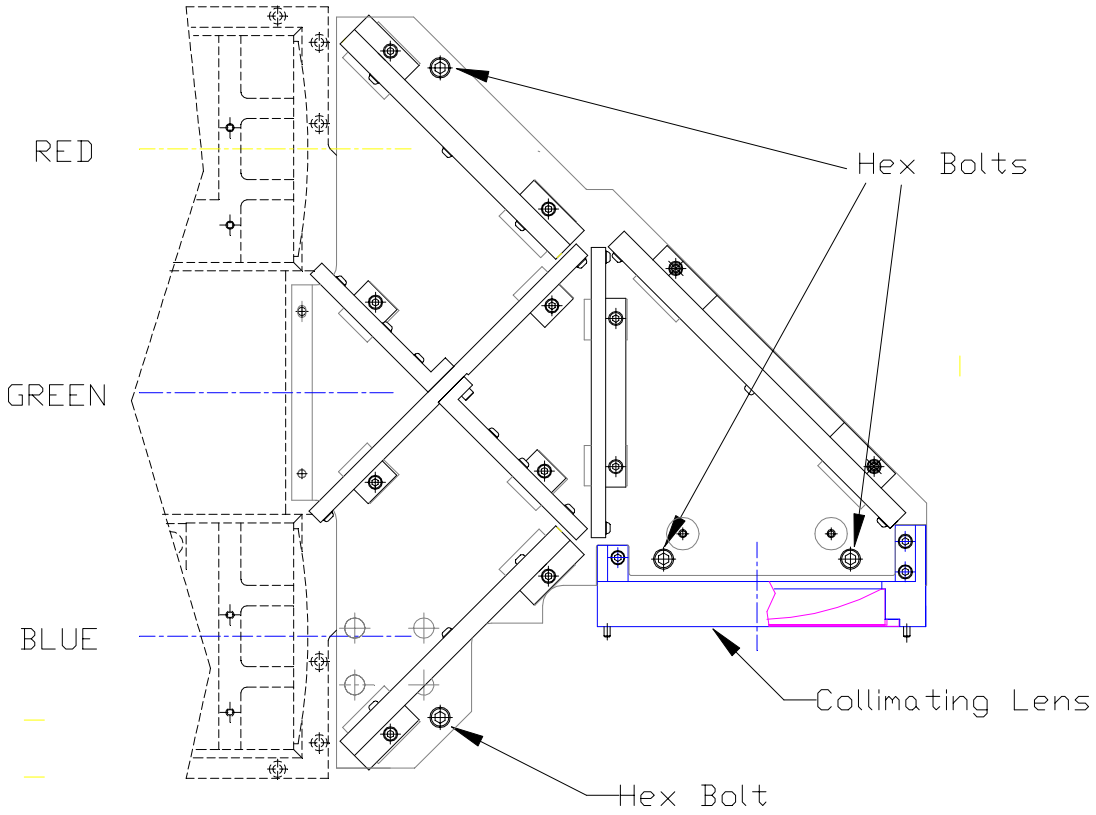


Figure 4-17. Dichroic Mirror Assembly.

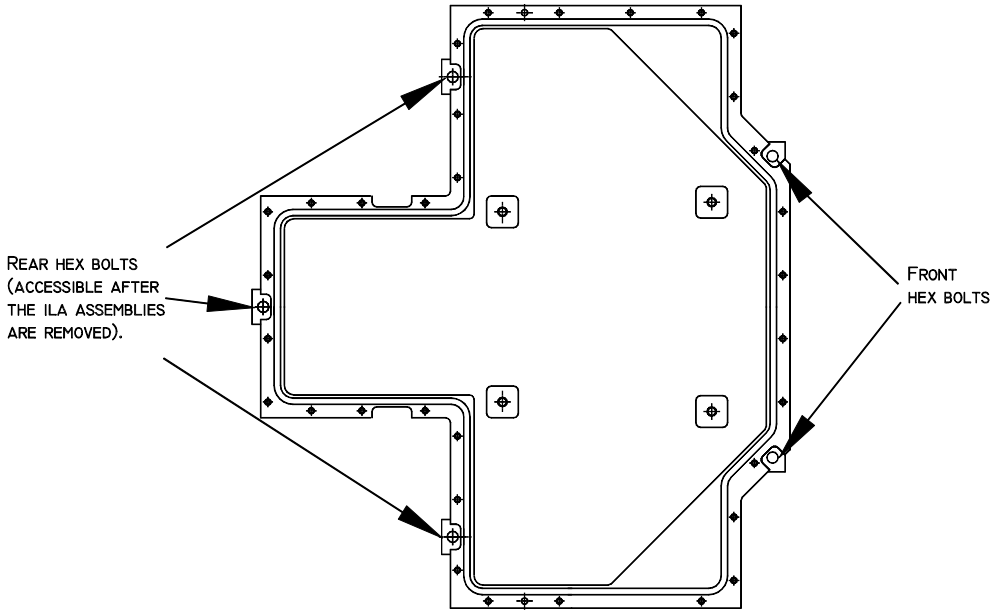


Figure 4-18. Prism Assembly mount.

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10. Remove the remaining three hex bolts from the rear of the Prism assembly. These screws are located in the cavities where the **ILA®** assemblies were removed.
11. The Prism is now free to be removed.



CAUTION! The Prism assembly is heavy (about 70 lbs). Use two people to lift it out of the projector.

12. Replace the Prism assembly in the reverse order.

4-20 Recommended Spares

It may be advisable to maintain a supply of spares for the projector to maximize performance. This is particularly important when projectors are being operated on a continuous basis or when multiple projectors are needed. Table 4-1, below, provides a list of the spares that HJT recommends for one to four projectors.

Table 4-1. Recommended minimum spares

PART NO.	DESCRIPTION	QUANTITY
102583	PCA Horiz/Vert Deflection	1
102581	PCA Conv/Defl	1
105232	PCA Video Amplifier	1
105234	PCA Video Processor	1
104678	PCA System Controller	1
102589	PCA Raster Timing Gen.	1
102585	PCA Scan Reversal	1
104413	PCA Graphics Enhancer VIC	1
102520	System Power Supply	1
102566	High Voltage Power Supply	1
104787	Arc Lamp Module	1-4

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5.0 Troubleshooting

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5.1 Status LEDs

The illustrations below indicate where various LEDs are located that indicate proper or improper operation of the System Controller, the Raster Timing Generator, the Video Processor Board, the Scan Reversal Board, the Convergence/Deflection Board, the Video Amplifier Board, the Low Voltage Power Supply, and the High Voltage Power Supply.

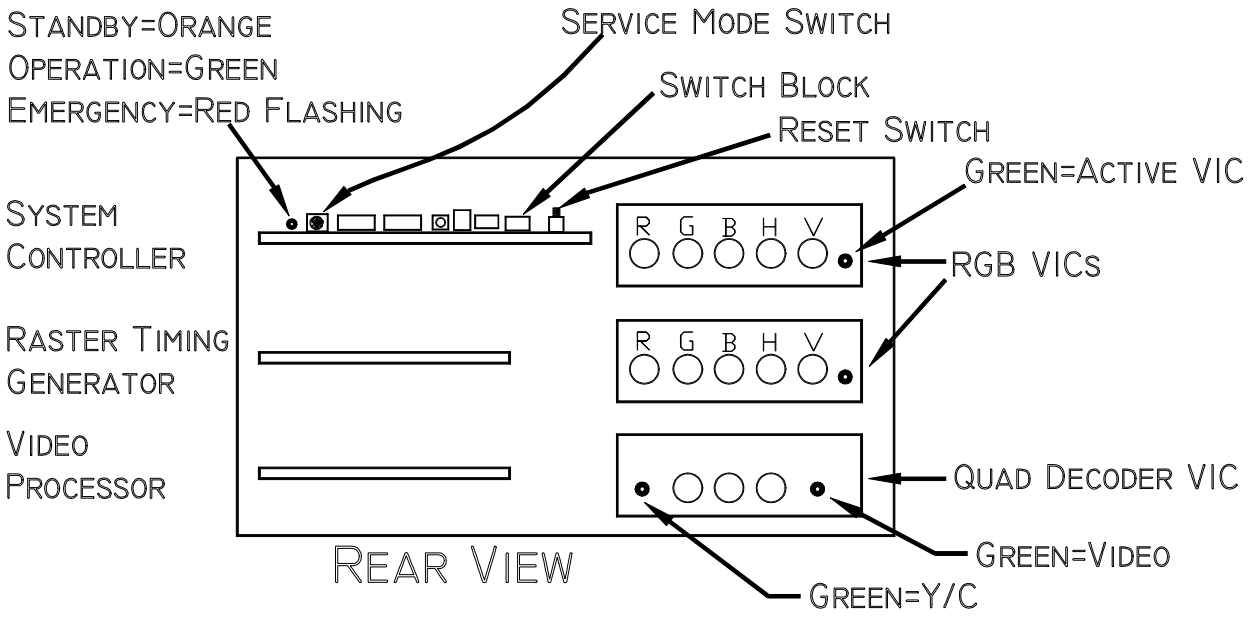


Figure 5-1. Projector rear with cover and rear panel off.

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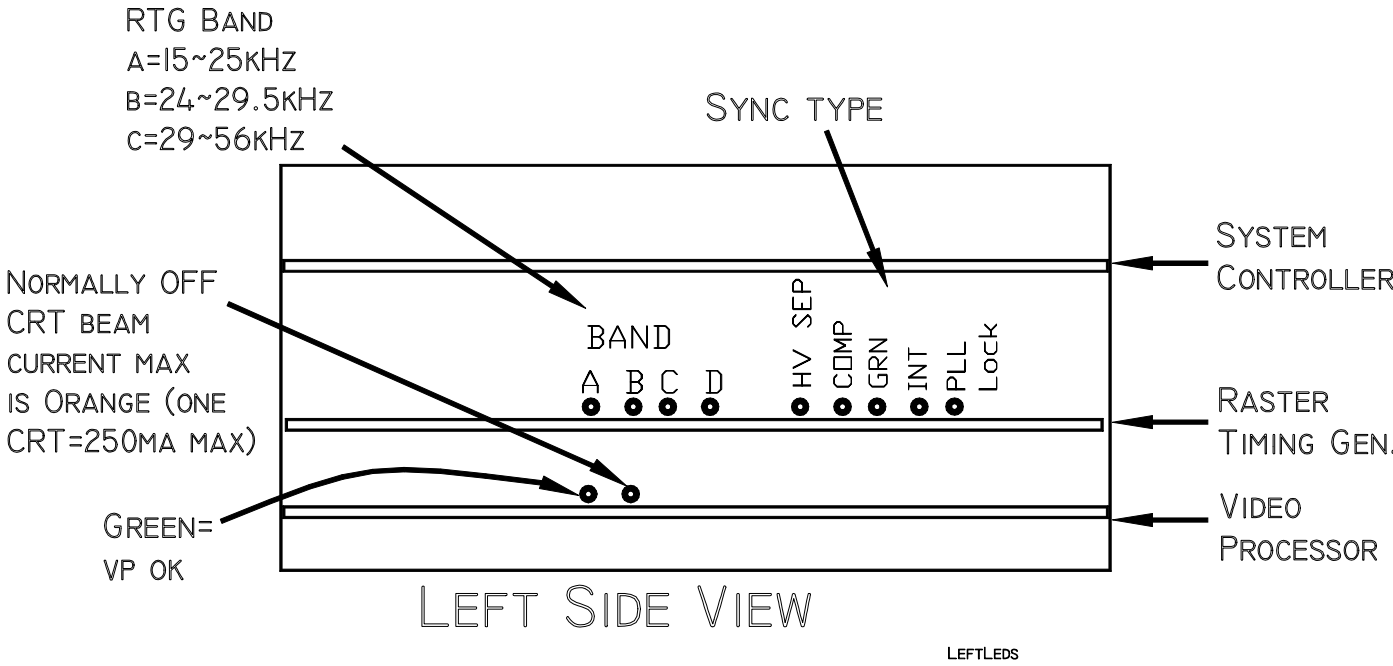


Figure 5-2. Left side of projector with rear cover off.

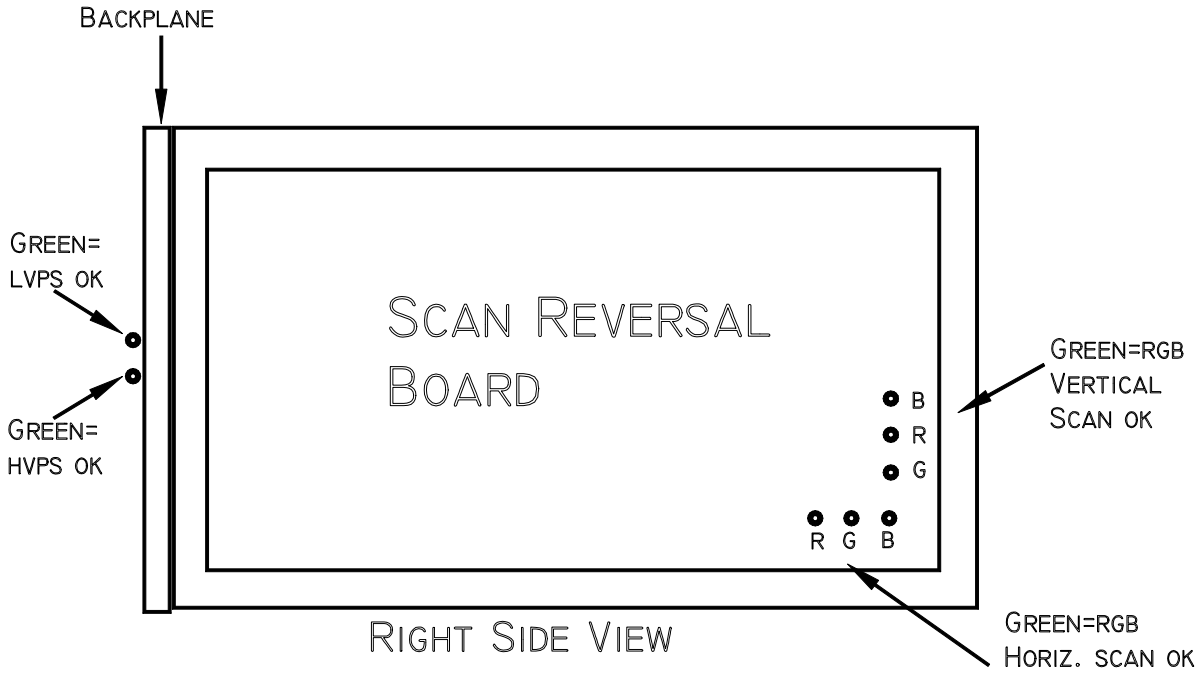


Figure 5-3. Right Side of projector with rear cover off.

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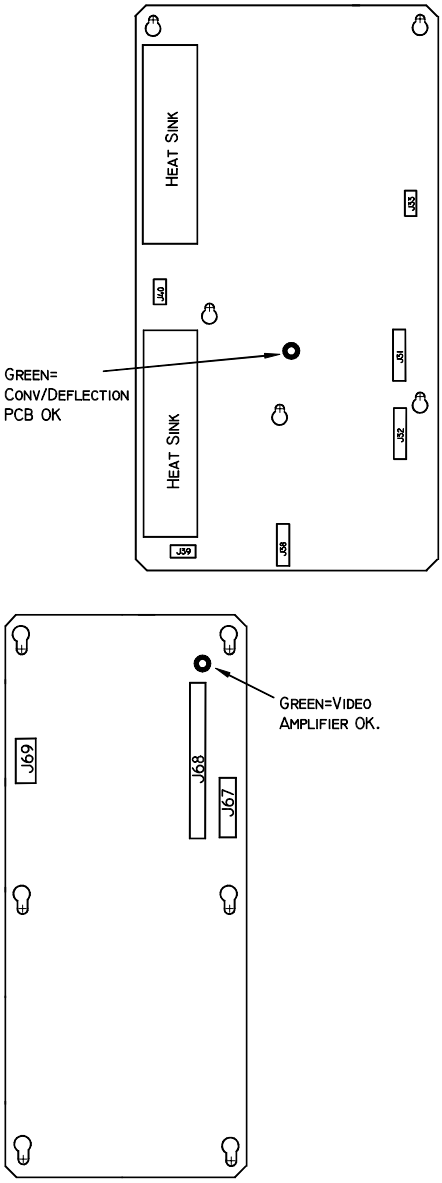


Figure 5-4. Convergence/Deflection and Video Amplifier LEDs.

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5.2 Error Codes

For certain errors that may occur in the Model 230 Projector the software provides error codes that are helpful in determining the nature of the problem. These error codes can be seen on the left side of the monitor screen when using a PC connected to Port A or Port B.

Table 5-1. Error Categories:

Category Number	Error category	Description
1	CEXEC	Operating System.
2	FLASH HW	Flash Memory HW driver.
3	IIC HANDLER	IIC Handler for Convergence/Deflection PCB, Horizontal/Vertical Deflection PCB, Raster Timing Generator PCB, Video Amplifier PCB, Video Processor PCB.
4	POWER ON/OFF	Power On Sequencing.
5	FLASH MANAGER	Flash Memory Data Manager.
6	VIDEO SWITCHER	EXTRON or JVC Video Switcher Handler.
7	ANSI OUTPUT	Ansi Output Display process.
8	UI CHAN/SRC	User Interface VIC Configuration Handler for Channel/SRC Data.
9	VIDEO INPUT CARD	VIC Card Handler.
10	HARDWARE	Misc HW (shutters, etc.).

The error codes listed in Table 5-2 describe problems associated with software (Version 0.9.8) and hardware while the projector is operating. The first column of the table lists the error number code that appears on the PC screen. The second column describes the on-screen text. The third column provides a description of the problem and any other pertinent information.

Table 5-2. Error Codes.

Error Number	On-screen text	Description
1.5	“Invalid read/wrt”	Software error-mismatch. Open mode vs. Write or Read command.
1.12	“Ser parity error”	Serial Port Parity error-not currently used.
1.13	“Bad dev I/O oper”	Software error-invalid I/O request.
1.27	“Timeout on Read”	Software error-unexpected timeout

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Error Number	On-screen text	Description
		on Read.
1.34	“No mem available”	Software error-no heap available for memory allocation.
2.1	“Invalid Sector”	Software error-invalid Flash sector number.
2.2	“Write Timeout”	Flash Memory Write Failure.
2.3	“Erase Timeout”	Flash Memory Erase Sector Failure.
2.4	“Verify Error”	Flash Memory Write Verify Failure.
NOTE: Category 3 error codes may occur when power is interrupted by opening the cover interlock switches or during power brown-outs.		
3.1	“Pin Timeout”	IIC Slave HW protocol error-possible on each byte transfer.
3.2	“BB Timeout”	IIC Slave HW protocol error-1st error possible on Read or Write.
3.3	“No Slave Ack”	IIC Slave HW protocol error-missing acknowledgement on byte transfer. NOTE: This error occurs if the slave is missing. During Power On, this error is reported in the POWER category.
4.1	“CD PCA Missing”	“No Slave Ack” on first poll of Convergence/Deflection PCB.
4.2	“CD PCA Not OK”	/CD_OK is high (BAD).
4.3	“”HVD PCA Missing”	“No Slave Ack” status on first poll of Horizontal/Vertical Deflection PCB.
4.4	“HVD PCA Not OK”	HVD_OK is High (BAD)-[/HVD_OK requires RTG Timing.
4.5	“VA PCA Missing”	“No Slave Ack” status on first poll of Video Processor.
4.6	“VA PCA Not OK”	/VA_OK is High (BAD).
4.7	“VP PCA Missing”	“No Slave Ack” status on first poll of VP.
4.8	“VP PCA Not OK”	VP_OK is High (BAD)
4.9	“RTG PCA Missing”	“No Slave Ack” status on first poll of RTG
4.10	“RTG PCA Not OK”	RTG_OK is High (BAD)
4.14	“Lamp Startup”	Lamp Failed to light (/LAMP_LIT_B

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Error Number	On-screen text	Description
		not Low for 3 seconds out of 20 seconds.)
4.15	“Low Voltage PS”	Low Voltage PS failed (/LV_OK_B is High).
4.16	“High Voltage PS”	High Voltage PS failed (/HV_OK_B is High).
4.17	“VIC1 Board Not OK”	/VIC_OK is High (BAD) on VIC Slot 1.
4.18	“VIC 2 Board Not Ok”	/VIC_OK is High (BAD) on VIC Slot 2
4.19	“VIC3 Board Not OK”	/VIC_OK is High (BAD) on VIC Slot 3
4.20	“VIC1 Invalid Type”	Software does not support VIC_ID in Slot 1
4.21	“VIC2 Invalid Type”	Software does not support VIC_ID in Slot 2
4.22	“VIC3 Invalid Type”	Software does not support VIC_ID in Slot 3
4.23	“Shutters Missing”	One or more shutters not installed (BAD)
4.24	"Lamp Start Not On"	/LAMP_OK is high, lamp module not installed, jumper missing, ALPS bad.
No error codes in Category 5 (Flash Manager)		
Most Category 6 error codes indicate RS232 communication errors and apply to Switchers only.		
6.1	“Sync Timeout”	No Header found in data stream - possible baud rate error.
6.2	“No Char Repeat”	Expected data characters to be repeated - failed.
6.3	“Invalid Format”	Data not in Extron or JVC Switcher format.
7.1	“Write Len Error”	Ansi Output to RS232 port was interrupted - incomplete.
8.1	“VIC Slot is empty”	User has selected a Channel - VIC is not present.
8.2	“VIC Type Changed”	User has selected a Channel - VIC type has changed. User may have

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Error Number	On-screen text	Description
		swapped a VIC into an incorrect slot.
8.3	“Interpol Blocked”	Software process error - Interpolation Process not allowed to run by higher priority processes.
9.1	“Quad Dec Not Init”	HW: Quad Decoder failed Startup Sequence.
10.1	“Shutter Stat BAD”	One or more shutters reading wrong status.

One other error may appear on the monitor screen with the statement **“Assertion Failed”** (only if the PC is connected to Port A). This is a very rare but serious error. If it occurs, *copy* the 3 lines that appear on the screen, *note* what occured just prior to this failure, and *call* Hughes-JVC.

5.3. Troubleshooting Guide

Table 5-2 shows some common projector problems, what to check when problems occur, possible solutions and the section in this Service Manual (If User’s Guide contains pertinent information, the appropriate section will be given) that provides some related information on the problem.

Table 5-3. Troubleshooting Guide.

Problem	Check	Possible solution	Section
No Power	Main Circuit Breaker on Projector rear panel.	Reset Circuit Breaker.	
	Main Circuit Breaker fails when reset.	Verify input power is correct. Replace defective Low Voltage Power Supply or Arc Lamp Power Supply.	4.5 and 4.6
	Power Interlock Switch	Test switch operation. If defective, replace switch.	
	Projector cover not enabling interlock switch?	Reposition projector cover.	4.2
No Picture	Correct channel input & VIC selected?	Select correct channel and VIC.	User’s Guide 4.6
	Arc Lamp turned off.	Restart projector.	User’s Guide 4.3.
	System power turned off.	Restart projector.	User’s Guide 4.3.
	Signal source	Verify signal source is turned on and properly connected.	User’s Guide 3.5.

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Problem	Check	Possible solution	Section
	HIDE command invoked?	Unhide image with the HIDE key on the remote.	
	One color is missing.	Turn on the missing color with the HIDE key.	
	No image or raster on one CRT.	Replace defective CRT or Video Amplifier Board.	4.15, 4.13
Arc Lamp	Arc Lamp will not light. Clicking noise is heard when projector is turned on.	Replace worn out Arc Lamp.	4.4
	Clicking noise not audible when projector is turned on.	LVPS, ALPS, or Ignitor faulty. Replace LVPS, ALPS, or Ignitor.	4.6, 4.5, 4.4
	Arc Lamp ignites but will not stay lit.	Replace defective Ignitor.	4.4
Arc Lamp	Brightness flicker or picture is very dim.	Arc Lamp may have too many hours of usage. Replace Arc Lamp.	4.4
Image out of focus	Spacer balls not visible.	Perform the Projection Lens Focus procedure.	User's Guide 5.5.15
	ILA® "spacer balls" are visible but the image is fuzzy.	Perform the CRT Mechanical Focus procedure.	3.5
	CRT focus range is limited and the image is fuzzy.	Adjust the Electronic focus.	5.6
	CRT focus in not effective.	Ensure the **ILA®** assembly is installed correctly.	4.16
	Image blurry with shadow on right edge.	Replace **ILA®** assembly.	4.16
	Characters do not appear legible.	Replace **ILA®** assembly.	4.16
	CRT focus problem is limited to one color.	Replace CRT.	4.15
	Sensitivity Offset is set too high.	Reset Sensitivity Offset.	User's Guide 5.9.2
Picture Geometry	Picture not centered or sized correctly.	Repeat the Blanking, Phase, Size, and Centering procedures.	User's Guide 5.4.3, 5.4.4, 5.5.1, 5.5.2.
	Picture "wraparound" at left or right edge.	Readjust Blanking and Phase.	User's Guide 5.4.3,

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Problem	Check	Possible solution	Section
			5.4.4.
	Retrace lines on raster.	Adjust TOP Blanking.	User's Guide 5.4.3.
	Image not squared.	Check Geometry and readjust if necessary.	User's Guide 5.5.3, through 5.5.10.
	Image bowed at left/right edge or top/bottom.	Check Bow, Pincushion Balance, and Pincushion adjustments.	User's Guide 5.5.3, 5.5.4, 5.5.10.
	Picture Linearity.	Readjust Horizontal, Vertical, or Edge Linearity.	User's Guide 5.5.7, 5.5.8.
XY Convergence	Linearity is different between colors. Unable to converge.	Yoke not properly set on CRT. Perform CRT Rotation procedure.	3.6
	Horizontal size is different between colors.	Adjust horizontal coils on Scan Reversal Board.	3.10
	Vertical size is different between colors.	Adjust vertical size pots on Horizontal/Vertical Deflection board.	3.10
XY Convergence	Not enough range in Red or Blue XY convergence.	Adjust Red or Blue CENTERING to match Green.	5.5.11
Picture Color Balance	Red, Green, or Blue is missing in the image.	**ILA®** assembly bias voltage is incorrect or there is no signal-replace Video Amplifier Board.	4.13
	Red, Green, or Blue lacks color.	Replace **ILA®** assembly or Video Amplifier Board.	4.16, 4.13
	Grey scale test pattern is correct but image color is incorrect.	Readjust Contrast.	User's Guide 5.11.2
	Black image is overdriven.	Adjust Threshold, Black level, and Brightness.	User's Guide 5.10.2, 5.9.1, 5.11.1.
	Bright Red, Green, or Blue area on screen	Adjust **ILA®** bias and shading.	User's Guide 5.7,

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Problem	Check	Possible solution	Section
	limited to corners or edge.		5.10
	Grey scale is Green in bright areas.	Subtract Green Sensitivity Offset and add Red and Blue.	User's Guide 5.9.2
	Grey scale is Red in bright areas.	Subtract Red Sensitivity Offset and add Green and Blue.	User's Guide 5.9.2
	Grey scale is Blue in bright areas.	Subtract Blue Sensitivity Offset and add Green and Red.	User's Guide 5.9.2
Picture-Various Problems	Out of focus, blurry area on image limited to Red, Green, or Blue.	Clean oily spot off CRT, Prism, or Projection Lens.	3.12
	Small, dark line or dot in Red, Green, or Blue image.	Scratch in optics or CRT burn. Replace CRT.	4.15.
	Bubbles in Red, Green, or Blue image.	Replace affected **ILA®** assembly.	4.16.
	Image ghost in picture.	Replace burn-in CRT or **ILA®** assembly	4.15, 4.16
	Reversed ghost image on screen.	If projecting through glass, prevent light from reflecting back into the lens.	
	Picture lacks depth of field.	Adjust Contrast or Brightness.	User's Guide 5.11.2, 5.11.1
Picture-Various Problems	Image jitter and noise.	Replace Video Processor Board.	4.8
	Image jitter present at one source only.	Replace Raster Timing Generator.	4.8
	Image is not level.	Level the projector or rotate the CRT Yoke.	3.6
	"Flagwaving" at top of picture or top of image is skewed.	VTR mode checked in Timing menu. Deselect VTR mode.	User's Guide 4.9 {4.Timing (5) }.
	Black line appears on the screen.	Loss of fluid in Prism. Replace Prism.	4.18
No Response when using Tether cable on the Remote.	Possible defective tether cable. Terminal port not set up correctly.	Replace tether cable. Select "Tethered Remote and correct baud rate from menu.	

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Problem	Check	Possible solution	Section
No Response when using IR remote.	Intermittent operation.	Replace remote battery or move closer to the projector. Stay in the “Line of sight” of the projector IR Receiver.	
New Software won't load properly	Switch position 4 on switch block on System Controller board is in incorrect position.	Switch position 4 on System Controller switch block sets the speed for Port A. This speed is reported in the Comm Setup menu for Port A. Switch position 4 must be in the UP position for a baud speed of 19200 and DOWN for 9600 baud.	See menu under Comm Setup, Section 4.5 of User Guide, Figure 5-1 of this manual, and Appendix B, page B-1, of this manual.

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6.0 Parts List

Description	Part no.
Arc Lamp Module	104787
Cathode Ray Tube (CRT)	103465
Contrast Enhancer	104247
CRT/Yoke Assembly	103350
Ignitor Assembly, 1600W (Ignitor & Laser P.S.)	104781
ILA®, SM Moving 3 x 4 Video (High Contrast) Add for Blue -14, for Green -15, for Red -16.	102630
ILA®, SM Moving 3 x 4 Video (Reduced Aperture) Add for Blue -14, for Green -15, for Red -16.	100594
Lens, Condensing	104805
Lens, Relay	103943
Manual, Operation (User's Guide)	104810
Manual, Service	104809
PCA Convergence Deflection	105210
PCA Horizontal/Vertical Deflection	102583
PCA Raster Timing Generator	102589
PCA System Controller	104678
PCA Video Amplifier	105232
PCA Video Processor	105234
PCA, Backplane	102595
PCA, Graphics Enhancer RGB VIC	104413
PCA, RGBHV VIC	102597
PCA, HDTV VIC (Option)	103765
PCA, Quad RGB Input VIC (Option)	103668
PCA, Quad Standard Decoder VIC (Option)	103545
PCA, Scan Reversal	102585

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DESCRIPTION	PART NO.
Power Cord (USA)	104769
Power Cord (Japan)	104498
Power Cord (Europe)	104768
Power Supply, Arc Lamp	104495
Power Supply, High Voltage	102566
Power Supply, Low Voltage	102520
Prism Assembly	103942
Projection Lens, 1:1, Fixed	104130
Projection Lens, 1.5:1, Fixed	104003
Projection Lens, 3:1, Fixed	103052
Projection Lens, 7:1, Fixed	104522
Projection Lens, Zoom	103746
Remote Control, Standard	104348
Remote Control, Technician	104019
Remote Control, Tethered Technician	105245
Yoke Assembly, CRT	103467

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Model 230 Configuration Data Export / Import Procedure

Rev 1.0.0

This appendix defines the steps to perform a Configuration Data Export & Import from the Model 230 projector to a Host Computer. The Host Computer can be any system that has RS232 download and upload capability, including an IBM-PC compatible, an Apple MacIntosh, or a UNIX system. This paper describes the procedures for an IBM-PC running the Windows 3.1 OS. We will use the Windows "TERMINAL" application for communication with the projector. Other Terminal emulation programs can be used (ProComm, .), but all testing has been done with the TERMINAL application.

Note 1: The TERMINAL application setup is the same as for controlling the projector via an ANSI TERMINAL (see Model 230 User's Guide, Section 4.11).

Note 2: Export/Import can be performed on either Port A or Port B. The Port must be configured for ANSI Terminal. Port A speed is determined by DIP SWITCH #4 on the System Controller board. DOWN is 9600 baud, UP is 19200 Baud. Port B can be configured for 2400, 9600 (default), or 19200 through the Comm Setup Menu. If both Port A and Port B are ANSI Terminals, PORT A must be used for Export/Import, so to use Port B, set Port A Device = None or Switcher, Port B Device = ANSI.

Remember to Power Off (Control+P) and HW RESET (Push RESET button -*figure 5-1 in Service Manual*- or Circuit Breaker-*on rear panel*) after changing any configuration parameters.

WARNING: If you use 19200 Baud, your computer must have a 16550 UART installed on the Comm Port. An unbuffered 8550 UART will lose data during EXPORT. This data loss cannot be detected until a later IMPORT is attempted. Use 9600 if you are not sure. In all cases use SOFTWARE FLOW CONTROL (XON/XOFF).

WARNING: Laptop computer users must disable Advance Power Management (APM) during an Export. APM power pulling causes loss of data.

EXPORT

1. Make sure the Windows TERMINAL program is configured for SOFTWARE FLOW CONTROL (XON/XOFF). A corrupt Export file will result if SW flow control is not used.
2. Choose the directory and filename for saving the Export Data. The Windows TERMINAL: *Transfers: Receive Text File...* dialog box will default to the c:\windows directory and no file. Create a directory (like \TEMP) (or have an existing one in mind) before starting the export process.
3. Model 230 Menu: **`7. System + 5. Maintenance + 5. Export`**

```
================================
|     Export Configuration     |
| Start RECEIVE TEXT Download  |
| to Host on Serial PORT A     |
|                              |
|      <ENTER> to Continue     |
|       < ESC> to Cancel       |
================================
```

4. Windows TERMINAL: ***Transfers* + *Receive Text File...***.

   4.1. Directories - set directory to desired download directory (C:\TEMP)

   4.2. File Name: - Type desired File Name (for example: export1.txt)

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4.3. Select ***OK*** with mouse or press ***Enter*** key (dialog will be removed)

4.4. Verify TERMINAL screen shows status line at bottom:
Stop, Pause, Bytes: 0, Receiving: EXPORT1.TXT

5. Model 230 Menu:

Press **ENTER** key to start export download. NOTE: Some VT100 Emulator programs (ProComm) will send the ENTER automatically when step 4.3 above is performed. Expect 10 minutes to export 20 sources (500,000 bytes) at 9600 baud).

Data Transfer will begin and continue until all source, channel, channel-source combination, and system data has been exported. The following dialog is displayed on the projector screen during the transfer.

```
================================
|    Export Configuration      |
|  EXPORT IN PROGRESS ... wait |
| - Press ESC to Abort         |
================================
```

The following message is sent at the end of the export data.

```
##########################
# Export Complete        #
# STOP Host Download Now #
# Then, Press ESC        #
##########################
.END
```

A similar message is displayed on the projector screen :

```
================================
|    Export Configuration      |
| EXPORT COMPLETE              |
| -> STOP Host Download        |
| -> THEN Press ESC            |
================================
```

6. Windows TERMINAL:

Select the Windows TERMINAL ***STOP*** button with the mouse to end the *Receive Text File...* transfer.

7. Model 230 Menu:

Press **Esc** to exit the projector Export operation and return to the Maintenance Menu.

IMPORT

1. Know the directory and filename for uploading the Import Data. The Windows TERMINAL: *Transfers: Send Text File...* dialog box will default to the C:\windows directory which contains several *.txt files - SETUP.TXT is NOT a Projector EXPORT file!

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2. Import will alter all projector setup data. Prior to starting, several warnings are displayed to prevent unintentional loss of setup data.

3. Model 230 Menu: **`7. System + 5. Maintenance + 6. Import`**

```
================================
|          WARNING             |
|  Importing New Configuration |
|  ALL SETUP DATA WILL BE      |
|  CHANGED!                    |
|  ________________________    |
|      <ENTER> to Continue     |
|       < ESC> to Cancel       |
================================
```

4. Press **ENTER** to continue with the Import.

```
================================
|    Import Configuration      |
|  Old Configuration will be   |
|  restored if import is Aborted |
|  ________________________    |
|      <ENTER> to Continue     |
|       < ESC> to Cancel       |
================================
```

5. Press **ENTER** to continue with the Import.

```
================================
|    Import Configuration      |
|  Start SEND TEXT Upload from |
|  Host on Serial PORT A       |
|  -To Abort:                  |
|  ->Stop Host Upload,         |
|  ->THEN Press ESC to Abort   |
================================
```

6. Windows TERMINAL: ***Transfers*** + ***Send Text File...***.

   6.1. Directories - set directory to desired upload directory (C:\TEMP)

   6.2. File Name: - Type desired File Name (for example: import1.txt)

   6.3. Select ***OK*** with mouse or press ***Enter*** key (upload begins)

   6.4. Verify TERMINAL screen shows status line at bottom:
   Stop, Pause, "% complete bar", Sending: EXPORT1.TXT

6.5 Data transfer will continue until complete or an arror occurs or the User Aborts:
Expect 10 minutes to import 20 sources (500,000 bytes) at 9600 baud.

6.6 At successful end, TERMINAL will remove the bottom line.

7. Model 230 Menu:

When the projector detects the successful end of the transfer the following screen is displayed:

```
================================
|    Import Configuration      |
|  IMPORT COMPLETE             |
|  New Configuration is active |
```


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```
|                                 |
| - Press ESC to Continue         |
===================================
```

Press ESC to exit the projector Import operation and return to the Maintenance Menu. There is a 10 second pause before the screen is redrawn.

8. USER ABORT:

Windows TERMINAL: **FIRST** press STOP to end the Host Upload transfer.

Model 230 Menu: **THEN** press **ESC** to abort the projector Import operation.

```
===================================
|     Import Failed               |
|  IMPORT ABORTED BY USER         |
|    Old Data was Restored.       |
| - STOP Host SEND DATA,          |
|   THEN Press ESC                |
===================================
```

FINALLY, press **ESC** to exit the projector Import operation and return to the Maintenance Menu. There is a 10 second pause before the screen is redrawn.

9. DATA TRANSFER ERROR (Example)

Model 230 Menu will display:

```
===================================
|     Import Failed               |
|  Bad EXPORT File Format         |
|   Old Data was Restored.        |
| -> STOP Host SEND DATA,         |
| -> THEN Press ESC               |
===================================
```

9.1. Windows TERMINAL: **FIRST** press STOP to end the Host Upload transfer.

9.2. Model 230 Menu: **THEN** press **ESC** to exit the projector Import operation and return to the Maintenance Menu. There is a 10 second pause before the screen is redrawn.

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Glossary Of Terms

Amorphous	Without definite form; not crystallized.
Arc Lamp	The xenon arc lamp in the Model 230 projector. It operates at high temperatures (160° to 200°) and produces dangerously intensive light with hazardous levels of ultraviolet and infrared radiation.
Aspect Ratio	The ratio of the picture width to picture height. The standard U.S. television aspect ratio is four units wide to three units high (4:3). High Definition Television (HDTV) is 16:9.
Bandwidth	The transmission or reception capacity of a computer or communications channel measured in bits per second in digital and in Hertz in communications. Bandwidth is the difference between the lowest and highest frequencies transmitted or received. Wider bandwidth provides more information or picture detail capability.
Chrominance	Abbreviated as "C." Color information signal or signals.
Cold Mirror	Mirror that absorbs infrared light so that its reflection contains only "cold' light that does not transmit appreciable heat. As a result of this absorption of infrared heat radiation, "cold" mirrors get quite hot.
CRT (Cathode Ray Tube)	The vacuum tube used as a display screen in video terminals or television sets. Commonly called the picture tube.
Dichroic Mirrors	The white light of the xenon arc lamp is separated into red, green and blue by means of *dichroic mirrors* which reflect only one color and pass all others.
Field	One half of a complete video frame. Odd lines in one field and even lines in another make up one frame.

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Frame	One complete TV picture or screen of information. It is composed of two fields and has a total of 525 scanning lines in NTSC transmission.
Horizontal Scan Reversal Jumper	Reverses the image projection for front or rear projection. Located on the Horizontal Deflection Board.
Horizontal Size Coils	Adjusting coils on the Scan Reversal Board. Used to adjust the horizontal size (width).
Hot Spot	The Arc Lamp's brightest area on the screen. Used to align and focus the Arc Lamp.
Hue	Also referred to as tint. A specific color such a blue, pink or aqua. Hue or tint control on a display device adjusts red/green balance.
Ignitor	Provides a momentary high voltage to excite the gases in the Xenon Arc Lamp to ignite.
Image Light Amplifier ILA®	A device that uses low-intensity images to phase modulate a high-intensity light through a liquid crystal layer. It is a key component in producing very bright, high resolution images from Hughes-JVC large-screen projectors.
Image Mirror	Directs the blue and red images toward the Combining Prism.
Interlacing	The technique that refreshes a display screen by alternately displaying all the odd lines (field one) and then all the even lines (field two) of one frame.
I/R Windows	The Model 230 Projector has two I/R windows, one in front, one in back. These windows receive projector control signals from the I/R remotes.
Lamphouse Dock	The housing that contains the Ignitor, the Laser Power Supply, and the Arc Lamp assembly.
Laser Power Supply	Provides boost voltage through a spark gap to the Ignitor.
Lumen	A unit of measure of the flow, or rate of emission, of light. An ordinary wax candle generates 13 lumens while a 100 watt bulb generates 1,200 lumens.

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Luminance	Abbreviated as "Y." The portion of the signal that contains the black and white information, which affects brightness.
Noise	An undesirable electrical interference of a signal.
Overscanning	Displaying less than the complete area of an image to a viewer (i.e., scanning beyond the visible area). All TV sets are overscanned at least slightly, so that viewers do not see blanking.
Raster	The area illuminated by the scan lines on a CRT.
Resolution	The degree of sharpness of a displayed or printed character or image; the amount of detail in a picture. On a display screen, resolution is expressed as the number of horizontal dots (columns) by the number of vertical lines (rows). For example, a 680 x 400 resolution means 680 dots across each of 400 lines.
Retrace	The blanked-out line traced by the scanning beam of a picture tube as it travels from the end of any horizontal line to the beginning of either the next horizontal line or field. The beam is turned "off" during retrace.
RGB (Red, Green, Blue)	Refers to the method of recording and generating colors in a video system. On a television or color monitor, colors are displayed as varying intensities of red, green and blue dots. When red, green and blue are all turned on high, white is produced. When all dots are turned off, the base color of the screen appears.
Rollbar Assembly	Assembly where the front and rear cover are hinged to. Used to hold covers in place.
S-VHS	A high band video recording process for VHS that increases picture quality and resolution capability. S-VHS tape machines use a special output terminal which allows separate output of luminance (Y) and chrominance (C) picture information to monitors equipped with S-Video inputs.
S-Video	A video signal that has the luminance (Y) information separated from chrominance (C) information.

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Saturated Color	1) A color as far from white, black or gray as it can be (i.e., vermilion rather than pink). 2) A display misadjustment that results in unnaturally bright colors.
Scan	To scan is to move across a picture frame a line at a time, either to detect the image, as in an analog or digital camera, or to refresh a CRT-based video screen.
Scan Line	One of many horizontal lines in a graphics frame.
Scan Rate	The frequency of line scanning for a monitor or projector.
Synchronization	Also called "sync" for short. Working together. At the same time, horizontal and vertical sync signals from the signal source control the monitor's scan circuits to properly time the lines and frames of a picture.
Technician Remote	Remote control used during Model 230 setup and adjustment. Alternative to Standard Remote. Provides access to many of the setup functions by direct keys instead of by menu maneuvering.
Throw	Distance to the screen from the projector.
Underscan	Decrease raster size H and V so that all four edges of the picture are visible on the display.
Vertical Height Pots	Potentiometers located on the Horizontal/Vertical Deflection Board. Used to adjust Vertical height.
Vertical Resolution	The amount of detail that can be perceived in the vertical direction; the maximum number of alternating white and black horizontal lines that can be counted from the top of the picture to the bottom.
Vertical Scan Frequency (V-Freq)	The vertical scan frequency of the input signal.
Vertical Scan Reversal Jumper	Reverses the image vertically for use with ceiling displays or mirror-bounced displays. Located on the Scan Reversal Board.
Vertical Synchronization Frequency	The number of times per second a frame is transmitted to a video display screen.
Xenon Arc Lamp	See Arc Lamp.

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