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Display Systems

MCP2000

OPERATION AND MAINTENANCE MANUAL

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About This Book

Introduction

This document provides operation and maintenance instructions for the *VDC Display Systems Projector* (MCP2000). This document does not provide instructions for the image generation system, host computer, or other components of the visual system. See the appropriate manuals for this information.

Document Structure

This document contains seven chapters and three appendices.

- Chapter 1, *System Overview*, provides an overview of the MCP2000 projector system.
- Chapter 2, *Installation*, provides instructions for unpacking, installing, and performing the initial power on and setup.
- Chapter 3, *Operation*, provides operating instructions that describe functional controls and indicators for the various components of the MCP2000 projector system. Procedures for normal startup, shutdown, and emergency shutdown are also included.
- Chapter 4, *Alignment Procedures*, provides the alignment procedures for the MCP2000 projector system.
- Chapter 5, *Auto-Alignment System Operation*, provides operating instructions for the auto-alignment system.
- Chapter 6, *Maintenance*, provides maintenance information and procedures for the MCP2000. It also includes scheduled maintenance, corrective procedures, and subassembly replacement procedures.
- Chapter 7, *Troubleshooting*, provides troubleshooting information.

- Appendix A, *DCPC Hardware Configuration*, provides hardware configuration information.
- Appendix B, *Connecting a VT Terminal to the Projector*, describes how to connect a VT terminal to the projector.
- Appendix C, *Optional Laptop or On-Board PC*, describes how to connect a laptop PC to the system for use in the cockpit.

Safety Summary

WARNING:

THE SERVICING OF THIS DEVICE REQUIRES TRAINED TECHNICAL PERSONNEL FAMILIAR WITH THE HAZARDS ASSOCIATED WITH THE SERVICING OF ELECTRONIC EQUIPMENT.

Safety Precautions

This device, its components, and the peripheral equipment use hazardous voltages and currents. In order to avoid injuring service personnel or damaging equipment, you must understand and follow these procedures.

1. Whenever possible, disconnect the power before you service the equipment.
2. Discharge the *cathode ray tubes* (CRTs) before you attempt to remove them.
3. While working alone, never service high-voltage devices under power.
4. If you work with or near high voltages, you must be familiar with methods of resuscitation.

Dangers, Warnings, and Cautions, and Notes

The following headings appear throughout this manual.

DANGER: Indicates an imminently hazardous situation that, if not avoided, *will* result in death or serious injury. This signal word is limited to the most extreme situations.

WARNING: Indicates a potentially hazardous situation that, if not avoided, *could* result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, *may* result in minor or moderate injury. A caution also alerts you to unsafe practices and indicates possible danger to equipment or software.

NOTE: This heading calls your attention to useful data or actions that, if you observe them, will improve performance, understanding, or both.

Electrostatic Discharge Control

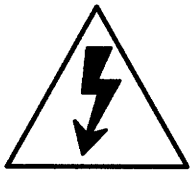
This device contains parts and assemblies that are sensitive to damage by *electrostatic discharge* (ESD). Thus you must use ESD procedures whenever you touch, remove, or insert cards or assemblies. All maintenance personnel should be familiar with these maintenance procedures and use an ESD device for all servicing operations.

Electromagnetic Interference

This device complies with electromagnetic emission limits for conducted and radiated emission, specified by the *International Special Committee on Radio Interference* (CISPR) Publication 22.

Safety Labels

The symbols shown below are typical of the safety labels found on VDCDS equipment.



WARNING–HIGH VOLTAGE



PROTECTIVE (SAFETY) GROUND TERMINAL



ATTENTION

918545–000 AB

Related Documents

These documents, some of which are referred to in this manual, may provide additional information. To purchase any of these documents not included in your order, contact your *VDC Display Systems* (VDCDS) sales representative.

MCP2000 Projector Auto-Alignment System Operation and Maintenance Manual
VDC Display Systems 902101-189

MCP2000 Projector Engineering Drawings and Associated Lists
VDC Display Systems 902100-691

ESIG-XXXX Image Generator Operation and Maintenance Manual
A separate manual exists for each image generator in the ESIG-XXXX family. These manuals explain the installation, operation, and maintenance of the *image generator* (IG).

ESIG-3000 Test Pattern User's Guide
VDC Display Systems 902100-529

Real-Time System Version RTSXX Reference Manual
Part number and revision depend on specific software delivered with systems.

Restoring the Hard Disk on the Calligraphic Projector DCPC Manual
VDC Display Systems 902101-294

Abbreviations and Acronyms

This document uses the international symbols for units in *IEEE Standard Letter Symbols for Units of Measurement.* It also uses these abbreviations and acronyms:

AGC	automatic gain control
AWG	American Wire Gauge
BNC	British Naval Connector
CCD	charge-coupled device
BLIP	bilinear interpolation
CISPR	International Special Committee on Radio Interference
CLI	command line interpreter
CRT	cathode ray tube
DAC	digital-to-analog converter
DCPC	display communications personal computer
DRAM	dynamic RAM
DIMM	dual in-line memory module
EHT	extra high tension (high-voltage supply)
E&S	Evans & Sutherland
ESD	electrostatic discharge
EMI	electromagnetic interference
EPO	emergency power off
ESIG	Evans & Sutherland image generator
FAA	Federal Aviation Administration
FET	field effect transistor
fL	footlambert
FOV	field of view
HHR	hand-held remote
HVPS	high-voltage power supply
IG	image generator
I/O	input/output
LCD	liquid crystal display
LRU	line-replaceable unit
PCMCIA	PC Memory Card International Association
PDS	power distribution system
PP/PBD	phosphor protect/parked-beam detector
RVR	runway visual range
RGB	red, green, blue

TOD	time of day
TTL	transistor-transistor logic
VCO	voltage-controlled oscillator

Document Conventions

This manual uses these conventions:

- Words and characters that you type are in ***`typewriter italics`***; since the program is case sensitive, you must enter them exactly as they appear here.
- Computer prompts and messages that appear on the screen are in the same `typewriter` font, but not italicized.
- Commands that you select on-screen, such as menus and dialog boxes, or buttons/keys that you press, such as, dials, buttons and keys, are in the same **`typewriter font, but bolded`**.
- Commands such as *Help → About* are in *lowercase typewriter italic with initial caps*.
- The names of items such as menus, dialog boxes, dials, buttons, and keys are in the same Lowercase Typewriter font with initial caps, but not italicized.
- Individual keys that you press are enclosed in angle brackets: <Enter> means to press the Enter key; <z> means to press z.
- Combinations of keys that you press simultaneously are enclosed in angle brackets and separated by a solidus: <Shift-F7> means to hold down the Shift key while pressing F7; <Control-[> means to hold down the Control key while pressing [.

MCP2000™
Declaration of Conformity

Application of council directive(s):

73/23/EEC	(17 February 1973)	*Product Safety*
89/336/EEC	(03 May 1989)	*Electromagnetic Compatibility (EMC)* (as amended by 93/68/EEC)

Standard(s) to which conformity is declared:

EN 60950 (1992) *Safety of Information Technology Equipment (Amendment 3)*

- EN 55022 (1994) *Limits and Methods of Measurement of Radio Interference from (Class A) Information Technology Equipment*
- EN 50082-2 (1995) *Generic Immunity Standard – part 2: industrial environment*

Manufacturer's name: Evans & Sutherland

Manufacturer's address: 600 Komas Drive
Salt Lake City, UT, U.S.A. 84108
(801) 588-1000

Type of equipment: Calligraphic Projector

Model number(s): MCP2000™

European contact(s): Evans & Sutherland Ltd.
3 Horsham Gates
North Street, Horsham
West Sussex, RH13 5PJ
England
11+44(0) 1403 211 571

I, the undersigned, hereby declare that the equipment specified above, conforms to the above directive(s) and standard(s).

Salt Lake City, Utah (Place) _____ (Signature)

July, 14, 1998 (Date) Stuart Anderson, General Manager Commercial Simulation (Name/Title)

1 System Overview

1.1 Introduction

This manual explains how to install, operate, troubleshoot, and maintain the MCP2000 projector system.

1.2 MCP2000 Features

The MCP2000 raster/calligraphic projector system is designed for use with multi-channel simulator visual systems requiring bright, high-resolution raster images enhanced with full-color calligraphic lightpoints. The MCP2000 features true digital correction and convergence, raster scan and calligraphic deflection, system protection, and extensive maintenance aids.

1.2.1 Digital Correction

True digital correction and control is the single most important feature of the MCP2000. Rather than summing a set of digitally weighted analog signals (as is done with older correction technologies) the correction functions are computed mathematically in the digital domain, converted to composite correction functions using a D/A converter, and applied to the display parameter. Spline curve splitting algorithms are used to generate the correction functions. Digital correction and control is used for the following display parameters:

- Geometric distortion
- Color convergence
- Edge blending

- Electronic static and dynamic focus
- CRT G2 level
- Black level
- Video intensity

The raster and calligraphic modes use separate correction functions for each color CRT.

1.2.2 Raster Scan/Calligraphic Deflection

The MCP2000 is a calligraphic projector with linear, high-power deflection amplifiers. It can display IG information in a raster scan format and has the ability to enhance the projected image with full-color calligraphic lightpoints. The resolution and brightness of lightpoints are considerably improved when drawn calligraphically. In the calligraphic mode, the IG provides digital address data for the calligraphic lightpoints. In the raster mode, the sweep of each raster line is controlled by the digital *y*-position, and horizontal and vertical synchronization from the IG.

1.2.3 System Protection

The MCP2000 has a robust self-protection system. The protection system includes the following features:

- High-voltage power supply is not enabled until all diagnostic signals are checked and verified to be good.
- Phosphor protect activates instantly upon any critical circuit failure in the MCP2000 or upon the loss of a proper IG input signal.
- Diagnostic reports are available from the display communications personal computer (DCPC) and can be viewed on any terminal connected through the WinTerm or modem.
- CRT beam current limiting protects the CRT from excessive power dissipation.
- Failure of any fan does not cause permanent damage.
- Power supply or main ac line power loss does not cause permanent damage.
- All power supplies are over-current protected.
- An advanced phosphor-protect scheme is based on energy dissipation per unit area of the phosphor.

The design provides several levels of phosphor protection. Beam-spot-high, raster scan failure, chew-out, IG drive failure, and power-supply failure monitoring are the major protection mechanisms. Beam-spot-high circuitry

monitors the beam current during lightpoint unblank to determine if a light is too bright and could be damaging to the phosphor. The raster scan failure circuitry is constantly checking to make sure the beam is moving during the raster scan mode.

If a failure or unsafe operating condition is detected, the MCP2000 immediately goes into phosphor-protect mode. Phosphor-protect mode forces the video driver to instantly zero the CRT beam current.

1.2.4 Maintenance Aids

Various aids are built into the MCP2000 to assist the maintenance technician. The MCP2000 is designed to simplify removal or installation of all assemblies and major parts. It has online monitoring and reporting of critical temperatures and voltages, and runtime diagnostics accessed from the DCPC or a VT100 emulator.

WARNING: The MCP2000 projector head unit and the power supply contain very high voltages. Use extreme caution with the high-voltage anode wire leading from the high-voltage power supply to the CRT anode. To prevent electrical shock, avoid contact with the wire. All service and maintenance personnel must be aware of potentially dangerous high-voltage charges that may remain on the CRT anode *after the system power is turned off*.

1.3 MCP2000 Projector System Specifications

1.3.1 ac Line Power Requirements

The main-line power input must be either:

- 230 ±10% V ac line-to-neutral (one line, one neutral, and one ground), or
- 208 ± 10% V ac line-to-line (two lines and one ground)

The ac frequency must be between 47 Hz and 63 Hz. Incoming power is protected by a circuit breaker and filtered through an ac line filter. Total power is less than 3,500 watts per projector head. The power factor is corrected to be greater than 0.9. Signal ground, power ground, and chassis ground are connected at a single point in the projector head unit.

1.3.2 Input Signals and Termination

The input signals and termination are shown in Table 1-1.

Table 1-1. Input Signals and Termination

Signal Name	Signal Type or Amplitude	Termination
Hsync	TTL	75 ohm
Vsync	TTL	75 ohm
Unblank	TTL	75 ohm
Red Video	0–1 ± 0.25 V	75 ohm
Green Video	0–1 ± 0.25 V	75 ohm
Blue Video	0–1 ± 0.25 V	75 ohm
Defocus	0–1 ± 0.25 V	75 ohm
Taxi +	50-MHz taxi standard	75 ohm
Taxi –	50-MHz taxi standard	75 ohm

Other input signals:

- *PC Memory Card International Association* (PCMCIA) connector a with type 1 interface for data uploading and downloading
- 25-pin D female connectors with RS-232/422 configurable communications connections

1.3.3 Raster/Calligraphic Synchronization

The MCP2000 auto syncs to horizontal raster line rates from 30 to 64 kHz and vertical field rates from 30 Hz to 80 Hz.

The MCP2000 can operate in either of two modes: interlaced or noninterlaced. In the interlaced mode, the first field of raster lines (odd numbered lines) is drawn, followed by the calligraphic lightpoints. Next, the second field of raster lines (even numbered lines) is drawn, followed by the calligraphic lightpoints. In the noninterlaced (progressive raster) mode, all raster lines and calligraphic lightpoints are drawn in each field.

The deflection circuits require no more than 40 microseconds to settle when switching from calligraphic mode to raster mode. When switching from raster mode to calligraphic mode, they require no more than 20-microseconds settling time before the first lightpoint is drawn.

1.3.4 Size

The projector head unit, without lenses, is 34 in × 33 in × 38 in. The three lenses extending from the projector front are each 7 inches in diameter by 10 inches long. The deflection power supply unit is 17 in × 22 in × 6 in.

1.3.5 Weight

The projector head unit weighs no more than 387 lbs (175.5 kg) and the deflection power supply unit weighs approximately 51 lbs (23.1 kg).

1.3.6 Environmental Conditions

The MCP2000 is designed to meet the following environmental conditions. The non-operating conditions are met when the MCP2000 is packed for shipment.

Table 1-2. MCP2000 Environmental Conditions

Operating	15 °C to 30 °C 20 to 80% relative humidity (non-condensing)
Non-operating	–18 °C to +50 °C 0 to 90% relative humidity (non-condensing)

1.4 MCP2000 Projector System Overview

A visual system generally includes the following:

- 3–5 projectors
- DCPC
- WinTerminal PC for remote access (or Wyse WinTerm 2300T on systems delivered before 1999)
- Hand-held remote (HHR) control
- Auto-alignment system (optional)
- Image generator

The IG supplies video, sync, digital deflection, unblank, and defocus signals to the projector head unit. Figure 1-1 is a block diagram of a visual system.

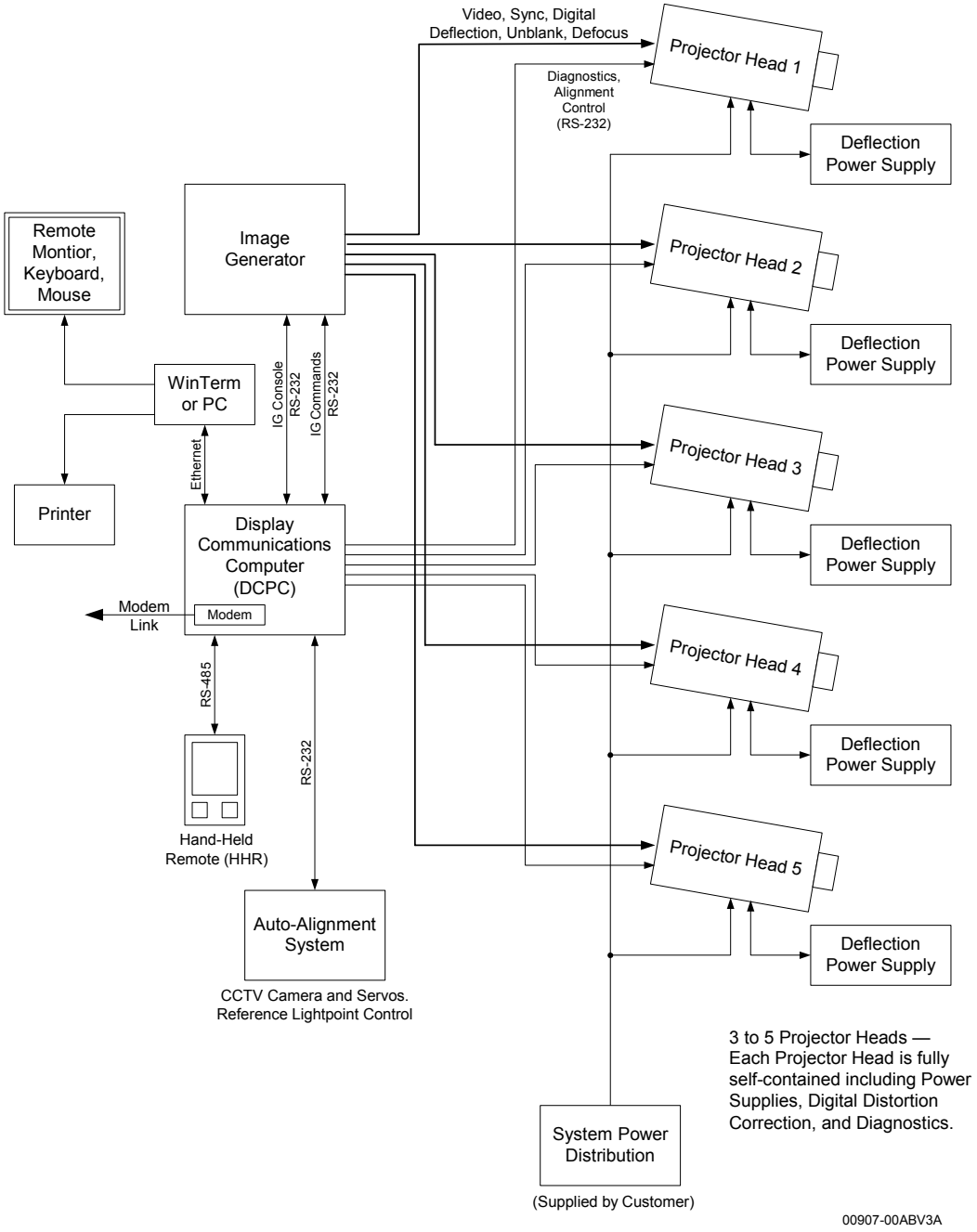


Figure 1-1. Visual System Block Diagram

The MCP2000 raster/calligraphic projector is completely contained in two units: a projector head unit and a deflection power supply unit. The deflection power supply unit is located within two meters of the projector head unit and is connected by three quick-disconnect cables for rapid module replacement. Figure 1-2 shows an MCP2000 projector with the covers on. Figure 1-3 and Figure 1-4 show the deflection amplifiers. Figure 1-5 shows the diagnostics and power distribution card assemblies.

MCP2000 is supported by a DCPC. The DCPC is the communication link between the projector and the external support devices. The DCPC backs up the operational software and the setup data for each projector head unit. It receives, time-stamps, and logs the operational condition and diagnostic reports from each projector head. It receives *time-of-day* (TOD) data from the IG and implements corresponding optimal setup parameters.

The DCPC provides the user interface to the MCP2000 through the monitor, printer, mouse, keyboard, and HHR. The DCPC is typically mounted in an equipment rack on the simulator platform. The DCPC manages the auto-alignment system to automatically correct geometry, focus, edge match, intensity, and color errors that may occur in the image. The bidirectional communication link between the DCPC and the IG enables the DCPC to select alignment test patterns from the IG for manual and automatic setup. Finally, the DCPC contains a modem that enables system managers to logon remotely and control the MCP2000 or access stored data through a WinTerminal PC interface.

The auto-alignment servo camera is housed immediately above the projector heads in the light-tight housing.



Figure 1-2. Front and Rear Views of the MCP2000

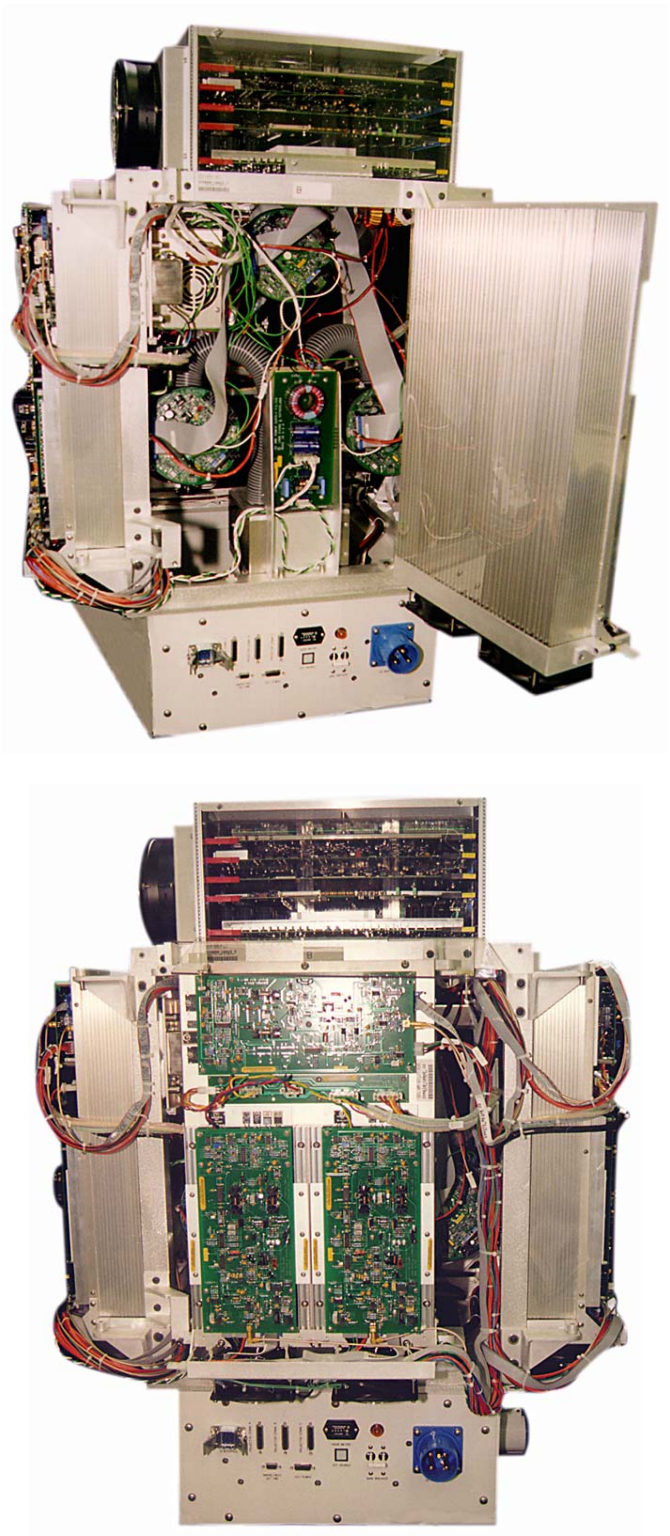


Figure 1-3. Rear View of Deflection Amplifier Door Open and Closed

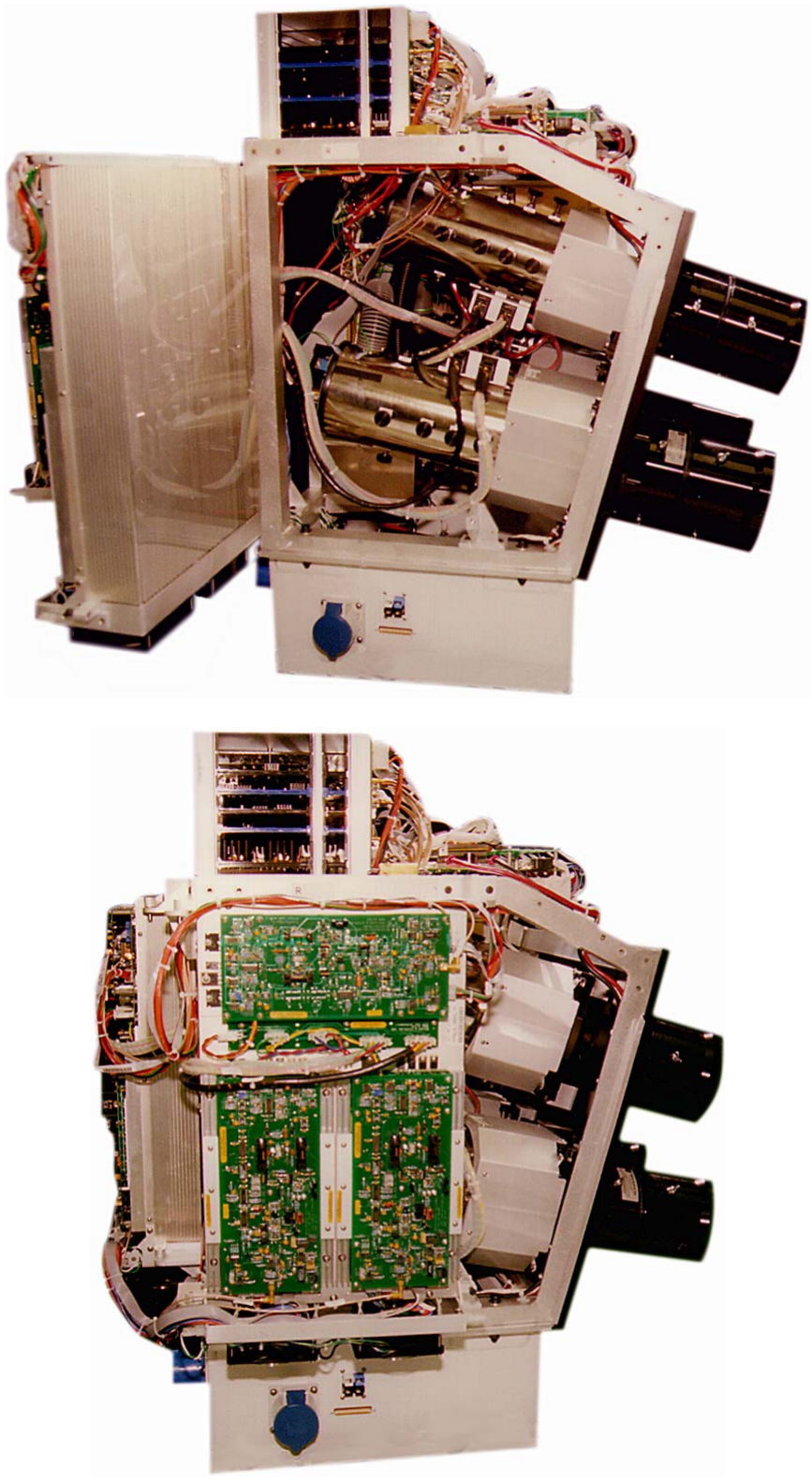


Figure 1-4. Side View of Deflection Amplifier Door Open and Closed

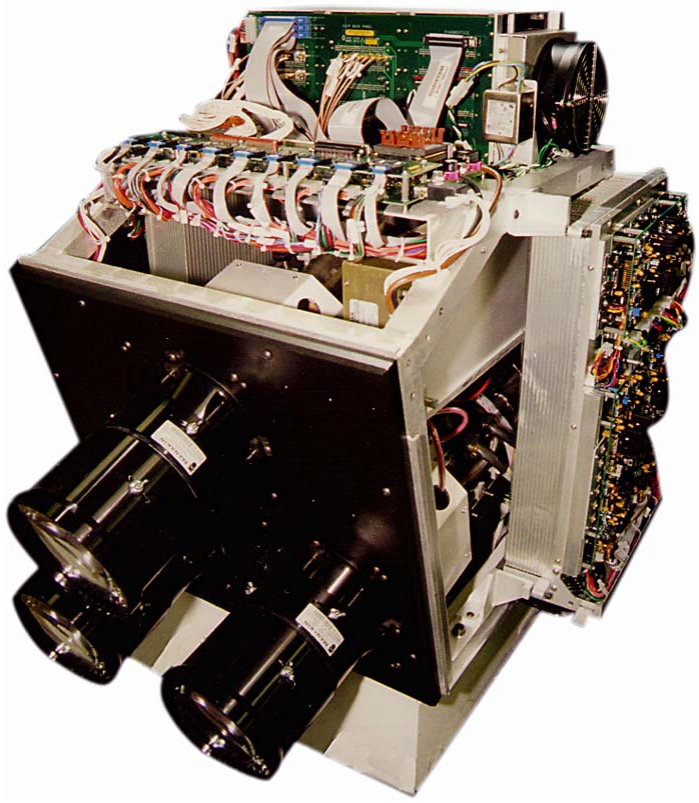


Figure 1-5. Top Angle View of Diagnostics Card and Power Distribution Card Assemblies

1.4.1 Projector Head Unit

Figure 1-6 is a block diagram of the functional components of the MCP2000 projector head unit. Functional components are typically the *line replaceable units* (LRUs). Each LRU is monitored by the runtime diagnostics and, in the event of failure, replaced by the maintenance technician. Cables from the IG, the DCPC, and line power inputs are connected to the input panel using quick-disconnect connectors. Each module is discussed in the following pages.

The MCP2000 projector head unit comprises the following LRUs:

- Three CRT assemblies (red, green, and blue)
- A card rack assembly (backpanel 239580) containing:
  - One processor card (239500)
  - One bilinear interpolator (BLIP) card (239510)
  - One ramp card (239530)
  - One video processor card (239540)
  - One power supply card (239590)
- Three deflection/focus assemblies (239610)

- Three video drivers (239670)
- One deflection diagnostics card (239680)
- One power distribution card (239690)
- One high-voltage power supply (801657)
- One high-voltage distribution block
- One 5 V power supply (415111)
- One 17 V filter card assembly (239550)
- One 5 V VME PS filter card assembly (239560)
- Eight fans (80135)
- One –95 V load resistor (803710)

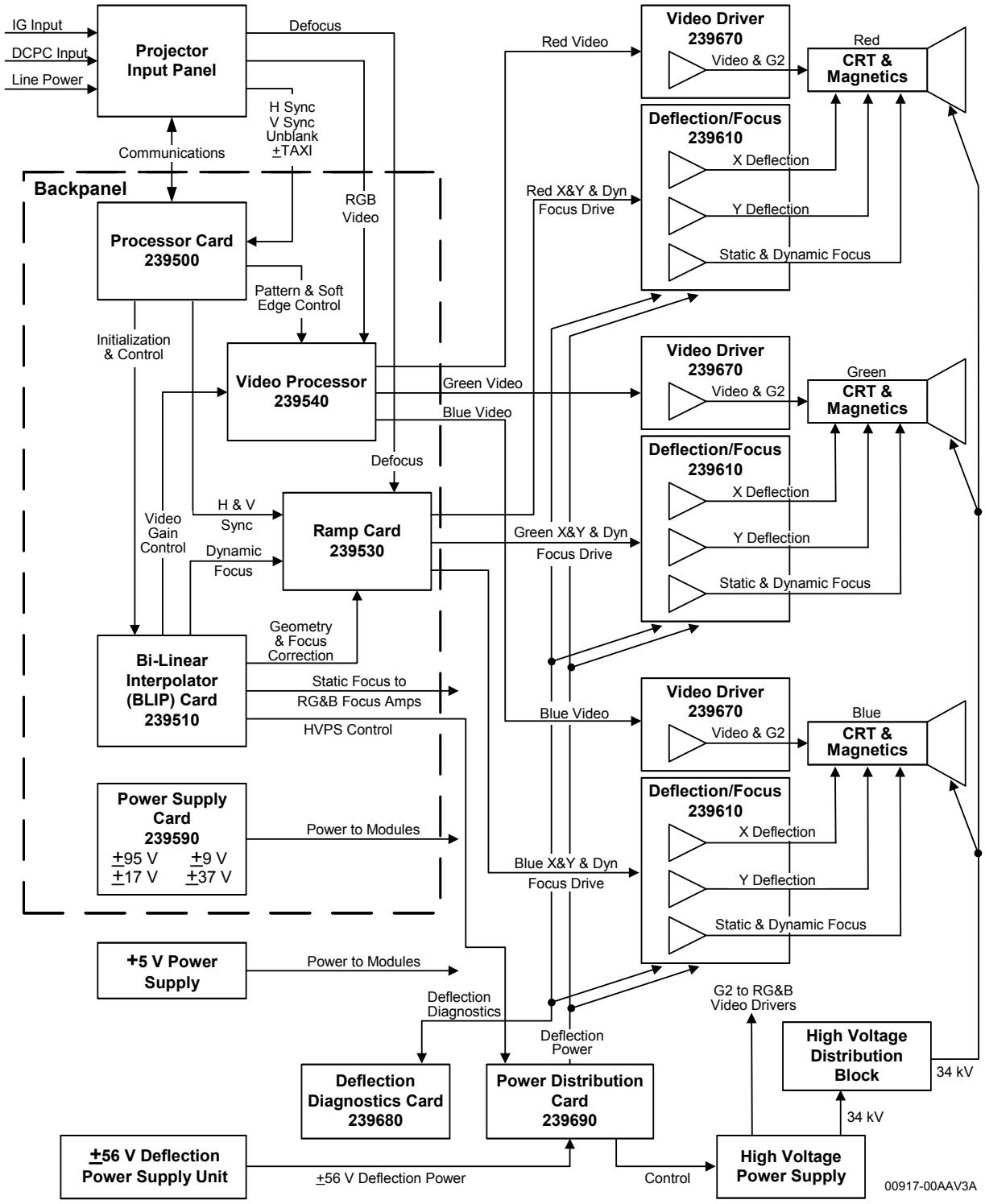


Figure 1-6. MCP2000 Projector Head Unit Block Diagram

1.4.1.1 CRT Assembly

Figure 1-7 shows the single-beam CRT.

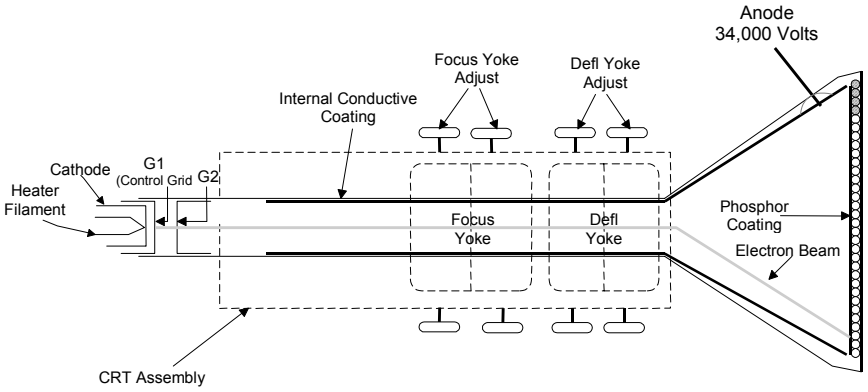


Figure 1-7. Single-Beam CRT

Figure 1-8 shows the CRT assembly. The CRT assembly includes the following components:

- One CRT with built-in optical C-element and faceplate cooling
- One mumetal shield assembly with magnetic alignment screws and connectors
- One magnetic focus coil
- One deflection coil

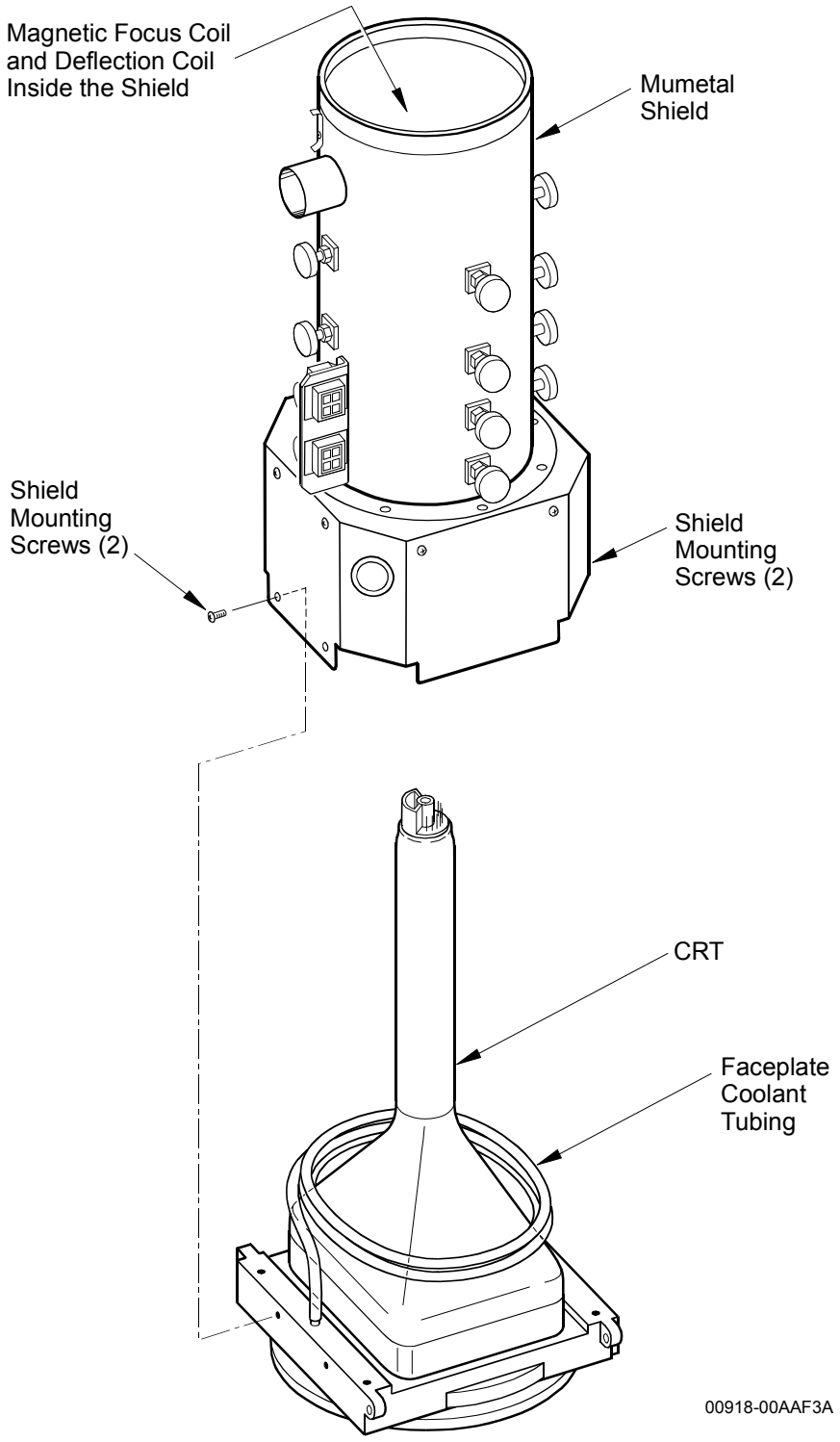


Figure 1-8. MCP2000 CRT Assembly

Figure 1-9 shows the location of the CRT assembly within the projector head unit.

The 9-inch, 4 × 3 aspect ratio, rectangular-faceplate CRT is the highest resolution, highest luminance, magnetically-focused CRT commercially available. It operates at +34 kV and has been modified by Barco Inc. to

incorporate a liquid-coupled optical C-element to provide cooling and optimal optical performance. The CRT is used in the high-performance Barco raster projector products and is readily available through Barco distributors.

The mumetal shield protects the CRT from stray magnetic fields present in the environment and provides a mounting fixture for the deflection and focus magnetics. It is recommended that any spare red, green, and blue CRTs be prealigned in a shield assembly to be available as a rapidly replaceable LRU for the MCP2000 .

The magnetic focus coil provides precision static focus and dynamic focus control. The electron beam is optimally focused or, if directed by the IG, properly defocused at all points throughout the projected image. The drive signals for the focus coil come from the focus amplifier located on the deflection/focus assembly.

The magnetic deflection yoke is designed for low hysteresis and high bandwidth. The deflection yoke, in conjunction with the linear calligraphic deflection amplifier, positions the electron beam precisely to any point within the projected image with an average lightpoint draw time of 2.5 microseconds and a maximum raster rate of 64 kHz.

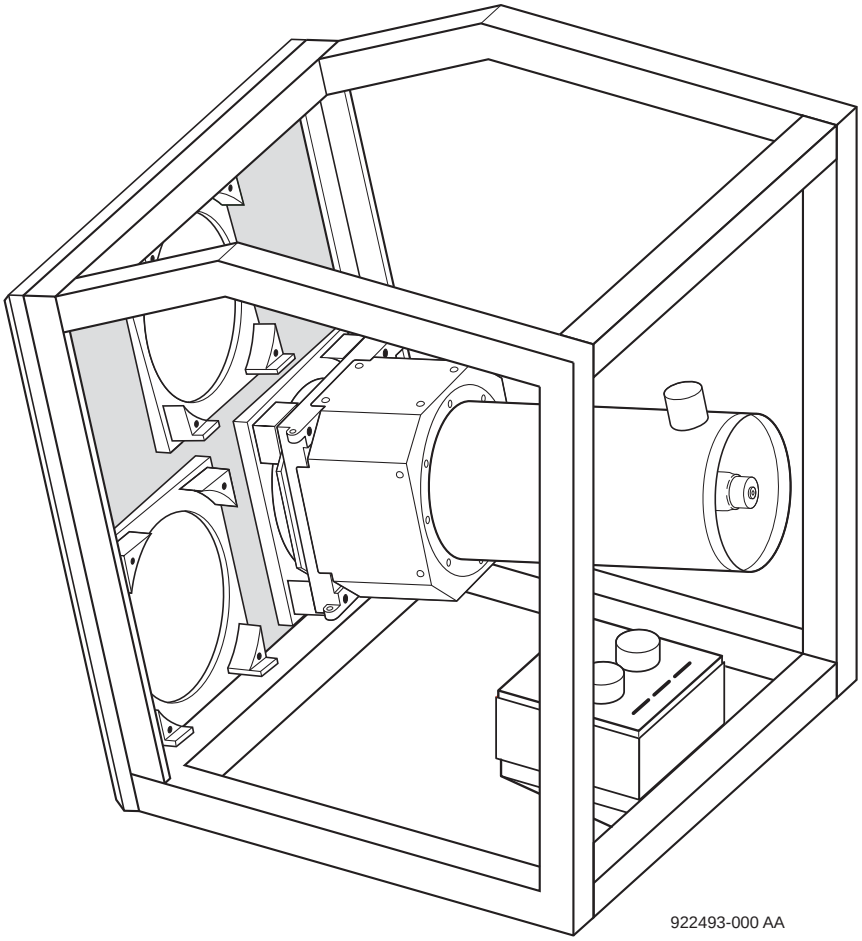


Figure 1-9. Location of CRT Assembly within the Projector Head Unit

1.4.1.2 Processor Card (239500)

The processor card (Figure 1-10) handles all user interfaces. It processes communications from the HHR and projector terminal window displayed on the DCPC and responds to requests. On-screen menus, patterns, and edge blend (soft edge) are generated on this card and then sent to the video processor to be combined with the external video signals. All alignment adjustments made to the MCP2000 as well as the code that runs the MCP2000 are stored in flash memory on this card. The processor card receives the digital deflection information for calligraphic lights as well as HSYNC, VSYNC, and unblank. Taxi information is the serial *x*, *y* light position data from the IG. The processor card also initializes, controls, and communicates with all other cards in the projector.

The processor card is designed with a chew-out circuit that divides the screen into a multitude of small areas. The chew-out circuit monitors the energy dissipated in each area where calligraphic lightpoints have been drawn. If the energy dissipated in a given area exceeds a critical threshold during a field time, no more lights will be allowed to display in that area. The processor card also monitors the IG signals: HSYNC, VSYNC, unblank, and taxi (digital address information). If any of these signals are not working correctly, the MCP2000 immediately switches to an internal sync mode and ignores the IG input until valid signals are present.

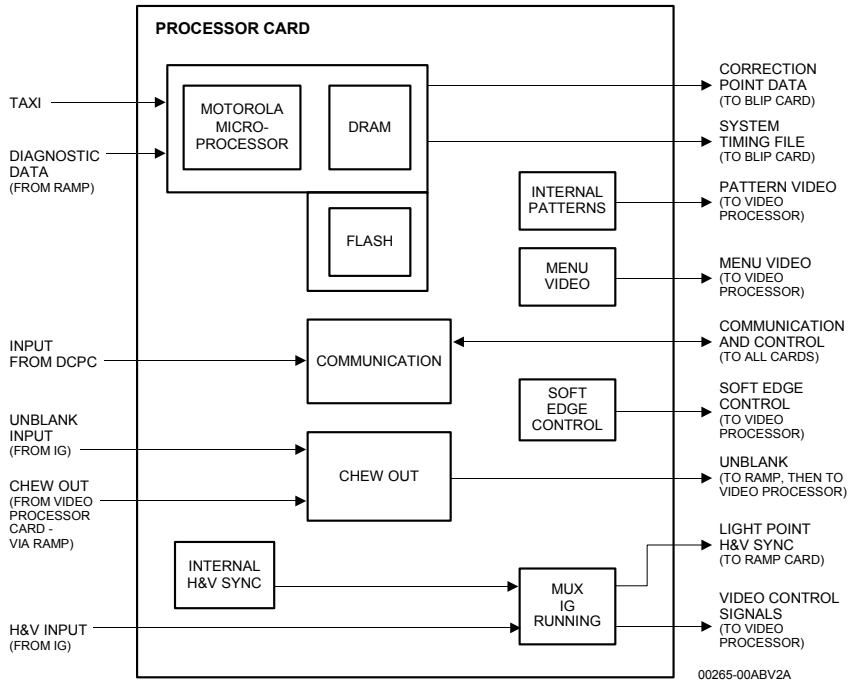


Figure 1-10. Processor Card Block Diagram

1.4.1.3 BLIP Card (239510)

The BLIP card (Figure 1-11) calculates the digital correction and dynamic focus functions. These functions are converted to analog signals that are sent to the ramp card. The BLIP card also has *digital-to-analog converters* (DACs) that control G2 levels, video gain, blue defocus, static focus, and black level.

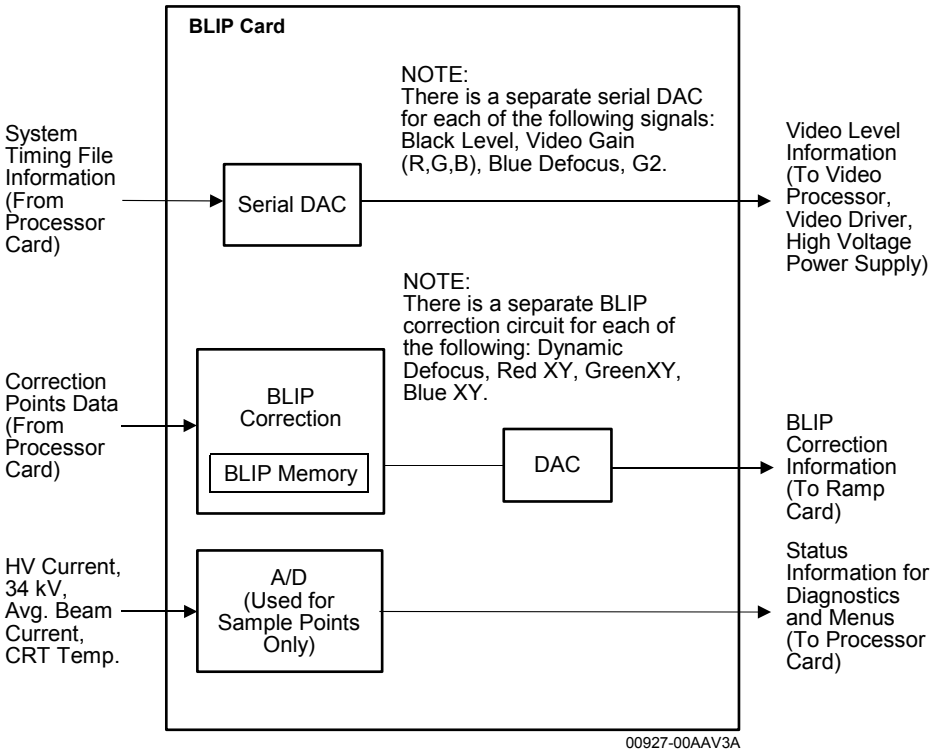


Figure 1-11. BLIP Card Block Diagram

1.4.1.4 Ramp Card (239530)

All *x* and *y* deflection signals are generated on the ramp card (Figure 1-12). Gains, offsets, and correction signals from the BLIP are summed into deflection signals before they are sent to the deflection amplifiers. IG defocus and dynamic focus are also summed together on the ramp card.

Phosphor protection is a primary function of the ramp card. Deflection signals are monitored to make sure the beam is constantly moving during raster mode. Deflection signals and video are monitored during calligraphic mode to ensure lightpoints are not too bright. All other warnings and failures from the system are reported to the ramp card, which in turn reports them to the processor card for communication to the DCPC.

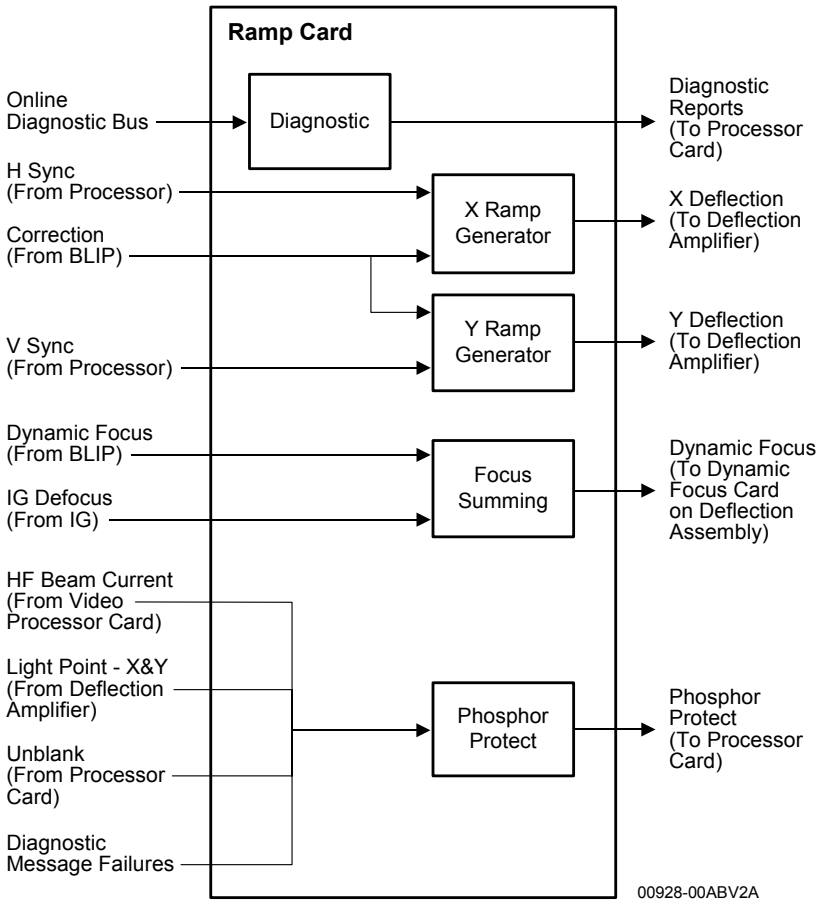


Figure 1-12. Ramp Card Block Diagram

1.4.1.5 Video Processor Card (239540)

IG video, internal pattern video, menu video, and soft edge control are combined on the video processor card (Figure 1-13). The video processor also performs *automatic gain control* (AGC). Beam current, measured at the video driver amplifiers, is processed on the video processor card to calculate a high-frequency version of the beam current. This signal is used as input for phosphor protect on the ramp card.

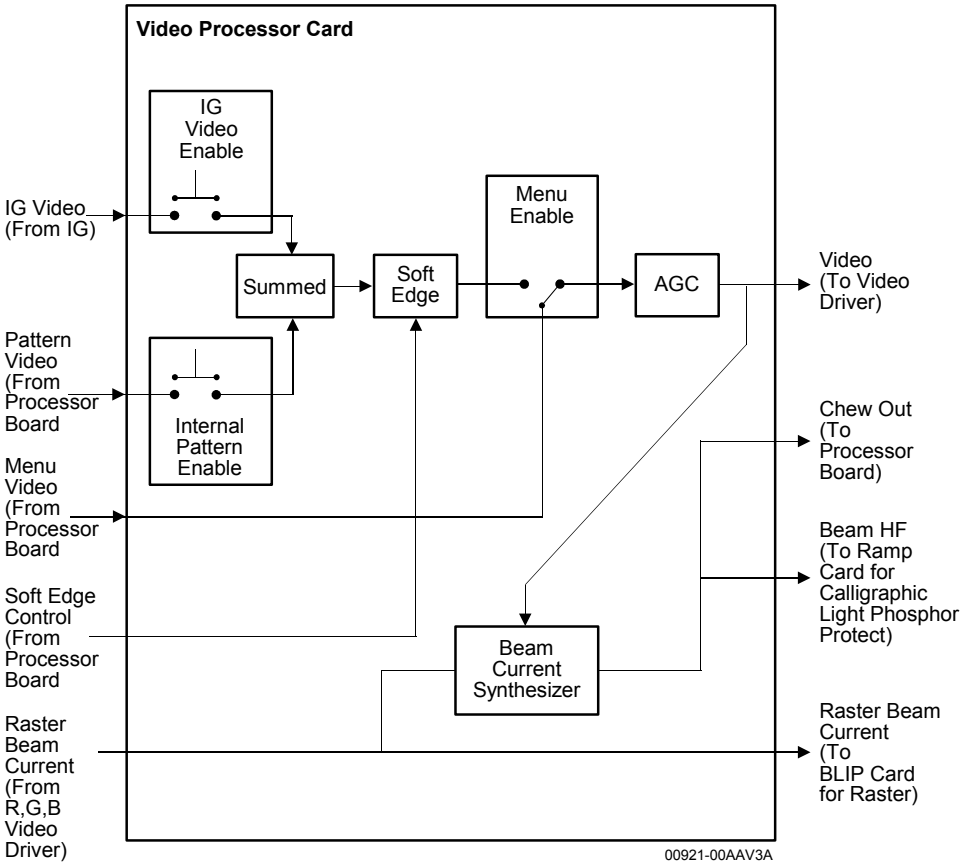


Figure 1-13. Video Processor Card Block Diagram

1.4.1.6 Power Supply Card (239590)

The power supply card (Figure 1-14) generates all of the low-power supply voltages for the system, except for the +56 V/–56 V high-power deflection voltages and the +5 V power to the digital electronics. The ac supply voltage to this card is 230 V ac. All outputs are enabled by a *5 V logic level* signal from the processor card.

NOTE: Depending on the projector requirements, the ±95 volt supplies may be adjusted to ±100 volts, and wherever the ±95 are talked about, use ±100 volts instead.

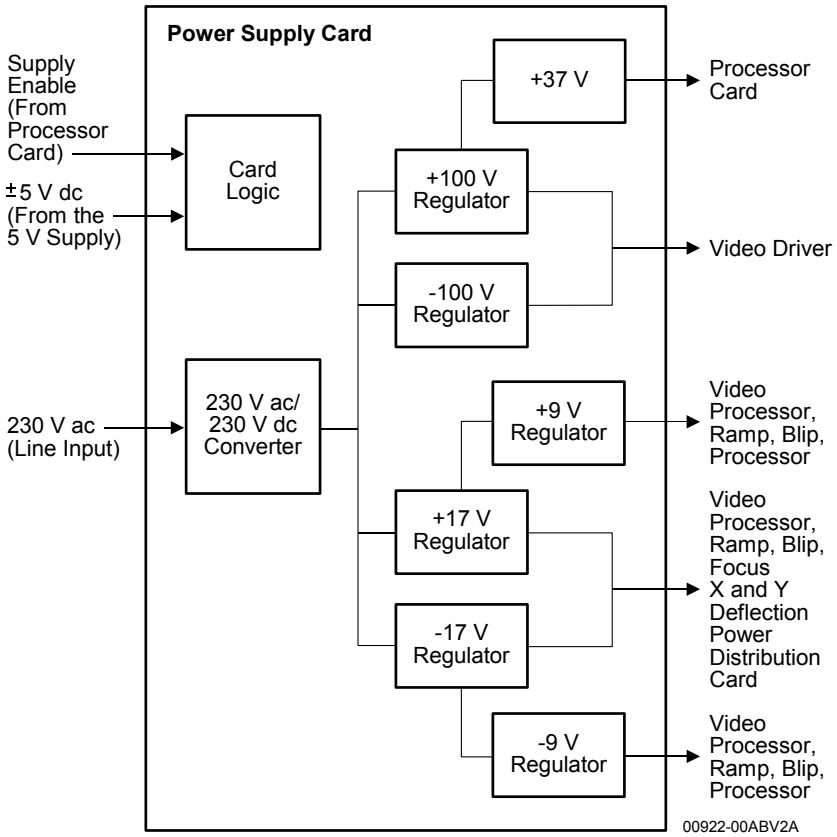


Figure 1-14. Power Supply Card Block Diagram

1.4.1.7 Deflection/Focus Assembly (239610)

The assembly includes a focus amplifier, an *x* deflection amplifier, a *y* deflection amplifier, and a yoke interconnect card. Each amplifier consists of two cards: an upper preamplifier card and a lower *field-effect transistor* (FET) power card. The deflection amplifiers (Figure 1-15) are fast, high-power amplifiers optimized for calligraphic light operations.

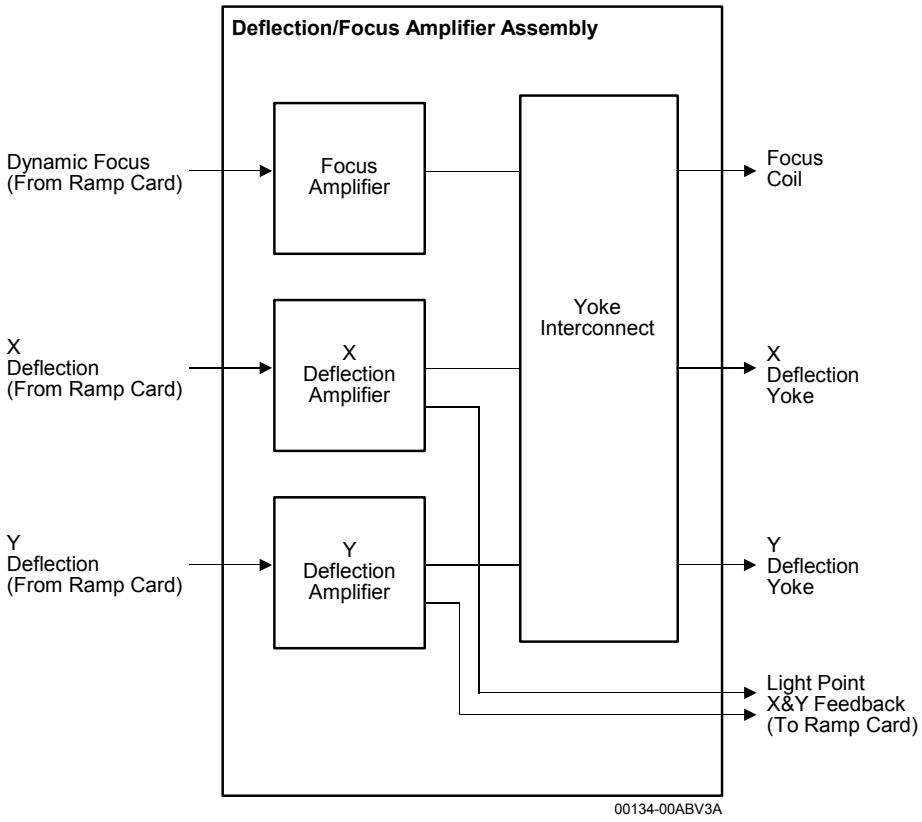


Figure 1-15. Deflection/Focus Amplifier Block Diagram

1.4.1.8 Video Driver (239670)

The video driver (Figure 1-16) card is a round card attached to the back of each CRT assembly. It amplifies the video signal from the video processor and regulates the G2-grid voltage. It also senses the CRT beam current as part of the phosphor-protect circuit.

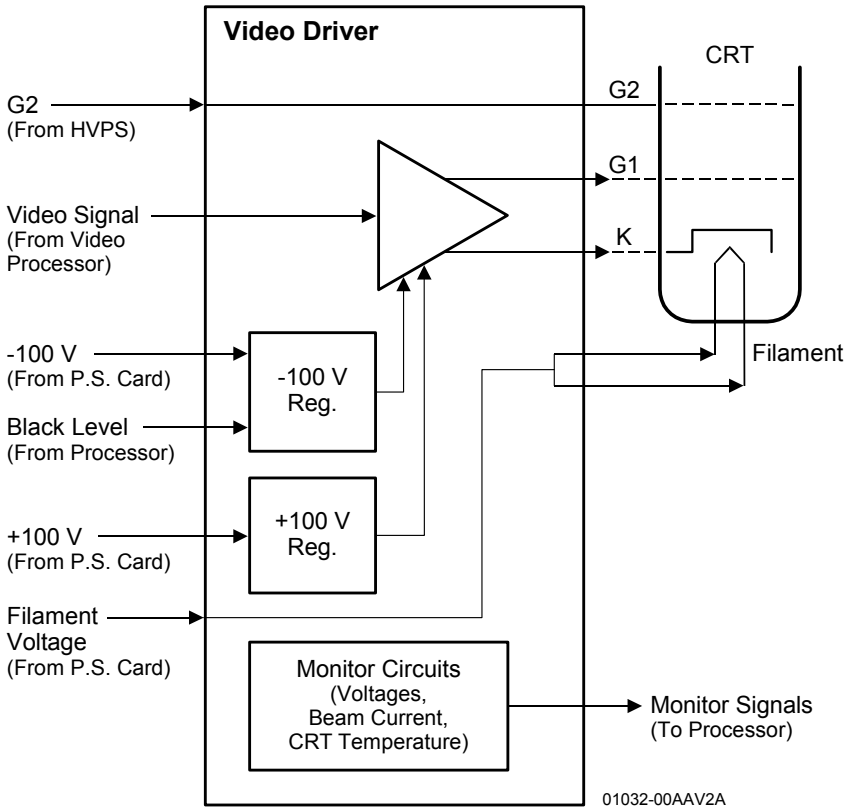


Figure 1-16. Video Driver Block Diagram

1.4.1.9 Deflection Diagnostics Card (239680)

Each deflection amplifier and focus amplifier located on the deflection/focus assemblies have a ribbon cable connected to the deflection diagnostics card. The diagnostics card collects information from the amplifiers and then passes it on to the processor when it is requested. Failures are reported immediately to the ramp card, so phosphor protection can be enabled.

1.4.1.9.1 Power Distribution Card (239690)

The power distribution card routes the high-current ±56 V power to the deflection amplifiers. Fuses on the power distribution card protect the harness wiring.

1.4.1.9.2 High-Voltage Power Supply and High-Voltage Distribution Block

The *high-voltage power supply* (HVPS) provides the 34-kV anode voltage common to all three CRTs and separately controllable 450–650 V G2 voltages to each CRT. The G2 voltages are controlled by signals from the BLIP card. The HVPS is enabled by a logic signal from the PROCESSOR card and can be disabled by a phosphor-protect signal from the RAMP card and the HVPS disable switch on the input panel. The 34-kV output is supplied to the high-voltage distribution block and then distributed to each CRT.

A 34-kV *voltage* sample signal and a 34-kV *current* sample signal are returned to the PROCESSOR card via the POWER DISTRIBUTION card for status reporting.

1.4.1.10 +5 V Power Supply

The +5 V power supply provides power to all the digital circuitry. It is the first supply to be activated in the power-on sequence. Without this supply, communication with or control of the projector head is not possible.

1.4.2 Deflection Power Supply Unit

The deflection power supply unit provides +56 V (Figure 1-17) and −56 V to the high-power deflection and focus amplifiers via the power distribution card. These nine amplifiers (*x*, *y*, and focus for each of the three CRT assemblies) consume most of the power supplied to the MCP2000. The deflection power supply unit houses two high-efficiency switching power supplies and associated filtering circuitry to reduce noise in the projected image. The power supply unit is separate from the projector head unit and connected by three quick-disconnect cables: an ac line power input cable, a dc power output cable, and a control cable. The deflection power supply control signal comes from the power distribution card.

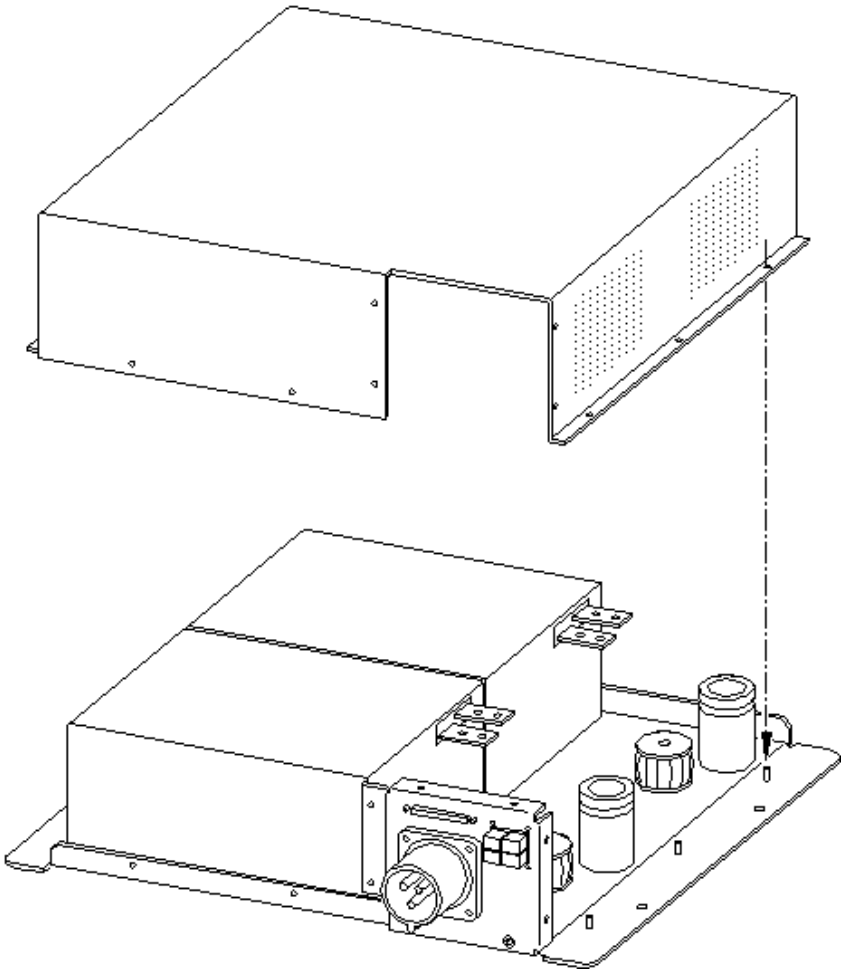


Figure 1-17. ±56 V Power Supply

1.4.3 DCPC Overview

The DCPC is a standard Pentium computer, mounted either inside the simulator in a rugged 19-inch rack or on the wall next to the MCP2000 (wall mount brackets are included). The peripheral cards are all available over-the-counter through local computer dealers. The DCPC is the central communications hub for the entire visual system.

The DCPC comes with six accessory cards:

- Video card—not normally used
- Ethernet card—connects with the Wyse WinTerm 2300T or the WinTerminal PC
- Frame grabber—used with the auto-alignment system
- RS-485 card—used to connect the HHR
- Octal Serial card—used to connect the projector heads to the DCPC

- Modem—optional and gives VDCDS remote login capability
- A/D-D/A card—used with auto-alignment system

1.4.3.1 Terminal PC

The Terminal PC is a remote terminal system that allows the user access to the DCPC. Even though up to three separate devices may remotely login to the DCPC, only one can be logged in at any one time because of the exclusive use of the COM ports. The Terminal PC is an off-the-shelf PC with an Ethernet card running NT Server Client. The following four additional pieces of hardware connect to the Terminal PC: monitor, keyboard, mouse, and a small 10Base-T hub.

1.4.3.2 WYSE WinTerm Overview

The WYSE WinTerm 2300T is the remote terminal system that preceded the use of the WinTerminal PC. It also allows user access to the DCPC. The WinTerm consists of five pieces of hardware: monitor, keyboard, mouse, WinTerm 2300T, and a small 10Base-T hub.

1.4.3.3 DCI-Comm Application Overview

The DCI-Comm software loads from the Windows Start menu. This software provides the user interface to the projector heads and the IG.

1.4.4 Hand-Held Remote

The HHR is the user interface to each of the projector heads for all alignments. Although a visual system can contain multiple projectors, a single HHR is used in conjunction with an onscreen menu system to make the adjustments and corrections to each of the projector head units.

1.4.5 Auto-Alignment System Overview

The auto-alignment system hardware is a mechanical assembly consisting of a *charge-coupled device* (CCD) camera and two photo sensors attached to a two-degree-of-freedom pan/tilt unit. The auto-alignment system performs geometry and convergence adjustments, static and dynamic focus, intensity adjustments, and edge blending. A complete description of the mechanical assembly, installation, signal interconnection, power, and operation is contained in the *MCP2000 Projector Auto-Alignment System Operation and Maintenance Manual.*

2 Installation

2.1 Introduction

This chapter explains the installation of the MCP2000, the DCPC, and HHR unit that comes with each system. This chapter also explains the mechanical focus procedure for the MCP2000. Installation procedures for the optional auto-alignment system may be found in the *MCP2000 Projector Auto-Alignment System Operation and Maintenance Manual* and additional information concerning the connection of the MCP2000 to the IG may be found in the appropriate IG operation and maintenance manual.

2.1.1 Unpacking and Inspection

Carefully unpack all of the equipment and determine whether the system is complete. Remove all material used to secure parts during shipment. Thoroughly inspect all parts for scratches, dents, broken connectors, and damaged cables.

If the equipment is damaged, notify the carrier and arrange to have the shipment inspected by the carrier's agent. Inform the carrier that you intend to file a claim. Prepare an VDC Display Systems (*VDCDS*) failure report form for each damaged or missing assembly, and then notify your VDCDS representative.

2.2 Mechanical Installation

There are five main mechanical pieces involved in the MCP2000 installation:

- External ±56 V power supply for the deflection amplifiers

- Projector head unit
- DCPC
- WinTerminal PC or WinTerm Wyse 2300T
- Auto-alignment system

2.2.1 Power Supply Unit

The ±56 V power supply is installed external from the projector head and is mounted on the platform. On some models, the ±56 V supply covers must be removed to access the screws. Some units have the power supply mounted under the projector head in the wedge. Three cables connect the projector head unit and the ±56 V supply:

- Signal cable (239337-100)
- ac main power cable (239398-100)
- ±56 V supply cable (239354-072)

2.2.2 Projector Head Unit

The projector head unit is mounted to the platform with four high-strength bolts located on the corners of the wedge. The projector head unit is normally shipped with the lenses attached. If not, the lenses should be installed before the projector is bolted into place as shown in Figure 2-1.

CAUTION: Be very careful when installing the lenses. It is very easy to scratch the inside surface of the lenses during installation.

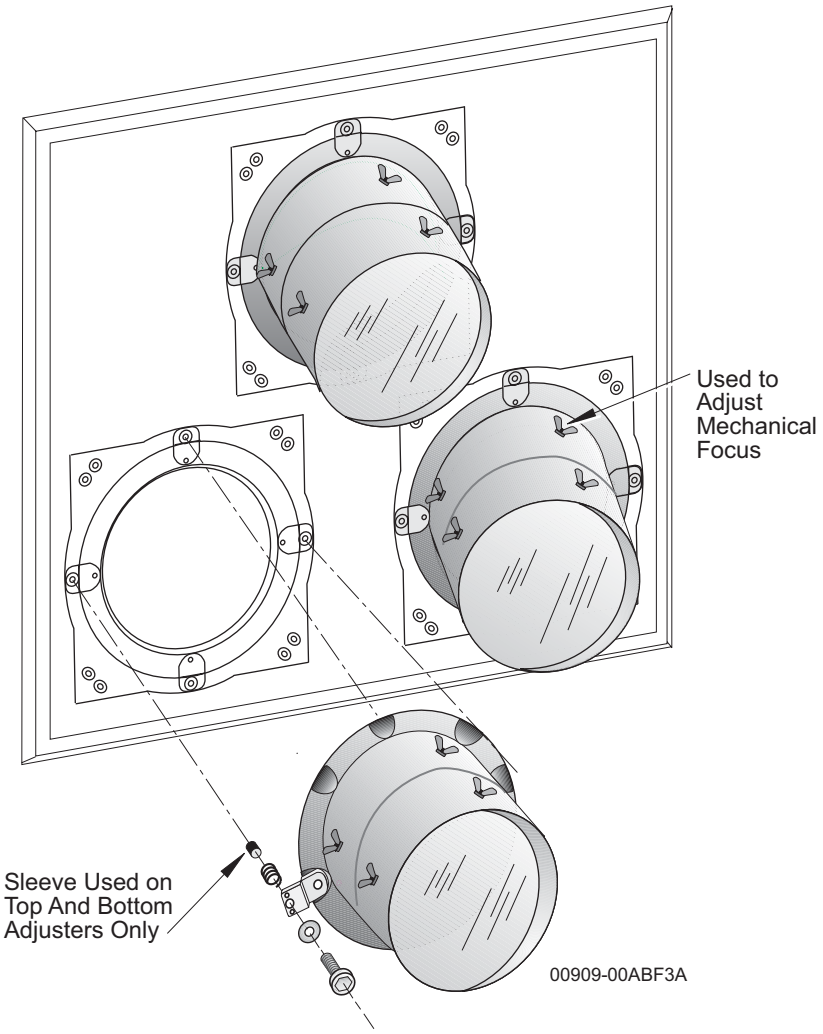


Figure 2-1. MCP2000 Lens Assembly

Each projector head unit comes with a set of lifting brackets and a lifting fixture. The top cover must be removed before the lifting brackets can be attached to the projector head unit frame. The bolts that hold the lifting brackets should be tightened to approximately 20-ft lbs. The lifting fixture then clips to the lifting brackets. The lifting brackets must be removed before the top cover can be replaced.

NOTE: The lifting brackets and fixture are rated to 500 lbs and should not be used for lifting any device except the projector head.

The projector head unit requires three external connections (Figure 2-2):

- 230 V ac single-phase power cable plugs into the ac main input.
- IG video cable (usually 208224-XXX) plugs into the IG interface connector.

- Communication cable plugs into Projector Comm A (Projector Comm A, Projector Comm B, and Projector Comm C are electrically identical). The VDCDS number for the communication cable is 917101-025 or 917101-040. The dash number identifies the cable length.

The MCP2000 can be set up for various system types. The system types are determined using DIP switches on the backpanel. Figure 2-3 shows the location of the DIP switches (the top cover must be removed for access to the DIP switches).

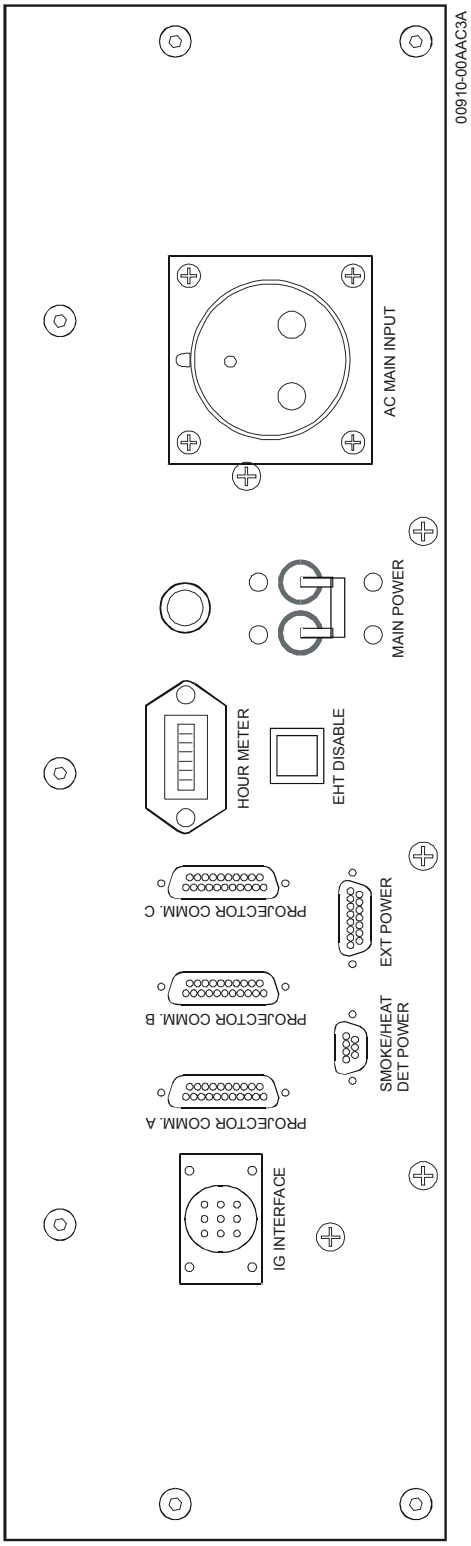


Figure 2-2. Input Panel

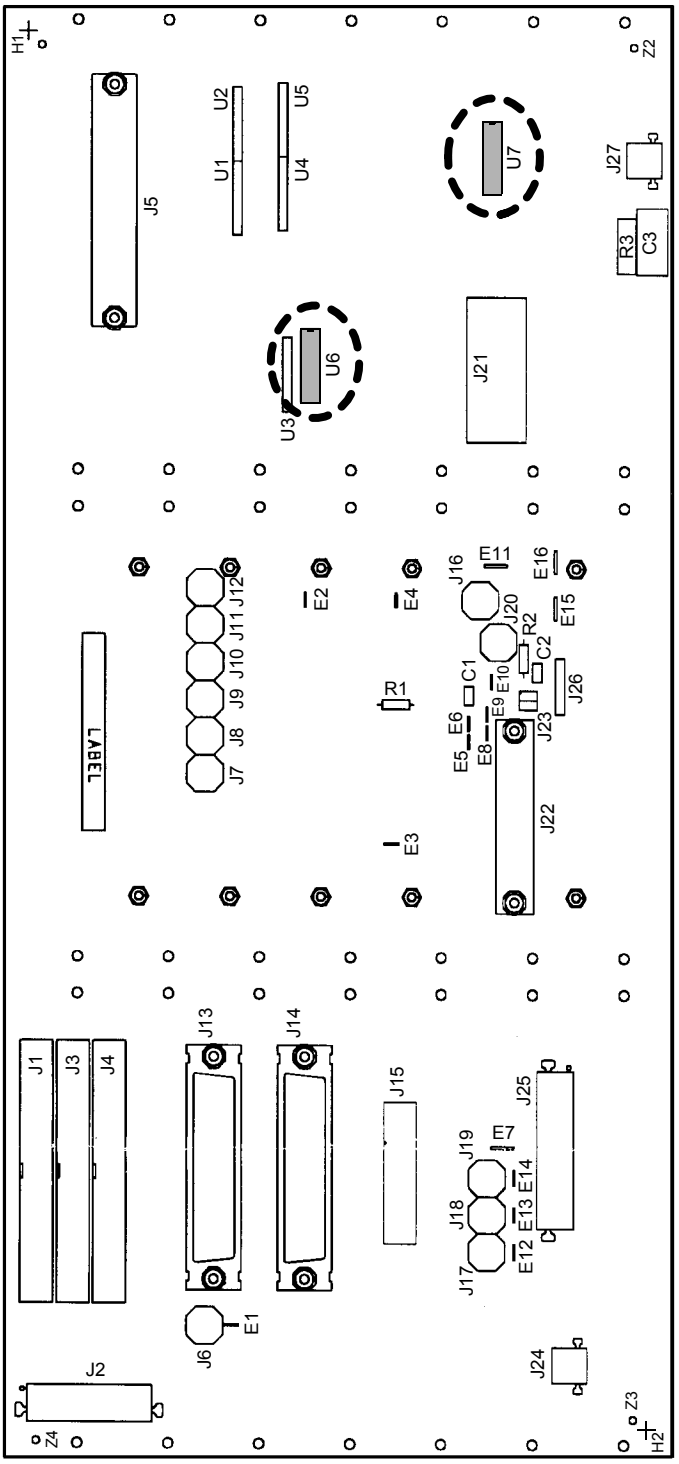


Figure 2-3. Location of DIP Switches on MCP2000 Backpanel Card Assembly

Table 2-1 shows the DIP switch setting for the various systems to date. Switch U6 locations 6–8 must be set to define the IG type.

Table 2-1. MCP2000 Backpanel DIP Switch

System	Switch U6 Name	Location	Position
WIDE-150 (56 × 40, with 3.0° soft edge)	SYS_CONFIG 0 SYS_CONFIG 1 SYS_CONFIG 2 SYS_CONFIG 3 SYS_CONFIG 4	1 2 3 4 5	OFF OFF OFF OFF OFF
WIDE-180 * (63 × 40, with 1.5° soft edge)	SYS_CONFIG 0 SYS_CONFIG 1 SYS_CONFIG 2 SYS_CONFIG 3 SYS_CONFIG 4	1 2 3 4 5	ON OFF OFF OFF OFF
WIDE-180 (66 × 40, with 3.0° soft edge)	SYS_CONFIG 0 SYS_CONFIG 1 SYS_CONFIG 2 SYS_CONFIG 3 SYS_CONFIG 4	1 2 3 4 5	OFF ON OFF OFF OFF
WIDE-185 (63 × 45, with 1.5° soft edge)	SYS_CONFIG 0 SYS_CONFIG 1 SYS_CONFIG 2 SYS_CONFIG 3 SYS_CONFIG 4	1 2 3 4 5	ON ON OFF OFF OFF
WIDE-200 (46 × 40, with 3.0° soft edge)	SYS_CONFIG 0 SYS_CONFIG 1 SYS_CONFIG 2 SYS_CONFIG 3 SYS_CONFIG 4	1 2 3 4 5	OFF OFF ON OFF OFF
ESIG	SYS_CONFIG 5 SYS_CONFIG 6 SYS_CONFIG 7	6 7 8	OFF OFF OFF
SPX	SYS_CONFIG 5 SYS_CONFIG 6 SYS_CONFIG 7	6 7 8	ON OFF OFF

* Default settings are set at the factory.

NOTE: All of the switches on U7 should be set to the OFF position except the `ALIGN MODE location 1)`.

2.2.3 Display Communications PC

The DCPC is mounted in a 19-inch rack inside the simulator or on a wall next to the MCP2000 (wall mount brackets are included). The DCPC is the

central communications hub for the visual system. The monitor, keyboard, and mouse are not connected directly to the DCPC in the normal operation mode; they are connected to the WinTerminal PC or WinTerm Wyse 2300T.

NOTE: The WinTerm Wyse 2300T was used in the original system and there are many systems with this configuration in the field. Current systems use a WinTerminal PC in place of the WinTerm Wyse 2300T. The systems are functionally the same.

Figure 2-4 shows the DCPC cable connections.

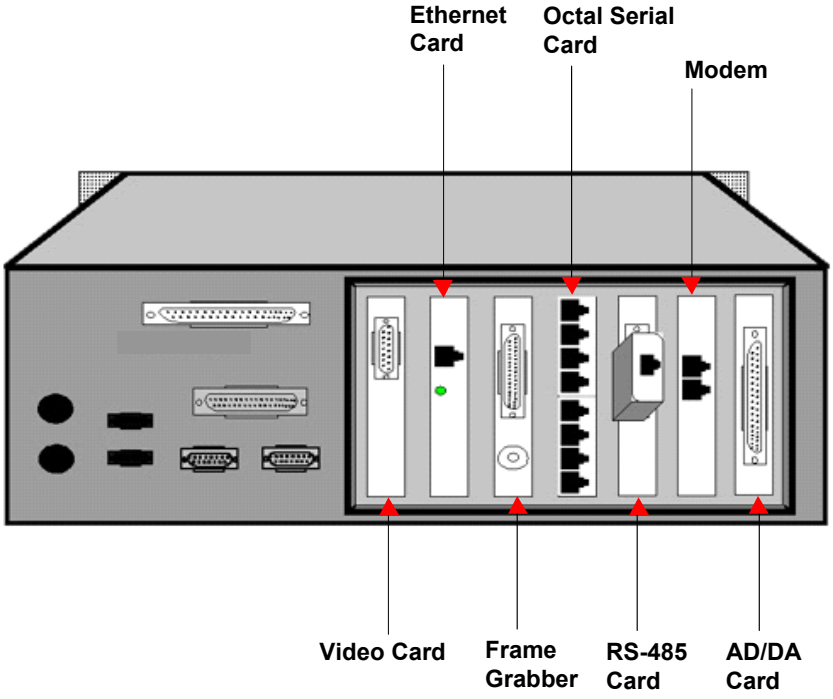


Figure 2-4. DCPC Cable Connections

The following cards are installed in the DCPC. Details on card configuration can be found in Appendix A of this document.

- Video card—HD-15 connector (not used in normal operation).
- Ethernet card—RJ45 (may have coax or other connectors) connects to the 10BaseT Ethernet hub with an Ethernet cable (VDCDS 802365-811).
- Frame grabber—RCA jack or DB-15, connects to auto-alignment system.
- Octal serial card—communicates with the MCP2000 projectors, the IG and the auto-alignment system. See Table 2-2 for a list of connections.

Table 2-2. MCP2000 Back of the DCPC Cable Connections

Location	Cable	Destination
COM 5 TOP	239396-0XX	Projector 0
COM 6	239396-0XX	Projector 1
COM 7	239396-0XX	Projector 2
COM 8	239396-0XX	Projector 3
COM 9	239396-0XX	Projector 4
COM10	239396-150	IG console port
COM11	239396-150	IG command port
COM12	Varies	Pan tilt unit

- RS-485 card with DB25 to RJ45 adapter—HHR cable plugs into the RJ45 side of the adapter (VDCDS 801594-409).
- Modem—uses a US-style phone jack (RJ12). Optional depending on customer's needs.
- AD/DA card—DB 37-pin connector, connects to the auto-alignment system.

2.2.3.1 Online Diagnostic Flag

The diagnostic system in the MCP2000 requires an active high signal to indicate that there is a diagnostic problem with the visual system. This signal is provided from the AD/DA card.

Pin 37	Output	Diagnostic signal
Pin 21	Output	Signal GND

2.2.4 WinTerminal PC or WinTerm 2300T

NOTE: The Ethernet (10BaseT, RJ45) cables attach to the hub. Currently, the hub supplied is a TRENDnet TE-500. This hub has five ports; the fifth one can be configured as a crossover port. This feature is useful attaching this hub to another hub. There is a switch that controls this crossover feature. If the last port is not used, the switch setting is not important. The IG can be connected to the hub for maintenance purposes, but should not be connected during normal operation. Power for the hub is provided by an ac power adapter. On systems using the Wyse WinTerm 2300T, power for the hub can be supplied by the Wyse WinTerm 2300T through the keyboard power adapter.

An Ethernet cable is provided to connect the WinTerminal PC or Wyse WinTerm 2300T box to the hub. Connect the monitor, keyboard, printer, and mouse to the back of the WinTerminal PC or Wyse WinTerm 2300T box. At the WinTerm terminal are the console windows for the IG and for each of the projectors in the system. To see the console window, logon to the DCPC through the WinTerm terminal and then start the DCI_Comm program in the MCP2000 program group.

Figure 2-5 shows the WinTerm cabling.

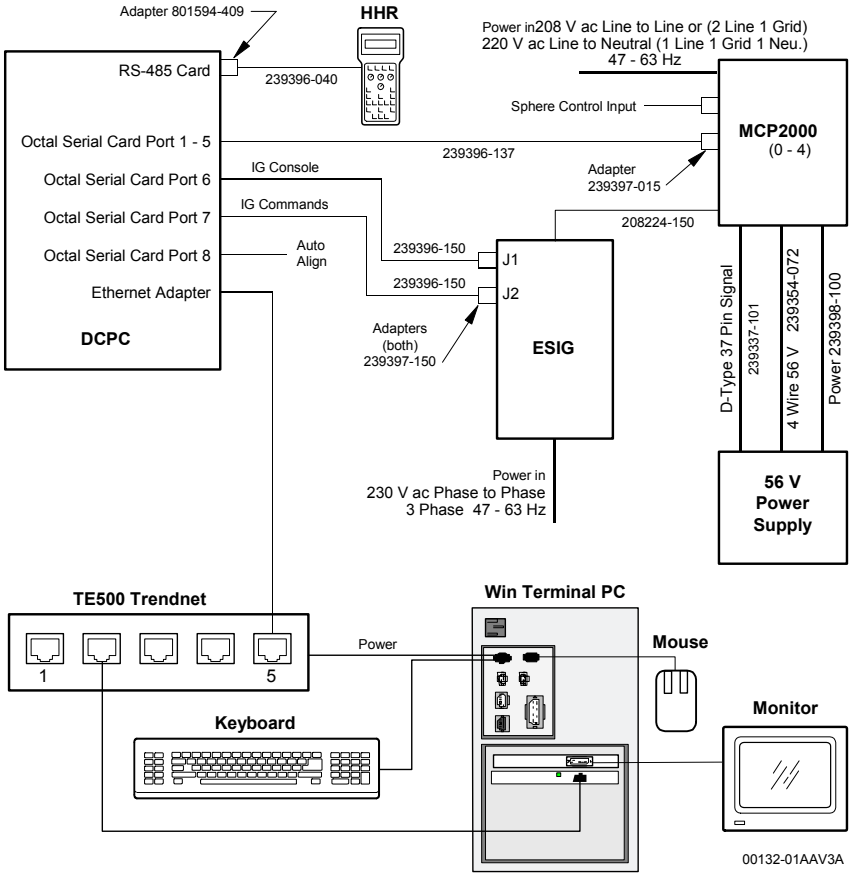


Figure 2-5. WinTerm Cabling Diagram

2.3 Initial Power Up and Bench Check

After the mechanical installation of the MCP2000 , power up, check, and align the MCP2000 to ensure that it is operating correctly. Use this power-up procedure only for the initial power-up of the MCP2000. For normal operation procedures, see Chapter 3.

2.3.1 Initial Power Up Procedure

The checks in this section must be performed the first time you apply power. The MCP2000 must be connected to the IG and powered off. Check the IG power cabinets and the MCP2000 to ensure that the power is off.

1. Measure the site power and verify that the power source for the MCP2000 is the correct voltage.

The following are the power cord (Figure 2-6) voltages:

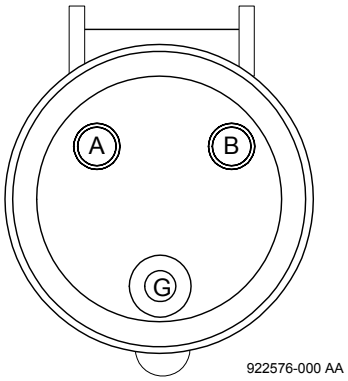


Figure 2-6. Power Cord

- 230 V ac (International)
  A = phase, B = neutral, G = safety ground
  - A–B 230 V
  - B–G 0 V
  - A–G 230 V
- 208 V ac (U.S.)
  A = neutral, B = line, G = safety ground
  - A–B 208 V
  - B–G 120 V
  - A–G 120 V

2. Use a multimeter to verify that the system safety ground is correctly connected and that the projector signal ground is connected to the system and site grounding.
3. Check all internal assemblies to see that they are secured and cabled correctly.
4. Verify that the circuit breaker on the projector is off. Power on the visual power-supply breaker.
5. Power on the DCPC and the WinTerm terminal.
6. Logon to the DCPC or the WinTerm terminal setting the user as `Administrator` and the password as `e&s` (case sensitive).

7. Start the DCI_Comm software.
8. Check the HHR to make sure it is communicating with the DCPC and does not have a communication error message on the LCD display. If an error message appears, check the cabling and make sure the DCI_Comm software is running.
9. Power on the IG. The projector is still off.
10. After the IG is running, type `int cal off` on the IG console window to disable lights.
11. Power on the main circuit breaker on one of the projectors. The +5 V supply and the fans come up first. After a short delay, the power supply card powers up.
12. Verify that the MCP2000 is communicating with the DCPC. On the WinTerm terminal, check for messages on the MCP2000's console window. If no messages appear, check the cables and restart the MCP2000.
    .
13. On the projector console window, type `S`. This command displays status information about that projector. In the status information, there is a label called `IG SIGNAL`. If it indicates PRESENT, then the projector is receiving video signals from the IG. If it indicates OUT-OF-SYNC or ABSENT, then the IG is not sending the proper signals or there is a cabling problem. If the MCP2000 is restoring a system file, it will not respond to the `S` command. Wait until the restore operation finishes and then try again.
14. If the IG is not running, you may continue with the initial power up; but do not try to align the MCP2000 and do not complete the rest of this step. With the IG running, type L on the MCP2000 console. The L command counts the number of lines that the IG is drawing to help sync up the MCP2000 internal rate to the IG line rate. This command is only needed until a system file is saved, then the information is stored with the system file.
15. Using the HHR, press the FUNC button and then the DISP PWR button. The MCP2000 should power up completely and an image should be present (if the IG is not running, press the MENU button to toggle on the menus). If the MCP2000 encounters a failure, it will not fully power up. Check the diagnostics to troubleshoot the error.
16. Repeat steps 11 though 15 for each projector.

2.4 Alignment Procedure for a New Installation

The alignment procedures assume that the MCP2000 has been bolted into place and the cabling has been connected between the projector and the DCPC and the WinTerm. The mechanical focus procedure is discussed in Section

2.4.1, the Scheimpflug adjustment is discussed in Section 2.4.2, and the alignment procedures are discussed in Chapter 4.

2.4.1 Mechanical Focus Procedure

Achieving optimal focus requires a combination of four focus adjustments (mechanical, Scheimpflug, static, and dynamic). The mechanical and Scheimpflug adjustments are performed during the initial installation and do not need to be performed again, unless a tube is replaced. The static and dynamic focus adjustments are performed as part of the scheduled maintenance alignment procedures.

Test Patterns: *Internal Test Pattern → Resolution*
/reset/sphere150.rst
/reset/sphere180.rst
/reset/sphere200.rst

Menus: *Static Focus*

Procedure:

1. Turn on the MCP2000 and the IG. Load the IG sphere test pattern. Pressing **F1, F2**, and **F3** on the HHR enable/disable red, green, and blue IG video respectively. Focus one color at a time.

NOTE: The internal resolution pattern can be used for the focus adjustments as well. Do not display both the internal test pattern and IG test pattern at the same time. Pressing **FUNC/F1**, **FUNC/F2**, and **FUNC/F3** on the HHR enables/disables red, green, and blue internal video respectively.

2. Open the Static Focus menu (Section 4.3.3.1) and select **Focus**. Adjust the focus of each color for the best overall picture in the center of the screen.
3. Loosen the three wing nuts on the lens barrel closest to the projector faceplate (see Figure 2-1). Rotate the lens barrel until the best focus is achieved at the top and bottom of the image. If the position of the best focus is not the same for the top and bottom of the image, achieve best focus for the bottom of the image. Scheimpflug adjustments have to be made to focus the top of the image.

NOTE: Mechanical focus is adjusted for the best center focus. This may not provide the best overall focus because the points radiating from the center may degrade. The best overall focus may be achieved by slightly compromising the center focus.

4. Repeat steps 2 and 3, as necessary, to achieve the best focus.
5. Once the focus is corrected, tighten the wing nuts.

6. Loosen the front three wing nuts on the front lens barrel and rotate the front lens barrel of the lens until the best focus is achieved at the edges of the picture.
7. Tighten the wing nuts after adjustment and verify that the focus still correct. Repeat steps 2–6 as necessary.

2.4.2 Scheimpflug Adjustment

NOTE: The mechanical focus procedure must be completed prior to performing this adjustment, but may be repeated as part of the procedure for best overall focus.

Scheimpflug refers to the angle of the lens relative to the CRT. To compensate for the off-axis position of the projector to the screen, the angle needs to be adjusted to tilt the focal plane (the focal distance to the bottom of the screen is greater than to the top). The objective of the Scheimpflug adjustment (Figure 2-7) is to correct for differences in focus of opposite sides (top/bottom and left/right) and enable the dynamic focus to focus all sides simultaneously. In general, projectors above the eyepoint need the lens to be tipped up. Four adjustment screws are located on each side of each lens, one to each side of the mounting bracket (Figure 2-1). Normally, the top screw is not used.

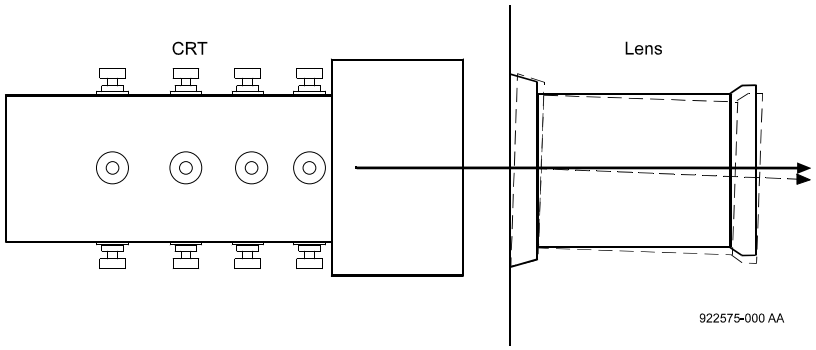


Figure 2-7. Scheimpflug Adjustments

It is important to note that the image displayed on the screen is 180˚ reversed relative to the eyepoint. In other words, if there is a problem at the top of the image, you must adjust the bottom of the lens. If there is a problem on the left side of the image, you must adjust the right side of the lens.

Test Pattern: */reset/sphere150.rst*
/reset/sphere180.rst
/reset/sphere200.rst

Menu: *Static Focus*

NOTE: Open the Static Focus menu to temporarily disable the dynamic focus.

Procedure:

1. Look at the test pattern to see if the top edge is in focus (the bottom edge was adjusted to best focus with the mechanical adjustment).
2. If the top edge is not in focus, loosen the left and right lens mounting screws.
3. Adjust the lower mounting screw to allow the lens to move out until the top of the picture is equally focused to the bottom. (Note that the bottom focus also changes slightly while you are adjusting the lower screw).

NOTE: On older projectors, there are two small set screws on each mounting bracket. Loosen the mounting screw and use one of the set screws to focus the picture. When proper focus is achieved tighten the second set screw (taking care not to push the lens out further than the first set screw did). Then tighten the mounting screw.

4. Loosen the wing nuts on the lens barrel closest to the projector faceplate. Rotate the lens barrel to see if the focus is equal for the top and bottom of the picture. (Equal focus does not necessarily mean the top and bottom edges are as well focused as the center, but rather that the top and bottom edges are equally focused). If not, rotate the lens barrel for best focus at the bottom of the screen and repeat step 3.
5. When the top and bottom edges are equally focused, tighten the left and right mounting screws. Make sure the top/bottom focus does not change.
6. Look at the test pattern to see if the left and right edges are in focus.
7. If the left and right edges are not equally focused, make small adjustments to the left and right screws by loosening one side and tightening the other by the same amount until the left and right focus is the same. (Point the lens toward the less focused side of the picture.)
8. Readjust overall focus by rotating the lens barrel to achieve best center focus. Tighten the wing nuts.
9. Loosen the front three wing nuts and rotate the front lens barrel of the lens until the best focus is achieved at the corners of the picture.
10. Recheck Static Focus before proceeding on to Dynamic Focus adjustments (Section 4.3.3.3). Static and dynamic focus are also performed by the auto-alignment system.

2.5 Auto-Alignment System

Installation of the auto-alignment system is explained in the *MCP2000 Projector Auto-Alignment System Operation and Maintenance Manual*. The auto-alignment system includes the following components:

- CCD camera
- Pan-tilt assembly and pan-tilt power supply
- Screen sensor
- CRT sensor
- Laser pointer
- Frame grabber card
- AD/DA converter card
- Quad amplifier card
- Associated cabling

The camera, pan-tilt unit, screen sensor, CRT sensor, and laser pointer are assembled into one unit (Figure 2-8), which is mounted inside the light-tight back-projection screen housing (Figure 2-9).

NOTE: The mounting bracket for the unit may vary depending on the type of optical system. Refer to the *MCP2000 Projector Auto-Alignment System Operation and Maintenance Manual*.

The frame grabber card and A/D converter card are located in the DCPC.

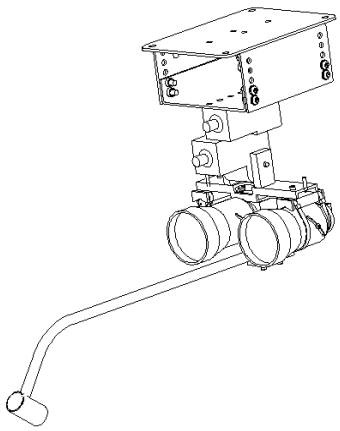


Figure 2-8. Auto-Alignment Assembly

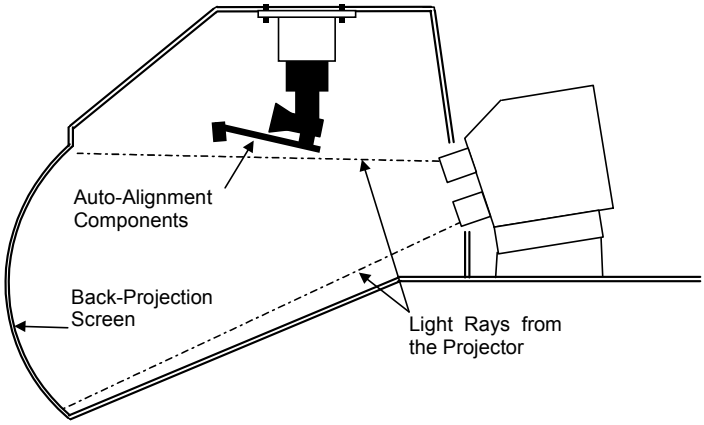


Figure 2-9. General Layout of the Auto-Alignment System

2.6 Preparation for Shipment

Follow these procedures when preparing the MCP2000 and its peripherals for shipment.

2.6.1 Disassembly of the Projector Head Unit

Follow these steps to disassemble the unit for shipping:

1. Make sure all power to the system is OFF, power cables are disconnected from any outlets, and any residual charges in the system have been discharged.
2. Disconnect the communications cables from the input panel of the MCP2000
3. Disconnect the IG signal cable.
4. Remove the top cover from the projector head unit and attach the four lifting brackets to the projector head frame. The bolts that hold the lifting brackets should be tightened to 20-ft lbs. The lifting fixture clips to the brackets.
5. Remove the bolts that attach the projector head unit to the platform.
6. Carefully lift the projector head unit to the platform with a crane or forklift.
7. The wedge attached to the bottom of the projector head unit must be removed before crating.

2.6.2 Packing

The following terms are defined as they are used in the packing instructions for the MCP2000 projector system:

- Flexible: A flexible item changes shape under moderate pressure without sustaining damage.
- Fragile: A fragile item shatters, fractures, or becomes damaged when subjected to moderate impact force.
- For the purpose of determining packaging requirements, the units of the MCP2000 projector system are classified as listed below:
- Flexible units: All cables removed and coiled according to the procedures listed in Section 2.6.1.
- Fragile units: lenses, projector head unit, power supply unit, and individual circuit cards. The units of the MCP2000 projector system must be packaged as required to provide protection under the following circumstances:

    1) Repeated handling during transportation and in-transit storage.
    2) Shock, vibration, and static loading for shipment by truck, rail, aircraft, or ocean transport.
    3) Temporary storage in a controlled warehouse environment.
    4) Effects of environmental exposure for short periods during shipment and in-transit storage.
    5) Stacking and supporting light superimposed loads during shipment and temporary storage.

It is recommended that MIL-STD-794 be used in configuring the containers required in the procedures listed in Sections 2.6.2.1 and 2.6.2.2.

2.6.2.1 Fragile Unit Packing

All fragile units of the MCP2000 projector system should be packaged to ensure adequate protection by using two containers. Separate the two containers with foam corners, die-cut cardboard inserts, or foam-in-place techniques.

2.6.2.2 Flexible Unit Packing

Package the flexible units of the MCP2000 projector system in a container having sufficient strength to support the weight of the contents. A flexible unit package and contents that weigh 200 lbs or greater must be configured with skids to permit the use of lifting devices.

2.6.2.3 Shipping Individual Circuit Cards

Individual circuit cards are considered fragile units in accordance with the definitions of MIL-STD-794. Circuit cards must be placed in an antistatic bag, wrapped in antistatic plastic bubble pack, and then shipped in a corrugated cardboard box that has been packed with antistatic foam packing material to prevent the movement of the circuit card while in transit. When shipping any faulty circuit card or faulty cable, include a description of the fault. A written description of the image effects and a notation indicating if the problem is either intermittent or heat sensitive must also be included.

3 Operation

3.1 Introduction

This chapter explains the controls and indicators on the projector head unit, HHR unit, and the DCPC. Correct startup, shutdown, and emergency shutdown procedures for the MCP2000 are explained. Normal operation of the MCP2000 through the IG is explained in the IG operation and maintenance manual. Auto-alignment operation is explained in Chapter 5.

3.2 Description of Controls

The projector head units are controlled using the HHR and the runtime console. There are no user controls on the projector head itself. The indicators located on the projector head are for troubleshooting purposes and are discussed in Chapter 6.

3.2.1 Hand-Held Remote Unit Keypad

Although a system can contain multiple projectors, a single HHR is used to control and align all of the projector head units in the system. Pressing the **ON/OFF** toggle button at the bottom of the keypad activates the HHR. It operates in conjunction with an on-screen menu system, accessed by pressing the **MENU** button on the keypad. The functions of the four HHR dials vary depending on the current menu selections. The dials are used to set video brightness, color thresholds, color balance, focus, and various other adjustments. As each dial is rotated, that dial's numerical value on the menu is changed accordingly (Figure 3-1). For proper system operations, maintenance staff should perform dial adjustment using the procedures described in Chapter 4.

Figure 3-1 illustrates the HHR keypad. The keypad buttons are described in Table 3-1.

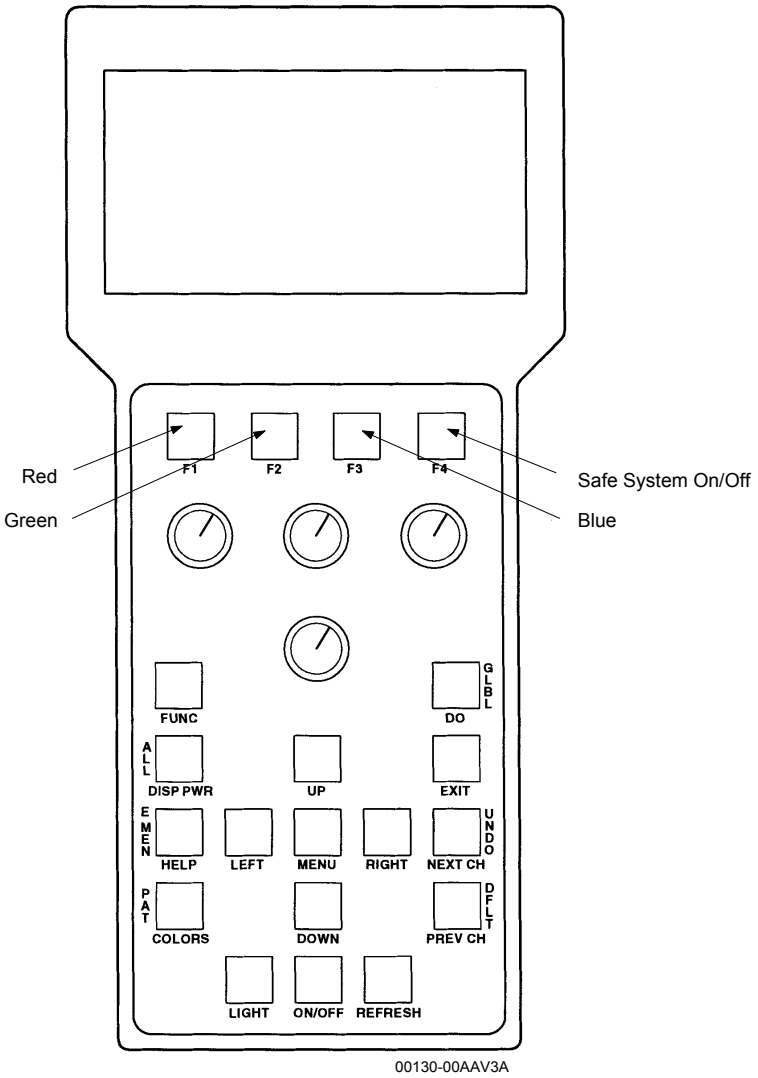


Figure 3-1. Hand-Held Remote

Table 3-1. HHR Button Functions

Button	Description/Effect
COLORS	On/off toggle button for patterns.
DISP PWR	Not used.
DO	The **DO** button is pressed to activate the highlighted option on the menu. It is also used as the scroll or toggle button for menu fields which contain more than one option; however, only one of the options can appear at a time in the field. The **DO** button is pressed until the desired option appears in the field.

Table 3-1. HHR Button Functions

Button	Description/Effect
DOWN	Acts as a standard keyboard down arrow to move the cursor through the highlighted menu selections and (if they appear on the menu) the selection options.
EXIT	Switches from a lower-level menu to the next-higher-level menu.
F1	Toggles red IG color on/off.
F2	Toggles green IG color on/off.
F3	Toggles blue IG color on/off.
F4	On/off toggle button for safe system.
FUNC	This button is used in conjunction with buttons having a secondary function. The **FUNC** button is first pressed and released. The second button is then pressed to obtain the desired function as described in the following definitions.
FUNC F1	Toggles the red menu/pattern color on/off.
FUNC F2	Toggles the green menu/pattern color on/off.
FUNC F3	Toggles the blue menu/pattern color on/off.
FUNC F4	Increments and locks the selected G2 value (Tube Init Menu only).
FUNC DISP PWR	Toggles the MCP2000 power on/off. When powering up the MCP2000, the ±56 V power supplies are turned on first. If there are no errors, the *extra high tension (high-voltage supply)* (EHT) is turned on and the system is put into a safe system state.
FUNC DOWN	N/A
FUNC DFLT	Sets the dials to their default values (usually mid-range, but not always).
FUNC EMEN	Activates the Emergency Menu (displayed on HHR).
FUNC EXIT	Aborts Auto-Align operation (Auto-Align Menu only).
FUNC GLBL	N/A
FUNC LEFT	N/A
FUNC MENU	Toggles the alignment pattern cursor on/off.
FUNC PAT	Cycles through selected internal patterns.
FUNC REFRESH	N/A
FUNC RIGHT	N/A
FUNC UNDO	Resets the dials to the position they were in when last saved.
FUNC UP	N/A

Table 3-1. HHR Button Functions

Button	Description/Effect
HELP	Provides help messages.
LEFT	Acts as a standard keyboard left arrow to move through the highlighted menu selections and (if they appear on the menu) the selection options.
LIGHT	On/off toggle button for the backlight of the *liquid crystal display* (LCD) on the HHR.
MENU	Acts as a toggle to make the active menu appear or disappear from the screen. When performing alignment procedures, the user uses this button frequently in order to view the raster or alignment pattern.
NEXT CH	Causes the next channel to become the active channel for any HHR adjustments or procedures.
ON/OFF	This is the standard power on/off toggle button used to either activate or disable the HHR.
PREV CH	Causes the previous channel to become the active channel for any HHR adjustments or procedures.
REFRESH	Updates the LCD on the HHR with the current options.
RIGHT	Acts as a standard keyboard right arrow to move the cursor through the highlighted menu selections within a group and (if they appear on the menu) the selection options.
UP	Acts as a standard keyboard up arrow to move through the highlighted menu selections and (if they appear on the menu) the selection options.

3.2.2 Runtime Console Commands

When a projector enters runtime, there are several things that can be done at the DCPC or WinTerm console. Type *h* or *?* to display a list of options. Each projector has its own window on the WinTerm console. These commands affect the projector whose window is active. The commands are explained in Table 3-2. If a command is accidentally started, a period (.) usually stops it.

Table 3-2. Runtime Commands

Commands		Description
d	Diagnostic bus scan	This runs the runtime diagnostics on the specified diagnostic device.
h	Display HELP message	Displays a list of all the available commands.

Table 3-2. Runtime Commands

Commands		Description
n	Toggle fast/ slow VCO clock	Makes the projector use the fast or slow *voltage-controlled oscillator* (VCO).
p	Display memory	Displays a page of memory (hexadecimal).
t	Display system version	Displays the current version of the software being used.
B	Power supply card enable/ disable	Enables/disables the power supply card. (The power supply card cannot be turned off unless the ±56 V and EHT are also disabled.)
E	High voltage enable/disable	Toggles the EHT on/off and the filament stand-by mode. (The EHT cannot be turned on unless the power supply card and the ±56 V power supply are also enabled.)
L	Lock internal line rate and count	Synchronizes the internal line rate to the IG line rate. This is only run is during the initial installation.
M	Alignment mode	Enables/disables alignment mode (phosphor protection override).
P	56 V enable/ disable	Toggles the ±56 V power supply on/off. (The ±56 V power supply cannot be turned off unless the EHT is also disabled.)
S	Display system status	Displays information about the status of the projector (see Section 7.4).
T	Phosphor protect enable/disable	Toggles the projector into a forced phosphor-protect mode.
X	Exit Runtime mode	Takes the projector out of runtime mode.
Y	Projector enable/disable	Performs the power up/down sequence (enables/disables ±56 V and EHT).
Z	Safe system enable/disable	Toggles the safe-system mode.

3.3 Startup Procedure

This startup procedure is used after a maintenance shutdown.

1. Power on the IG according to its operation and maintenance manual.

NOTE: <Shift-F12> on the DCPC keyboard has replaced the <Shift-F20> on the DEC terminal normally supplied with the IG.

2. Turn on the main circuit breaker for the MCP2000 projector system located on the input panel of each projector head unit.
3. Log on to the DCPC or the WinTerm terminal with the username as Administrator and the password as e&s (case sensitive). Wait for a few seconds after the operating system tells you to log on to allow time for the drivers to be loaded.
4. Start the DCI_Comm application.
5. Turn on the HHR and power up each projector head unit using the **FUNC DISP PWR** buttons. Switch between projector head units using the **NEXT CH** and **PREV CH** buttons. If one of the projector head units does not power up, check the projector window on the WinTerm console for that projector head unit. If an error occurs, use the techniques described in Chapter 7 to diagnose the problem.
6. Check the picture to verify that all colors are present and that the raster size is correct.
7. On the HHR, press **F4** to take the projector out of safe-system mode. The picture turns red, then green, and then blue for a few seconds.

3.4 Maintenance Shutdown Procedure

Before performing maintenance on MCP2000, use the following procedures to completely shut down the MCP2000.

3.4.1 Projector Shutdown

1. Using the HHR, press the FUNC DISP PWR buttons to power down each projector.
2. Turn the main breaker off.

3.4.2 DCPC Shutdown

The DCPC must be powered down properly to avoid corrupting files. If maintenance is required on the DCPC or WinTerm, follow these steps to power down:

1. Exit the DCI_Comm application.
2. Select Start → Programs → DOS Command Prompt.
3. Type shutdown at the prompt. Shutdown/R reboots the DCPC and shutdown/? shows available commands.

4. A timer counts down (usually 60 seconds) and returns a message to indicate that shutdown is complete. The DCPC can now be switched off.
5. The Wyse WinTerm 2300T can be switched off.
6. If the system uses a WinTerminal PC instead of the WinTerm 2300T, follow these steps:
   a. Shut down using <Control-Alt-Delete>.
   b. Turn the power off.

3.5 Standby Mode

Frequent power on/off cycling might reduce the reliability of theMCP2000. The MCP2000 should be left on unless maintenance is necessary. Putting the MCP2000 in standby mode disables the EHT and reduces the filament voltage. Standby mode helps prolong tube life without having to power the MCP-2000 on and off.

To put the projector in standby mode, type *E* in each projector's terminal window. To bring the projectors out of standby mode, scan the diagnostic bus on the projector's terminal window for failures. If there is an error, see Chapter 7 for troubleshooting suggestions. Type *E* again to toggle out of standby mode.

3.6 Turning the MCP2000 On and Off Without the DCPC

If the DCPC is unavailable or inoperable, the MCP2000 can be powered up from a VT100 terminal or a PC running the Terminal Server Client software (Appendix B). Type *?* to get a list of keys and their functions. Substitute the appropriate PC keys for the HHR keys.

3.7 Emergency Power Shutdown Procedures

CAUTION: This emergency shutdown procedure can damage software and erase data or files that have not been stored. Use this procedure only in the case of a real emergency.

In the event of an emergency, the entire system can be shut down by locating and pressing the red *Emergency Power Off* (EPO) button on the front of the *power distribution system* (PDS) control cabinet.

3.8 Projector Software Installation

Updates to the DCI_Comm software application that runs on the DCPC and the projector executable software are normally supplied in CD format. It is also possible to install the projector executable software from a PCMCIA

card. Procedures on rebuilding a hard disk on the DCPC after a disk crash are found in the *Restoring the Hard Disk on the Calligraphic Projector DCPC Manual*.

3.8.1 DCPC Software Installation

For floppy disk installations:

1. Put DISK 1 in the drive.
2. Select *Start* → *Run…* and type `setup.exe`. The setup program executes automatically. Do not change any of the default settings when the setup program requests input.

For CD installations:

1. Insert the CD and run the install program.

3.8.1.1 DCI_Comm Software Updates

1. Check the current revision number of the DCI_Comm application by selecting
   Help → *About*.
2. Quit the DCI_Comm application.
3. Insert the CD into the DCPC.
4. Open **`NT Explorer`** and rename the directory *C:\ESCP* to *C:\ESCP_old*.
5. Select the CD drive (*D:*) and execute the *setup.exe* file. Follow the on-screen instructions for installation, but Do not choose to reinstall the Meteor drivers when prompted. On completion of the installation a new *C:\ESCP* directory is installed.
6. Delete all files contained in the *C:\ESCP\data* directory.
7. Copy all the files from the *C:\ESCP_old\data* directory to *C:\ESCP\data* directory. (These are system specific auto-alignment files.)
8. Remove the CD from the drive and start the DCI_Comm application.
9. Ensure no errors occur, all terminal windows are responding, and that the revision number of the DCI_Comm application has updated (select *Help* → *About*).
10. If problems are experienced after the update, rename the directory *C:\ESCP* to *C:\ESCP_XX*. Rename *C:\ESCP_old* to *C:\ESCP* to restore the original version of the DCI_Comm application.

3.8.2 Projector Executable Software Installation

Updates to the projector executable software are normally supplied in CD format for loading onto the DCPC and transferred to the processor card in each projector. Projector software can also be loaded from a PCMCIA card.

3.8.2.1 Installing Projector Software from the DCPC

1. Insert the CD into the DCPC.
2. Install the projector software (*escp##.pbn*) in the *C:\ESCP\Projector* directory on the DCPC hard drive.
3. Make sure the projector is operating in runtime mode, but do not enable the ±56 V or EHT power supplies.
4. Select the projector window on the DCPC.
5. Using the pulldown menu on the DCPC top bar menu, select **`Restore Projector Executable`**.
6. Select and open the *escp##.pbn* file in the Open Dialog box and select **`OK`**.
7. Select **`OK`** in the warning message box. The executable file transfer from the DCPC to the projector begins. The File Progress box displays the status of the ongoing file transfer operation (complete transfer takes approximately ten minutes).
8. After the file transfer is complete, select the **`OK`** button in the Transfer Completed message box.
9. Power off the projector. Wait 20 seconds before continuing with the next step.
10. Power on the projector and enable the ±56 V and EHT power supplies.
11. Verify that a picture is present on the projector.
12. Type `t` in the projector's terminal window and verify the software version is correct.
13. Repeat the file transfer operation for each projector in the system.

3.8.2.2 Verify Software or Boot from PCMCIA Card

Use the following steps to boot and verify the projector software on the PCMCIA card:

1. Using the HHR, press the **`FUNC DISP PWR`** buttons to power down the projector.
2. Type `X` in the projector window to exit runtime.

3. Install the PCMCIA card in the PCMCIA memory connector on the processor card.
4. While holding the reset button, press the **PCMCIA** button.
5. Continue holding the **PCMCIA** button and release the **Reset** button. The LED by the PCMCIA button illuminates.
6. Release the **PCMCIA** button. Do not proceed if the PCMCIA LED is not on. Repeat the steps 4 and 5 until the LED is on.
7. Power up the projector with the new software to verify the software performs correctly.

3.8.2.3 Install or Restore Software from PCMCIA Card

Use the following steps to install or restore the projector from the PCMCIA card:

1. Using the HHR, press the **FUNC DISP PWR** buttons to power down the projector.
2. Access the projector console window on the DCPC and type *X*. The Main menu displays.
3. Type *D* <Return>. The Diagnostics menu displays.
4. Type *m* <Return>. The Processor Memory Diagnostics menu displays.
5. Type *c* <Return>. The Restore File Type prompt displays.
6. Type *e* <Return>. The executable file is transferred from the PCMCIA card to the flash memory on the processor card. The file copied successfully message displays when the transfer is complete.
7. Power down the projector.
8. Remove the PCMCIA card, install the projector top cover, and power on the projector.

3.9 Backing Up System Files

While performing visual alignments, it is recommended that changes be saved frequently to the projector. These changes are stored in flash memory located on the processor card and may be restored at any time. There are a total of seven registers from which to choose for saving and restoring these system-timing files.

3.9.1 Saving Changes to the Projector

After making modifications to alignment parameters, select **Save** on the Maintenance menu or select *Maintenance* → *Save/Restore* and select any one of the seven files to save to.

NOTE: The current file is the default. It is this file that is used when the `Save` button is used on all of the other menus.

3.9.2 Restoring from a Previous Save

Selecting the **`Restore`** button on the Maintenance menu restores the saved parameters from the default file, or select *`Maintenance`* → *`Save/Restore`* and select any one of the seven files to restore from.

3.9.3 Backing Up Projector System Timing Files to the DCPC

The most dependable backup is the DCPC. Any number of backup files can be stored on the DCPC hard disk. These same files may be transferred to floppy disks for a permanent archive. Unlike the SRAM PCMCIA backup, this backup can be performed while the projector is displaying a picture.

1. Power up the projector. The projector must be in runtime mode to perform this backup.
2. Select the projector console window on the DCPC for the projector you want to backup.
3. Using the Projector pulldown menu on the DCPC top menu bar, select **`Backup Projector Timing File`**. The Backup/Restore menu displays.
4. Use the pulldown box to select the system timing file for backup and select **`OK`**. The Save menu displays and asks for the destination name of the file you want to save. The default name includes the projector number, file number, and date.
5. Change the filename and directory, if necessary, and select **`Save`**. The system timing file transfer from the projector to the DCPC begins. The File Progress box displays the status of the file transfer operation in progress (complete transfer takes approximately 20 seconds).
6. After the transfer operation is complete, select **`OK`** in the Transfer Completed message box.

3.9.4 Restoring a Projector System Timing File from the DCPC

1. Power up the projector. The projector must be in runtime mode to perform this restore.
2. Select the projector console window for the projector you wish to restore.
3. Using the Projector pulldown menu on the DCPC top menu bar, select **`Restore Projector Timing File`**. The Open menu displays.
4. Select the file to restore and select **`Open`**.

5. Select the timing file number in the Restore dialog box.
6. Select **OK** in the Warning Message box. The system timing file transfer from the DCPC to the projector begins. The File Progress box displays the status of the file transfer operation in progress (complete transfer takes approximately 20 seconds).

CAUTION: Remember that the restore procedure is destructive. Once a file has been written over, it cannot be retrieved.

7. After the transfer operation is complete, select **OK** in the Transfer Completed message box.

4 Alignment Procedures

4.1 Introduction

This chapter explains the alignment procedures for the MCP2000. The following areas are covered:

- On-screen alignment menus—menu descriptions are in alphabetical order.
- Alignment procedures—the alignment procedures are discussed in the following categories:
  - System configuration
  - Electrical focus
  - Hysteresis adjustments
  - Geometry adjustments
  - Video adjustments
  - Soft edge adjustments

4.2 Alignment

Alignments on the MCP2000 are performed using test patterns and, in the last stages, images from user databases. The alignment section is organized to guide the technician in performing alignments in sequence for the following tasks:

- MCP-2000 installation and initial alignment
- Troubleshooting and problem correction
- Realignment after LRU replacement

4.2.1 Alignment Problem Identification and Correction

Use the procedures in this chapter to perform projector alignment. The problems discussed here assume that the power supply is functioning properly and that the IG is providing a correct image. The following general principles apply to solving alignment problems:

1. Check the problem using a reliable database and test pattern.
2. Verify that the problem is in the projector. Check adjacent projectors on the same system to see if the problem is on the projector or the IG. Do this by swapping projector cables at the IG.
3. Define the area of the problem. Determine whether the problem is with focus, geometry (gain, offset, or convergence), video (black level, gain, unblank), or other areas such as noise.
4. Verify the projector alignment using the procedures in Section 4.3.
5. If alignment does not solve the problem, exchange the assemblies identified as faulty. When you install new assemblies, you must repeat alignment procedures. See Chapter 5 for specific alignment procedures for each LRU.

4.2.2 Alignment Using the Hand-Held Remote

The majority of alignment procedures are performed using the HHR unit shown in Figure 3-1. Users responsible for alignment of the projectors must become familiar with the HHR controls described in Chapter 3. The functionality of the four dials on the HHR varies according to which *Dials* option has been activated in the current menu.

4.2.2.1 HHR Alignment Menus

This section describes each of the on-screen alignment menus and the available options. To activate the HHR and the menu system, press the **ON/OFF** button on the HHR. To toggle the menu on and off, press the **MENU** button. Note that the menu options, including the active dials, remain functional when the menu has been toggled off, as long as the HHR remains turned on. The functionality of dials on the HHR is based on the dials submenu that appears below the currently active menu. Dials are inactive if the HHR has been toggled off or if the current menu does not display a dials submenu.

NOTE: The menus shown in Figure 4-1 through Figure 4-14 are version 7.0 of the projector software. Earlier versions of the software have slight differences in the menus, but those differences do not affect the procedures in this manual.

The **UP**, **DOWN**, **LEFT** and **RIGHT** buttons on the HHR are used to navigate through the alignment menus. To enable a function, press the **DO** button when that menu button is highlighted. It is important to note, however, that the **LEFT** and **RIGHT** buttons on the HHR do not work on the Front Page and Maintenance Pages menus.

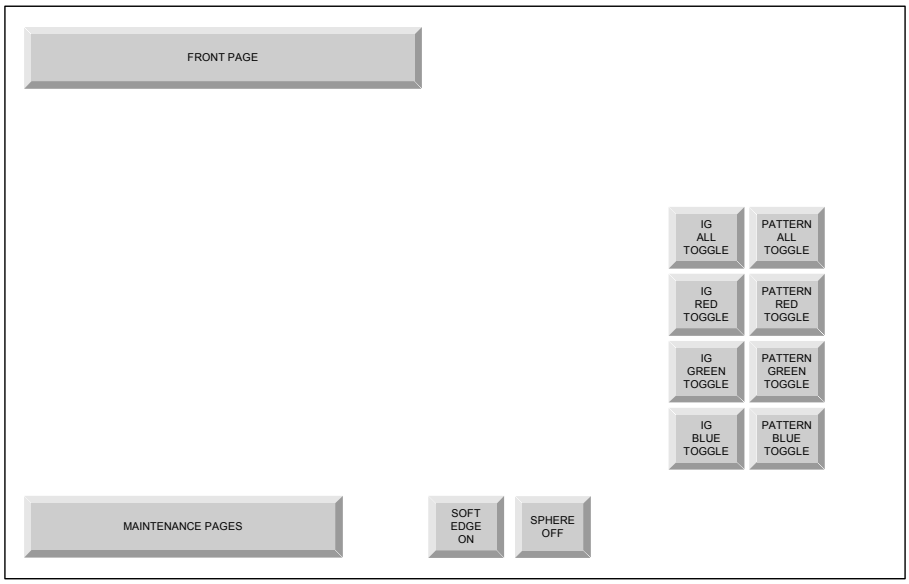


Figure 4-1. Front Page Menu

Selection Text	Description/Effect
Maintenance Pages	Pressing **DO** with the cursor positioned on **Maintenance Pages** opens the Maintenance Pages menu.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.

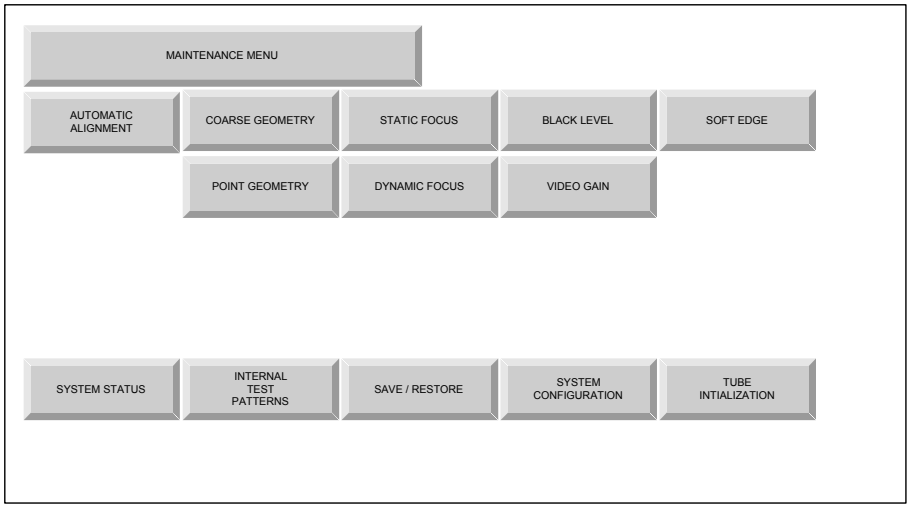


Figure 4-2. Maintenance Menu

Selection Text	Description/Effect
Auto Alignment	Opens the **Auto Alignment** menu.
Coarse Geometry	Opens the **Coarse Geometry** menu.
Point Geometry	Opens the **Point Geometry** menu.
Static Focus	Opens the **Static Focus** menu (includes static focus, rain focus, and blue focus).
Dynamic Focus	Opens the **Dynamic Focus** menu.
Black Level	Opens the **Black Level** menu.
Video Gain	Opens the **Video Gain** menu.
Soft Edge	Opens the **Soft Edge** menu.
System Status	Opens the **System Status** menu.
Internal Test Patterns	Opens the **Internal Test Patterns** menu.
Save/Restore	Opens the **Save/Restore** menu.
System Configuration	Opens the **System Configuration** menu (includes pattern delay, x-phase, and blanks).
Tube Initialization	Initializes the tube.

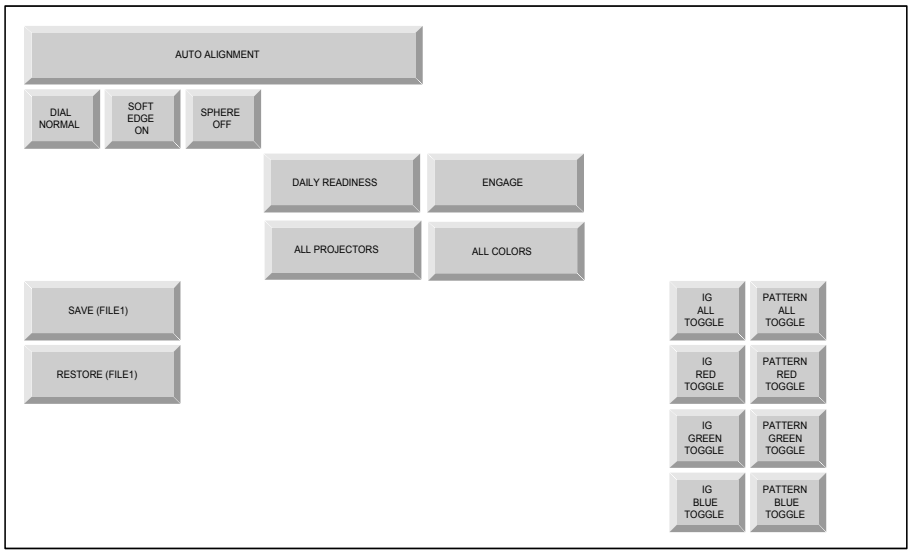
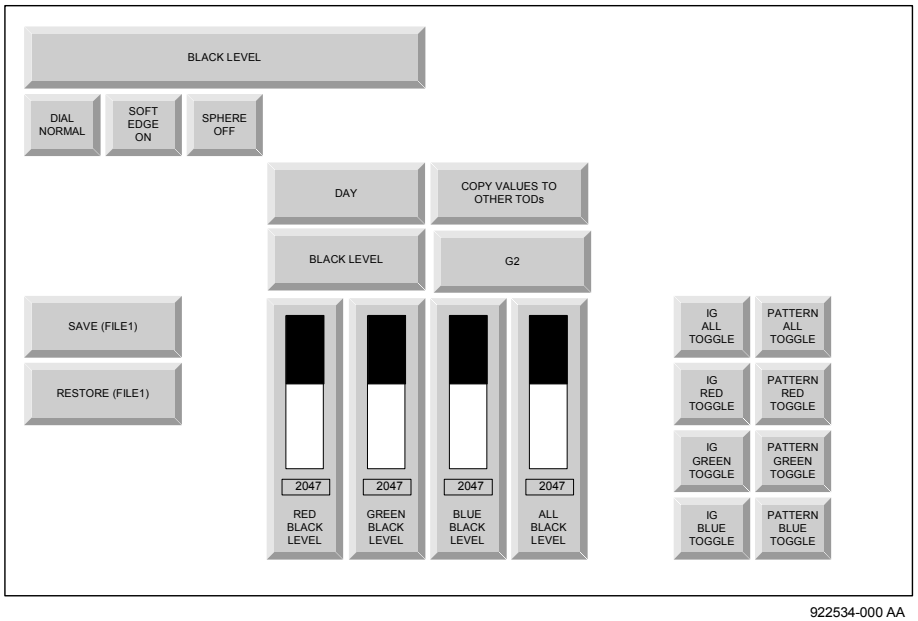


Figure 4-3. Auto Alignment Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, and **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Daily Readiness **Quick Converge** **Full Converge** **Quick Intensity** **Full Intensity** **Dynamic Focus** **Static Focus** **Edge Blend**	Pressing **DO** with the cursor positioned on **Daily Readiness** cycles through the available auto-alignment functions. The function is not activated until the engage button is selected (see below).
All Projectors **This Projector**	**Pressing DO with the cursor positioned on Projector toggles between running the auto-alignment system functions specified above on the projector displaying the menu, or all projectors installed in the system.** **Only certain auto-alignment system functions are available for individual projectors, so the system freezes the This Projector selection in some cases.**
All Colors **Red** **Green** **Blue**	**Pressing DO with the cursor positioned on Color cycles between running the auto-alignment system functions specified above on all colors or one color**

Selection Text	Description/Effect
	only.
Engage	**Pressing** DO **with the cursor positioned on** Engage **activates the auto-alignment system function that has been selected above, for the channel and color specified.**
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	**Pressing** DO **while the cursor is positioned on** IG Red, IG Green, IG Blue, **or** IG All Toggle **enables or disables the corresponding IG video color**.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	**Pressing** DO **while the cursor is positioned on** Pattern Red, Pattern Green, Pattern Blue, **or** Pattern All Toggle **enables or disables the corresponding internal pattern video color. This also affects the menu color.**
Save	**Pressing** DO **while the cursor is positioned on** Save **saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.**
Restore	**Pressing** DO **while the cursor is positioned on** Restore **restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.**



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Figure 4-4. Black Level Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on Soft Edge toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Day **Dusk** **Night**	Pressing **DO** with the **Day** button highlighted toggles through the **Day**, **Dusk**, and **Night** modes.
Black Level	Pressing **DO** with the cursor positioned on **Black Level** enables the dials to adjust the black level.
G2	Pressing **DO** with the cursor positioned on **G2** enables the dials to adjust the G2 level.
Copy Values to All TODs	Pressing **DO** while the cursor is positioned on this button copies G2 or black level values (depending on which function is enabled) from selected TOD mode (normally day) into other TOD modes (dusk, night).
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.

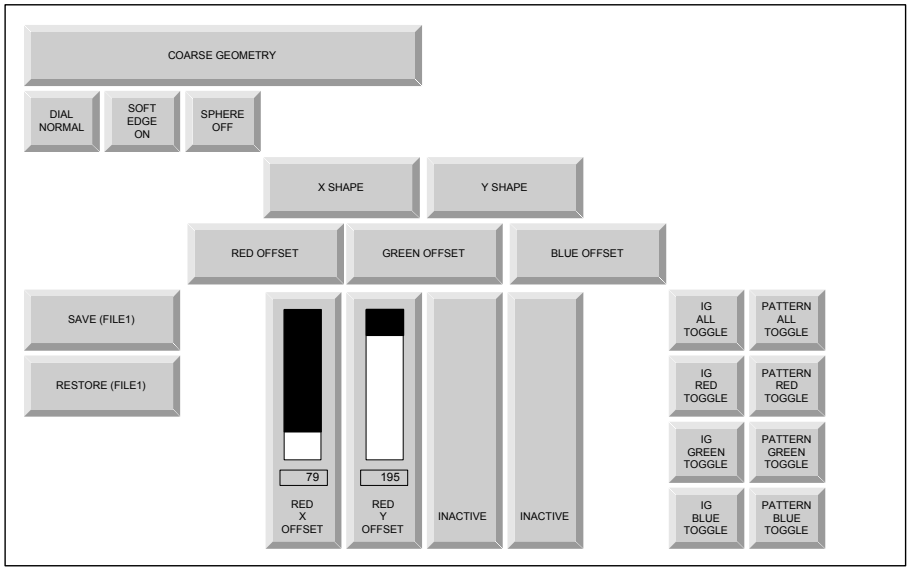


Figure 4-5. Coarse Geometry Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
X Shape	Pressing **DO** with the cursor positioned on **X Shape** enables the dials to adjust the gain and offset in the X direction for all colors.
Y Shape	Pressing **DO** with the cursor positioned on **Y Shape** enables the dials to adjust the gain and offset in the Y direction for all colors.
Red Offset **Green Offset** **Blue Offset**	Pressing **DO** with the cursor positioned on **Red Offset**, **Green Offset**, or **Blue Offset** enables the dials to adjust the offset for each color in both the *x* and *y* direction.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.

Selection Text	Description/Effect
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number sown. The system prompts for verification of the restore before proceeding.

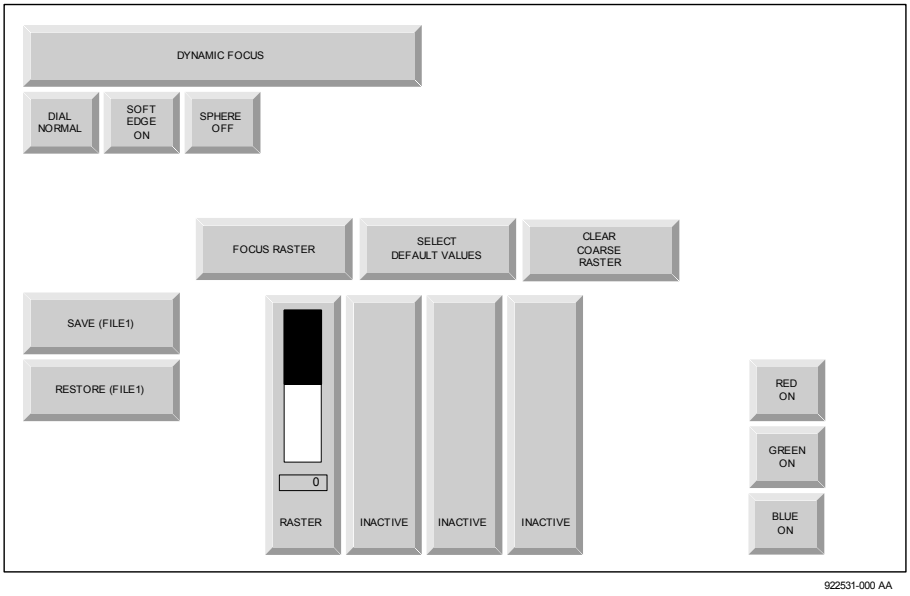


Figure 4-6. Dynamic Focus Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.

Selection Text	Description/Effect
Focus Raster **Focus Lights**	Pressing **DO** with the cursor positioned on **Focus** toggles the dials between focus lights and focus raster. It also changes the clear mode.
Clear Raster **Clear Lights**	Pressing **DO** with the cursor positioned on **Clear** clears the mode indicated by the button.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.

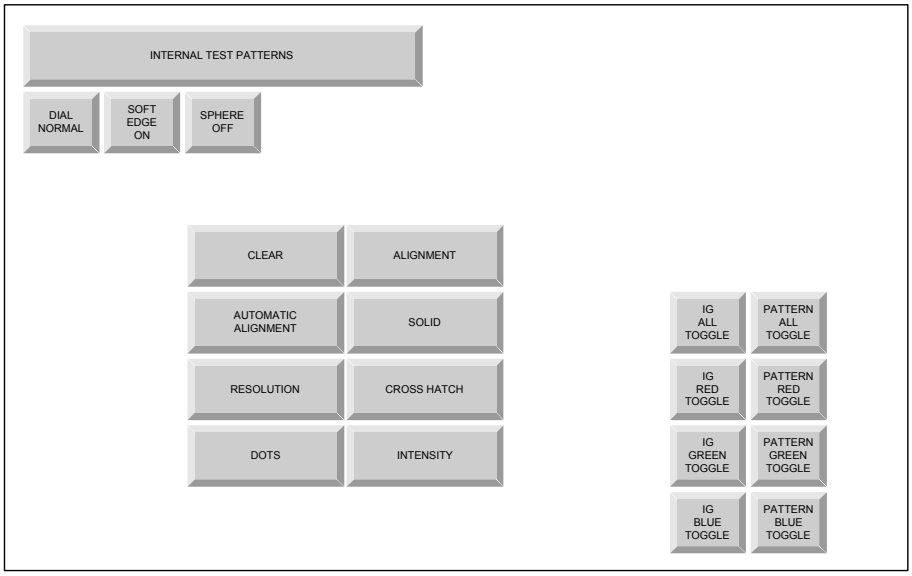


Figure 4-7. Internal Test Patterns Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Clear **Alignment** **Automatic Alignment** **Solid** **Resolution** **Cross Hatch** **Dots** **Intensity**	Pressing **DO** with the cursor positioned on any of these buttons enables the selected internal test pattern. **Clear** clears the internal test patterns.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.

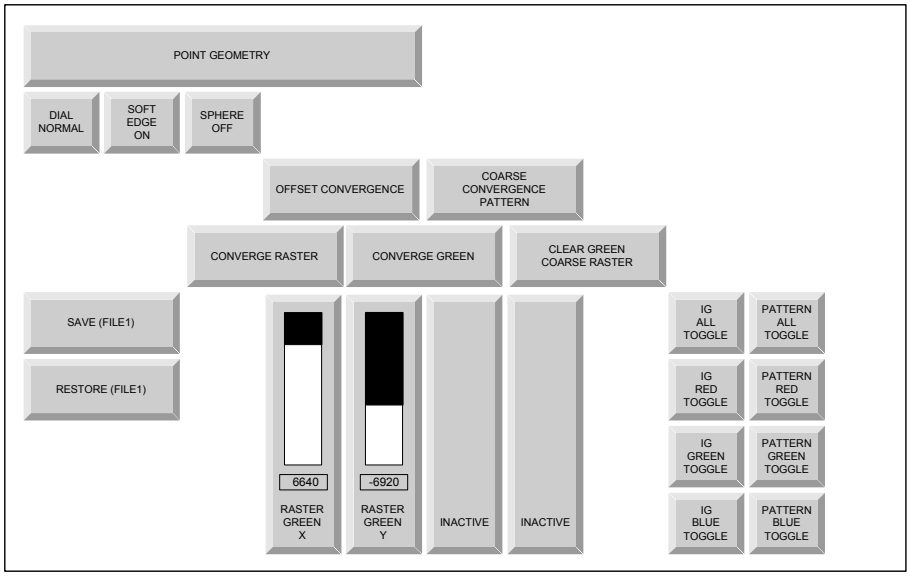
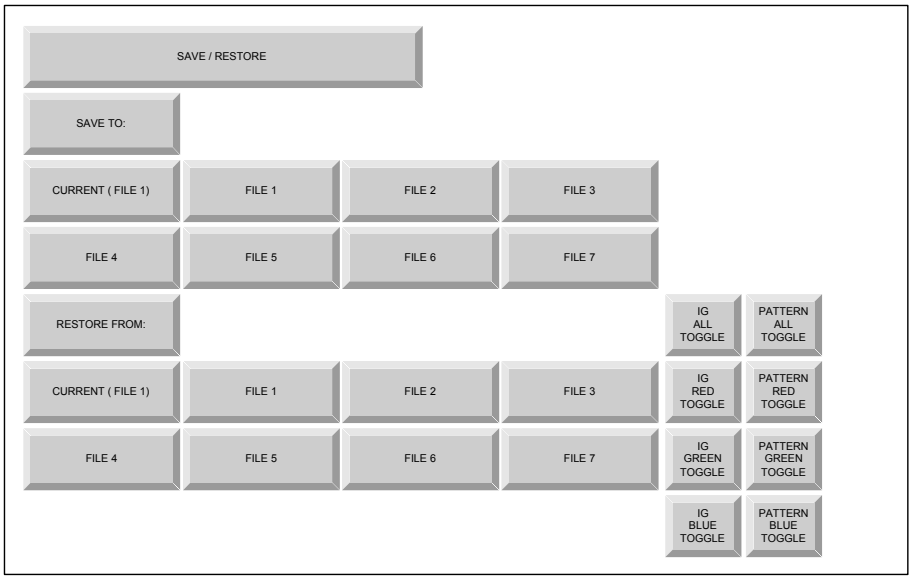


Figure 4-8. Point Geometry Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Point Convergence **Size Convergence** **Offset Convergence**	Pressing **DO** with the cursor positioned on **Offset Convergence** toggles the dials between **Point**, **Size**, or **Offset** convergence. It also changes the clear mode.
Coarse Convergence Pattern **Fine Convergence Pattern**	Pressing **DO** with the cursor positioned on **Coarse Convergence Pattern** toggles the pattern between coarse and fine. It also changes the clear mode.
Converge Raster **Converge Lights** **Converge Raster/Lights**	Pressing **DO** with the cursor positioned on **Converge Raster** toggles the dials between lights convergence, raster convergence, and both lights and raster convergence. It also changes the clear mode.
Converge Red **Converge Green** **Converge Blue** **Converge All**	Pressing **DO** with the cursor positioned on **Converge Color** toggles the dials between red, green, and blue convergence. It also changes the clear mode.
Clear	Pressing **DO** with the cursor positioned on **Clear** clears the mode indicated by the button.

Selection Text	Description/Effect
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.



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Figure 4-9. Save/Restore Menu

Selection Text	Description/Effect
Save To: **Current** **File 1 ñ File 7**	Pressing **DO** with the cursor positioned on any of these buttons saves the file to that location. Selecting a file location changes the **Current** file to that same selection.
Restore From: **Current** **File 1 ñ File 7**	Pressing **DO** with the cursor positioned on any of these buttons restores that file. Selecting a file changes the **Current** file to that same selection.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.

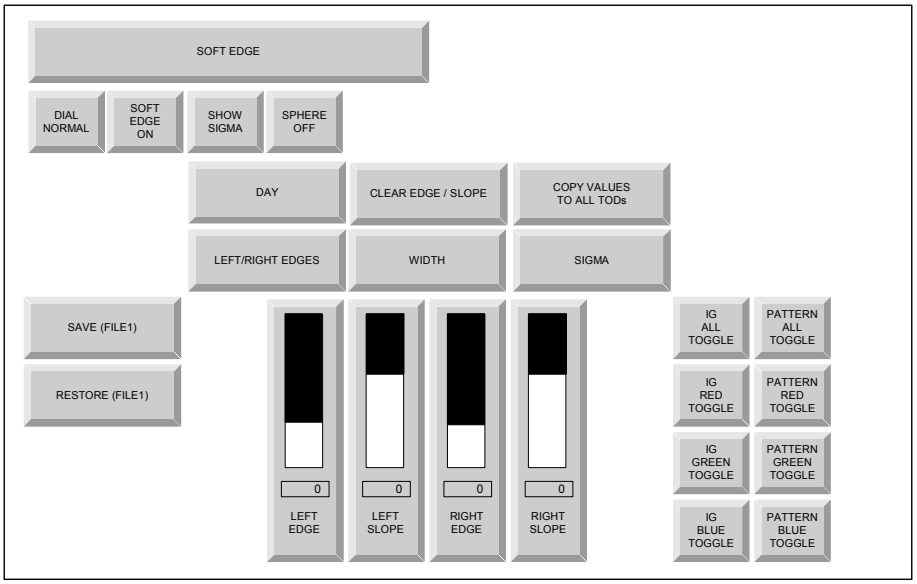


Figure 4-10. Soft Edge Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Show Sigma **Show Edge** **Show Width**	Pressing **DO** with the cursor positioned on **Show Sigma** toggles the soft edge mode between **Sigma**, **Edge**, and **Width**.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Day **Dusk** **Night** **Lights**	Pressing **DO** with the **Day** button highlighted toggles through the **Day**, **Dusk**, **Night**, and **Lights** modes.
Clear Edge/Slope **Clear Width** **Clear Sigma**	Pressing **DO** with the cursor positioned on **Clear** clears the mode indicated by the button.
Left/Right Edges	Pressing **DO** with the cursor positioned on **Left/Right Edges** enables the dials to adjust the left and right edges. It also changes the clear mode.
Width	Pressing **DO** with the cursor positioned on **Width** enables the dials to adjust the widths. It also changes the clear mode.

Selection Text	Description/Effect
Sigma	Pressing **DO** with the cursor positioned on **Sigma** enables the dials to adjust the sigmas. It also changes the clear mode.
Copy Values to All TODs	Copies Left/Right edge values and Width values (depending on which function is enabled) from selected TOD mode (normally day) into other TOD modes (dusk, night).
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.

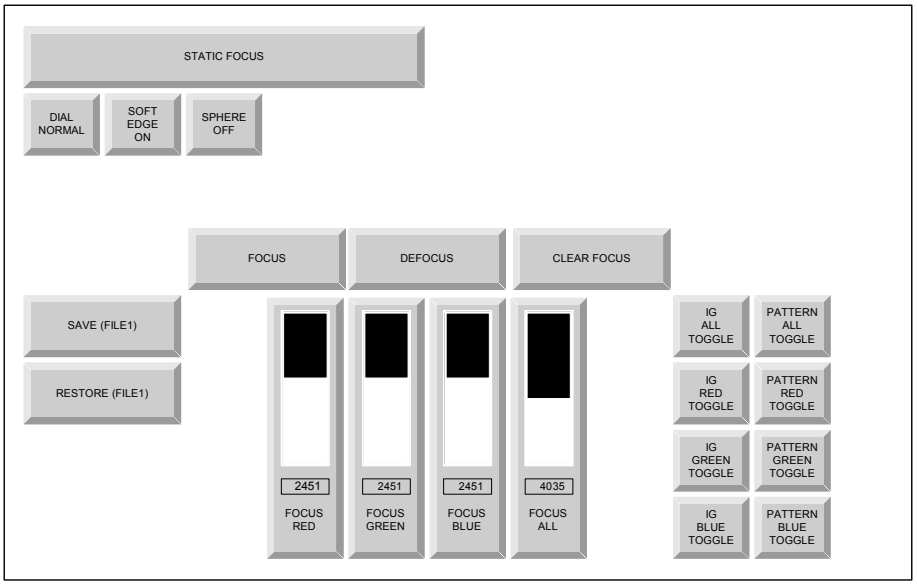
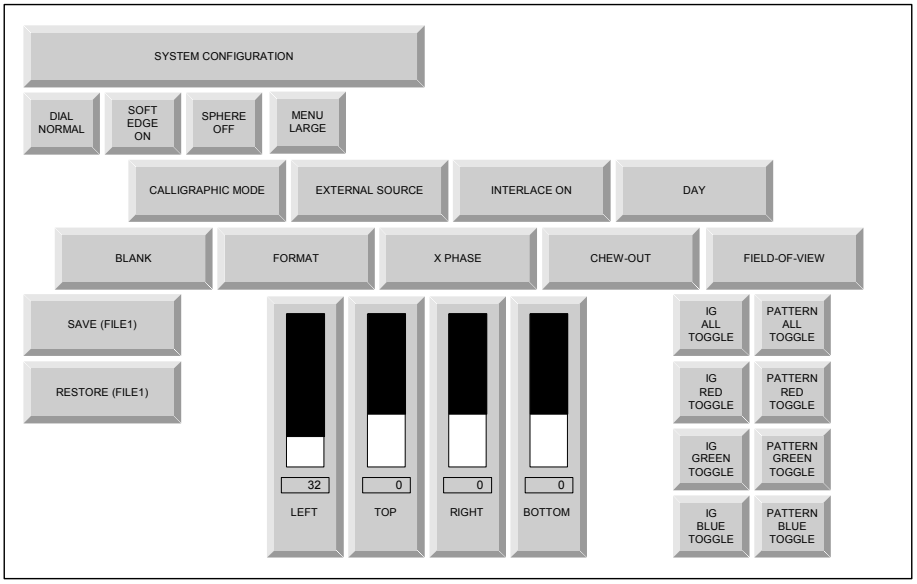


Figure 4-11. Static Focus Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Focus	Pressing **DO** with the cursor positioned on **Focus** enables the dials to adjust static focus for the individual or all colors.
Defocus	Pressing **DO** with the cursor positioned on **Defocus** enables the dials to adjust Blue Defocus and Rain Defocus.
Clear Focus **Clear Defocus**	Pressing **DO** with the cursor positioned on **Clear** clears the mode indicated by the button.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.

Selection Text	Description/Effect
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.



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Figure 4-12. System Configuration Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Menu Large **Menu Small**	Pressing **DO** with the cursor positioned on **Menu** toggles the on-screen menu size large or small. A small menu is useful on low-resolution systems where the bottom of the large menu may not be visible.
Calligraphic Mode **Raster Mode**	Pressing **DO** with the cursor positioned on **Calligraphic Mode** toggles between calligraphic and raster modes.

Selection Text	Description/Effect
External Source **Internal Source**	Pressing **DO** with the cursor positioned on **External** source toggles between external (IG) and internal syncs.
Interlace On **Interlace Off**	Pressing **DO** with the cursor positioned on **Interlace** toggles between interlace mode on and off.
Day **Dusk** **Night**	Pressing **DO** with the **Day** button highlighted toggles through the **Day**, **Dusk**, and **Night** modes.
Blank	Pressing **DO** with the cursor positioned on **Blank** enables the dials to adjust the blanks.
Format	Pressing **DO** with the cursor positioned on **Format** enables the dials to adjust the pattern delay.
X Phase	Pressing **DO** with the cursor positioned on **X Phase** enables the dials to adjust the X-Phase.
Chew-out	Pressing **DO** with the cursor positioned on **Chew-out** enables the dials to adjust the chew-out value.
Field-of-View	Pressing **DO** with the cursor positioned on **Field-of-View** enables the dials to adjust for offset.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.

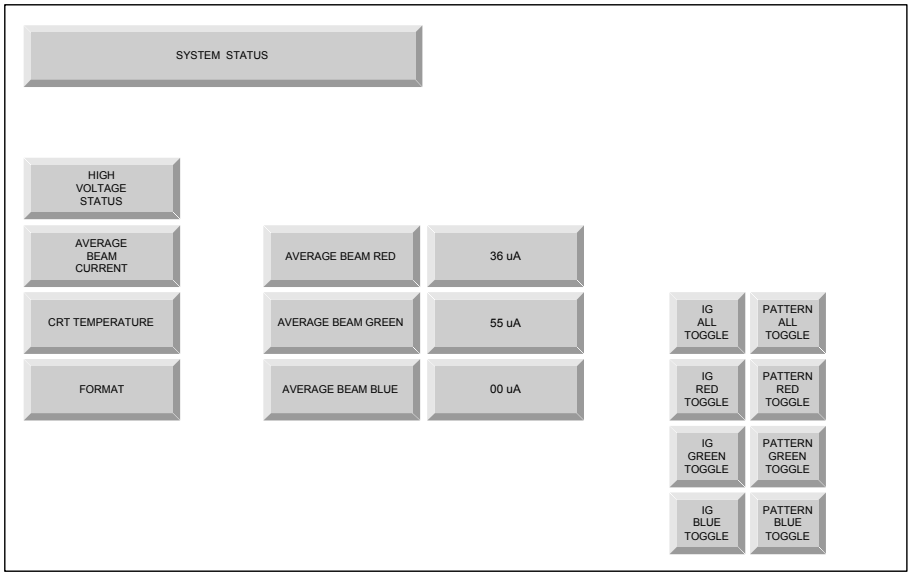


Figure 4-13. System Status Menu

Selection Text	Description/Effect
High Voltage Status **Average Beam Current** **CRT Temperature** **Format**	Pressing **DO** with the cursor positioned on any of these buttons updates the menu to show the selected information.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.

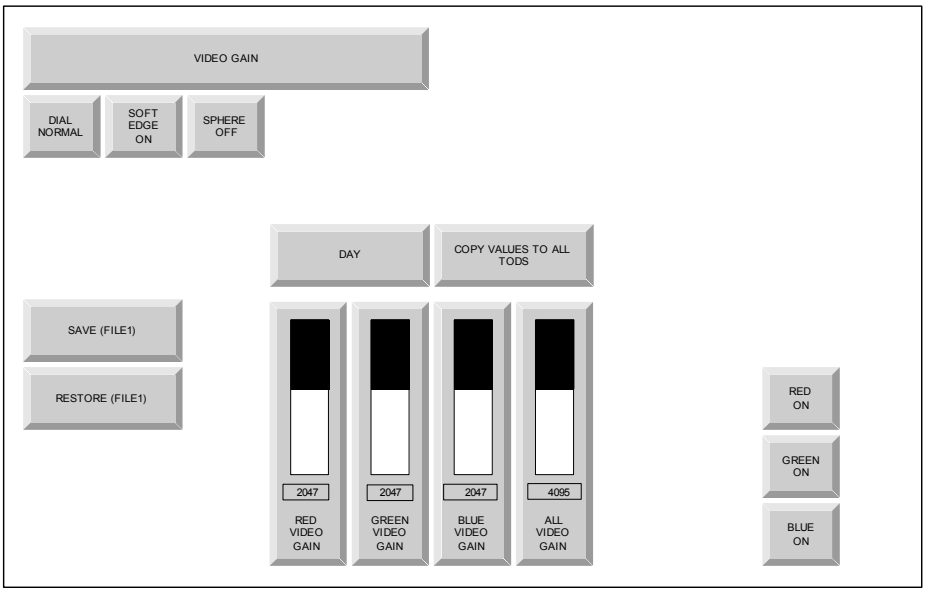


Figure 4-14. Video Gain Menu

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: **Fine**, **Normal**, or **Coarse**.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Day **Dusk** **Night**	Pressing **DO** with the **Day** button highlighted toggles through the **Day**, **Dusk**, and **Night** modes.
Copy Video Gain Values To All TODs	Pressing **DO** while the cursor is positioned on the video gain button copies video gain values (depending on which function is enabled) from selected TOD mode (normally day) into other TOD modes (dusk, night).
IG Red On/Off **IG Green On/Off** **IG Blue On/Off** **IG All Toggle**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, **IG Blue**, or **IG All Toggle** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off** **Pattern All Toggle**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, **Pattern Blue**, or **Pattern All Toggle** enables or disables the corresponding internal pattern video color. This also affects the menu color.

Selection Text	Description/Effect
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.

4.3 Alignment Procedures

Most of the following procedures require a test pattern to be displayed while you make the various adjustments using the HHR. Watching the effect these adjustments have on the test pattern is key to adjusting the projectors and learning how the HHR controls affect the image. Some of the IG test patterns are defined by the system *field of view* (FOV). For example, if the system has a total FOV of 180°, select the test pattern that includes 180 in the name (sphere180, raster180).

In some cases, it may be necessary to deviate slightly from the values recommended in these instructions in order to achieve a satisfactory result in the test pattern. Often, the following instructions recommend a specific numerical value for a dial setting. Unless stated explicitly that a setting must be followed exactly, refer to the appearance of the test pattern as the ultimate guideline. The following sections contain instructions for making adjustments. These adjustments and the order in which to perform them are:

- System configuration
- Electrical focus
- Geometry adjustments
- Video adjustments
- Soft edge

4.3.1 Useful ESIG Commands

4.3.1.1 Disable Video Auto-Blanking

Many systems are configured in the ESIG site file to auto-blank the video after a specified amount of time. This video auto-blank feature can be disabled so that the display does not blank in the middle of an alignment procedure. Type the following commands on the ESIG:

```
CLI> video \blank eye off
CLI> video \blank host off
CLI> video \blank CLI off
```

This command can be restored after alignments are finished by reloading the ESIG site file (type `sys I full`) at the `CLI>` prompt).

4.3.1.2 Enable/Disable Time-of-Day Commands

The ESIG sends TOD commands (day, dusk, night) through an IG commands (smart) port. When the smart port is enabled, it automatically matches the projector TOD to the TOD commands coming from the IG. If the smart port is disabled, you must configure the projectors to match the IG TOD.

The port is disabled by clicking the TOD button on the menu bar of the DCPC or by typing the following command on the ESIG:

```
CLI> set \smart off
```

The port is enabled by clicking the TOD button on the menu bar on the DCPC or by typing `set \smart on 1` at the *command line interpreter* (CLI) prompt on the ESIG.

4.3.2 System Configuration

Most system configuration changes are normally performed only during installation, with the exception of pattern delay, blanks, and X phase. Check these three adjustments if the processor or ramp card is replaced.

The procedure to use for system configuration is as follows:

- Set up video format information (System Configuration menu)
- Set up FOV if system is offset
- Set up pattern delay
- Set up blanks
- Set up X phase
- Lights unblank display

4.3.2.1 System Configuration Menu

This menu defines the type of information that is available in video format. The typical ESIG IG uses the following settings: Calligraphic Mode, External Source, and Interlaced On.

1. The IG is assumed to be running and sending good video information to the projector head unit.
2. On the DCPC, at the desired projector console window, type L. This displays and records how many horizontal lines the IG is drawing.

3. Select **Calligraphic Mode**.
4. Select **External Source**.
5. Select **Interlace On**.
6. Using the HHR, save the system file. The next time the MCP2000 is powered up, it remembers these settings because they are stored in the system file.

4.3.2.2 Field of View

The FOV adjustment is used only when the system is vertically offset. On systems that have a vertical FOV of 20°/20°, which is most common, the FOV value is set to 0. If the optical system is offset (15°/25°, 20°/25°), use the following procedure:

Test Pattern: */reset/sphere150.rst or*
/reset/sphere180.rst or
/reset/sphere200.rst
Internal Test Patterns → Alignment

Menu: *Soft Edge Off*
System Configuration → Field-of-View

Procedure:

1. Make sure Soft Edge is off.
2. Display the Internal Test Patterns menu and select the **Alignment** button.
3. Open the System Configuration menu and select the **Field-of-View** button.
4. Adjust the **Vertical** dial so that the center of the internal test pattern aligns with the top of the center of the IG sphere image. The **Horizontal** value should remain at 0.

4.3.2.3 Pattern Delay

The pattern delay adjustment is used to calibrate the internal test patterns to the internal alignment space.

Test Pattern: *Internal Test Patterns → Alignment*

Projector Menu: *Point Geometry → Red Raster*
System Configuration → Pattern Delay

Procedure:

NOTE: This may be easier with only one color visible at a time.

1. Open the Internal Test Patterns menu and select the **Alignment** button.

2. Open the Point Geometry menu and select the **`Converge Raster`** button.
3. Move the alignment cursor to the center of the screen and create a large vertical distortion in the pattern (**`FUNC/MENU`** toggles the cursor on and off).
4. The cursor should appear at the peak of the distortion (Figure 4-15). If not, go to the System Configuration menu, select the **`Format`** button and adjust the Pattern Delay dial accordingly (a typical value is 36).
5. After the **`Pattern Delay`** value is determined, remove the vertical distortion created in step 3.

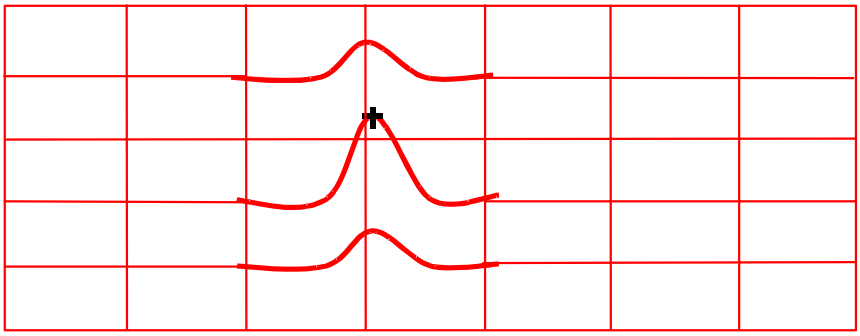


Figure 4-15. Alignment Pattern Distortion

NOTE: If the pattern delay is set to optimum on systems that run low line rates (i.e., 1 million pixels, 43 kHz), there is not enough range on the **Blanks** adjustment to align the internal projector pattern with the IG spherical pattern. The optimum value appears to be 37; set the pattern delay value to 36 instead.

4.3.2.4 Blanks

Overlay the IG sphere test pattern and the internal test pattern. This procedure only needs to be done when a processor card is replaced or when a new system is first being aligned.

Test Pattern: */reset/raster150.rst*
/reset/raster180.rst
/reset/raster200.rst
Internal Test Patterns → *Alignment*

Menu: *Soft Edge Off*
System Configuration → *Blank*

NOTE: Use the appropriate IG reset file that matches your system configuration (i.e., *raster150.rst* is for a 150° WIDE system).

Procedure:

NOTE: Watch and align the edges of the patterns. Once the edges match, the rest of the pattern matches.

1. Make sure that **Soft Edge** is off.
2. Load the IG raster test pattern.
3. Open the Internal Test Patterns menu and select the **Alignment** button.
4. Open the System Configuration menu and select the **Blanks** button.
5. Adjust the **Left** and **Right** dials so that the left and right edges of the IG raster pattern and the internal test pattern line up on top of each other (an exact match may not be possible).

4.3.2.5 X Phase

X Phase moves the entire raster picture to the left or right. Watch the right edge of the picture and look for the image to fold over. The objective is to move the image as far as possible to the right without getting any fold over to allow for the maximum amount of horizontal sweep time.

Test Pattern: */reset/sphere150.rst*
/reset/sphere180.rst
/reset/sphere200.rst

Menu: *System Configuration → X Phase*

Procedure:

1. Open the System Configuration menu and turn **Soft Edge** to off.
2. Load the IG sphere test pattern.
3. In the System Configuration menu, select **X Phase**.
4. Adjust **X Phase** so that the projected image is as far to the right as possible without image foldover.

NOTE: Not all systems have a fold-over effect. This is due to the individual characteristics of the deflection and ramp assemblies and the line rate. If your system does not fold over, set the X Phase value to 4050.

4.3.2.6 Lights Unblank Delay

The lights unblank delay control compensates for the IG lights settling time and the deflection performance of the projector amplifiers. The lights unblank delay value should be set to 0 to match the lights settling time characteristics of the SPX and ESIG family of IGs and the speed of the MCP2000.

amplifiers. If the lights unblank delay is set too high, the lights have streaks that look like comet tails when the projector displays them.

4.3.3 Focus

It is assumed that the mechanical focus of the lenses was performed during the installation procedure. If the desired focus is not obtained using the HHR, repeat the mechanical focus procedure in the installation section (Section 2.4.1).

Electrical focus is divided into three categories: static, dynamic, and defocus. Each is explained in the appropriate sections below.

NOTE: Static focus should be performed before geometry adjustments.

4.3.3.1 Static Focus

Static focus is best described as focusing the center region of the screen.

Test Pattern: *Internal Test Pattern → Resolution*

Menu: *Static Focus*

Procedure:

1. Open the Internal Test Pattern menu and select the **`Resolution`** button.
2. Turn green and blue beams off (**`F1`** for red, **`F2`** for green, **`F3`** for blue).
3. Open the Static Focus menu, select the **`Focus Raster`** button and adjust the **`FOCUS RED`** dial for the best overall focus in the center of the screen.
4. Turn the green beam on and turn red and blue off. Adjust the **`FOCUS GREEN`** dial for the best overall green focus in the center of the screen.
5. Turn the blue beam on and turn red and green off. Adjust the **`FOCUS BLUE`** dial until there is a dim circle in the center of the screen. This circle will be removed in the defocus procedure (see 4.3.3.2).
6. Save the data.

4.3.3.2 Defocus

Blue defocus is used to defocus the blue raster in order to obtain an even blue intensity level without sacrificing focus to blue lights. You must adjust the blue defocus until the dim circle in the middle of the image disappears.

Rain defocus is an IG function that simulates rain on the windscreen of the aircraft by applying a voltage level to the focus coil of the CRT. The level of defocus is proportional to the value set on the dial. If this value is set too high,

it can cause the projector to go into phosphor protect mode. The following procedure gives the recommended values.

Test Pattern: */reset/raster150.rst*
/reset/raster180.rst
/reset/raster200.rst

Menu: *Static Focus → Defocus*

Procedure:

1. Open the Static Focus menu and select the **`Defocus`** button.
2. Set **`BLUE DEFOCUS`** to 500.
3. Set **`RAIN DEFOCUS`** to 65.
4. Save the data.

4.3.3.3 Dynamic Focus

Dynamic focus is like point geometry. The dynamic focus adjusts the portion of the screen where the cursor is located. Raster and lights each have one set of adjustments. Dynamic focus adjustments affect all colors. However, when adjusting dynamic focus, use only one color (green or red); if more than one color is showing, the focus tends to be harder to see. The dynamic focus procedure should be performed after the geometry adjustments (Section 4.3.4).

Test Pattern: /*reset/sphere150.rst*
/reset/sphere180.rst
/reset/sphere200.rst
/reset/raster150.rst
/reset/raster180.rst
/reset/raster200.rst

Menu: *Dynamic Focus*

Procedure:

1. Load the IG sphere test pattern.
2. Open the Dynamic Focus menu and press **`DO`** with the **`Focus`** button highlighted until it says **`Focus Lights`**.
3. Focus the lightpoints, starting in the top left corner and moving across the row of lightpoints, ending up at the bottom right of the picture.
4. Press **`DO`** with the **`Focus`** button highlighted until it reads **`Focus Raster`**.
5. Adjust the **`Raster`** dial for the best overall focus in all corners. Focus at the center of the screen was accomplished with static focus.

NOTE: Dynamic focus adjustments to raster can cause uneven intensity in blue resulting in discolored blotches on the image.

6. Load the IG raster pattern and look for discolored areas. Set the dial sensitivity to **FINE**. Start in the upper left corner and try to *chase* the blotches down to the bottom right corner. A few clicks of the dial can make a big difference.

NOTE: Bring up the menu periodically to make sure it is still in focus. Because the internal and external patterns focus differently when displayed simultaneously, do not just focus the cursor at the top of the IG raster test pattern.

7. Save the data.

4.3.3.4 Hysteresis Adjustment

Hysteresis adjustments (Figure 4-16) are made by adjusting potentiometers located on the deflection preamplifier cards. There are two preamplifier cards (*x* and *y*) for each color on a projector. It may be necessary for one person to look at the image in the cockpit while another adjusts the potentiometers. There are two hysteresis adjustment procedures, depending on the type of deflection preamplifier card installed on the projector.

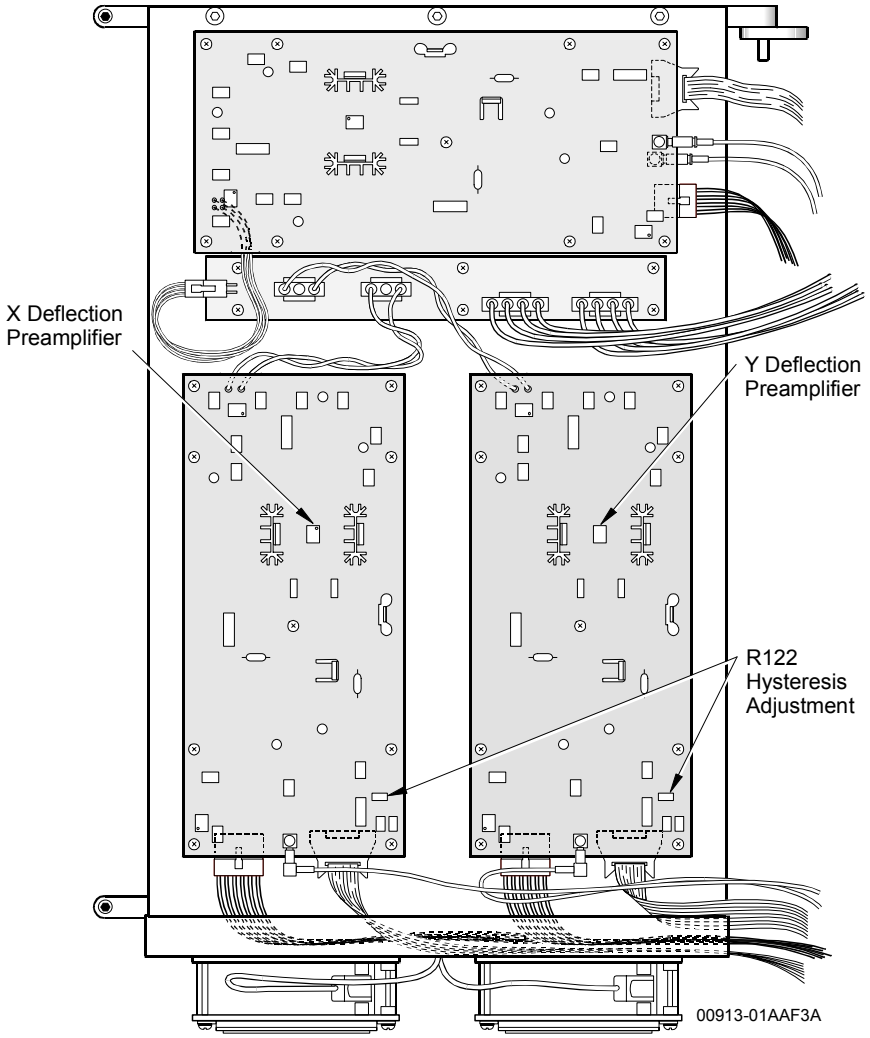


Figure 4-16. Hysteresis Adjustments

4.3.3.4.1 Hysteresis Procedure 1—Deflection Amplifier 239610-104 (Preamplifier 239620-111)

Test Pattern: */reset/hyst_x.rst*
/reset/hyst_y.rst

Menu: *None*

Procedure:

1. Bring up the *hyst_x.rst* test pattern.
2. Turn blue and green off (**`F1`** for red, **`F2`** for green, **`F3`** for blue).
3. Adjust R122 on the red x-deflection preamplifier (230620) located on the deflection amplifier assembly to eliminate any wag in the test pattern.

4. Adjust R98 on the red x-deflection preamplifier (230620) located on the deflection amplifier assembly to eliminate any movement on the top of the light string in the test pattern.
5. Repeat step 3 if necessary.
6. Repeat steps 3 through 5 for green and blue.
7. Bring up the *hyst_y.rst* test pattern.
8. Turn blue and green off (**`F1`** for red, **`F2`** for green, **`F3`** for blue).
9. Adjust R122 on the red *y*-deflection preamplifier (230620) located on the deflection amplifier assembly to eliminate any wag in the test pattern.
10. Adjust R98 on the red *y*-deflection preamplifier (230620) located on the deflection amplifier assembly to eliminate any movement on the top of the light string in the test pattern.
11. Repeat step 9 if necessary.
12. Repeat the steps 9 through 11 for green and blue.

4.3.3.4.2 Hysteresis Procedure 2—Deflection Amplifier 239610-xxx (Preamplifier 239620-100)

Test Pattern: */reset/hyst_x.rst*
/reset/hyst_y.rst

Menu: *None*

Procedure:

1. Bring up the *hyst_x.rst* test pattern.
2. Turn blue and green off (**`F1`** for red, **`F2`** for green, **`F3`** for blue).
3. Adjust R122 on the red *x*-deflection preamplifier (230620) located on the deflection amplifier assembly to eliminate any wag in the test pattern.
4. Repeat the previous step for green and blue.
5. Bring up the *hyst_y.rst* test pattern.
6. Turn blue and green off (**`F1`** for red, **`F2`** for green, **`F3`** for blue).
7. Adjust R122 on the red *y*-deflection preamplifier (230620) located on the deflection amplifier assembly to eliminate any wag in the test pattern.
8. Repeat the step 7 for green and blue.

4.3.4 Geometry Adjustments

With the digital correction abilities of the MCP2000, the alignment concepts have changed considerably from the analog concepts. All the analog corrections like keystone, pincushion, non-linearity, and convergence have been eliminated. These analog functions have all been reduced to two

fundamental adjustments: size and offset. These size and offset functions are all that is needed to correct for any keystone, pincushion, linearity, or convergence errors. There are two geometric correction menus: Coarse Geometry and Point Geometry. The main difference in functionality between the Coarse and Point Geometry menus is how they are processed. The coarse geometry functions are applied to the ramp card, which provides the actual deflection signal to the deflection amplifiers. The point geometry functions are processed by the BLIP card.

4.3.4.1 Coarse Geometry

The Coarse Geometry menu is limited to size and center (or offset) for both *x* and *y* deflection. The size acts just like the analog gain function. The offset function is just like the analog offset function but unlike the size function, it has separate controls for each of the three colors. The Coarse Geometry menu is used to size and center the entire image on the screen and provide a rough convergence of the three colors by modifying the ramp signal.

4.3.4.1.1 X Shape

This menu is used to size and center the picture using the coarse geometry terms (X Size and X Center). The size controls the amount of deflection (or size) in the horizontal direction. The center adjustment performs an offset function and offsets (or centers) the image on the horizontal axis. These adjustments are intended to be rough adjustments only and, therefore, are applied to each color (red, green, and blue) equally.

Test Pattern: */reset/sphere150.rst or*
/reset/sphere180.rst or
/reset/sphere200.rst
Internal Test Pattern → None
Sphere projector → On

Projector Menu: *Coarse Geometry → X Shape*

Procedure:

NOTE: You may need to converge the three colors by selecting the **RED/GREEN/BLUE OFFSET** buttons and adjusting the appropriate dials (Section 4.3.4.1.3).

NOTE: For initial setup, clear all the raster and lights convergence in the Point Geometry menu.

1. Turn on the sphere projector. The sphere projector provides the reference points for the IG *sphereXXX.rst* alignment pattern.
2. Load the IG sphere test pattern.

3. Press **F2** and **F3** on the HHR to turn off the green and blue. Red should be the only color visible.

NOTE: X shape adjustments are more easily made with only one color visible. Be aware that the other colors are also adjusted. Red is used in this example, but green or blue could be used as well.

4. Go to the Coarse Geometry menu and select the **X Shape** button.
5. Adjust the **X Size** dial until the outer edges of the IG image align with the sphere projector image.

NOTE: It may be necessary to move the Red Offset by selecting the **Red Offset** button and adjusting the dials (Section 4.3.4.1.3).

6. Adjust the **X Center** dial, to balance any error between the two outer edges. Then readjust **X Size** for desired results.
7. Steps 5 and 6 may have to be repeated several times to obtain the desired results.
8. Press **F2** and **F3** on the HHR to turn the green and blue colors back on.

4.3.4.1.2 Y Shape

The Y Shape menu is used to size and center the picture using the coarse geometry terms (Y Size and Y Center). The size controls the amount of deflection (or size) in the vertical direction. The center adjustment performs an offset function and offsets (or centers) the image on the vertical axis. These adjustments are intended to be rough adjustments only and, therefore, are applied to each color (red, green, and blue) equally.

NOTE: These adjustments only need to be made if a ramp card or a deflection amplifier is replaced, or if you have run out of range in the point geometry adjustments.

Test Pattern: */reset/sphere150.rst*
/reset/sphere180.rst
/reset/sphere200.rst
Internal Test Pattern → None
Sphere Projector → On

Projector Menu: *Coarse Geometry → Y Shape*

Procedure:

NOTE: On initial setup, clear all the raster and lights convergence in the Point Geometry menu.

1. Turn on the sphere projector.
2. Load the IG sphere test pattern.

3. Press **F2** and **F3** on the HHR to turn off the green and blue colors. Red should be the only color visible.

NOTE: Y shape adjustments are more easily made with just one color visible, but be aware that the other colors are also adjusted. Red is used in this example, but green or blue could be used as well.

4. Go to the Coarse Geometry menu and select the **`Y Shape`** button.
5. Adjust the **`Y Size`** until the outer edges of the IG image align with the sphere projector image.
6. Adjust the **`Y Center`** dial to balance any error between the two outer edges. Then readjust X Size for desired results.
7. Steps 5 and 6 may need to be repeated several times to obtain the desired results.
8. Press **F2** and **F3** on the HHR to turn the green and blue colors back on.

4.3.4.1.3 Offset (Red/Green/Blue)

X and Y offsets only apply to individual colors, but both raster and lightpoints are affected. Fine convergence (or offset) is performed through the Point Geometry menu (see Section 4.3.4.2).

Test Pattern: */reset/sphere150.rst*
/reset/sphere180.rst
/reset/sphere200.rst
Sphere projector → On

Menu: *Coarse Geometry → R/G/B Offset*

Procedure:

1. Turn on the sphere projector.
2. Load the IG sphere test pattern.
3. Open the Coarse Geometry menu and select the **`Red Offset`** button.
4. Adjust the red **X** and **`Y Offset`** for best convergence with respect to the sphere projector.
5. Open the Coarse Geometry menu and select the **`Green Offset`** button.
6. Adjust the green **X** and **`Y Offset`** for best convergence with respect to red.
7. Open the Coarse Geometry menu and select the **`Blue Offset`** button.
8. Adjust the blue **X** and **`Y Offset`** for best convergence with respect to red and green.
9. Save the data.

4.3.4.2 Point Geometry Adjustments

Point geometry adjustments correct linearity, keystone, pincushion, and convergence for both raster and lights. Point geometry functions are processed by the BLIP card, which performs correction calculations prior to sending the results to the ramp card.

In point geometry, two different alignment pattern sizes can be chosen: a fine pattern or a coarse pattern. The coarse pattern is recommended for all raster and light convergence. The fine pattern may be used for fine-tuning lights to a user database. Fine and coarse represent two entirely different mathematical spline surfaces, so an error introduced in the fine pattern cannot be compensated for in the coarse pattern. Thus, any time a major component is replaced that affects convergence, it is recommended that the fine pattern be cleared before adjusting the convergence on the coarse pattern.

The following are a few hints for converging the system. These are not absolute rules, but they may help.

- Align the red raster to the sphere projector because it is easy to see the red raster against the sphere lines. Turn off the sphere projector. Align the green raster to the red and then align the blue raster to the red. Next, align the red lights to the red raster, then green lights to the red lights, and the blue lights to the red lights.
- In raster mode, it is sometimes easier to converge the cursor than the actual IG lines.
- Converge only the point where the alignment cursor is pointing.
- Use the coarse convergence pattern with the IG sphere test pattern.
- Make sure your focus is very good before spending much time on convergence.
- Fine tune lights convergence with an actual IG database.
- Before you turn the menu off and start converging, select Save. This way you can save by just pressing the DO button without bringing up the menu.

4.3.4.2.1 Offset/Size/Point Convergence

This button toggles between **`Offset`**, **`Size`**, and **`Point Convergence`** modes (press the **`DO`** button to select). The offset and size functions are similar to the center and size adjustments in the Coarse Geometry menu, but the Point Geometry menu functions have less range due to the characteristics of the BLIP card. Make sure the Coarse Geometry procedure has been performed before performing the Point Geometry procedure.

The **`Point Convergence`** mode adjusts the portion of the screen where the cursor is located. The cursor can be moved by pressing the arrow keys on

the HHR. Adjust the point under the cursor. Correct convergence and geometric errors during this phase of the alignment.

4.3.4.2.2 Converge Raster/Lights/Both

Pressing the **DO** button with the **Converge Raster/Lights/Both** button highlighted on the Point Geometry menu selects the convergence function to apply to raster, lights, or both.

4.3.4.2.3 Converge Green/Red/Blue/All Colors

Pressing the **DO** button with the **Converge Red/Green/Blue/All Colors** button highlighted on the Point Geometry menu selects the convergence function to apply to individual colors or to all colors.

4.3.4.3 Point Geometry Procedure

Test Pattern: */reset/sphere150.rst*
/reset/sphere180.rst
/reset/sphere200.rst
Internal Test Pattern → Coarse Alignment
Sphere Projector → On

Menu: *Point Geometry*

Procedure: This procedure must be repeated for all three colors of raster and all three colors of lights.

NOTE: Allow forty-five minutes for the MCP2000 to warm up before you perform static or dynamic convergence procedures.

1. Load the IG sphere test pattern.
2. Open the Point Geometry menu. Set the **Dial** to **Normal**, turn **Soft Edge** to **Off**, and turn the **Sphere** to **On**.
3. Visually examine the convergence of the raster and lightpoints to determine what adjustments need to be made.
4. Press **DO** with the **Offset/Size/Point Convergence** button highlighted to select **Offset**, **Size**, or **Points**.
5. Press **DO** with the **Coarse/Fine Convergence Pattern** button highlighted to select **Coarse**.
6. Press **DO** with the **Converge Raster/Lights/Both** button highlighted to select **Raster** or **Lights**.
7. Press **DO** with the **Converge [Color]/All** button highlighted to select desired color.
8. Adjust the geometry to correct any misconvergence or geometric error found. Offset and size should be adjusted before individual points.

NOTE: Pressing the **COLORS** button on the HHR turns off the internal Coarse Alignment pattern but leaves the cursor.

9. Save the data.

NOTE: For lights, it may be necessary to put up a runway scene to fine-tune the light convergence.

4.3.5 Video Adjustments

The video adjustments are comprised of several adjustment menus: Black Level/G2, Video Gain, and Soft Edge. Each menu provides a separate description and procedure to obtain the desired results.

G2 and Video Gain are interactive and must be aligned in their proper order. It may be necessary to recheck G2 levels after the video gains are set up.

For better results, there are separate adjustments for G2/Black level and video gain for day, dusk, and night scenes. This allows better tuning of the low-intensity scenes (dusk and night) without compromising the high-intensity scenes that are associated with daytime.

When performing the video alignments the projector mode (day, dusk, or night) needs to match the TOD command of the IG (day, dusk, or night). Basically, the IG TOD setting must match the projector day/dusk/night mode you are calibrating.

It is also recommended that the day values for G2/Black Level and video gain be copied to the dusk and night modes. This provides a starting point from which to calibrate the dusk and night levels of G2 and black level settings.

Turn off room lights so that the only measurable light source should be from the MCP2000 and perform the adjustments in the following order:

Day Mode:

- Black Level/G2
- Video Gain
- Copy day values of G2/Black Level and Video Gain to the dusk and night modes.

Dusk Mode:

- Black Level/G2

Night Mode:

- Black Level/G2

Soft Edge Alignments

4.3.6 Black Level

The Black Level menu provides two basic adjustments: black level and G2. The **BLACK LEVEL** dials are set to mid-range (2047) for each color. The **G2** dials are used to set the overall video brightness and low intensity color balance. Ideally, G2 is set to the point where black video just starts to appear. However, to achieve more brightness in the day scenes, the G2 could be set slightly higher for day mode. For dusk and nighttime flying, it is mandatory to have the G2 set lower, so unwanted retrace lines do not break through.

4.3.6.1 Black Level/G2

This procedure is used to setup the Black Level and G2 levels.

Test Pattern: */reset/black.rst*

Menus: *Black Level → G2*

Procedure: Allow approx. 10 minutes for your eyes to become accustomed to the darkness in the cockpit.

1. Set IG to **Day** mode (`CLI>TOD DAY`).
2. Open the Video Gain menu and set video gains for each color in day, dusk and night modes to approximately mid-range .
3. Open the Black Level menu and select the **Day** button.
4. Select the **Black Level** button and adjust the **Black Level** dials for red, green, and blue to the mid-range value (2047).
5. Turn green and blue beams off (**F1** for red, **F2** for green, **F3** for blue).
6. Select the **G2** button and adjust the **Red G2 Level** dial until the inside square on the test pattern is just barely visible.
7. Turn the green beam on and turn red and blue off. Adjust the **Green G2 Level** dial until the inside square on the test pattern is visible, and the outer square is just invisible.
8. Turn the blue beam on and turn red and green off. Adjust the **Blue G2 Level** dial until the inside square on the test pattern is visible, and the outer square is just invisible.
9. Turn all colors on.
10. Load a runway from the user database with known lightpoint distances.
11. Set all IG channels to 0° heading:

    ```
    CLI > view view 1 heading 0

    CLI > view view 2 heading 0
    ```

12. Copy values for day G2 into dusk and night G2. Verify that the black levels for dusk and night are set to 2047.

13. Check known runway in dusk mode and night mode. Make any necessary adjustments to G2.

NOTE: If the G2 levels are set properly, black level values do not need to be changed. Also, the G2 adjustments may need to be repeated after the video gain has been set.

14. Save the data and exit from the menu.

4.3.7 Video Gain

The Video Gain menu is used for IG color balancing or to control the amplitude of the video signal (brightness).

NOTE: For dusk and night video gain procedures, using the same numeric values as defined in the day procedures seems to work best. Therefore, it is recommended that the technician copy the values from the **`Day`** mode to the **`Dusk`** and **`Night`** modes. Once the values have been set for each TOD mode, it may not be necessary to make any further adjustments to the video gain.

Test Pattern: */reset/raster150.rst*
/reset/raster180.rst
/reset/raster200.rst

Menu: *Video Gain*

Procedure:

1. Load the IG raster test pattern.
2. Set the IG to day (`CLI> TOD DAY`).
3. Set the IG visibility to 50 miles (`CLI> Vis mile 50`).
4. Open the Video Gain menu and select the **`Day`** button.
5. Adjust the **`RED`**, **`GREEN`**, and **`BLUE VIDEO GAIN`** dials for the desired output intensity and best "white."

NOTE: If using a luminance meter, a suggested output for FAA regulations is a total output of 6 fL. With a combination of green at 70% (4.2 fL), red at 20% (1.2 fL), and blue at 10% (0.6 fL) for a good overall white.

6. Save the data and exit from the menu.

4.3.8 Soft Edge Adjustment

The Soft Edge menu adjustments are based upon the configuration of the system. The amount of soft-edge overlap varies. A 150° WIDE system has a 6° overlap (3° on each side of the centerline of the overlap); a 180° WIDE

system has 3° overlap (1.5° on each side of the centerline of the overlap). The IG sphere test pattern has raster lines for every degree in the soft-edge overlap region. This is used as a reference for setting the edges and widths (Figure 4-17).

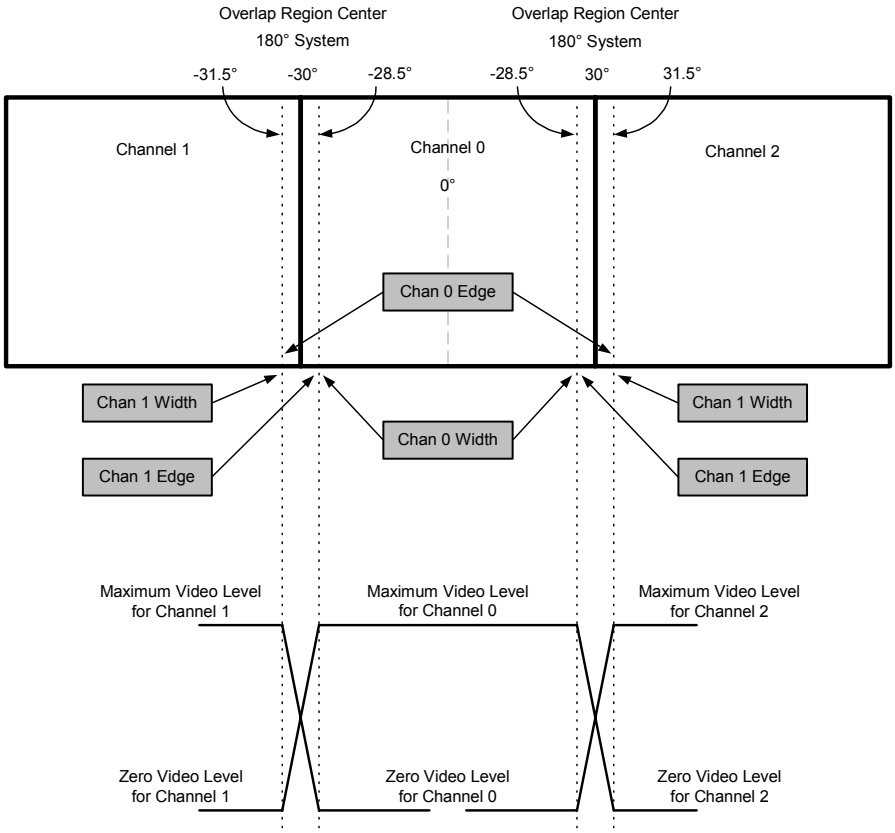


Figure 4-17. Soft Edge Matching (180°)

Test Pattern: */reset/raster150.rst*
/reset/raster180.rst
/reset/raster200.rst

Menu: *Soft Edge → Left/Right Edges*
Soft Edge → Width
Soft Edge → Sigma

Procedure:

1. Open the Soft Edge menu on the selected projector.
2. Make sure the **`Soft Edge`** is **`On`**.
3. Press **`DO`** with the **`Show Sigma`** button highlighted to select **`Show Edge`**.
4. Select **`Day`**.
5. Select **`Dial Fine`**.

6. Select the **Left/Right Edges** button.
7. Adjust the **Left Edge** dial until it eats away at the picture and then turn the dial back one numerical value. The typical values for left edge are close to 0.
8. Repeat step 6 for the **Right Edge** dial. The value is typically approximately 240.
9. Set the **Slope** dials to 0.
10. Repeat steps 1–7 for each projector.
11. Open the Soft Edge menu on the projector to be adjusted and press **DO** with the **Show Sigma** button highlighted to select **Show Width**.
12. Set the adjacent projector to **Show Edge**.
13. Adjust the width so that it lines up with the hard edge from the adjacent projector with little or no overlap. The width for a WIDE-150 system is approximately 100 and less for a WIDE-180 system. Repeat this for both sides of each projector.

    Adjustments are normally performed in the following order:

    - **Show Edge** on the front projector. **Show Width** on both side projectors. Adjust the widths on both side projectors.
    - **Show Edge** on both side projectors. **Show Width** on the front projector. Adjust width on the front projector.
14. Select Show Sigma and press **DO** on adjacent projectors.
15. Adjust the RED SIGMA dials of adjacent channels to get the best match. The sigma for red is typically 190. (Turn off the green and blue beams using F2 and F3 on the HHR).
16. Once you have achieved the best match, look at the Red Sigma numbers for each projector and split the difference. This should give you a good soft edge.
17. Repeat steps 12 and 13 for the green and blue colors. The sigma for green is typically 190 and blue is typically 150.

NOTE: The sigma value for each color should be similar across all projectors. If there is a large difference between the sigma values, the soft edge will never look as good as possible.

18. Turn all three colors on and make any fine adjustments with the ALL dial.
19. Select Dusk. Set the TOD from the IG to Dusk (TOD DUSK).
20. Adjust the Sigma values to achieve a good edge blend at dusk.
21. Select Night. Set the TOD from the IG to Night (TOD NIGHT).

22. Adjust the Sigma values to achieve a good edge blend at night.
23. Toggle through Day, Dusk, and Night mode by pressing DO on the button. A Soft Edge Lights menu should appear.
24. Load a runway with calligraphic lights and slew the lights so that they straddle the join area.
25. Select `Show Edge`.
26. Select the **`Left/Right Edges`** button and adjust the lights so they are clipped at the raster edge.
27. Select Show Width.
28. Select the **`Width`** button and adjust the lights so they are clipped at the raster edge.
29. Save the data.
30. Select **`Show Sigma`** and exit from the menu.

4.3.8.1 Chew-Out Adjustment

The Chew-Out adjustment is a feature that helps prevent phosphor burns by limiting the amount of displayed lightpoints in a region. This parameter is increased until lightpoints start disappearing then backed off a couple of clicks.

Test Pattern: Choose any runway with lightpoints.

Menu: *System Configuration* → *Chew Out*

Procedure:

1. Open the System Configuration menu and select the **`Chew-Out`** button.
2. Adjust the **`CHEW-OUT`** dial until you see the lightpoints at the far end of the runway disappear, then back off a few clicks. It may be necessary to position the eyepoint on approach to see the effects of the Chew-Out adjustment. Typical values are approximately 20.

5 Auto-Alignment System Operation

5.1 Introduction

This chapter explains how to operate the auto-alignment system. Proper operation of the auto-alignment system requires you to complete the installation and calibration procedures.

5.2 Auto-Alignment Overview

The auto-alignment system has two modes of operation: daily readiness and control of individual functions. The daily readiness mode provides a fast convergence and, as the name suggests, is intended to be run daily in order to maintain a high quality image for pilot training. The second mode of operation provides you with control over the following functions individually:

- Geometry
- Color balance/intensity
- Focus
- Edge blend

These functions are of primary use when major hardware components such as projector tubes are swapped out. Each function is selected as required to align the system back to specification values.

The auto-alignment system can be controlled either by simple on-screen menus using the HHR, or by dedicated windows selected on the DCPC

console itself. Both methods are discussed in this chapter. Regardless of which control option is chosen, the auto-alignment system reports status information on the DCPC regarding the setup in progress. A time and date stamped ASCII log file is also generated for post setup analysis.

5.3 Auto-Alignment Operation

In order for the auto-alignment system to operate to its full capability, personnel should be mindful of the following when executing the auto-alignment system functions.

- The cockpit should be as dark as possible and the mirror surface should be free from bright external reflections.
- Personnel should avoid opening and closing the cockpit doors or mirror access doors and removing light-tight panels.
- The auto-alignment system does not save the newly aligned picture without user intervention.
- Upon completion of each selected auto-alignment system function, the system automatically returns the pan-tilt unit to the parked position.
- Upon completion of any auto-alignment system function that affects intensity, the system comes up in safe-system mode (unfocused) to prevent tube burns in case of a problem.

5.4 On-Screen Control of the Auto-Alignment System

The auto-alignment on-screen menu is accessed with the HHR. See Chapter 4 for a complete description of the operation of the MCP2000 on-screen menus.

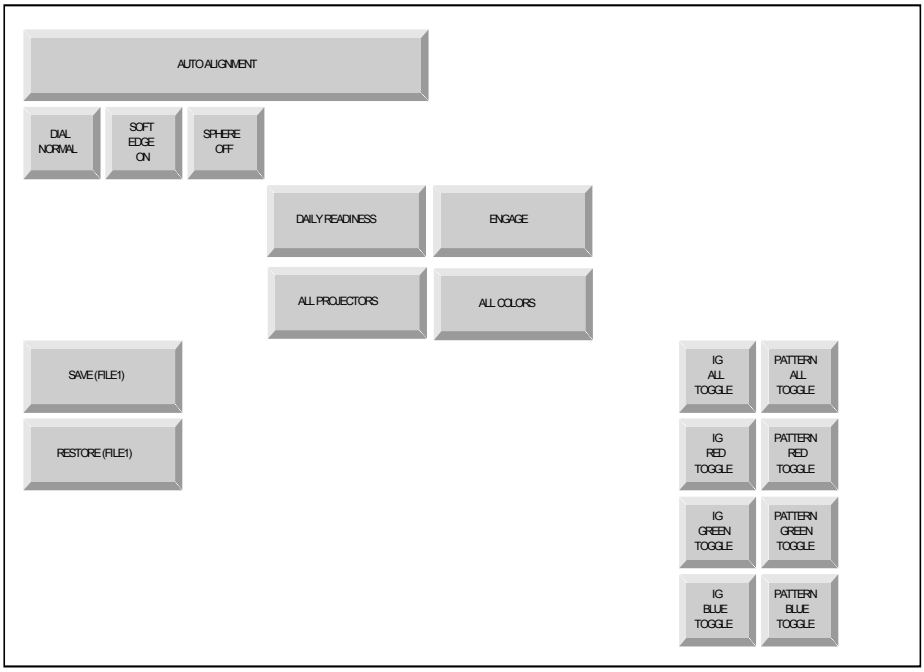


Figure 5-1. Auto-Alignment Menu

The Auto-Alignment menu is shown in Figure 5-1. Each menu option is summarized briefly below. The **DO** button is pressed to activate the highlighted option on the menu. It is also used as the scroll or toggle button for menu fields which contain more than one option; however, only one of the options can appear at a time in the field. The **DO** button is pressed until the desired option appears in the field.

Table 5-1. Auto-Alignment Description

Selection Text	Description/Effect
Dial Fine **Dial Normal** **Dial Coarse**	Pressing **DO** with the cursor positioned on **Dial** changes the sensitivity of the dials to one of the following: fine, normal, and coarse.
Soft Edge On **Soft Edge Off**	Pressing **DO** with the cursor positioned on **Soft Edge** toggles the soft edge on and off.
Sphere On **Sphere Off**	Pressing **DO** with the cursor positioned on **Sphere** toggles the sphere projector on and off.
Daily Readiness **Convergence** **Intensity** **Focus** **Soft Blend**	Pressing **DO** with the cursor positioned on Auto-alignment System Function cycles through the available auto-alignment features. The respective feature is not activated until the **Engage** button is selected (see below).

Table 5-1. Auto-Alignment Description

Selection Text	Description/Effect
All Projectors **This Projector**	Pressing **DO** with the cursor positioned on Projector Select toggles between running the auto-alignment system functions specified above on the projector displaying the menu, or all projectors installed in the system. Only certain auto-alignment system functions are available for individual projectors, so the system freezes the **This Projector** selection in some cases.
All Colors **Red** **Green** **Blue**	Pressing **DO** with the cursor positioned on Color Select cycles between running the auto-alignment system functions specified above on all colors or one color only. Only certain auto-alignment system functions are available for individual colors, so the system freezes the individual colors selection in some cases.
Engage	Pressing **DO** with the cursor positioned on **Engage** activates the auto-alignment system function that has been selected above, for the channel and color specified.
IG Red On/Off **IG Green On/Off** **IG Blue On/Off**	Pressing **DO** while the cursor is positioned on **IG Red**, **IG Green**, or **IG Blue** enables or disables the corresponding IG video color.
Pattern Red On/Off **Pattern Green On/Off** **Pattern Blue On/Off**	Pressing **DO** while the cursor is positioned on **Pattern Red**, **Pattern Green**, or **Pattern Blue** enables or disables the corresponding internal pattern video color. This also affects the menu color.
Save	Pressing **DO** while the cursor is positioned on **Save** saves the current display alignment settings to the file number shown. The system prompts for verification of the save before proceeding.
Restore	Pressing **DO** while the cursor is positioned on **Restore** restores a previously saved display alignment for the file number shown. The system prompts for verification of the restore before proceeding.

NOTE: To abort an activated auto-alignment system function, press the [**FUNC**] [**EXIT**] buttons on the HHR.

5.4.1 Daily Readiness Test

Time—10 minutes

As the name suggests, this function should be run on a regular basis to ensure that the system is running at specification values and is ready for pilot training. This function simply runs Convergence on the center channel, regardless from which projector menu it is started.

5.4.2 Convergence

Time—10 minutes per channel

Convergence is classic geometry and convergence combined. This procedure is generally performed as required or when major system components have been replaced. Convergence can be selected for individual channels and colors.

Once enabled, the system first resets the pan-tilt unit. The auto-alignment system then takes each point described in the *AAPoints.txt* file and moves the camera and IG patterns to that point and converges all colors for both raster and lightpoints.

The system takes approximately 10 minutes per channel. Time may vary depending on how far out of alignment the points are. Points must be within 2° of the specified value (in the *AAPoints.txt* file).

5.4.3 Intensity

Time—10 minutes per channel

Intensity adjusts video gain, G2, and black level to a memorized value (as set during the memorize intensities procedure, which is part of the calibration process).

It should be noted that the system is not restoring saved values of the dials themselves, but is measuring, comparing, and adjusting the sensed brightness value of the respective parameters. Thus, the system compensates for the aging of the projector tubes during their operational lifetime. Intensity can be selected for individual channels and colors.

Once enabled, intensity starts by resetting the pan-tilt unit, after which it waits for 30–90 seconds for the tube phosphors to dim. The system starts G2 adjustments for RGB for day, dusk, and night. This is achieved when the tube sensor (boom mounted) looks back into the tube and sets the sensed intensity to the memorized values.

The sensors then look forward and the sensed intensity is set to 90% of maximum brightness The video gain is then adjusted, followed by black level for day, dusk, and night.

Since video gain and G2 are interactive, one pass at the adjustments is not always adequate when adjusting for large errors. For this reason, the video gain and G2 intensities are measured, compared, and adjusted for two more consecutive iterations. Each projector in the system is then adjusted in turn as described above, if multiple channel operation has been selected.

Once all selected projectors have completed the above procedure, the black level is adjusted on each projector unless the value has been fixed in the *Aapoint*s file. (To take out the interaction of black level, G2, and video gain, the G2 and video gain are memorized with black level at mid range).

5.4.4 Focus

Time—15 minutes per channel

Focus should be run as needed. This procedure clears the dynamic focus and defocus values and uses the center point (as defined in the *AAPoints* file) in each channel to adjust static focus. The dynamic and defocus values are restored after static focus adjustments are made.

5.4.5 Soft Edge

Time—20 minutes per 3-channel system

The edge blend procedure adjusts the sigma values for the edge blend regions. This procedure uses the values in the *Ipoints* file to adjust sigma values to the best blend between adjacent projectors. This procedure can only be selected for all projectors.

5.4.6 Saving New Alignments

The auto-alignment system does not save any new alignments automatically. You should visually verify that the new setup has improved the quality of the image in day, dusk, and night for both raster and calligraphic portions of the picture.

Once satisfied that the newly aligned picture is acceptable for training, you should use the *Save* button on the auto-alignment system main menu to save the new alignments to the system timing files.

5.5 DCPC Control of the Auto-Alignment System

In addition to the on-screen controls, the auto-alignment system can also be controlled directly from the auto-alignment system console in the DCI_Comm software running on the DCPC.

The auto-alignment system DCPC control menus must be enabled before the control console is visible to you. Select *Setup* → *ShowAutoAlign*. The auto-alignment console appears, as well as a minimized auto-alignment camera

image window. This window can be maximized to view alignment points as seen through the camera, if desired.

5.5.1 Auto-Alignment Console

The auto-alignment system control console is shown in Figure 5-2. Each control bar option is summarized briefly in Table 5-2 and a more detailed description of the auto-alignment controls is given in the following sections.



Figure 5-2. Auto Align Console Bar on DCPC

Table 5-2. Auto Align Console Controls

Icon	Function	Description
	Return to First Point	Returns the geometry functions back to the first geometry point in the *AAPoints.txt* file.
	Previous Horizontal Point	Selects the previous geometry point for alignment, as defined in the *AAPoints.txt* file. This allows you to single-step through the points in order to resume geometry from a given position.
	Next Vertical Point	Selects the next geometry point for alignment, as defined in the *AAPoints.txt* file. This allows you to single-step through the points in order to resume geometry from a given position.
	Next Horizontal Point	As above.
	Previous Vertical Point	As above.
	Continuous Image Capture (diagnostic only)	Pressing this button activates the camera image for diagnostic purposes.
STOP	Stop Continuous Image Capture (diagnostic only)	Stops the camera image capture.
GO	Run Auto Align	This button selects the main Auto-alignment System menu dialog box described in Section 5.5.2.

Table 5-2. Auto Align Console Controls		
Icon	**Function**	**Description**
	Stop Auto Align Function In-Progress	Stops the auto-alignment function in progress. This action may take a period of time to actually stop auto-alignment, since the software only stops at defined breakpoints, and not in the middle of any given calculation.
	Help	Enables help functions.

5.5.2 Auto-Alignment Selection Dialog From the DCPC

Control of the auto-alignment system from the DCPC is similar to the operation of the system from the on-screen menus, as described earlier in this chapter. Running the auto-alignment system from the DCPC allows you to select multiple functions at one time. This provides you with a more flexible and uninterrupted sequence of alignment procedures. The available controls are shown in Figure 5-3. To enable the options, click on the mode(s), projector(s), and color(s) required.

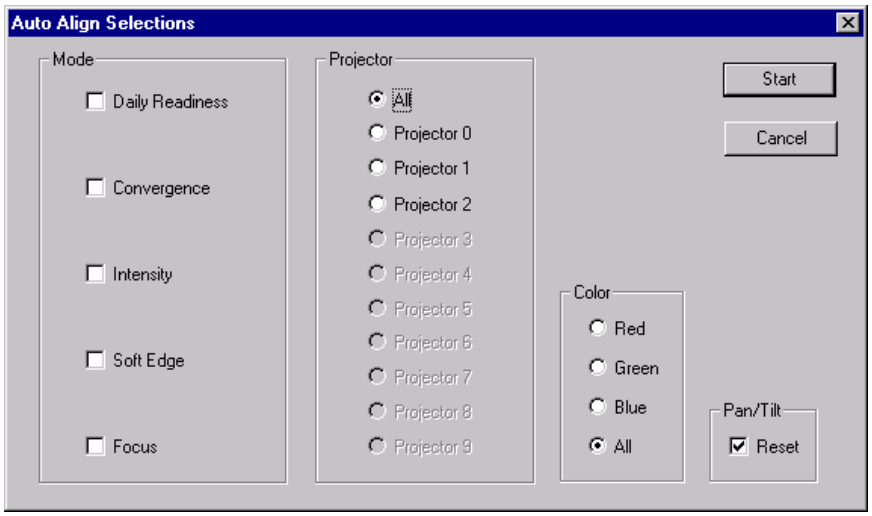


Figure 5-3. Auto Align Selection Dialog Box from DCPC

Pressing 

causes the auto-alignment system to begin the alignment process. Each respective mode of operation is described below.

5.5.2.1 Convergence

Time—10 minutes per channel

This function is the classic geometry and convergence combined. This procedure is generally run as required, or when major system components have been replaced.

When using the DCPC to control the convergence function, you have the option of starting convergence from any one of coordinates defined in the *AAPoints.txt* file. Details of the specific steps taken by the system when carrying out this function are given in Section 5.4.2, which describes the auto-alignment system control from the HHR. There are, however, additional functions available to you when controlling Convergence directly from the DCPC.

Before starting the Convergence procedure, you can step through the available points (defined in the *AAPoints.txt* file) using the arrow buttons on the *AutoAlign* console (Figure 5-1). The current camera coordinates are shown in the lower right corner of the *AutoAlign* console. This allows you to choose the screen coordinate to start the Convergence procedure.

Alternatively, if you previously halted the Convergence process (i.e., the Stop button was pressed), the system remembers the coordinates of the last point adjusted.

As a result of one of the above, when the Convergence process is launched using the Auto Alignment Selection Dialog box (Figure 5-3). The system presents you with the decision box shown in Figure 5-4:



Figure 5-4. Restart Geometry Dialog Box

If you select **NO**, the system starts the process from the selected point (or last point processed). If you select *Yes*, the system starts the convergence process from the beginning. This is useful when you run out of time before pilot training is due to start and wish to complete the Convergence process at a later time. Convergence can be selected for individual channels and colors using the appropriate checkboxes on the Auto Align Selection Dialog box.

5.5.2.2 Intensity

Time—10 minutes per channel

Full intensity adjusts video gain, G2, and black level, to a memorized value (as set during the memorize intensities process, which is part of the calibration process). It should be noted that the system is not restoring saved values of the dials themselves, but measures, compares, and adjusts the sensed brightness value of the respective parameters. The system, therefore, compensates for the aging of the projector tubes during their operational lifetime.

Details of the specific steps taken by the system when carrying out this function are given in section describing the auto-alignment system control

from the HHR in Section 5.4.3. The function can be selected for individual channels and colors using the appropriate checkboxes.

5.5.2.3 Daily Readiness Test

Time—15 minutes for a three-channel system

This function should be run on a daily basis to ensure that the system is ready for pilot training. This function simply runs Convergence on the center channel.

5.5.2.4 Focus

Time—15 minutes per channel

Static focus should be run as needed. This procedure clears the dynamic focus and defocus values and uses the center point (as defined in the *AApoints.txt* file) in each channel to adjust static focus. The dynamic and defocus values are restored after static focus adjustments are made.

5.5.2.5 Soft Edge

Time—20 minutes per 3-channel system

The edge blend procedure adjusts the sigma values for the edge blend regions. This procedure uses the values in the *Ipoints* file to adjust sigma values to the best blend between adjacent projectors. This procedure can only be selected for all projectors.

5.5.2.6 Saving New Alignment

The auto-alignment system does not save any new alignments automatically. You should visually verify that the new setup has improved the quality of the image in day, dusk, and night for both raster and calligraphic portions of the picture. Once satisfied that the newly aligned picture is acceptable for training, you should use the *Save* button on the auto-alignment system main menu to save the system timing files.

5.6 Log Files

The auto-alignment produces a time stamped log file in the *C:\ESCP\LOG* directory for each auto-alignment function. If the auto-alignment function appears to have run incorrectly, the log file can be checked for errors.

6 Maintenance

6.1 Introduction

This chapter explains maintenance of the MCP2000. The following maintenance procedures are covered:

- Scheduled maintenance—Includes procedures for inspection, cleaning, and alignment; and for daily, weekly, and monthly maintenance. Maintenance record keeping is also described.
- Removal and installation—Includes procedures to remove and install LRU components of the MCP2000.

WARNING: Power is still present at the MCP2000 main breaker even when that breaker is off. When servicing any internal MCP2000 components, the maintenance technician should physically unplug the main power input to the projector head unit for complete safety. In the following procedures, the term *shutdown all power* includes unplugging this main power connector.

CAUTION: Replace each of the four MCP2000 ard-cage securing screws in the correct location. The fours screws that secure the rack to the rest of the projector are different sizes. The two screws nearest the door are longer than the two screws at the back. Failure to replace the four screws in the correct location will result in power supply failure and a flagging error on the PSU card.

6.1.1 Visual Inspection

A valuable tool in a scheduled maintenance program is a thorough visual inspection. Some items to check are listed below.

WARNING: Before attempting inspection or cleaning of the MCP2000, shutdown all power (Section 3.4.1).

To prepare for inspection, remove the power supply and projector head unit covers for internal visual inspection (Section 6.3.2.1). Do the following:

1. Inspect the units for dust and dirt build-up that could cause short circuits or affect the MCP2000's ability to dissipate heat.
2. Check all fans for proper operation and clean cover screens.
3. Make sure that all connectors are secure and that there are no frayed wires.
4. Check for burned or discolored components.
5. Look for indications of arcing around the high-voltage power supply or CRT.
6. Make sure that the deflection power-supply heat sink is clean and free from oil or dust.
7. Do not touch the lenses. Simply blow the dust from the surface of the lens with compressed air.

6.1.2 Cleaning

The units must be kept free of dust and dirt. Excessive dust or dirt can prevent proper heat dissipation. Combined with moisture or high humidity, dirt can provide a conductive path.

WARNING: Before cleaning the MCP2000, shutdown all power (Section 3.4.1).

1. Before cleaning the interior of the power supply or projector head unit assembly, remove the covers (Section 6.3.2.1). Carefully use a vacuum cleaner or low-velocity dry air source to remove dust and dirt from the interior. Clean circuit cards that are extremely dirty or corroded with an ultrasonic cleaning unit.
2. Deflection heat sinks may be cleaned with isopropyl alcohol and a brush to help remove any oils that may have collected.

6.1.3 Maintenance Record Keeping

Keeping a full and complete maintenance log is an important element of the overall maintenance system. A log describing, in detail, alignment problems, component failures, scheduled maintenance activities, the implementation of

field service bulletins, and the installation of system upgrades is recommended. The following information could be included in the log:

- The date and time the problem or maintenance activity occurred.
- The name of the person reporting the problem or performing the maintenance procedure.
- A full description of the problem or activity.
- A detailed explanation of the steps taken to resolve the problem.
- The part number, revision level, and serial number of any assembly installed or removed.
- Revision information on any software added to the system.

6.2 Scheduled Maintenance

A regular maintenance schedule ensures that optimum performance levels are maintained and minimizes failures. Adhere to a proper scheduled maintenance system to detect minor problems before they lead to more serious failures. The maintenance procedure is comprised of a schedule of regular visual inspection, alignment, and cleaning. An important part of a good maintenance program is the proper evaluation of a system during operation.

A list of the recommended scheduled maintenance intervals is given in Table 6-1.

Table 6-1. Scheduled Maintenance Intervals

Scheduled Maintenance Procedure	Interval
Check all power supply and MCP2000 head fans for noise and correct operation.	Monthly (Section 6.2.2)
Clean and visually inspect the projector head unit, power supplies, and the deflection amplifiers.	Monthly (Section 6.2.2)
Check and adjust power supply voltages	Annual (Section 6.2.3

6.2.1 Daily System Readiness Check

The daily system readiness check involves a visual examination of projectors for video quality and video size. Also, perform any daily readiness checks outlined in the IG operation and maintenance manual.

NOTE: Allow the projector to warm up for forty-five minutes before you perform this test.

If no adjustments or corrections are needed, the following daily readiness check should take approximately 15 minutes to perform on an image generation system with three projectors. To perform the daily readiness check,

execute the following steps (refer to the IG operation and maintenance manual and the *Real-Time System Reference Manual* for the exact procedures):

1. Open the Internal Test Patterns menu and turn on the sphere projector by clicking on the **`Sphere Off`** button until it says **`Sphere On`**.
2. Check the vertical and horizontal gain and offset to ensure that the image is correctly sized and positioned on the screen.
3. Check adjoining projectors for matching edge geometry.
4. Load and run a training database with a familiar scene containing lights, buildings, or ships. Each projector shows a portion of the scene defined by the differing channel descriptions. Activate host control of the IG.
5. Set the scene to day mode. Check the horizon as it passes between adjoining projectors.
6. Perform a heading change. Check adjoining projectors for correct projector alignment of the images.
7. Set the scene to dusk mode and the visibility (RVR) to 1,000 ft. (300 m). Select T/O Reset and verify that the eyepoint is perpendicular to the edge lights. Make sure the colors balance between projectors and that the lights in the scene attenuate at the proper distance. Five runway edge lights should be visible from the runway threshold. Set PDT ON (same heading on all channels). Verify that the side channels match the center channel. Repeat the check for day and night modes.
8. Make necessary alignment adjustments (refer to Chapter 4). If there is an auto-alignment system, run the daily readiness function.
9. Record the readiness check performance in the system log. List any alignments done and any problems witnessed.

6.2.2 Monthly Maintenance

Monthly maintenance includes inspection, cleaning, and performance test procedures. These procedures should be performed monthly to assure optimum performance. Instructions for adjustments indicated by the performance test procedure can be found in Chapter 4.

1. Perform daily maintenance as needed.
2. Check the alignment and align as necessary (Chapter 4). If there is an auto-alignment system, run the convergence, intensity, and soft edge functions on all projectors.
3. Check fan operation in the projector head unit and power supply. Use a stick with a paper streamer to determine if the fans are drawing in air.
4. Check fan operation on the Video Driver (239670).
5. Visually inspect the deflection amplifiers and clean as necessary.

6. Run projector diagnostics to check for warnings.
7. Clean filter on the DCPC.
8. Record the monthly readiness check performance in the system log. List any alignments made and any problems witnessed.

6.2.2.1 Deflection Power Supply Cleaning and Inspection Procedure

WARNING: Before attempting inspection or cleaning of the MCP2000, shut down all power and wait five minutes to allow the capacitors to completely discharge any residual currents.

1. Turn the power to the projectors off.
2. Disconnect the power at its source.
3. Disconnect all three cables from the rear of the power supply.
4. Remove the screws holding the cover of the power supply and remove the cover.
5. Using the soft, clean cloth, a small brush, and the vacuum cleaner, remove the dust from the assemblies until no dust appears on the cloth wiped on the components. Use a forced-air blower to remove any remaining dust.
6. Inspect the internal components. Look for cracked or damaged wires, darkening of components, leakage of capacitors, or other signs of damage.
7. Replace the power supply cover and replace the cover screws.
8. Reconnect the three cables on the back of the power supply.
9. Turn ON the main circuit breaker on the front of the power controller and the remote ON/OFF switch on the projector head unit. Since the IG is off, no lights should appear on the MCP2000.
10. Repeat the above procedure for all other MCP2000 power supplies.

6.2.2.2 Deflection Amplifier Cleaning and Inspection Procedure

WARNING: Before attempting to inspect or clean the MCP2000, shut down all power.

1. Turn the power to the projectors off.
2. Remove the covers of the projector head unit using the proper sized screwdriver.
3. Using an Allen wrench, loosen the two captive screws that secure the deflection amplifier doors. Swing the deflection assembly doors open so the heat sinks can be inspected. Be sure the fan shield or other assemblies do not pull on any wiring.

4. Loosen and remove the screws that secure the plastic shields and remove the shields.
5. Using the forced-air supply, blow air through the deflection amplifier fans and heat sinks.
6. Inspect the heat sinks and repeat the preceding step until the heat sink is free of dust. If a residue of oil is on the heat sink assembly, remove it with a soft cloth and some isopropyl alcohol (this oil is most likely hydraulic fluid from the simulator).
7. Use the forced-air supply to remove any dust accumulated on the printed circuit cards of the deflection amplifier assembly.
8. Reinstall the plastic deflection covers and secure the deflection assembly to the chassis.
9. Repeat steps 2 through 8 for each projector.

6.2.3 Annual Maintenance

These procedures should be performed yearly to assure optimum performance.

1. Perform daily maintenance as needed.
2. Perform monthly maintenance as needed.
3. Check and adjust power supply voltages (Section 6.4).
4. Record the annual readiness check performance in the system log. List any alignments made and any problems witnessed.

6.3 Replacement Procedures

The following procedures explain the disassembly/reassembly procedures for the MCP2000 projector system. The drawings in the *MCP2000 Projector Engineering Drawings and Associated Lists* are used to support the step-by-step procedures.

6.3.1 General Precautions

The MCP2000 projector system has been designed to allow easy removal of the major parts. Listed below are a few of the general precautions to be considered before removing or installing a part.

WARNING: High voltages capable of causing death or serious injury are used in the MCP2000. Before attempting inspection or cleaning of the MCP2000, shut down all power (Section 3.4.1) and wait a few minutes for the capacitors to discharge.

1. Remove all power from the unit.

2. Label any wires or cables before removal, so they can be reinstalled in the correct place.
3. Never pry a component or printed circuit card.
4. Be careful not to strip the threads on any nuts, bolts, or threaded retainer.
5. Be sure that all multipin connectors are installed correctly.
6. Be careful not to pull cables or wires loose.

6.3.2 Projector Head Assembly

The following text explains the disassembly/reassembly of the major LRUs of the projector head unit. Refer to the *MCP2000 Projector Engineering Drawings and Associated Lists*.

WARNING: High voltages capable of causing death or serious injury are used in the MCP2000. Be certain that all power is turned off.

WARNING: CRTs are subject to implosion if dropped, hit, scratched, or subjected to more than moderate pressure. Wear heavy protective clothing, including gloves and safety goggles with side shields, when working on the CRT.

The MCP2000 LRUs are described in Table 6-2.

Table 6-2. MCP2000 Parts and Assemblies

Callout	LRU Description	Part Number
1	CRT assembly red	239200-100
2	CRT assembly green	239200-101
3	CRT assembly blue	239200-102
4	Deflection assembly	239610-100
5	5 V power supply	415111-001
6	5 V filter card	239560
7	17 V filter card	239550
8	Video driver	239670
9	Diagnostic card	239680
10	Power distribution card	239690
11	Fan CRT and card cage	801035-770
12	Deflection amp fan	801035-201
13	EHT	801657-501
14	Power supply card	2395590

Table 6-2. MCP2000 Parts and Assemblies		
Callout	**LRU Description**	**Part Number**
15	Processor card	239500
16	BLIP card	239510
17	Ramp card	239530
18	Video processor card	239540
19	Back panel	239580

6.3.2.1 Projector Head Covers

There are four removable covers on the projector head unit, each one secured by several fasteners. Remove or install the covers using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Disconnect the power at its source.
3. Remove the top cover.
4. Remove the side covers
5. Remove the back cover.

Reinstall the covers by reversing the order of the preceding steps.

6.3.2.2 CRT Assemblies

Remove the CRT assemblies (Figure 6-1) using the following procedures:

1. Open the Black Level menu and set the G2 and black level values for the selected color to midrange (2047). Be sure to set the values to midrange for all TOD modes.
2. Open the Video Gain menu and set the video gain for the selected color to midrange (2047). Be sure to set the values to midrange for all TOD modes.
3. Save the data to File 1.
4. Power down the projector head unit (**`FUNC DISP PWR`** buttons on the HHR).
5. Turn off the main circuit breaker located on the input panel of the projector head unit.
6. Disconnect the power at its source.
7. Remove projector covers and open the deflection amplifier assembly.

8. Disconnect the five connections to the video driver card (G2, ground, ribbon cable, 100 V power signal, and video signal).
9. Release the Velcro strips that hold the video driver to the CRT assembly (Figure 6-2).
10. Grasp the video driver by the ribbon cable connector and a heat sink and gently rock while pulling the card out.
11. Remove the focus and deflection yoke cables from the CRT assembly.
12. Remove the ground strap from the CRT assembly.
13. Remove the anode wire that goes to the CRT assembly from the splitter block. Hold the end of the wire against the CRT mumetal shield to discharge the CRT anode voltage.
14. Discharge the anode tip to the MCP2000 chassis.
15. Remove the CRT fan hose.
16. If necessary, remove the 5 V assembly (239402 Figure 6-4).
17. While holding the back of the CRT assembly with one hand, unscrew the four socket head cap screws (these screws are captive). The CRT will not fall because it will be resting on a small shelf.
18. With both hands, pull the CRT assembly straight back and out the back of the projector or out the side of the projector.

CAUTION: Pull the CRT assembly straight back. If the CRT assembly is moved sideways the lens can be scratched.

Reinstall a new CRT assembly by doing the following:

1. Verify the power is disconnected at its source.
2. With both hands, put the CRT assembly straight into the CRT mount. Rest the CRT on the mounting shelf (Figure 6-1).

CAUTION: Put the CRT assemblies in straight. If the CRT assembly is moved sideways the lens can be scratched.

3. While holding the back of the CRT with one hand, screw in the four socket head cap screws (these screws are captive) shown in Figure 6-1. The CRT will not fall because it will be resting on a small shelf.
4. Connect the focus and deflection yoke cables to the CRT assembly.
5. Connect the CRT fan hose.
6. Connect the anode wire that goes to the CRT assembly from the splitter block.
7. Connect the ground strap from the CRT assembly.
8. Align the video driver with the CRT socket and push the video driver onto the CRT. Make sure that it seats well.

9. Attach the Velcro strips that hold the video driver to the CRT assembly.
10. Reconnect the five connections to the video driver card (G2, ground, ribbon cable, 100 V power signal, and video signal).
11. Install the 5 V power assembly if it has been removed.
12. Close the deflection amplifier assembly.
13. Connect the power at its source.
14. Turn on the main circuit breaker located on the input panel of the projector head unit.
15. Power up the projector head unit (FUNC DISP PWR buttons on the HHR).
16. Check the picture to verify that all the colors are present.
17. On the HHR, press F4 to take the projector out of safe-system mode. The picture will go red, then green, and then blue for a few seconds.
18. Perform the mechanical focus procedure as described in Section 2.4.1.
19. Check the Scheimpflug adjustment as described in Section 2.4.2.
20. Perform the geometry and video adjustments as described in Chapter 4.

NOTE: If an auto-alignment system is present, run the full convergence and full intensity procedures (Chapter 5) instead of step 20. Geometry points must be within 2° of specified value, so it may be necessary to manually perform coarse geometry adjustments first.

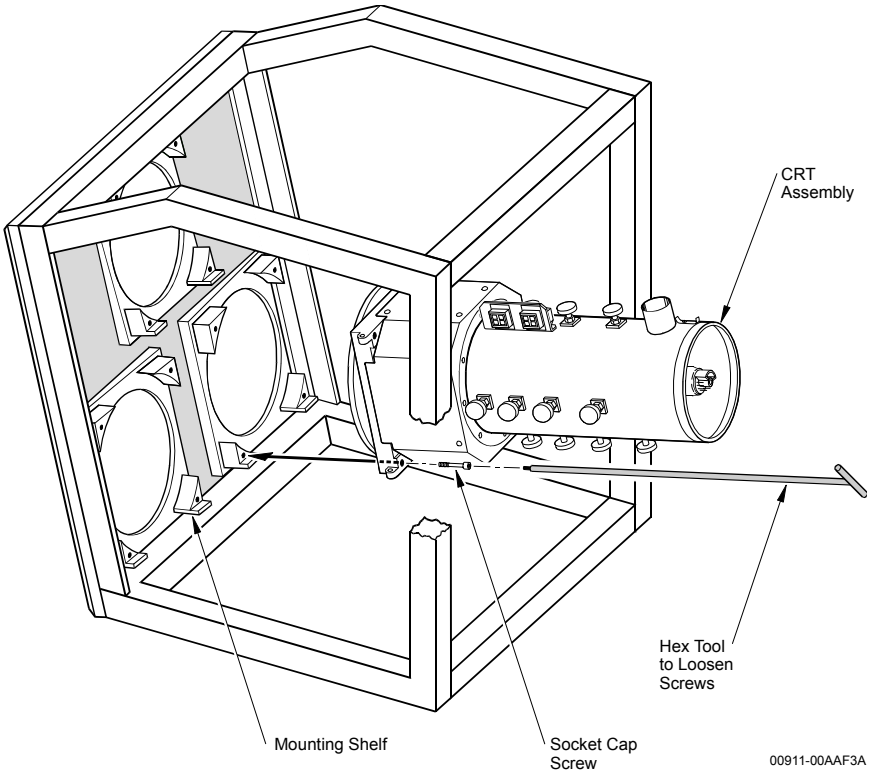


Figure 6-1. CRT Mechanical Assembly

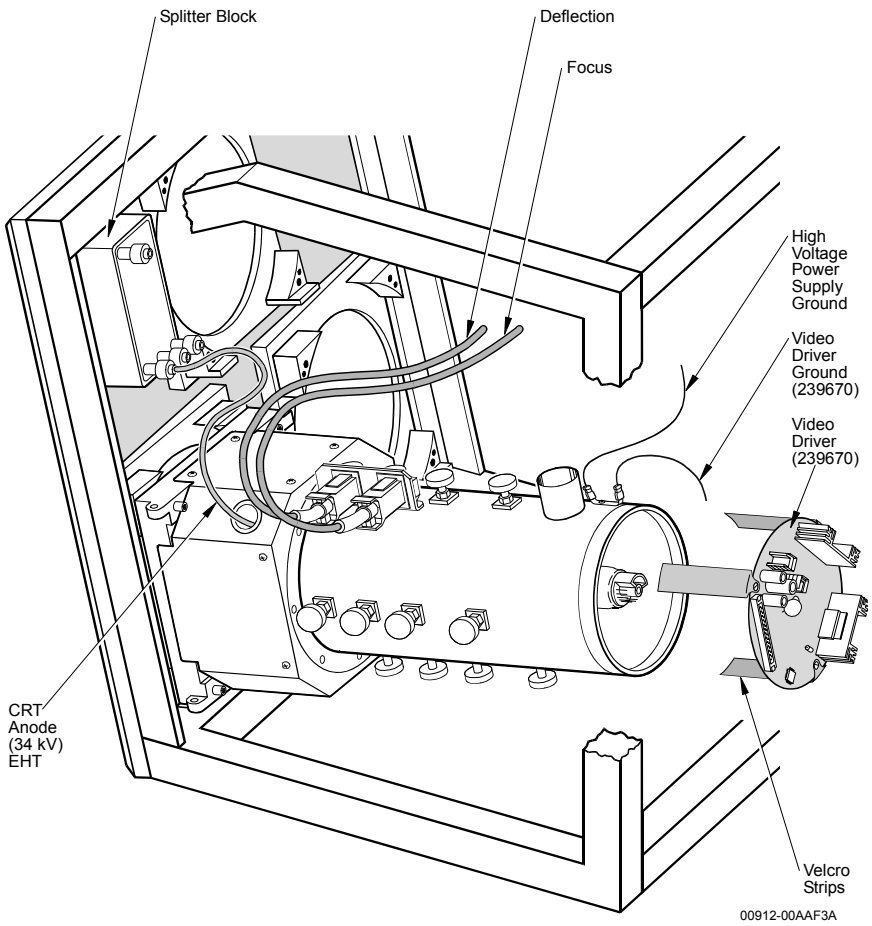


Figure 6-2. CRT Cabling and Wiring

6.3.2.3 Deflection/Focus Amplifier Assemblies

Remove a deflection/focus amplifier assembly (Figure 6-3) using the following procedure:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Remove the projector covers.
3. Remove the clear plastic airflow cover on the topside of the deflection amplifier. Six screws hold it in place. The screws do not need to be removed, only loosened.
4. Remove the four focus cables (1 Molex, 2 coax, and 1 ribbon cable).
5. Remove the two yoke cables.
6. Remove the deflection-input cable (coax).
7. Remove the deflection power and ribbon cables (four cables).
8. Remove the fan ac power cable.

9. Unscrew the two screws that secure the deflection assembly to the frame.

10. Lift the deflection amplifier assembly straight up.

The three deflection amplifiers are the same except one swings in the opposite direction. To accommodate this, the two bars that mount the deflection amplifier to the chassis are removable. To change from one swing direction to another, simply remove the bars and replace with the appropriate type.

Reinstall in the reverse order. Perform hysteresis adjustments (Section 4.3.1.3.4). Perform geometry adjustments (Section 4.3.1.4) or run full convergence with auto-alignment system.

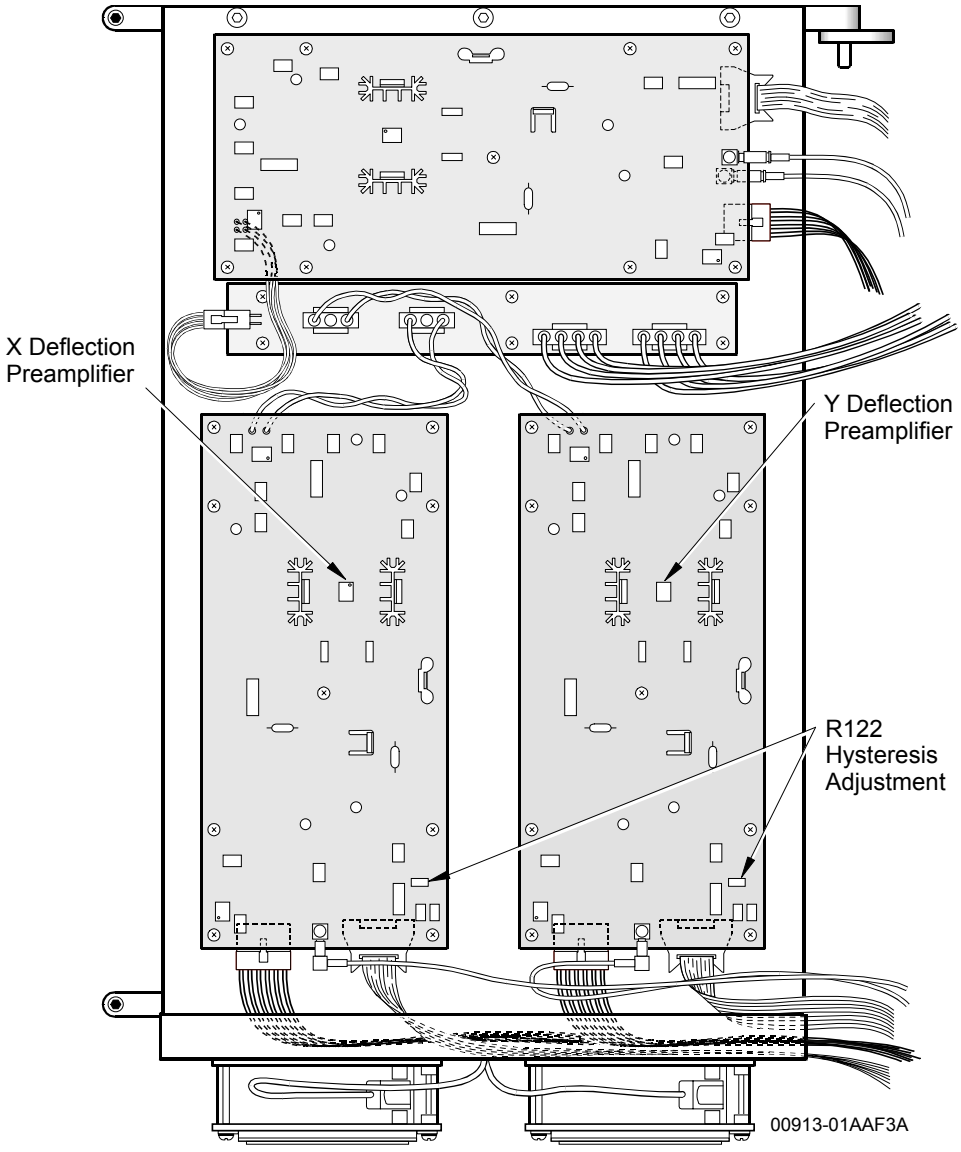


Figure 6-3. Deflection/Focus Amplifier LRU Cabling

6.3.2.4 5 V VME Power Supply and 5 V Filter Assembly

Remove 5 V power supply assembly (239402 Figure 6-4) using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Disconnect the power at its source.
3. Unscrew the two bolts at the base of the 5 V power assembly.
4. Disconnect the ac in cable and the +5 V out cable.
5. Reinstall by reversing the order of the preceding steps.

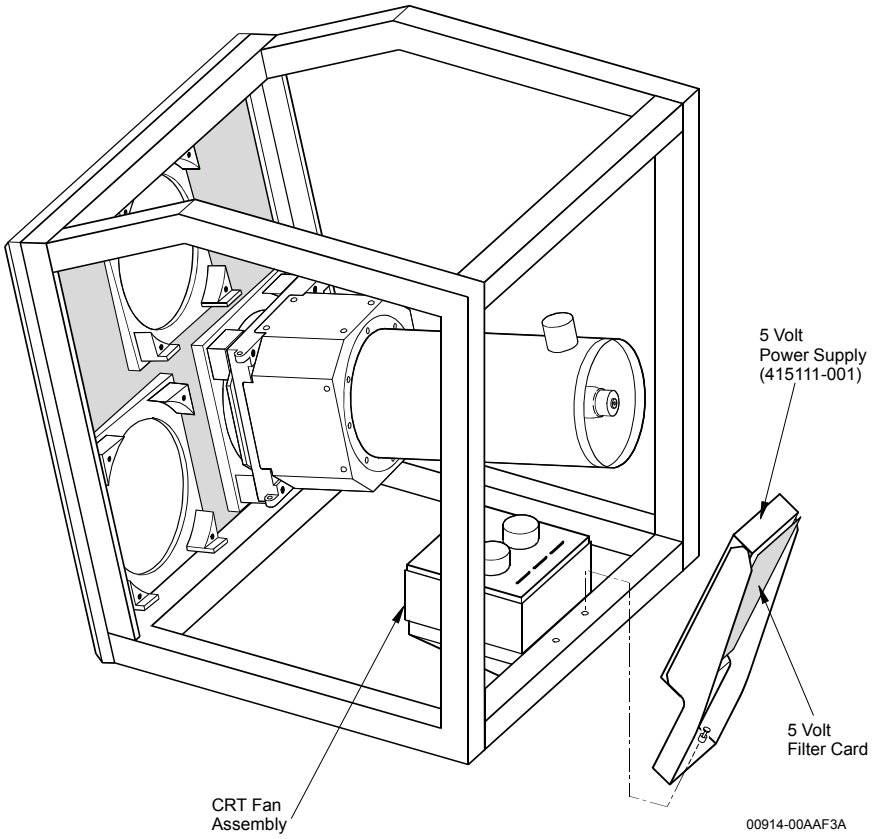


Figure 6-4. 5 V VME Power Supply Assembly

6.3.2.5 17 V Filter Card

Remove the 17 V filter card (Figure 6-5) using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Disconnect the power at its source.
3. Disconnect the two connectors at the ends of the card.
4. Unscrew the four screws that are in the corners of the card.

Reinstall by reversing the order of the preceding steps.

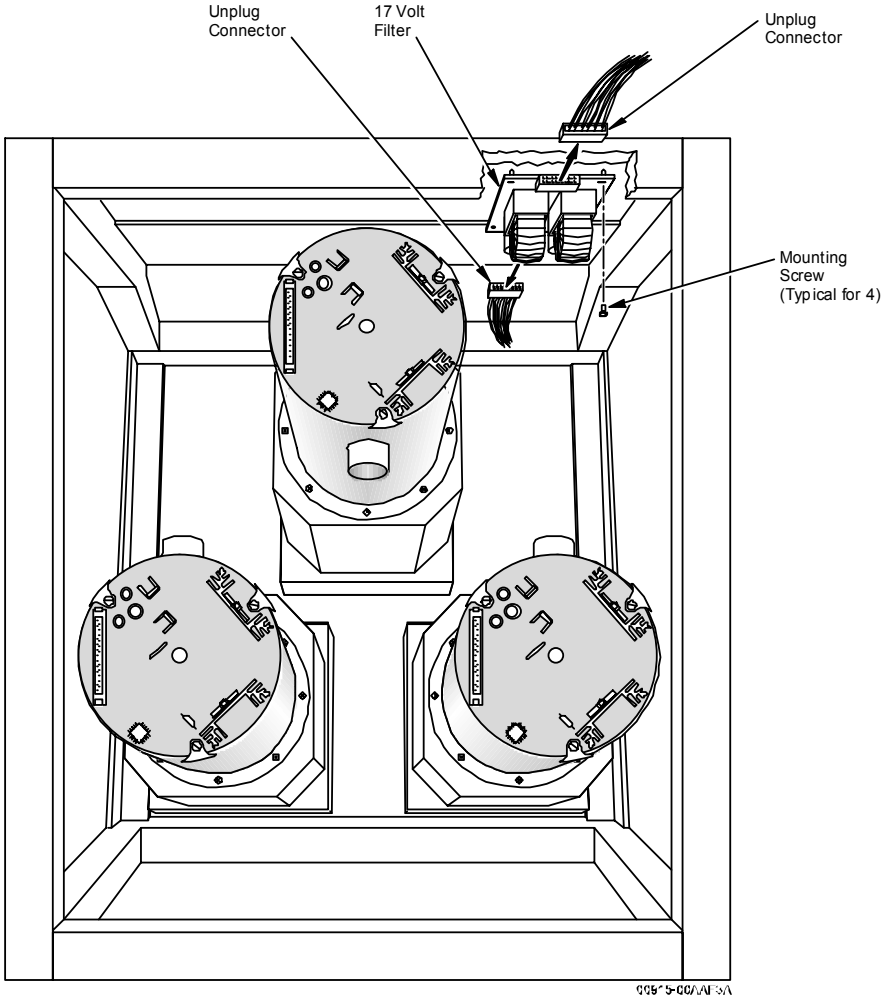


Figure 6-5. 17 V Filter Card

6.3.2.6 Video Driver

Remove the video driver card (Figure 6-5 and Figure 6-6) using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Disconnect the power at its source.
3. Disconnect the five connections to the video driver card (G2, ground, ribbon cable, 100 V power signal, and video drive signal).
4. Release the Velcro strips that hold the video driver to the CRT assembly.
5. Grasp the video driver by the ribbon cable connector and a heat sink and gently rock while pulling the card out.

Reinstall by reversing the order of the preceding steps. Check G2 level (Section 4.3.6.1). Perform the video driver/video processor beam-current calibration procedure (Section 6.3.3).

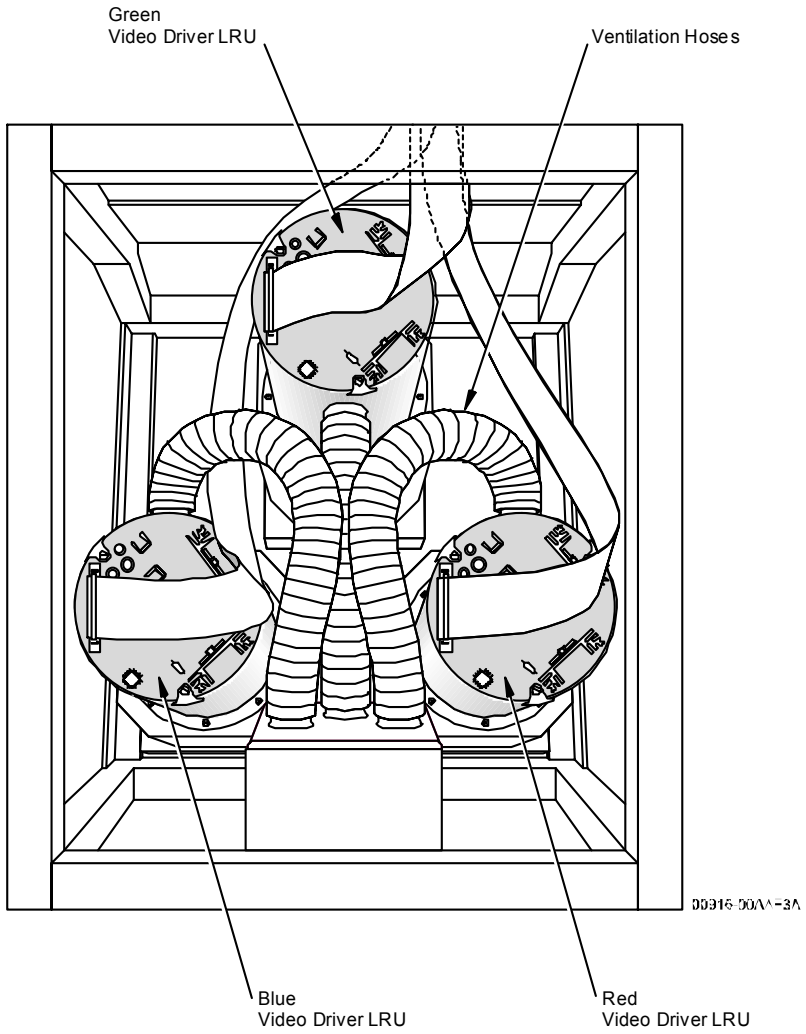


Figure 6-6. Video Driver Cabling

6.3.2.7 Deflection Diagnostic Card

Remove the diagnostic card (Figure 6-7) using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Disconnect the power at its source.
3. Remove all cables attached to the diagnostic cards.
4. Unscrew the card from the standoffs.
5. Lift card straight off.

Reinstall by reversing the order of the preceding steps.

6.3.2.8 Power Distribution Card

Remove the power distribution card (Figure 6-7) using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.
2. Disconnect the power at its source.
3. Remove the cables attached to the card. Unscrew the 56 V power cables.
4. Remove the retaining screws and lift the card.

Reinstall by reversing the action of the preceding steps (be sure the 56 V supply cables are securely screwed down).

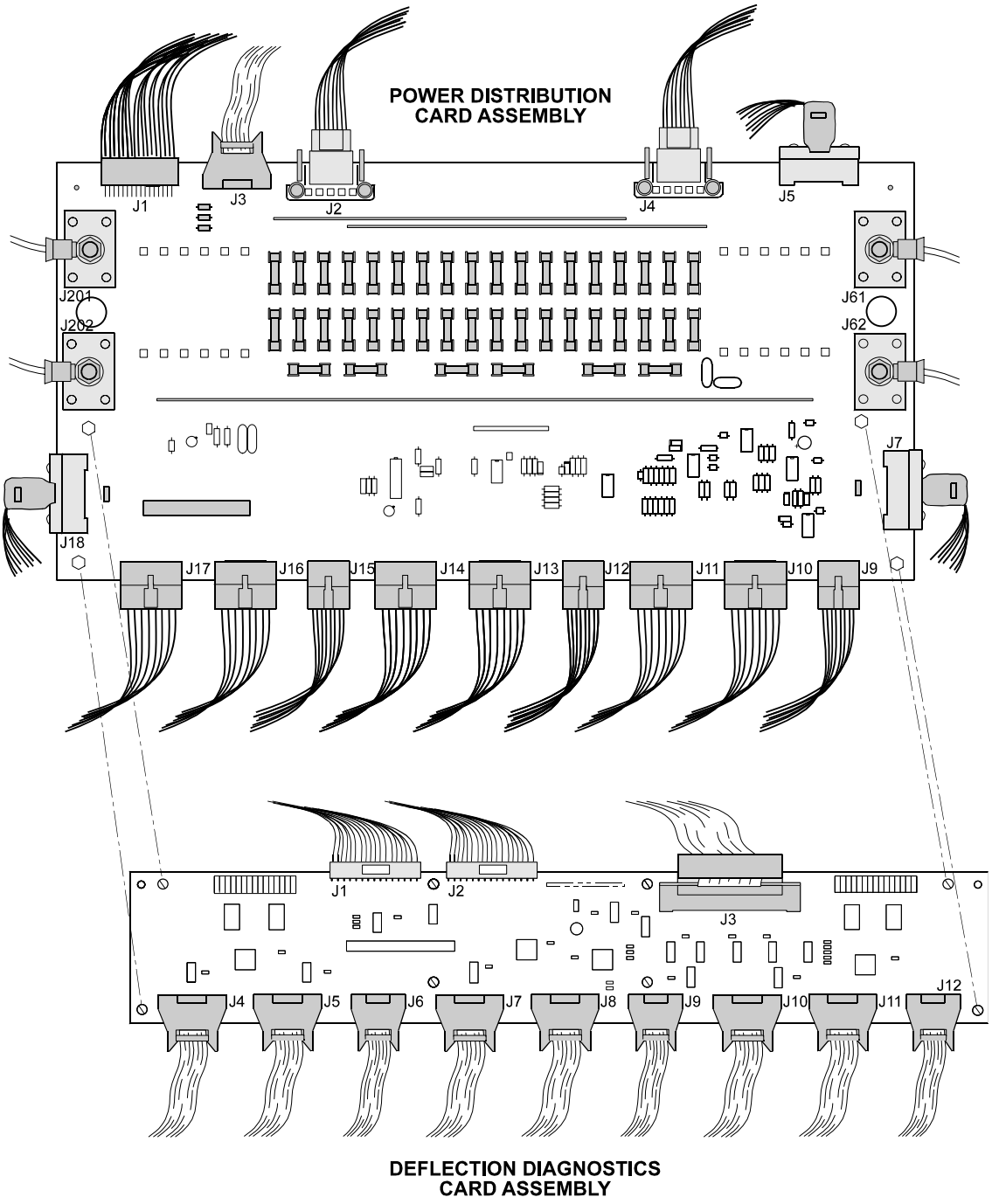


Figure 6-7. Power Distribution Card and Deflection Diagnostics Card Assemblies

6.3.2.9 EHT Power Supply

Remove the EHT power supply (Figure 6-8) using the following procedures:

1. Turn off the main circuit breaker located on the input panel of the projector head unit.

2. Disconnect the power at its source.
3. Remove the five cables attached to the power supply.
4. Unscrew the four captive retaining screws.
5. Slide the power supply out the back of the projector head chassis.

Reinstall the EHT power supply by reversing the order of the preceding steps. Check G2 level (Section 4.3.6.1).

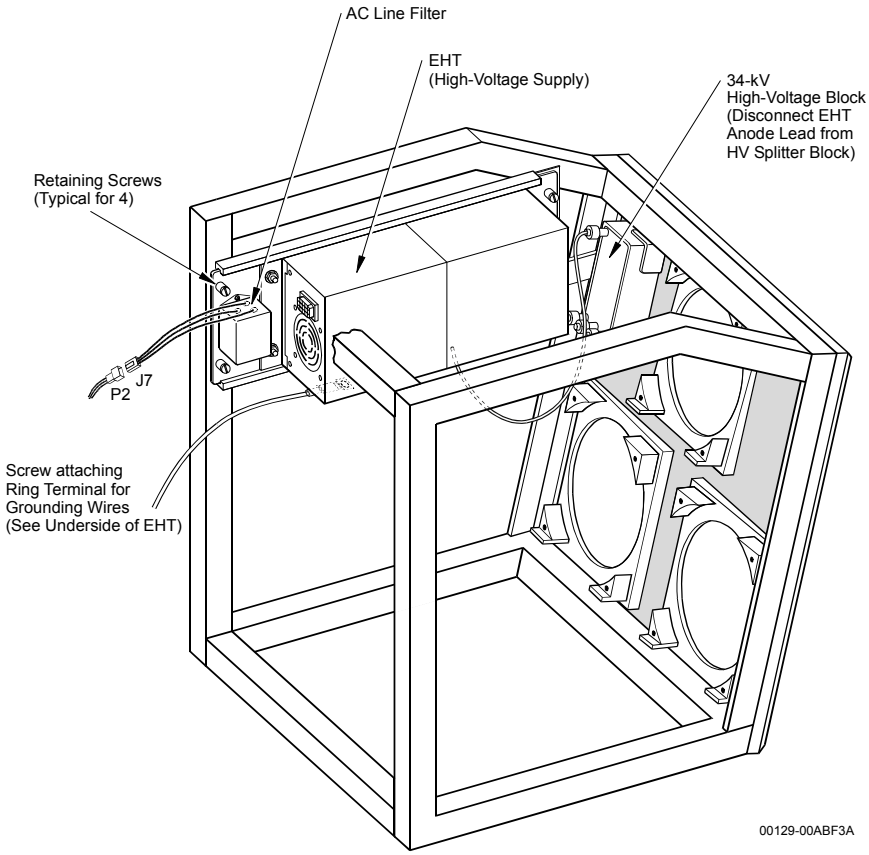


Figure 6-8. EHT Power Supply

6.3.2.10 Power Supply Card, Processor Card, BLIP Card, Ramp Card, and Video Processor

All cards in the card cage are keyed so they cannot be plugged into the wrong location. To remove cards, turn off the power. Remove the top skins, open the card cage door, and use the rockers to loosen the card. When installing the cards, especially the power supply card, the center of the card may need to be lifted so it will mate properly to the backpanel.

NOTE: If the video processor card is replaced, perform the video driver/video processor beam-current calibration procedure (Section 6.3.3).

See Table 6-3 for required alignments when cards are replaced.

Table 6-3. Alignments

Video processor card	Video Gain (Section 4.3.7)
BLIP card	Point Geometry (Section 4.3.4.2)
Ramp card	X Phase (Section 4.3.2.5) Coarse Geometry (Section 4.3.4.1)
Processor card	Load System Timing file Pattern Delay (Section 4.3.2.3) Blanks (Section 4.3.2.4) X Phase (Section 4.3.2.5)
Power supply card	None

6.3.3 Video Driver/Video Processor Beam-Current Calibration

Every time a video processor card (239540) or the video driver card (239670) is replaced, the following calibration procedure should be done (refer to Figure 6-9 for test adjustment points). If it is not done, variations in the beam current limit will occur.

1. Allow the projector to warm up approximately 20 minutes before making adjustment.
2. Eliminate all video to the projector.
3. Hook the scope probe to test point E18 (RED), E35 (GREEN), or E53 (BLUE) on the video processor card (239540). Set scope for 100m V/DIV.
4. Disable the high-voltage power supply by pressing the EHT **DISABLE** button on the rear of the projector (Input Panel).
5. Adjust R142 on the red video driver to get a zero voltage reading at test point E18 on the video processor.
6. Adjust R142 on the green video driver to get a zero voltage reading at test point E35 on the video processor.
7. Adjust R142 on the blue video driver to get a zero voltage reading at test point E53 on the video processor.
8. Once the calibration is complete, enable the high-voltage power supply by pressing the EHT **DISABLE** button on the rear of the projector.

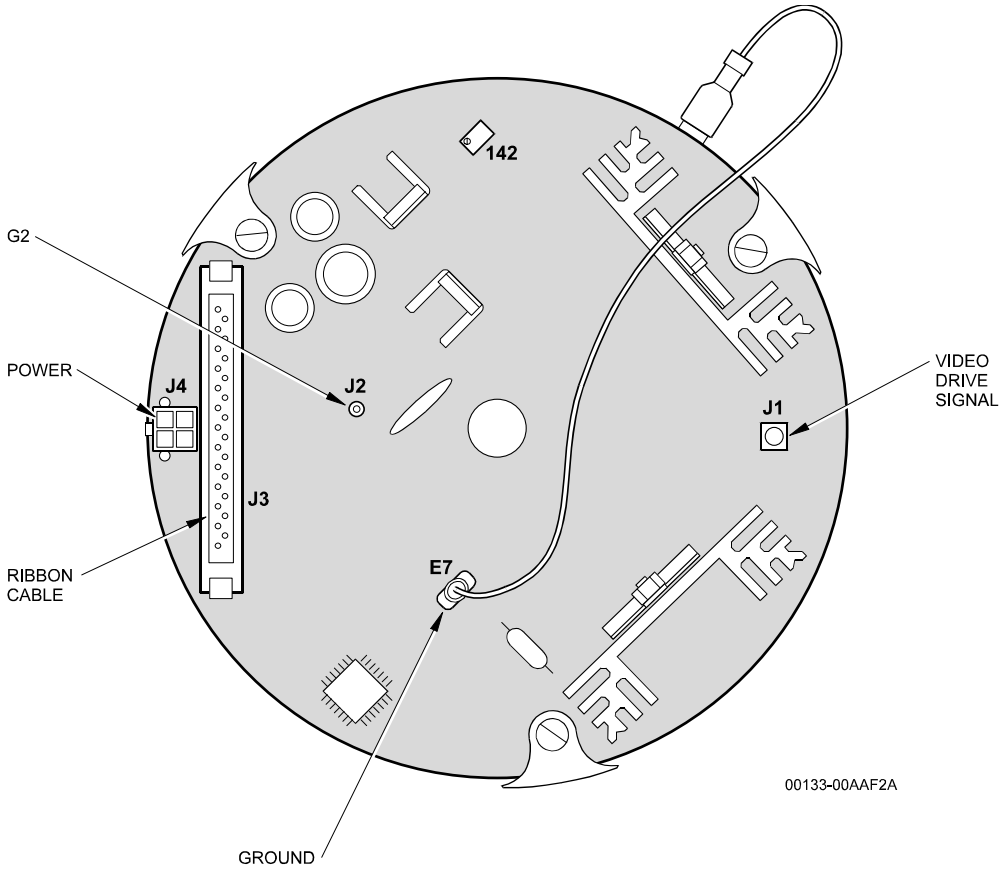


Figure 6-9. Video Driver Card

6.4 Power Supply Adjustment Procedures

The power supply voltages must periodically be measured and adjusted. The following procedures must be performed as part of the annual scheduled maintenance and when a power supply is replaced.

WARNING: Adjust power supplies cautiously. High voltages are present in the ac input of the power supply, even with IG powered down. These voltages could cause death or serious injury.

6.5 Deflection Power Supply Adjustment (239404)

1. Shut down the visual system as described in Section 3.4.
2. Remove top cover of remote deflection power supply (Section 6.2.2.1).
3. Turn on the projector and type P on the DCPC to the deflection power supply.
4. Using a voltmeter, measure the positive power supply at the lugs on the supply. Adjust the supply for +57 V (+/-1.0).

5. Using a voltmeter, measure the negative power supply at the lugs on the supply. Adjust the supply for –57 V (+/-1.0).
6. Measure across J201 and J202 to verify that the voltage at the deflection power distribution card (239690) is +57 V (+/-1.0).
7. Measure across J61 and J62 to verify that the voltage at the Deflection power distribution card (239690) is –57 V (+/-1.0).

6.5.1 5 V VME Power Supply Adjustment (239402)

WARNING: Adjust power supplies cautiously. High voltages are present in the ac input of the power supply, even with IG powered down. These voltages could cause death or serious injury.

1. Shut down the visual system as described in Section 3.4.
2. Loosen the 2 bolts that secure the 5 V VME power supply (Figure 6-4).
3. Power on the projector and enable the EHT and deflection power supplies.
4. Using a voltmeter, measure the voltage between E6 and E5 on the VME power supply.
5. Adjust the supply to read 5.6 V.
6. Measure the voltage on the VME backpanel at the J21 terminal block (Figure 2-3). The voltage should be 5.1 V (+/-0.05), if it is not, adjust power supply as required.

6.5.2 EHT/High-Voltage Power Supply Adjustment Procedure

You must use a 1000-to-1, high-voltage probe hooked to a voltmeter to perform this procedure.

WARNING: Adjust power supplies cautiously. High voltages are present in the ac input of the power supply, even with IG powered down. These voltages could cause death or serious injury.

1. Shut down the visual system as described in Section 3.4.
2. Unscrew the four bolts that secure the EHT power supply and slide the unit part way out.
3. Remove one CRT anode lead going into the high-voltage distribution block.
4. Connect the positive voltmeter lead securely to the distribution block and the negative voltmeter lead to the chassis ground.
5. Turn on projector and enable deflection and EHT power supplies.
6. Adjust the supply to read 3.4 (34,000) V. Verify that the green 34-kV OK LED on the deflection diagnostic card (239680) is enabled.

6.5.3 Power Supply Card Adjustment Procedure (239590)

1. Verify that the projector is turned on and the EHT and deflection power supplies are enabled.
2. Using a voltmeter, place the black lead on the E5 testpoint of the power supply card and the red lead on the E2 testpoint of the power supply card.
3. Adjust R33 to read –16.5 V (+/-0.1V).
4. Place the voltmeter red lead to the E3 testpoint of the power supply card.
5. Adjust R36 to read +16.5 V (+/-0.1V).

7 Troubleshooting

7.1 Introduction

This chapter explains how to troubleshoot the MCP2000. The following aids are included in this chapter:

- Troubleshooting Quick Reference Guide—Table 7-3 guides the technician to the most probable causes of common malfunctions.
- Voltages Generated in the MCP2000 —Table 7-1 provides information regarding the voltages used in the MCP2000, including the source of each voltage, where it is used, where it is sensed, and the power supply failure indicator affected by the voltage.
- MCP2000 Troubleshooting Symptoms—Section 7.8 contains a variety of malfunction symptoms and procedures for correcting the malfunction.

7.2 Additional Troubleshooting Aids

The technician should use the aids included in this manual and the *MCP2000 Projector Engineering Drawings and Associated Lists* to assist in troubleshooting the MCP2000 projector system. Here are a few of the major aids within these manuals:

- System Overview—Chapter 1 describes the circuits and operation of the MCP2000 at the LRU level.
- Schematics and Block Diagrams—Schematics and block diagrams can be found throughout various chapters of this manual. The block diagrams are valuable in understanding the interrelationship between modules or circuits.

- Parts Lists—The MCP2000 Projector Engineering Drawings and Associated Lists contains parts lists, schematics, and card drawings to help the technician determine the characteristics or specifications of the parts used in the equipment.

7.3 Isolating the Problem

Before attempting to troubleshoot the MCP2000, you should have:

- A thorough knowledge of the system and LRU under consideration;
- A good understanding of the capabilities and the limitations of the test equipment to be used;
- The ability to analyze and diagnose the symptoms and test results noted during the troubleshooting operation.

Before referring to the MCP2000 troubleshooting symptoms contained in Section 7.8, follow these steps:

1. Display the system status screen on the projector console to check the current condition of the projector.
2. Check the condition of the MCP2000 diagnostic failures on the projector console. Note any first failures and any current failures. Also, check for any warnings.
3. Assess the condition of the image on the CRT and note any anomalies. Note whether the image is present, is not present, or does not meet specifications. If the image is present but does not meet specifications, note the nature of the image defect.

7.4 MCP2000 Status Screen

The status screen (Table 7-1) can be displayed on the projector window on the DCPC. The projector must be in `Runtime Mode`, which is the normal operating mode of the MCP2000. Type *S* <Return> in the terminal window. The following screen displays:

```
+---------------------Projector Status--------------------------+
|  POWER SUPPLY BOARD:  enabled     PROJECTOR MODE:  lights     |
|   56-VOLT SUPPIES:    enabled     SYNC SOURCE:     external   |
|   HIGH-VOLT SUPPLY:   enabled     H-SYNC RATE:     51391      |
|   HIGH-VOLT OVERRIDE: disabled    V-SYNC RATE:     60         |
|   CRT FILAMENT:       enabled     RASTER LINES:    513        |
|   PHOSPHOR PROTECT:   disabled    IG SIGNAL:       present    |
|   SYSTEM FAILURE:     absent      TIME-OF-DAY:     day        |
|   SYSTEM WARNINGS:    absent                                  |
+---------------------------------------------------------------+
```

Table 7-1. MCP2000 Status Screen

Selection	Status	Description
Power supply card	Enabled/Disabled	Normal operation = enabled. Power supply card is powered on/off.
56 V supplies	Enabled/Disabled	±56 V power supply is powered on/off.
High-volt supply	Enabled/Disabled	EHT is on/off.
High-volt override	Enabled/Disabled	State of the EHT enable/disable button.
CRT filament	Enabled/Standby	CRT filament is enabled when EHT is on. When EHT is off, the CRT filament goes into standby mode.
Phosphor protect	Enabled/Disabled	Normal operation = disabled. Phosphor protect can be forced (enabled) by use of a run-time command.
System failure	Absent/Present	Normal operation = absent. Run diagnostics if system failure is present.
System warning	Absent/Present	Normal operation = absent. Run diagnostics if system warning is present.
Projector mode	Lights/Raster	Calligraphic or raster mode. (Selected in the System Configuration menu).
Sync source	External/Internal	Sync source = IG or projector. (Selected in the System Configuration menu).
H-sync rate		Horizontal sync rate (determined by system resolution).
V-sync rate		Vertical sync rate (60 Hz).
Raster lines		Raster lines per field (determined by system resolution).
IG signal	Absent/Present/ Out-of-Sync	Normal operation = present. IG signal is absent when there is no video signal to the projector. An incorrect video signal can cause out-of-sync error.
Time-of-Day	Day/Dusk/Night	Time of day.

7.5 Voltages Generated in the MCP2000

Table 7-2 details the source of each of the voltages generated in theMCP2000, where they are used, and where the device senses them.

Table 7-2. Voltages Generated in the MCP2000

Voltage Problem	Source	Failure Indicator	Where Used	Where Sensed
+34,000 V	High-voltage power supply in the projector head unit	Diagnostic warning	CRT anode	Power distribution card
450 V – 650 V	High-voltage power supply in the projector head unit (G2 voltage)	None	CRT socket	None
+56 V	56 V power supply	Diagnostic failure, diagnostic card LED	Focus amplifier, deflection amplifier	Power distribution card, focus amplifier, deflection amplifier
–56 V	56 V power supply	Diagnostic failure, diagnostic card LED	Focus amplifier, deflection amplifier	Power distribution card, focus amplifier, deflection amplifier
+95 V	Power supply card	Diagnostic failure, power supply card LED	Video driver	Power supply card, video driver
–95 V	Power supply card	Diagnostic failure, power supply card LED	Video driver	Power supply card, video driver
+37 V	Power supply card	Diagnostic failure, power supply card LED	Processor card	Power supply card
+17 V	Power supply card	Diagnostic failure, power supply card LED	Video processor, ramp card, BLIP card, processor card, focus amplifier, deflection amplifier, video driver, power distribution card	Power supply card

Table 7-2. Voltages Generated in the MCP2000

Voltage Problem	Source	Failure Indicator	Where Used	Where Sensed
–17 V	Power supply card	Diagnostic failure, power supply card LED	Video processor, ramp card, BLIP card, processor card, focus amplifier, deflection amplifier, power distribution card	Power supply card
+9 V	Power supply card	Diagnostic failure, power supply card LED	Video processor, ramp card, BLIP card, processor card	Power supply card
–9 V	Power supply card	Diagnostic failure, power supply card LED	Video processor, ramp card, BLIP card, processor card	Power supply card
+5 V	+5 V power supply	None	Video processor, ramp card, BLIP card, processor card, focus amplifier, deflection amplifier, video driver, diagnostic card, power distribution card	None
230 V ac	Line input	None	+5 V assembly, power supply card, 56 V deflection power supply, high-voltage supply	None

7.6 Projector Head Indicators

The projector head controls and indicators (Figure 7-1) are in three places: along the edge of cards in the card cage, on the diagnostics card, and on the input panel. Table 7-3 lists each control and indicator and what it does or means.

NOTE: Many of the controls and indicators are not visible with the skins on, so the top cover may have to be removed. However, the state of all the hidden indicators can be obtained from the DCPC.

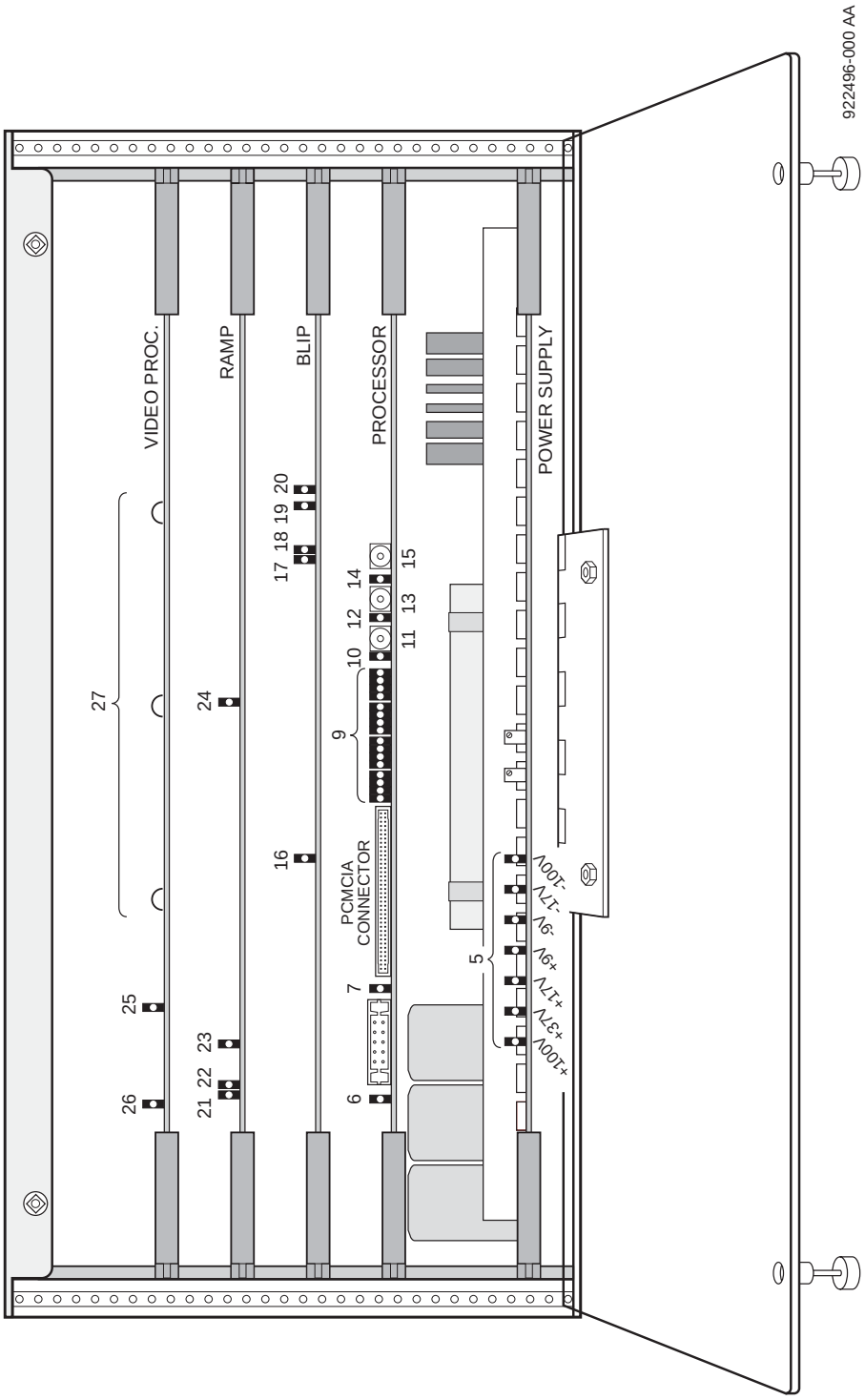


Figure 7-1. Projector Head Controls and Indicators

Table 7-3. Projector Head Controls and Indicators

Item	Control or Indicator and location		Purpose
1.	Hour meter Input panel	Not shown	This meter displays the number of hours that EHT has been enabled on the MCP2000.
2.	Power on indicator (AMBER) Input panel	Not shown	This indicates that the MCP2000 has power applied to it.
3.	EHT Disable Input panel	Not shown	This is an illuminated switch. When illuminated it indicates that the EHT can be enabled. When not illuminated, it indicates that the EHT cannot be enabled.
4.	Main switch Input panel	Not shown	This is the main power on switch for the MCP2000.
5.	Power supply card LEDs (GREEN) Power supply card		When illuminated, these LEDs indicate that the silk-screened voltages are present and in range (+100 V, –100 V, +17 V, –17 V, +9 V, –9V, +37 V).
6.	IG_RUNNING LED (GREEN) Processor		When all necessary IG signals are present (HSYNC, VSYNC, +TAXI, –TAXI), this LED is illuminated.
7.	Battery-low LED (RED) Processor		When a SRAM based PCMCIA card is inserted in the PCMCIA socket on the processor card, this LED indicates if the battery on the PCMCIA card is low and should be replaced. Illuminated = battery is low and should be replaced.
8.	PCMCIA connector Processor		This connector is used to load and save software on PCMCIA cards.
9.	Processor-status LEDs 0–15 (AMBER) Processor		These LEDs are software-controlled processor status indicators. The low 8 bits indicate interrupts being handled by the processor. The upper 8 bits are not defined at this point.
10.	Reset LED (AMBER) Processor		This LED is illuminated when the processor is in reset mode. This occurs when the reset button is pushed when the power is on.
11.	Reset button Processor		This button resets both the hardware and software components of the MCP2000.

Table 7-3. Projector Head Controls and Indicators

Item	Control or Indicator and location		Purpose
12.	PCMCIA LED (AMBER) Processor		This LED indicates the MCP2000 is operating from the software on the PCMCIA card instead of the software on the FLASH memory.
13.	PCMCIA button Processor		When this button and the reset button are pushed simultaneously, the MCP2000 boots with the software on the PCMCIA card instead of the software on the FLASH.
14.	Download LED (AMBER) Processor		This LED indicates that the processor is in a diagnostic debug mode.
15.	Download button Processor		This button is used with the reset button to put the system into diagnostic debug mode. Debug mode is only used in the factory.
16.	+5 V (GREEN) BLIP		This shows the presence of +5 V digital on the BLIP card.
17.	+5 VA (GREEN) BLIP		Shows the presence of +5 V analog. This voltage is post-regulated from the +9 V supply.
18.	–5 VA (GREEN) BLIP		Shows the presence of –5 V analog. This voltage is post-regulated from the –9 V supply.
19.	–15 V (GREEN) BLIP		Shows the presence of –15 V. This voltage is post-regulated from the –17.5 V supply.
20.	+15 V (GREEN) BLIP		Shows the presence of +15 V. This voltage is post-regulated from the +17.5 V supply.
21.	SYS_FAIL (RED) Ramp card		Whenever there is a failure in the system, it is reported to the ramp card and is then sent to the processor card. This LED indicates these failures.
22.	ILL_SYS (RED) Ramp card		Whenever there is a warning in the system, it is reported to the ramp card and then sent to the processor card. This LED indicates these warnings.
23.	PHOS PROT (RED) Ramp Card		Phosphor protection can be disabled for tube alignment. However, an MCP2000 should never be run under normal conditions with phosphor protection off. When this LED is illuminated, the phosphor protection has been disabled.

Table 7-3. Projector Head Controls and Indicators

Item	Control or Indicator and location		Purpose
24.	RAMP POWER FAIL (RED) Ramp card		If one of the power supplies on the ramp card fails, this LED illuminates.
25.	PHOS PROT (RED) Video processor		If the MCP2000 is in phosphor protection mode, this LED illuminates.
26.	POWER FAIL (RED) Video processor		If one of the supplies on the video processor card fails, this LED illuminates.
27.	AVERAGE BEAM CURRENT TOO HIGH (RED) Video processor		The video processor monitors the average beam current of each CRT. There is an LED for each CRT (RGB) that will illuminate if the beam current is too high.
28.	RXPL RYPL GXPL GYPL BXPL DRPL DGPL DBPL (GREEN) Diagnostic card	Not shown	The X and Y deflections and the focus for each color have a power limit circuit. If the power is too high, the circuit trips and the MCP2000 goes into phosphor protect mode and this LED does not illuminate.
29.	RXLS RYLS GXLS GYLS BXLS BYLS DRLS DGLS BGLS (GREEN) Diagnostic card	Not shown	If the X or Y deflection or focus for each color looses a power supply voltage, the MCP2000 goes into phosphor protect mode and this LED does not illuminate.

Table 7-3. Projector Head Controls and Indicators

Item	Control or Indicator and location		Purpose
30.	RXOT RYOT GXOT GYOT BXOT BYOT DROT DGOT DBOT (GREEN) Diagnostic card	Not shown	Each amp on the deflection assembly (X, Y, focus) has an over-temperature sensor. If an over-temperature condition exists, the appropriate LED does not illuminate.
31.	+56LS –56LS (GREEN) Diagnostic card	Not shown	If the 56 V supply fails to come up, the supply LED does not illuminate.
32.	+56OK –56OK (GREEN) Diagnostic card	Not shown	If the 56 V supplies are in range, these LEDs illuminate. When a supply is out of range, a warning is registered.
33.	34KV_OK (GREEN) Diagnostic card	Not shown	If the 34-kV EHT supply is in range, this LED illuminates.

7.7 MCP2000 Diagnostics

Section 7.7.1 through 7.7.5 describe malfunction symptoms and the steps required for correcting the underlying problem. These symptoms are organized in two major sections. The first deals with diagnostic messages from the MCP2000 diagnostics. The second deals with malfunctions apparent on the MCP2000 image that are not specifically addressed in the diagnostics. Within each section are subsections in which individual malfunctions are described and the troubleshooting steps required to resolve them are explained.

The troubleshooting procedures outlined in this section assume that at the time of malfunction the MCP2000 was properly aligned in accordance with the procedures set forth in Chapter 4. The technician should ascertain, before using these procedures, that the problem is not the result of a misalignment. A projector interconnection diagram and a cable-wiring diagram have been included at the end of this chapter for additional reference.

NOTE: The following troubleshooting procedures include instructions on how replace hardware in the MCP2000 at the LRU level. When you are instructed to replace an LRU, you will be referred to the sections in Chapter 4 containing the appropriate assembly/ disassembly instructions. Table 7-4 is provided as a quick reference to direct the technician to the appropriate troubleshooting section.

7.7.1 About Online Diagnostics

The MCP2000 built-in diagnostics are comprised of ten diagnostic units located within the following assemblies:

- Power supply card
- Video processor card
- Ramp generator card
- Deflection power supply
- Each deflection amplifier assembly (3 total)
- Each video driver (3 total)

In addition, two master diagnostic units are located on the ramp card. The master diagnostic units gather data from the other diagnostic units. One unit collects failures and the other collects warnings. Every failure and warning condition within the MCP2000 is reported from both the individual diagnostic unit and the master diagnostic unit. When a system problem occurs, it is recommended that diagnostic unit tests be run on the two master diagnostic units first. The master diagnostic units typically do not indicate the exact failure, but point to the individual diagnostic unit that originally detected the failure. Then that individual diagnostic unit can then be tested for a more complete diagnostic report.

Any failure will cause the system to enter phosphor-protect mode. Warnings are for notification and alert the technician of potential problems that may need servicing soon. Warnings do not cause the projector to enter phosphor-protect mode.

Each diagnostic unit has the ability to store the first failure and warning that occurred since the last time the diagnostic unit was interrogated. This is useful in determining what caused the system to enter phosphor-protect mode. Normally, only one first failure or first warning is stored. However, if an error occurs and then goes away and another appears before the diagnostic unit is read, both failures and warnings will be reported as a first failure.

If more than one failure occurs simultaneously, they will all show up as first failures or first warnings. The best example of this is when the MCP2000 is first turned on. The 5-V power supply is the first thing to come up. It is also the supply for all the diagnostic units. Thus, all the diagnostic units will show

nearly every failure and warning as a first failure and first warning because the analog voltages are not initially present.

After the first failures and first warnings are read from a diagnostic unit, the first failures and first warnings will be reset. If there are current failures and warnings when the read occurs, they then show up as first failures and first warnings.

Current failures and warnings describe the state of the MCP2000 exactly as it was when the diagnostic unit was read. If you get first failures but they are not current failures, the failure condition has either gone away or it only occasionally happens (transient).

7.7.2 Running Online Diagnostics

Diagnostics are run from the projector window on the DCPC. The projector must be in `Runtime Mode` to run the diagnostics. This is the normal operating mode of the MCP2000. Type *d* <Return> in the terminal window. The following message should appear:

```
Enter diagnostic bus unit (failures,
                           warnings,
                           rampCard,
                           deflectionRed,
                           deflectionGreen,
                           deflectionBlue,
                           videoDriverRed,
                           videoDriverGreen,
                           videoDriverBlue,
                           deflectionVoltage,
                           videoProcessorCard,
                           powerSupplyCard):
```

The MCP2000 will try to match what you type to one of the selections. If you type *f* <Return>, the MCP2000 displays failures. If you type *d*, the MCP2000 just displays a `d` because the diagnostic software does not know which selection you want. There are four choices that start with `d`. You can type the complete word or you can press the <Space Bar>. The <Space Bar> forces the MCP2000 to complete as much of the command as it can. In the case of `d`, the MCP2000 will return with `deflection` because the possible choices are:
`deflectionRed`,
`deflectionGreen`,
`deflectionBlue`, and
`deflectionVoltage`.

To complete the word, type *R*, *G*, *B*, or *V* <Return> and the MCP2000 fills in the rest.

Example: Type *d f* <Return> to look at failure diagnostics. You would see something like the following if the ±56 V power supplies and the EHT were not enabled.

```
Diagnostic bus unit data:
Name = Ramp PHOSPROT PAL
ID = 1
Register (bit-flags) = 00000000
First diagnostic errors (bit-flags) = 00002f7f
Current diagnostic errors (bit-flags) = 000020f0


First failures =

!!! FAILURE !!!  Ramp card power supply failure
!!! FAILURE !!!  Blue video driver power supply failure
!!! FAILURE !!!  Green video driver power supply failure
!!! FAILURE !!!  Red video driver power supply failure
!!! FAILURE !!!  Blue deflection/focus power limit or supply failure
!!! FAILURE !!!  Green deflection/focus power limit or supply failure
!!! FAILURE !!!  Red deflection/focus power limit or supply failure
!!! FAILURE !!!  Raster Y output failure
!!! FAILURE !!!  Raster X output failure
!!! FAILURE !!!  Card cage power supply failure
!!! FAILURE !!!  Video processor card failure
!!! FAILURE !!!  Deflection power supply failure

Current failures =

!!! FAILURE !!!  Blue deflection/focus power limit or supply failure
!!! FAILURE !!!  Green deflection/focus power limit or supply failure
!!! FAILURE !!!  Red deflection/focus power limit or supply failure
!!! FAILURE !!!  Ramp card failure
!!! FAILURE !!!  Deflection power supply failure

First warnings =
Current warnings =

Repeat diagnostic bus unit test? (y/n):
```

There are six important sections to this report.

The Header

This information may change slightly in each software version. Most of this information is for factory use only and is the binary representation of the failures and warnings. The ID is a number representing the version of the card. If this number is 15, then the device is not responding or a card is not installed.

```
Diagnostic bus unit data:
Name = Ramp PHOSPROT PAL
ID = 1
Register (bit-flags) = 00000000
First diagnostic errors (bit-flags) = 00002f7f
Current diagnostic errors (bit-flags) = 000020f0
```

First Failures

The diagnostic bus has the ability to record the very first failure that occurred. In this example, the MCP2000 had just been turned on and the 5 V power supply came up first, so anything dealing with analog voltages should report a failure. Normally only one first failure is reported at a time, but on power up most failures are present.

```
First failures =

!!! FAILURE !!!  Ramp card power supply failure
!!! FAILURE !!!  Blue video driver power supply failure
!!! FAILURE !!!  Green video driver power supply failure
!!! FAILURE !!!  Red video driver power supply failure
!!! FAILURE !!!  Blue deflection/focus power limit or supply failure
!!! FAILURE !!!  Green deflection/focus power limit or supply failure
!!! FAILURE !!!  Red deflection/focus power limit or supply failure
!!! FAILURE !!!  Raster Y output failure
!!! FAILURE !!!  Raster X output failure
!!! FAILURE !!!  Card cage power supply failure
!!! FAILURE !!!  Video processor card failure
!!! FAILURE !!!  Deflection power supply failure
```

Current Failures

Current failures show the current state of all the devices. In this example, the power supply card was turned on before the diagnostic bus was read and the 56 V was not on. Thus, the only failures were due to the 56 V power supply not being enabled.

```
Current failures =

!!! FAILURE !!!  Blue deflection/focus power limit or supply failure
!!! FAILURE !!!  Green deflection/focus power limit or supply failure
!!! FAILURE !!!  Red deflection/focus power limit or supply failure
!!! FAILURE !!!  Ramp card failure
!!! FAILURE !!!  Deflection power supply failure
```

First Warnings

First warnings are similar to first failures, but they do not cause the system to go into phosphor-protect mode. Warnings are considered nonhazardous, but they may affect performance. They are intended to alert technicians of potential problems in the future.

Current Warnings

Current warnings describe the current state of the system warnings.

Message to Retry

All diagnostic bus tests have a message giving you an option to retry the test. If you do not desire to test again, type *n* <Return> (while the console is waiting for a response, the HHR cannot communicate with the projector).

7.7.3 How to Move Through the Diagnostics

If the MCP2000 has a problem, start with the online diagnostics. Look at the failure diagnostic unit first. The failures diagnostic unit is a collection point for all the other diagnostic unit failures. In most cases, the failure indicates which diagnostic unit to read. The three exceptions are:

```
!!! FAILURE !!!  Raster Y output failure
!!! FAILURE !!!  Raster X output failure
!!! FAILURE !!!  Ramp card power supply failure
```

These indicate that the X or Y output from the ramp card is not functioning correctly, or the ramp card has blown a fuse or regulator and should be replaced.

In another example, if the projector stopped displaying an image and the diagnostics were run on the failures diagnostics unit and it said:

```
!!! FAILURE !!!  Blue video driver power supply failure
```

If this was the only failure, it would indicate that the blue video driver was missing one of its voltages. To find out more information, read the diagnostics for the blue video driver or type ***videoDriverBlue***. Any number of the following messages could appear.

NOTE: The 100-V failure should read 95 V.

```
Diagnostic bus unit data:
Name = Blue Video driver
ID = 0
Register (bit-flags) = 00000000
First diagnostic errors (bit-flags) = 000001e0
Current diagnostic errors (bit-flags) = 000001e0

First failures =

!!! FAILURE !!!  +100V failure on the Blue Video driver
!!! FAILURE !!!  +5V failure on the Blue Video driver
!!! FAILURE !!!  -5V failure on the Blue Video driver
!!! FAILURE !!!  -100V failure on the Blue Video driver

Current failures =

!!! FAILURE !!!  +100V failure on the Blue Video driver
!!! FAILURE !!!  +5V failure on the Blue Video driver
!!! FAILURE !!!  -5V failure on the Blue Video driver
!!! FAILURE !!!  -100V failure on the Blue Video driver

First warnings =
Current warnings =

Repeat diagnostic bus unit test ? (y/n):
```

This information makes locating the problem much easier. The problem is either cabling, connectors, or a failed part on the video driver. Inspect the cables and connections. If they seem okay, replace the video driver card.

7.7.4 Multiple Diagnostics Failures: How To Proceed

Some failures cause many diagnostic messages. For example: If the +56 V supply failed approximately five current failures would be reported by the failures diagnostic unit.

```
Current failures =

!!! FAILURE !!!  Blue deflection/focus power limit or supply failure
!!! FAILURE !!!  Green deflection/focus power limit or supply failure
!!! FAILURE !!!  Red deflection/focus power limit or supply failure
!!! FAILURE !!!  Ramp card failure
!!! FAILURE !!!  Deflection power supply failure
```

The real failure is the power supply. The deflection/focus amplifier is just complaining about the loss of power, and the ramp card is complaining because it cannot see any feedback from the deflection amplifiers because they do not have any power. Table 7-4 shows the sequence for correcting multiple failures. As a general rule, take care of power supply problems first. The following is an example of the sequence for diagnosing the source of a failure.

Check the power supplies first.

```
!!! FAILURE !!!  Card cage power supply failure
!!! FAILURE !!!  Deflection power supply failure
```

If the power supplies appear to be working properly, check the raster output failures next.

```
!!! FAILURE !!!  Raster Y output failure
!!! FAILURE !!!  Raster X output failure
```

Finally, if the power supplies and the raster outputs are okay, look at the color deflection/focus failures.

```
!!! FAILURE !!!  Blue deflection/focus power limit or supply failure
!!! FAILURE !!!  Green deflection/focus power limit or supply failure
!!! FAILURE !!!  Red deflection/focus power limit or supply failure
```

When one problem has been resolved, power up the MCP2000 and try to bring the system up again. If the problem persists, look at the diagnostics again and continue troubleshooting.

7.7.5 When the Diagnostics Will Not Tell You Anything

The diagnostics have a difficult time determining if an analog waveform is correct. The best it can do is determine if the signal voltage varies between two specified points. In these cases, your best indicator is the projected image. Try and determine if the problem is in video, deflection, or focus and then use Table 7-4 to look up the symptoms.

7.8 MCP2000 Symptoms

For each symptom in Section 7.9, follow the troubleshooting steps until the problem is resolved and then stop. It might not be necessary to perform all of the steps under a given symptom.

Table 7-4 contains a list of all common symptoms for the MCP2000. The first symptoms listed are the results of diagnostic messages. They are organized according to card or diagnostic unit. There is a section on visual anomalies, and the last two sections deal with the DCPC and the HHR.

7.9 MCP2000 Troubleshooting

Section 7.9.1 through 7.9.11.4 contain troubleshooting steps for malfunctions indicated by the online diagnostic as well as LEDs located throughout the system.

Table 7-4. Troubleshooting Symptom References

Symptom Description for the Projector Software	
Diagnostics Failures (failure diagnostic unit)	
`!!! FAILURE !!!  Ramp card power supply failure`	7.9.1.1
`!!! FAILURE !!!  Blue video driver power supply failure`	7.9.1.2
`!!! FAILURE !!!  Green video driver power supply failure`	7.9.1.3
`!!! FAILURE !!!  Red video driver power supply failure`	7.9.1.4
`!!! FAILURE !!!  Blue deflection/focus power limit or supply failure`	7.9.1.5
`!!! FAILURE !!!  Green deflection/focus power limit or supply failure`	7.9.1.6
`!!! FAILURE !!!  Red deflection/focus power limit or supply failure`	7.9.1.7
`!!! FAILURE !!!  Raster Y output failure`	7.9.1.8
`!!! FAILURE !!!  Raster X output failure`	7.9.1.9
`!!! FAILURE !!!  Card cage power supply failure`	7.9.1.10
`!!! FAILURE !!!  Video processor card failure`	7.9.1.11
`!!! FAILURE !!!  Deflection power supply failure`	7.9.1.12
Diagnostics Warnings (warning diagnostic unit)	
`!!! WARNING !!!  Ramp card warning`	7.9.2.1
`!!! WARNING !!!  Red deflection/focus over-temp`	7.9.2.2
`!!! WARNING !!!  Green deflection/focus over-temp`	7.9.2.3
`!!! WARNING !!!  Blue deflection/focus over-temp`	7.9.2.4
`!!! WARNING !!!  Deflection power supply out-of-range`	7.9.2.5
`!!! WARNING !!!  Video processor warning`	7.9.2.6
Diagnostics Ramp Card (239530)	
`!!! FAILURE !!!  Red spot beam over-current`	7.9.3.1
`!!! FAILURE !!!  Green spot beam over-current`	7.9.3.1
`!!! FAILURE !!!  Blue spot beam over-current`	7.9.3.1
`!!! FAILURE !!!  Red X ramp failure`	7.9.3.2
`!!! FAILURE !!!  Green X ramp failure`	7.9.3.3
`!!! FAILURE !!!  Blue X ramp failure`	7.9.3.4
`!!! FAILURE !!!  Red Y ramp failure`	7.9.3.5

Table 7-4. Troubleshooting Symptom References

Symptom Description for the Projector Software	
!!! FAILURE !!! Green Y ramp failure	7.9.3.6
!!! FAILURE !!! Blue Y ramp failure	7.9.3.7
!!! WARNING !!! Loss of H-sync occurred	7.9.3.8
!!! WARNING !!! Light intensity too high; some lights removed	7.9.3.9
!!! WARNING !!! Phosphor protection disabled	7.9.3.10
!!! WARNING !!! Align mode activated	7.9.3.11
Diagnostics Deflection Red (239610)	
!!! FAILURE !!! Red X deflection power limit	7.9.4.1
!!! FAILURE !!! Red Y deflection power limit	7.9.4.2
!!! FAILURE !!! Red X deflection power failure	7.9.4.3
!!! FAILURE !!! Red Y deflection power failure	7.9.4.4
!!! FAILURE !!! Red focus power limit	7.9.4.5
!!! FAILURE !!! Red focus power failure	7.9.4.6
!!! WARNING !!! Red X deflection over-temp	7.9.4.7
!!! WARNING !!! Red Y deflection over-temp	7.9.4.8
!!! WARNING !!! Red focus over-temp	7.9.4.9
Diagnostics Deflection Green (239610)	
!!! FAILURE !!! Green X deflection power limit	7.9.4.1
!!! FAILURE !!! Green Y deflection power limit	7.9.4.2
!!! FAILURE !!! Green X deflection power failure	7.9.4.3
!!! FAILURE !!! Green Y deflection power failure	7.9.4.4
!!! FAILURE !!! Green focus power limit	7.9.4.5
!!! FAILURE !!! Green focus power failure	7.9.4.6
!!! WARNING !!! Green X deflection over-temp	7.9.4.7
!!! WARNING !!! Green Y deflection over-temp	7.9.4.8
!!! WARNING !!! Green focus over-temp	7.9.4.9
Diagnostics Deflection Blue (239610)	
!!! FAILURE !!! Blue X deflection power limit	7.9.4.1
!!! FAILURE !!! Blue Y deflection power limit	7.9.4.2
!!! FAILURE !!! Blue X deflection power failure	7.9.4.3
!!! FAILURE !!! Blue Y deflection power failure	7.9.4.4
!!! FAILURE !!! Blue focus power limit	7.9.4.5

Table 7-4. Troubleshooting Symptom References

Symptom Description for the Projector Software	
!!! FAILURE !!! Blue focus power failure	7.9.4.6
!!! WARNING !!! Blue X deflection over-temp	7.9.4.7
!!! WARNING !!! Blue Y deflection over-temp	7.9.4.8
!!! WARNING !!! Blue focus over-temp	7.9.4.9
Diagnostics Video Driver Red (239670)	
!!! FAILURE !!! +100 V failure on the red video driver	7.9.5.1
!!! FAILURE !!! +5 V failure on the red video driver	7.9.5.2
!!! FAILURE !!! -5 V failure on the red video driver	7.9.5.3
!!! FAILURE !!! -100 V failure on the red video driver	7.9.5.4
Diagnostics Video Driver Green (239670)	
!!! FAILURE !!! +100 V failure on the green video driver	7.9.5.1
!!! FAILURE !!! +5 V failure on the green video driver	7.9.5.2
!!! FAILURE !!! -5 V failure on the green video driver	7.9.5.3
!!! FAILURE !!! -100 V failure on the green video driver	7.9.5.4
Diagnostics Video Driver Blue (239670)	
!!! FAILURE !!! +100 V failure on the blue video driver	7.9.5.1
!!! FAILURE !!! +5 V failure on the blue video driver	7.9.5.2
!!! FAILURE !!! -5 V failure on the blue video driver	7.9.5.3
!!! FAILURE !!! -100 V failure on the blue video driver	7.9.5.4
Diagnostics Deflection Voltages	
!!! FAILURE !!! +56 V failure	7.9.6.1
!!! FAILURE !!! -56 V failure	7.9.6.2
!!! WARNING !!! +56 V out-of-range	7.9.6.3
!!! WARNING !!! -56 V out-of-range	7.9.6.4
!!! WARNING !!! 34 kV High voltage out-of-range	7.9.6.5
Diagnostics Video Processor Card (239540)	
!!! FAILURE !!! +15 V failure on the video processor	7.9.7.1
!!! FAILURE !!! -15 V failure on the video processor	7.9.7.2
!!! FAILURE !!! +5 VA failure on the video processor	7.9.7.3
!!! FAILURE !!! -5 VA failure on the video processor	7.9.7.4
!!! FAILURE !!! BLIP card power supply failure	7.9.7.5
!!! FAILURE !!! Red video driver output failure	7.9.7.6

Table 7-4. Troubleshooting Symptom References

Symptom Description for the Projector Software	
`!!! FAILURE !!!  Green video driver output failure`	7.9.7.7
`!!! FAILURE !!!  Blue video driver output failure`	7.9.7.8
`!!! WARNING !!!  Video driver temp is high`	7.9.7.9
`!!! WARNING !!!  Missing AGC signal from the IG`	7.9.7.10
`!!! WARNING !!!  AGC clamp missing`	7.9.7.11
`!!! WARNING !!!  H-clamp missing`	7.9.7.12
`!!! WARNING !!!  Red video is in limit`	7.9.7.13
`!!! WARNING !!!  Green video is in limit`	7.9.7.14
`!!! WARNING !!!  Blue video is in limit`	7.9.7.15
`!!! WARNING !!!  Red input missing`	7.9.7.16
`!!! WARNING !!!  Green input missing`	7.9.7.17
`!!! WARNING !!!  Blue input missing`	7.9.7.18
Diagnostics Power Supply Card (239590)	
`!!! FAILURE !!!  +9 V failure on the power supply card`	7.9.8.1
`!!! FAILURE !!!  -9 V failure on the power supply card`	7.9.8.2
`!!! FAILURE !!!  +17 V failure on the power supply card`	7.9.8.3
`!!! FAILURE !!!  -17 V failure on the power supply card`	7.9.8.4
`!!! FAILURE !!!  +100 V failure on the power supply card`	7.9.8.5
`!!! FAILURE !!!  -100 V failure on the power supply card`	7.9.8.6
`!!! FAILURE !!!  +37 V failure on the power supply card`	7.9.8.7
HHR Messages	
ER0 Interrupted Communications	7.9.9.1
DCPC WinFrame Software	7.9.10
Visual Anomalies	
One of the projector colors will not come on.	7.9.11.1
Projector will not defocus for rain scenes, fog scenes, or defocus test patterns.	7.9.11.2
Projector image will not come into focus.	7.9.11.3
Color completely out of convergence.	7.9.11.4

7.9.1 Diagnostic Failure Descriptions (Failure Diagnostic Unit)

7.9.1.1 !!! FAILURE !!! Ramp Card Power Supply Failure

Cause: One of the ramp card power supplies is not present. This could be a result of a bad power supply card, a faulty 17 V filter card (239550), faulty cables, or a fuse or regulator blown on the ramp card.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. If a failure is indicated, correct the problem on the power supply card and retry the system.
2. Check the video processor card diagnostics to see if it has power supply failures and if the BLIP card power supply failure is indicated (the BLIP card also has LEDs on the edge of the card that indicates the voltage that has failed). If no other failures are indicated, replace the ramp card and retry the system.
3. If multiple power supply failures are indicated (from step 2) and the failure is the +17 V or –17 V supply, inspect the cable (J25 on the back panel 239580) that goes to the 17 V filter card (239550). Inspect the 17 V filter card for damage. If damage is evident, replace the card.
4. Replace the power supply card (239590) and retry the system.

7.9.1.2 !!! FAILURE !!! Blue Video Driver Power Supply Failure

See Section 7.9.1.4.

7.9.1.3 !!! FAILURE !!! Green Video Driver Power Supply Failure

See Section 7.9.1.4.

7.9.1.4 !!! FAILURE !!! Red Video Driver Power Supply Failure

Cause: One of the video driver card's voltages is not present. This could be a result of a bad power supply card, faulty cables, or a blown regulator on the video driver card.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. If a failure is indicated, correct the problem on the power supply card and retry the system.
2. If all video drivers are indicating a power supply failure, make sure that the cable attached to J2 on the backpanel is connected. If the cable is properly attached, then replace the power supply card and retry the system.

3. Replace the offending video driver.

7.9.1.5 !!! FAILURE !!! Blue Deflection/Focus Power Limit or Supply Failure

Cause: One of the deflection/focus card's voltages is not present (+56 V, –56 V, +17 V,
–17 V) or the current is too high and the amplifier is in current limit. This could be a result of a bad power supply card, faulty cables, a blown fuse on the power distribution card, a bad amplifier, or a picture that is sized too big.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. Also, verify that the 56 V power supply is supplying power by checking the deflection Voltage diagnostic. If a failure is indicated, correct the problem on the power supply or power supply card and retry the system.
2. Run diagnostics on the deflectionBlue and follow the procedure indicated by the failures.

NOTE: A blown fuse is generally an indicator of a greater problem, thus replacing the fuse will not resolve the problem. A card that contains a blown fuse should be replaced and tested before being returned to VDCDS for repair.

7.9.1.6 !!! FAILURE !!! Green Deflection/Focus Power Limit or Supply Failure

Cause: One of the deflection/focus card's voltages is not present (+56 V, –56 V, +17 V,
–17 V) or the current is too high and the amplifier is in current limit. This could be a result of a bad power supply card, faulty cables, a blown fuse on the power distribution card, a bad amplifier, or a picture that is sized too big.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. Also, verify that the 56 V power supply is supplying power by checking the deflectionVoltage diagnostic. If a failure is indicated correct the problem on the power supply or power supply card and retry the system.
2. Run diagnostics on the deflectionGreen and follow the procedure indicated by the failures.

7.9.1.7 !!! FAILURE !!! Red Deflection/Focus Power Limit or Supply Failure

Cause: One of the deflection/focus card's voltages is not present (+56 V, –56 V, +17 V,
–17 V) or the current is too high and the amplifier is in current limit. This could be a result of a bad power supply card, faulty cables, a blown fuse on the power distribution card, a bad amplifier, or a picture that is sized too big.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. Also, verify that the 56 V power supply is supplying power by checking the deflectionVoltage diagnostic. If a failure is indicated correct the problem on the power supply or power supply card and retry the system.
2. Run diagnostics on the deflectionRed and follow the procedure indicated by the failures.

7.9.1.8 !!! FAILURE !!! Raster Y Output Failure

Cause: It could be caused by a loss of a power supply, a faulty ramp card, or a faulty processor card (239500).

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics.
2. Run the rampCard diagnostics. Check for any power supply errors and troubleshoot them.
3. Replace ramp card (239530),
4. Replace processor card (239500).

7.9.1.9 !!! FAILURE !!! Raster X Output Failure

Cause: It could be caused by a loss of a power supply, a faulty ramp card, or a faulty processor card (239500).

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics.
2. Run the rampCard diagnostics. Check for any power supply errors and troubleshoot them.
3. Replace ramp card (239530).
4. Replace processor card (239500).

7.9.1.10 !!! FAILURE !!! Card Cage Power Supply Failure

Cause: The power supply card has detected a failure on one of its output voltages. This could be caused by a bad part on the card or a blown fuse.

Procedure:

1. Replace the power supply card.
2. If all voltages have failed and replacing the power supply has not helped, check that there is 220 V ac coming out of the line filter located next to the fan for the VME. Also, verify the ac connection to the backpanel.

7.9.1.11 !!! FAILURE !!! Video Processor Card Failure

Cause: The failure could be a loss of a power supply, a loss of a voltage on the BLIP, or an output failure on a video driver.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. If a failure is indicated, correct the problem on the power supply card and retry the system.
2. Run the videoProcessorCard diagnostics.

7.9.1.12 !!! FAILURE !!! Deflection Power Supply Failure

Cause: Either the +56 V or the –56 V supply has failed.

Procedure:

1. Verify that the power supply card is generating all its voltages by checking the power supply card diagnostics. If a failure is indicated, correct the problem on the power supply card and retry the system.
2. Run deflectionVoltage diagnostics and troubleshoot the errors indicated.

7.9.2 Diagnostic Warning Descriptions (Warning Diagnostic Unit)

7.9.2.1 !!! WARNING !!! Ramp Card Warning

Cause: The ramp card has a warning.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. Run the rampCard diagnostics.

7.9.2.2 !!! WARNING !!! Red Deflection/Focus Over-Temp

Cause: The red X, red Y, or red focus amplifier is over temperature.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. Run the deflectionRed diagnostics.

7.9.2.3 !!! WARNING !!! Green Deflection/Focus Over-Temp

Cause: The green X, green Y, or green focus amplifier is over temperature.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. Run the deflectionGreen diagnostics.

7.9.2.4 !!! WARNING !!! Blue Deflection/Focus Over-Temp

Cause: The blue X, blue Y, or blue focus amplifier is over temperature.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. Run the deflectionBlue diagnostics.

7.9.2.5 !!! WARNING !!! Deflection Power Supply Out-of-Range

Cause: Either the +56 V, –56 V, or 34 kV is out of range.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. Run the deflectionVoltage diagnostics.

7.9.2.6 !!! WARNING !!! Video Processor Warning

Cause: The video processor card has a warning.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. Run the videoProcessorCard diagnostics.

7.9.3 Diagnostics Ramp Card (239530) Failure and Warning Descriptions

7.9.3.1 !!! FAILURE !!! Red/Green/Blue Spot-Beam Over-Current

Cause: The beam current on a light is too high or the collective beam current of a collection of closely spaced lights is too high. This can be caused by lights that are too bright, too many lights close together, a fault in the ramp card, a fault in the video driver, or a fault in the video processor. The lights on the display will also appear to flicker at about a 10-Hz rate.

Procedure:

1. This fault occurs if lights are too closely packed and too bright. Lower the G2, video gain, or change the model so fewer lights are shown.
2. If the number and intensity of lights is within normal operation, then one of the following cards could have a problem and should be replaced: the ramp, the video processor, or the video driver card for the offending color.

7.9.3.2 !!! FAILURE !!! Red X Ramp Failure

See Section 7.9.3.4.

7.9.3.3 !!! FAILURE !!! Green X Ramp Failure

See Section 7.9.3.4.

7.9.3.4 !!! FAILURE !!! Blue X Ramp Failure

Cause: This failure occurs when the feedback from the deflection amplifier goes away. This could be caused by a faulty ramp card, a faulty deflection amplifier, a cable that is open, a deflection yoke that is open, or a power supply failure.

Procedure:

1. Verify that there are no power supply related problems.
2. With the power off, check the cable connections to the deflection amplifier. Verify that none of the wires have been pinched or cut. Follow the wires to the backpanel and the tube assembly and inspect the yoke interconnect contacts of the tube assembly. With an ohmmeter, measure the yoke resistance. It should be below 100 ohms.
3. Replace deflection amplifier assembly (239610).
4. Replace ramp card (239530).

7.9.3.5 !!! FAILURE !!! Red Y Ramp Failure

See Section 7.9.3.7.

7.9.3.6 !!! FAILURE !!! Green Y Ramp Failure

See Section 7.9.3.7.

7.9.3.7 !!! FAILURE !!! Blue Y Ramp Failure

Cause: This failure occurs when the feedback from the deflection amplifier goes away. This could be caused by a faulty ramp card, a faulty deflection amplifier, a cable that is open, a deflection yoke that is open, or a power supply failure.

Procedure:

1. Verify that there are no power supply related problems.
2. With the power off, check the cable connections to the deflection amplifier. Verify that none of the wires have been pinched or cut. Follow the wires to the backpanel and the tube assembly and inspect the yoke interconnect contacts of the tube assembly. With an ohmmeter, measure the yoke resistance. It should be below 100 ohms.
3. Replace deflection amplifier assembly (239610).
4. Replace ramp card (239530).

7.9.3.8 !!! WARNING !!! Loss of H-Sync Occurred

Cause: The ramp card is not receiving a valid H-sync. This warning can occur temporarily.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).
2. If the error is on continuously, replace the ramp card.
3. If replacing the ramp card did not correct the problem, replace the processor.

7.9.3.9 !!! WARNING !!! Light Intensity too High; Some Lights Removed

Cause: The chew-out circuit on the processor card has removed some lights to prevent burns. This is normal in a runway scene with lots of lights.

Procedure:

1. Verify that there are no failures in the system (a failure can also cause warnings).

2. If the removal of lights is obvious and objectionable, adjust the Chew-out in the System Configuration menu to a higher number.
3. If necessary, replace the processor card.

7.9.3.10 !!! WARNING !!! Phosphor Protection Disabled

Cause: The align mode has been enabled and has disabled all phosphor protection. Do not run the projector in this mode. This is only for tube alignments and testing. There are two things that must be in place for align mode to be activated: the DIP switch on the backpanel must be off and the software must also indicate that align mode should be activated.

Procedure:

1. To disable align mode, switch U7 switch 8 to the ON position (ON disables align mode, OFF enables align mode).
2. To disable the software switch, type M <Return> on the projector console.
3. If the projector remains in align mode when it should not be, replace the ramp card.

7.9.3.11 !!! WARNING !!! Align Mode Activated

Cause: The align mode has been enabled and has disabled all phosphor protection. Do not run the projector in this mode. This is only for tube alignments and testing. There are two things that must be in place for align mode to be activated: the dip switch on the backpanel must be off and the software must also indicate that align mode should be activated.

Procedure:

1. To remove align mode, switch U7 switch 8 to the ON position (ON disables align mode, OFF enables align mode).
2. To disable the software switch, type M <Return> on the projector console.
3. If the projector remains in align mode when it should not be, replace the ramp card.

7.9.4 Diagnostic Deflection Red/Green/Blue (239610) Failure and Warning Descriptions

7.9.4.1 !!! FAILURE !!! <Color> X Deflection Power Limit

Cause: Power limit suggests that the deflection amplifier is outputting too much current. This could be for three reasons: the x size is too large, there is a failure on the ramp card causing the deflection to swing too hard, or a bad deflection amplifier.

Procedure:

1. Verify that there are no power failures in the system.
2. Reduce the size for the x raster.
3. Replace the ramp card.
4. Replace the deflection assembly.
5. Replace the diagnostic card.

7.9.4.2 !!! FAILURE !!! <Color> Y Deflection Power Limit

Cause: Power limit suggests that the deflection amplifier is outputting too much current. This could be for three reasons: the y size is too large, there is a failure on the ramp card causing the deflection to swing too hard, or a bad deflection amplifier.

Procedure:

1. Verify that there are no power failures in the system.
2. Reduce the size of the y raster.
3. Replace the ramp card.
4. Replace the deflection assembly.
5. Replace the diagnostic card.

7.9.4.3 !!! FAILURE !!! <Color> X Deflection Power Failure

Cause: The X deflection amplifier has lost one of its voltages. This could be cause from a failed power supply, bad cable, or blown fuse.

Procedure:

1. Verify that there are no failures in the deflection voltage or power supply card.
2. Check the cabling. Make sure all cables to the deflection amplifier are in good shape and plugged in correctly.

3. Check fuses for the appropriate color and function (+17 V, ~17 V, +56 V, ~56 V).
4. If after replacing the fuse it immediately blows again, replace the deflection amplifier.
5. Replace the diagnostic card.

7.9.4.4 !!! FAILURE !!! <Color> Y Deflection Power Failure

Cause: The Y deflection amplifier has lost one of its power supplies. This could be cause from a failed power supply, bad cable, or blown fuse.

Procedure:

1. Verify that there are no failures in the deflection voltage or power supply card.
2. Check the cabling. Make sure all cables to the deflection amplifier are in good shape and plugged in correctly.
3. Check fuses for the appropriate color and function (+17 V, ~17 V, +56 V, ~56 V).
4. If after replacing the fuse it immediately blows again, replace the deflection amplifier.
5. Replace the diagnostic card.

7.9.4.5 !!! FAILURE !!! <Color> Focus Power Limit

Cause: Power limit suggests that the focus amplifier is outputting too much current. This could be for two reasons: there is a failure on the ramp card causing the focus to swing too hard or a bad focus amplifier.

Procedure:

1. Verify that there are no power failures in the system.
2. Replace the ramp card.
3. Replace the deflection assembly.
4. Replace diagnostic card.

7.9.4.6 !!! FAILURE !!! <Color> Focus Power Failure

Cause: The focus amplifier is missing a voltage. This could be caused by a failed power supply, bad cable, or blown fuse.

Procedure:

1. Verify that there are no failures in the deflection voltage or power supply card.

2. Make sure all cables to the focus amplifier are in good condition and are plugged in correctly.
3. Check fuses for the appropriate color and function (+17 V, ~17 V, +56 V, ~56 V).
4. If after replacing the fuse it immediately blows again, replace the deflection amplifier.
5. Replace the diagnostic card.

7.9.4.7 !!! WARNING !!! <Color> X Deflection Over-Temp

Cause: The deflection amplifier is getting too hot. This occurs occasionally when a lot of lights are on one side of the display. If the frequency of this warning starts to increase, this indicates a problem.

Procedure:

1. Check all fans to verify they are working properly and replace any with problems.
2. Verify that there are no obstructions to the airflow in the deflection amplifier assembly.
3. Clean the heat sink on the deflection amplifier assembly with a mild soap or alcohol and a soft cloth.
4. Check the cabling.
5. Replace deflection amplifier.
6. Replace diagnostic card.

7.9.4.8 !!! WARNING !!! <Color> Y Deflection Over-Temp

See Section 7.9.4.7.

7.9.4.9 !!! WARNING !!! <Color> Focus Over-Temp

See Section 7.9.4.7.

7.9.5 Diagnostic Video Driver Red/Green/Blue (239670) Failure and Warning Descriptions

7.9.5.1 !!! FAILURE !!! +100 V Failure on the <Color> Video Driver

NOTE: This 100 V failure should read 95 V.

Cause: The video driver is not receiving the proper voltages.

Procedure:

1. Verify that there are no failures on the power supply card.
2. Inspect the ribbon cable and power cable going to the video driver. Make sure the wires have not been pinched and that they are mated securely to the appropriate connector.
3. Replace video driver. Perform the beam current calibration procedure in Section 6.3.3.
4. Replace power supply card.

7.9.5.2 !!! FAILURE !!! +5 V Failure on the <Color> Video Driver

See Section 7.9.5.1.

7.9.5.3 !!! FAILURE !!! –5 V Failure on the <Color> Video Driver

See Section 7.9.5.1.

7.9.5.4 !!! FAILURE !!! –100 V Failure on the <Color> Video Driver

See Section 7.9.5.1.

7.9.6 Diagnostic Deflection Voltages Failure and Warning Descriptions

7.9.6.1 !!! FAILURE !!! +56 V Failure

Cause: The power distribution card is not receiving +56 V. This could be because of cabling or something that failed in the 56 V power supply.

Procedure:

1. Check the fan on the 56 V supply. If it is not running, the 56 V supply is not getting the 220 V ac. Check cabling.
2. Verify the voltages on the 56 V supply cables on the power distribution card.
3. Check the cabling between the projector and the power supply. Make sure the cables are secure and verify the cabling on the power distribution card.
4. Open the 56 V power supply. Measure the voltages on the terminal coming out of the switching power supplies (there are 2, one for +56 V and one for ~56 V). If 56 V is present on both supplies, trace the voltage back. Verify that the series resistor has not failed.

7.9.6.2 !!! FAILURE !!! –56 V Failure

See Section 7.9.6.1.

7.9.6.3 !!! WARNING !!! +56 V Out-of-Range

Cause: The 56 V supply is low.

Procedure:

1. Check for the +56 V coming into the power distribution card. If it is low, open up the 56 V power supply and adjust the supplies up.
2. If the voltage is okay, check the power distribution card and the diagnostic card. One or both of them may need to be replaced.

7.9.6.4 !!! WARNING !!! –56 V Out-of-Range

Cause: The 56 V supply is low.

Procedure:

1. Check the +56 V coming into the power distribution card. If it is low, open up the 56 V power supply and adjust the supplies up.
2. If the voltage is okay, check the power distribution card and the diagnostic card. One or both of them may need to be replaced.

7.9.6.5 !!! WARNING !!! 34 kV High-Voltage Out-of-Range

Cause: The 34-kV supply is low or not enabled.

Procedure:

1. Check for any failures in the system (a failure will cause the EHT to be turned off).
2. Check the input panel. Verify that the EHT Enable switch is on.
3. If the projector is displaying a picture, the EHT is just low. Access the EHT supply and, with the tweeker, adjust the voltage up slightly. (In the system status menu, you can read the approximate voltage. Each time you press the DO button, the value is updated.) Refer to Section 6.5.2 for the EHT/high voltage power supply adjustment procedure.

7.9.7 Diagnostic Video Processor Card (239540) Failure and Warning Descriptions

7.9.7.1 !!! FAILURE !!! +15 V Failure on the Video Processor

Cause: The video processor has lost a voltage. This could be a failure on the power supply card, a blown fuse, or failure on the video processor card.

Procedure:

1. Check the power supply card for failures and correct any problems found.
2. Replace the video processor. Perform the beam current calibration in Section 6.3.3.
3. Replace the power supply card.

7.9.7.2 !!! FAILURE !!! –15 V Failure on the Video Processor

See Section 7.9.7.1.

7.9.7.3 !!! FAILURE !!! +5 VA Failure on the Video Processor

See Section 7.9.7.1.

7.9.7.4 !!! FAILURE !!! –5 VA Failure on the Video Processor

See Section 7.9.7.1.

7.9.7.5 !!! FAILURE !!! BLIP Card Power Supply Failure

Cause: The video processor has lost a voltage. This could be a failure on the BLIP card, a failure on the power supply card, a blown fuse, or failure on the video processor card.

Procedure:

1. Check the power supply card for failures and correct any problems found.
2. Replace the BLIP card (the BLIP card has LEDs that should indicate which power supply is missing).
3. Replace the power supply card.
4. Replace the video processor card. Perform the beam calibration procedure in Section 6.3.3.

7.9.7.6 !!! FAILURE !!! Red Video Driver Output Failure

Cause: The video driver appears to have failed.

Procedure:

1. Check the power supply card for failures and correct any problems found.
2. Replace the video driver.
3. Replace video processor. Perform the beam calibration procedure in Section 6.3.3.

7.9.7.7 !!! FAILURE !!! Green Video Driver Output Failure

See Section 7.9.7.6.

7.9.7.8 !!! FAILURE !!! Blue Video Driver Output Failure

See Section 7.9.7.6.

7.9.7.9 !!! WARNING !!! Video Driver Temp is High

Cause: This is serious. This indicates a problem with cooling that must be fixed as soon as possible.

Procedure:

1. Verify that the fan for the +5 V power supply and the CRTs is working.
2. Inspect the tubing that pipes the air to the CRTs. Make sure all CRTs are attached.
3. Unplug the CRTs from the tube assemblies one at a time and verify that air is being forced out.
4. Replace video driver. Perform the beam calibration procedure in Section 6.3.3.
5. Replace video processor. Perform the beam calibration procedure in Section 6.3.3.

7.9.7.10 !!! WARNING !!! Missing AGC Signal from the IG

Cause: The AGC line from the IG was not detected and the internal reference is being used**.**

Procedure:

1. If the picture looks normal, then the IG is not working properly. Reboot the IG.
2. Replace the video processor. Perform the beam calibration procedure in Section 6.3.3.
3. Replace processor card.

7.9.7.11 !!!WARNING !!! AGC Clamp Missing

Cause: The AGC from the processor is not detected.

Procedure:

1. Check other warnings and failures first.
2. Replace the processor card.
3. Replace video processor card. Perform the beam calibration procedure in Section 6.3.3.

7.9.7.12 !!! WARNING !!! H-Clamp Missing

Cause: The H-clamp from the processor if not detected**.**

Procedure:

1. Check other warnings and failures.
2. Replace the processor card.
3. Replace video processor card. Perform the beam calibration procedure in Section 6.3.3.

7.9.7.13 !!! WARNING !!! Red Video is in Limit

Cause: The video processor card has detected that too much power is being sent to the tube faceplate (43 watts) and it is trying to dim part of the picture to keep the tube from breaking. Under normal operating conditions, the CRTs are well below the limit. The picture is probably too bright.

Procedure:

1. Check other warnings and failures first.
2. Adjust video gain down.
3. Adjust G2 down.
4. Replace video processor card. Perform the beam calibration procedure in Section 6.3.3.
5. Replace video driver. Perform the beam calibration procedure in Section 6.3.3.

7.9.7.14 !!! WARNING !!! Green Video is in Limit

See Section 7.9.7.13.

7.9.7.15 !!! WARNING !!! Blue Video is in Limit

See Section 7.9.7.13.

7.9.7.16 !!! WARNING !!! Red Input Missing

Verify that the connections for the color are properly connected.

7.9.7.17 !!! WARNING !!! Green Input Missing

Verify that the connections for the color are properly connected.

7.9.7.18 !!! WARNING !!! Blue Input Missing

Verify that the connections for the color are properly connected.

7.9.8 Diagnostic Power Supply Card (239590) Failure and Warning Descriptions

7.9.8.1 !!! FAILURE !!! +9 V Failure on the Power Supply Card

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.8.2 !!! FAILURE !!! –9 V Failure on the Power Supply Card

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.8.3 !!! FAILURE !!! +17 V Failure on the Power Supply Card

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.8.4 !!! FAILURE !!! –17 V Failure on the Power Supply Card

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.8.5 !!! FAILURE !!! +100 V Failure on the Power Supply Card

NOTE: This 100 V failure should read 95V.

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.8.6 !!! FAILURE !!! –100 V Failure on the Power Supply Card

NOTE: This 100 V failure should read 95V.

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.8.7 !!! FAILURE !!! +37 Failure on the Power Supply Card

Cause: The failure of a voltage on the power supply card.

Procedure:

1. Replace the power supply card.
2. Replace the processor card.

7.9.9 Hand-Held Remote Message Descriptions

7.9.9.1 ER0 Interrupted Communications

Cause: The hand-held remote is not communicating with the DCPC. This could be a bad cable or the software on the DCPC is not running.

Procedure:

1. Verify that the DCPC DCI_comm software is running. If not, start it.
2. Replace cable between DCPC and HHR.
3. Replace HHR.
4. Replace ULTRA-485 card in the DCPC.

7.9.10 DCPC WinFrame Software

Never reload the WinFrame software from scratch. This causes the 5-user license that came with the system to be lost. Try using the emergency disk to recover the system. If that does not work, refer to the WinFrame manuals that came with the system. As a last resort, reinstall the Citrix WinFrame for windows. You may have to call Citrix to have the installation disk reset.

7.9.11 Visual Anomalies

The following sections contain troubleshooting steps used to resolve anomalies in the MCP2000 creen image.

7.9.11.1 Missing Color

Symptom: One of the projector colors will not come on.

Procedure:

1. Verify that the video and threshold controls are set at a visible level for that color.

NOTE: Loss of one color is probably due to a failure of the video signal or the threshold voltage for that color.

2. If another MCP2000 is available, swap the IG signal cable to the known good MCP2000 to see if the projector or IG signals are faulty.

WARNING: Turn off the MCP2000 power before handling the connectors mentioned in the next step, and use extreme caution. These connectors carry voltages capable of causing death or serious injury.

3. Verify that the connections to the 239670-video driver and high-voltage power supply in the projector head unit are correct and secure. Correct any problems and try the MCP2000 to see whether the problem remains.
4. Replace the video driver and try the MCP2000 to see whether the problem remains.
5. Replace the video processor and try the MCP2000 to see whether the problem remains.

NOTE: If a video driver or video processor is replaced, the beam calibration procedure in Section 6.3.3 should be performed.

7.9.11.2 Inoperable Defocus

Symptom: MCP2000 does not defocus for rain scenes, fog scenes, or defocus test patterns.

Procedure:

1. Activate the Static Focus menu from the HHR and select the **DEFOCUS** dials. Adjust the IG **DEFOCUS** dial to a high number.
2. Check the focus signal from the IG while displaying the focus test pattern to see if the signal is active. The signal is at maximum defocus at +5 V (unterminated). If the signal is not correct, refer to the appropriate image generator operation and maintenance manual.
3. Replace the ramp card.
4. Replace the deflection amplifier assembly of the color affected.

7.9.11.3 Inoperable Focus

Symptom: Image does not come into focus.

Procedure:

1. Make sure that the system is not in safe-system state (press **F4** on the remote).
2. If the problem does not go away when the IG is paused, turn down the IG **DEFOCUS**.
3. Replace the BLIP card.
4. Replace the ramp card.
5. Replace the deflection amplifier.

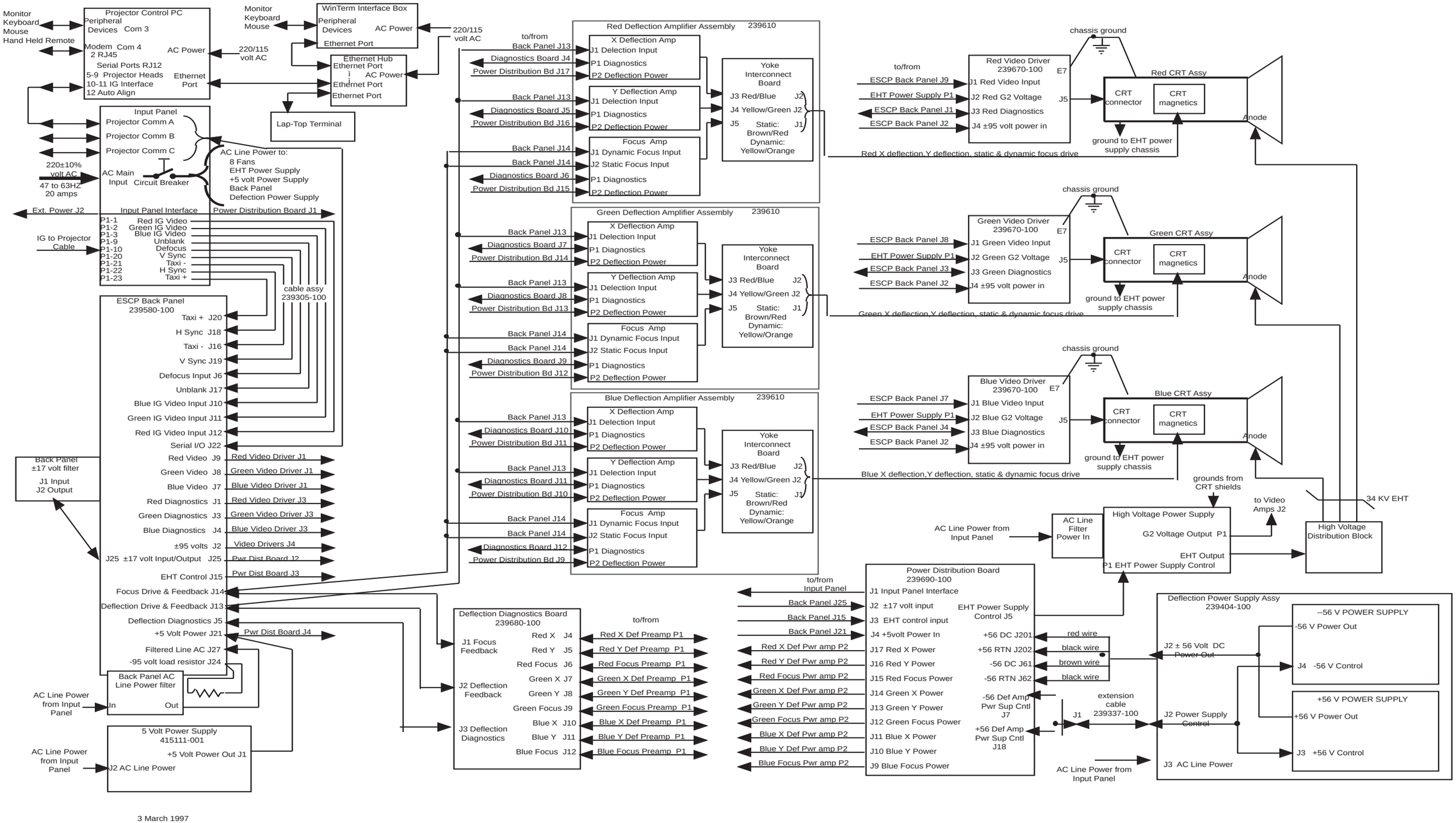
7.9.11.4 Color Completely Out of Convergence

Symptom: One or more colors that were once converged now are completely misconverged and do not adjust.

Procedure:

NOTE: Convergence signals are generated on the BLIP, then sent to the ramp card, the convergence amplifier, and yoke. Convergence failures could be in the BLIP, ramp, or deflection amplifier.

1. Cycle power on the projector (sometimes the DACs in the BLIP card have been known to latch up).
2. Replace the BLIP card.
3. Replace the ramp card.
4. Replace the deflection amplifier.



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Figure 7-2. MCP2000 Projector System Interconnection Diagram

Video Driver Diagnostics
239342

ESCP Back Panel J1	-020	Red Video Driver J3
ESCP Back Panel J3	-030	Green Video Driver J3
ESCP Back Panel J4	-034	Blue Video Driver J3

Pin Number		Pin Number
1.	ILL VID-	1.
2.	ILL VID+	2.
3.	SER DBDAT-	3.
4.	FAIL VID +	4.
5.	SER DB DAT+	5.
6.	FAIL VID -	6.
7.	SER CMD1+	7.
8.	SER CMD1-	8.
9.	SER MPDAT-	9.
10.	SER MPDAT+	10.
11.	SER CLK-	11.
12.	SER CLK+	12.
13.	SER CMD2-	13.
14.	SER CMD2+	14.
15.	ADDR 1	15.
16.	ADDR 2	16.
17.	BLANK+	17.
18.	BLANK-	18.
19.	PHOSPROT-	19.
20.	PHOSPROT+	20.
21.	CRT TEMP	21.
22.	GND	22.
23.	INTENS+	23.
24.	GND	24.
25.	BLEVEL+	25.
26.	BLEVEL-	26.
27.	BEAM+	27.
28.	GND	28.
29.	+17V	29.
30.	+5V	30.
31.	GROUND	31.
32.	GND	32.
33.	-17V	33.
34.	~HCLAMP-	34.
35.	~STANDBY	35.
36.	~HCLAMP+	36.
37.		37.
38.	+5V	38.
39.		39.
40.		40.

Serial I/O
239380-100

ESCP Back Panel J22 — Input Panel: Comm A, Comm B, Comm C

Pin Number		Pin Number
1.	Ground	1.
2.	232 RX	2.
3.	232 TX	3.
4.	Ground	4.
5.	EXTERN IN0	5.
6.	EXTERN IN1	6.
7.	Ground	7.
8.	EXTERN SP0	8.
9.	232/422RX1-	9.
10.	232/422TX1-	10.
11.	Ground	11.
12.	232/422RX2-	12.
13.	232/422TX2-	13.
14.	~EXTERN POWERUP	14.
15.	EXTERN SP1	15.
16.	EXTERN SP2	16.
17.	EXTERN SP 3	17.
18.	232 RX3	18.
19.	232 TX3	19.
20.	Ground	20.
21.	422RX1+	21.
22.	422TX1+	22.
23.	Ground	23.
24.	422RX2+	24.
25.	422TX2+	25.

Backpanel EHT Control
239390-100

ESCP Back Panel J15 — Power Dist Board J3

Pin Number		Pin Number
1.	HV On 1.	
2.	Ground	2.
3.	Red G2 Ret	3.
4.	Red G2	4.
5.	Green G2 Ret	5.
6.	Green G2	6.
7.	Blue G2 Ret	7.
8.	Blue G2	8.
9.	Blue G2 Ret	9.
10.	HV Disable	10.
11.	+34 KV Monitor	11.
12.	Gnd 12.	
13.	HV Current +	13.
14.	HV Current -	14.

EHT Power Supply Control
239392-100

Power Dist Board J5 — High Voltage Pwr Supply P1

Pin Number		Pin Number
1.	HV On	1.
2.	ground	2.
3.	Red G2	3.
4.	Red G2 Ret	4.
5.		5.
6.	Green G2	6.
7.	Green G2 Ret	7.
8.	-17v	8.
9.	Blue G2	9.
10.	Blue G2 Ret	10.
11.	+17	11.
12.	+34kv Monitor	12.
13.	Gnd	13.
14.	HV Current +	14.
15	HV Current -	15.

Input Panel Interface
239308-100

Power Dist Board J1 — Input Panel

Pin Number		Pin Number
1.	+17v ext	P2-1
2.	Gnd P2-3	
3.	-17v ext	P2-5
4.	+5v ext	P2-7
5.	+5v ext	P2-8, S1-L+
6.	Ground	P2-12, S1 COM 2
7.	EHT Switch	S1 NO1
8.	Ground	S1 COM 1
9.	ETI- ETI-	
10.	+17v ext	P2-2
11.	Ground	P2-4
12.	-17v ext	P2-6
13.	+5v ext	P2-15
14.	Ground	P2-13
15	Ground	P2-14
16.	EHT Switch	S1 NC 1
17.	+17v ETI+	
18.	Earth Gnd	PHOENIX BLACK

± 17 volt Power
239348-100

ESCP Back Panel J25		±17 volt filter input J1		ESCP Back Panel J25		±17 volt filter output J3	
Pin Number		Pin Number		Pin Number		Pin Number	
1.	+17v UF	1.		11.	+17v	14.	
2.	+17v UF	2.		12.	+17v	15.	
3.	+17v UF	3.		13.	+17v	16.	
4.	Gnd	5.		14.	Gnd	3.	
5.	Gnd	6.		15.	Gnd	6.	
6.	Gnd	7.		16.	Gnd	7.	
7.	Gnd	8.		17.	Gnd	8.	
8.	-17v UF	10.		18.	-17v	9.	
9.	-17v UF	11.		19.	-17v	10.	
10.	-17v UF	12.		20.	-17v	11.	

±17 volt filter output J3		Power Dist Board J2
Pin Number		Pin Number
4.	Gnd	1.
12.	-17v	2.
5.	Gnd	3.
13.	+17v	4.

Deflection Diagnostics
239385-100

ESCP Back Panel J5 — Deflection Diagnostics Board J3

Pin Number		Pin Number
1.	Fail Red Defl+	1.
2.	III Red Defl+	2.
3.	Fail Green Defl+	3.
4.	III Green Defl+	4.
5.	Fail Blue Defl+	5.
6.	III Blue XDefl+	6.
7.	Fail Defl Pwr Sup+	7.
8.	III Defl Pwr Sup+	8.
9.	SER BDDATG+	9.
10.	SERCLK+	10.
11.	SER MPDAT+	11.
12.	SER CMD1+	12.
13.	SER CMD2+	13.
14.	SER BDDATR+	14.
15.	SER BDDATB+	15.
16.		16.
17.		17.
18.		18.
19.		19
20.	Fail Red Defl-	20.
21.	III Red Defl-	21.
22.	Fail Green Defl-	22.
23.	III Green Defl-	23.
24.	Fail Blue Defl-	24.
25.	III Blue Defl-	25.
26.	Fail Defl Pwr Sup-	26
27.	III Defl Pwr Sup-	27.
28.	SER BDDATG-	28.
29.	SERCLK-	29.
30.	SER MPDAT-	30.
31.	SER CMD1-	31.
32.	SER CMD2-	32.
33.	SER BDDATR-	33.
34.	SER BDDATB-	34.

± 95 volt Power
239335-100

ESCP Back Panel J2 — Red Video Driver J4, Green Video Driver J4, Blue Video Driver J4

Pin Number		Pin Number
1.	+95v	Green-1
2.	+95v	Red-1
3.	Gnd	Green-2
4.	Gnd	Green-3
5.	Gnd	Red-2
6.	Gnd	Red-3
7.	-95v	Red-4
8.	-95v	Green-4
9.	+95v	nc
10.	+95v	Blue-1
11.	Gnd	Blue-2
12.	Gnd	Blue-3
13.	Gnd	nc
14.	Gnd	nc
15.	-95v	Blue-4
16.	-95v	nc

±56v Def Amp Pwr Sply Control
239357-100

56v Def Amp Pwr Supply J1 — Power Dist Board

Pin Number		Pin Number
1.	~AC Fail +56	J18-1
2.	Pwr Sply Enb+	J18-2
3.	I Monitor V1+	J18-4
4.	Margin V1+	J18-11
15	~AC Fail -56	J7-8
16.	Pwr Sply Enb-	J7-7
17.	I Monitor V1-	J7-5
18.	Margin V1-	J7-13
19.		
20.	Ground UP	J18-9
21.	Ground UP	J18-10
22.	Margin Ref V1+	J18-3
23.		
24.	Logic Com V1+	J18-12
33.	Ground UP	J7-15
34.	Ground UP	J7-14
35	Margin Ref V1-	J7-6
36.		
37.	Logic Com V1-	J7-12

X Deflection Amp Diagnostics
239375

Deflection Diagnostics Board J4	-067	Red X Deflection Preamp P1
Deflection Diagnostics Board J7	-077	Green X Deflection Preamp P1
Deflection Diagnostics Board J10	-081	Blue X Deflection Preamp P1

Pin Number		Pin Number
1.	V Sync-	1.
2.	Defl FdBk X-	2.
3.	VSync +	3.
4.		4.
5.	FdBk Pulse	5.
6.	~ R +	6.
7.	H Drive X+	7.
8.	~ R -	8.
9.	H Drive X-	9.
10.	Pwr Lmt X	10.
11.	Lost Suply X	11.
12.	Amp Fail X	12.
13.	Over Temp X	13.
14.	Defl FdBk X+	14.

Y Deflection Amp Diagnostics
239375

Deflection Diagnostics Board J5	071	Red Y Deflection Preamp P1
Deflection Diagnostics Board J8	-078	Green Y Deflection Preamp P1
Deflection Diagnostics Board J11	-082	Blue Y Deflection Preamp P1

Pin Number		Pin Number
1.	V-	1.
2.	Defl FdBk Y-	2.
3.	V+	3.
4.		4.
5.		5.
6.	L+	6.
7.	H+	7.
8.	L-	8.
9.	H-	9.
10.	Pwr Lmt Y	10.
11.	Lost Suply Y	11.
12.	Amp Fail Y	12.
13.	Over Temp Y	13.
14.	Defl FdBk Y+	14.

+5 volt Power Input

239342-100 +5v Power Supply — 239340-100 ESCP Back Panel J21 — Power Dist Board J4

Pin Number	Pin Number		Pin Number
1.	1.	+5v	1.
2.	2.	+5v	2.
3.	3.	Ground	3.
4.	4.	Ground	4.

±56v Def Amp Pwr Sply Control
(internal to power supply assy)
239352-100

56v Pwr Supply assy J2 — ±56 Power Supplies

Pin Number		Pin Number
1.	~AC Fail +56	J3-6
2.	Pwr Sply Enb+	J3-8
3.	I Monitor V1+	J3-10
4.	Margin V1+	J3-12
15	~AC Fail -56	J4-6
16.	Pwr Sply Enb-	J4-8
17.	I Monitor V1-	J4-10
18.	Margin V1-	J4-12
19.		
20.	Ground UP	J3-7
21.	Ground UP	J3-9
22.	Margin Ref V1+	J3-11
23.		
24.	Logic Com V1+	J3-20
33.	Ground UP	J4-7
34.	Ground UP	J4-9
35	Margin Ref V1-	J4-11
36.		
37.	Logic Com V1-	J4-20
nc	-56V Sense -	J4-15 E1
nc	-56V Sense +	J4-16 E2
nc	+56V Sense -	J3-15 E3
nc	+56V Sense +	J3-16 E4

Deflection Drive & Feedback
239322-100

ESCP Back Panel J13 — Deflection Diagnostics Board J2

Pin Number		Pin Number
1.	Ground UP	1.
2.	PS ENABLE	2.
3.	~AC FAIL	3.
4.	DEF FDBK RX+	4.
5.	DEF FDBK RX-	5.
6.	DEF FDBK RY+	6.
7.	DEF FDBK RY-	7.
8.	DEF FDBK GX+	8.
9.	DEF FDBK GX-	9.
10.	DEF FDBK GY+	10.
11.	DEF FDBK GY-	11.
12.	DEF FDBK BX+	12.
13.	DEF FDBK BX-	13.
14.	DEF FDBK BY+	14.
15.	DEF FDBK BY-	15.
16.	HDRIVE X-	16.
17.	HDRIVE X+	17.
18.		18.
19.		
20.		
21.	REDX OUT-	Red X Defl J1
22.	REDX OUT+	Red X Defl J1
23.	REDX OUT-	Red X Defl J1
24.	GRNX OUT+	Green X Defl J1
25.	GRNX OUT-	Green X Defl J1
26.	GRNX OUT-	Green X Defl J1
27.	BLUX OUT-	Blue X Defl J1
28.	BLUX OUT+	Blue X Defl J1
29.	BLUX OUT-	Blue X Defl J1
30.	REDY OUT-	Red Y Defl J1
31.	REDY OUT+	Red Y Defl J1
32.	REDY OUT-	Red Y Defl J1
33.	GRNY OUT-	Green Y Defl J1
34.	GRNY OUT+	Green Y Defl J1
35.	GRNY OUT-	Green Y Defl J1
36.	BLUY OUT-	Blue Y Defl J1
37.	BLUY OUT+	Blue Y Defl J1
38.	BLUY OUT-	Blue Y Defl J1

Deflection Amp Power
2393325

Power Dist Board J17	-063	Red X Deflection Amp P2
Power Dist Board J16	-073	Red Y Deflection Amp P2
Power Dist Board J14	-077	Green X Deflection Amp P2
Power Dist Board J13	-067	Green Y Deflection Amp P2
Power Dist Board J11	-078	Blue X Deflection Amp P2
Power Dist Board J10	-074	Blue Y Deflection Amp P2

Pin Number		Pin Number
1.	-56v	1.
2.	-56v	2.
3.	+56v	3.
4.	+56v	4.
5.	+56v	5.
6.	+5v	6.
7.	+5v	7.
8.	+5v	8.
9.	-56v	9.
10.	High Crnt Gnd	10.
11.	High Crnt Gnd	11.
12.	+17v	12.
13.	-17v	13.
14.	High Crnt Gnd	14.
15	High Crnt Gnd	15.
16	High Crnt Gnd	16.

Focus Drive & Feedback
239312-100

ESCP Back Panel J14 — Deflection Diagnostics Board J1

Pin Number		Pin Number
1.	Ground	1.
2.	VSYNC+	2.
3.	VSYNC-	3.
4.	L~R+	4.
5.	L~R-	5.
6.	FOCUS FDBKR+	6.
7.	FOCUS FDBKR-	7.
8.	FOCUS FDBKG+	8.
9.	FOCUS FDBKG-	9.
10.	FOCUS FDBKB+ 10.	
11.	12. HRET RX+	12.
13.	HRET RX-	13.
14.	HRET GX+	14.
15.	HRET GX-	15.
16.	HRET BX+	16.
17.	HRET BX-	17.
18.	RED SFOCUS RET	Red Focus Amp J2
19.	RED SFOCUS	Red Focus Amp J2
20.	RED SFOCUS RET	Red Focus Amp J2
21.	GREEN SFOCUS RET	Green Focus Amp J2
22.	GREEN SFOCUS	Green Focus Amp J2
23.	GREEN SFOCUS RET	Green Focus Amp J2
24.	BLUE SFOCUS RET	Blue Focus Amp J2
25.	BLUE SFOCUS	Blue Focus Amp J2
26.	BLUE SFOCUS RET	Blue Focus Amp J2
27.		
28.		
29.		
30.	DYNFOC DRVB-	Blue Focus Amp J1
31.	DYNFOC DRVB+	Blue Focus Amp J1
32.	DYNFOC DRVB-	Blue Focus Amp J1
33.	DYNFOC DRVG-	Green Focus Amp J1
34.	DYNFOC DRVG+	Green Focus Amp J1
35	DYNFOC DRVG-	Green Focus Amp J1
36.	DYNFOC DRVR-	Red Focus Amp J1
37.	DYNFOC DRVR+	Red Focus Amp J1
38.	DYNFOC DRVR-	Red Focus Amp J1

Focus Amp Drive
239372

Deflection Diagnostics Board J6	-069	Red Focus Preamp P1
Deflection Diagnostics Board J9	-054	Green Focus Preamp P1
Deflection Diagnostics Board J12	-061	Blue Focus Preamp P1

Pin Number		Pin Number
1.	Pwr Limit Focus	1.
2.	Lost Sply Focus	2.
3.	Amp Fail Focus	3.
4.	Over Temp Focus	4.
5.	Focus FdBk+	5.
6.	Focus FdBk-	6.
7.		7.
8.		8.
9.		9.
10.		10.

Focus Amp Power
239315

Power Dist Board J15	-068	Red Focus Amp P2
Power Dist Board J12	-049	Green Focus Amp P2
Power Dist Board J9	-057	BlueFocus Amp P2

Pin Number		Pin Number
1.	+56v	1.
2.	+56v	2.
3.	-56v	3.
4.	-56v	4.
5.	+17v	5.
6.	-17v	6.
7.	High Crnt Gnd	7.
8.	High Crnt Gnd	8.

Figure 7-3. MCP2000 Projector System Cable Wiring Diagram

Appendix A
DCPC Hardware Configuration

A.1 Introduction

All the cards in the DCPC are commercially available and include the following:

- Video card—PCI
- Ethernet card—PCI
- Frame grabber card—PCI
- RS-485 card—ISA
- Octal RS-232—ISA
- Modem—ISA
- Data acquisition and control (AD/DA) card—PCI

A.2 Video Card

The video card configured for each system is a Matrox Millennium G200ABP or better. Any video card will work as long as Windows NT supports it.

A.3 Ethernet Card

The Ethernet card shipped with each system is either a 3Com 3C590-COMBO card or a 3Com 3C905BTX card. In the future, other cards may be used. Open *Networks* on the *Control Panel* and set up the Ethernet card using the TCP/IP protocol. Use the following to configure the TCP/IP:

1. Do not enable the automatic DHCP.
2. Use the IP address 130.187.101.1.

3. Use subnet mask 255.255.255.0.
4. Use the default gateway 130.187.250.0.

If you connect the MCP2000 network to the company network, contact your network administrator for the appropriate numbers to use.

A.4 Frame Grabber

The frame grabber card is a Matrox Meteor II. This card is used for auto alignment.

A.5 RS-485 Card

The RS-485 card is anUltra-485 card (Figure A-1 and Figure A-2) from Industrial Computer Source and is used to communicate with the HHR. The Ultra-485 has been modified by VDCDS to allow the HHR to receive power through the RJ-45 cable. If this card should ever be replaced, the modifications need to be made to the new card. The modifications are as follows:

1. Lift leg 6 of U9.
2. Add a wire from R14 pin 1 to the DB25 connector, pins 10 and 11.
3. Add a wire between the DB25 connectors, pins 7, 8, 9, and 23.

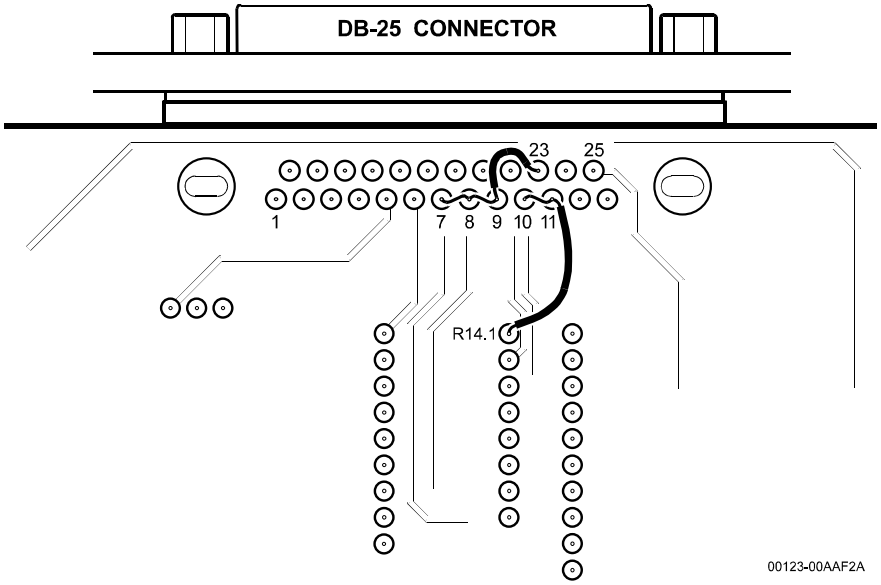


Figure A-1. RS-485 (Ultra-485) Card (Rear)

4. Set the following jumpers and switches as follows:
   - Jumper E1 — 11
   - Jumper E2 — SM
   - Jumper E3 and E5 — auto

- All switches on SW2 — on
- SW1 positions 1 and 2 — on
- SW1 positions 3 and 4 — off
- Jumper E4 block — SIO-485

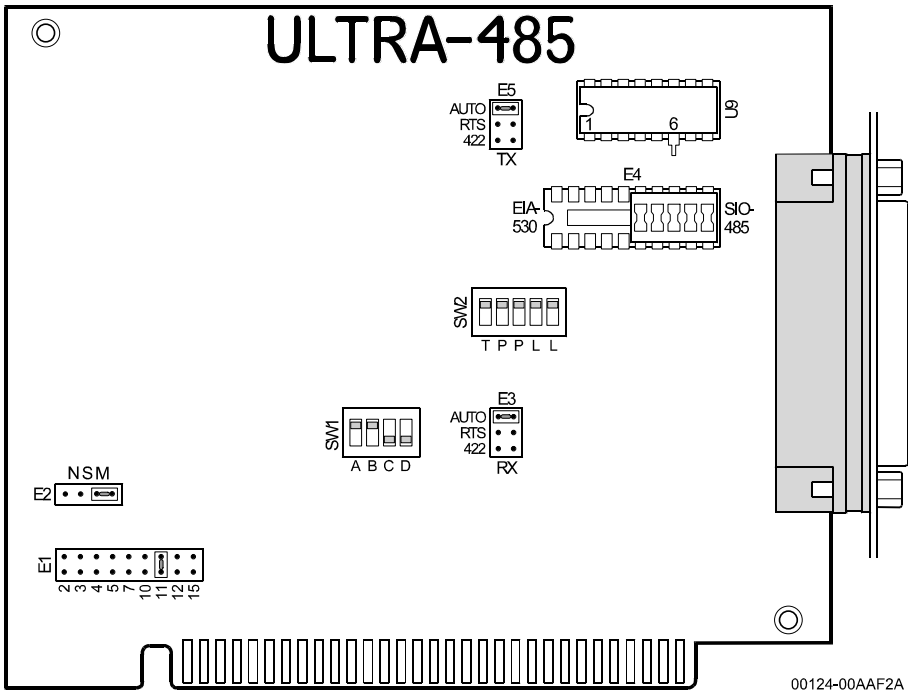


Figure A-2. RS-485 (Ultra-485) Card (Front)

5. Open **`Ports`** on the Control Panel and set the address for COM3 as 3e8 and the IRQ as 11.

A.6 Octal Serial Card

The octal serial card is the Rocket Port 8J from Comtrol. This card has its own driver that needs to be installed.

1. Use the ***`180-1c3 Hex Default`*** for the *input/output* (I/O) address and COM5 as the starting Com port.
2. The IRQ should be set to ***`None`*** and the scan rate to ***`10(Default)`***.

A.7 Modem

The DCPC has a 3Com 28.8-K or 3Com 56-K modem. The modem should be configured as follows:

1. Set the modem as COM4 with 5 as the IRQ. The jumpers should be set for IRQ5 and COM SEL.

2. In the CMOS setup, set the IRQ5 and IRQ11 as ***Legacy ISA***, all others should be set to ***PCP/ISA PNP***. Set the Halt On: field to ***No Errors***.
3. To make the boot up faster, open **System** on the Control Panel and change the Show list *for_seconds* to ***3***.
4. Open **Desktop** on the Control Panel and set the screen save to **none** or **blank screen**.

A.8 Data Acquisition and Control Card (AD/DA)

This card is used for auto-alignment and is a COMPUTER BOARDS CIO-DAS1602/16.

Appendix B
Connecting a VT Terminal to the Projector

B.1 Introduction

Each projector can be accessed individually by connecting a VT terminal, or terminal emulator, to the projector head. This can enable the system to be used for training in the event of a major failure on the DCPC.

B.2 Cable Requirement

The VT terminal connects directly into the projector input panel. The cable needed to connect the VT terminal to the projector is wired as follows:

Projector Comm 1 (DB25 Male)	VT100 (DB25 Female)
Pin 11	Pin 7
Pin 12	Pin 2
Pin 13	Pin 3

B.3 Terminal Setup

In order for the terminal to interact properly with the projector, the following parameters have to be set up in the terminal.

Transmit = 19,600 baud
Receive = transmit
XOFF at 64
Eight bits, no parity
One stop bit
Jump scroll
VT100 mode

B.4 Operation

1. Connect the terminal to the projector.
2. Power on the projector.
3. When the projector has booted up, type ? to get a menu of commands.
4. Enable the ±56 V power supply and the high-voltage power supply.
5. Take the projector out of safe-system mode.

The terminal can now be disconnected and moved to the next projector to enable the system to be used for training.

Appendix C
Optional Laptop or On-Board PC

C.1 Connecting a Laptop or On-Board PC

Sometimes it is desirable to connect a laptop PC to the system for use in the cockpit. This appendix provides the procedures for configuring a laptop or on-board PC.

NOTE: Because these are optional procedures, VDCDS is not responsible for providing the hardware configured in the following procedures.

The laptop must have an IP address specified. This is accomplished as follows:

1. Right-click on the **`Network Neighborhood`** icon.
2. Select Properties → Protocols → Properties.
3. Select Specify an IP address.
4. Enter:

   `IP address` *`130.187.101.5`*

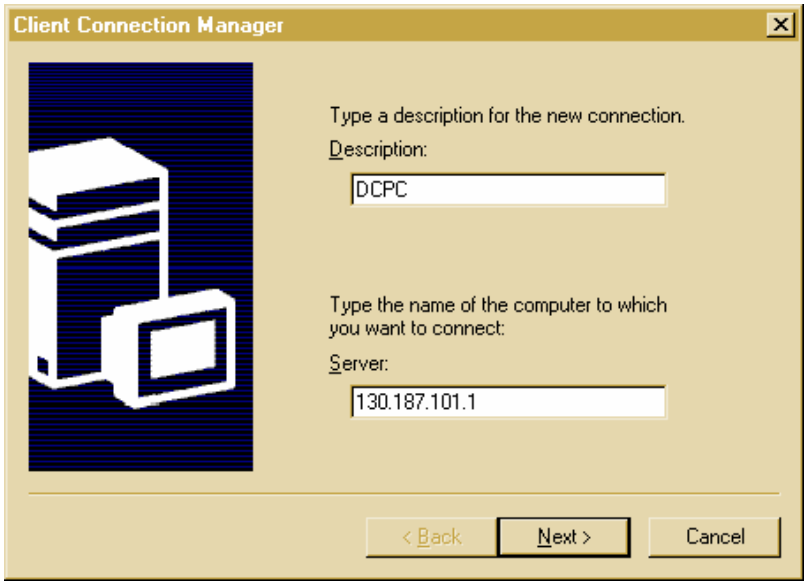
   `Subnet mask` *`255.255.0.0`*

   `Default gateway` *`130.187.101.250`*

5. Choose one the following procedures to connect a laptop PC to the system based on whether the system has a WinTerminal PC or a WinTerm 2300T.

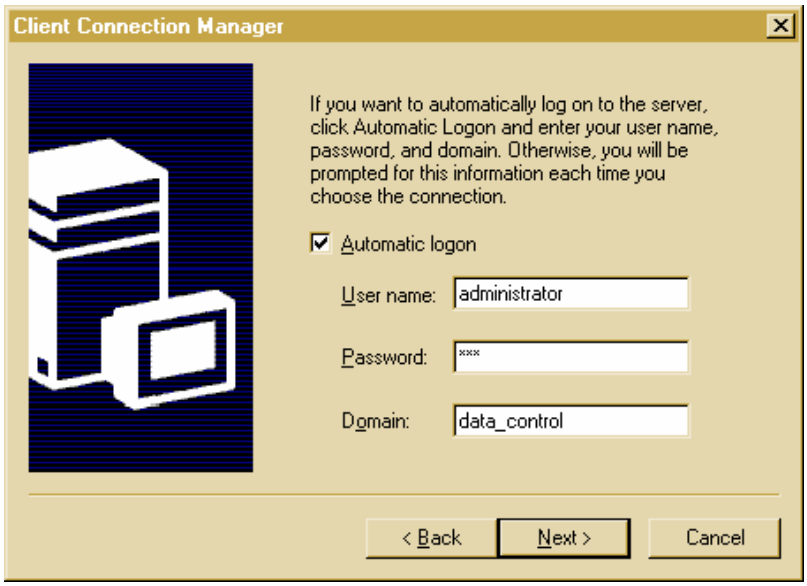
C.1.1 Connecting a Laptop Using Windows NT 4 Terminal Server Client (WinTerminal PC)

1. Insert the Windows NT 4 Terminal Server Client CD into the drive. The NT setup dialog box should come up automatically.
2. Select **`Win32 Client Setup`**. The software installs on the laptop.
3. After the software is installed, select
   Start → *Programs* → *Terminal Server Client*
   and start the **`Client Connection Manager`**. The following window displays.

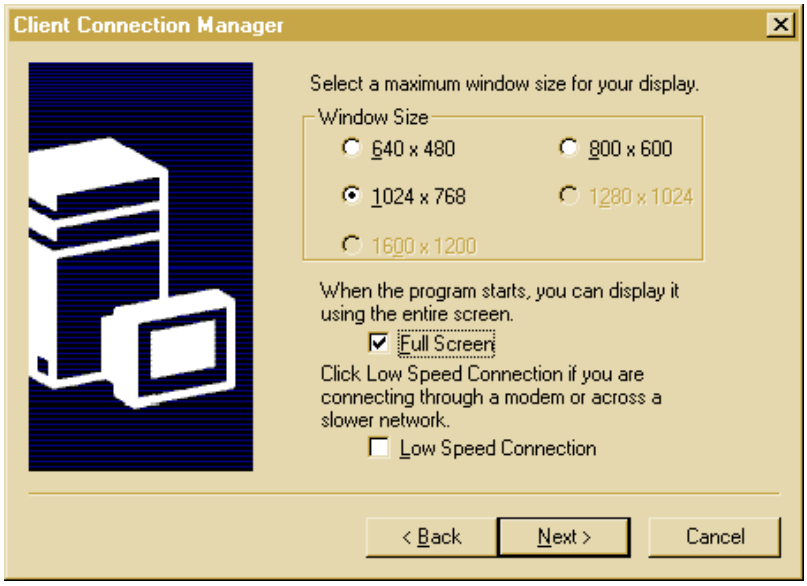


NOTE: The default server address is the address of the DCPC. It is confirmed by checking the properties on the *Network Neighborhood* icon as described in the previous section.

4. Fill in the required information and select the **Next>** button. The following window displays.



5. Select **Automatic logon** and fill in the required fields. The password is *e&s*. Select the **Next>** button. The following window displays.



6. Select the resolution and then select **Full Screen**. Select the **Next>** button. Do not make any changes to the last two windows.
7. Select the **Finish** button.
8. The DCPC connection should be visible in the Client Connection Manager window. Double-click on the icon to connect to the DCPC.

NOTE: The DCI_Comm application will not run on multiple PCs simultaneously. Make sure the application is closed at the main terminal before opening the DCPC connection on the laptop.

C.1.2 Connecting a Laptop Using WinFrame (WinTerm 2300T)

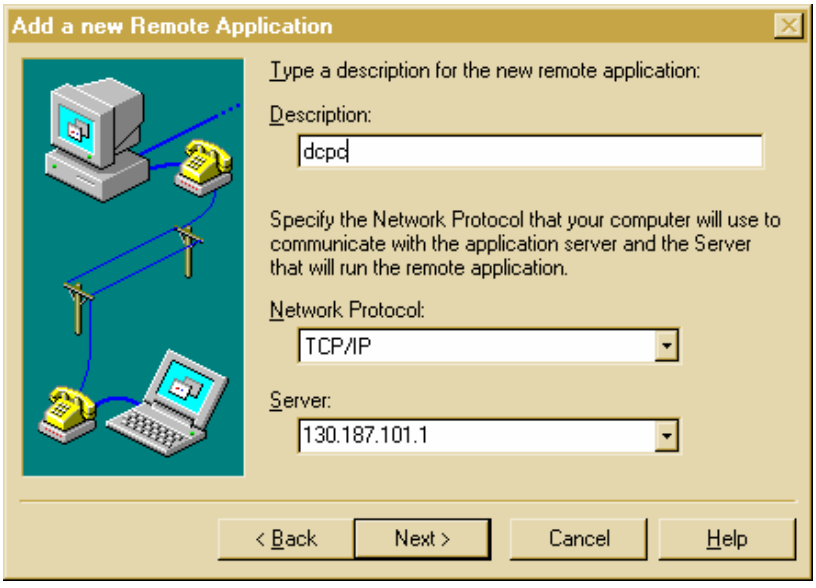
1. Insert the WinFrame CD into the drive. Select *Start* → *Run*.
2. Type

   `d:\wfclient\terminal\win32\setup.exe` in the Open field. The WinFrame client setup screen displays.
3. Select the **`Next>`** button until the Registration screen displays.
4. Fill in the registration information as follows:

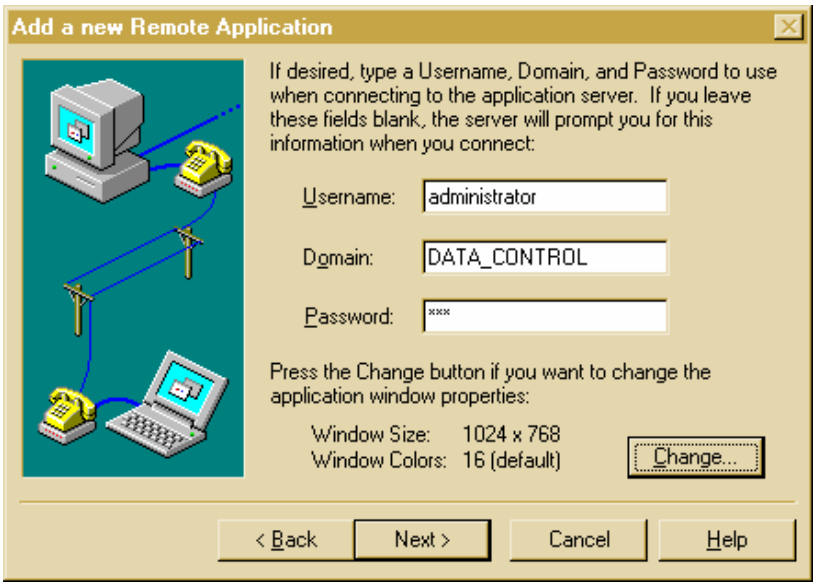
   Name `e&s`

   Company `e&s`

   Serial Number CCPO-116-3C2E-001096
5. After the software is installed, select *Start* → *Programs* → *WinFrame Client* and start the Remote Application Manager.
6. Select **`New`** from the Entry pulldown menu.
7. Select **`Network Connection`** in the dialog box that displays. The following window displays.



8. Fill in the required information. Select the **Next>** button. The following window displays.



9. Select **Automatic logon** and fill in the required fields. The password is *e&s*.
10. Select desired resolution and then select the **Next>** button. Do not make any changes to the last two windows.
11. Select the **Finish** button.
12. The Data Control connection should be visible in the Client Connection Manager window. Double-click on the icon to connect to the DCPC.

NOTE: The DCI_Comm application will not run on multiple PCs simultaneously. Make sure the application is closed at the main terminal before opening the DCPC connection on the laptop.

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