

## Service Manual

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# Introduction

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## 1.1 Using This Manual

This manual provides technical information to assist qualified Electrohome service technicians in servicing and repair of *ECP 4500* series projectors. Organization of the manual permits easy access to service related information for the system and its serviceable modules.

**WARNING: BEFORE PERFORMING ANY SERVICING, READ SECTION 3, SERVICE GUIDELINES IN ITS ENTIRETY.**

### Conventions ►

Please note the following typographical conventions used in this manual.

- ▣ Warnings that relate to user safety are highlighted in **bold print**.
- ▣ First and second level subsection titles are located in the left margin of each page. Third level titles are located within the body text and are in ***bold italic*** print.
- ▣ The pointing hand symbol  emphasizes important information.
- ▣ Special notes and comments appear in *italics*.
- ▣ Important terms within a paragraph appear in *italics*.
- ▣  is intended to alert the user to the presence of important operating and maintenance (servicing) instructions. All components on schematics and parts lists identified with this symbol are critical safety.
- ▣  is intended to alert the user to the presence of uninsulated "dangerous voltage" within the projector's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.
- ▣ Each schematic and parts list is identified with the module number for which the data applies. Part numbers for service replacement modules are provided in section 5, *Parts & Disassembly*.

### Updates ►

Call Electrohome for available updates.

*Note: When referring to the module parts lists or schematics, always make sure that the information applies to the module for which you are servicing. Module part numbers are clearly identified on parts lists and schematic pages.*

**Disclaimer** ➤ Due to constant research, the information in this manual is subject to change without notice. The information provided in this manual is believed to be reliable; however, Electrohome assumes no responsibility for inaccuracies or omissions.

## 1.2 Projector Description & Theory

The Electrohome *ECP 4500* series projector is a high resolution data/graphics projector compatible with most input sources. Its high performance places it well above other projection systems in its class. Its features include:

- ▣ high definition optics
- ▣ automatic input locking between 15 kHz and 90 kHz horizontal
- ▣ automatic input locking between 45 Hz and 120 Hz vertical
- ▣ projected display size from 5 to 25 feet diagonal
- ▣ simple push-button control using the full-function built-in keypad, infrared hand-held remote keypad or optional wired remote keypad
- ▣ displayed menus and help screens
- ▣ advanced features such as *ASR* and *Auto Power-up*
- ▣ an RS-232 serial port interface
- ▣ two input slots for interface modules
- ▣ a two input RGB interface
- ▣ microprocessor control circuitry
- ▣ 120V and 240V input voltage capability

**Optical** ➤ The *ECP 4500* uses HD6 lenses for the red, green and blue. The optics are formed from glass and acrylic aspheric elements. Two stage focusing allows independent focusing of the image center and corners. It also enables the projector to be used with a variety of screen types, e.g., curved, flat, or rear screens.

Each CRT/lens assembly can be mechanically adjusted to accommodate a wide range of screen sizes. Each lens can be mechanically tilted side to side and top to bottom, with respect to the CRT, to optimize screen focus at various throw angles.

*Note: The Red and Blue assemblies may be moved in and out horizontally to match the green raster.*

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

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

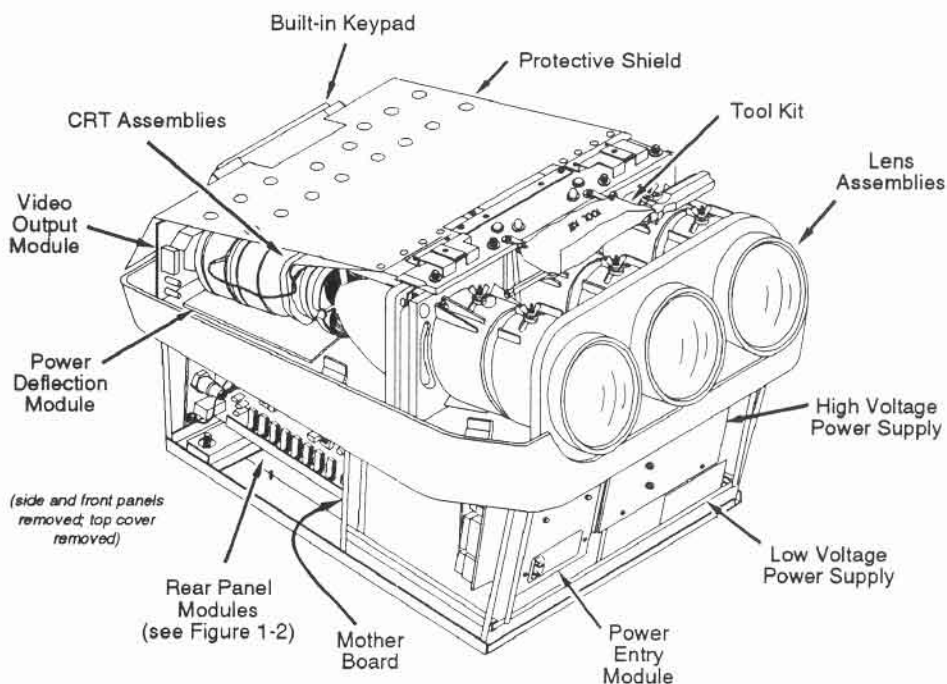


Figure 1-1. Projector Modules

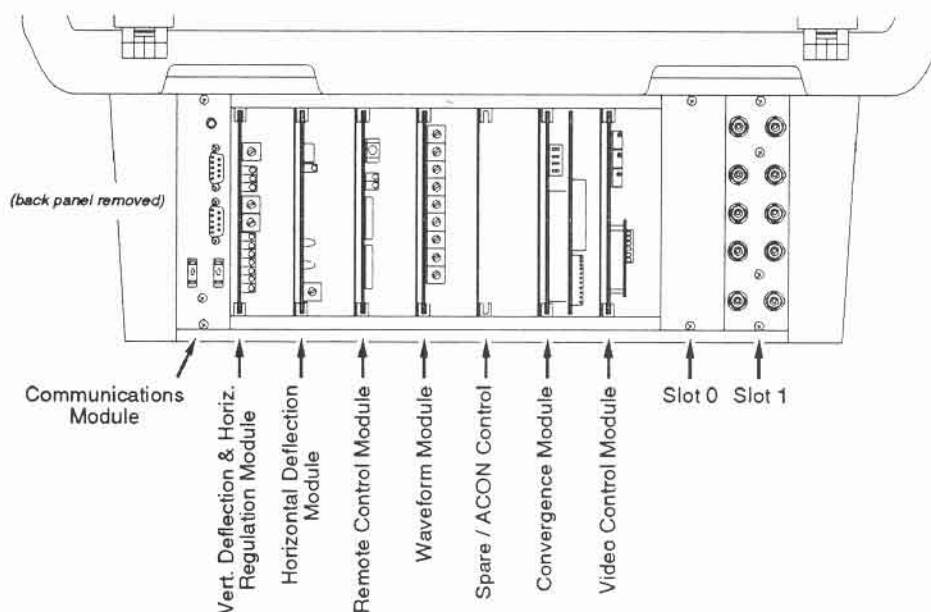


Figure 1-2. Rear Panel Modules

**Electronic** ➤

The projector takes video input signals and processes them through video, sync/deflection, and correction circuits to produce a projected video image. To do this, many individual system modules work together. These modules and their basic functions are explained in the following paragraphs. Figures 1-1 and 1-2 show their locations.

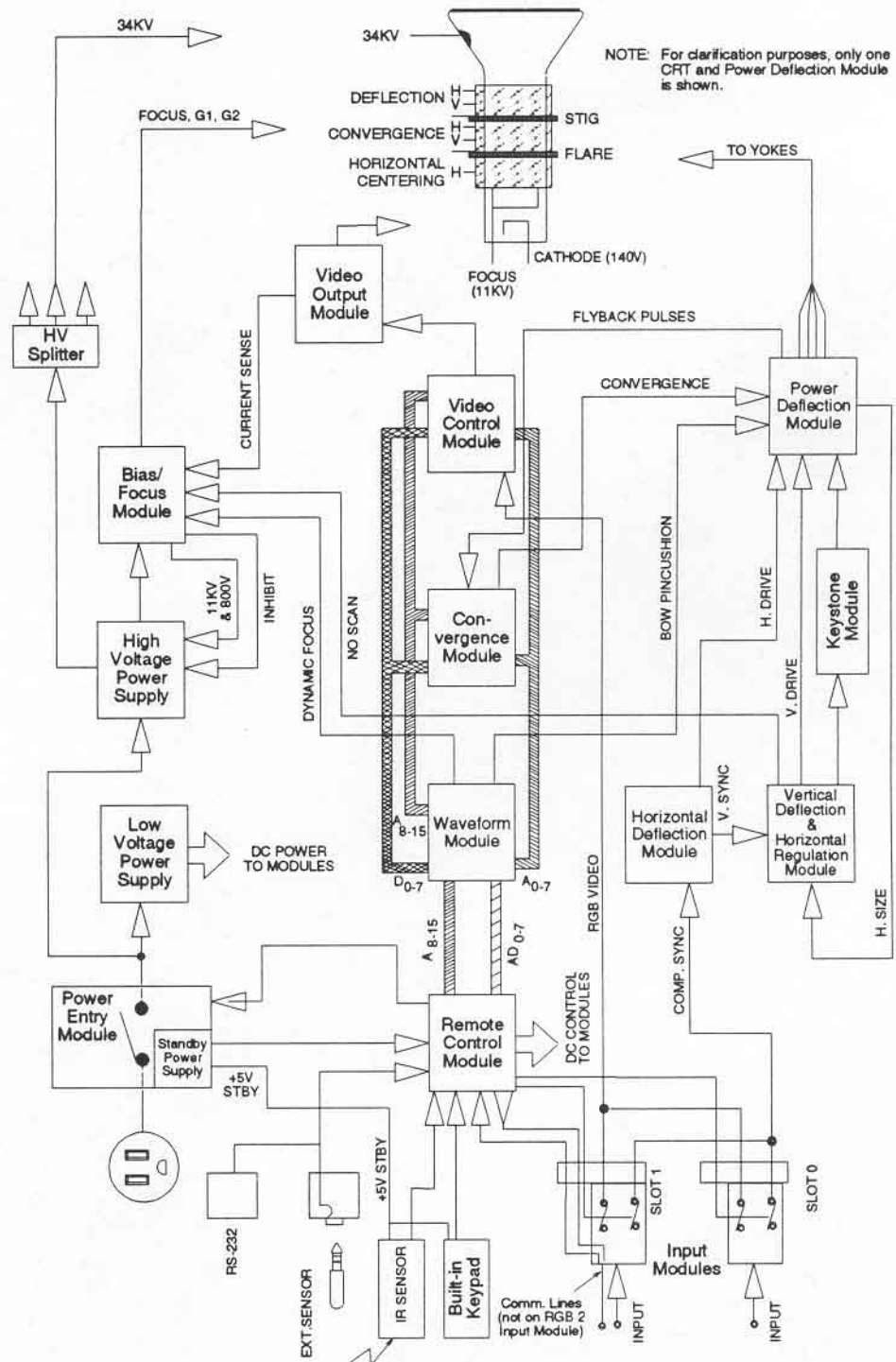


Figure 1-3. Function Block Diagram

### Power Supply Modules

The power supply circuitry contains the following modules:

- a) Power Entry (PEM)
- b) Low Voltage (Switch Mode) Power Supply
- c) High Voltage Power Supply
- d) Bias/Focus Module

### *Power Entry Module (PEM)*

The Power Entry Module (PEM) accepts 120V or 240V AC input power for distribution to the projector power supplies. A 120V/240V switch on the Power Entry Module is set to the input voltage in use. The PEM generates +12 STBY for the IR /wired remote keypads and provides +5V STBY for the Remote Control Module and the RS-232 Communications Module.

### *Low Voltage Switch Mode Power Supply*

The Low Voltage Switch Mode Power Supply (LVPS) provides +5, +6.3,  $\pm 12$ ,  $\pm 24$ , +150 and +200 Vdc for the logic and control circuitry. It is non-serviceable.

### *High Voltage Power Supply*

The High Voltage Power Supply (HVPS) provides 34 KV to each CRT anode, 11 KV to the focus circuitry and 800 VDC for G2 cut-off. It is non-serviceable.

### *Bias/Focus Module*

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

### *Remote Control Module*

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

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

### *Video Modules*

The video circuitry includes the following modules:

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

### *Input Module*

Input modules receive input signals from a video source and condition them for use by the projector. The projector includes an RGB Sync 2 Input Module video module installed in slot 1. Other input modules are available.

The input module directs the video component of the input signal to the Video Control Module, and the sync component to the Horizontal Deflection Module. The module's output is RGB and composite sync. Also contained on the module are relays for input and module selection.



### *Waveform Module*

The Waveform Module provides video gain control voltages for the Video Control Module and geometry correction waveform signals for the Keystone, Power Deflection and Bias/Focus Modules. This module also includes color correction circuitry which provides a small ramp in gain of the red and blue colors over the horizontal sweep range to compensate for luminosity differences of these colors between the left and right side of the image. (These luminosity variations are due to the relative position of the red and blue CRTs to the screen. The green CRT is centered with the screen but the red and blue CRTs are slightly offset and angled).

### *Video Control Module*

The Video Control Module performs two primary functions: 1) It amplifies video input signals by multiplying them by the gain signal from the Waveform Module; 2) It provides crosshatch and text generation. Outputs of the Video Control Module are fed to the Video Output Module.

### *Video Output Module*

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

### *Sync/Deflection Circuits*

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

### *Horizontal Deflection Module*

The Horizontal Deflection Module splits the composite sync into horizontal and vertical components. Now phase lock loops can be used to adjust picture position. The vertical sync pulse is fed to the Vertical Deflection & Horizontal Regulation Module. The horizontal sync pulse is used by the auto-frequency lock, bandswitch and horizontal processor circuitry to form a horizontal drive pulse.

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

### *Vertical Deflection & Horizontal Regulation Module*

This module uses a vertical processor to lock onto the vertical signal and generate the vertical drive pulses for the Power Deflection Modules. A second function is to generate the variable power supply (or Buck Inverter) that is used to supply the horizontal deflection circuitry. This module also contains an EHT INHIBIT circuit.



*Power Deflection Module*

This module contains the vertical and horizontal deflection amplifiers, the vertical and horizontal convergence deflection amplifiers, and the horizontal position amplifier.

*Correction Circuits*

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

*Convergence Module*

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

The Convergence Module contains the following circuitry:

- a) Horizontal Phase Locked Loop (HPLL)
- b) Vertical Phase Locked Loop (VPLL)
- c) Alpha Generation
- d) RAM Bank Switching
- e) Band Switch
- d) Address Generation and Multiplexing
- f) Waveform Channel

*Waveform Module*

The Waveform Module provides geometry correction waveforms to the Keystone, Power Deflection and Bias/Focus Modules.

## 1.3 Electrohome Technical Support

For additional technical support, see below for the nearest Electrohome technical support office.

*Electrohome Service Locations*

Electrohome Limited  
809 Wellington Street North  
Kitchener, Ontario  
Canada N2G 4J6  
Telephone (519) 744-7111  
U.S. customers call toll-free  
1-800-265-2171  
Fax: (519) 749-3136

*Electrohome USA (1989), Inc.*

9216 Bally Court  
Rancho Cucamonga  
California 91730-5835  
Telephone: (909) 466-3816  
Fax: (909) 466-3824

181 Cooper Ave.,  
Suite 100,  
Tonawanda, N.Y. 14150  
Telephone: (716) 874-3630  
Fax: (716) 874-4309

Electrohome Europe Ltd.  
ImagePoint  
58 Suttons Park Avenue  
Reading, Berkshire  
UK RG6 1AZ  
Tel.: (0) 1734 266300  
Fax: (0) 1734 266322

Electrohome Asia  
80 Marine Parade Rd.  
#21-06 Parkway Parade  
Singapore 1544  
Telephone (65) 346 5515  
Fax: (65) 346 5304

# Specifications

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This section includes:      2.1   ECP 4500/4501 Performance Specifications ..... 2-1

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*Note: Due to constant research, specifications are subject to change without notice.*

## 2.1 ECP 4500/4501 Performance Specifications

- Models** ➤
  - ECP 4500 - Model #38-B09991-94
  - ECP 4501 - Model #38-B09991-AC (includes ACON)
- Optics** ➤
  - High definition F1.0 hybrid lens
  - 10 line pairs per mm
  - 7" high resolution electrostatic focus CRTs
- Resolution** ➤
  - 1280 x 1024 pixels or 1020 TV lines
- Brightness** ➤
  - 725 lumens (10% peak white)
  - Usable brightness per industry standard 120 ANSI lumens
- Display** ➤
  - Electronic geometry circuits separately correct top, bottom and sides for flat, curved or rear screens from 5 to 25 feet diagonal
  - Keystone circuitry to correct pictures for angles up to  $\pm 15^\circ$  vertically from screen axis
  - ACON automatic convergence on the *ECP 4501* aligns red, green, and blue for a sharp image in less than three minutes
  - Selectable image blanking time for source to source switching (0s to 5s)
- Signals** ➤
  - Input Level: 0.5 to 1.5 volts p-p,  $75\Omega \pm 1\%$  terminated
  - Automatic sync mode selection between sync-on-green, H & V sync, and composite sync in any polarity combination
- ASR** ➤
  - The projector will automatically update all parameters, including convergence, contrast, brightness, keystone, move, etc., when a new source is detected. The new setup is taken from matching memories, or interpolated from preset zone memories.

- Frequency Response** ➤
- 70 MHz bandwidth (-3 dB)
  - Accommodates 7 nanosecond pixels and digital clock rates over 140 MHz

- DC Restoration** ➤
- Keyed clamp

- Geometry Distortion** ➤
- Horizontal: <1.0%
  - Vertical: <2.0%

**Deflection Circuits** ➤ **Vertical Deflection**

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

**Horizontal Deflection**

- Frequency Range: 15 kHz to 90 kHz autolock
- Size: automatically regulated over frequency range and adjustable from 10% underscan to 10% overscan
- Retrace Time: 2.5 microseconds

- High Voltage** ➤
- 34 KV regulated to better than  $\pm 1\%$

- Power Requirements** ➤
- 90 VAC to 264 VAC
  - Line Frequency: 50 to 60 Hz nominal
  - Power: 450 watts maximum

- Inputs** ➤
- Provided with an RGB Sync 2 Input module which allows connection of two RGB sources.
  - Built-in RS-232 for networking and computer/controller control
  - Many optional input modules available

- Optional Source Expansion** ➤
- The Electrohome IR Remove Video/Data Switcher allows use of 6 additional input modules. Up to four switchers can be connected via multi-switcher interface modules for up to 48 inputs.

- Control Features** ➤
- Menu driven interface with on-screen help
  - Built-in set up tutorials
  - Auto power up after power interruption
  - Built-in test pattern

- Servicing** ➤
- Modular design provides ease of servicing

**Environment ➤ Maximum Operating Range**

- ▣ Temperature: 0 to 35°C
- ▣ Humidity: 0 to 90% non-condensing
- ▣ Altitude: 0 to 3000m (0-10,000 ft.)

**Storage**

- ▣ Temperature: -30°C to +65°C

**Heat Dissipation**

- ▣ 1700 BTU/Hr (approximate)

- Mounting ➤** ▣ The ECP 4500/4501 can be ceiling mounted on its optional ceiling mount or placed on a castered cart for portable applications.

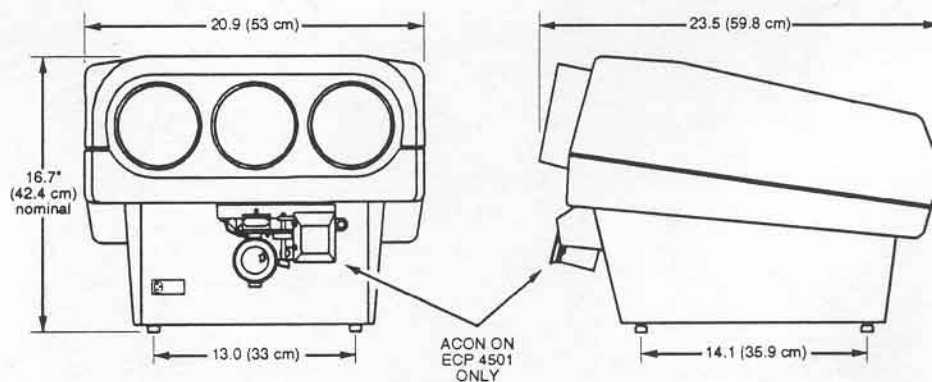
- Weight ➤** ▣ ECP 4500: 105 lbs / 47.6 kg (127 lbs / 57.6 kg shipping weight)  
 ▣ ECP 4501: 109 lbs / 49.5 kg (131 lbs / 59.4 kg shipping weight)

- Accessories Included ➤**
- ▣ IR Remote Control Keypad
  - ▣ Built-in, Full Function Keypad
  - ▣ Tool Kit
  - ▣ User's Manual
  - ▣ RGB Sync 2 Input Module

- Regulatory Approvals ➤**
- ▣ FCC Class A, D.H.H.S. 21 CFR, HWC
  - ▣ CSA C22.2.950/NRTL (UL)
  - ▣ EU Directives 73/23/EEC, 89/336/EEC (CE marked)

- Warranty ➤** ▣ One year parts and labour

**Physical ➤**



# Service Guidelines

This section includes:	3.1 Safety Precautions & Warnings .....	3-1
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	3.3 Extender Card Use .....	3-4
	3.4 Cleaning .....	3-6

**WARNING: PERFORM SERVICING ONLY AFTER BECOMING THOROUGHLY FAMILIAR WITH THE FOLLOWING SERVICING GUIDELINES. NONCOMPLIANCE INCREASES THE RISK OF HAZARDS AND INJURY TO THE USER. DO NOT MODIFY ANY CIRCUIT.**

## 3.1 Safety Precautions & Warnings

### Labels and Markings ►

The *ECP* projection system is designed for safe and reliable operation. To assure safety to users and technicians, it is imperative that the following precautions be taken during servicing and that the original projector design be maintained.

Observe and follow all warnings and instructions marked on the projector and within this service manual.

The exclamation point within the equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the projector.



The lightning flash with arrowhead symbol, within the equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the projector's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



### High Voltage ►

High voltages capable of causing DEATH are used in this projector. Observe all precautions necessary for working on HIGH VOLTAGE equipment before servicing.

**HIGH VOLTAGES MAY BE EXPOSED**



**QUALIFIED PERSONNEL ONLY**


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

- X-RAY Radiation** ➤ The projector is internally shielded to protect the user from exposure to x-ray radiation. Improper servicing may result in personal injury.



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

- Power Supplies** ➤ The projector's two power supplies (high voltage and low voltage) are not serviceable. Do not open or attempt servicing of the supplies should a supply failure occur. Contact Electrohome for replacement power supplies.

- Component Replacement** ➤ All components on schematics and parts lists which are identified with a  are critical safety. These components MUST be replaced by exact equivalents. Failure to do so may result in unsafe operation. Replace all components that show signs of overheating.

### 3.2 General Guidelines

#### STATIC SENSITIVE COMPONENTS



APPROPRIATE STATIC PRECAUTIONS MUST BE  
TAKEN DURING ALL SERVICING

- Lead Dress** ➤ Before servicing, observe the original lead dress. Take extra precaution to maintain the original lead dress, especially in the high voltage circuitry areas. Replace any wire that has damaged insulation.
- High Voltage** ➤ Check that the high voltage is at its correct value. Use an accurate, calibrated, high voltage meter. When troubleshooting a projector with a high voltage problem **DO NOT** operate the projector longer than is necessary to locate the cause of the problem.
- Ordering Parts** ➤ When ordering replacement parts, quote the part numbers of the items required. Also provide the projector model number, serial number, and date of manufacture which is available from the licence label located next to the line cord input at the front of the projector.
- Note: When ordering parts for warranty replacement, you must provide the model and serial number of the projector.*
- AC Leakage Test** ➤ Perform an AC leakage test on exposed metallic parts after each servicing. This will ensure that the projector is safe to operate without danger of electric shock. Perform the test as follows:

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

- b) Connect a  $1500\ \Omega$ , 10 watt resistor in parallel with a  $150\text{nF}$  AC capacitor between a known good earth ground and each exposed metallic part, one at a time. With an AC voltmeter having a minimum sensitivity of  $1000\ \Omega/\text{V}$ , measure the voltage across the  $1500\ \Omega$  resistor. See Figure 3-1 below. The rms voltage measured **MUST NOT EXCEED**  $0.3\text{V rms}$  (equivalent to  $0.5\text{ mA rms}$  current). Values exceeding this limit are potential shock hazards. Correct immediately!

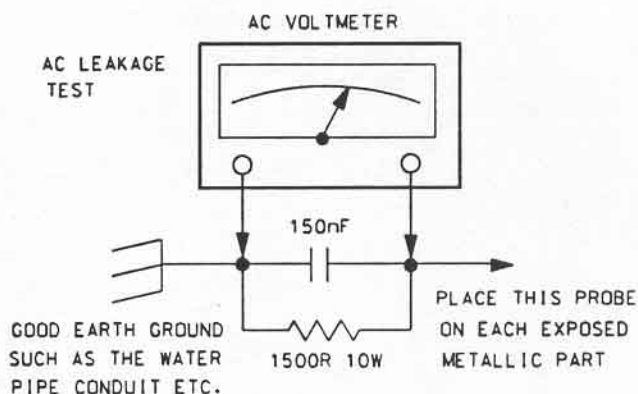


Figure 3-1. AC Leakage Test

### Component Removal

If a through-hole component is defective and must be replaced, cut the leads near the body of the component as shown in Figure 3-2.

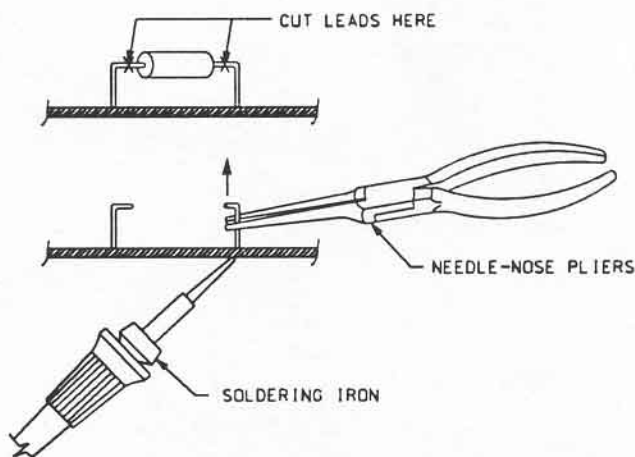


Figure 3-2. Component Removal

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

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



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

Check component markings and the parts list to determine the correct replacement component.

### **Repair Cautions** ►

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

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

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

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

**DO NOT** operate the projector with parts removed (except covers).

**DO NOT** operate the projector with lead shielding removed.

**DO NOT** handle modules without taking static precautions.

### **3.3 Extender Card Use**

The *ECP* extender card allows service technicians to physically extend *ECP* projector card rack modules to fully expose circuit components for testing and diagnosis. See Figure 3-3 below. To obtain an ECP extender board, call Electrohome. Ask for part number 03-230330-01P

Install the extender card as follows:

- a) Unplug the projector.
- b) Remove the 6 Phillips head screws which secure the back panel to the projector chassis. Set the panel aside.
- c) Each card rack card rack mounted module has a hole located at its outer top and/or bottom corners. Remove the printed circuit board extractor from the tool pouch located beneath the front top cover. Insert the hook of the extractor into one of the holes of the module to be removed. Refer to Figure 3-3. Pull the module out of the projector.
- d) Slide the extender card into the card slot until it is firmly seated then plug the module into the extender card as shown in Figure 3-4.
- e) Plug in the projector then press **POWER** to turn it on. Proceed with testing and diagnosis.

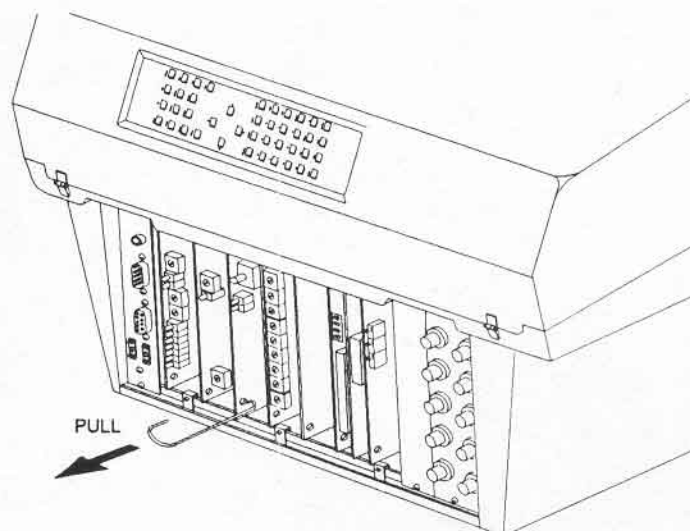


Figure 3-3. Card Rack Module Removal

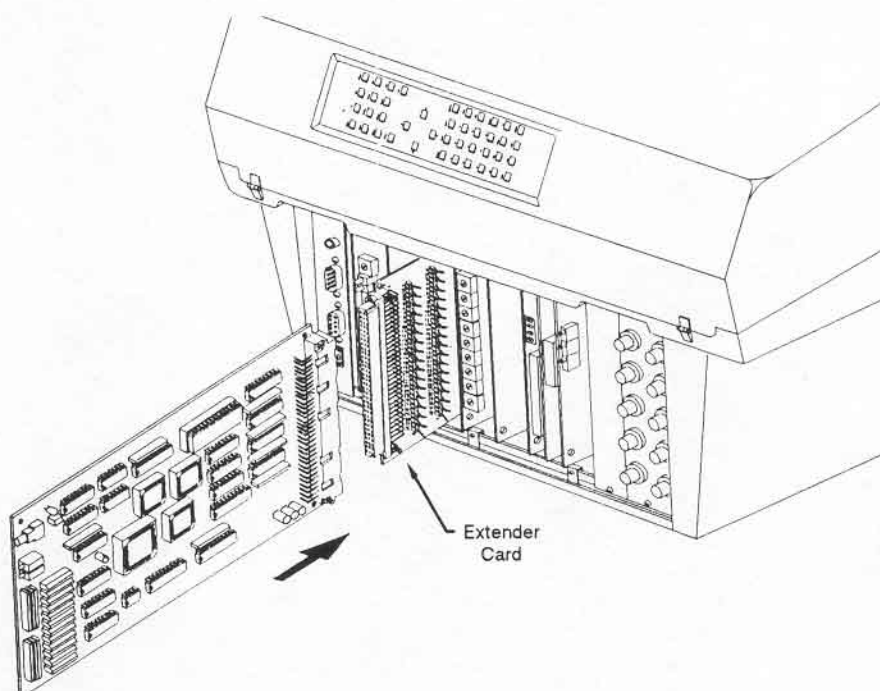


Figure 3-4. Extender Card Use

### 3.4 Cleaning

Clean the projector as required after each servicing. Before cleaning, always unplug the projector from the power outlet.

#### **Lens Cleaning** ➤

To avoid the risk of scratching the lenses, only clean the lenses if absolutely required. A small amount of dust on the lenses will have very little effect on picture quality. If the lenses must be cleaned, use a DRY soft cotton cloth. A suitable cloth is supplied with the projector. Rub gently in a circular motion.

*Note: Replacement cloths can be ordered. Ask for part number 39-001539-01P.*

#### **Case Cleaning** ➤

Clean the case with a soft dampened cloth. Use a mild commercial cleaner. Do not use liquid or aerosol cleaners.

#### **ACON Cleaning** ➤



The lens on the ACON Locator Assembly is very tolerant to dust and should only be cleaned if ACON performance is affected. Cleaning of the lens (if required) must be performed with great care. Use a DRY soft cotton cloth. Rub gently in a circular motion.