

# 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 *Marquee 8110+/8500/8500LC and 9500LC* projection systems. Organization of the manual permits easy access to service related information for the complete system (Part A) as well as information specific to its serviceable modules (Part B).

**Conventions** ► Please note the following typographical conventions used in this manual.

- Warnings that relate to user safety are highlighted in **bold** print.
- ▲ 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 and should be replaced by Electrohome recommended parts only when required.
- ▲ 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 serious electric shock to persons.
- 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*.
- The ACON symbol indicates that the associated subsection applies only to projectors which include the optional ACON automatic convergence feature. ACON is a registered trademark of Electrohome Limited. 
- An asterisk (\*) next to a digital signal name indicates that the signal is active low, i.e. - DISABLE\* may be understood as **DISABLE**.

- In the module sections, each schematic and parts list is identified with the module number for which the data applies. In some cases, a module will have a different service part number than its factory part number. If the part has its own service part number, it is provided for your reference. In most cases the service part number begins with "03". For example, the service part number for the Focus Module is "03-270334-01P" whereas its factory part number is "02-270334-01P". Part numbers are provided in section 5.2, *Modules & Parts* and in the individual module sections.
- The Convergence Amplifier module (CVA) PCB and the Vertical Deflection Module (VDM) PCB are assembled together as one complete module called the Convergence/Vertical Module (also referred to as the Convert Module). The CVA and VDM each have their own functions, but share the same PCB assembly. In most cases, this manual refers to these two modules separately (CVA and VDM). If either the CVA or VDM requires separate service or replacement, one module can be detached from the other by carefully clipping the tabs between the the two modules.

**Updates** ► Updates to this manual are created on an as-required basis. 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 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 accurate; however, Electrohome assumes no responsibility for inaccuracies or omissions.

## 1.2 Projector Description

The Electrohome *Marquee* series of projectors are ultra high resolution graphics projectors compatible with virtually all input sources. Superior performance and high quality place them well above other projection systems in their class. Features of the *Marquee* projectors include:

- auto-lock to inputs between 15 kHz and 110 kHz (8110+)
- auto-lock to inputs between 15 kHz and 130 kHz (8500/8500LC/ 9500LC)
- a projected display size up to 25 feet (diagonal)
- high brightness projection – 200 ANSI lumens (8110+); 225 ANSI lumens (8500); 235 ANSI lumens (8500LC); 260 ANSI lumens (9500LC)
- high video bandwidth; on 9500LC – 120 MHz (-3dB), on 8110+/8500/8500LC - 100MHz (-3dB)
- a multi-use full function keypad
- an intuitive menu driven, multi-language interface with on-line help
- enhanced circuitry for superior contrast, astigmatism correction and color performance
- Contrast Modulation (8500/8500LC/9500LC)
- external computer control capability
- ASR and ASI which reduce the need for manual display adjustments
- optional ACON II automatic convergence feature

**Functional Description** ►

The projector accepts data/graphics and video input signals from a variety of sources for projection onto flat, curved, or rear projection screens. System inputs are processed to provide separate red, green, and blue image components for projection through the unit's three front lenses. The three primary color components converge on the projection screen to provide a high quality display output.

Sophisticated processor-based logic and control circuitry provide many of the automatic features designed into *Marquee* series projectors. This circuitry interfaces with the keypad to provide projector control by the user. Control functions include:

- turning the projector on or off
- switching input sources
- adjusting all display settings such as contrast, brightness, and size
- correcting for undesirable display effects and input noise
- displaying projector operating status screens and help information
- controlling the projector's operating settings

The keypad is used by service personnel to make service adjustments and alignments. In some cases the projector may be serviced without accessing the projector's internal circuitry. Because projector settings are usually different for different sources, the projector stores most display settings for each source individually. All display settings and operating settings are retained until changed by the user, even if power is removed from the projector.

**Hardware Description** ►**Mechanical**

The projector body is comprised of a sturdy metal chassis, metal top covers, and durable plastic side covers. The front top cover can be temporarily removed to access the keypad and align the lenses. The rear top cover and rear panel are removable for servicing and projector upgrading.

**Optical**

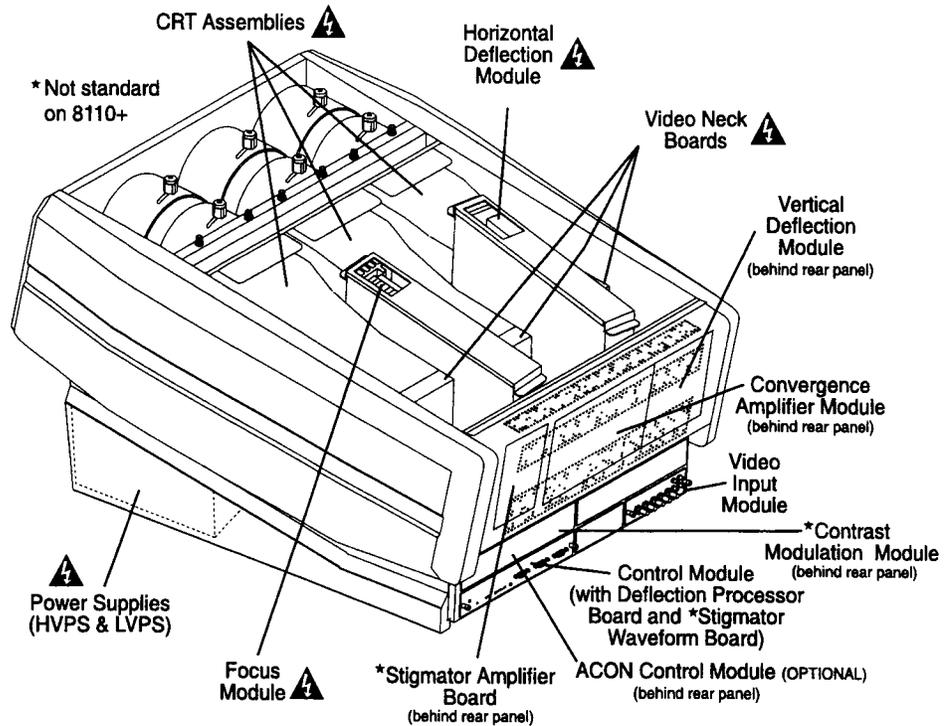
The projector uses F1.1, color corrected, hybrid optics. The optics are formed from glass and acrylic aspheric elements. Two stage focusing allows independent focusing of the image center and corners. It also enables the projector to be used with a variety of screen types, e.g., curved, flat, or rear screens. The actual lens type is based on model, with optional lens types available for the 8500LC and 9500LC.

**Circuit Modules** ►

Every Marquee projector includes the following circuit modules: a Video Input Module (VIM), a Control Module (CLM), a Vertical Deflection Module (VDM), a Horizontal Deflection Module (HDM), a Convergence Amplifier Module (CVA), a Focus Module (FCM), three Video Neck Boards (VNB), a Low Voltage Power Supply (LVPS) and a High Voltage Power Supply (HVPS). Every projector also has an Upper Mother Board (UMB) and a Backplane Mother Board (BMB) to connect most modules together. Marquee 8500, 8500LC, and 9500LC models also include a Contrast Modulation Module (CMM), a Stigmator Amplifier Board (SAB) and Stigmator Waveform Board (SWB). Marquee 8111+, 8501, 8501LC, and 9501CL include

the ACON II automatic convergence feature consisting of an ACON Control Module (ACM) and Locator Assembly. The modules are briefly described in the following. For detailed descriptions of each, refer to Part B of this manual.

*Note: The LVPS and HVPS are non-serviceable items.*



**Figure 1-1. Projector Modules**

### **Video Input Module (VIM)**

The VIM, located at the back of the projector, selects and receives video, sync and audio signals from external sources for processing. The module can select input signals from the input connectors on the module's panel, an optional plug-in input module, or from the projector's optional video decoder. The VIM also inputs "internal" video signals from the CLM for displaying on-screen text and test patterns, and for blanking the image during retrace. The selected RGB video signals are buffered, clamped, gain-controlled and modulated by waveforms from the CMM. Gamma correction is applied to the blue video channel. The processed video signals are output to the VNBs. The VIM can process sync-on-green, composite sync, or separate horizontal and vertical sync signals from the selected input source. Processed sync signals are output to the CLM. Stereo audio signals from the input source are preamplified for volume control and output via RCA connectors on the module's panel. The VIM also contains protection circuitry to process the beam current signals from the CRTs and perform a shutdown of the HVPS if required.

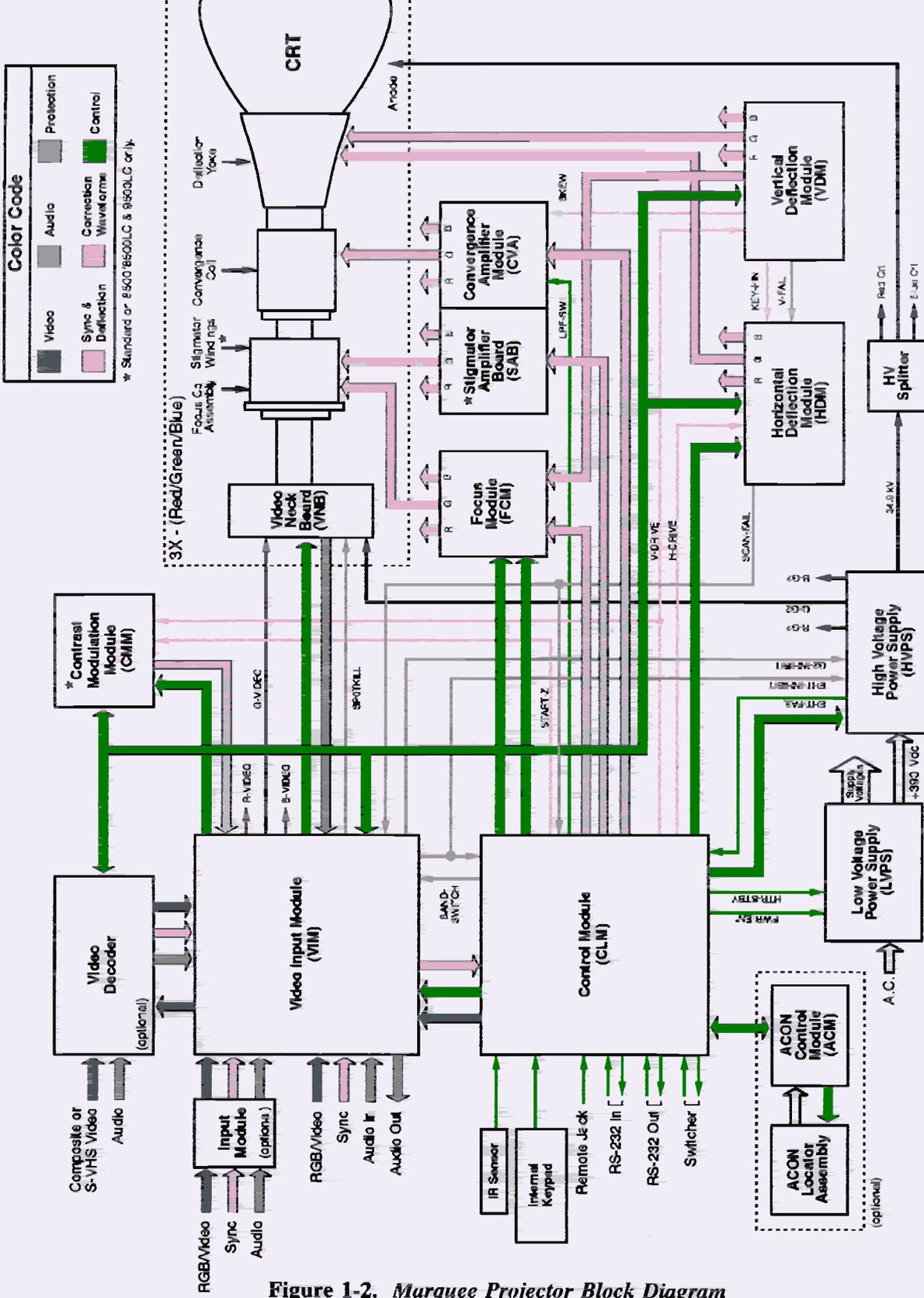


Figure 1-2. Marquee Projector Block Diagram

### ***Control Module (CLM)***

The CLM, located at the back of the projector, is the projector's control center, containing its operating software and controlling all its functions. It consists of a Control Board (CLB), a Deflection Processor Board (DPB) and, depending on projector model, a Stigmator Waveform Board (SWB). The DPB and SWB are daughterboards. The module contains several microprocessors, read only memory, random access memory, and input/output ports. It receives user control input from the projector's internal keypad, remote keypads, and RS-232. It also monitors diagnostic inputs from other modules within the projector. The CLM outputs convergence waveforms to the CVA, horizontal dynamic focus waveforms to the FCM, G2 control voltages to the HVPS, drive signals for horizontal and vertical deflection to the HDM and VDM, respectively, and numerous control signals. It also outputs RGB video signals to the VIM which are used for displaying on-screen text and test patterns as well as for blanking the display during retrace. In 8500, 8500LC and 9500LC models, the CLM also outputs astigmatism correction waveforms to the SAB. These are generated by the SWB daughterboard.

### ***Contrast Modulation Module (CMM)***

The CMM is located at the back of the projector. Its function is to control the relative gains of the red, green and blue video signals in multiple zones throughout the image in order to achieve uniform luminosity and color temperature. The module creates correction waveforms synchronized to the horizontal and vertical raster scans and controls them independently for each zone in the image and for each color. The waveforms are scaled by red, green and blue gain control voltages from the VIM and then output back to the VIM to modulate the amplitudes of the red, green and blue video signals.

### ***ACON Control Module (ACM) - optional***

With ACON installed, the ACM is located at the back of the projector. In conjunction with the ACON Locator Assembly at the front of the projector, the ACM allows the projector's software to automatically converge the projected image. Under software control, the ACM drives a pair of stepper motors in the Locator Assembly, which contains a proprietary photodiode sensor, and aims the sensor at a particular point on the screen. The module then digitizes the signals it receives from the photosensor in order to measure the positions of the red, green and blue rasters at the observed image point. The red and blue rasters at that location are then moved using the projector's digital zone convergence controls until the signals from the sensor indicate that all three colors are aligned. This process is repeated at multiple points on the screen until the entire image is converged.

### ***Vertical Deflection Module (VDM)***

The VDM, located behind the rear panel of the projector, drives the vertical deflection windings within each of the main deflection yokes on the three CRTs with ramps of current in response to a vertical drive pulse from the CLM. The amplitude and linearity of these ramps is scaled under software control to set the vertical size and vertical linearity of the rasters. The VDM also creates, and places under software control, a number of other vertical rate

waveforms used by other modules in the projector. These include vertical dynamic focus waveforms for the FCM, a keystone/pincushion waveform for the HDM, and a skew waveform for the CVA.

### **▲ Horizontal Deflection Module (HDM)**

The HDM, located between the green and blue CRTs, controls and monitors the horizontal electron beam deflection in the CRTs. It drives the horizontal deflection windings in each of the three main deflection yokes with a ramp of current. The amplitude of the ramp in each deflection winding determines the widths of each of the three rasters. Modulation of the widths by a vertical rate waveform input from the VDM controls the amount of keystone and pincushion. The timing of the deflection ramps is controlled by a horizontal drive signal from the CLM. The CLM also provides a variety of control signals which configure the HDM for different scan frequency ranges. If beam scanning in any of the CRTs stops, the HDM outputs a scan fail signal to the VIM and the CLM.

### **Convergence Amplifier Module (CVA)**

The CVA, located behind the rear panel of the projector, drives the convergence coils on the neck of each CRT with current waveforms that have the same shape as voltage waveforms received from the CLM and VDM. There are two windings in each convergence coil assembly, one for horizontal movement, the other for vertical movement. The magnetic fields produced by the currents in the windings cause movement of the electron beam within the necks of each CRT to align the three projected images and correct for N/S geometry and E/W linearity distortions. The range of movement is a fraction of the range of the main deflection yokes.

### **Stigmator Amplifier Board (SAB)**

The SAB attaches to the CVA module. It receives voltage waveforms from the CLM and outputs current waveforms of the same shape which drive stigmator windings within the focus coil assembly on the neck of each CRT. These waveforms modulate the shape of the electron beam in each CRT independently in axial and diagonal directions in order to achieve a round spot shape uniformly over each CRT's face.

### **▲ Focus Module (FCM)**

The FCM, located between the red and green CRTs, supplies the magnetic focus coils on the neck of each CRT with a current waveform. This creates a magnetic field within the neck of each CRT which controls the diameter of the electron beam as it lands on the CRT face plate. The focus is modulated dynamically as the beam sweeps across the face by voltage waveforms input from other modules. Horizontal rate modulation waveforms are provided by the CLM. Vertical rate waveforms are provided by the VDM.

### **Video Neck Boards (VNB)**

The VNBs, located at the end of the neck of each CRT, amplify the red, green and blue video signals input from the VIM to drive each respective CRT. A brightness control voltage input to each VNB from the VIM controls the DC offset of the black level of each video signal. G2 supply voltages from the HVPS are also input and applied to each CRT.

### **Power Supplies**

The projector has two power supplies; a Low Voltage Power Supply (LVPS) and a High Voltage Power Supply (HVPS). Both supplies are non-serviceable.

The LVPS is a power-factor corrected DC supply that accepts line-cord input in the range 90-264 VAC. It outputs regulated  $\pm 5\text{Vdc}$ ,  $\pm 15\text{Vdc}$ ,  $\pm 24\text{Vdc}$ , and  $\pm 85\text{Vdc}$  supply rails for powering the projector's electronics and  $+390\text{Vdc}$  for the HVPS. These outputs are turned on and off by a control signal from the CLM. The LVPS also outputs three standby supply voltages which remain active as long as AC is connected. Two of these voltages, at  $+5\text{Vdc}$  and  $+12\text{Vdc}$ , are used to power a portion of the CLM, allowing it to detect a "power-on" message from a keypad or other control device. The third standby voltage is used to heat the filaments of the CRTs and measures  $+6.3\text{Vdc}$  when the projector is on and  $+3.9\text{Vdc}$  when the projector is turned off.

The HVPS inputs  $+390\text{Vdc}$  from the LVPS and outputs a 35kV EHT voltage. This is passed through a splitter to the anode of each of the three CRTs. The HVPS also outputs three additional voltages in the range 0 - 1000Vdc which are used to bias the G2 grids of the CRTs. The level of each G2 supply is controlled by a DC voltage from the CLM.

**Warning: These power supplies are NON-SERVICEABLE. Do not attempt to open or service them. Serious injury may result. Faulty supplies must be replaced.**

### **Expandability**

The *Marquee* projector can be expanded or upgraded to include additional features, accessories and input options; these include a variety of plug-in input modules to suit specific types of signal sources, a Marquee signal switcher, a Multi-standard Video Decoder module, an Image Shifter module (standard on the 9500LC), the ACON II automatic convergence system, and ceiling mounting hardware. In addition, some features, such as Contrast Modulation, can be added to models that do not include them as standard. For more information contact your dealer or Electrohome.