

1.0 System Description

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1.1 Introduction

This chapter is divided into four basic sections: the Electrical Section, the Optical Section, the Electronic Section and the Miscellaneous Items. Each section gives a basic description of the components in the section and a description of the function of those components. This provides an overall view of the projector and its subsystems for a general understanding of how these systems contribute to the function of the projector.

1.2 Electrical Section

The electrical section consists of the Incoming Power Circuit, and the Power Supplies and the Igniter Assembly. The following paragraphs give a list of major components and a brief description of those components. For a more detailed description of a component, refer to the chapter and section dedicated to that particular component.

Incoming Power Circuit

Power Cord

The AC power comes in through the Power Cord to the AC Circuit Breaker.

AC Circuit Breaker and Subassemblies AC Circuit Breaker

The Circuit Breaker connects and disconnects the projector from electrical energy and protects the projector from over-voltage conditions.

The Subassemblies AC Circuit Breaker is located on the front panel of the Projection Module. It has three circuit breakers that control the following:

- ❑ Control Panel - (monitors and controls airflow and temperature for the Arc Lamp and ILA[®] devices) and ventilation fans. The ventilation fans and the Arc Lamp blower will energize when this circuit breaker is switched on.
- ❑ Low Voltage Power Supply - powers the System Controller PCB and the High Voltage Power Supply.
- ❑ Arc Lamp Power Supply - powers the Arc Lamp Power Supply that ignites and powers the Arc Lamp.
- ❑ +48 V Power Supply - supplies power to the ILA[®] device cooling blower

Power Supplies

Low Voltage Power Supply

The Low Voltage Power Supply supplies standby voltages and the main system voltages to the projector.

Arc Lamp Power Supply (ALPS)

The ALPS supplies power to the Igniter Assembly while the Arc Lamp is lighting. After the Arc Lamp has lit, ALPS provides the steady state power to the Arc Lamp.

High Voltage Power Supply (HVPS)

The HVPS provides the Anode, Focus (G₃), Black Level (G₂), and Blanking (G₁).

+48 VDC Power Supply

The +48 VDC Power Supply provides power to the large blower inside the ILA® device Air Handler (under the ILA® devices at the front of the Projection Module).

Igniter Assembly

The Igniter Assembly provides the high voltage pulse that lights the Arc Lamp and acts as a link from the Arc Lamp Power Supply to the Arc Lamp after the Arc Lamp has been lit.

- Igniter - The Igniter actually performs three functions. It is a step-up transformer that supplies the high voltage pulse to light the Arc Lamp. It also supplies the spark gap for the high voltage pulse. Once the Arc Lamp is lit, the Igniter acts as a link between the Arc Lamp Power Supply and the Arc Lamp for steady state operation.
- Laser Power Supply - The Laser Power Supply provides the voltage for the spark gap. The spark gap produces a high voltage pulse in the Igniter that lights the Arc Lamp.

1.3 Optical Section

The optical section of the ILA-12K consists of the Arc Lamp Module, the Optical Path, the ILA® device, the CRTs, the Relay Lenses and the Projection Lens.

Arc Lamp Engine

The Arc Lamp Module supplies high intensity light for the ILA-12K. Its output is rated at 7 kW. The Arc Lamp has a lifetime rating of 500 hours as specified by the Arc Lamp Bulb manufacturer.

Optical Path

The Optical Path consists of all the optical components that transmit, filter, separate, bend, or straighten the Arc Lamp light. The Optical Path also includes Polarizing Prisms, and Prepolarizing Prisms that control the image path inside the Prism Assembly.

Cold Mirrors (2)

The Cold Mirrors remove infrared light rays, which contain most of the heat, from the white light coming from the Arc Lamp. There are two Cold Mirrors, the first one is located above of the Arc Lamp Engine and after the #3 Lens.



CAUTION! The term "cold mirror" is used because the mirror passes infrared light and its reflection contains only "cold" light that

does not transmit appreciable heat. As a result of the absorption of infrared heat radiation, "**cold**" mirrors get very hot.

Condensing Lenses (2)

The #1 Lens collects all the light and begins to bend the light rays into a straight path. The #2 Lens works with the #1 Lens to collimate or "straighten" the light path before it enters the Dichroic Mirrors.

UV Filters

The UV Filter removes much of the unwanted ultraviolet light from the white light of the Arc Lamp.

Dichroic Mirrors w/ Steering Mirrors

The Dichroic Mirrors separate white light into Red, Green, and Blue component colors. The Steering Mirrors direct the separated light beams into their respective Prism Assemblies.

Prism Assemblies (3)

The Prism Assemblies are tanks filled with optical fluid. They house the following optical components:

- ❑ Pre-polarizing Beamsplitter - The Pre-polarizing Beamsplitter performs the first part of the polarizing process.
- ❑ Polarizing Beamsplitter - The Polarizing Beamsplitter performs the final function of the polarizing process.

ILA[®] Devices - Image Light Amplifier (3)

The ILA[®] device is a very important component in the ILA-12K projector. The ILA[®] device modulates the polarized light from the Arc Lamp. The image light from the CRT that strikes the input side of the ILA[®] device interacts with the Liquid Crystal layer of the ILA[®] device to impose an image on the polarized light from the Arc Lamp. The ILA-12K uses the Super Contrast ILA[®] device. The contrast ratio for the Super Contrast ILA[®] device is dependent on the input source configuration.

CRTs (3)

There are three Cathode Ray Tubes (CRTs), one for each color. The CRT generates the image light that strikes the input of the ILA[®] device. There are two types of CRTs, one is recommended for use with graphics, and the other is recommended for use with video sources. The type used with video sources has a faster reaction time. CRTs are covered in the Electronics Section.

Relay Lens Assemblies (3)

There are three Relay Lenses, one for each color. The Relay Lens focuses the image light from the CRT onto the photosensitive layer on the input side of the ILA[®] device. The Relay Lens is physically connected to the CRT.

Front Projection Lens

The ILA-12K comes with a choice of four standard lenses, two special order lenses and three lens converters.

Standard Lenses

- 1.5:1
- 3:1
- 5:1
- 7:1

Special Order Lenses

- .885:1
- 2.177:1
- 10:1

0.8 Lens Adapters

- Converts 3:1 to 2.4:1
- Converts 5:1 to 4:1
- Converts 7:1 to 5.6:1

1.4 Electronic Section

The electronics section consists of the Printed Circuit Boards (PCBs), and the CRT/Yoke assemblies.

Printed Circuit Boards (PCB)

The ILA-12K has five main PCBs that are located in the Electronic Card Cage and one smaller PCBs attached to the back of each CRT:

System Controller PCB

The System Controller PCB controls much of the electronics system. It uses digital and analog circuitry to generate Menu and internal pattern overlays, and directs convergence correction and shading information. It controls the IIC data bus that sends geometric correction and video input selection data. The System Controller PCB controls and monitors the status of power supply operations during and after the projector is powered ON.

Raster Timing Generator PCB

The Raster Timing Generator PCB generates an internal sync for the PLL (Phase Lock Loop) circuitry. It provides sync detection and selection. It also generates the blanking pulse, provides horizontal and vertical phase adjustments, and Interlace detection.

Video Processor PCB

The Video Processor PCB receives external image and sync signals and sends horizontal sync, vertical sync, and green sync signals to the Raster Timing Generator PCB. It adds Contrast, Brightness, Sensitivity and Threshold, Gamma and Video Peaking adjustments to the image signals and sends the image signals, G_2 control lines, and G_1 bias to the Video Amplifier PCB. It also provides the ILA[®] device bias and sensitivity. The Video Processor PCB provides ILA[®] device thermal compensation for digital-ready projectors.

Vertical Deflection PCB

The Horizontal Vertical Deflection PCB supplies the deflection waveforms that drive the deflection yokes on the CRTs for the horizontal and vertical raster. It integrates the geometry correction such as pincushion, keystone, and vertical linearity onto the horizontal deflection waveform and adjusts the horizontal and vertical center raster.

Horizontal Deflection PCB

The Horizontal Deflection PCB generates the horizontal and vertical convergence correction waveforms. It generates the horizontal and vertical Dynamic Focus Parabola used by the High Voltage Power Supply.

Video Amplifier PCBs (3)

The three Video Amplifier PCBs amplify the video signals and drive the cathodes for the three CRTs. They sense the cathode beam current and regulate the G_1 and G_2 for all the CRTs. The Video Amplifier PCB also provides phosphor protection for all three CRTs and CRT interface for the Focus, Heater Voltage, and Arc ground. IK stabilization is also available.

Backplane PCB

The Backplane forms the bottom of the Electronics Card Cage. The System Controller PCB, Raster Timing Generator PCB, Video Processor PCB, Horizontal and Vertical Deflection PCBs plug into directly the Backplane PCB. It provides an interconnection interface for all the electronic components in the projector. It also provides LED indicators for the system voltages. The Backplane PCB provides voltages to the Ultra Digital Processor as required.

CRT/Yoke Assemblies

The CRT/Yoke Assemblies bridge between the Optical and the Electronic sections. The CRTs could be included in the Optical section because they produces the image light transmitted to the ILA[®] devices, but they are included in

the Electronic section because they are the end user for the image signals from the Video Processor PCB, and Video Amplifier PCB. The CRTs also use the Anode, Focus, G_1 , and G_2 voltages from the High Voltage Power Supply. The Yoke Assemblies contain the horizontal and vertical deflection coils and convergence coils. The deflection coils are driven by waveforms from the Horizontal and Vertical Deflection PCBs. The convergence coils are driven by the Vertical Deflection PCB.

1.5 Miscellaneous Items

The Miscellaneous Items section consists of components that indirectly support the main function of the projector.

Cover Panels

The Projection Module has many removable cover panels to allow access to the various power supplies, PCBs, ILA[®] devices, Arc Lamp and other components that need periodic servicing.

Ventilation

The cooling fans maintain thermal stability for the projector. The Arc Lamp and PCBs generate a lot of heat and require airflow from the blowers, cooling and exhaust fans.

The Arc Lamp especially depends on the positive airflow. If the blower and exhaust fans are not circulating air through the Arc Lamp Engine while the Arc Lamp is on, the Lamp will implode from overheating. The Arc Lamp Module has a large blower under the Arc Lamp Engine and one large exhaust fan to remove hot air in the top of the cabinet.

Air Filters

The ILA-12K uses a HEPA (High Efficiency Particulate Air) air filter to clean incoming air to the ILA[®] devices. The Arc Lamp has a large filter that filters the air pulled in to cool the Arc Lamp. This filter has a pre-filter that filters the incoming air before it passes through the blower. The air filters filter the incoming air to minimize the amount of dust and air-borne particles inside the projector. These air-borne particles can land on optics such as the ILA[®] devices and cause large diffuse dark areas on the screen.

Control Panel

The control panel contains instrumentation that monitors and controls airflow and temperature within the Projection Module and Arc Lamp Module. It also monitors Arc Lamp operation hours.

EMI Shield

The ILA-12K has many EMI (Electro-Magnetic Interference) Shields that trap and collect high frequency noise that is radiated by switching power supplies such

as the Arc Lamp Power Supply and the Low Voltage Power Supply. This high frequency noise can interfere with the operation of radios, televisions, and other electronic devices.