Section 6

Troubleshooting

This section includes:

6.1 Overview 6-1
6.2 Problems & Solutions 6-1
6.3 Circuit Notes & Waveforms 6-5

6.1 Overview

This troubleshooting section is provided to assist service technicians for troubleshooting the *ECP* projector. Refer to section 6.2 for a listing of problems and possible solutions. This listing is in addition to that covered in the troubleshooting section of the user's manual. Section 6.3 includes a set of brief circuit notes with diagrams and waveforms.

Before beginning any troubleshooting, read Section 3, *Service Guidelines*. This section contains important service warnings and guidelines which **must** be observed for troubleshooting and servicing of the projector. For general operating theory, refer to section 1.2, *Projector Description and Theory*. For schematics of the circuit modules, refer to Section 7, *Schematics*. For component layout drawings, including connector pin-outs, refer to Section 8, *Layouts and Wiring*.

6.2 Problems & Solutions

The following is a listing of various projector problems, possible solutions and test notes.

Power-On Problems ➤

Refer to the following if the projector does not turn on properly.

Symptom: The green READY indicator light at the rear panel does not illuminate when you press [POWER] to turn the projector on (both keypads tried).

Cause/Remedy:

1) AC power is not reaching the projector. Check the AC power connections at the wall outlet and the Power Entry Module.
2) Check the main fuse in the PEM. Note: A blown fuse may indicate too much current draw by the projector. Determine the cause of the blown fuse before using the projector. Is the voltage selector correct? Refer to the user's manual for more information about voltage selection.
3) The Low Voltage Power Supply has failed. Check the voltage status LEDs at the rear panel.
4) The Power Entry Module may have failed. Check the internal relay. The 5Vdc standby supply may be failing.

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Symptom: Cannot power up even though the green READY indicator light is on. The red ERROR LED is off.

Cause/Remedy:
1) Check the AC harness from the Power Entry Module to the Low Voltage (switch mode) Power Supply. Verify input and output voltages.
2) The Low Voltage Power Supply may be loaded down by a faulty Vertical Deflection Module.
3) The Low Voltage Power Supply may have failed.

Symptom: The green READY indicator light and the red ERROR LED are simultaneously lit.

Cause/Remedy:
1) Check the Remote Control Module first. Check s-ram IC29.
2) Maybe a hard reset is required. Refer to section 4.2 for instructions.
3) Check the Waveform Module, Video Control Module, and Convergence Module.

Symptom: The +12V or -12V LED at the rear panel is not illuminated.

Cause/Remedy:
1) The Low Voltage Power Supply may be faulty. Check all low level voltages at the power supply output. (You can easily check the voltages in the system by installing and extender card in the spare slot at the rear of the projector. Voltages are labeled on the card. See section 3.3 for more information).

Symptom: All low voltage indicators (LEDs) at the rear panel are on, the READY LED is on and no red INHIBIT LEDS are on, but there is no display.

Cause/Remedy:
1) There may be a high voltage failure such as a shorted CRT. Check CRTs for filament. If one is not lit, the CRT is shorted.
2) There may be a problem with the High Voltage Power Supply. Check the input to the supply.

Video Failures ➤

Refer to the following if the projector does not display video properly.

Symptom: No external or internal video or raster present.

Cause/Remedy:
1) Check the red INHIBIT LEDs. If okay, there may be a high voltage failure in the system.
2) If the red ERROR LED is on there may be a problem with the Remote Control Module.

Symptom: External video is present but no internal video.

Cause/Remedy:
1) Video Control Module failure possible.
2) Waveform Module failure possible.

Symptom: Internal video is present but no external video.

Cause/Remedy:
1) Check interface and cables to the projector's input module. Check the power supply for the input module/interface.
2) Make sure the proper slot and input has been selected. If you are unable to change the slot and input number, there may be a problem with the Remote Control Module.

Symptom: One color (red, green or blue) is missing.

Cause/Remedy:
1) Check to see if the color is missing when displaying the internal crosshatch pattern (#). If the color is present, the problem is most likely external to the projector.

2) If the color is not present when displaying the internal crosshatch, check the following outputs from the Video Control Module (VCM):
   - row C , pin 2 for red
   - row A, pin 1 for green
   - row A, pin 3 for blue

   If the color is missing per above, the problem is likely with the VCM.
3) If all three colors are present per 2) above, make sure P7 and P9 on the Video Output Module for the color is secure and proper. Look for broken wires. Check the video level at K on the module. At full contrast the signal should be about 140Vp-p. If the signal is not present, the module may be faulty.
4) Check that the switches on the Bias/Focus Module are on.

Sync Failures ➤ Refer to the following if a video synchronization problem is observed.

Symptom: No H or V sync present. (The internal video relies on the external sync for stability.)
Cause/Remedy:
1) No horizontal or vertical sync is present. Check the sync output at pin 8 on row A of the Input Module. If sync is not present check for sync pulses to the input module from the source or interface. If you detect sync from the source, the Input Module may be faulty.

Symptom: No H sync present. (The internal video relies on the external sync for stability.)
Cause/Remedy:
1) Check the signal at pin 8, row C on the Horizontal Deflection Module. If there is composite sync present at this point, the Horizontal Deflection Module is probably faulty.

   Note: The sealed potentiometers on the Horizontal Deflection Module should never be adjusted unless op-amp replacement on the module is necessary.
2) Perform a Horizontal Deflection Module setup per section 4.13.
3) If the projector locks-up at higher frequencies but not at video signal levels, check the +24Vdc and -24Vdc supply lines on the Vertical Deflection Module. Pin 26 of row A is +24Vdc. Pin 25 of row A is -24Vdc. If these supplies are off by more than 1 Vdc, the Low Voltage Power Supply should be replaced.

Symptom: No V sync present. The internal video relies on the external sync for stability.
Cause/Remedy:
1) If composite incoming sync is present at pin 8 of row C on the Horizontal Deflection Module, check for vertical sync pulses at pin 10, row A. If no sync is present, the Horizontal Deflection Module may be faulty. If there is sync, the Vertical Deflection Module is probably faulty.
2) If both modules (per above) are okay and there is no vertical sync, check the +12Vdc and -12Vdc supply lines at pins 28 and 27 of row A (respectively). These voltages will cause lock-up problems if they are off by more than 1 volt. If this is the case, the Low Voltage Power Supply may need to be replaced.

Inhibit Failures ➤

Symptom: Horizontal Inhibit Failure.

Cause/Remedy:

1) Check the horizontal drive pulse at pin 14 of row A on the Horizontal Deflection Module. If the pulse is missing, the module may be faulty.
2) Check for BUCK OUT voltage at pin 23, row A on the Vertical Deflection module. This is a varying dc level voltage which is frequency dependant. At a horizontal frequency of 15.70 kHz it should be about 40Vdc. If this voltage is not present or at least at a low level (20 Vdc), the Vertical Deflection Module may be causing the problem.
3) If the Vertical and Horizontal Deflection Modules are believed to be okay, one of the Power Defection Modules is most likely at fault. On the Vertical Deflection Module check for a +7 to +10Vdc level to indicate proper operation of the module at the following points: pin 22, row A for red, pin 21, row A for green, and pin 20, row A for blue. If the dc return is missing for one of the colors, the Power Deflection Module for the color is likely to be faulty.

Symptom: Vertical Inhibit Failure.

Cause/Remedy:

1) Check the vertical drive pulse at pin 3 of row A on the Vertical Deflection Module. If the pulse is missing, the module may be faulty.
2) If the drive pulse is present, check to determine if one of the Power Defection Modules is at fault. On the Vertical Deflection Module check for a +5 Vp-p vertical ramp at the following points: pin 1, row A for red, pin 4, row A for green, and pin 2, row A for blue. If the ramp is missing for one of the colors, the Power Deflection Module for the color is likely to be faulty.

6.3 Circuit Notes & Waveforms

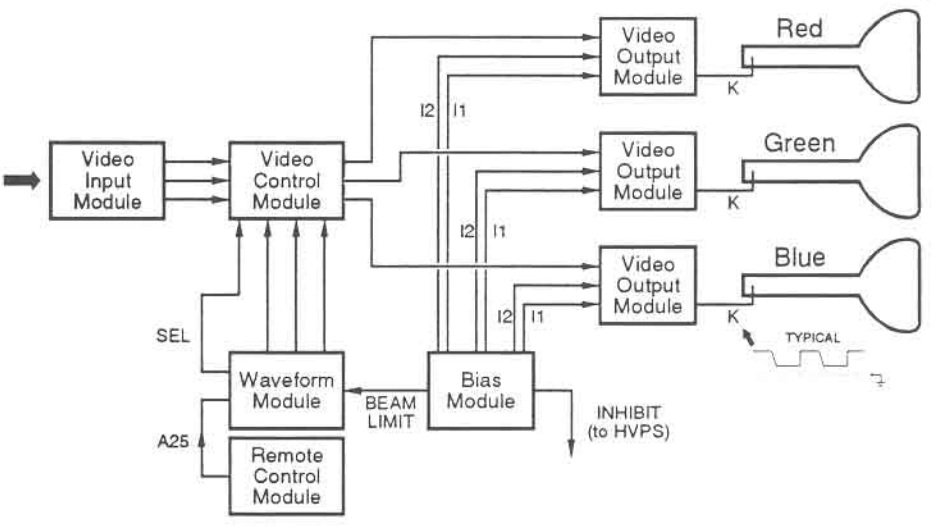
This sub-section contains a set of brief circuit notes with diagrams and waveforms to assist you when troubleshooting.

Video ➤

The video signal is passed through the Input Module where it is amplified to give unity gain and the sync is detected. The outputs are fed to the Video Control Module (VCM). The VCM selects between an internal test pattern and the external video signal. The selected video is amplified in multiplying amplifiers and fed into the Video Output Modules (VOMs). Each VOM (3 total) amplifies the video signal and passes it to the cathode of its associated CRT (red/green/blue).

Two opto-isolated detector circuits measure the current. If it is high, I1 goes high. If it is very high, I2 goes high as well. The Bias Module receives the separate I1, I2 data and generates the beam limit signal to limit the video level and uses the I2 signal to shut down the HVPS.

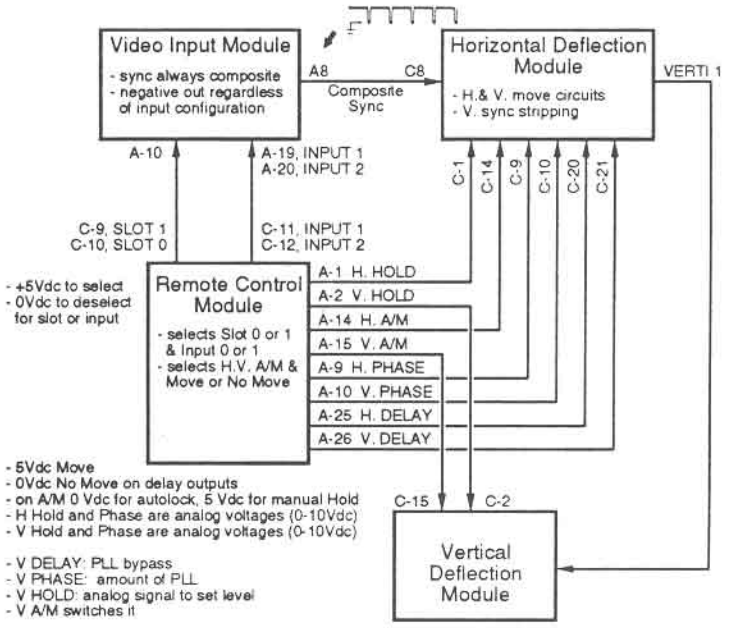
The Waveform Module receives the CONTRAST signal from the Remote module which is used to generate a voltage level to control the gain of the multiplying amplifiers on the VOM. The BEAM LIMIT signal from the Bias Module will reduce the gain voltages to limit the video gain if it exceeds the maximum level.



Sync Paths ➤

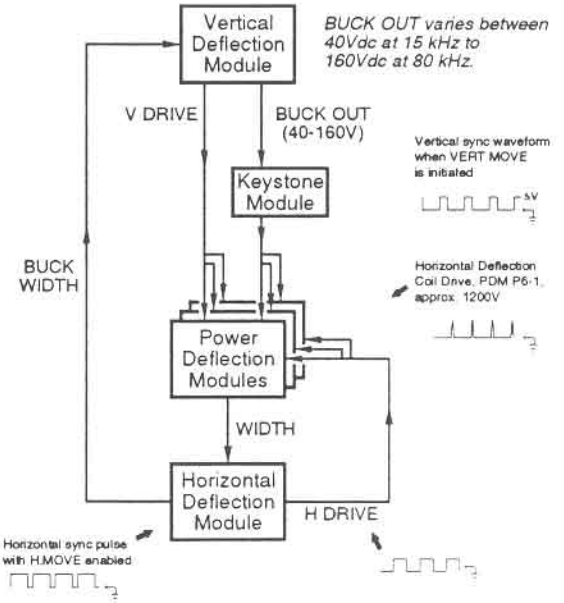
The Input Module is able to detect sync from composite, separate or sync-on-green. The output sync is always composite sync and is fed into the Horizontal Deflection Module. The Horizontal Deflection Module (HDM) separates the horizontal and vertical syncs. If the HDELAY or VDELAY control lines are enabled, the horizontal or vertical sync is then passed through a phase lock loop phase shifter. The analog signals, HPHASE and VPHASE, control the amount of phase shifting required.

The logic signal H.A/M is used to disable the automatic lock on the HDM. The HHOLD analog signal controls the frequency setting for the manual lock. V.A/M and VHOLD are used in the same way to control the vertical hold on the Vertical Deflection Module.



Vertical & Horizontal Scan ➤

The HDM outputs Horizontal drive pulses to the Power Deflection Modules. These are fed to MOSFET switches which generate the current ramp inside the horizontal yokes to deflect the beam inside the CRT. Power to the yokes is supplied from the 200 volt power rail which is fed to the Vertical Deflection Module (VDM). The voltage supply is then reduced depending on the frequency, then passed through to the Keystone Module. The Keystone Module modulates the dc voltage with the vertical keystone waveform which then powers the yokes.



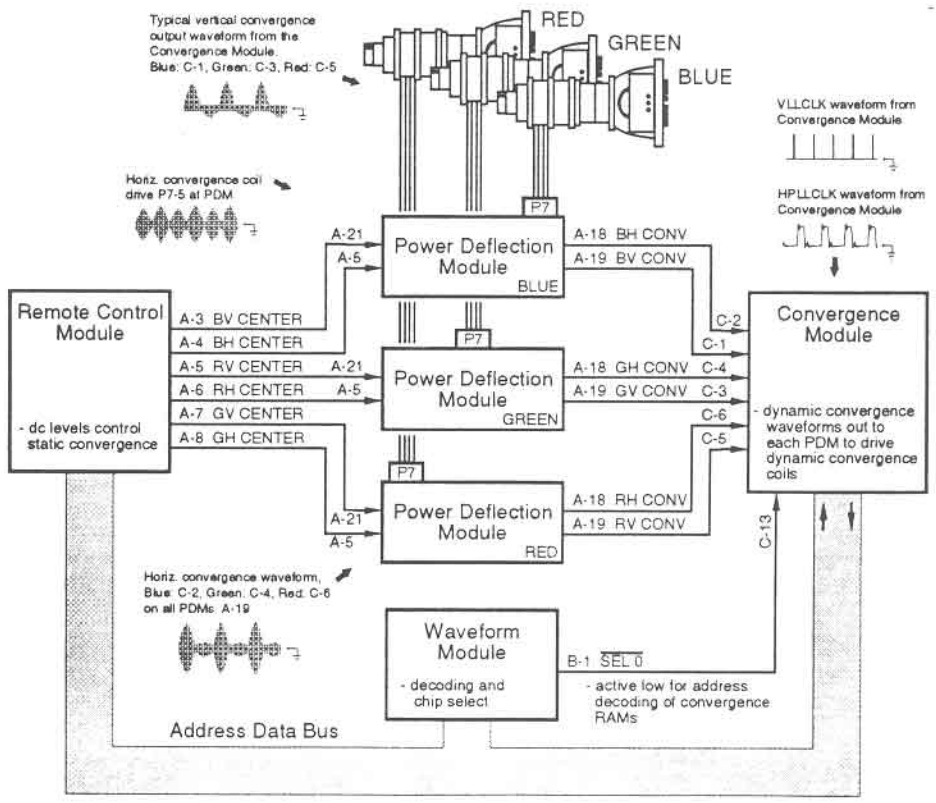
The voltage across the FETs is monitored in the PDM and used to generate an analog voltage - WIDTH, which goes to the HDM and is combined with the SIZE control from the Remote Control Module (RCM) to make the analog signal, BUCK WIDTH, which inturn regulates the output voltage BUCK OUT from the VDM.

Convergence ➤

Convergence is a secondary deflection process where the main deflection of the beam is minutely corrected in order to register the three colors on top of each other. The Convergence Module (CVM) is digitally controlled in 44 zones on the screen. The horizontal and vertical values for these zones is loaded through the Mother Board buss from the Remote Control Board via the Waveform Module.

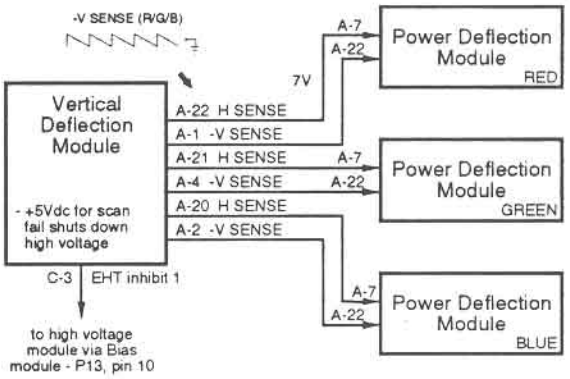
In order to map the zones on the screen the vertical and horizontal flyback sense lines VFB and HFB are used to clock two phase lock loop frequency multipliers on the CVM. The resulting clocks, HPLLCK and VPLLCK, provide a clock that maps the screen out horizontally into 256 parts and vertically into 256 parts. These clocks are then used to generate an analog waveform for the vertical and horizontal convergence. There are two waveforms for RED, two for GREEN, and two for BLUE (BH CONV, BV CONV etc).

Static convergence (moving the whole image up or down or side to side) is much simpler. Vertical static convergence is done by feeding an extra dc current into the vertical deflection circuit on the PDM. The analog signals BV, RV, and GV, from the RCM are used to control the static vertical movement. Horizontal static convergence is done by a special amplifier and yoke controlled from the PDM. The analog voltages BH, RH and GH from the RCM are used to control the sideways movement.



Scan Fail Detection ➤

The sweep voltage across the FET's on the Power Deflection Modules is monitored by sensing circuits which generate an HSENSE and a VSENSE signal which is sent to the Vertical Deflection Module. (There are a total of six sense lines to the VDM). In the VDM the six sense voltages are monitored in a comparator circuit. If one of the inputs goes below 6 volts, an inhibit signal is sent to the Bias Module and from there to the HVPS as an inhibit signal to turn off the HVPS output.



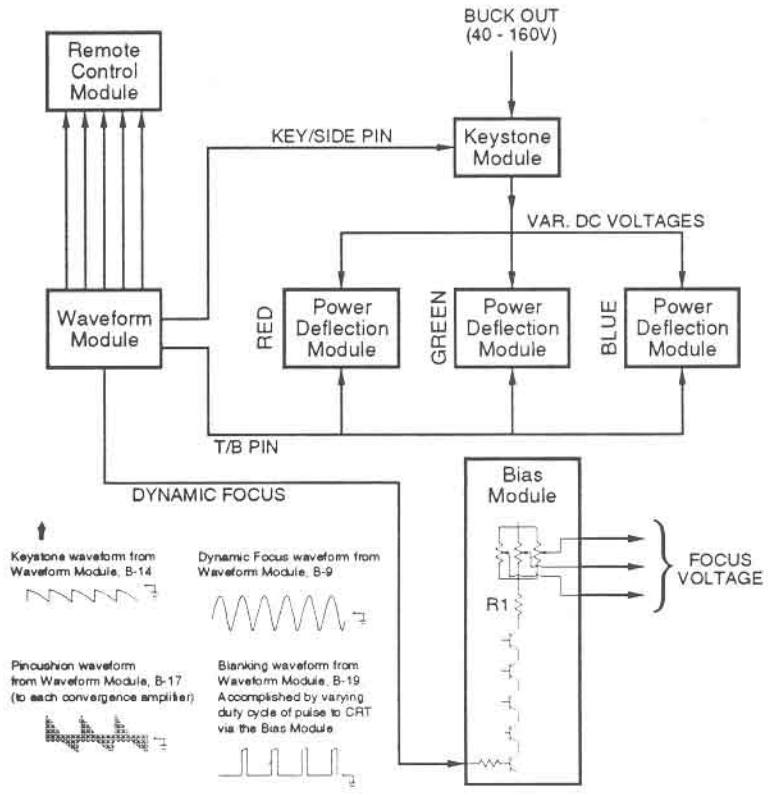
Geometry ➤

In order to project a rectangular image to the screen there are six special correction waveforms needed, they are:

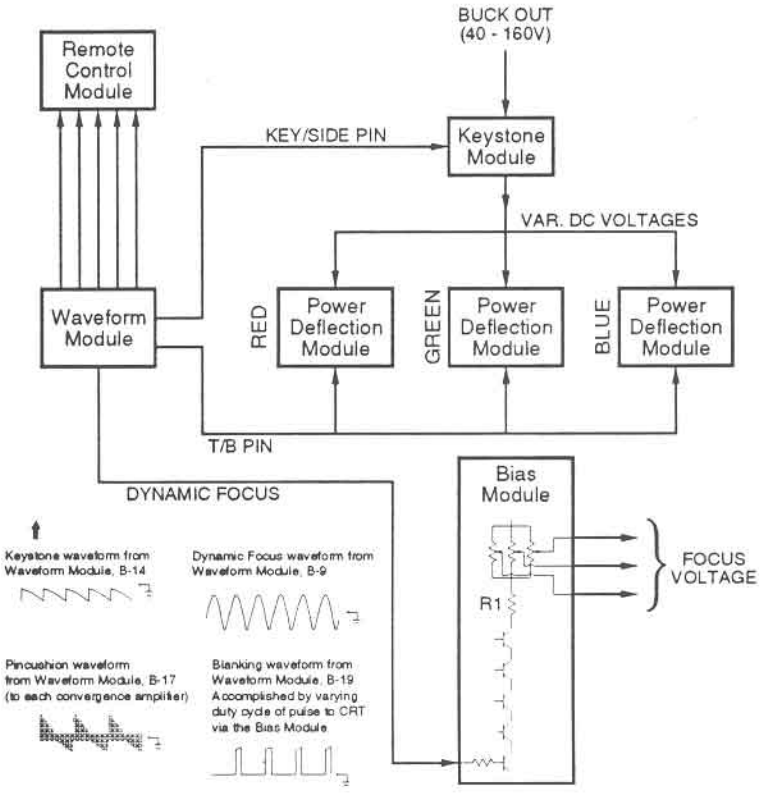
1. KEY to correct for the vertical angle between the projector and the screen.
2. SIDE PIN to correct for the optical distortion in the vertical axis when projecting onto a flat screen.
3. TOP PIN to correct for the optical distortion at the top of the screen.
4. BOTTOM PIN to correct for the optical distortion at the bottom of the screen.
5. BOW to correct for the distortion resulting when projecting onto a curved screen.
6. DYNAMIC FOCUS to modify the focus voltage as the electron beam moves horizontally and vertically.

KEY and SIDE PIN are vertical corrections and are made by modulating the voltage supplied to the horizontal deflection yokes. By changing the horizontal voltage as the beam moves vertically down the screen, the width of the picture is changed to match the required KEYSTONE and SIDE PIN. The waveforms for KEY and SIDE PIN are generated on the WFM and are combined and sent to the Keystone Module.

TOP and BOTTOM PIN waveforms are generated on the WFM and combined. BOW is used to set the amount by which each is combined. The resulting waveform is sent to the PDMs to the vertical convergence amplifier where they combine with the vertical convergence waveform to control the shape of the picture.



The DYNAMIC FOCUS waveform is generated on the WFM and fed into the Bias Module. The focusing voltage applied to the CRTs is approximately 10.5 KV at the center of the screen but needs to be approximately 450 volts more in the corners. The waveform from the WFM is amplified in a totem pole transistor circuit on the Bias Module.



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