

SECTION 15

BIAS MODULE

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No tables are included in this section.

15.1 TECHNICAL DESCRIPTION

15.1.1 General Description

The Bias module controls each CRT and their operating voltages via the Power Deflection and Video Output modules. Circuit functions include: beam limiter, over-current trip, G1 control, G2 bias, static focus, and dynamic focus.

15.1.2 Circuit Description

15.1.2.1 Beam Limiter

By overriding the contrast signal, the beam limit circuit limits the average beam current on each CRT to a safe level. The I1 current sense signals from the three video boards are ORed together by D19 through D21 and compared to a 4 volt reference (IC3) by IC4. D22 pulls the beam limit line low to reduce contrast if any I1 inputs rise above 4.3V.

15.1.2.2 Over Current Trip Circuit

The over current trip circuit shuts off the high voltage module outputs if the beam limit circuit fails. Comparator IC5 compares the three I2 signals (from the video modules) to a 6.4V reference (IC2). If any input goes above the 6.4V reference, the collector output of IC5 opens and the High Voltage module is disabled.

15.1.2.3 G1 Circuit

The G1 circuit provides biasing, blanking, and spot kill. The G1 is biased to -10.5V by D13 and D14. The blanking waveform is amplified by Q10 to approximately 22V_{p-p} and coupled to the G1 output through C56.

The spot kill circuit provides a -160V bias to the CRTs whenever the power or deflection circuits are disabled. C50 is charged to 150V through D13 on power-up. When EHT Inhibit 1 goes open, Q1 turns on pulling the positive side of C50 to ground. The negative side of C50 then goes to -160V, dragging the G1 (through D14) with it.

15.1.2.4 G2 Circuit

The G2 circuit consists of a set of potentiometers which derive the G2 supply voltage from the 800V supply. The potentiometer outputs connect to switches which allow the G2 of each CRT to be turned off for set-up.

15.1.2.5 Static Focus

The static focus circuit provides an adjustable (8.9KV to 10.4KV) focus voltage to the CRTs from a 17KV tap in High Voltage module. Potentiometers R26 through R30 of the focus board provide individual adjustment of focus voltage for each CRT. IC4B, Q6, Q7, Q8, Q9, Q10, and Q14 form a 2kV shunt regulator for fine main focus. The regulator is controlled by the 0-10V electric focus signal from the Remote Control module.

15.1.2.6 Dynamic Focus

A dynamic focus voltage is generated by two amplifiers to supply the parabolic voltage required between center and edge of the raster. Q12, Q13 and Q16 form a low frequency amplifier which amplifies the vertical parabola of the dynamic focus signal. Amplifier gain is approximately 65. Q11, Q14 and Q15 amplify horizontal parabola approximately 40 times to drive T2 steps up the horizontal parabola approximately 40 times and combines the output with the vertical parabola generating a composite parabola of roughly 400V_{p-p}. The output is then coupled to the G4 of each CRT (through C27, C28 and C29). SG1 and SG2 are 250V spark gaps which protect the amplifiers from high voltage arcs.

15.2 SERVICING AND ALIGNMENT

15.2.1 Disassembly and Access

WARNING

**STATIC SENSITIVE COMPONENTS
STATIC CONTROLLED WORK STATION REQUIRED**

Module Location:

- projection head

Tools & Equipment Required:

- Phillips screw driver
- 1/4" hex head socket

a) Remove the front and rear top covers as described in Section 5.2.

b) Locate the Bias module and disconnect the P1, P3, P4, P5, P6, P7, P8, P9, P10, P11, and connectors. (Refer to Appendix C, *Harness/Wiring Diagram* for reconnection.)

c) Remove the 2 hex head screws securing the module to the top bracket as shown below.

e) Lift the Bias module from the projector.

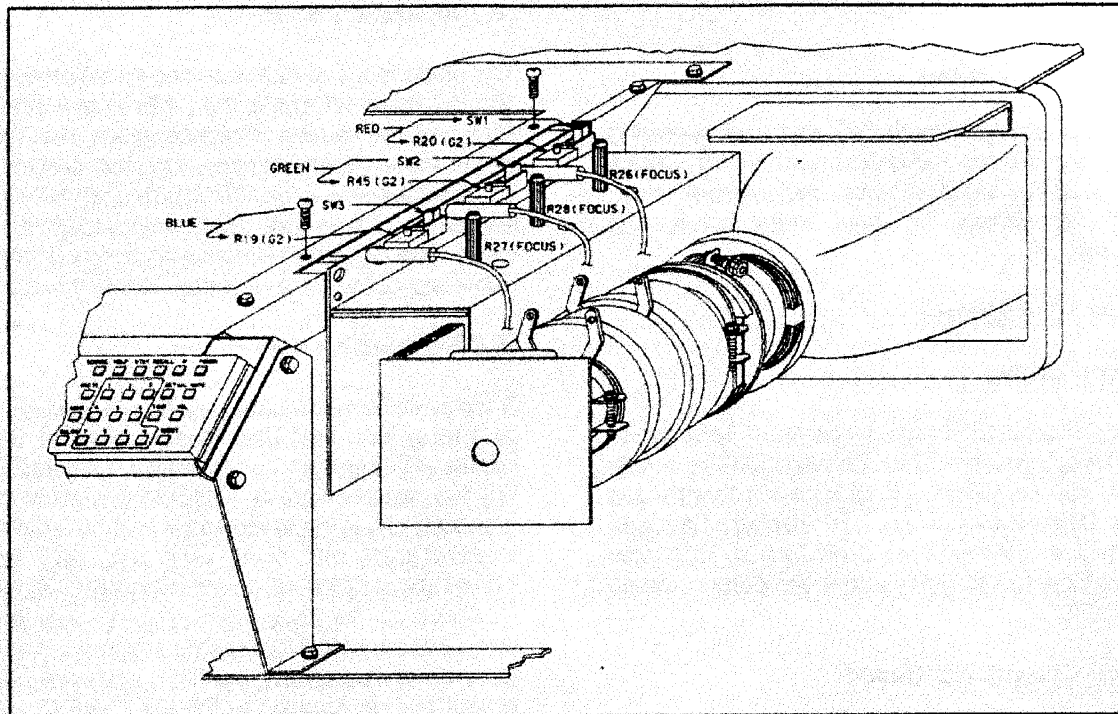


FIGURE 15-1. Bias Module Removal/Alignment

15.2.2 Alignment

Set-up of the electronic focusing circuitry may be performed via adjustments to the Bias module as follows:

NOTE: The projector must be optically focused before performing this procedure.

Reference Figure 15-1.

Tools & Equipment Required:

- fine tip slot screwdriver
- Phillips screw driver

STEP 1

- a) Turn the room lights off. Project an image on the screen.

STEP 2 – Adjust Red Focus

- a) Turn OFF the green and blue CRTs by moving slide switches, SW2 and SW3, down. The projected image should be red.
- b) Adjust BRIGHTNESS and CONTRAST to 3 on the function bar graph.
- c) Adjust R26 until the focus at the center of the picture appears best.

STEP 3 – Adjust Green Focus

- a) Turn OFF the red CRT by moving slide switch SW1 down. Turn on the green CRT by moving SW2 up. SW3, should be in the down position. The projected image should be green.

- b) Adjust R28 until the focus at the center of the picture appears best.

STEP 4 – Adjust Blue Focus

- a) Turn OFF the green CRT by moving SW2 down. Turn ON the blue CRT by moving SW3 up. Slide switch, SW1, should be in the down position. The projected image should be blue.

- b) Adjust R27 until the focus at the center of the picture appears best.

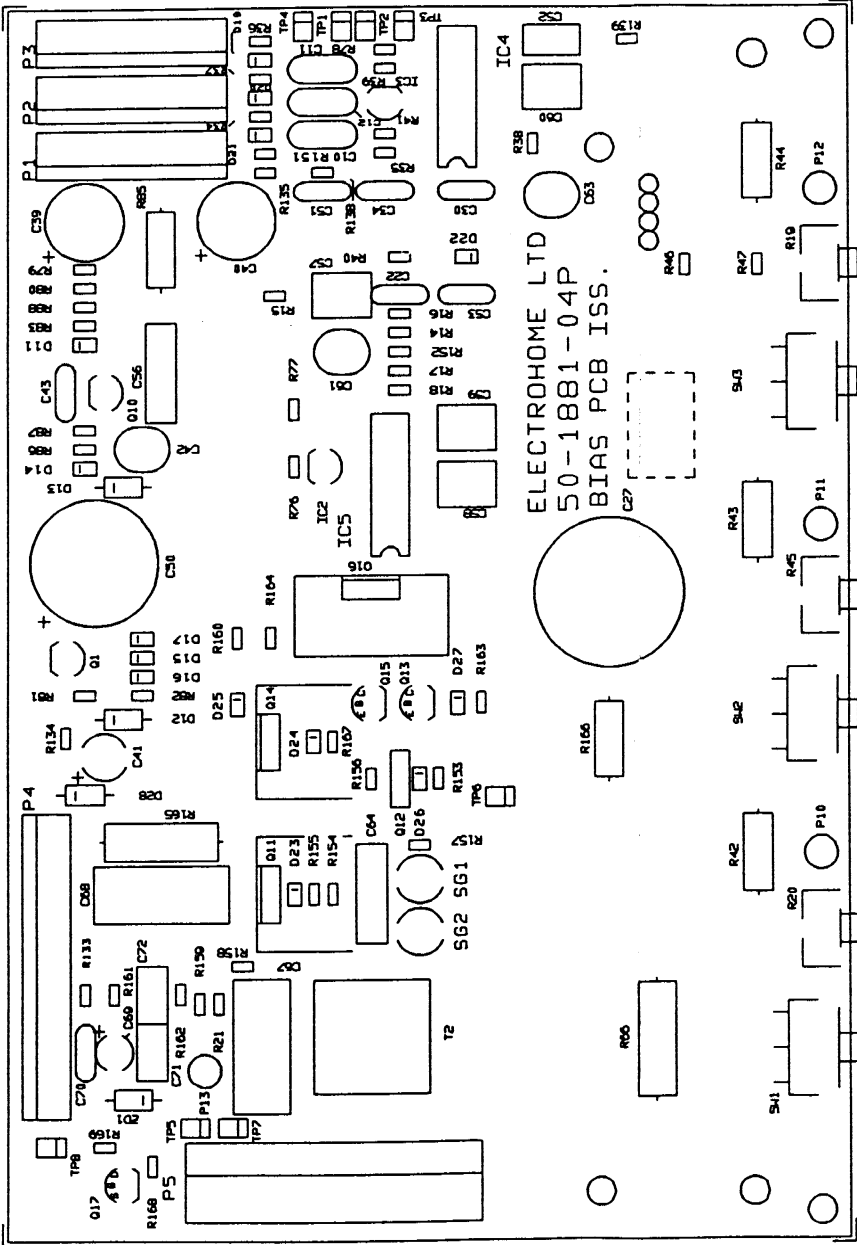
STEP 5 – Completion

- a) Turn ON all 3 CRTs by moving SW1, SW2 and SW3 to the up position.

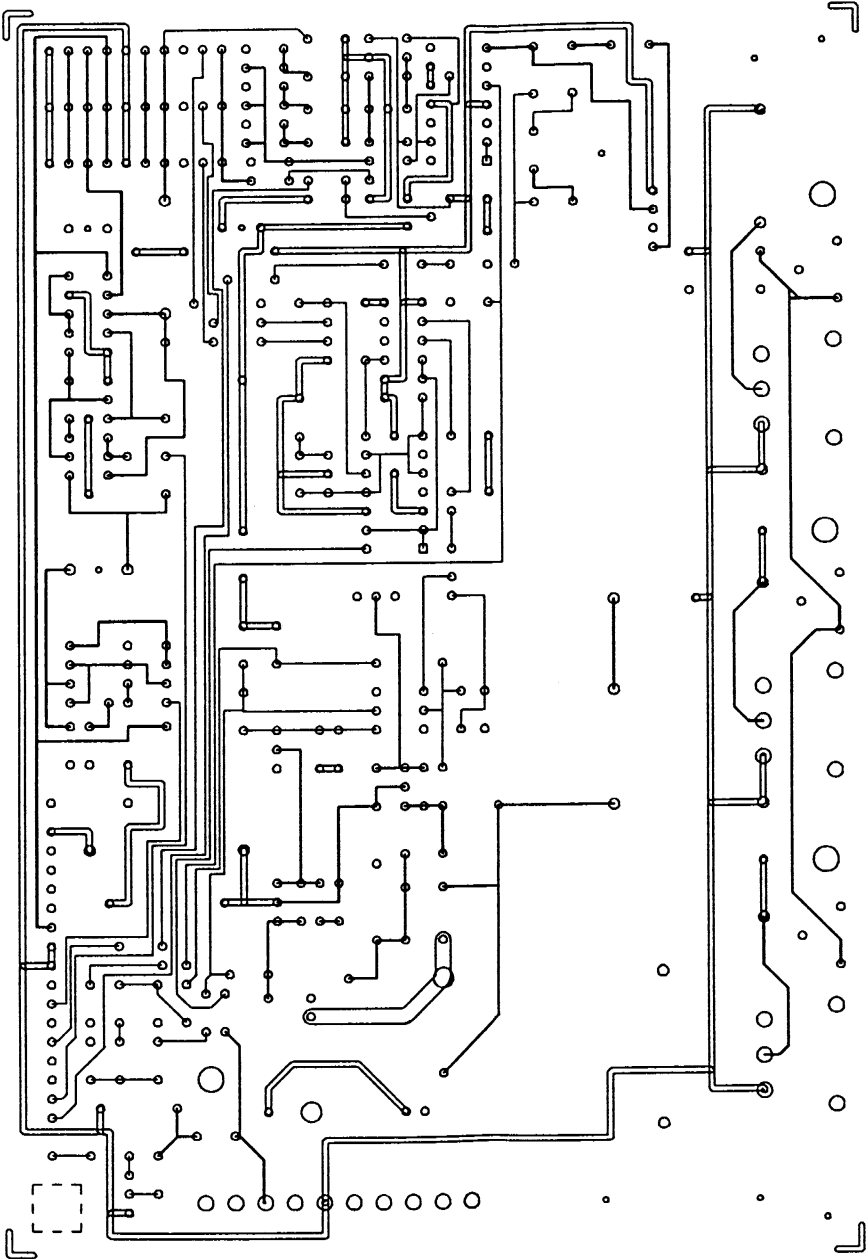
15.2 COMPONENT LAYOUT AND SCHEMATICS

Refer to the following pages for component layouts and schematics of the Bias module.

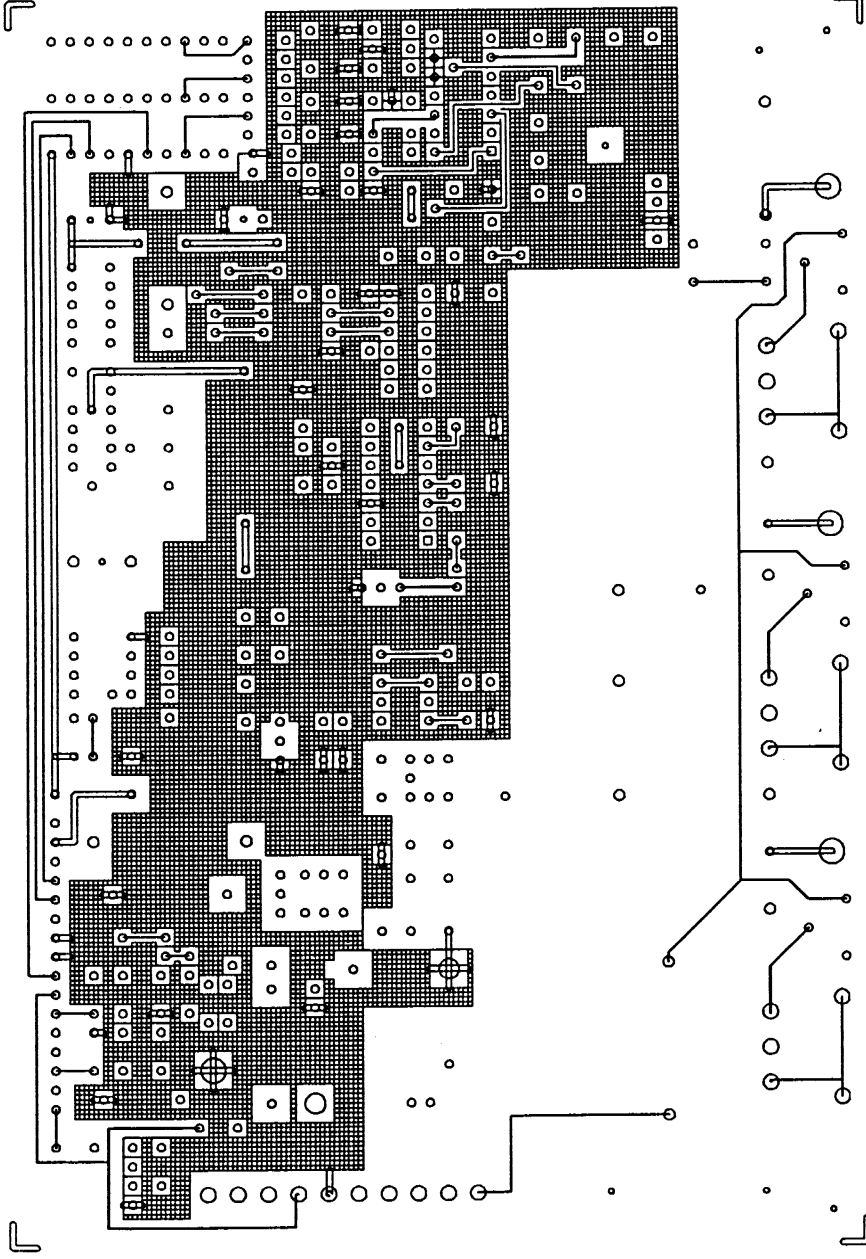
50-1881-04P ISS.1



Component Layout

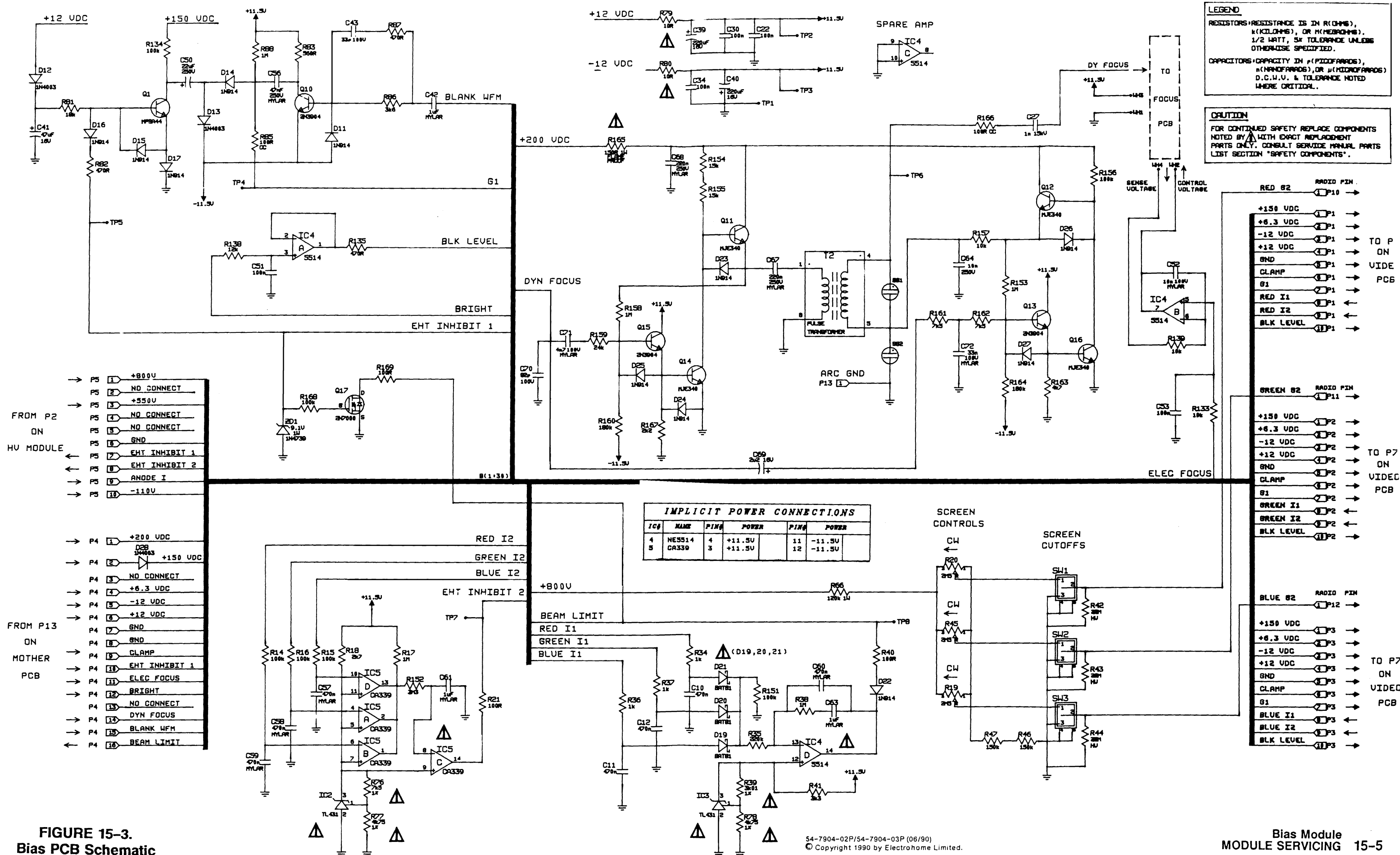


Solder Side
(Viewed from Component Side)



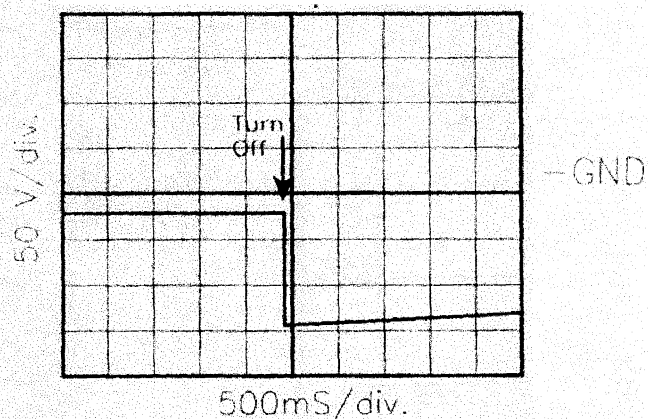
Component Side

FIGURE 15-2.
Bias PCB Component Layout

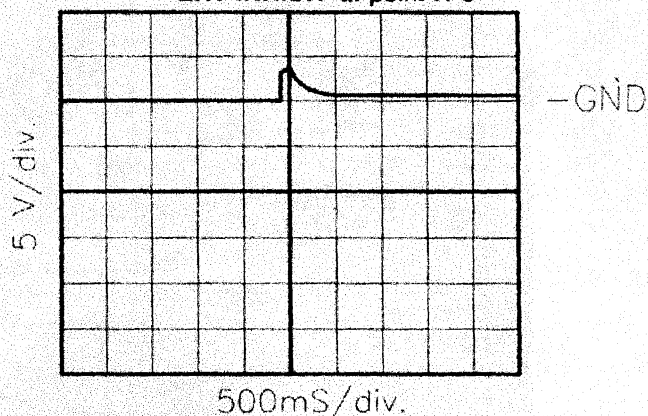


SCHEMATIC REFERENCE

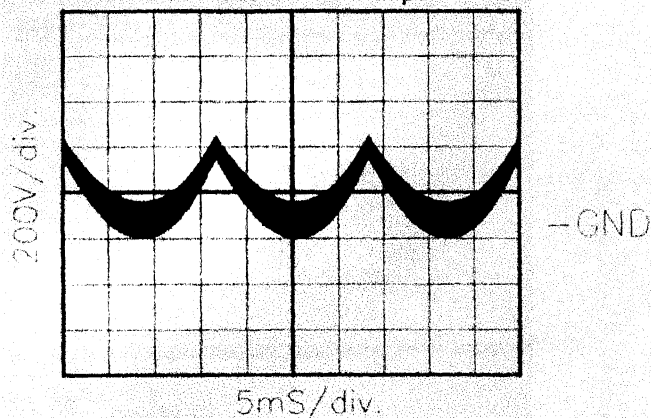
G1 at point TP4



EHT INHIBIT at point TP5



DYNAMIC FOCUS at point TP6



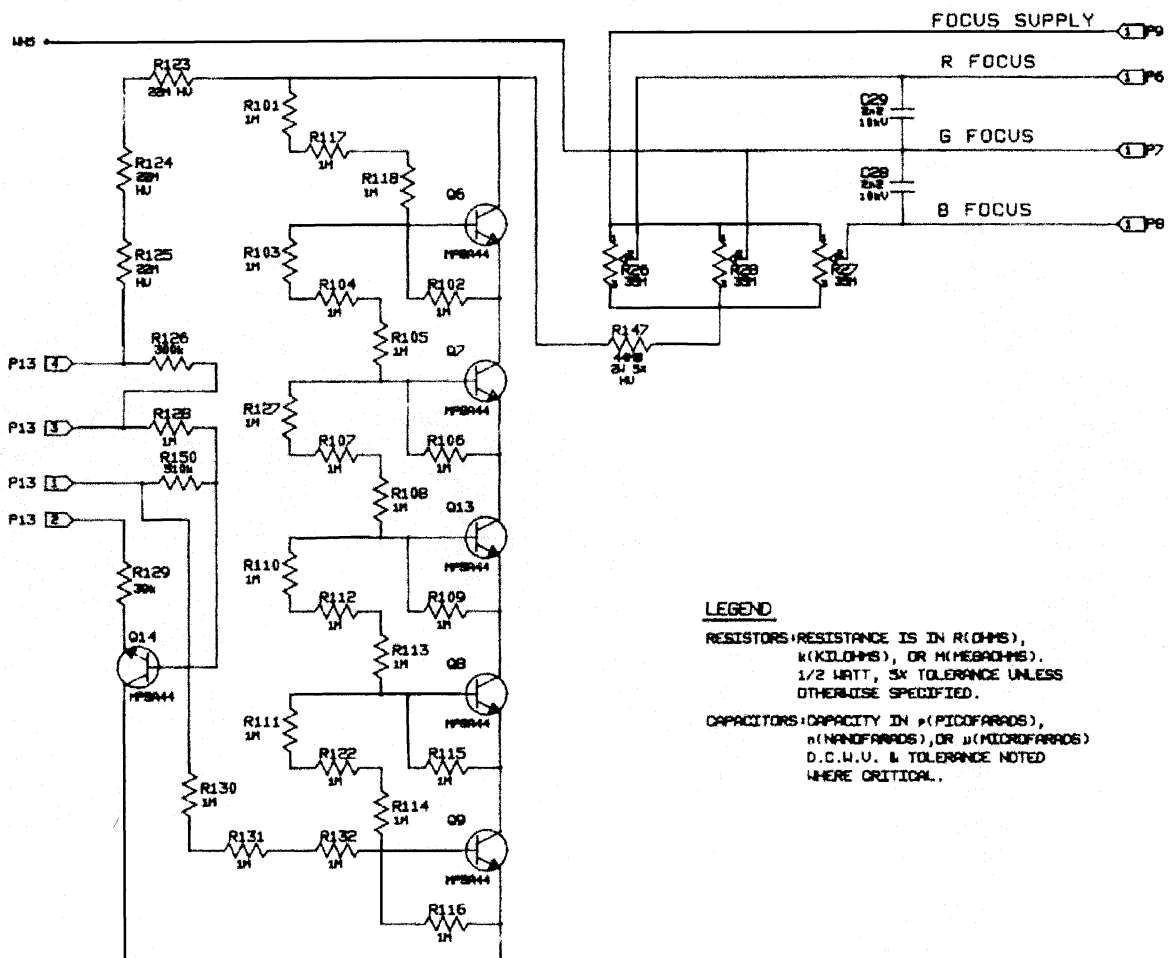






FIGURE 15-5. Focus PCB Schematic

15.4 PARTS LIST

15.4.1 Bias PCB Assembly

Item Ref.	Part No.	Description
Integrated Circuits		
 IC2,IC3	14-002833-01P	TL431C, precision shunt regulator SAFETY COMPONENT
 IC4	14-002813-08P	NE5514, quad linear amplifier SAFETY COMPONENT
 IC5	14-002154-01P	CA339, quad linear voltage comparator SAFETY COMPONENT
Transistors & Diodes		
Q1	14-000889-01P	MPSA44, small signal NPN, 400V, 0.3A, 0.6W
Q10,Q13,Q15	14-000881-06P	2N3904, NPN, 40V, 0.2A, 0.35W
Q11,Q12,Q14,Q16	14-000986-03P	MJE340, NPN, 300V, 0.5A, 20W
Q17	14-A00705-01P	2N7000, TMOS, 60V, 0.2A, 4W
D11,D14-D17, D22-D27	14-000513-01P	1N914, diode, 0.075A, 75V
D12,D13,D28	14-000525-53P	1N4003, rectifier diode, 1A, 200V
 D19,D20,D21	14-000533-01P	BAT81, Schottky barrler diode SAFETY COMPONENT
ZD1	14-000531-39P	1N4739A, zener diode, 9.1V, 1W
Capacitors		
C10,C11,C12	89-000032-02P	0.47 μ F, 50V, \pm 20%
C22,C30,C34, C51,C53	89-000032-03P	100 nF, 50V
C27	46-500002-02P	1 nF, 15KV, HV
C39,C40	84-422103-03P	220 μ F, 16V
C41	84-447003-02P	47 μ F, 16V
C42,C61,C63	88-171053-12P	1 μ F, 50V, mylar
C43	46-633031-10P	33 pF, 100V, N750
C50	44-422010-09P	22 uF, 250V
C52	88-171031-02P	10 nF, 100V, 10%
C56	48-174732-02P	47 nF, 250V, 10%, mylar
C57-C60	88-174740-12P	470 nF, 63V, 10%
C64	48-171032-02P	10 nF, 250V, 10%
C67,C68	48-172242-02P	220 nF, 250V, \pm 10%
C69	84-422506-01P	2.2 μ F, 50V, 20%, electrolytic
C70	86-682034-04P	82 pF, 2%, 100V
C71	88-174721-02P	4.7 nF, 100V, 10%, mylar
C72	88-173331-01P	33 nF, 100V, mylar

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15.4 PARTS LIST (cont.)

15.4.1 Bias PCB Assembly (cont.)

Item Ref.	Part No.	Description
Resistors		
R14-R16,R134, R151,R156,R168	80-110035-11P	100K, 1/2W, 5%, metal film
R17,R38,R88, R153,R158	80-110045-11P	1M, 1/2W, 5%, metal film
R18	80-127015-11P	2.7K, 1/2W, 5%, metal film
R19,R20,R45	41-000371-01P	2.5M, HV potentiometer
R21,R40,R169	80-110005-11P	100R, 1/2W, 5%, metal film
R34,R36,R37	80-110015-11P	1K, 1/2W, 5%, metal film
R35	80-122035-11P	220K, 1/2W, 5%
△ R39	82-330111-29P	3.01K, 1/3W, 1% SAFETY COMPONENT
R41	80-133015-11P	3.3K, 1/2W, 5%, metal film
R42-R44	80-222055-23P	22M, 1/2W, 5%, HV, metal glaze
R46,R47	80-115035-11P	150K, 1/2W, 5%, metal film
R66	40-424735-01P	47K, 1W, 5%
△ R76	82-375011-29P	7.5K, 1/4W, 1% SAFETY COMPONENT
△ R77,R78	82-347511-29P	4.75K, 1/3W, 1% SAFETY COMPONENT
△ R79,R80	80-110095-11P	10R, 1/2W, 5%, metal film SAFETY COMPONENT
R81	80-118025-11P	18K, 1/2W, 5%, metal film
R82,R87,R135	80-147005-11P	470R, 1/2W, 5%, metal film
R83	80-156005-11P	560R, 1/2W, 5%, metal film
R85,R166	40-221015-37P	100R, 1/2W, 5%, carbon
R86	80-136015-11P	3.6K, 1/2W, 5%, metal film
R133,R139,R157	80-110025-11P	10K, 1/2W, 5%, metal film
R138	80-112025-11P	12K, 1/2W, 5%, metal film
R152	40-123355-31P	3.3M, 1/4W, 5%
R154,R155	80-115025-11P	15K, 1/2W, 5%, metal film
R159	80-124025-11P	24K, 1/2W, 5%, metal film
R160,R164	80-118035-11P	180K, 1/2W, 5%, metal film
R161,R162	80-175015-11P	7.5K, 1/2W, 5%, metal film
R163	80-147015-11P	4.7K, 1/2W, 5%, metal film
△ R165	42-000136-01P	150R, 1W, 5% SAFETY COMPONENT
R167	80-122015-11P	2.2K, 1/2W, 5%
Coils, Transformers and Miscellaneous		
T2	24-170003-01P	dynamic focus transformer
SW1-SW3	26-000340-01P	right angle slide switch
SG1,SG2	27-000011-09P	argon lamp (spark gap)

15.4 PARTS LIST (cont.)

15.4.2 Focus PCB Assembly (Included as part of Bias module)

Item Ref.	Part No.	Description
Transistors and Diodes		
Q6-Q9,Q13,Q14	14-000889-01P	MPSA44, small signal NPN, 400V, 0.3A, 0.6W
Capacitors		
C28,C29	46-500004-01P	2200 pF, 10KV
Resistors		
R26-R28	41-000251-11P	35M, $\pm 10\%$, potentiometer
R101-R118,R122, R127,R128, R130-R132	80-110045-11P	1M, 1/2W, 5%, metal film
R123-R125	80-222055-23P	22M, 1/2W, 5%, metal film
R126	80-130035-11P	300K, 1/2W, 5%, metal film
R129	80-139025-11P	39K, 1/2W, 5%, metal film
R147	42-000128-01P	44.8M, 2W, 5%, high voltage
R150	80-151035-11P	510K, 1/2W, 5%, metal film

15-14 MODULE SERVICING

Bias Module

15.5 SPECIFICATIONS

Beam Limiter Circuit:

Plugs 1, 2 & 3 pin 8 **RGB I1** inputs
Signal Levels
(to Video Output modules) 0 to 6VDC
Input Resistance 100K Ω min

Plug 4, pin 16 **BEAM LIMIT** output
(P1, 2 & 3 pin 8 connected to +6VDC;
2.2K Ω resistor between +5V and P4, pin 16)
Signal 0.9VDC max
Output Impedance (+ve current) 100 Ω
Output Impedance (-ve current) ∞

Beam Over-Current Circuit:

Plugs 1, 2 & 3 pin 9 **RGB I2** inputs
Signal Levels
(to Video Output modules) 0 to 6VDC
Input Resistance 100K Ω min

Plug 5, pin 8 **EHT INHIBIT 2** output
(P1, or 2 or 3 pin 9 grounded; 4.7K Ω resistor between
+5V and P5, pin8)
Signal 0.5VDC max
(P1, or 2 or 3 pin 9 connected to 6.6VDC; 4.7K Ω resistor
between +5V and P5, pin8)
Signal 4.5VDC min

Brightness Circuit:

Plug 4, pin 12 **BRIGHTNESS** input
Signal Level 0 to 10VDC
Input Resistance 12K Ω min

Plugs 1 & 2, pin 10 **BLK LEVEL** output
(0 to 10V applied to P4, pin 12)
Signal Level 0 to 7.5VDC \pm 5%
Output Resistance 470 Ω nom
Load Impedance 1.6K Ω

Dynamic Focus Amplifier Circuit:

Plug 4, pin 14 **DYNAMIC FOCUS** input
Parabolic Waveform Level 0 to 10V p-p
Input Resistance 16K Ω min
Plugs 6, 7 & 8, pin 1 **RGB FOCUS** output

WARNING

HIGH VOLTAGE!

Parabola Output at TP6

amplifier bias point 198 to 242VDC
Clipping Levels w.r.t. Vertical Parabola
bottom of parabola 80V max
top of parabola 450V min

NOTE: For version 02P, the following apply:

TP6 bias 72VDC nom.
vertical parabola 160V p-p nom.
horizontal parabola 240V p-p nom.

Electrical Focus Circuit:

Plug 4, pin 11 **ELECTRICAL FOCUS** input
Signal Level 0 to 10VDC
Input Resistance 10K Ω min

Plugs 6, 7 & 8 **RGB FOCUS** output
(master focus set to center)
Signal Level 8.9 to 10.4KV
(individual controls set at minimum master focus range)
Signal Level 800V min

G1 Circuit:

Plug 4, pin 10 **EHT INHIBIT 1** input
pin 15 **COMP BLANKING** input
HC Level 0 to 5V

Plugs 1 & 2, pin 7 G1 grid 1 bias out
no blanking,
spot kill OFF -11 to -10V
blanking @ min -35 to -30V
connection to EHT INHIBIT 1 opened,
momentary G1 level -160V max
(exponential decay to 0 after 22 s)

blanking dynamic response

rise time 200 ns max
fall time 100 ns max

vertical pulse

2.5 ms pulse width,
18 ms period 5V

spot killer dynamic response

rise time 20 s min
fall time 150 μ s max

G2 Circuit:

Input Controls R19,R20,R45,SW1,SW2,SW3
Output RGB G2
Output Level 210V to 760V

Power Supplies:

Plug 9 Focus supply
Level 170 μ A nom
Plug 5, pin 1 800V \pm 5%
Load Current 0.5mA nom

Plug 5, pin 3 +550V \pm 5%
Load Current 9mA nom
NOTE: This pin is not required on version 02P.

Plug 4, pin 2 Video B, +150V
Load Current 3mA max

Plug 4, pin 6 +12VDC
Load Current 30mA

Plug 4, pin 5 -12VDC
Load Current 30mA