

## SECTION 8

### BIAS MODULE

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## SECTION 8

### BIAS MODULE

#### 8.1 TECHNICAL DESCRIPTION

##### 8.1.1 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.

##### 8.1.2 Circuit Description

###### 8.1.2.1 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 Read 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.

###### 8.1.2.2 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.

###### 8.1.2.3 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<sub>p-p</sub> 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.

###### 8.1.2.4 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.

##### 8.1.2.5 Static Focus

The static focus circuit provides an adjustable (8.9KV to 10.4KV) focus voltage to the CRTs from a 17KV tap in the High Voltage module. Potentiometers R26 through R28 of the focus board provide individual adjustment of the focus voltage for each CRT. IC4B, Q6, Q7, Q8, Q9, Q13 and Q14 form a 2kV shunt regulator for fine master focus. The regulator is controlled by the 0-10V electronic focus signal from the Remote Control module.

##### 8.1.2.6 Dynamic Focus

A dynamic focus voltage is generated by two amplifiers to supply the parabolic voltage required between the center and edge of the raster. Q12, Q13 and Q16 form a low frequency amplifier which amplifies the vertical rate parabola of the dynamic focus signal. Amplifier gain is approximately 65. Q11, Q14 and Q15 amplify the horizontal parabola approximately 40 times to drive T2. T2 steps up the horizontal parabola approximately 1.7 times and combines the output with the vertical parabola, generating a composite parabola of roughly 400V<sub>p-p</sub>. 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.

#### 8.2 SERVICING AND ALIGNMENT

##### 8.2.1 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 top cover as described in Section 5.2.

b) Locate the Bias module and disconnect the P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, and P12 connectors. (Refer to Appendix C, *Harness/Wiring Diagram* for reconnection.)

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

d) Lift the Bias module from the projector.

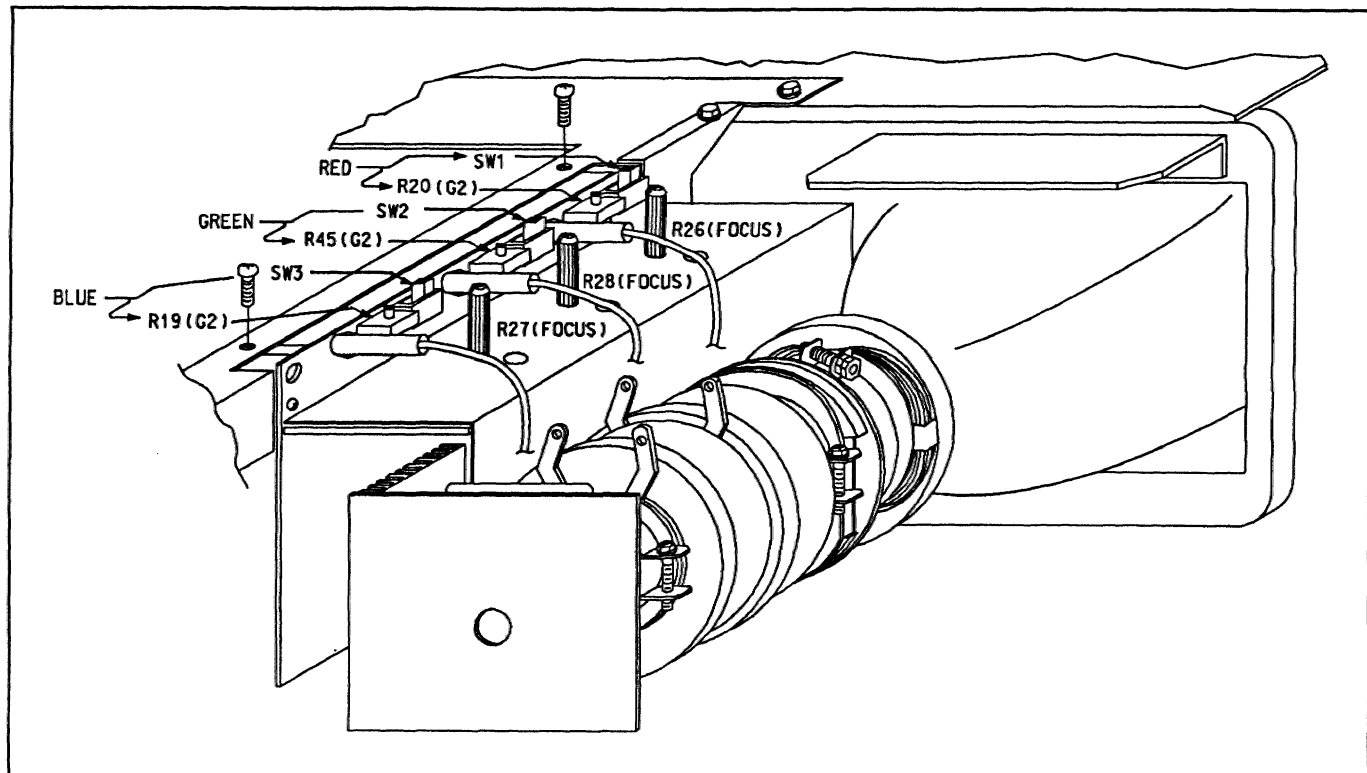


FIGURE 8-1. Bias Module Removal/Alignment

02080824

### 8.2.2 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 8-1.

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 Blue Focus

- a) Turn OFF the green and red CRTs by moving slide switches, SW2 and SW3, up. The projected image should be blue.

- b) Adjust BRIGHTNESS, CONTRAST and FOCUS to 5 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 blue CRT by moving slide switch SW1 up. Turn on the green CRT by moving SW2 down. SW3, should be in the up position. The projected image should be green.

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

#### STEP 4 - Adjust Red Focus

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

- 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 down position.

### 8.3 COMPONENT LAYOUT AND SCHEMATICS

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

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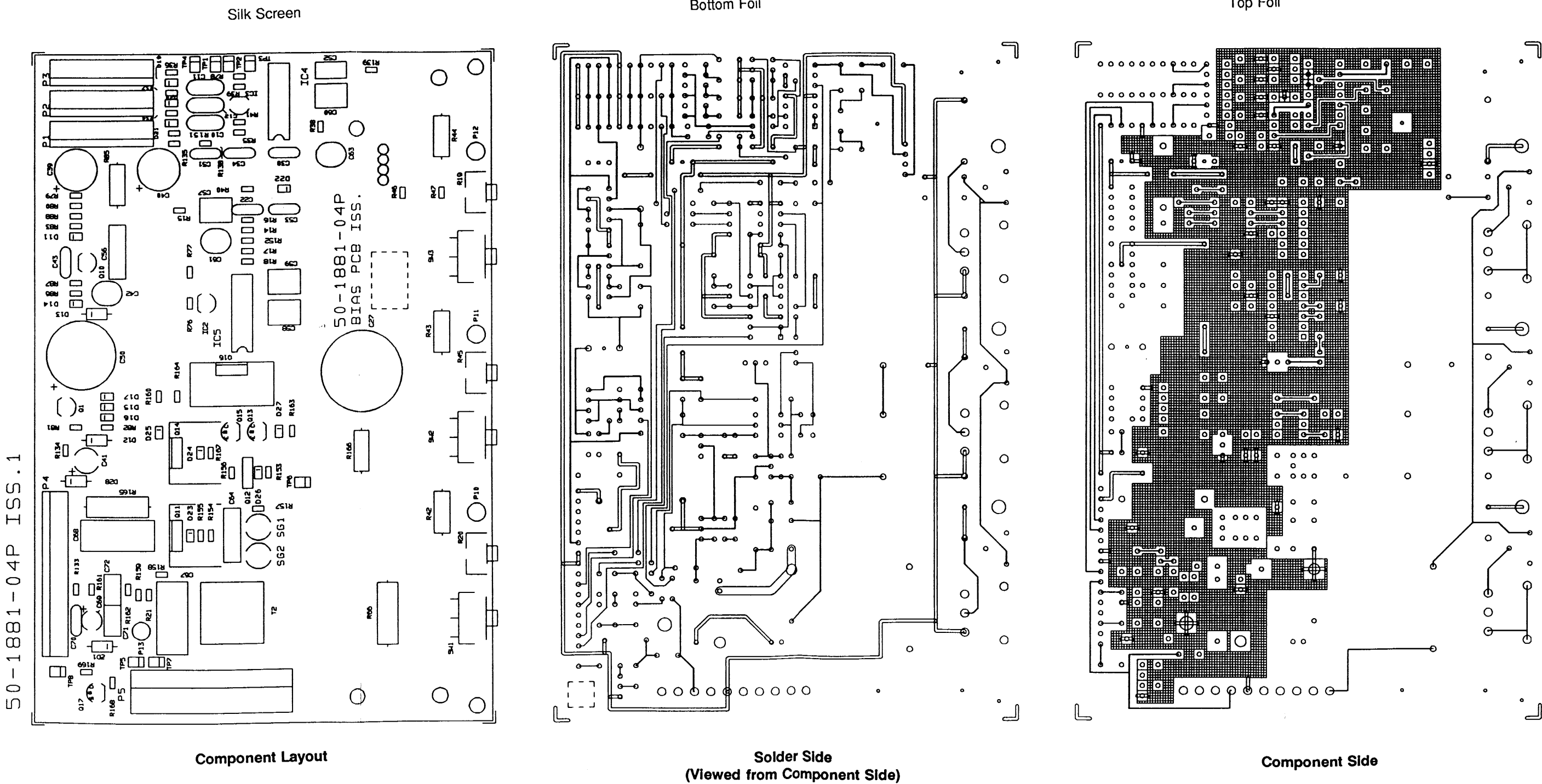
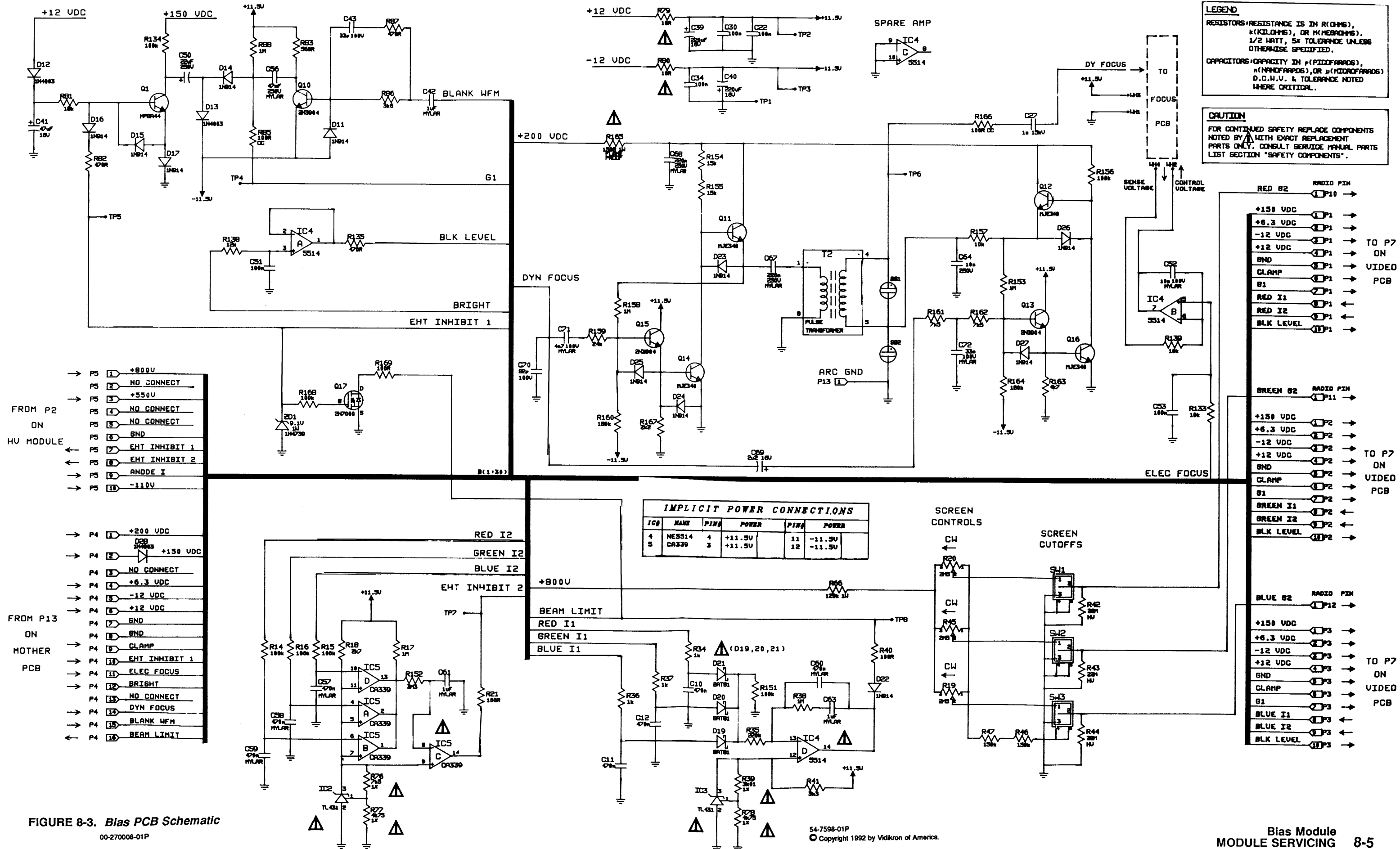
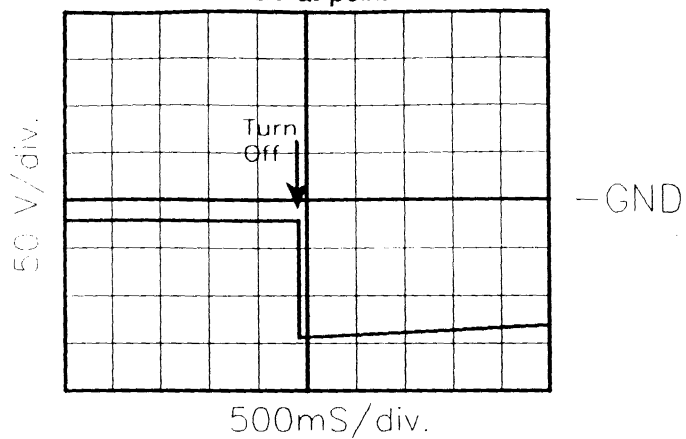


FIGURE 8-2. Bias PCB Component Layout

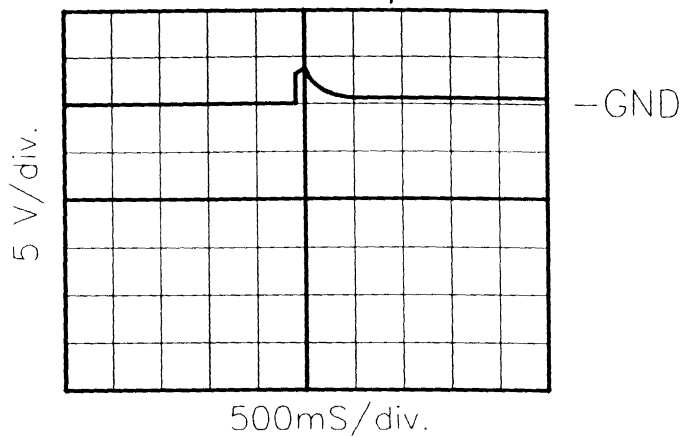


**SCHEMATIC REFERENCE**

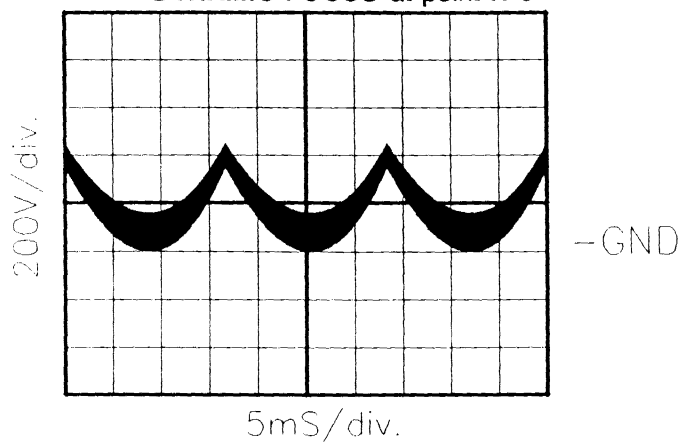
**G1 at point TP4**



**EHT INHIBIT at point TP5**

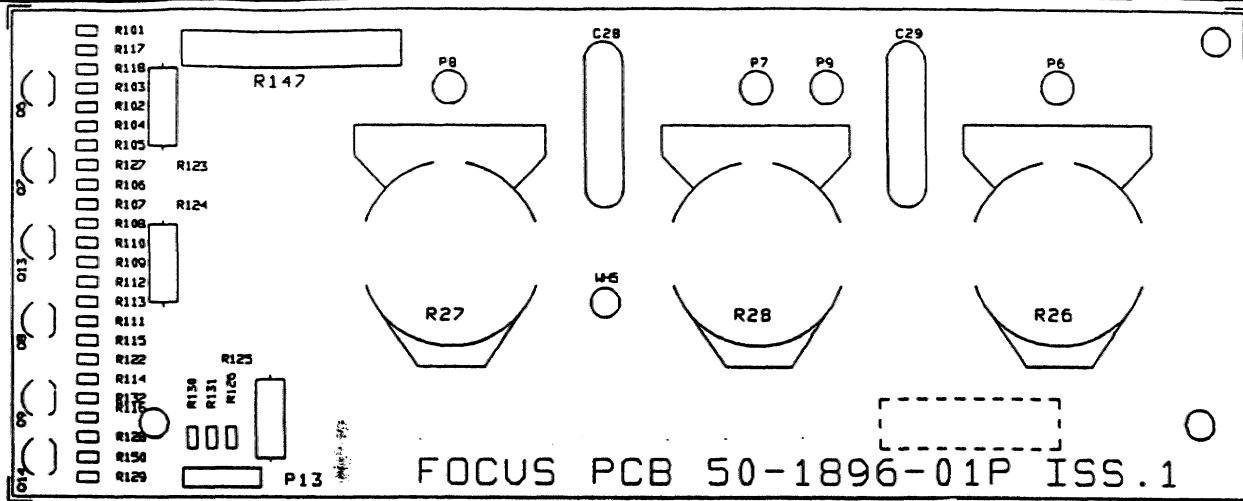


**DYNAMIC FOCUS at point TP6**

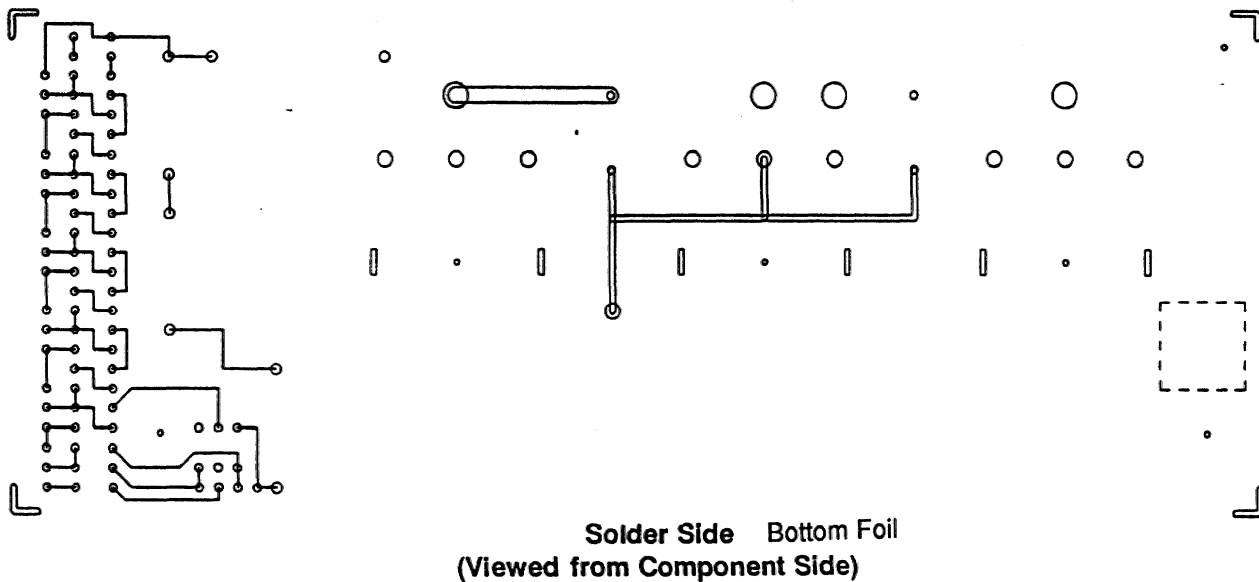


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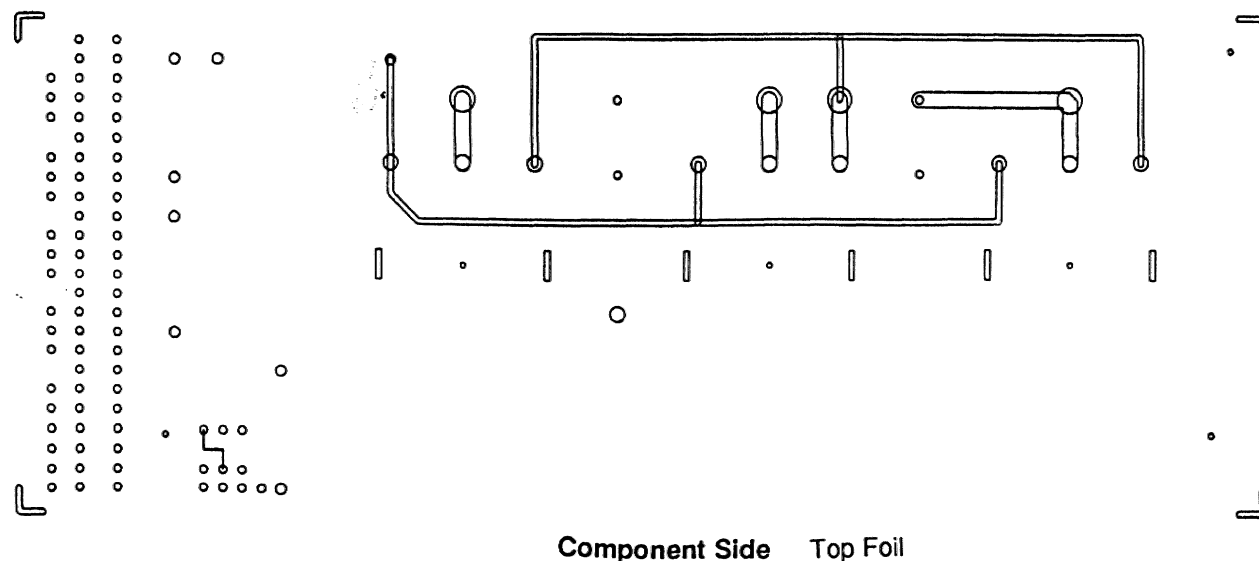




Component Layout Silk Screen

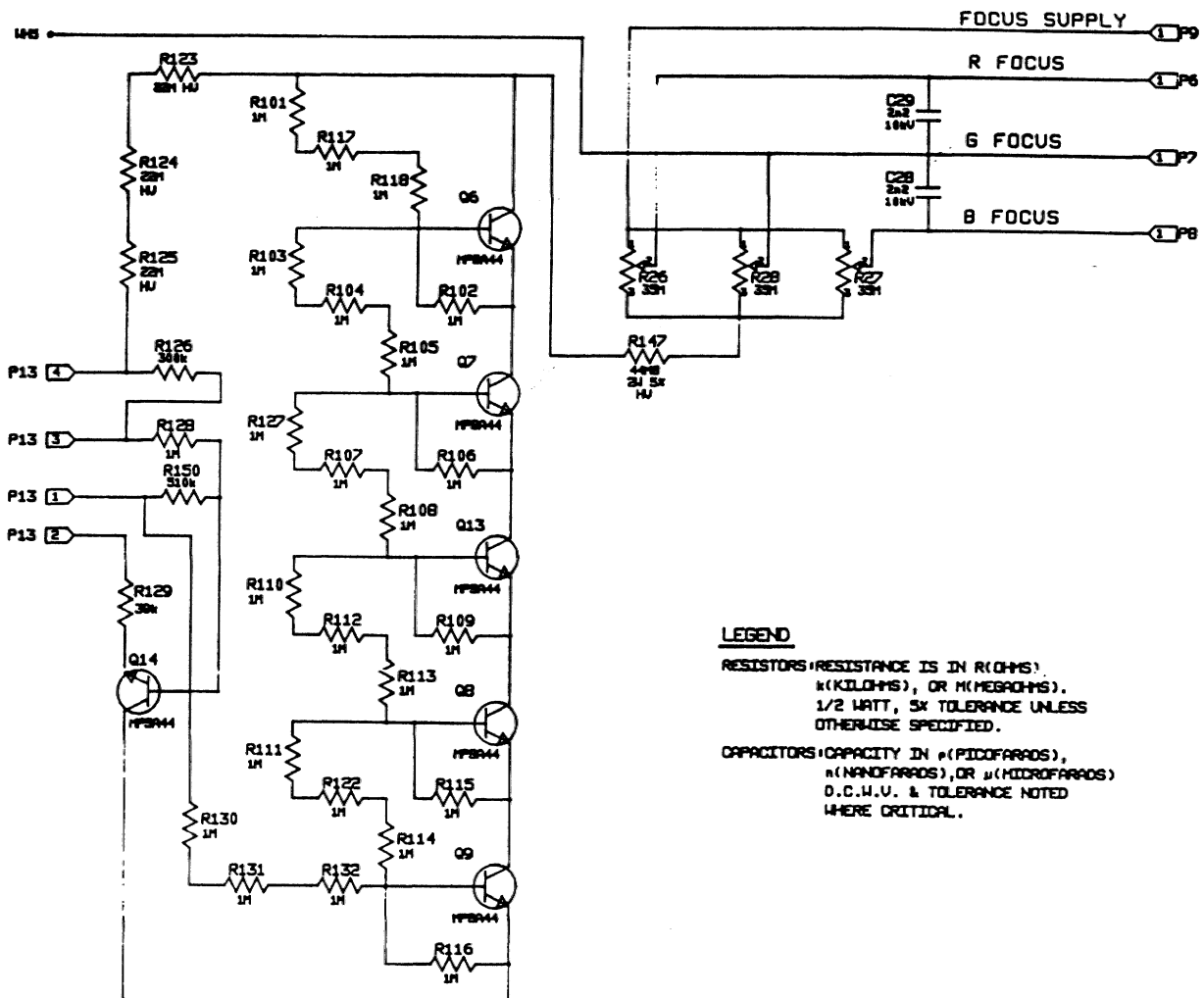


Solder Side Bottom Foil  
(Viewed from Component Side)



Component Side Top Foil

FIGURE 8-4. Focus PCB Component Layout



#### LEGEND

RESISTORS: RESISTANCE IS IN  $\Omega$  (OHMS),  
K (KILOHMS), OR M (MEGAHMS).  
1/2 WATT, 5% TOLERANCE UNLESS  
OTHERWISE SPECIFIED.

CAPACITORS: CAPACITY IN p (PICOFARADS),  
n (NANOFARADS), OR  $\mu$  (MICROFARADS).  
D.C.H.V. & TOLERANCE NOTED  
WHERE CRITICAL.

FIGURE 8-5. Focus PCB Schematic

00-250008-02P



## 8.4 PARTS LIST

▲ - CRITICAL SAFETY COMPONENT  
(REPLACE WITH IDENTICAL PART)

## 8.4.1 Bias PCB Assembly

Item Ref.	Part No.	Description
<b>Integrated Circuits</b>		
▲ IC2,IC3	IC-14-002833-01P	TL431C, precision shunt regulator
▲ IC4	IC-14-002813-08P	NE5514, quad linear amplifier
▲ IC5	IC-14-002154-01P	CA339, quad linear voltage comparator
<b>Transistors &amp; Diodes</b>		
Q1	TR-14-000889-01P	MPSA44, small signal NPN, 400V, 0.3A, 0.6W
Q10,Q13,Q15	TR-14-000881-06P	2N3904, NPN, 40V, 0.2A, 0.35W
Q11,Q12,Q14,Q16	TR-14-000986-03P	MJE340, NPN, 300V, 0.5A, 20W
Q17	TR-14-A00705-01P	2N7000, TMOS, 60V, 0.2A, 4W
D11,D14-D17,D22-D27	D-14-000513-01P	1N914, diode, 0.075A, 75V
D12,D13,D28	D-14-000525-53P	1N4003, rectifier, 1A, 200V
▲ D19-D21	D-14-000533-01P	BAT81, Schottky barrier diode
ZD1	DZ-14-000531-39P	1N4739A, zener diode, 9.1V, 1W
<b>Capacitors</b>		
C10-C12	C-89-000032-02P	0.47 $\mu$ F, 50V, $\pm$ 20%, ceramic, multi layer
C22,C30,C34,C51,C53	C-89-000032-03P	100 nF, 50V, 20%, ceramic, multi layer
C27	C-46-500002-02P	1 nF, 15KV, HV, ceramic disc
C39,C40	C-84-422104-03P	220 $\mu$ F, 25V, electrolytic
C41	C-84-447004-02P	47 $\mu$ F, 25V, electrolytic
C42,C61,C63	C-88-171053-12P	1 $\mu$ F, 50V, mylar
C43	C-46-633031-10P	33 pF, 100V, N750, ceramic
C50	C-44-422010-08P	22 $\mu$ F, 250V, electrolytic
C52	C-88-171031-02P	10 nF, 100V, 10%, mylar
C56	C-48-174732-02P	47 nF, 250V, 10%, mylar
C57-C60	C-88-174740-12P	470 nF, 63V, 10%, mylar
C64	C-48-171032-02P	10 nF, 250V, 10%, mylar
C67,C68	C-48-172242-02P	220 nF, 250V, $\pm$ 10%, mylar
C69	C-84-422506-01P	2.2 $\mu$ F, 50V, 20%, electrolytic
C70	C-86-682034-04P	82 pF, 2%, 100V, ceramic
C71	C-88-174721-02P	4.7 nF, 100V, 10%, mylar
C72	C-88-173331-01P	33 nF, 100V mylar
<b>Resistors</b>		
R14-R16,R134,R151, R156,R168	R-80-110035-11P	100K, 1/2W, 5%, metal film
R17,R38,R88,R153, R158	R-80-110045-11P	1M, 1/2W, 5%, metal film
R18	R-80-127015-11P	2.7K, 1/2W, 5%, metal film
R19,R20,R45	VR-41-000371-01P	2.5M, HV potentiometer
R21,R40,R169	R-80-110005-11P	100R, 1/2W, 5%, metal film
R34,R36,R37	R-80-110015-11P	1K, 1/2W, 5%, metal film
R35	R-80-122035-11P	220K, 1/2W, 5%, metal film
▲ R39	R-82-330111-29P	3.01K, 1/3W, 1%
R41	R-80-133015-11P	3.3K, 1/2W, 5%, metal film
R42-R44	R-80-222055-23P	22M, 1/2W, 5%, HV, metal glaze

## 8.4 PARTS LIST (cont.)

⚠ - CRITICAL SAFETY COMPONENT  
(REPLACE WITH IDENTICAL PART)

### 8.4.1 Bias PCB Assembly (cont.)

Item Ref.	Part No.	Description
<b>Resistors</b>		
R46,R47	R-80-115035-11P	150K, 1/2W, 5%, metal film
R66	R-40-424735-01P	47K, 1/2W, 5%, metal film
⚠ R76	R-82-375011-29P	7.5K, 1%, 1/3W, 5%, metal film
⚠ R77,R78	R-82-347511-29P	4.75K, 1/3W, 1%
⚠ R79,R80	R-80-110095-11P	10R, 1/2W, 5%, metal film
R81	R-80-118025-11P	18K, 1/2W, 5%, metal film
R82,R87,R135	R-80-147005-11P	470R, 1/2W, 5%, metal film
R83	R-80-156005-11P	560R, 1/2W, 5%, metal film
R85,R166	R-40-221015-37P	100R, 1/2W, 5%, carbon
R86	R-80-136015-11P	3.6K, 1/2W, 5%, metal film
R133,R139,R157	R-80-110025-11P	10K, 1/2W, 5%, metal film
R138	R-80-112025-11P	12K, 1/2W, 5%, metal film
R152	R-40-123355-31P	3.3M, 1/4W, 5%, metal film
R154,R155	R-80-115025-11P	15K, 1/2W, 5%, metal film
R159	R-80-124025-11P	24K, 1/2W, 5%, metal film
R160,R164	R-80-118035-11P	180K, 1/2W, 5%, metal film
R161,R162	R-80-175015-11P	7.5K, 1/2W, 5%, metal film
R163	R-80-147015-11P	4.7K, 1/2W, 5%, metal film
⚠ R165	R-42-000136-01P	150R, 1W, 5%, C/S
R167	R-80-122015-11P	2.2K, 1/2W, 5%, metal film

### Coils, Transformers and Miscellaneous

T2	T-24-170003-01P	transformer, dynamic focus
SG1,SG2	SG-27-000011-09P	lamp, argon
SW1-SW3	S-26-000340-01P	switch, right angle, slide

### 8.4.2 Focus PCB Assembly (included as part of Bias module)

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

**8.5 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 $\Omega$  min

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

**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 $\Omega$  min

Plug 5, pin 8 ..... **EHT INHIBIT 2** output  
(P1, or 2 or 3 - pin 9 grounded; 4.7K $\Omega$  resistor between  
+5V and P5, pin8)  
Signal ..... 0.5VDC max  
(P1, or 2 or 3 - pin 9 connected to 6.6VDC; 4.7K $\Omega$  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 $\Omega$  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 $\Omega$  nom  
Load Impedance ..... 1.6K $\Omega$

**Dynamic Focus Amplifier Circuit:**

Plug 4, pin 14 ..... **DYNAMIC FOCUS** input  
Parabolic Waveform Level ..... 0 to 10V p-p  
Input Resistance ..... 16K $\Omega$  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

**Electrical Focus Circuit:**

Plug 4, pin 11 ..... **ELECTRICAL FOCUS** input  
Signal Level ..... 0 to 10VDC  
Input Resistance ..... 10K $\Omega$  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  $\mu$ 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  $\mu$ A nom  
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  
+12VDC  
Load Current ..... 30mA

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