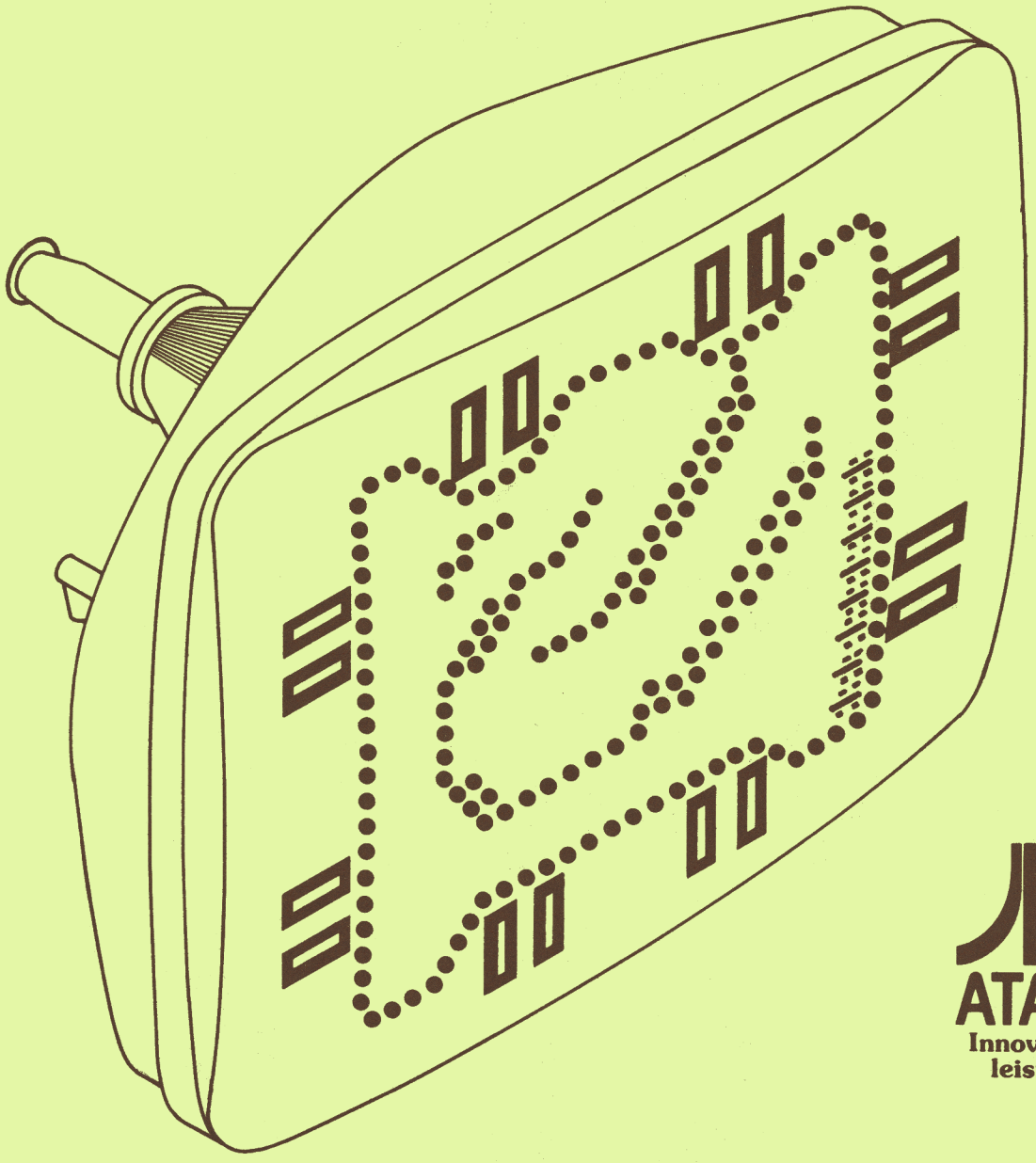
TM-053

G.E. #25MB COLOR MONITOR TROUBLESHOOTING MANUAL

For Indy 800 and similar games



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ATARI INC. 14600 WINCHESTER BLVD, LOS GATOS, CA 95030 (408) 374-2440 TELEX 357-488
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IMPORTANT NOTE TO

TV REPAIR TECHNICIANS

The TV used in this game is a General Electric 25 MB chassis and is used as a video amplifier. The tuner, IF, audio, and chroma modules have been removed. Information from the computer is fed directly to the RGB module, via an Atari PCB plugged in, in place of the chroma module.

All remaining modules and circuits remain as original and are approached as are all other 25 MB chassis. Service adjustments are the same with the following exceptions:

1.) The RGB drives located on the RGB module are factory-set and should not be adjusted.

2.) The RGB screen adjustments are made with a picture and the brightness control set at maximum. Use the background as the reference.

3.) There is no contrast control.

Further details on this GE chassis are found in this manual.

Note: There will be no raster without computer information.
Use Sams Photofact 1400.

TABLE OF CONTENTS

I. INTRODUCTION

The purpose of this manual is to familiarize the technician with the basic Indy 800 TV monitor, identify the more common problems, and localize the defective area in minimum time. In addition, the troubleshooting procedures can effectively be utilized in over-the-phone discussions between distributor and operator.

1.1 INPUT REQUIREMENTS

Computer information to the TV consists of vertical and horizontal sync pulses from the sync board, car and score information from the score board and also +5 volts from the score board.

1.2 SIGNAL PATHS

The block diagram shown in Figure 1 depicts the TV modules or circuits and describes the functions of each section (see next page).

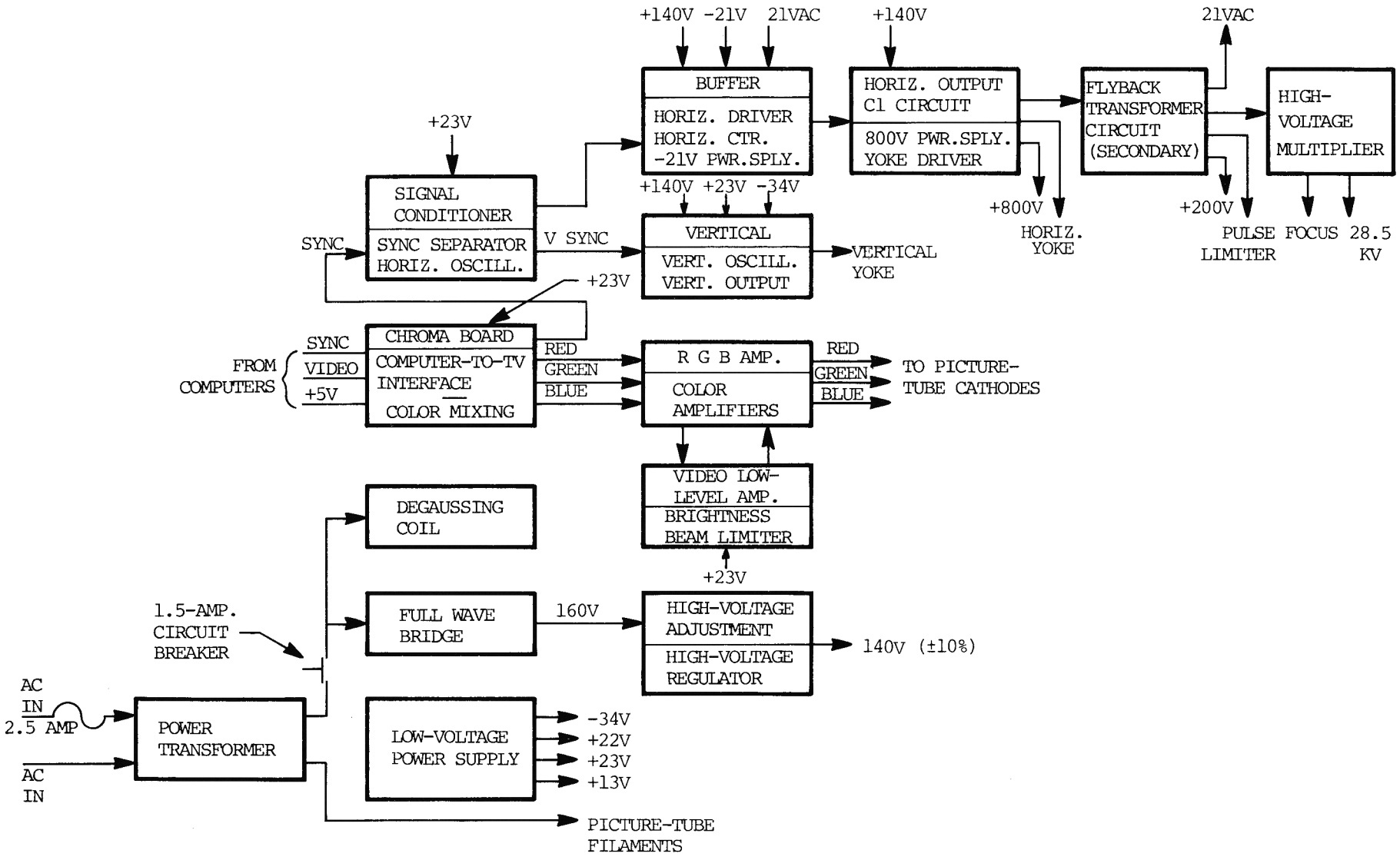


Figure 1: Block Diagram, GE 25 MA/MB Color Television Chassis

2.1 VERTICAL SIZE

Adjust until picture is filled from top to bottom.

2.2 VERTICAL CENTERING

Adjust until picture is centered between top and bottom.

2.3 FOCUS

Adjustment is made for maximum overall definition of fine picture detail. For this adjustment, turn brightness control down to barely a visible picture and adjust for definition of white objects.

2.4 HORIZONTAL HOLD

Adjust until picture is horizontally stable.

2.5 VERTICAL HOLD

Adjust until picture stops rolling top to bottom.

2.6 BRIGHTNESS

Adjust for sufficient brightness of white details, without losing focus.

Colors are formed using the three basic colors of the picture tube as in Table 1 below. For example, white consists of equal quantities of red, green, and blue; purple consists of red and blue, etc.

	Red	Green	Blue
White	X	X	X
Yellow	X	X	
Peach		X	X
Green		X	
Purple	X		X
Red	X		
Blue			X
Light Blue*	X	X	X

*Unequal quantities

Table 1: Indy 800 Color Mixtures

From the above table, you can determine which color is missing in TV problems. For instance, if the blue car and score are missing, the white score and car will appear as yellow, and the peach score and car will be green.

3.1 Measure collector voltages (large heat sinks on RGB board) of three outputs. All three should be around 125 volts. An unusual reading of one output from the other two indicates a defective amplifier stage.

3.2 Pull off the bad color lead from the RGB board and insert in its place one of the other known good color leads.

3.2.1 If a color now appears, the problem lies in the RGB amplifier or chroma board.

3.2.2 If a color does not appear, the problem lies in a bad picture tube, picture tube socket or screen drive control.

IV. COLOR SCREEN ADJUSTMENTS

These adjustments are made to set the voltages of the picture screen grids at a proper level so that each color gun produces an equal brightness on the screen. The red, green, and blue screen controls are located above the focus control (refer to Figure 2).

4.1 Turn all screen controls fully counterclockwise (minimum color).

4.2 Turn brightness fully clockwise (maximum brightness).

4.3 Increase red screen until red lines are barely visible in the background. (Do not be concerned with the scores, pylons, or cars.) Now slowly decrease red screen until red just disappears.

4.4 Repeat step 4.3 for blue and green screens.

4.5 Reduce brightness for acceptable playfield.

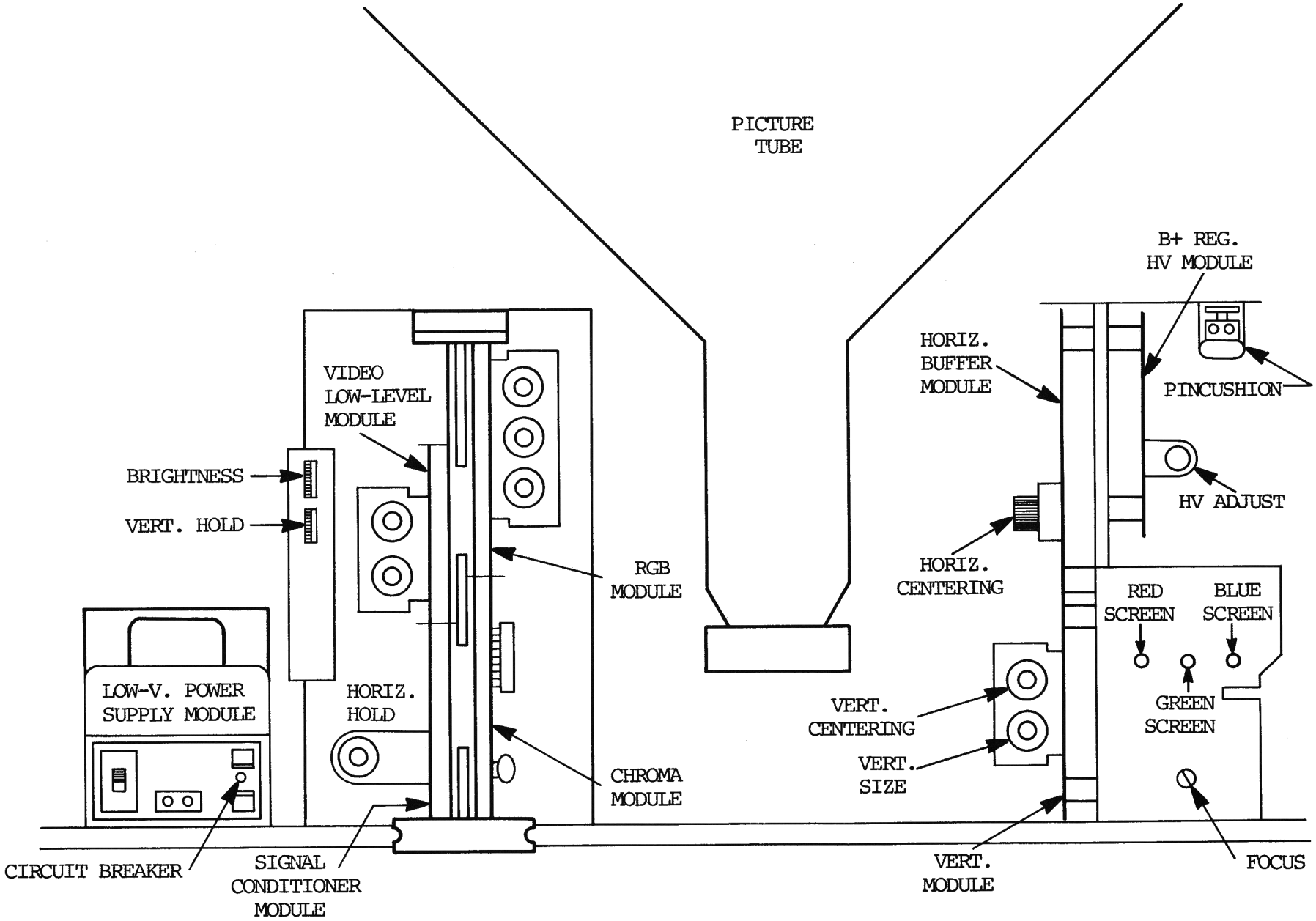


Figure 2: GE Monitor Chassis Layout

The primary purpose of convergence is to keep the cars and scores recognizable over the entire playing area at a normal viewing distance. Some imperfections occurring in the corners are normal. Since the picture tube is placed in the vertical position, the earth's magnetic field will greatly affect the purity and convergence. Factory color adjustments are made with the cars in the starting position facing south. ON LOCATION, THE GAME MUST FACE SOUTH TO MAINTAIN THE COLORS.

5.1 STATIC CONVERGENCE

This adjustment is made to converge the three color guns at the center of the picture. The four adjusting magnets are located on the neck of the picture tube on the convergence yoke assembly, right below the main yoke. The red adjustments move the color beam diagonally from left to right, while the green adjustment moves the beam diagonally from right to left. The two blue adjustments are for vertical and horizontal beam movement. See Figure 3 below.

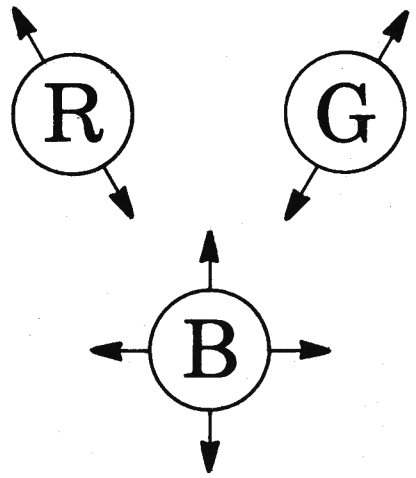


Figure 3: Directions of Red, Green and Blue Adjustments

Proceed as follows using one pylon at the center of the screen. Turn brightness down.

5.1.1 Adjust red and green dots until they are on top of one another.

5.1.2 Adjust blue vertical and horizontal to coincide with the red/green dot. At normal viewing distance, the dot or pylon should appear white.

5.1.3 Readjust red and green, if necessary.

5.2 DYNAMIC CONVERGENCE

10

These adjustments are necessary to correct convergence at the centers of all four sides. For this, use three or four pylons located right between pairs of scores at the outer edges of the race track. Do not be concerned with the pylons in the corners of the picture.

The procedure outlined in Figure 4 below is recommended for dynamic convergence. Two basic convergence functions are involved, the vertical (steps 5.2.1 through 6) and the horizontal steps 5.2.7 through 12).

VERTICAL:

5.2.1 Adjust the red/green vertical control until the red and green pylon dots on the far side (between the green and yellow scores) are either on top of one another or side-by-side.

5.2.2 Adjust the red/green vertical control as above except using the near-side pylons between the red and blue scores. Repeat steps 5.2.1 and 2 several times, since these controls affect one another.

5.2.3 Adjust the red/green horizontal control to bring the red and green dots together on the far side.

5.2.4 Adjust the red/green horizontal control as in step 5.2.3 except on the near-side pylons. Repeat steps 5.2.3 and 4 until good red/green convergence is obtained. In some extreme cases, such as a new picture tube, steps 5.2.1 through 4 may have to be repeated.

5.2.5 Adjust blue horizontal control to converge the blue dot on the far side.

5.2.6 Adjust blue horizontal control to converge the blue dot on the near side. Repeat steps 5.2.5 and 6 until the pylons appear white at the normal viewing distance.

HORIZONTAL:

The adjustment steps 5.2.7 through 12 are identical to 1 through 6, except that the pylons between the scores on the right and left sides are converged.

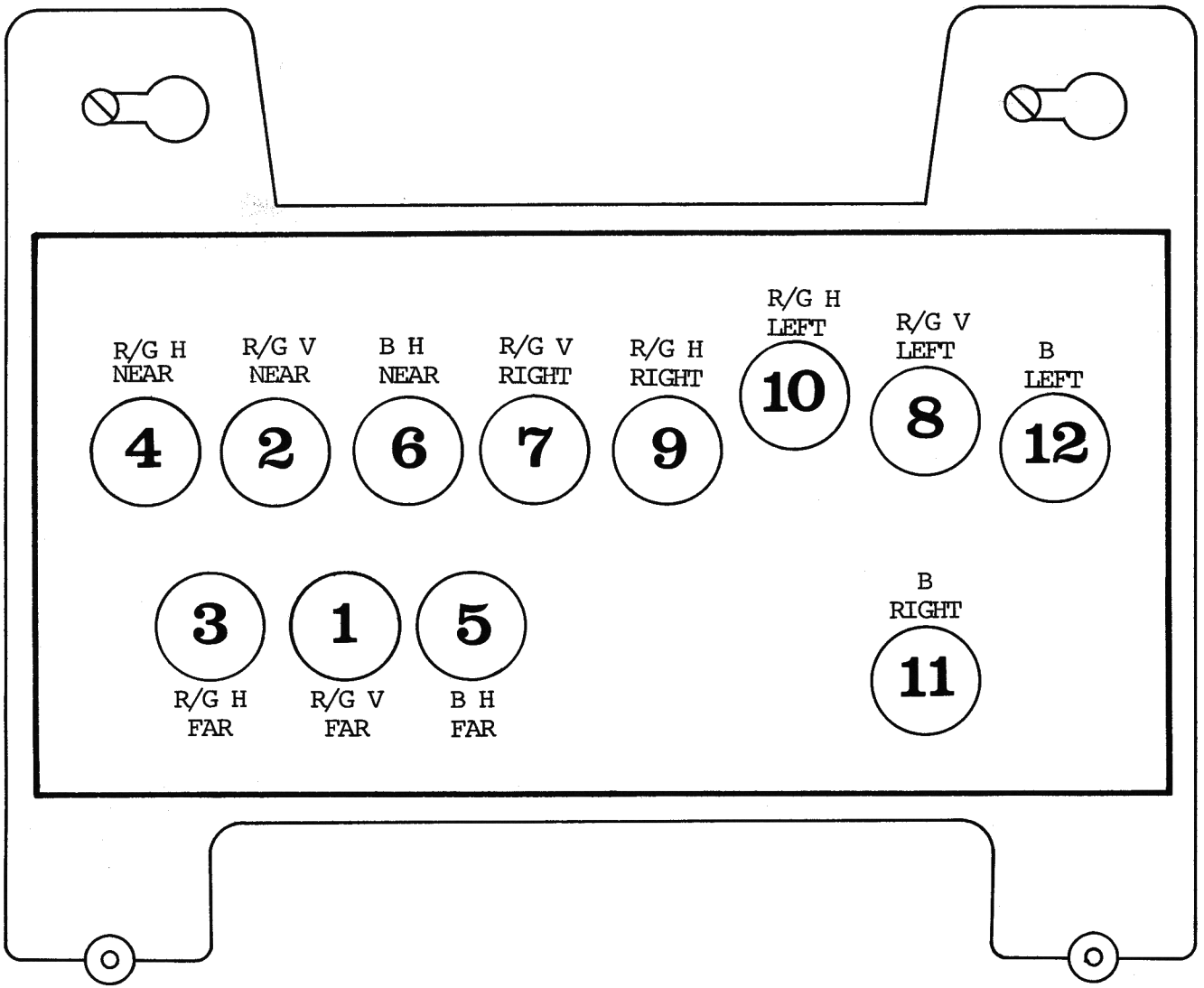


Figure 4: Correct Order of Making Dynamic Convergence Adjustments

6.1 Problem: No Picture, Fuse OK, Circuit Breaker OK, Filament of CRT Visible

A no-picture condition paired with an open fuse is generally a power supply problem. Since the color monitor used in video games differs from a normal TV because the screen will be black until some form of information is received, determination of the problem requires a different approach.

First measuring the collector voltages of the color output amplifiers is the most informative, because if they are alright, you can be fairly certain that the horizontal oscillator, the high-voltage regulator, and the horizontal output circuits are operating. Then proceed to the other measurements. See chart on next page.

6.2 Problem: Circuit Breaker Opens

There are two causes for this condition: either the output of the high-voltage regulator is greater than 155 volts or more than 2.0 amps are passing through the circuit breaker. In addition, we need to decide if the problem is dynamic or static.

A dynamic problem is found in the secondary of the high-voltage transformer, while the static is a DC problem that can occur anywhere from the power supply to the horizontal output transistor circuit. The first step, then, is to kill the horizontal oscillator by removing the signal conditioner board. Now proceed to troubleshoot. See chart on page 15.

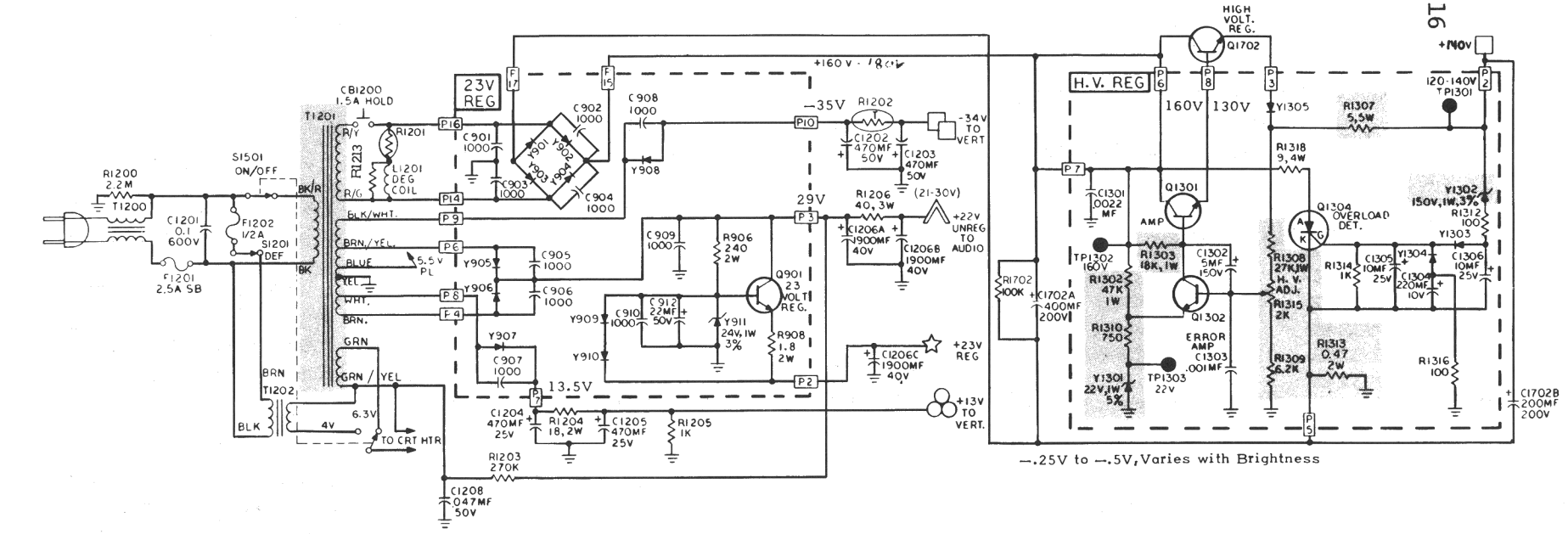
PROBLEM: No Picture, Fuse OK, Circuit Breaker OK, Filament of CRT Visible

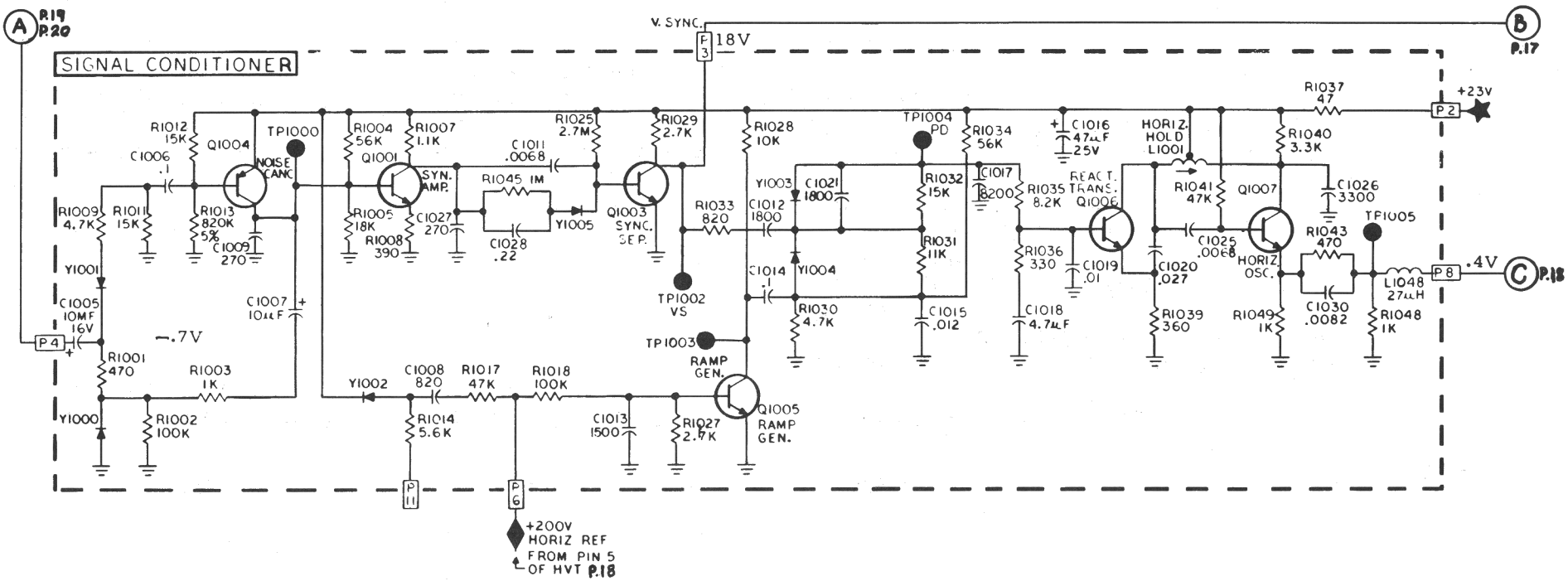
STEP	PROCEDURE	LOCATION	VOLTAGE MEASURED	RESULTS	PROCEED TO STEP
1	Measure collector voltage of color amplifier.	Three large heat sinks on RGB board.	115*	Indicates horizontal circuits are operating.	2
			0	No 200V from horizontal output.	5
			200	23V or -21V power supply defective, RGB board defective.	---
2	Measure voltage at pin 12 at input to chroma board.	Chroma board.	0	Computer problem. No 5V from score board.	---
			5	Computer ok.	3
3	Measure 800-volt power supply.	Grey wire on blue-screen drive.	800	Boost circuit ok.	4
			0	Defective diode Y1601.	---
4	Measure high voltage (use a 30KV probe).	CRT high-voltage cap.	28.5KV	Test picture tube.	---
5	Collector of horizontal buffer transistor.	Buffer module (the can of the large transistor).	85	Horizontal oscillator and buffer ok. Check diode Y1621 (200V diode) and horizontal output transformer.	---
			0	Check 140V power supply; if ok, you have a defective buffer board.	---
			140	No input to transistor.	6
6	Measure 23-volt power supply.	Pin 12 on signal conditioner board.	23	Defective signal conditioner board (horizontal oscillator).	---
			0	23-volt power supply defective.	---

*Range from 85V-145V permissible (a ±25% range)

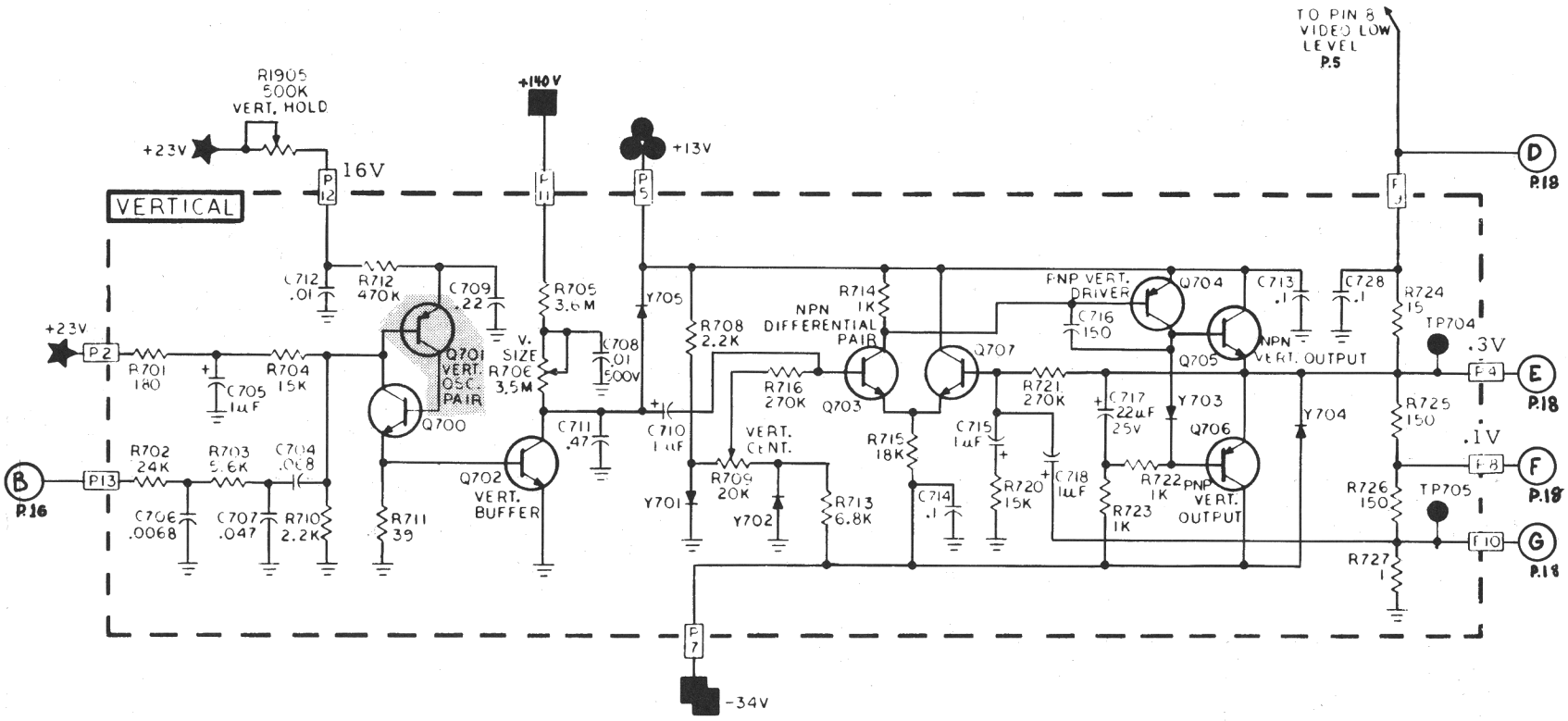
PROBLEM: Circuit Breaker Opens

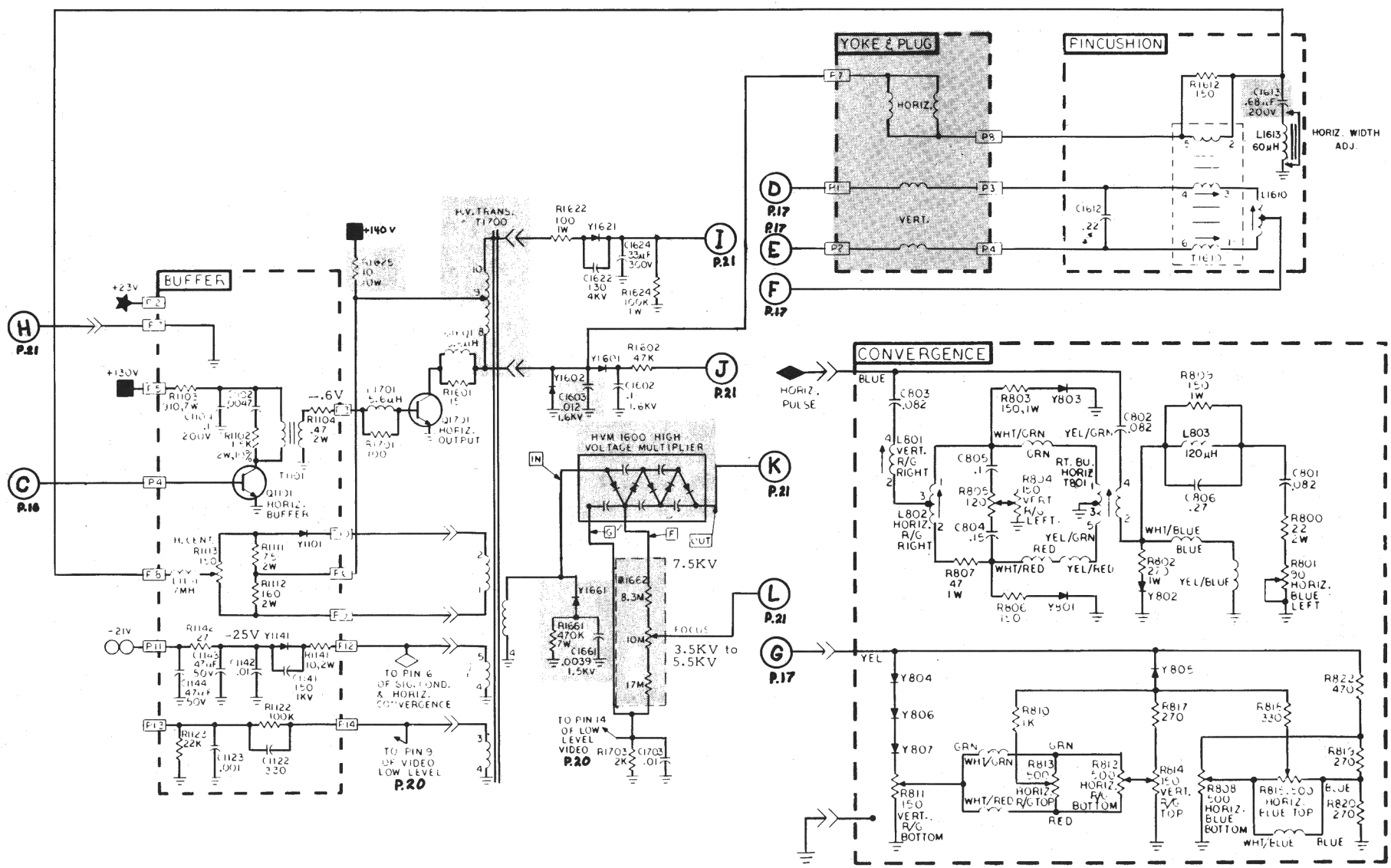
STEP	PROCEDURE	LOCATION	RESULTS	PROCEED TO STEP
1	Pull out signal conditioner; turn on.	Lower left (see Figure 2).	Circuit breaker opens (static).	2
			Circuit breaker remains closed (dynamic); then one of the following components is faulty: Pulse-limiter diode Y1661 200V diode Y1621 800V diode Y1601, 1602 High-voltage tripler	---
2	Measure collector-emitter resistance of series regulator.	On large heat sink on back of set, right over filter cap. Collector is the red lead and emitter is yellow.	0 ohms: replace transistor and also check Q1301, Q1302, and Y1301 on high-voltage regulator board.	---
			20K ohms or more.	3
3	Measure resistance between emitter of the series regulator and ground. Use positive lead of meter on the emitter.	Same as above.	Less than 100K ohms: check horizontal output transistor and damper diode Y1603.	---
			Greater than 100K ohms.	4
4	Remove high-voltage regulator board, turn set on and measure collector voltage of series regulator.	Upper right (see Figure 2).	Voltage is 200V. Regulator board defective.	---
			Circuit breaker opens.	5
5	Remove the degaussing coil. Turn on.	Three-pin molex connector containing one black and two white wires located on back of main power supply chassis.	Circuit breaker remains closed. Defective degaussing coil.	---
			Circuit breaker opens; defective power supply diodes Y901, 902, 903, 904, or a short within the power supply chassis.	---



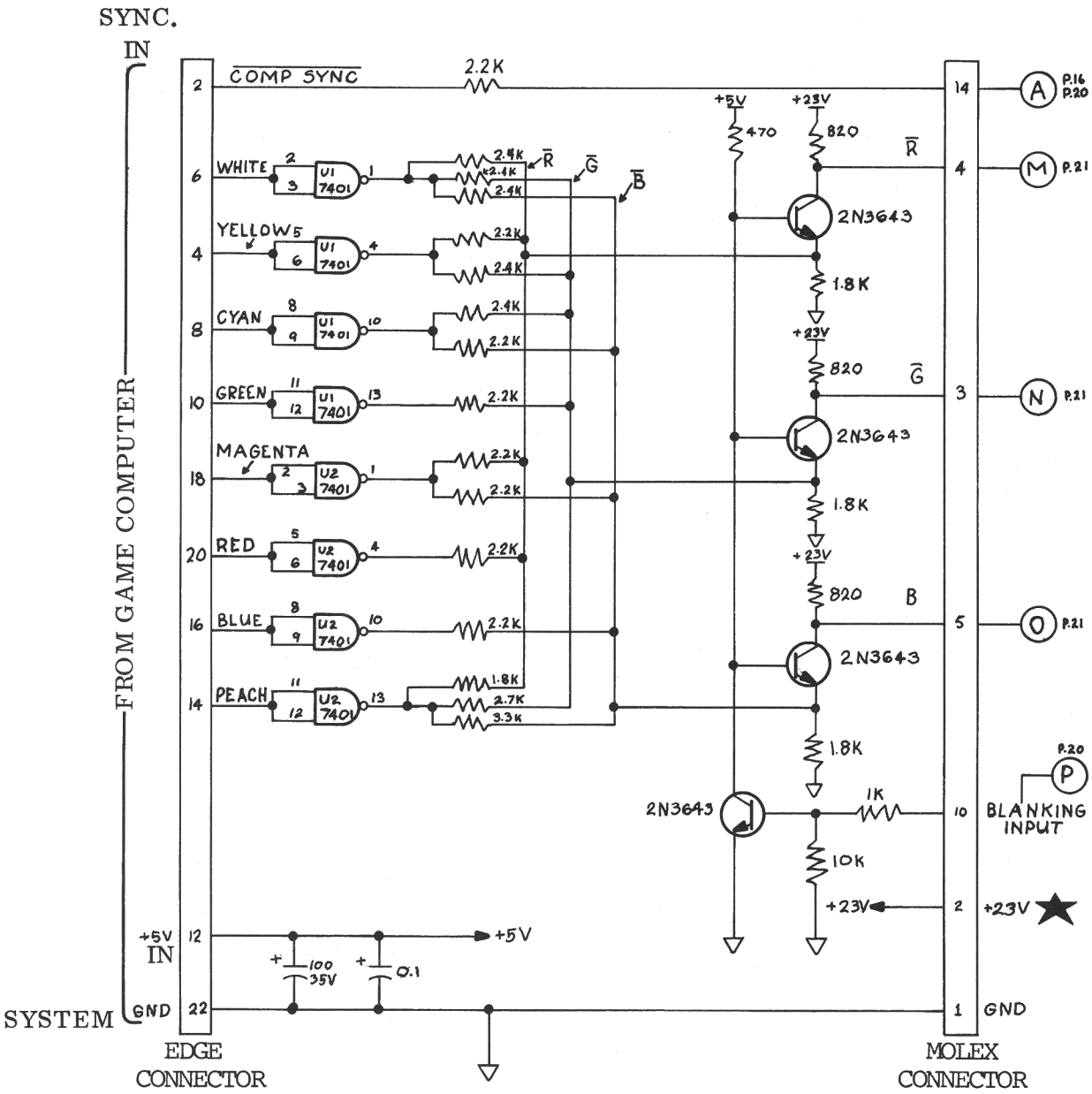


-.25V to -.5V, Varies with Brightness


VERTICAL
R1905
500K
VERT. HOLD
+23V
16V
+140V
+13V
TO PIN 8
VIDEO LOW
LEVEL
P.5
D
P.18
E
P.18
F
P.18
G
P.18
B
P.16
P2
P13
P12
P11
P5
P7
P4
P8
P10
C712
.01
R712
470K
C709
.22
Q701
VERT.
OSC.
PAIR
Q700
R701
180
C705
1uF
R704
15K
R705
3.6M
V.
SIZE
R706
3.5M
C708
.01
500V
C711
.47
Q702
VERT.
BUFFER
R702
24K
R703
5.6K
C704
.0068
C706
.0068
C707
.047
R710
2.2K
R711
39
Y705
R708
2.2K
C710
1uF
VERT.
CENT.
R709
20K
Y701
Y702
R713
6.8K
R714
1K
NPN
DIFFERENTIAL
PAIR
Q703
Q707
R716
270K
R715
18K
C714
.1
C715
1uF
R720
15K
R721
270K
C718
1uF
C716
150
PNP VERT.
DRIVER
Q704
Q705
C713
.1
C717
22uF
25V
Y703
Y704
Q706
R722
1K
R723
1K
PNP
VERT.
OUTPUT
NPN
VERT. OUTPUT
C728
.1
R724
15
TP704
.3V
R725
150
.1V
R726
150
TP705
R727
1
-34V

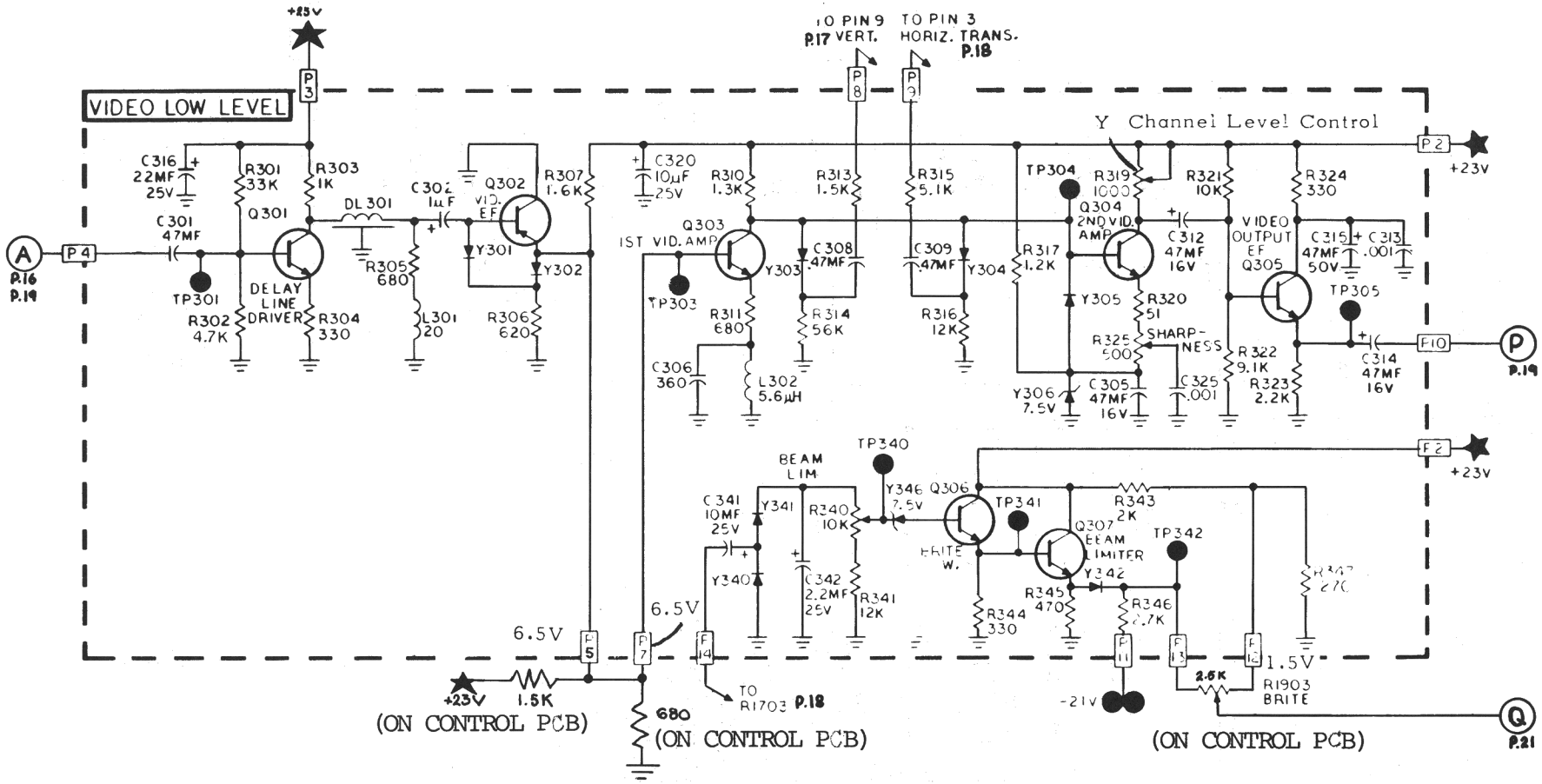

YOKE & PLUG
PINCUSHION
HORIZ.
VERT.
HORIZ. WIDTH ADJ.
BUFFER
H.V. TRANS. T1700
HVM 1600 HIGH VOLTAGE MULTIPLIER
7.5KV
3.5KV to 5.5KV
FOCUS
CONVERGENCE
HORIZ. PULSE
+140 V
+23V
+130V
-.6V
-25V
-21V
TO PIN 6 OF SIG. COND. & HORIZ. CONVERGENCE
TO PIN 9 OF VIDEO LOW LEVEL
P.20
TO PIN 14 OF LOW LEVEL VIDEO
P.20
BLUE
YEL
GRN
WHT/GRN
YEL/GRN
WHT/BLUE
YEL/BLUE
WHT/RED
YEL/RED
RED
BLUE
WHT/BLUE
WHT/RED
VERT. R/G RIGHT
HORIZ. R/G RIGHT
VERT. R/G LEFT
VERT. R/G BOTTOM
VERT. R/G TOP
HORIZ. R/G TOP
HORIZ. R/G BOTTOM
HORIZ. BLUE BOTTOM
HORIZ. BLUE TOP
HORIZ. BLUE LEFT
RT. BU. HORIZ. T801
H P.21
C P.16
D P.17
E P.17
F P.17
I P.21
J P.21
K P.21
L P.21
G P.17

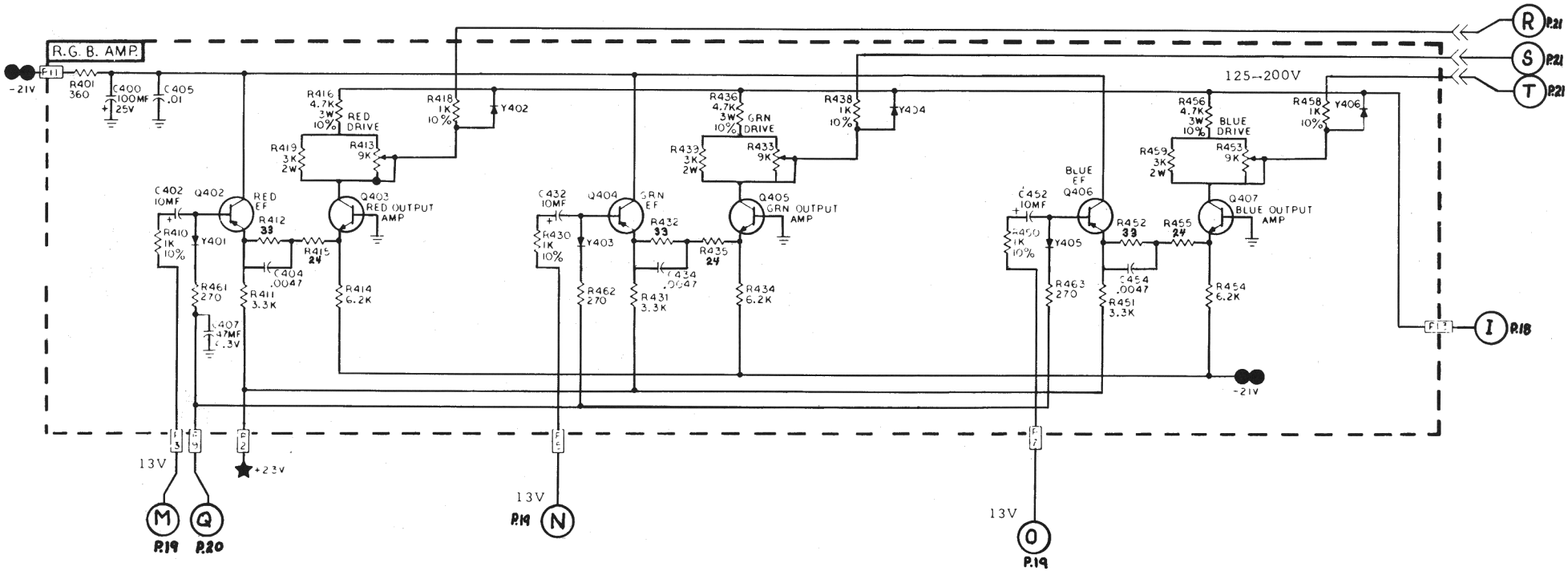
CHROMA BOARD

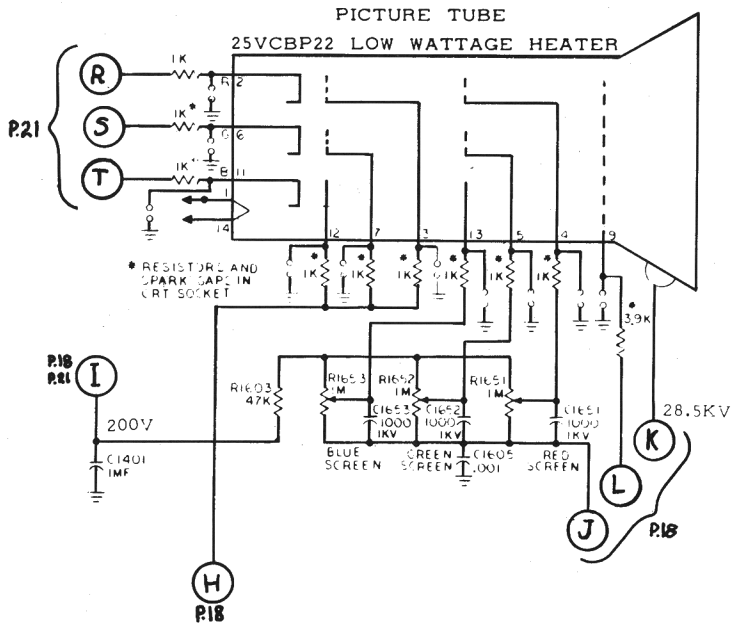


NOTES:

1. Color Inputs Are Positive-Going TTL
2. $\overline{\text{COMP SYNC}}$ Input Is Negative-Going TTL


VIDEO LOW LEVEL
Y Channel Level Control
TO PIN 9 VERT. P.17
TO PIN 3 HORIZ. TRANS. P.18
+23V
C316 22MF 25V
R301 33K
R303 1K
C301 47MF
Q301
DL 301
C302 1μF
Q302 VID. EF
R307 1.6K
C320 10μF 25V
R310 1.3K
R313 1.5K
R315 5.1K
TP304
R319 1000
R321 10K
R324 330
Q304 2ND VID. AMP
C312 47MF 16V
VIDEO OUTPUT EF Q305
C315 47MF 50V
C313 .001
TP305
C314 47MF 16V
R317 1.2K
R320 51
R325 500 SHARPNESS
R322 9.1K
R323 2.2K
C325 .001
C305 47MF 16V
Y305
Y306 7.5V
Y301
Y302
Y303
Y304
C308 .47MF
C309 .47MF
R305 680
L301 20
R306 620
R314 56K
R316 12K
Q303 IST VID. AMP
TP303
R311 680
C306 360
L302 5.6μH
TP301
R302 4.7K
DELAY LINE DRIVER
R304 330
A P.16 P.19
P4
P3
P8
P9
P2
P10
P
P.19
TP340
BEAM LIM
C341 10MF 25V
Y341
Y340
R340 10K
C342 2.2MF 25V
R341 12K
Y346 7.5V
Q306
TP341
R343 2K
Q307 BEAM LIMITER
BRITE W.
TP342
Y342
R344 330
R345 470
R346 2.7K
R347 270
6.5V
6.5V
1.5K
+23V
(ON CONTROL PCB)
680
(ON CONTROL PCB)
TO R1703 P.18
-21V
2.5K
R1903 BRITE
1.5V
(ON CONTROL PCB)
Q
P.21


R.G.B. AMP.
-21V
R401 360
C400 100MF 25V
C405 .01
R416 4.7K 3W 10%
RED DRIVE
R419 3K 2W
R413 9K
R418 1K 10%
Y402
C402 10MF
Q402
RED EF
Q403
RED OUTPUT AMP
R410 1K 10%
Y401
R412 33
R415 24
C404 .0047
R461 270
R411 3.3K
R414 6.2K
C407 47MF 6.3V
R436 4.7K 3W 10%
GRN DRIVE
R433 3K 2W
R433 9K
R438 1K 10%
Y404
C432 10MF
Q404
GRN EF
Q405
GRN OUTPUT AMP
R430 1K 10%
Y403
R432 33
R435 24
C434 .0047
R462 270
R431 3.3K
R434 6.2K
125→200V
R456 4.7K 3W 10%
BLUE DRIVE
R459 3K 2W
R453 9K
R458 1K 10%
Y406
C452 10MF
Q406
BLUE EF
Q407
BLUE OUTPUT AMP
R450 1K 10%
Y405
R452 33
R455 24
C454 .0047
R463 270
R451 3.3K
R454 6.2K
-21V
13V
+23V
13V
13V
R P.21
S P.21
T P.21
I P.18
M P.19
Q P.20
N P.19
O P.19


PICTURE TUBE
25VCBP22 LOW WATTAGE HEATER
P.21
R
S
T
1K
* RESISTORS AND SPARK GAPS IN CRT SOCKET
3.9K
P.18 P.21
I
200V
C1401 1MF
R1603 47K
R1653 1M
R1652 1M
R1651 1M
C1653 1000 1KV
C1652 1000 1KV
C1651 1000 1KV
C1605 .001
BLUE SCREEN
GREEN SCREEN
RED SCREEN
28.5KV
K
L
J
P.18
H
P.18