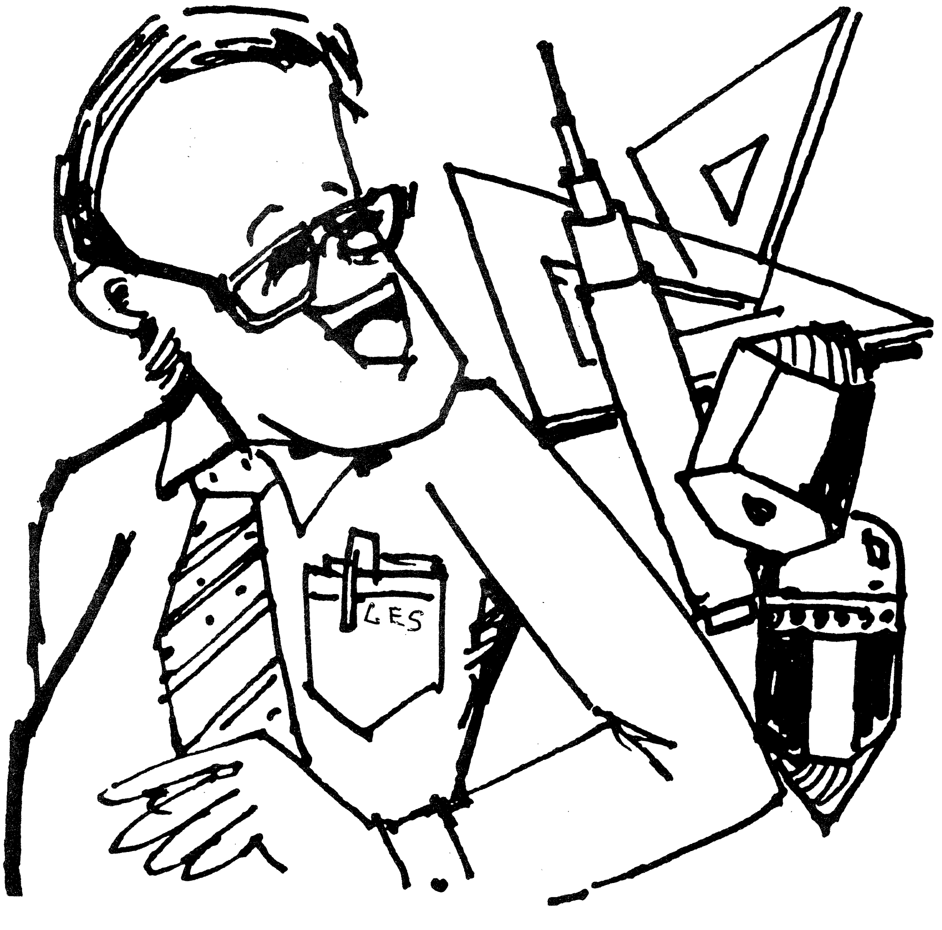
Service Manual

COLOR MONITOR

OMNISCAN SERIES

CM17MBD/H/R

CM20MBD/H/R



TATUNG

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1. GENERAL

1.1 SAFETY

WARNING:
DANGEROUS VOLTAGE ARE PRESENT IN THIS CIRCUIT WHENEVER POWER IS CONNECTED TO THE CIRCUIT BOARDS, EVEN THOUGH THE PRODUCT POWER SWITCH MAY BE IN THE 'OFF' POSITION. PROPER SAFETY PRECAUTIONS MUST BE TAKEN TO ENSURE THE SAFETY OF PERSONS WORKING ON THE BOARDS.

POTENTIOMETER ADJUSTMENTS:
R481, R626, R818, R640, R211 SHOULD BE ADJUSTED TO CORRECT POSITION DURING FUNCTIONAL TEST.

1.2 SPECIFICATIONS

17" SPECIFICATIONS

Picture Tube	17 inch (16V), Dark Tinted, Anti-Glare, 0.28/0.31 mm dot pitch (option) 90 degree deflection. (Dynamic focus/Single focus option)		
Resolution	640 × 350 (min.), up to 1280 × 1024 (max.)		
Display Colors	unlimited		
*Display Area	290 mm × 218 mm (typical)		
Video Input	Analog-RGB (positive)		
Video Bandwidth	BNC: 100 MHz D-SUB: 70 MHz		
Scanning Frequency	Vertical: 50Hz to 90Hz (Automatic) Horizontal: 29KHz to 66KHz (Automatic)		
Sync. Input Form	Separate Sync. Sync. on green Composite Sync.		
Applications	VGA, XGA, 8514A, PGC, MACII CAD/CAM, Workstation, etc.		
Power Input	Switch Selectable AC 100 to 125V (60Hz) AC 200 to 240V (50Hz)		
Power Consumption	120W (max.)		
Weight	21.5KG/24.5KG (N.W./G.W.)		
Dimension (W/O base)	411 × 380 × 480 mm (W/H/D)		
Safe Standard	UL/CSA, TUV Optional		
EMI Standard	FCC Class A model, Fh: 29KHz to 66KHz FCC Class B model, Fh: 29KHz to 62KHz (Class B) Fh: 63KHz to 66KHz (Class A) FTZ Optional		
Standard Accessory	Tilt/Swivel Base (47 mm height) D-15 pin to Mini D-15 pin signal cable. Power cord		
Optional Accessory	signal cables (BNC)		
Recommended Ambience	Operating Temperature:	+ 0 to +35 degree C,	(32 to 95 degree F)
	Storage Temperature:	−20 to +60 degree C,	(−4 to 140 degree F)
	Humidity:	10% to 80 %	

* Approximate only. Active display area depends on actual signal timing.
* Specifications subject to change without notice.

20" SPECIFICATIONS

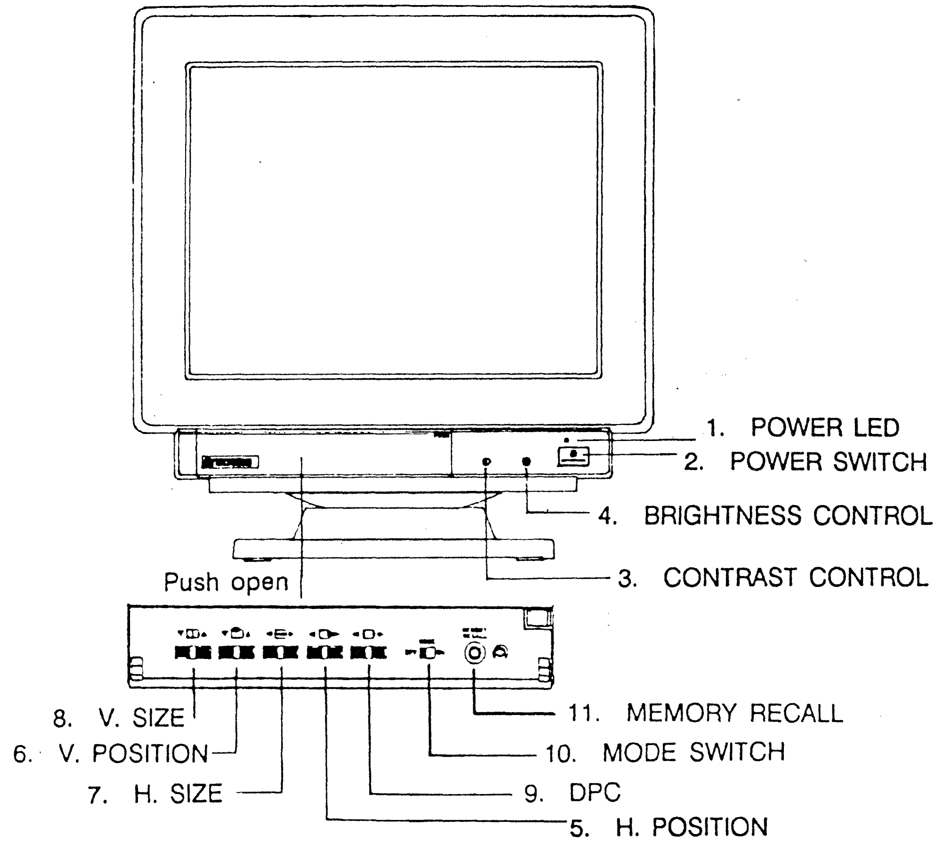
Picture Tube	20 inch (19V), Dark Tinted, Anti-Glare, 0.31 mm dot pitch 90 degree deflection. (Dynamic focus/Single focus option)
Resolution	640 × 350 (min.), up to 1280 × 1024 (max.)
Display Colors	unlimited
*Display Area	350 mm × 262 mm (typical)
Video Input	Analog-RGB (positive)
Video Bandwidth	BNC: 100 MHz D-SUB: 70 MHz
Scanning Frequency	Vertical: 50Hz to 90Hz (Automatic) Horizontal: 29KHz to 66KHz (Automatic)
Sync. Input Form	Separate Sync. Sync. on green Composite Sync.
Applications	VGA, XGA, 8514A, PGC, MACII CAD/CAM, Workstation, etc.
Power Input	Switch Selectable AC 100 to 125V (60Hz) AC 200 to 240V (50Hz)
Power Consumption	135W (max.)
Weight	28.5KG/32.6KG (N.W./G.W.)
Dimension (W/O base)	480 × 420 × 540 mm (W/H/D)
Safe Standard	UL/CSA, TUV Optional
EMI Standard	FCC Class A model, Fh: 29KHz to 66KHz FCC Class B model, Fh: 29KHz to 62KHz (Class B) Fh: 63KHz to 66KHz (Class A) FTZ Optional
Standard Accessory	Tilt/Swivel Base (47 mm height) D-15 pin to Mini D-15 pin signal cable. Power cord
Optional Accessory	signal cables (BNC)
Recommended Ambience	Operating Temperature: + 0 to +35 degree C, (32 to 95 degree F) Storage Temperature: −20 to +60 degree C, (−4 to 140 degree F) Humidity: 10% to 80 %

* Approximate only. Active display area depends on actual signal timing.

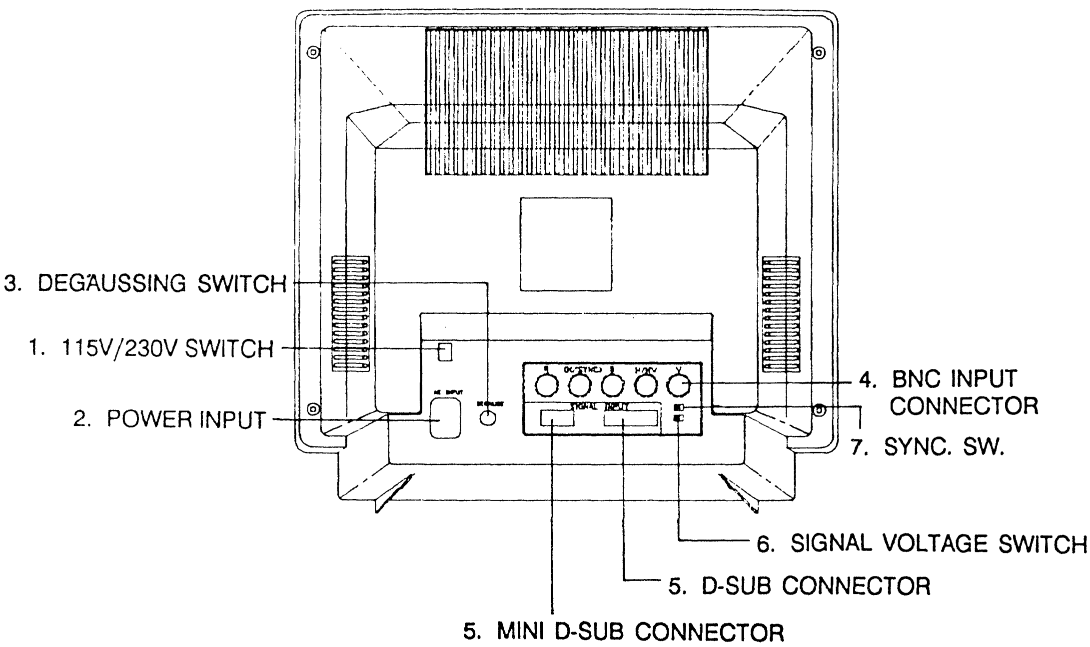
* Specifications subject to change without notice.

1.3 CONTROLS

17" FRONT/REAR PANEL CONTROLS

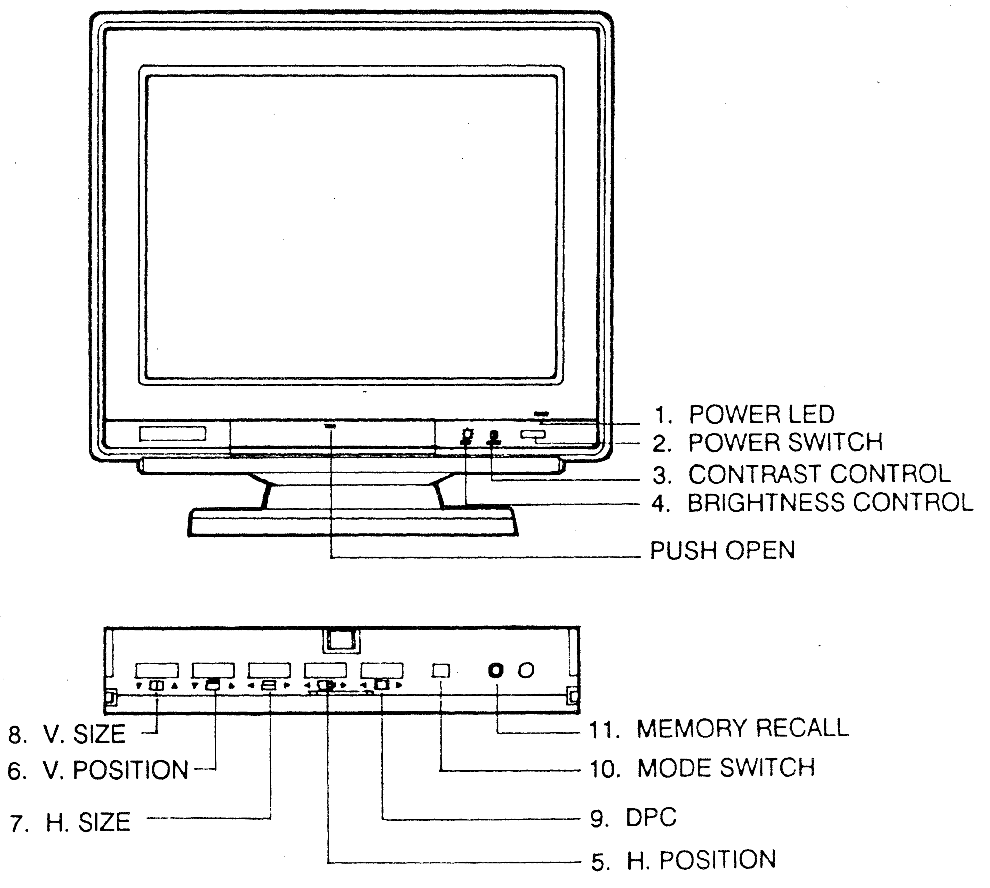


Front Panel Controls

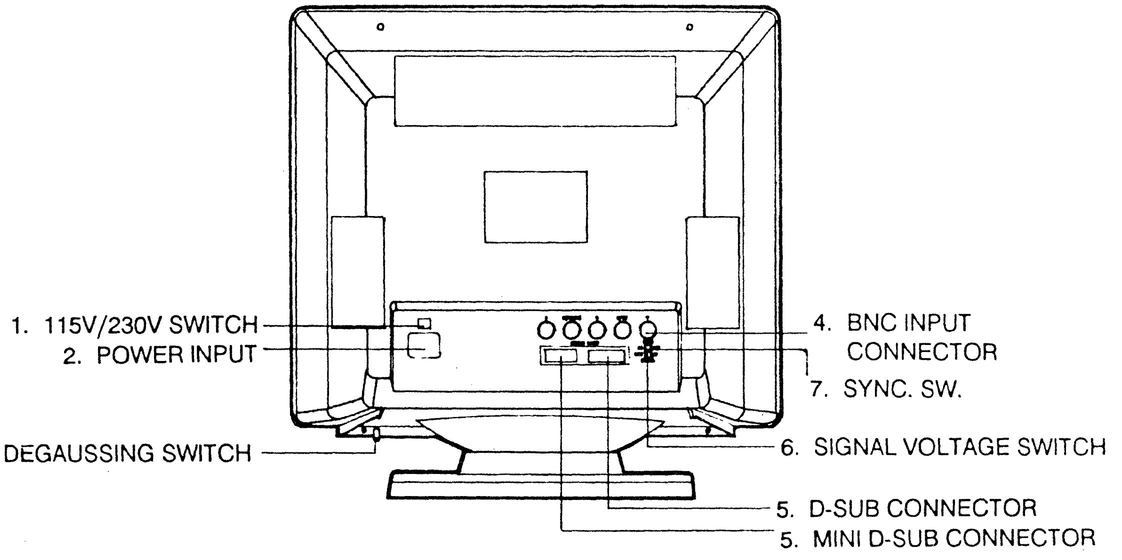


Rear Panel Control

20" FRONT/REAR PANEL CONTROLS



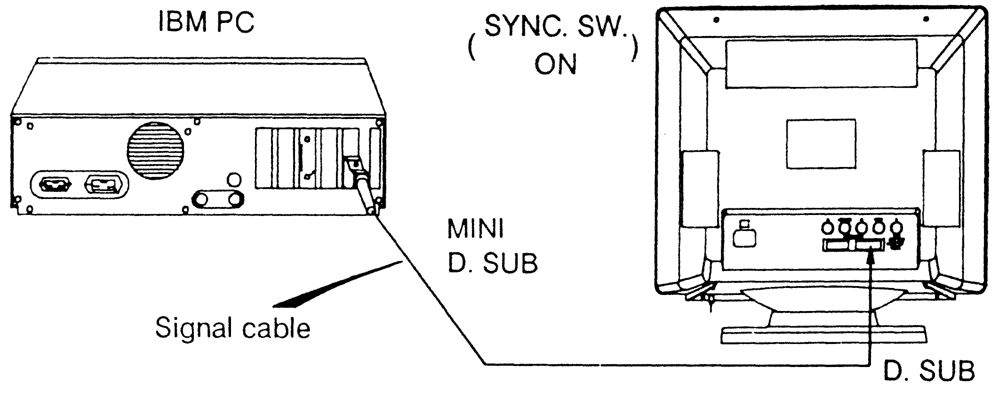
Front Panel Controls



Rear Panel Control

1.4 MAKING CONNECTIONS

(1)



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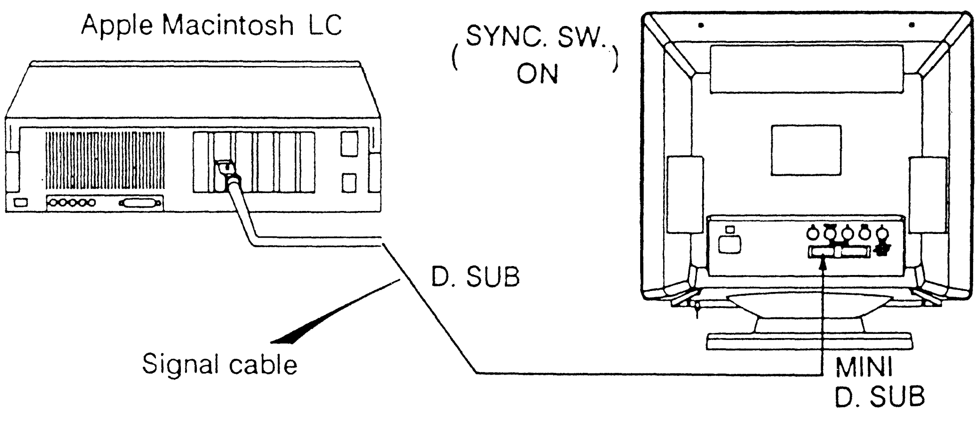

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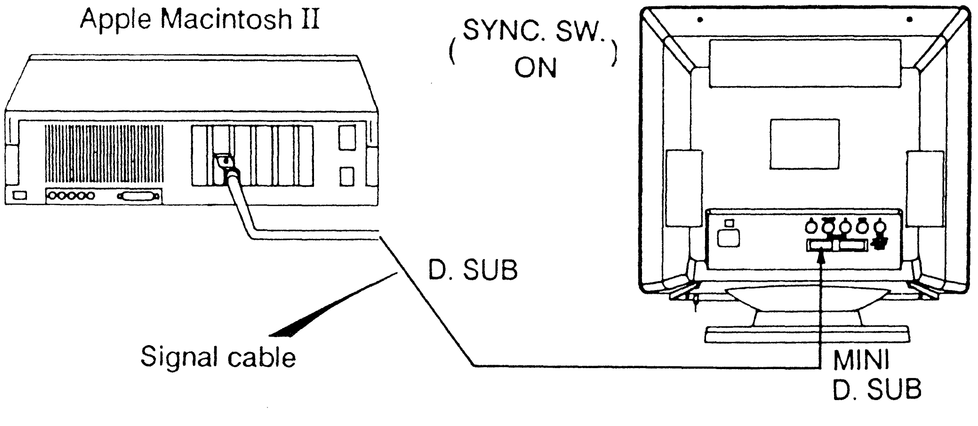

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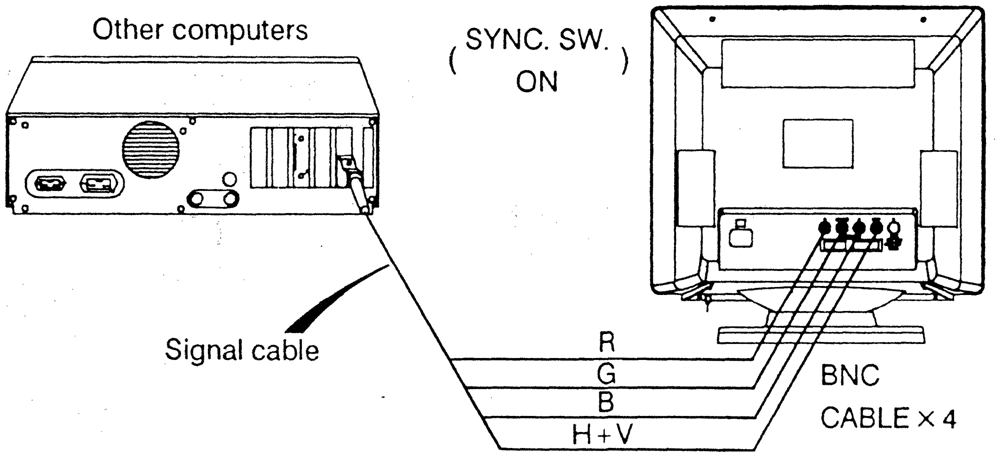
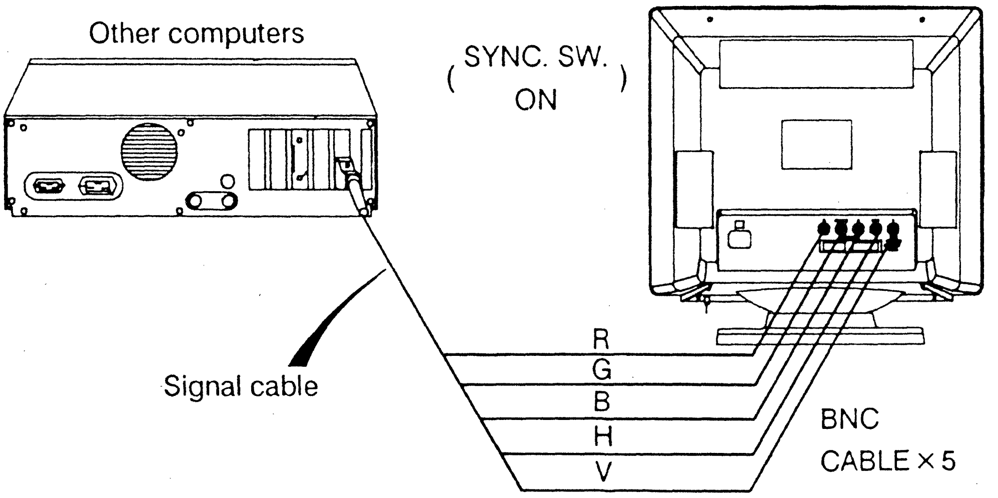


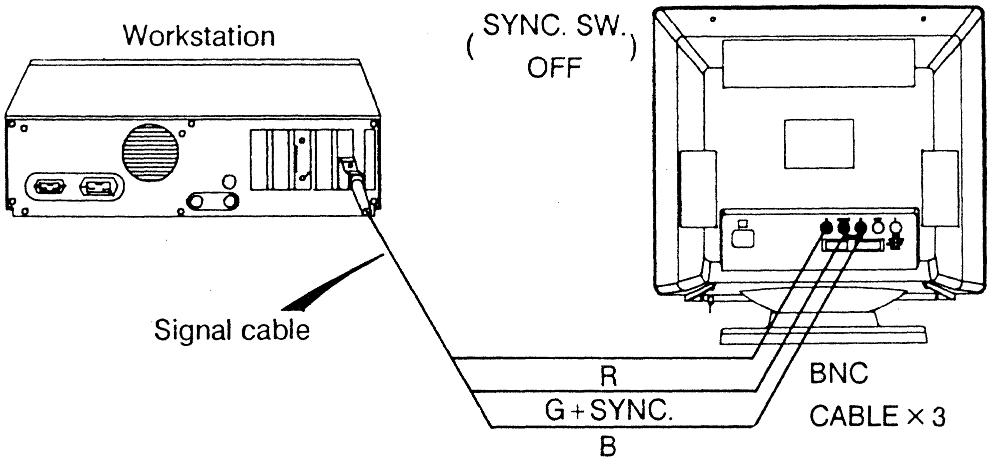
Other computers
(SYNC. SW. ON)
Signal cable
R
G
B
H+V
BNC CABLE × 4

(5)



Other computers
(SYNC. SW. ON)
Signal cable
R
G
B
H
V
BNC CABLE × 5

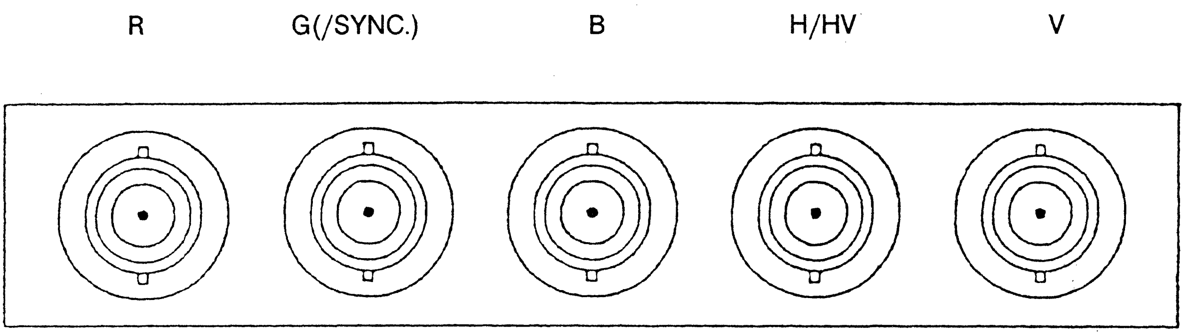
(6)



Workstation
(SYNC. SW. OFF)
Signal cable
R
G+SYNC.
B
BNC CABLE × 3

BNC CONNECTIONS & CABLE PIN ASSIGNMENTS

BNC Connections



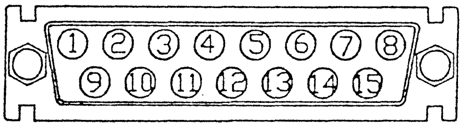
CONNECTOR	SYNC. ON GREEN	COMPOSITE SYNC.	SEPARATE SYNC.
R	RED	RED	RED
G(/SYNC.)	GREEN & SYNC.	GREEN	GREEN
B	BLUE	BLUE	BLUE
H/HV	–	H+V SYNC.	H
V	–	–	V

REMARKS:

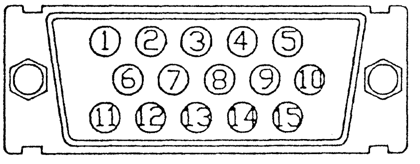
1. VIDEO SIGNAL LEVEL IS 0.7/1.0 Vp-p (SELECTABLE).
   SYNC. SIGNAL LEVEL IS TTL.

2. "–" MEANS NO CONNECTION.

D-SUB 15 PIN



MINI D-SUB 15 PIN



SIGNAL CABLE PIN ASSIGNMENTS

SIGNAL	PIN NO. FOR D-SUB 15 PIN (MAC II)	PIN NO. FOR MIN D-SUB 15 PIN (VGA/8514A)
RED	2	1
GREEN/SYNC. ON GREEN	5	2
BLUE	9	3
H SYNC./H+V SYNC.	7	13
V SYNC./V MODE	8	14
GROUND	1 4 6 11 13 14	4 6 7 8 10 11
OPEN PIN	3 10 12 15	5 9 12 15

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2. ADJUSTMENT PROCEDURE

2.0 Standard Adjustment Conditions

A. Power supply voltage: AC 110V, 60Hz.

B. Warm up time:
The display must be on for at least 20 minutes before starting alignments.
This is especially critical in color temperature and white balance adjustments.

C. Instrument: CHROMA-2000 or similar PATTERN GENERATOR

D. Setting:
(G+Sync.) Sync. Switch OFF (signal 86/88/89)
(H/V) Sync. Switch ON (signal 81/82/83/84/87)
(H+V) Sync. Switch ON (signal 85)

* When G+Sync. output, simultaneously output a H/V to the H. Sync. line, so the Sync. Switch should set at "OFF". (Refer 2.15)

Signal Level switch	0.7V
Contrast Control	Max.
Brightness Control	Max.

E. Signals
Video: Analog 0.7 Vp-p, 75 ohm
Analog sync. on green
Video: 0.7Vp-p
Sync.: 0.3Vp-p

Sync.: TTL level NEGATIVE/POSITIVE polarity
Separate/Composite (Refer 2.15).
(Terminated resistor 1 Kohm)

Scanning Freq.: H 29KHz ~ 65KHz
V 45Hz ~ 100Hz

2.1 Pre-Adjustment of POWER SUPPLY (PWB-1641)

A. The POWER SELECTOR SW. is connected to Pin A of PWB-1641, for the different line source input.

Model	Line	Pin A/A
UL/CSA	AC 115V	SHORT
HONG KONG/EUROPEAN (TUV)	AC 230V	OPEN

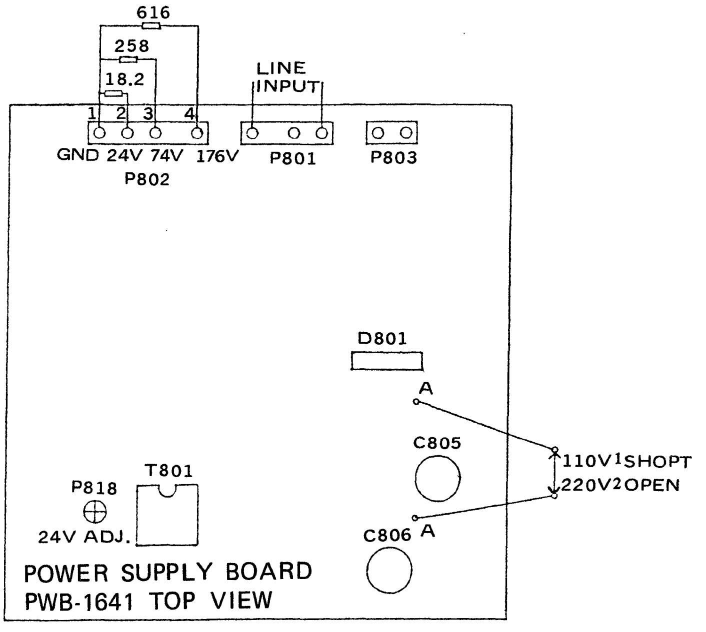
B. Connect the Dummy Load Resistor with the proper rating values shown below.

C. Set R818 to minimum position (fully clockwise, viewed from component side).

Pin			
4	R1	616	ohm/50W (approx.)
3	R2	258	ohm/25W (approx.)
2	R3	18.2	ohm/35W (approx.)

D. Adjust R818 (24V ADJ.) so that the voltage on Pin 2 of P802 is as shown below.

	TOSHIBA 17" TUBE	HITACHI 17"/20" TUBE	NEC 17" TUBE
Pin 2	24.5V	24V	24V

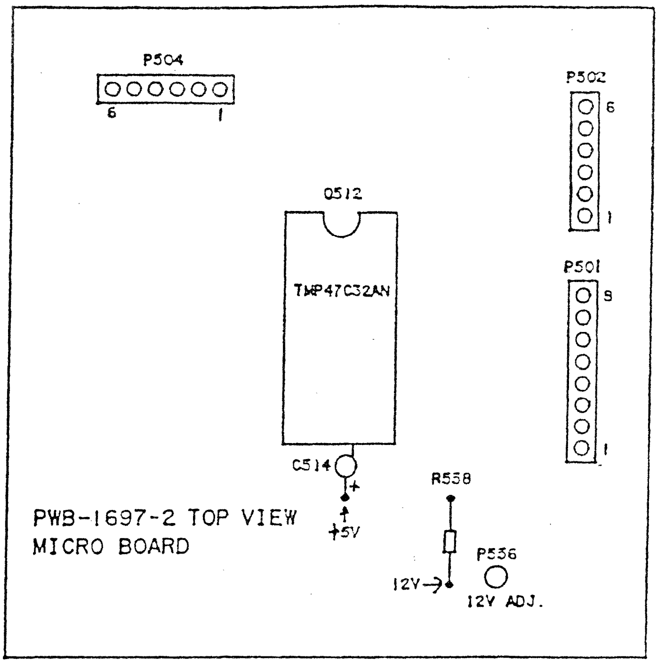


2.2 Pre-Adjustment of MICRO BOARD (PWB-1697-2)
+12V Adjustment

A. Apply 24V dc voltage to Pin 7 of P501.

B. Adjust R556 (12V ADJ.) so that the voltage on C503 is 12V (+/− 0.1V).

C. Check the voltage on C514 or R558 is 5.0V (+/− 0.25V).



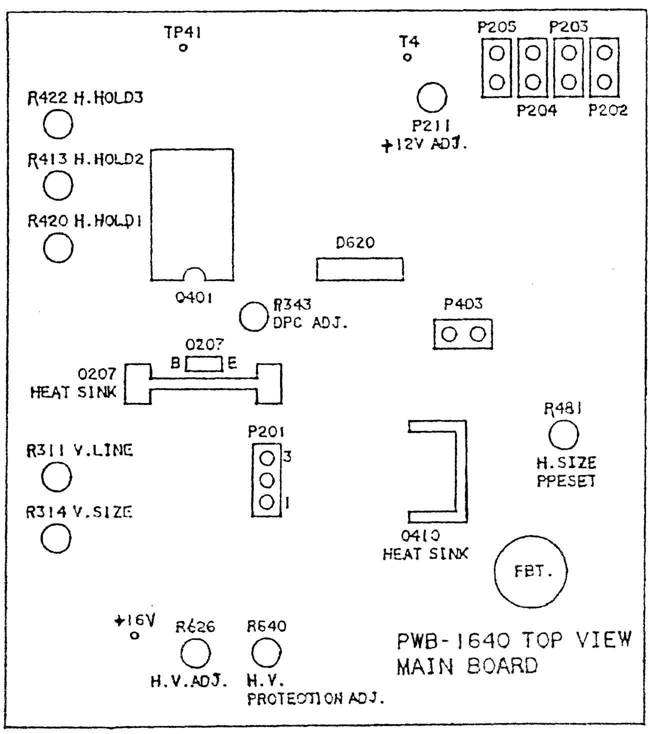
2.3 Pre-Adjustment of MAIN PCB (PWB-1640/1701)

+12V (R211) Adjustment

A. Apply signal 89 (64KHz), full white pattern.

B. Adjust R211 so that the voltage on Pin 4 of P201 (or +12V test Pin) is 12V.

C. Check the DC voltage on Pin 3 of P201 is 5.98V to 6.04V.



2.4 MAIN BOARD (PWB-1640/1701)ADJUSTMENT

(1) Horizontal Hold (R422/R413/R420)

A. Short between T4 and GROUND (with 0.1uf/50V capacitor).

B. Apply signal 89 (64KHz) and adjust H. hold 3 R422 so that the entire picture appears.

C. Apply signal 88 (48KHz) and adjust H. hold 2 R413 so that the entire picture appears.

D. Apply signal 80 (28KHz) and adjust H. hold 1 R420 so that the entire picture appears.

NOTE: ALIGNMENT PROCEDURE

64KHz -----> 48KHz -----> 28KHz
(R422) (R413) (R420)

(2) H.V. ADJ. (R626)

A. Brightness control and contrast control set at fully clockwise (maximum).

B. Apply signal 89 (64KHz), FULL WHITE pattern.

C. Adjust R626 so that high voltage is 26KV.

(3) H.V. Protection (R640)

A. Apply signal 89 (64KHz), FULL WHITE pattern.

B. Adjust R626 so that protection voltage is 7.7V~7.8V.

C. Check the protection function:
Short T1 and T2, the output (high voltage) should shut down. Open the "short" and power on again, the high voltage will back to normal.

(4) Horizontal Raster Centering

A. Apply signal 89 (64KHz).

B. If necessary, adjust the brightness control so that the raster is faintly illuminated.

C. If necessary, press the width control (S501/S502) so that both edges of the horizontal raster can be seen.

D. Select P202, P203 or P204 (either end of the plug), until the raster is centered on the screen.

(5) Horizontal Width pre-setting (R481)

A. Apply signal 89 (64KHz).

B. Adjust H. SIZE control S502 to get minimum width on the screen.

C. Adjust R481 so that the voltage on TP41 is Va (see table).

D. Check the collector voltage of Q410 is 16.5V (+/− 0.5V).

E. Adjust H. SIZE control S501 to get maximum width on the screen.

F. Check the collector voltage of Q410 is 20V (+/– 1V), check the voltage on TP41 is Vb (+/– 5V).

	17" TOSHIBA M41KJF26XX12 M41KMK26XX12	17" HITACHI M41KKL80X-12	17" NEC M41KMG23XX	20" HITACHI M48KAY80X01
Va	122V	95V	124V	114V
Vb	143.5V	112.5V	144.7V	133.0V

* With the different CRT or YOKE the voltage of Va/Vb should set at the correct value. If it is not correct setting, it may damage the output circuit or lack of the enough width.

(6) Vertical size pre-set (R314)

A. Apply signal 84 (35KHz), crosshatch pattern.
B. Adjust V. SIZE control S505 to maximum.
C. Adjust V. SIZE pre-set R314 so the vertical height is reach to the following values.

17"	20"
235 (+/– 7)mm	278 (+/– 3)mm

(7) Vertical Linearity (R311)

A. Apply signal 89 (64KHz), crosshatch pattern.
B. Adjust size control S506/S507 so that the vertical size is approximately (17": 218mm, 20": 262mm).
C. Adjust R311 so that vertical linearity is optimum.

(8) Side Pincushion (R343)

A. Apply signal 83 (VGA480), crosshatch pattern.
B. Adjust V. Size control S506/S507 so that the vertical size is (17": 218mm, 20": 262mm) approximately.
C. Adjust H. size control S501/S502 so that the horizontal size is (17": 290mm, 20": 350mm) approximately.
D. Adjust DPC control S513 to minimum.
E. Adjust DPC pre-set R343 so that the minimum CONCAVE is 2mm to 2.5mm (measure to the straight line).
F. Check the maximum BARREL. The value is greater than 0.5mm when DPC control S512 set to maximum (Apply 8514 signal).

2.5 Screen Position, Size, Side Pin Cushion, Digital control

HOW TO PROCEED THE FACTORY SETTING?

A. PUSHING THE FACTORY SETTING SW. WITH TIP THINGS AND POWER ON FOR 2 SECONDS THEN RELEASE THE PUSHING.
* The FACTORY SETTING SW. is in side the control cover (the first hole of the right side.)
B. During the setting (change MODE) or leave setting for 4 seconds the data will be saved into the memory automatically.
C. After 4 seconds later, switch off the power and power on again, the data stored inside the memory will be the factory setting data.
D. The data could be retrieved by pushing the MEMORY RECALL SW. (Second hole of the right side)
E. If more than one signal requires readjustment, please repeat steps (A) through (C).

* For signal 1 to 9, check that the screen position and size fall within the following limits.

(1) Screen Size

	17"	20"
Horizontal	290(+/– 5)mm	350(+/– 5)mm
(MAC-II)	280(+/– 8)MM	340(+/– 8)MM
Vertical	218(+/– 5)mm	262(+/– 5)mm
(MAC-II)	210(+/– 8)MM	255(+/– 8)MM

Screen Position

Space between bezel picture

Top and bottom space difference: +/–5mm
Right and left space difference: +/–5mm

(2) Side Pin Cushion

A. Apply crosshatch pattern.
B. Check to if the side pin cushion distortion is within +1, –2 mm.

2.6 Video Amplitude Adjustment

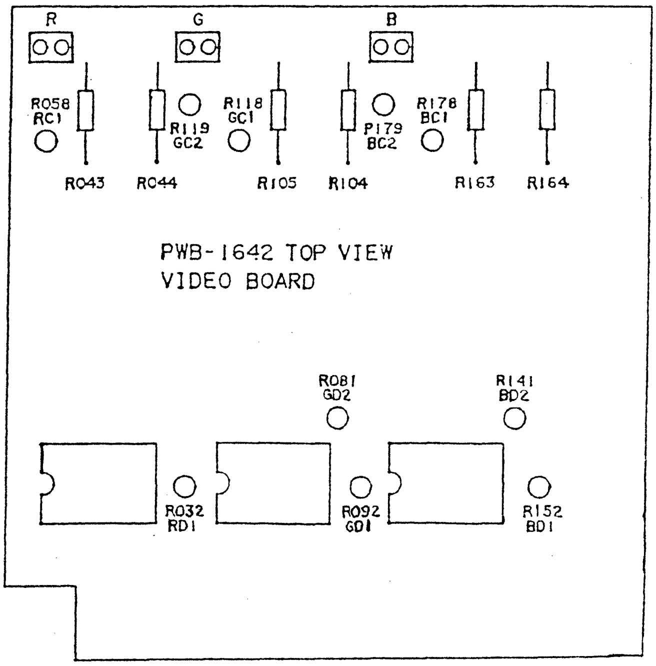
* Check to make sure the video input signal is set at the following level.
A. Video: Analog 0.7Vp-p (75 ohm), not include the sync. signal.
B. Sync. Switch: OFF
C. Signal: 89 (64KHz), crosshatch.
D. Initial Settings of Adjustment VRs.

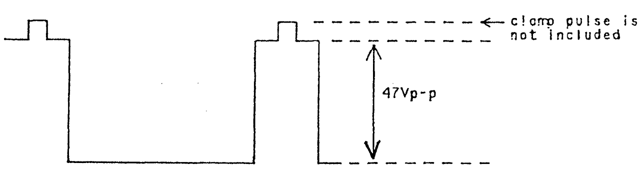
R721:	Contrast VR	fully clockwise
R722:	Brightness VR	fully counterclockwise
R032, R092, R152:	GAIN 1 VR	Mid'POINT
R081, R141:	GAIN 2 VR	Mid'POINT
SCREEN VR		Mid'POINT

2.7 Gain adjustment

A. Adjust R032(R), R092(G), R152(B) so that the terminals (Pins 1 of P901, P902, P903) on the CRT PWB are each set to 47Vp-p not including the clamp pulse.)

* Please use the plastic adjusting pole to do the alignment.





2.8 Cut-off adjustment

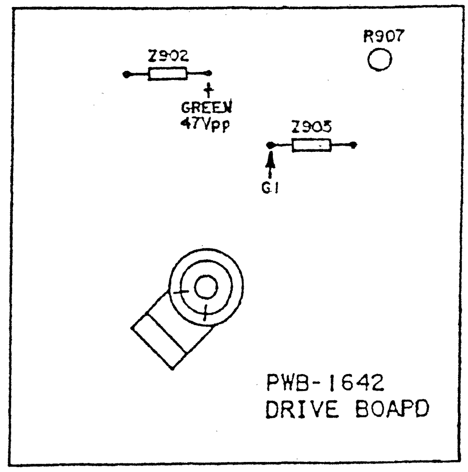
A. Initial setting of the adjustment VRs.

R119, R179:	CUTOFF 2 VR	MID'POINT
R058, R118, R178:	CUTOFF 1 VR	MID'POINT
R722:	Brightness VR	fully clockwise
SCREEN VR:		fully counterclockwise

B. Apply signal 89 (64KHz), crosshatch pattern.

C. Adjust G1 control R907 (PWB-1642-3) so that the voltage on G1 is Vc (See Table).

	17" TOSHIBA	17" HITACHI	17" NEC	20" HITACHI
	M41KJF26XX12 M41KMK26XX12	M41KKL80X-12	M41KMG23XX	M48KAY80X01
Vc	−90V	−60V	−90V	−70V



D. As SCREEN VR is gradually turned clockwise, a signal color will appear. Turn the CUTOFF 1 VR fully counterclockwise for this color.

E. Again, turn SCREEN VR clockwise gradually, a signal color will appear again. This color is the reference color for the cut off adjustment. Set the background color faintly appears with SCREEN VR. Use this as your reference then adjust the other two CUTOFF VRs (other than the reference color) to form a white background.

F. Measure the color temperature X and Y.

X = 281 (+/− 5)
Y = 311 (+/− 5)

NOTE:

* White tracking will be best at dark cut off adjustment settings. For the best setting, therefore, perform the cut off adjustment in as dark a place as possible.

2.9 Contrast Tracking 1

A. Apply signal 89 (64KHz), full white pattern.

B. Initial Settings of Adjustment VRs.

R721:	Contrast VR	fully clockwise
R722:	Brightness VR	MID'POINT
R081, R141:	GAIN 2 VR	MID'POINT

C. Adjust R GAIN 1 VR (R032) and B GAIN 1 VR (R152).

D. Measure the color temperature X and Y.

X = 281 (+/− 5)
Y = 311 (+/− 5)

2.10 Contrast Tracking 2

A. Apply signal 89 (64KHz), full white pattern.

B. Initial Settings of Adjustment VRs.

R721:	Contrast VR	Adjust to obtain 3FL.
R722:	Brightness VR	MID'POINT

C. Adjust G GAIN 2 VR (R081) and B GAIN 2 VR (R141).

D. Measure the color temperature X and Y.

X = 281 (+/- 5)
Y = 311 (+/- 5)

E. Check the color temperature X and Y between the following condition:

X=281 (+/- 15)
Y=311 (+/- 15)

(1) Brightness MID'POINT., Contrast MAX.
(2) Brightness MID'POINT., Contrast Adjust to obtain > 5 FL

2.11 Background Luminance Adjustment

A. Initial setting of the adjustment VRs.

R722:	Brightness VR	MID'POINT
R721:	Contrast VR	MIN.

B. Apply signal 89 (64KHz), crosshatch pattern.

C. Adjust SCREEN VR so that the background just disappear.

2.12 Focus Adjustment

(1) Single Focus (TOSHIBA Tube)

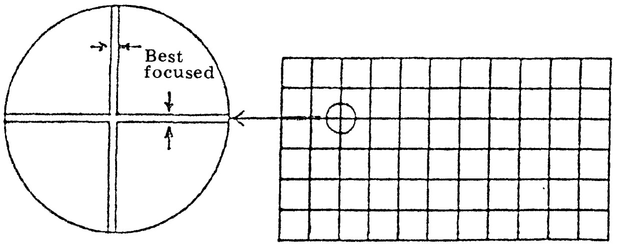
A. Apply signal 89 (64KHz), crosshatch pattern.

B. Initial setting of the adjustment VRs.

R722:	Brightness VR	MID'POINT
R721:	Contrast VR	MAX.

C. Or receive the pattern with "e" character.

D. Adjust the FBT focus VR to achieve the best focus at an intermediated point between the center of the screen and the corner.

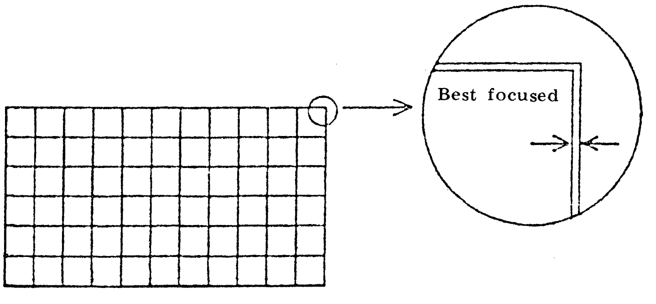


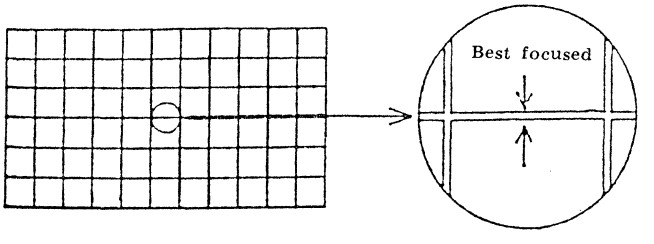
(2) Double Focus (NEC/HITACHI Tube)

A. Apply signal 89 (64KHz), crosshatch pattern.
B. Initial setting of the adjustment VRs.

R722:	Brightness VR	MID'POINT
R721:	Contrast VR	MAX.

C. Or receive the pattern with "e" character.
D. Focus 1:
Should be adjusted so that the vertical lines become narrowest in all over the screen.
E. Focus 2:
Should be adjusted so that the horizontal lines become narrowest in all over the screen.
F. Repeat the adjustment procedure in step D & E until the vertical and horizontal lines are all clear at center and corner of screen.



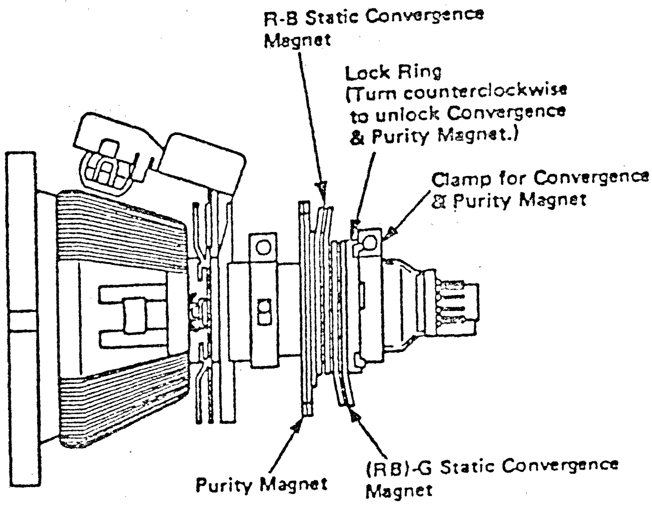


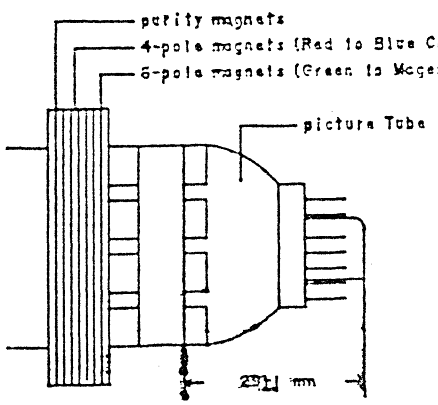
2.13 Purity Adjustment

A. Be sure the display is not being exposed to any external magnetic fields.
B. Ensure that the spacing between the Purity Convergence Magnet (PCM) assembly and the CRT stem is 29mm (+/- 1mm).
C. Produce a complete red pattern on the screen.

D. Adjust the purity magnet rings on the PCM assembly to obtain a complete field of the color red. This is done by moving the two tabs in such a manner that they advance in an opposite direction but at the same time to obtain the same angle between the two tabs, which should be approximately 180 degrees.

F. Check the complete blue and complete green patterns to observe their respective color purity. Repeat steps A to D if needed.





Purity Convergence Magnet Assembly (PCM)

2.14 Convergence Adjustment

* Before adjustment convergence,the vertical size, linearity and focus adjustment must completed.
* Make sure the Purity is good before the following adjustment.

A. Apply signal 89 (64 KHz), crosshatch pattern (pattern 2).

B. The brightness level should be no higher than necessary to obtain a clear pattern.

C. Loosen the convergence magnet lock ring, converge the RED and BLUE lines at the center of the screen by rotating the R-B static Convergence Magent.

D. Align the converged RED/BLUE lines with the GREEN lines at the center of the screen by rotating the (R/B)-G Static Convergence Magnet.

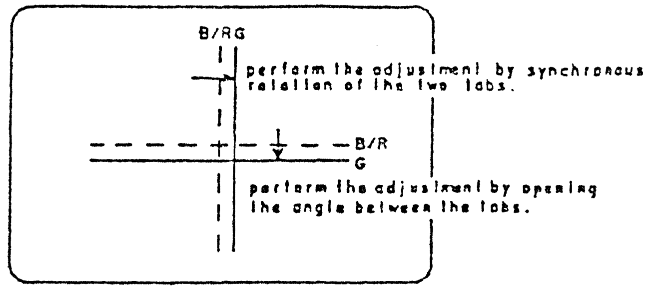
E. Tighten the convergence magnet lock ring.

F. Remove the IY wedges and slightly tilt (do not rotate) the deflection yoke horizontally and vertically to obtain good overall convergence.

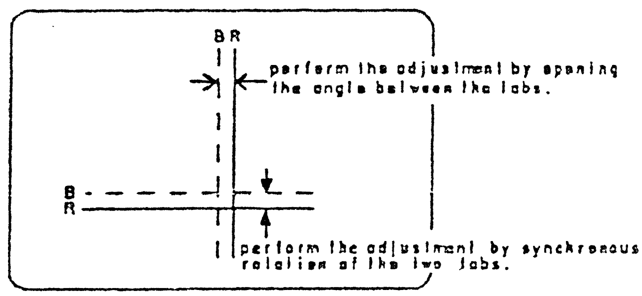
G. Secure the deflection yoke by re-inserting the wedges.

H. Check convergence and Purity. If purity error is found.

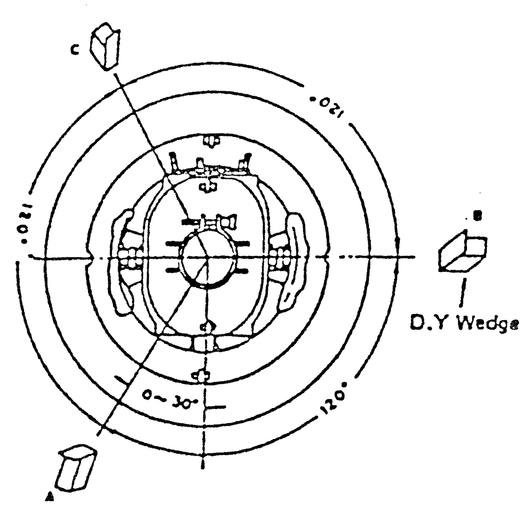
Please repeat the purity adjustment.



Green to Magenta Convergence (White)



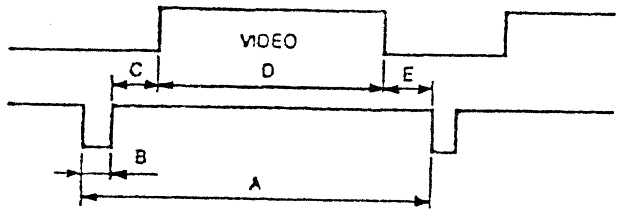
Red to Blue Convergence (Magenta)



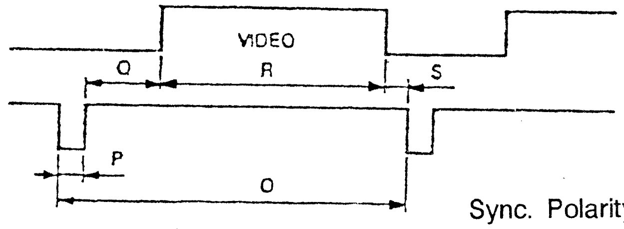
2.15 Timing Charts

SEPARATE SYNC.

HORIZONTAL



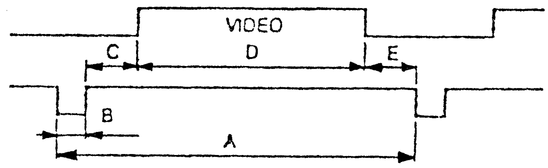
VERTICAL



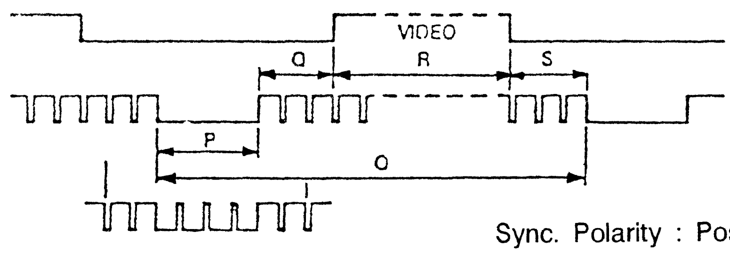
Sync. Polarity : Positive/Negative

COMPOSITE SYNC.

HORIZONTAL



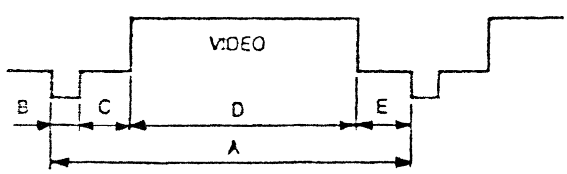
VERTICAL



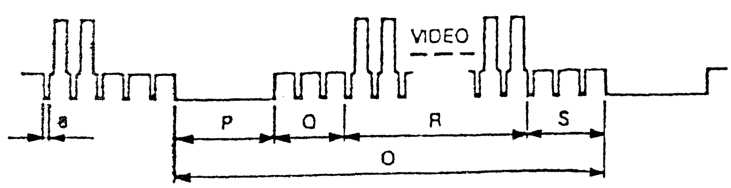
Sync. Polarity : Positive/Negative

COMPOSITE SYNC. & VIDEO (SYNC. ON GREEN)

HORIZONTAL



VERTICAL



2.16 Adjustment Signal and Timing

Adjustment signals (Nos. 1-9 : Preset Signals)

No.	Timing	Signal	SYNC.	Sync. Polarity Hor.	Sync. Polarity Vert.	
1.	81	VGA 350	H/V	+	–	
2.	82	VGA 400	H/V	–	–	
3.	83	VGA 480	H/V	–	–	
4.	84	8514A	H/V	+	+	interlace
5.	85	PGC	H+V			
6.	86	MAC-II	G+Sync.			#1
7.	87	800×600 (56)	H/V	+/–	+/–	
8.	88	1024×768 (60)	G+Sync.			
9.	89	1280×1024 (60)	G+Sync.			
10.	77	V. HOLD (50)				Fv=50Hz
11.	78	V. HOLD (90)				Fv=90Hz
12.	80	H. HOLD (54)	H/V	–	–	Fh=28.4KHz

#1 When G+Sync. output, simultaneously output a H/V to the H. Sync. line, so the Sync. Switch should set at "OFF".

PRE-SET TIMING

	77 1280×1024	78	80	81 VGA350	82 VGA400	83 VGA480
Fh (KHz)	64.000	35.520	28.400	31.500	31.500	31.500
Aμs	15.620	28.150	35.200	31.770	31.770	31.770
Bμs	1.000	3.920	3.840	3.770	3.770	3.770
Cμs	2.000	1.250	4.400	1.890	1.890	1.890
Dμs	11.875	22.800	25.600	25.170	25.170	25.170
Eμs	0.750	0.180	1.360	0.940	0.940	0.940
Fv (Hz)	49.600	90.000	54.000	70.000	70.000	70.000
Oms	20.160	11.111	18.480	14.270	14.270	16.680
Pms	0.080	0.113	0.070	0.064	0.064	0.064
Qms	0.580	0.563	1.162	1.880	1.080	1.020
Rms	19.490	10.426	16.896	11.126	12.716	15.246
Sms	0.020	0.014	0.352	1.200	0.410	0.350
Sync.	G+Sync. H+V	H/V	H/V	H/V	H/V	H/V
H		+	–	+	–	–
V		+	–	–	+	–

	84 8514A	85 PGC	86 MACII	87 800×600 (56)	88 1024×768 (60)	89 1280×1024 (60)
Fh (KHz)	35.520	30.480	35.000	35.160	48.370	64 .000
Aμs	28.150	32.800	28.570	28.440	20.675	15.620
Bμs	3.920	4.000	2.100	2.000	1.000	1.000
Cμs	1.250	2.800	3.200	3.560	2.957	2.000
Dμs	22.800	25.600	21.500	22.220	15.950	11.875
Eμs	0.180	0.400	2.100	0.670	0.750	0.750
Fv (Hz)	87.000	60.000	67.000	56.000	60.500	60.000
Oms	11.500	16.670	15.000	17.780	16.520	16.670
Pms	0.113	0.070	0.086	0.060	0.080	0.080
Qms	0.563	0.790	1.120	0.600	0.540	0.580
Rms	10.810	15.740	13.700	17.070	15.880	16.000
Sms	0.014	0.070	0.086	0.030	0.020	0.020
Sync.	H/V INTERLACED	H+V	G+Sync.	H/V	G+Sync.	G+Sync.
H	+			+		
V	+			−		

2.17 Set the user switch before packing

A. POWER SELECTOR SW.

UL/CSA MODEL — AC 115V

HONG KONG/EUROPEAN (TUV) — AC 230V

B. CONTRAST VR — Fully clockwise (MAX.)

C. BRIGHTNESS VR — MID'POINT

D. SIGNAL LEVEL SW. — 0.7V

E. SYNC. SW. — ON

F. MODE SW. — OFF

TABLE OF CONTENTS

3. *CIRCUIT DESCRIPTION*

3.1 SWITCHING MODE POWER SUPPLY (SMPS)

```
            (P802)
┌ ─ ─ ─ ┐   4                      40-150V
|        |
| +175V  ├──┬────> DC/DC CONVERTER ─────────────────> H DEFLECTION
|        |  |                                           |
|        |  |                                           |     350V
|        |  |                                           |
| SMPS   |  |                                         (T401) ──────────> DYNAMIC
| UNIT   |  |                                                            FOCUS
|        |  |                      40-150V
|        |  └────> DC/DC CONVERTER ─────────────────> HIGH VOLTAGE
|        |                                              |
|        |                                              |     -210V
|        |                                              |
|        |                                            (FBT) ───────────> G1
|        |  3
| +75V   ├──────────────────────────────────────────> VIDEO BOARD
|        |  2
| +24V   ├──┬───────────────────────────────────────> VERTICAL CKT.
| (24.5V)|  |                                         & MAIN BOARD
|        |  |                        16V
|        |  ├────> LINEAR REGULATOR ────────────────> MAIN BOARD
|        |  |                        12V
|        |  ├────> ZENER DIODE ─────────────────────> H OSC CKT.
|        |  |                        12V
| PWB-   |  ├────> SMP REGULATOR ───────────────────> VIDEO BOARD
|        |  |         |                6V
| 1641   |  |         └──> LINEAR REGULATOR ────────> HEATER
|        |  |                  |       5V
|        |  |                  └──> DIODE ──────────> VIDEO BOARD
└ ─ ┬ ─ ┘  |                        12V
    |  1    └────> LINEAR REGULATOR ────────────────> MICRO BOARD
    |                 |                               (LED)
   GND                |                5V
                      └──> LINEAR REGULATOR ────────> MICRO BOARD
```

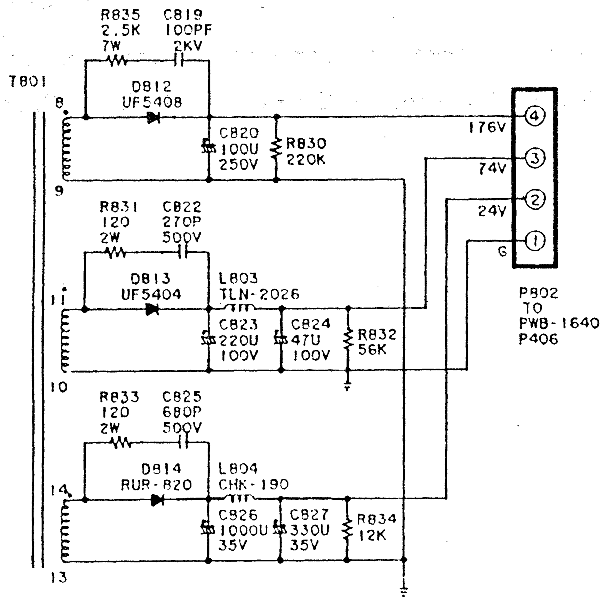
(The power of the LED is fed from P505 of the micro board PWB-1697-2. Please Refer to circuit diagram Fig-38)

Analog circuit supply lines of 175V, 74V, 24V are supplied by the secondary winding of T801 (pins 4, 3, 2 of P802 respectively).

(Refer to circuit diagram Fig-1)

175V/0.3A	(approximately)
74V/0.2A	(approximately)
24V/1A	(approximately)

SMPS SECONDARY CIRCUIT *Fig-1*



3.2 PRIMARY CIRCUIT

(Refer to circuit diagram Fig-2)

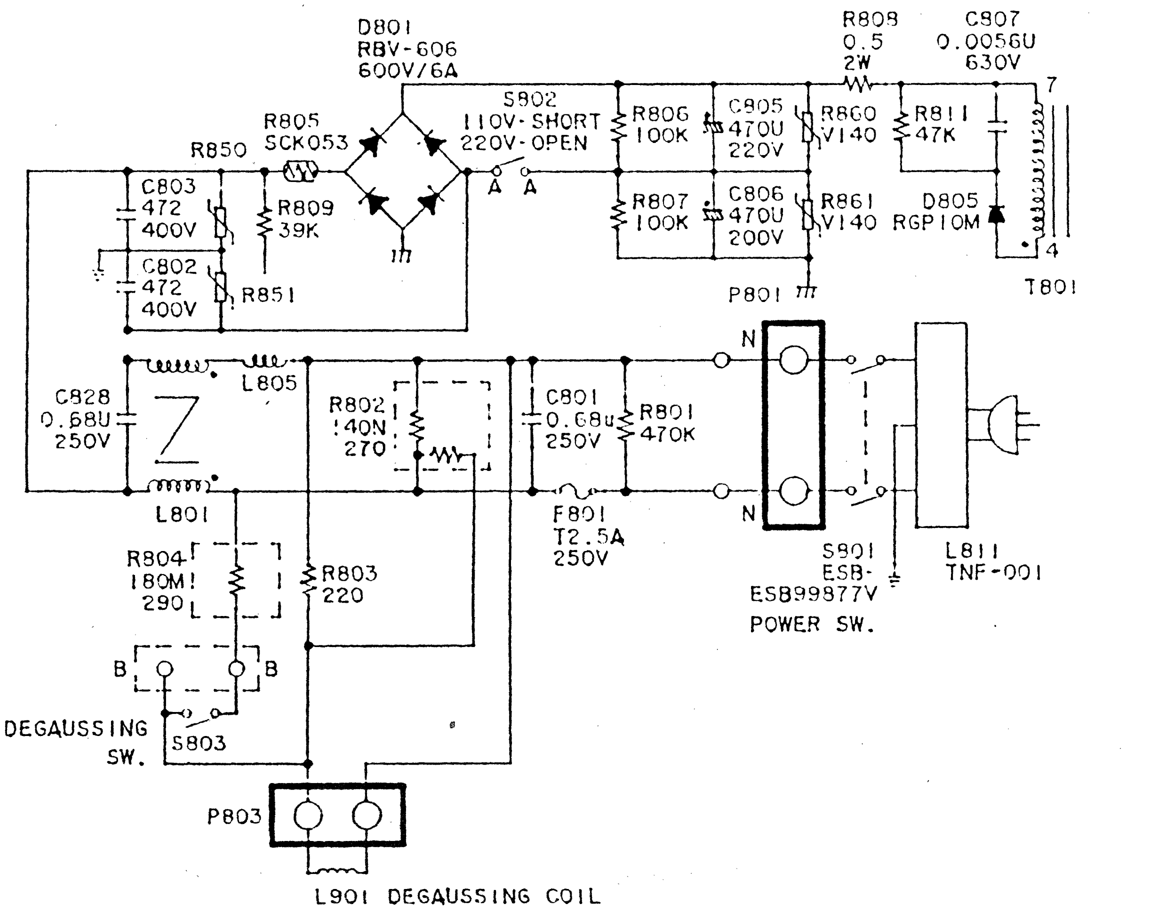
Mains electricity is filtered by line choke L801 and rectified by bridge D801. The rectified high tension (HT.) line is smoothed by storage capacitor C805–C806.

Suppressors R850, R851, R860 and R861 are designed to protect the circuit from the effects of destructive voltage transients. When subjected to high energy transient currents their impedance rapidly changes from a high standby value to a low conducting value to keep voltages within safe limits.

Switch S802 is used to select 110V or 220V line input. (110V–SHORT; 220V–OPEN).

S801 is the power switch of the line input.

SMPS PRIMARY CIRCUIT *Fig-2*



3.3 CURRENT MODE CONTROLLER

(Refer to circuit diagram Fig-3)

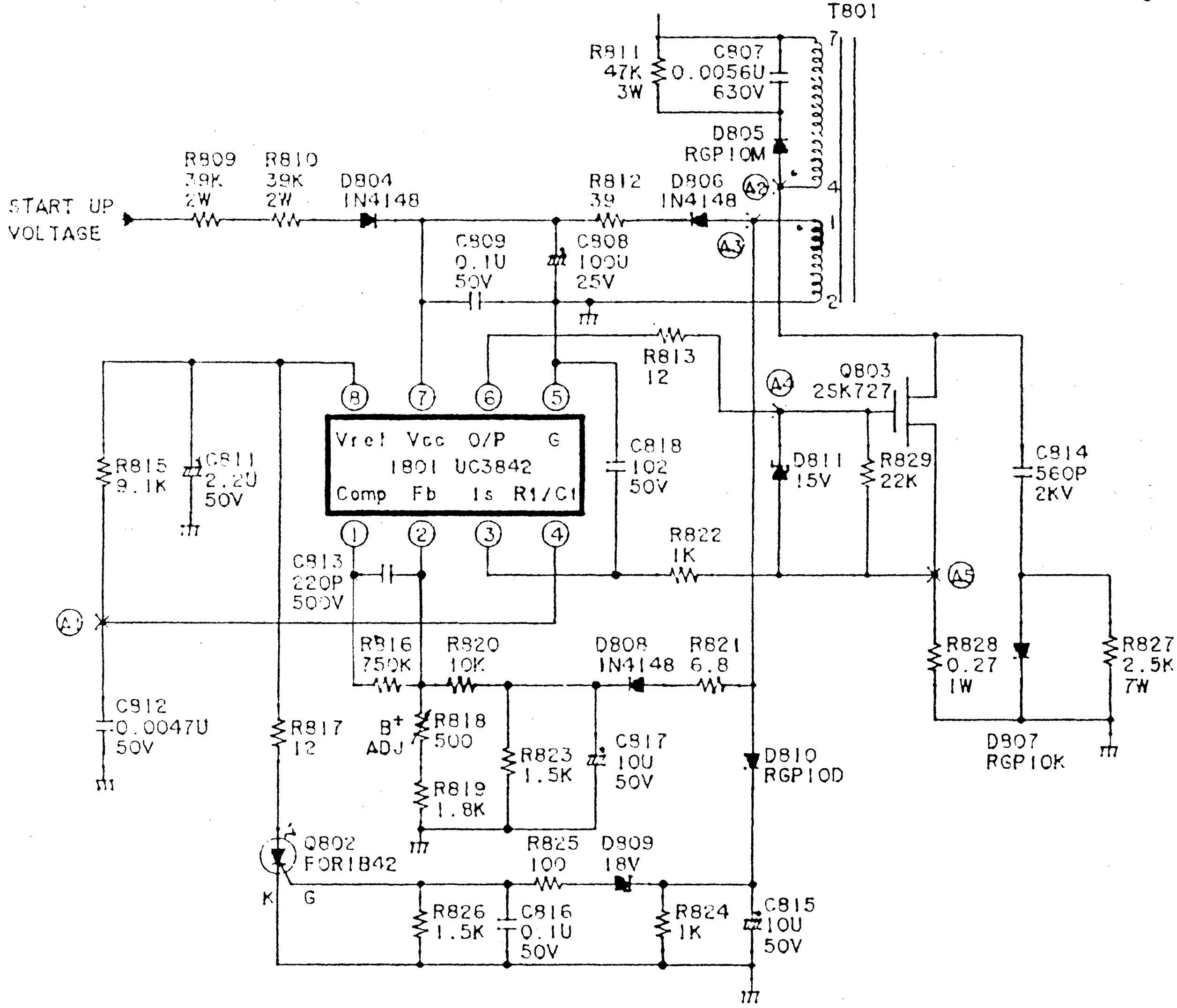
Current Mode PWM controller module I801 (UC3842) is used to drive the SMPS switching MOSFETs Q803. The drive signal is inhibited if the current sense line (pin 3) rises above 1V.

START UP CIRCUIT

The start up voltage to the module (pin 7) is provided from C808 which charges through R809–R810 (connected to the HOT LINE) on turn on. The start up line is about 20V during normal operation.
R812 reduces the supply voltage to the module in order to decrease the gate drive to within the manufacturers specification

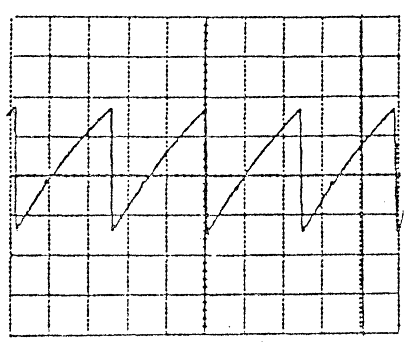
SMPS DRIVE

Fig-3

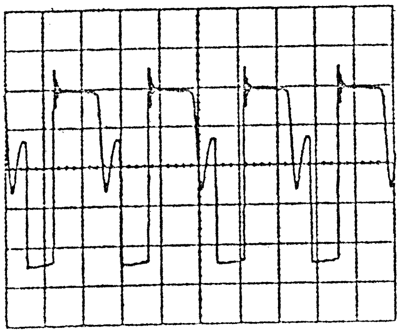


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	A1	OSC VOLTAGE
	A2	DRAIN VOLTAGE
	A3	AUXILIARY WINDING PULSE
	A4	GATE VOLTAGE
	A5	SOURCE VOLTAGE

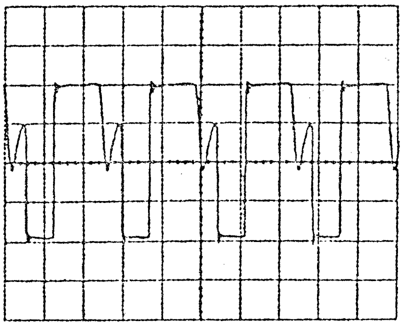
A1 1.5 Vpp



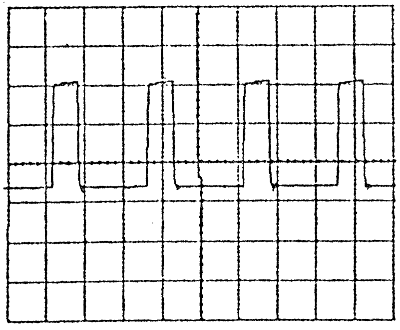
A2 450 Vpp



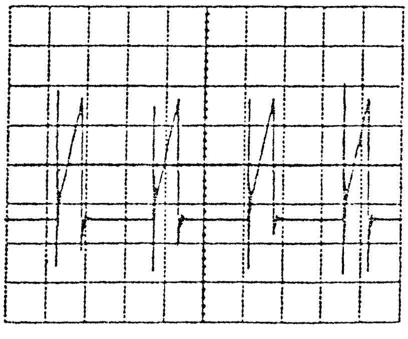
A3 40 Vpp



A4 15 Vpp



A5 0.9 Vpp



PULSE WIDTH CONTROL CIRCUIT

The supply outputs are regulated by monitoring the voltage on the auxiliary winding (Pins 1 and 2) of T801 which is well-coupled and in phase with primary winding.

The feedback voltage is connected to pin 2 of I801 through divider R820–R818–R819 with R818 enabling fine adjustment of the output voltage.

Pin 2 of I801 is the inverting input of the Error Amplifier.
The error amplifier compare the voltage (pin 2) with the internal reference voltage (2.5V) then generates an error voltage to next stage.
The voltage on R828 is proportional to inductor current and is connected to pin 3 via R822.

The internal comparator compare the error voltage with the voltage of pin 3 then generate a modulated PWM signal for the output stage Q803.

C813–R816–R818–R819 (on pins 1, 2) optimize the stability of the control system by defining the loop gain of the Error Amplifier.

D811 holds the base of Q803 at 15V during normal operation.

Snubber C814–R827–D807 compensates for leakage inductance in T801 and shapes the base drive waveform so that the initial turn on current is high.

SAWTOOTH OSCILLATOR CIRCUIT

The oscillator frequency and maximum output duty cycle are programmed by connecting resistor R815 to Vref (pin 8) and capacitor C812 (on pin 4) to ground. The oscillating frequency is around 40KHz.

PROTECTION CIRCUIT

The power supply has a full protection circuit against output overload, short circuit and over voltage.

OVER CURRENT PROTECTION CIRCUIT

Once the over load or short circuit occurred at the secondary, the voltage of R828 reach to 1 Vp-p rapidly. It blocks the power output, so the voltage on pin 7 of decreased below 10V, Q803 turns off, then the power circuit will shut down and latched by Q802.

OVER VOLTAGE PROTECTION CIRCUIT

On abnormal conditions, if the over voltage presents at auxiliary winding (pins 1, 2 of T801), Q802 will be triggered by the voltage Via D809, R825, R826 and C816. The voltage on pin 8 is latched and grounded to 0V, then I801 turns off, the power circuit will shut down.

If the output housing is disconnected, the output

voltage will shut down.
For the single power supply PCB test only, a dummy load should be connected to P802. (see alignment.)

DEGAUSSING CIRCUIT

(Refer to circuit diagram Fig-3A)

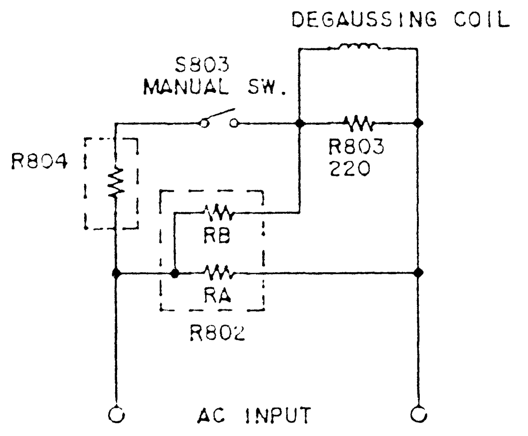
AUTOMATIC DEGAUSSING CIRCUIT

Posistor R802 and degaussing coil compose an automatic degaussing circuit to demagnetic the shadow mask and internal shield in the CRT.
Posistor shows low resistance value (8 ohms) in normal temperature, when apply AC line voltage, a big current flows into degaussing coil, a few seconds, the resistance of posistor increase rapidly due to rising in heat, degaussing current thus decrease to less than 100 mA rapidly, degaussing function is completed.
The degaussing coil has a resistance of 20 ohms (approx.).

MANUAL DEGAUSSING CIRCUIT

Switch S803 and posistor R804 are used as a manual degaussing.

DEGAUSSING CIRCUIT *Fig-3A*



LOW VOLTAGE REGULATOR

On the main board, there are four different dc voltages (16V, 12V, 6V, 5V) converted from the 24V of the switching power supply.

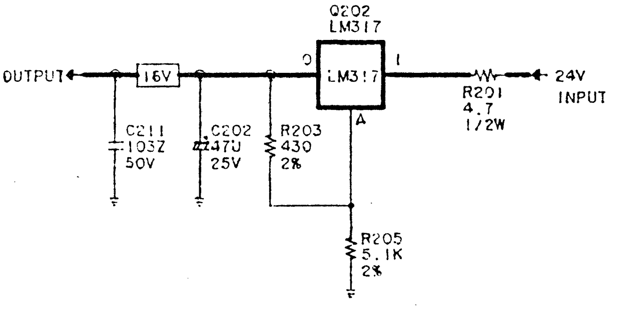
3.4 16V LINEAR REGULATOR

(Refer to circuit diagram Fig-4)

The 16V voltage supply is derived from network Q202–R203–R205–C202–R201.
Q202 (LM317) is a three-terminal adjustable output positive voltage regulator, the output voltage is controlled by the resistor divider R203 and R205.
Pin I of Q202 is the voltage input, pin A is the voltage adjust Pin, pin O is the voltage output pin.

R201 is a fusible protection resistor.

16V REGULATOR *Fig-4*



3.5 12V SWITCHING REGULATOR

(Refer to circuit diagram Fig-5)

The 12V switching regulator is mounted on main PC board, network Q203a–Q204a–Q205–Q206–T201 and some discrete components achieve a high efficient 12V switching regulator.

PWM (PULSE WIDTH MODULATION) GENERATOR

Q204a is the Pulse Modulation Comparator, saw-tooth signal is fed to pin 3 via the collector of Q602, the error voltage is fed to pin 2 via pin 1 of Q203a, the PWM (square waveform) pulses is generated from pin 1 of Q204a.

Q203a (LM358) is the error amplifier,the reference voltage on pin 3 of Q203a is provided by R214 and zener D202.
The voltage on pin 2 is the feedback signal from output voltage (12V). If have any voltage difference on the output will be detected by the error amplifier.
Divider R210–R211–R212 with R211 enabling fine adjustment of the output voltage.
C203–R216–R215 (on pins 1, 2) optimize the stability of the control system by defining the loop gain of the Error Amplifier.

OUTPUT STAGE

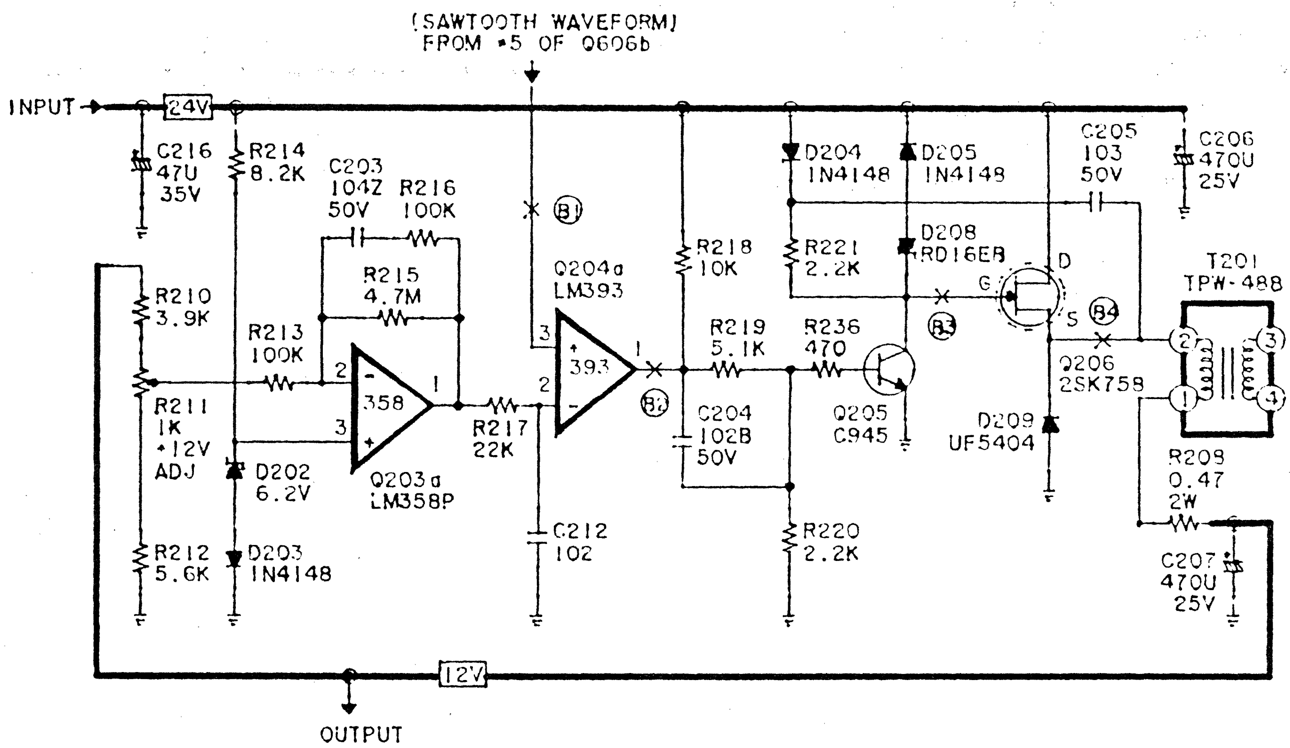
The drive signal is fed to the output stage via buffer stage Q205.
Network D204–C205 is the voltage pump-up circuit to provided 40Vp-p signal on the collector of Q206, the signal is clipped by D208-D205.
Power MOSFETs Q206 switches the termination of T201 primary (pin 2) between 0V and 24V with a

Pulse-Width Modulated Switching signal at the horizontal frequency.

Varying the duty cycle of the switching signal varies the time-average voltage across the winding thereby controlling the output dc voltage.

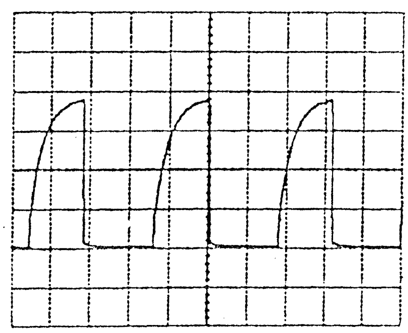
D209 is a fly-wheel diode. When Q206 is on, voltage +24V will supply to pin 2 of T201 via Q206, simultaneously the energy will store in T201. When Q206 is off, the energy which originally store in T201 will discharge via D209 to C206. R208–C207 is the decoupling circuit.

12V SWITCHING REGULATOR *Fig-5*

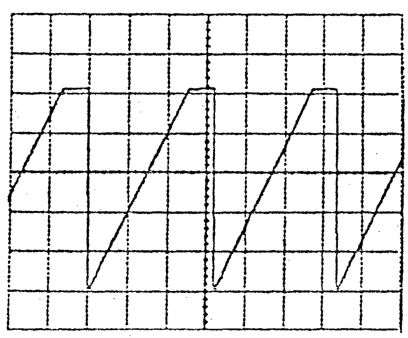


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	B1	SAWTOOTH WAVEFORM
	B2	OUTPUT PULSE
	B3	GATE PULSE
	B4	SOURCE VOLTAGE

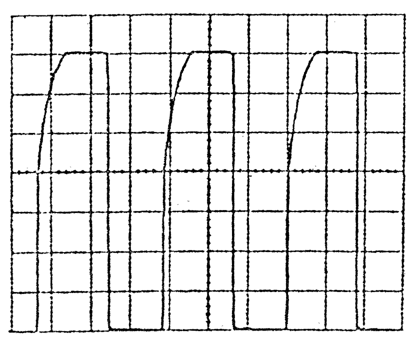
B2 9 Vpp



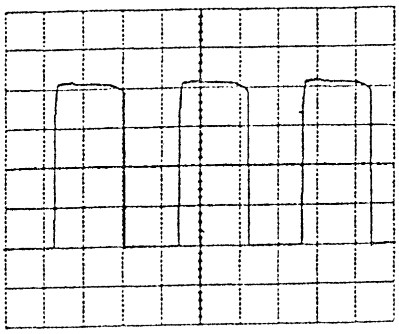
B1 10 Vpp



B3 35 Vpp



B4 22 Vpp



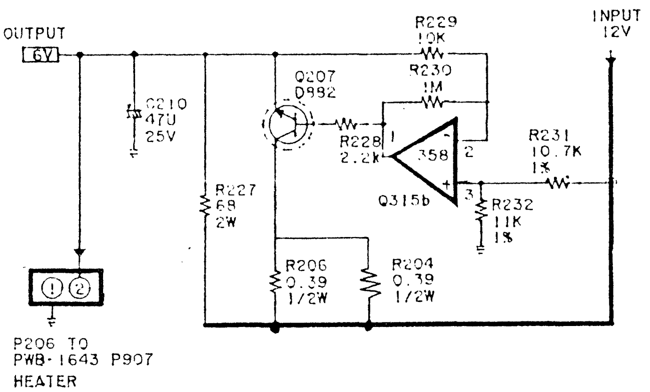
3.6 6V LINEAR REGULATOR

(Refer to circuit diagram Fig-6)

The 6V regulator is consists of Q207 and error amplifier Q315b.
The reference voltage (6V) on pin 3 of Q315b is provided by resistor divider R231 and R232. The feedback signal is fed to pin 2 of Q315 via R229.

The output signal is fed to the base of Q207 via R228. The 6V voltage is derived from the emitter of Q207 and R227–C210.

6V LINEAR REGULATOR *Fig-6*



5V SUPPLY

The 5V voltage is derived from 6V via diode D046. There is a 0.7V voltage drop on the diode, so 5.3V voltage is available after the diode.

3.7 DEFLECTION CIRCUIT

The deflection circuit consists of the mode selection, horizontal oscillator, horizontal deflection, vertical deflection, position control, DPC control, dynamic focus, and X-Ray protection circuit.

3.8 VERTICAL DEFLECTION CIRCUIT

(Refer to circuit diagram Fig-8)

The power amplifier driving the vertical yoke assembly is an AC design based on a single chip power amplifier module (TDA-1675A).

Vertical deflection coil is connect to pin 1 of Q301 via P301.

The ramp generator which is inside the TDA-1675A, generates ramp signal through a buffer stage to pin 9, then send to linearity provides adjustable frame linearity for product set up purposes. Pin 12 is the inverting input of the amplifier.

The output of power amplifier from pin 1 of Q301 drives the vertical deflection coil by a negative slope current ramply, R309 and C307 are used to stabilize the power amplifier.

R307 and R310 define the dc level across C309, so allowing a correct centering of the output voltage. R308 and C308 in conjunction with R307 and R310, applied at the feedback input pin 12 of Q301, a small part of the parabola, available across C309, and the AC feedback voltage, taken across R312.

Pin 14 is the main supply voltage (+24V) input. Pin 8 is the ground pin.

The supply voltage of the power stage is forced at pin 2. During the trace time the voltage of pin 2 is obtained from the main supply voltage via D301; while during the retrace time pin 2 is supplied from flyback generator via C302 and pin 15 of Q301.

The vertical SYNC. is applied to pin 5 of Q301 via R301–C301. R341–D303–C304–R302 connected to pins 3, 4, 6 determine the free-run frequency and pull-in range of the oscillator inside Q301. The pull-in range is from 45Hz to 100Hz.

Pin 9 is the output of the current mirror that charges the series of C313 and C305. This pin is also the input of the buffer stage.

Pin 10 is the output of the buffer stage and it is internally coupled to the inverting input of the power amplifier through R1.

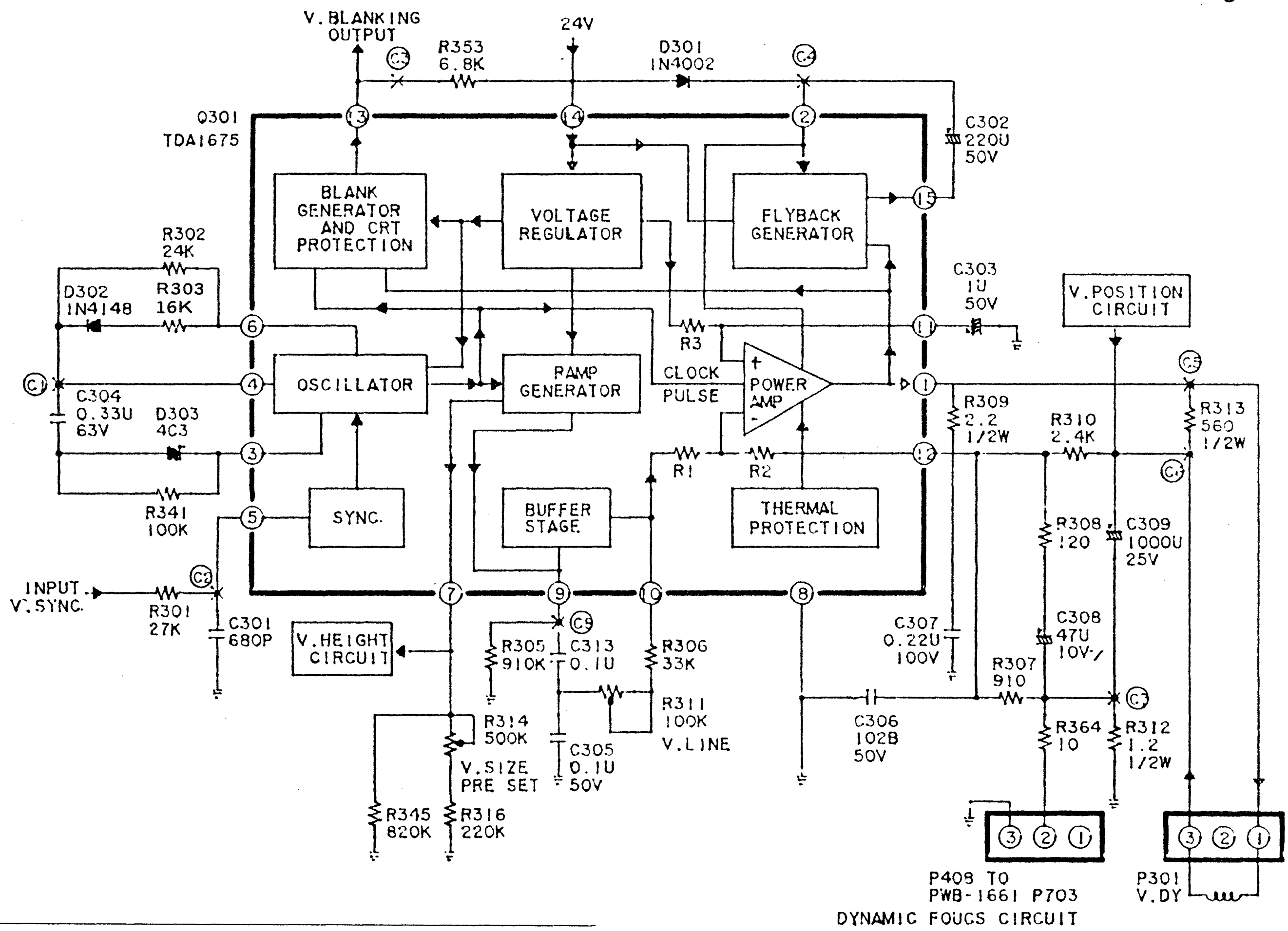
Network R306–R305–C305–C313–R311 is connected between input and output of the buffer stage (pins 9, 10) which determine the linearity of the vertical deflection with R311 enabling the fine adjustment.

Pin 11 is the non-inverting input and it is not used.
Pin 13 is the output of the vertical blanking pulse. This width of the blanking pulse is controlled by R303.

VERTICAL DEFLECTION COIL SPECIFICATION

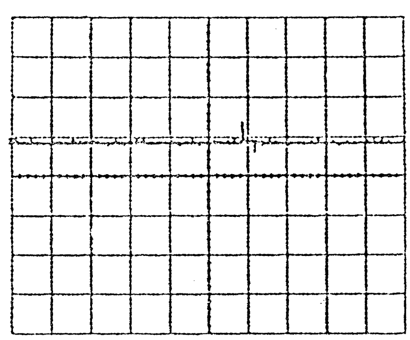
	HITACHI (17")	HITACHI (20")	NEC (17")	TOSHIBA (20")
INDUCTANCE	5.3 mH	6.4 mH	6 mH	8.0 mH
RESISTANCE	6.8 ohm	6.7 ohm	6 ohm	8.8 ohm

VERTICAL DEFLECTION CIRCUIT *Fig-8*

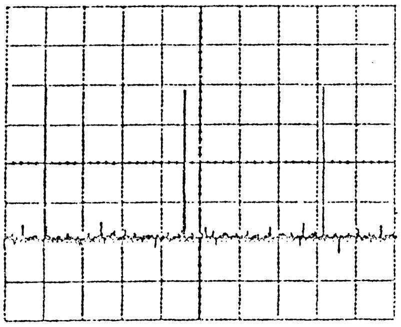


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	C1	OSC VOLTAGE
	C2	V SYNC.
	C3	BLANKING PULSE
	C4	PUMP-UP PULSE
	C5	V OUTPUT
	C6	FEEDBACK PULSE
	C7	FEEDBACK PULSE
	C8	BUFFER OUTPUT

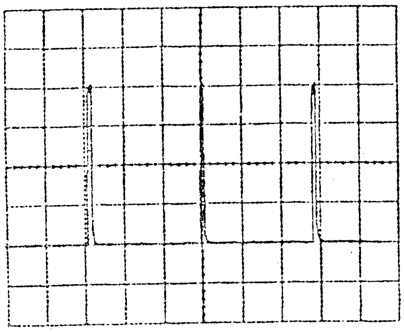
C1 0.3 Vpp



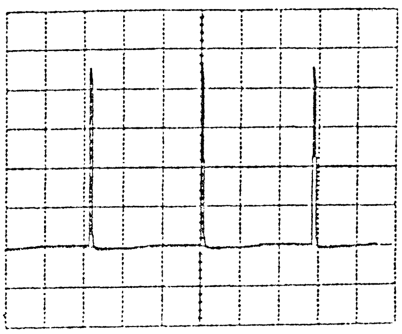
C2 0.8 Vpp



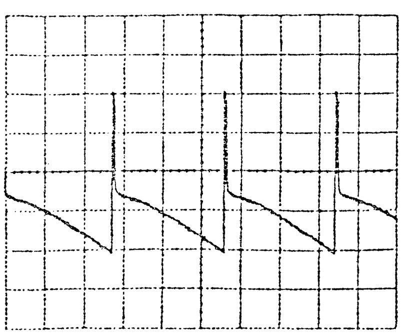
C3 20 Vpp



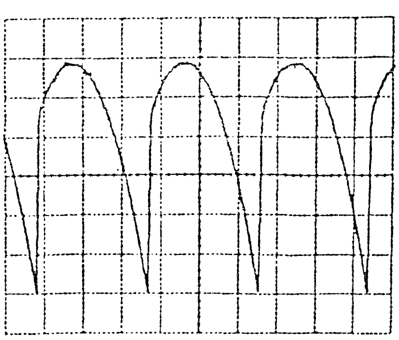
C4 23 Vpp



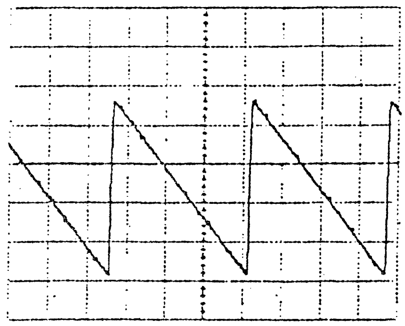
C5 43 Vpp



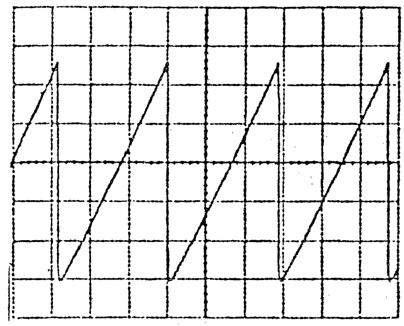
C6 3 Vpp



C7 2.3 Vpp



C8 11 Vpp



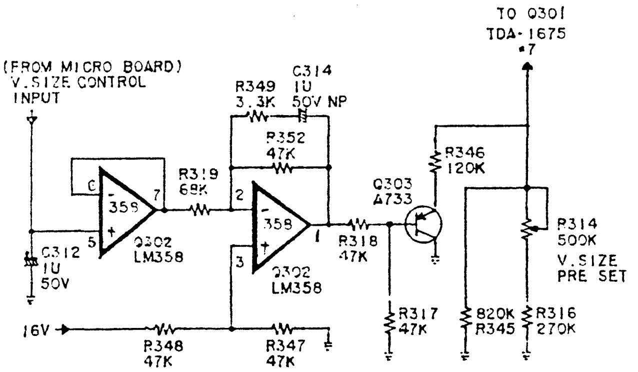
3.9 VERTICAL HEIGHT ADJUSTMENT

(Refer to circuit diagram Fig-9)

The resistance between pin 7 of Q301 and ground defines the current mirror and then the height of the scanning.

R314 and network Q303–Q302–R346–R316–R345 define the amplitude of the ramp signal on the input of the deflection power amplifier. R314 is the vertical size pre-setting resistor.

VERTICAL HEIGHT ADJUSTMENT CIRCUIT *Fig-9*



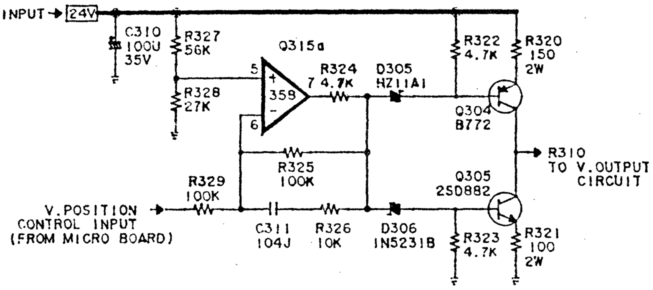
3.10 VERTICAL POSITION ADJUSTMENT

(Refer to circuit diagram Fig-10)

The raster vertical position adjustment is achieved by using the network Q315a–D305–D306–Q304–Q305–R302–R321, control voltage is fed to pin 6 of Q315a, when output voltage on pin 7 of Q315a is high, this voltage will turn on Q305 via D306, part of vertical deflection dc current will flow to ground via Q305 and R321, the raster position will be moving up.

Similarly, when output voltage on pin 7 of Q351a is low, this voltage will turn on Q304 via D305, part of dc current will flow into vertical deflection coil via R320 and Q304, the raster position will be moving down.

VERTICAL POSITION ADJUSTMENT *Fig-10*



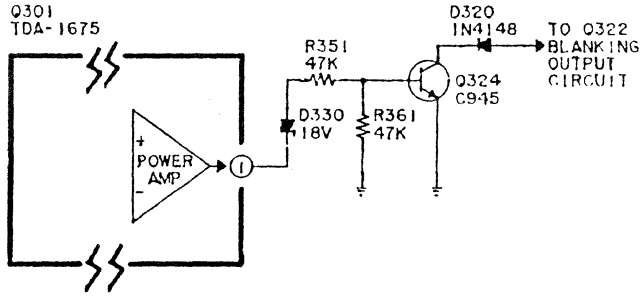
3.11 VERTICAL BLANKING CIRCUIT

(Refer to circuit diagram Fig-11)

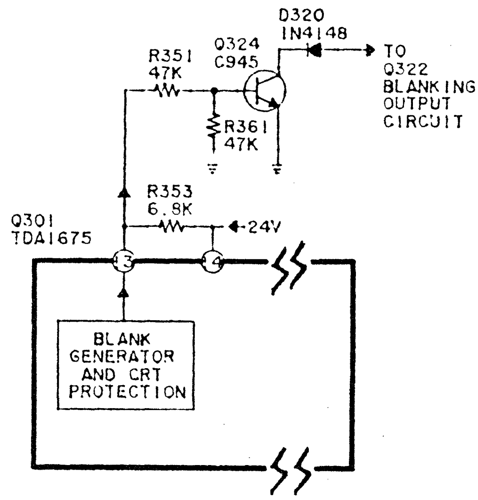
Vertical blanking pulse is produced by clipping the vertical pulse with a 18V zener diode from pin 1 of Q301 via R351 and network R361–D320–Q324, it is also combined with horizontal blanking signal via network D321–Q321–R354–C341–R358. (BLANKING CIRCUIT 1.)

(The vertical blanking pulse is produced from pin 13 of Q310 via R353 in some other model). (BLANKING CIRCUIT 2.)

VERTICAL BLANKING CIRCUIT 1. *Fig-11A*



VERTICAL BLANKING CIRCUIT 2. *Fig-11B*



3.12 DPC (EASE-WEST CORRECTION) CIRCUIT

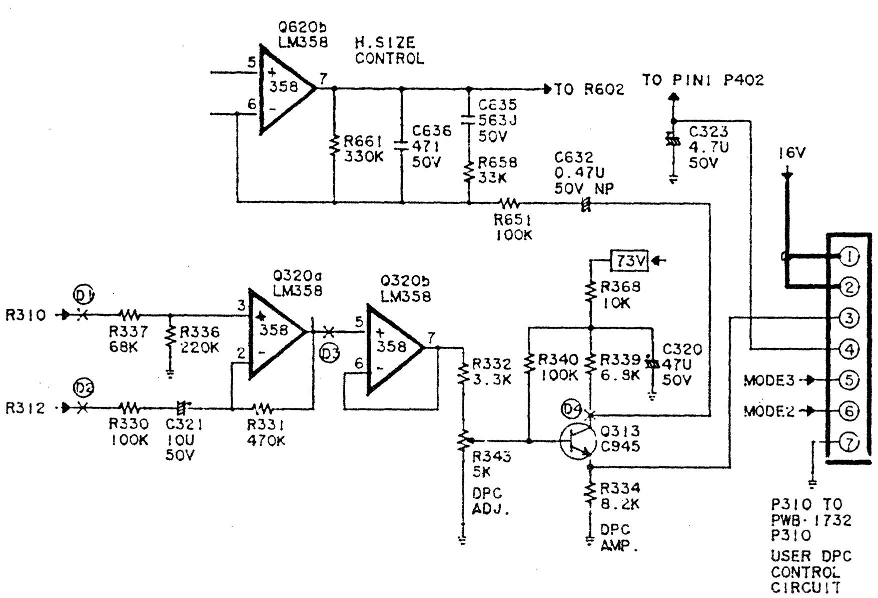
(Refer to circuit diagram Fig-12)

The East-West correction can be reached by modulation the horizontal yoke with a parabola, the parabola can be obtained directly from the coupling capacitor C309 in the vertical output stage.

Network Q320a–Q320b–R343–Q310 is introduced to generate the parabola signal, vertical saw-tooth (ramp) signal is fed to pin 2 of summing amplifier Q320a via R330-C321, a DC signal is fed to pin 3 of Q320a via R337-R336 to adjust the symmetry of the parabola ("trapezoidal" or "keystone" correction).

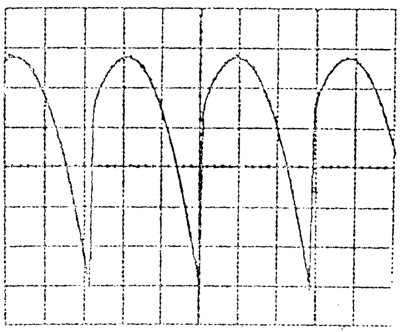
R343 is used to set the amplitude of parabola signal. The parabola signal is also controlled by network Q350–Q351–Q352 and relatives resistors.

EAST-WEST CORRECTION CIRCUIT *Fig-12*

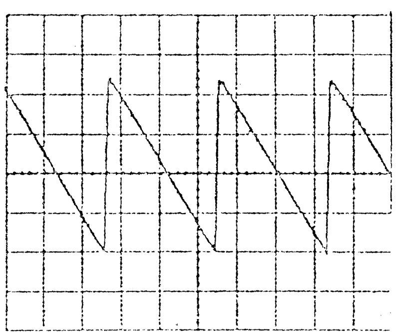


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	D1	NON-INVERTING INPUT
	D2	INVERTING INPUT
	D3	PARABOLA OUTPUT
	D4	BUFFER OUTPUT

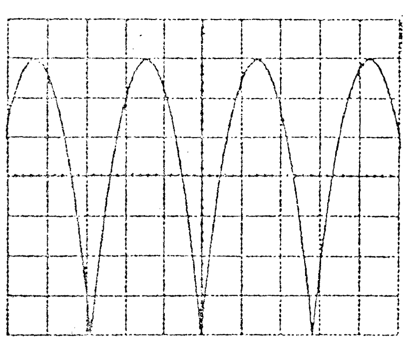
D1 3 Vpp



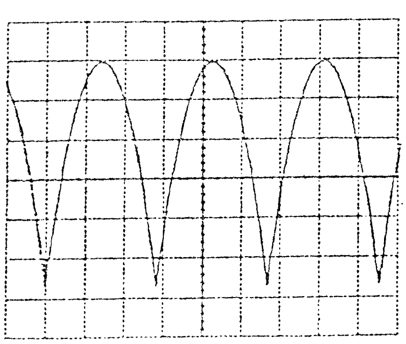
D2 2.3 Vpp



D3 7 Vpp



D4 5.5 Vpp



3.13 USER DPC ADJUSTMENT CIRCUIT

(Refer to circuit diagram Fig-13)

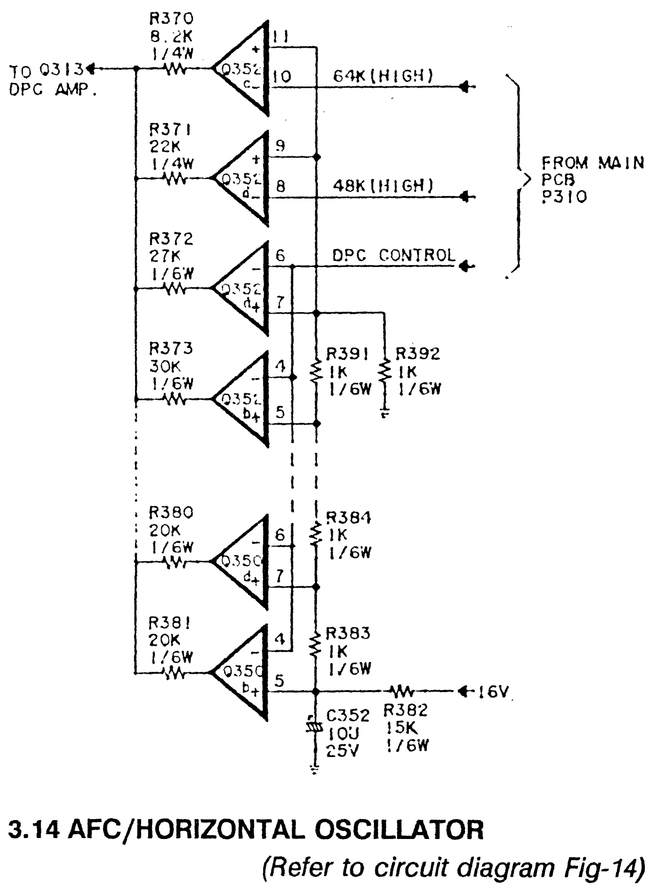
There are ten similar comparator circuit (Q352c–Q352d, Q351a–Q351d, Q350a–Q350d) to achieve ten-step user's DPC control function, all the comparator's output is connected to the emitter of Q313 via resistors (R370 to R381) to control the gain of the amplifier Q313. The user's DPC control voltage is fed to the inverting pin of the comparator, the non-inverting pin of the comparator is connected to 16V via resistor chain R382 to R392. This resistor chain gives each non-inverting pin of the comparator different dc voltage. Obviously the voltage on pin 2 of Q350d is higher than the voltage on pin 7 of Q352c.

When the voltage on non-inverting pin is higher than inverting pin, the output of the comparator is grounded.

So when user's DPC control voltage is getting higher, the emitter impeadance of Q313 is lower. Then, the output of Q313 is larger.

The parabola signal is fed to horizontal circuit via C632–R651 to modulate the horizontal deflection current in the yoke.

USER DPC CONTROL CIRCUIT *Fig-13*



3.14 AFC/HORIZONTAL OSCILLATOR

(Refer to circuit diagram Fig-14)

The phase detector part of the Q403 (LA7851 scan processor IC.) is used to synchronize the output of the horizontal deflection stage to normalized horizontal sync. pulses (pin 4 of Q403).

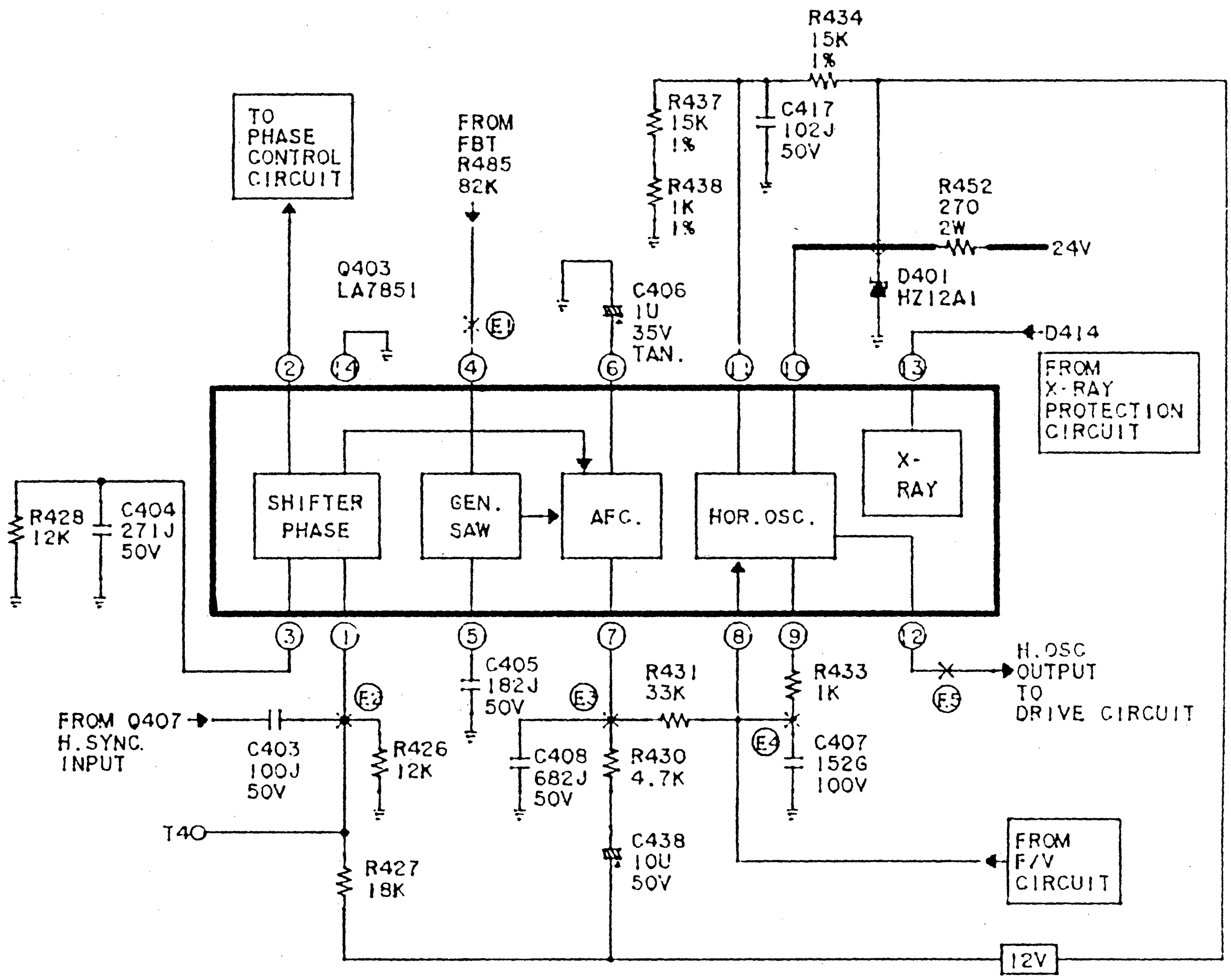
The horizontal SYNC. signal is fed to pin 1 of Q403 via Q407, the feedback signal from the horizontal output circuit is fed into the AFC circuit (inside the Q403) through pin 4, the AFC control signal is obtained from pin 7. This AFC signal is applied to the input (pin 8) of the horizontal oscillator via C408, R431, R433, C407 to determine the time constant of the horizontal oscillation.

The horizontal oscillation frequency is also controlled by the horizontal F/V circuit.

The oscillator output is a square wave and derived from pin 12 of Q403, the width of the square wave is controlled by pin 11 of Q403, at 31KHz operating mode, Q423b is on to set up correct duty cycle.

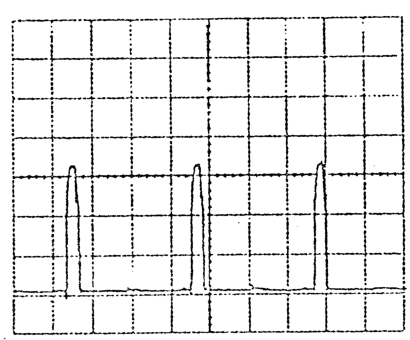
Pin 10 of Q403 is the main supply voltage (12V) input via D401–R452.

AFC/HORIZONTAL OSCILLATOR CIRCUIT *Fig-14*

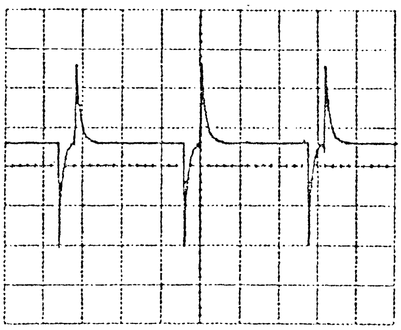


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	E1	FEEDBACK PULSE
	E2	SYNC. PULSE
	E3	AFC PULSE
	E4	AFC PULSE
	E5	OSC OUTPUT

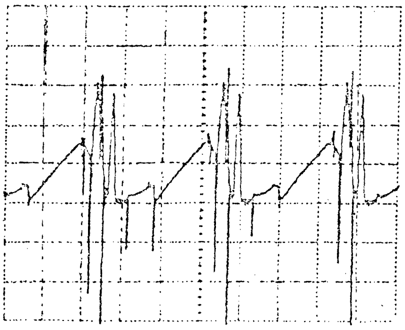
E1 1.8 Vpp



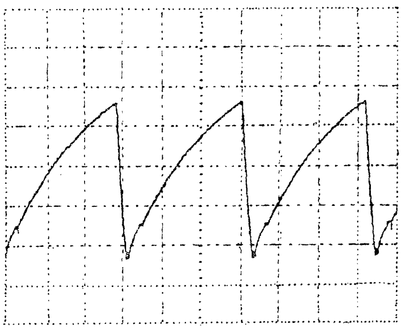
E2 4.5 Vpp



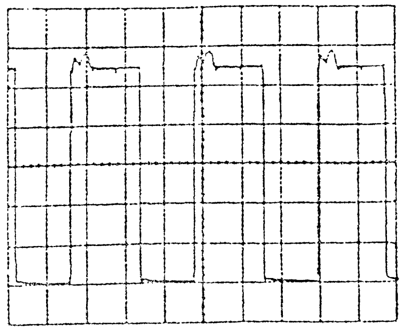
E3 0.35 Vpp



E4 4 Vpp



E5 12 Vpp



3.15 HORIZONTAL F/V CIRCUIT

(Refer to circuit diagram Fig-15)

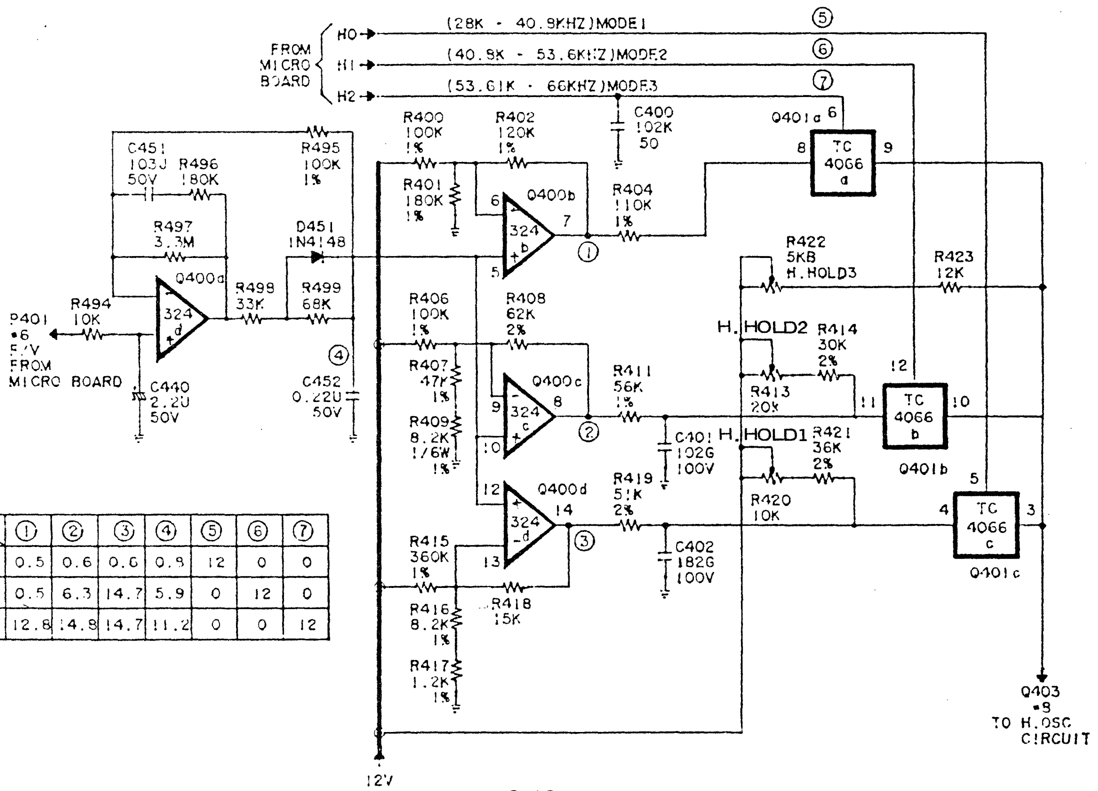
The horizontal F/V circuit is consists of Q400a, Q400b, Q400c, Q400d and some discrete components. The F/V signal is fed to pin 3 of buffer stage (Q400a) via pin 6 of P401, then the output voltage is applied to comparator Q400b, Q400c and Q400d.

According to the different input frequency, the output voltage of Q400b, Q400c and Q400d is fed to pin 8 of Q403 via analog switch Q401a, Q401b or Q401c.

For example:
When input frequency is between 28KHz to 40.8KHz, Pin 3 and Pin 4 of analog switch (Q401c) is on.
When input is 40.8KHz to 53.6KHz, Q401b is on.
When input is 53.61KHz to 66KHz, Q401a is on.

R422, R413 and R420 enable the free-run frequency to

HORIZONTAL F/V CIRCUIT *Fig-15*



	①	②	③	④	⑤	⑥	⑦
31K	0.5	0.6	0.6	0.9	12	0	0
48K	0.5	6.3	14.7	5.9	0	12	0
64K	12.8	14.8	14.7	11.2	0	0	12

be tuned during the set up procedure.
For 64KHz, 48KHz and 31KHz mode, R420, R413 and R422 is adjusted sequentially.

Note that the network values are chosen so that R420, R413 has negligible in the 64KHz mode. In the low frequency mode, it adds to the effect of R422, therefore, during setup, it is advised that the high frequency operating modes be optimized first.

ALIGNMENT PROCEDURE

64KHz ---------> 48KHz ---------> 31KHz
(R422) (R413) (R420)

3.16 HORIZONTAL PHASE SHIFT CIRCUIT

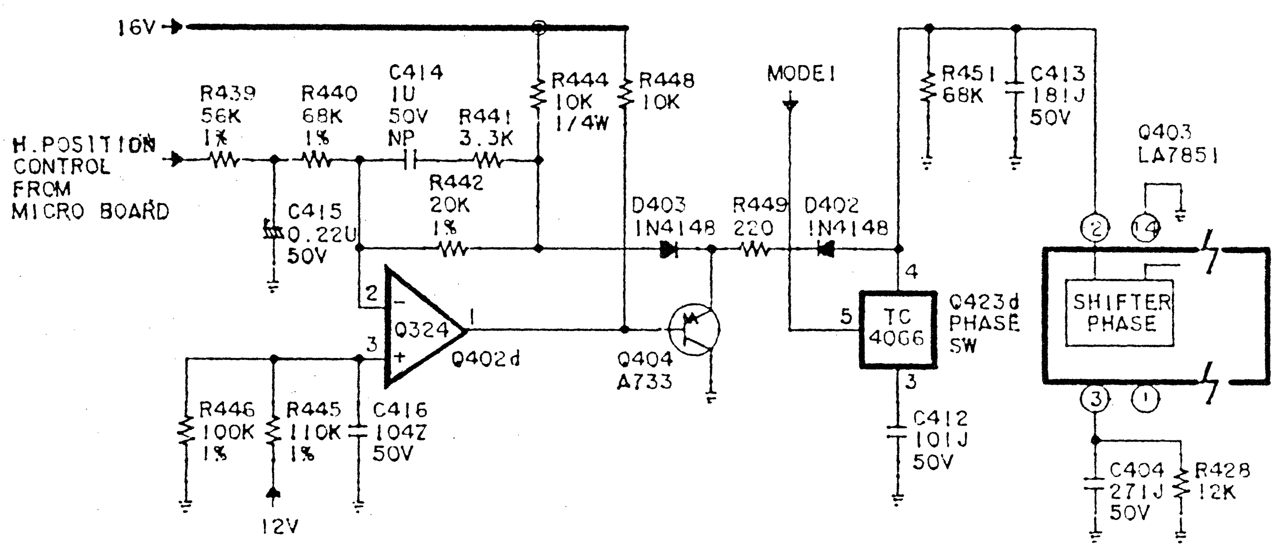
(Refer to circuit diagram Fig-16)

An adjustable delay is introduced at the phase shift pin 2 of Q403.

The phase control signal is derived from pin 5 of P401 and fed into Q402a to achieve good noise rejection, the phase control is achieved by making use of the Q404, Q423a and relative components.

For the 31KHz operating modes, analog switch Q423a is on to optimize the picture phasing in the low frequency operating mode.

HORIZONTAL PHASE SHIFT CIRCUIT *Fig-16*



3.17 HORIZONTAL DRIVE CIRCUIT

(Refer to circuit diagram Fig-17)

The product is designed around a COMMON base-drive circuit driving separate horizontal deflection and HV. OUTPUT circuit, to provide sufficient switching current.

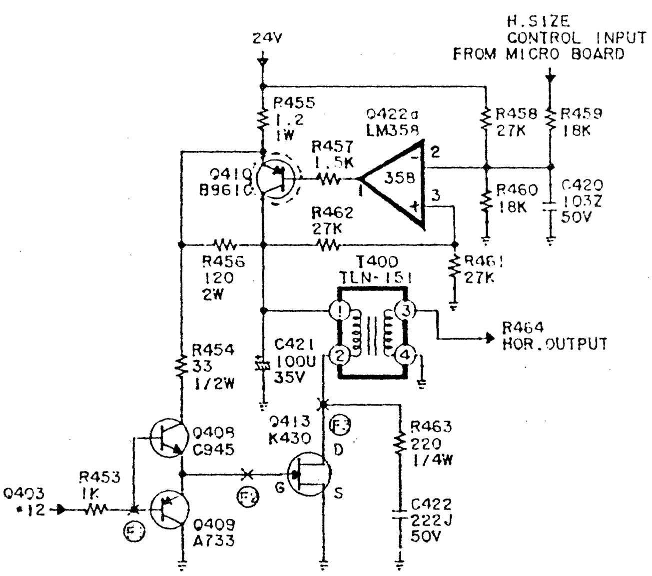
Q413 is switched by the horizontal drive signal from Q403 via network Q408–Q409.This produces a sufficient voltage to T400.

Snubber network R463–C422 compensates for leakage inductance in T400 and shapes the base drive waveform.

The drive current of Hor. output Q411 is automatically compensated by network Q410–Q422a–R456. Pin 2 of Q422a receive a raster width control voltage and a dc voltage is giving to the base of Q410 via pin 1. So when raster width is changed the primary windings of T400 will receive different drive voltage via Q410.

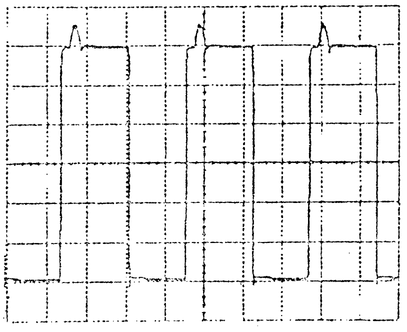
The result is that the current in secondary winding is proportional to the primary drive voltage.

HORIZONTAL DRIVE CIRCUIT *Fig-17*

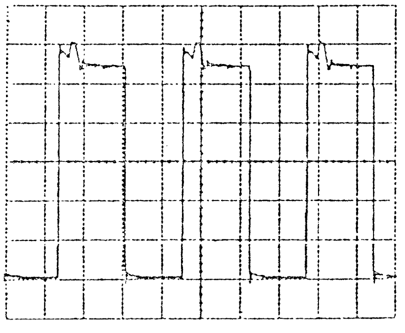


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	F1	OSC VOLTAGE
	F2	BUFFER OUTPUT
	F3	DRIVE VOLTAGE
	F4	DRIVE VOLTAGE
	F5	OUTPUT PULSE
	F6	CS VOLTAGE

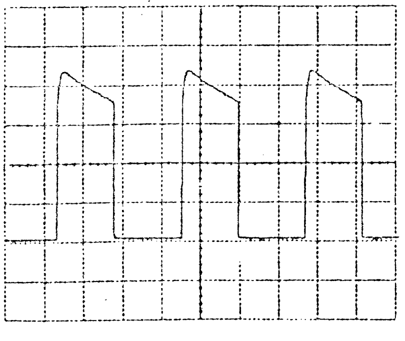
F1 12 Vpp



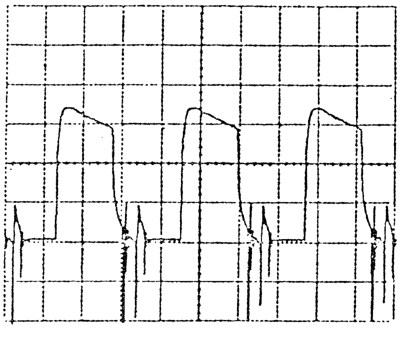
F2 12 Vpp



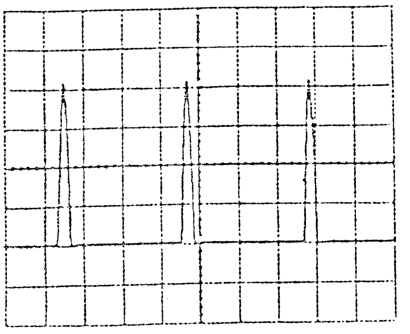
F3 42 Vpp



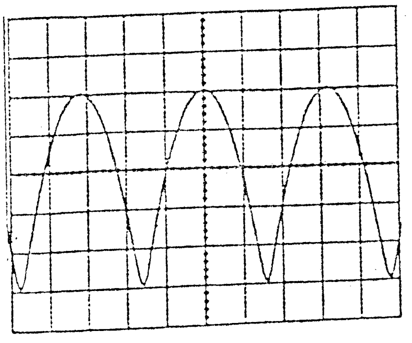
F4 12 Vpp



F5 840 Vpp



F6 25 Vpp



3.18 HORIZONTAL DEFLECTION CIRCUIT

(Refer to circuit diagram Fig-18)

A horizontal deflection output circuit uses the transistor's switching function, combined with a damping diode and makes sawtooth wave current flow through a deflection coil.

The basic deflection circuit comprises switching transistor Q411,transformer T401, diode D405, D415, D416, C423, C424, and the horizontal deflection coil connected to P404. Network L402–L405, R473–C426, R466–C427, modifies the current wave form in the deflection coil to give good horizontal picture linearity.

In 31KHz operating mode

Q414 is on, relay RY401 is open, L402 and L405 are in series.

Q420 and Q421 are on and S correction is provided by the combination of C428, C429 and C430.

In 48KHz operating mode

Q414 is off, relay RY401 is short, L405–R466–C427 is short, linear coil is provided by L402 along.

Q420 is on, Q421 is off, S correction is provided by the combination of C428 and C430.

In 64KHz operating mode

Q414 is still off, linear coil is provided by L402 along.

Q420 is off, Q421 is off, S correction is provided by C430 along.

The width of the raster is proportional to the peak scan current in the deflection coil.

The rate of change of which is proportional to the voltage across the horizontal output transformer primary winding.

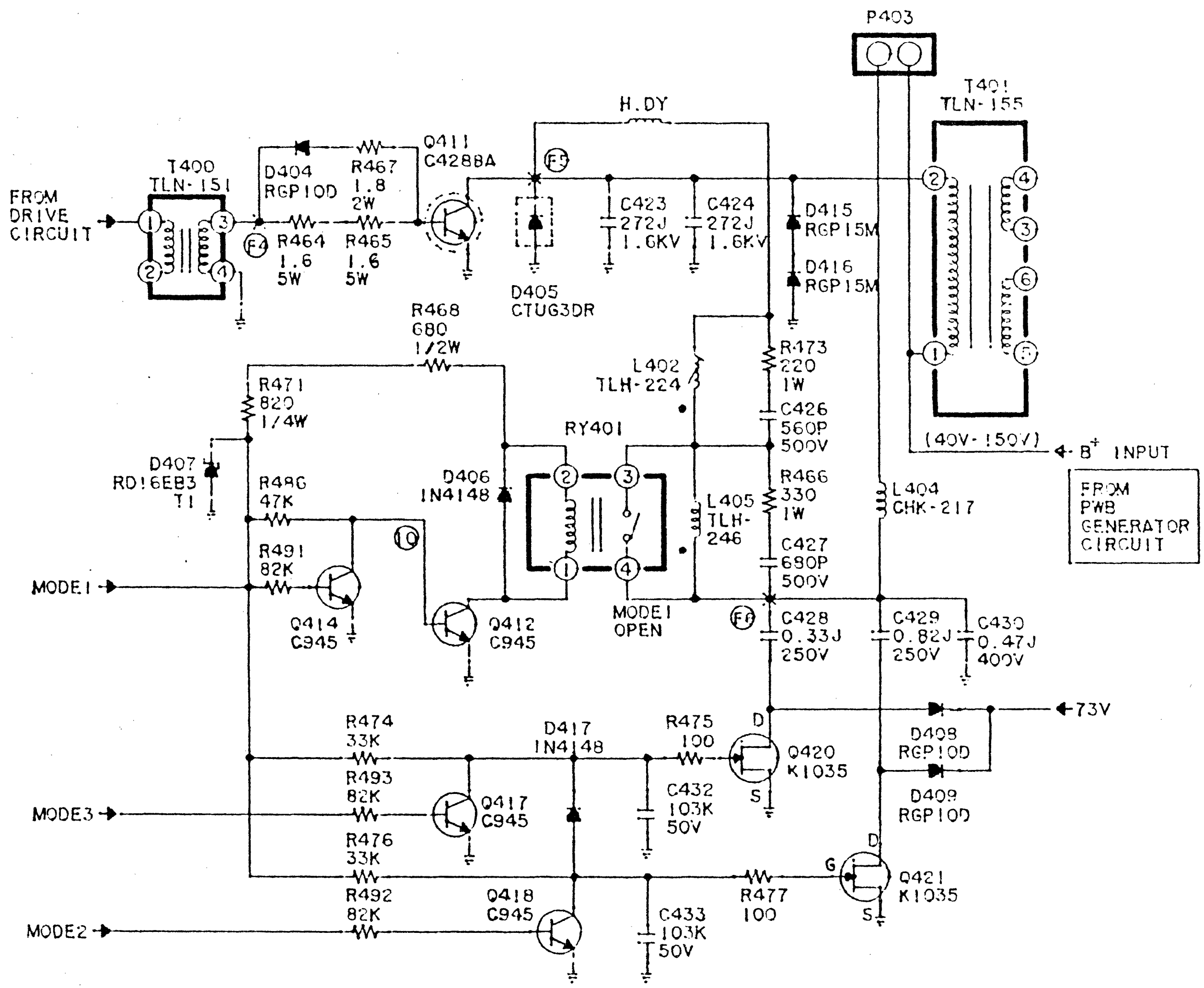
Therefore if the scan period changes, the voltage across the winding must change to maintain a constant scan width.

A variable voltage (40–150V) which is generated from PWM SIGNAL GENERATOR is fed to Pin 1 of T401 to maintain the constant scan width.

HORIZONTAL DEFLECTION COIL SPECIFICATION

	HITACHI (17")	HITACHI (20")	NEC (17")	TOSHIBA (17")
INDUCTANCE	0.13 mH	0.18 mH	0.18 mH	0.18 mH
RESISTANCE	0.21 ohm	0.3 ohm	0.3 ohm	0.34 ohm

HORIZONTAL DEFLECTION CIRCUIT *Fig-18*



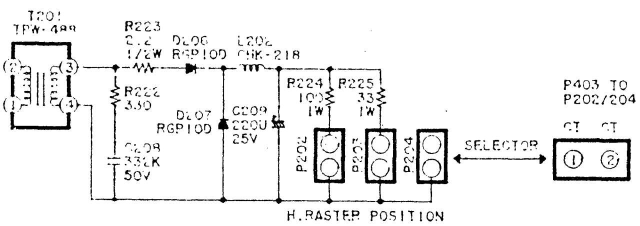
3.19 HORIZONTAL POSITION (RASTER)CIRCUIT

(Refer to circuit diagram Fig-19)

Adjustable horizontal raster centering is achieve using complementary voltage derived from secondary winding T201 and network D206–D207–L202.

The raster's horizontal position is achieved by selecting P202, P203, P204 on either end of the connector, the DC voltage (10V) produced across R224, R225 introduces a DC element to the current in L404 and the yoke assembly. The background raster should be centralized with respect to the edges to the bezel during the set up procedure.

RASTER'S HORIZONTAL POSITION CIRCUIT Fig-19

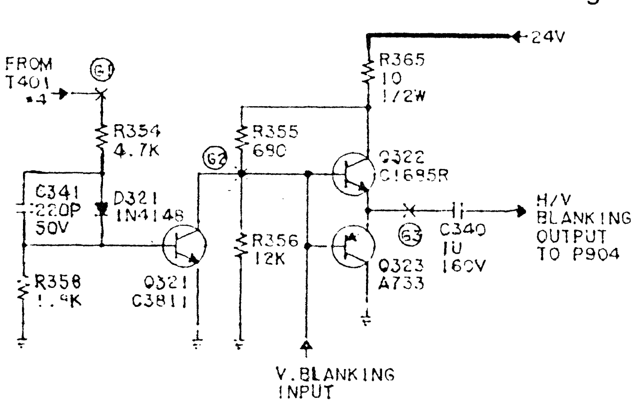


3.20 HORIZONTAL BLANKING CIRCUIT

(Refer to circuit diagram Fig-20)

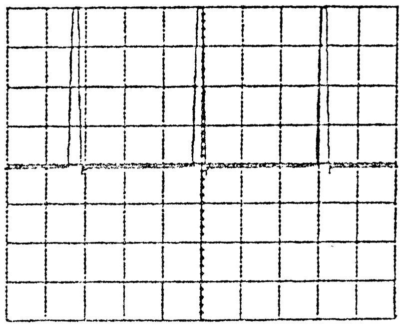
The flyback pulse on secondary winding pin 4 of T401(Horizontal output transformer) not only provides the raster width control signal but also combined with the vertical blanking signal via Q321–Q324–Q322–Q323 to produce a composite blanking signal for the video amplifier.

HORIZONTAL BLANKING CIRCUIT Fig-20

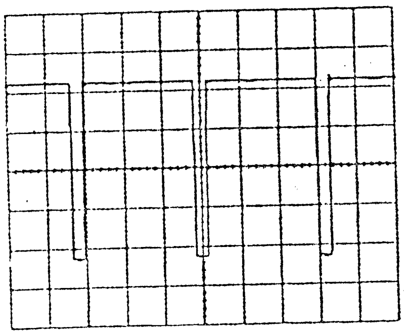


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	G1	H PULSE
	G2	H BLANKING
	G3	H & V BLANKING OUTPUT

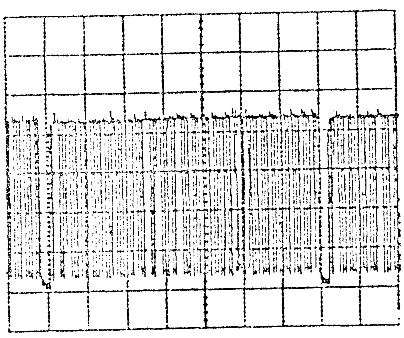
G1 42 Vpp



G2 23 Vpp



G3 23 Vpp



3.21 PWM SIGNAL GENERATOR

(Refer to circuit diagram Fig-21)

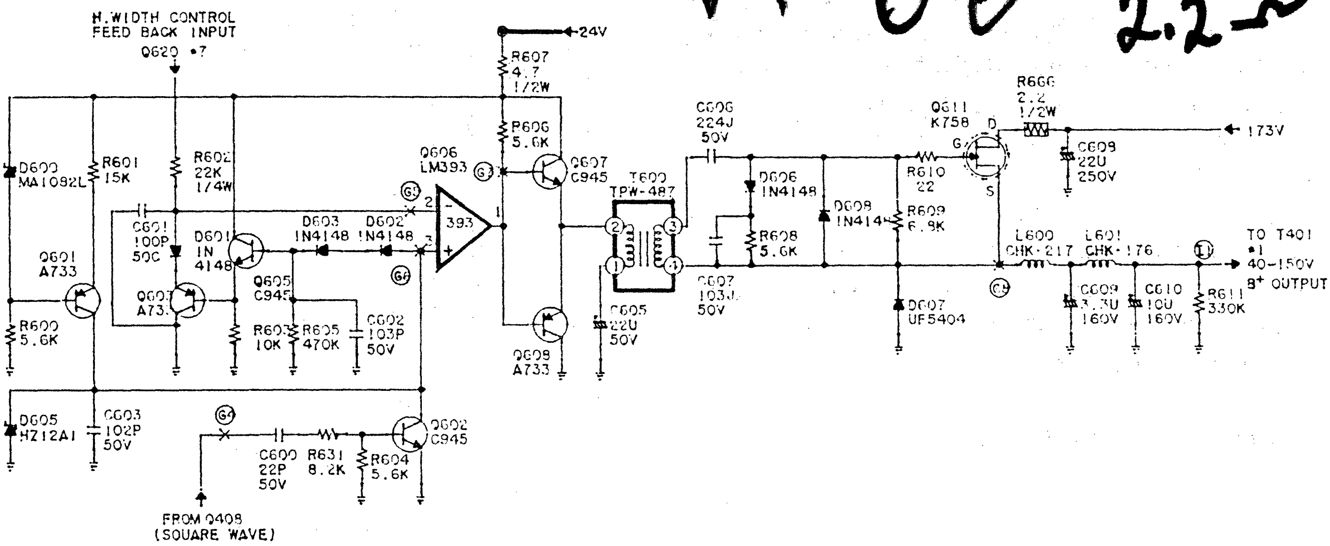
A square waveform signal is fed to Q602 via C600–R631, a ramp signal is generated by C603 with the peaks being clipped to 12V by D605. In order for the system to function correctly, the slope of the PWM reference signal is modified by Q601–D600.

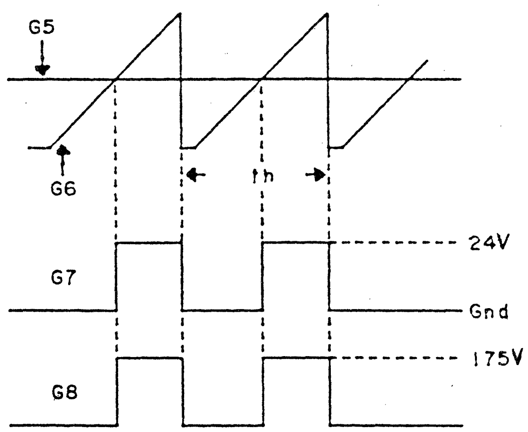
The ramp signal is fed to pin 3 of Q606a and pin 5 of Q 606b, and used as the reference signal for the Pulse Modulation Comparator in the horizontal and HV. control circuit.

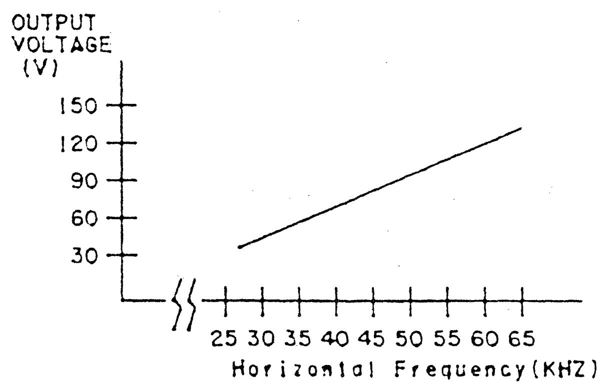
PWM SIGNAL GENERATOR CIRCUIT

R666 2.2Ω

Fig-21

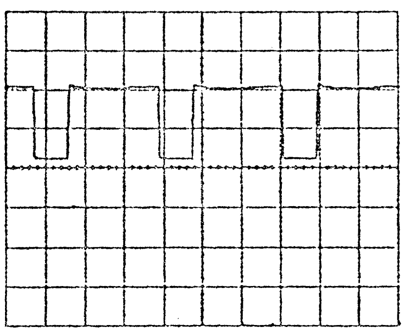




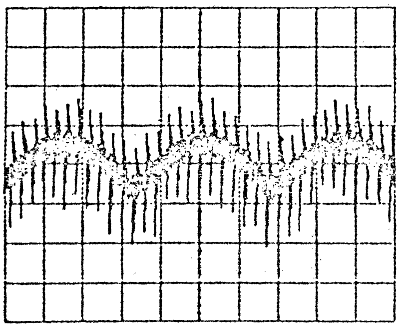


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	G4	OSC VOLTAGE INPUT
	G5	H WIDTH FEEDBACK
	G6	SAWTOOTH WAVEFORM
	G7	PWM OUTPUT
	G8	SOURCE VOLTAGE

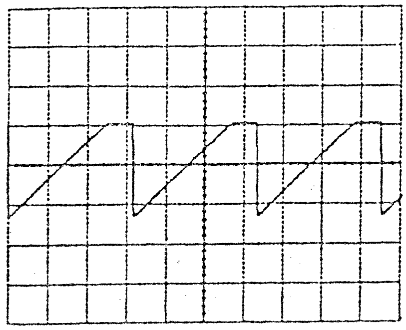
G5 0.8 Vpp



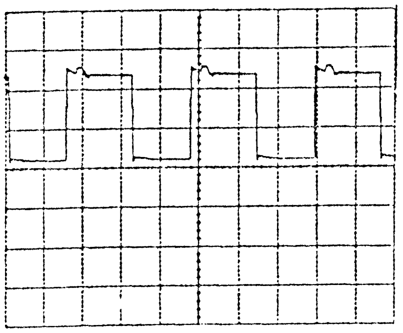
G4 12 Vpp



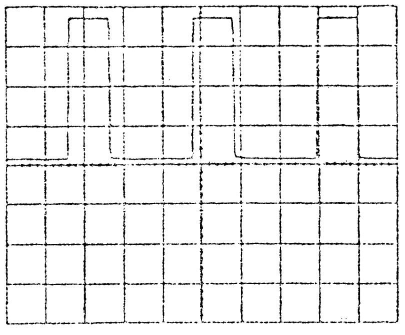
G6 12 Vpp



G7 23 Vpp



G8 173 Vpp



3.22 WIDTH CONTROL CIRCUIT (DC/DC CONVERTER)

(Refer to circuit diagram Fig-22)

This circuit supplies dc voltage (40–150V) to H deflection circuit, the output voltage level is proportion to H SIZE and horizontal frequency.

The width control circuit can be thought of as the error signal processing block of the feedback control loop. The feedback signal is derived from the flyback pulse on pin 4 of T400 which is peak-detected by D411–C435. Width adjustment is applied at input through potential divider chain R480–R481–R482. R481 is used as a H. size pre-setting potentiometer.

The picture width should be optimize using R481 during the set up procedure.

The user horizontal size control is implemented by Q422b.

Pin 6 of Q422b receive the size control signal from pin 2 of P402 via R657, pin 7 of Q422b produce a dc voltage to pin 6 of Q620b.

The signal on pin 6 of Q422b is the summary of DPC control signal (see DPC control generator), user size control signal and H. size pre-setting control signal.

The output from the summing amplifier Q620b therefore include EAST-WEST pincushion correction information. This signal is noise-filtered by R602–C601 before comparison with the PWMreference signal. The latter being applied to the positive comparator input.

The output from the comparator Q606a is a square wave with pulse-width modulation and used to drive Q611 via buffer stage Q607, Q608 and T600. T600 is a isolating transformer used to isolate low voltage on primary side and high voltage on secondary side.

Network L600–C609–C610 is a decoupling circuit, R666 is a fusible protection resister. D606 and D608 are initial turn on diodes, to prevent transient instability on power up.

D607 is a fly-wheel diode. When Q611 is on, voltage +175V will supply to pin 1 of T401 via L600, simultaneously the energy will store in the choke L600. When Q611 is off, the energy which originally store in L600 will discharge via D607 to C609.

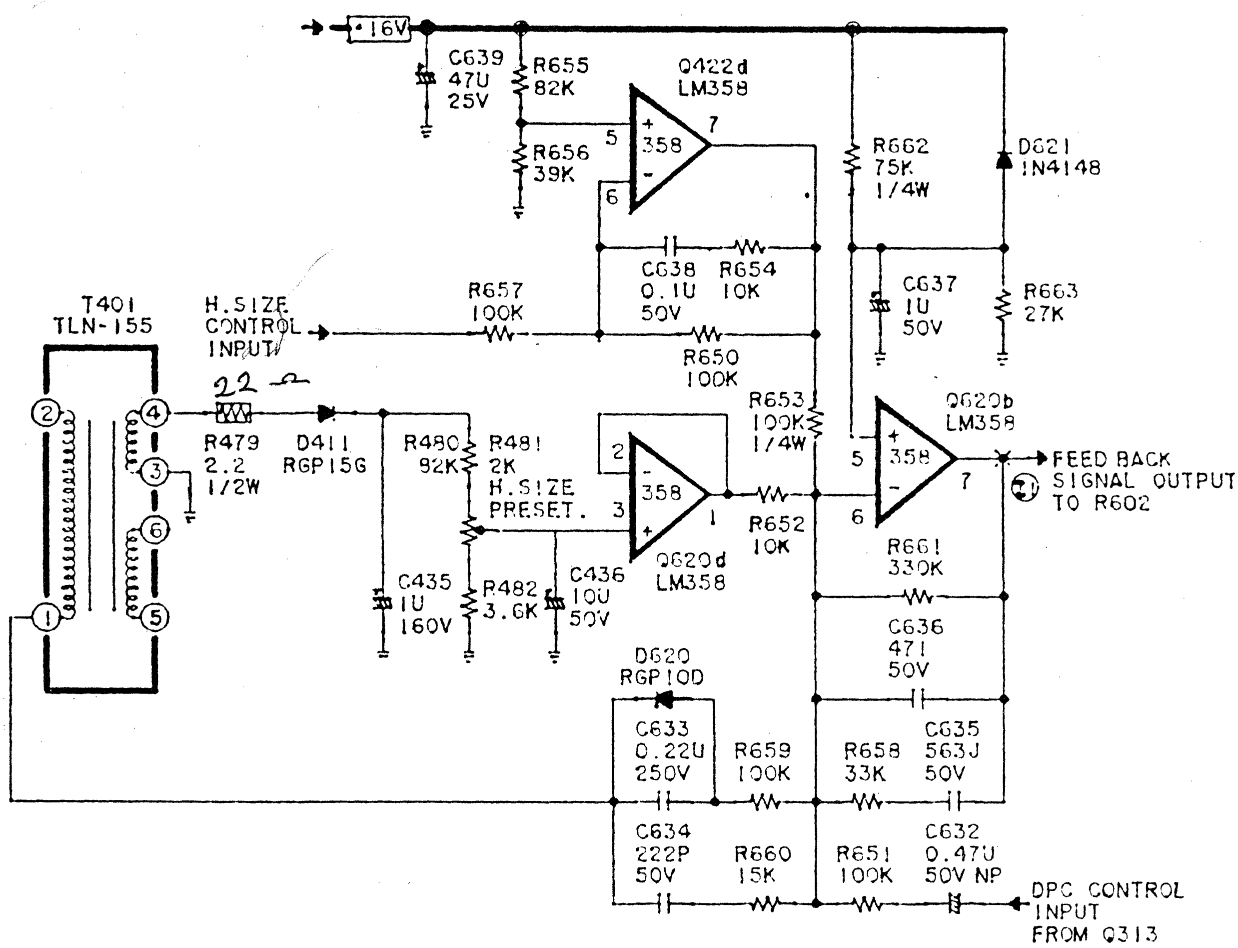
Power MOSFET Q611 switches the termination of L600 between 0V and 175V with a Pulse-Width Modulated Switching signal at the horizontal frequency.

Varying the duty cycle of the switching signal varies the time-average voltage of the output thereby controlling the width of any horizontal scan cycle.

A voltage from 40V to 150V is generated from C610, this voltage is varied according to the H. SIZE dc feedback signal (Pin 3 of Q620a).

Network, Q603–Q604–Q605, D601–D602D603–D604 is a initial turn on circuit and used to force Q606a generate a PWM signal before pin 4 of T401 is ready to generate a feedback control signal on power up.

Network D620–C633–R659, C634–R660 is a negative feedback circuit and used to limit the excursions of the error voltage upon the PWM reference to prevent instability on power up.



3.23 HIGH VOLTAGE CONTROL CIRCUIT (DC/DC CONVERTER)

(Refer to circuit diagram Fig-23)

This circuit supplies dc voltage (40–150V) to HIGH VOLTAGE circuit, the output voltage level is proportion to HIGH VOLTAGE and horizontal frequency.

As shown by functional circuit diagram, the high voltage control circuit is similar to the width control circuit.

The high voltage regulation feedback signal is derived from pin GR. (7) of T603 and R622 to give good high voltage regulation.

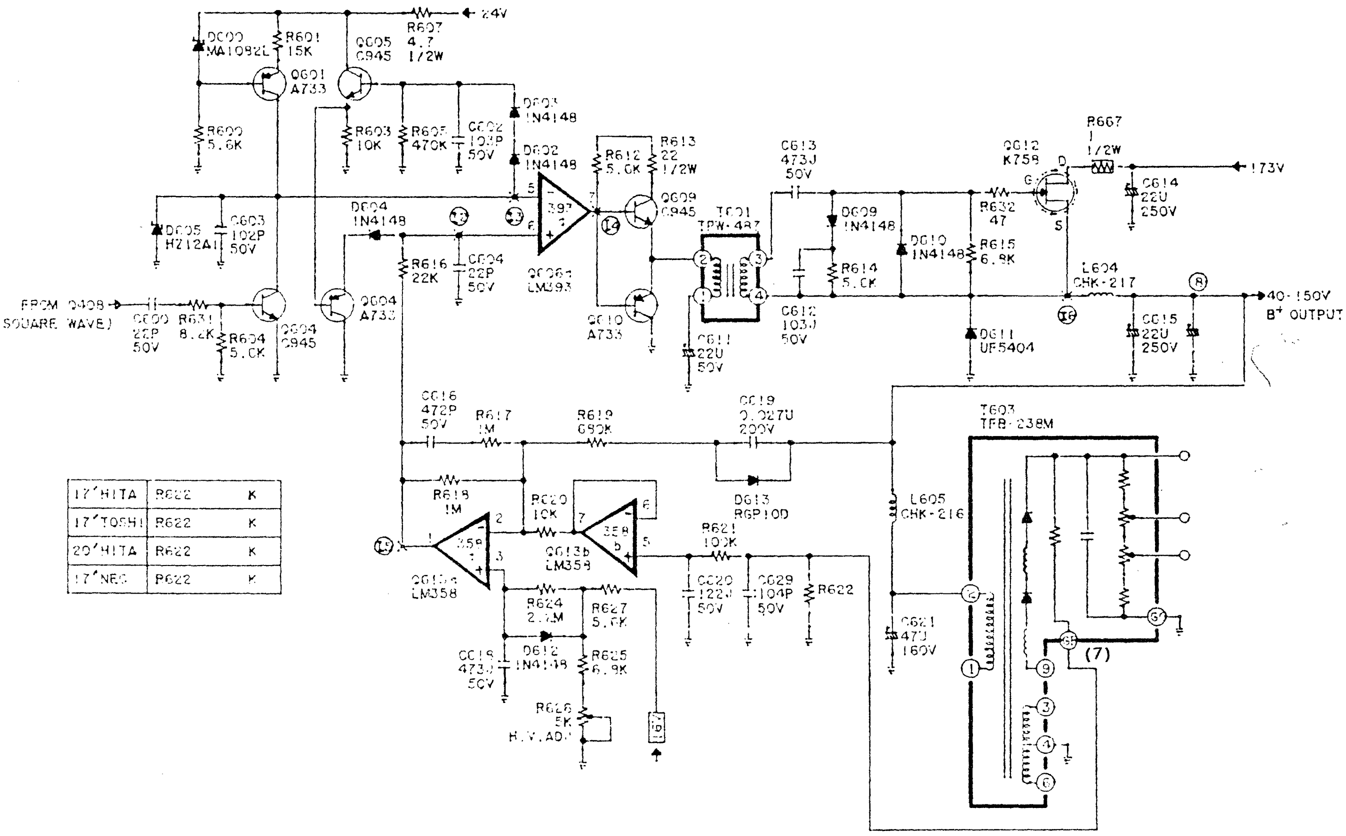
The high voltage (anode voltage) is set by potential divider chain R626–R625–R627; the output of which is applied to the non-inverting input of buffer stage Q613b, the output of Q613b is fed to pin 2 of summing amplifier Q613a through R620.

The voltage on the output of Q613a is the error signal which is compared to the PWM reference signal by Q606b. The output square wave from comparator Q606b is used to drive the regulating switch Q612 via buffer stage Q609, Q610 and isolating transformer T601.

Varying the duty cycle of the switching signal varies the time-average voltage across the primary winding thereby controlling the high voltage during any horizontal scan cycle.

A voltage from 40V to 150V is generated from C621, this voltage is varied according to the HV. dc feedback signal (Pin 5 of Q613b).

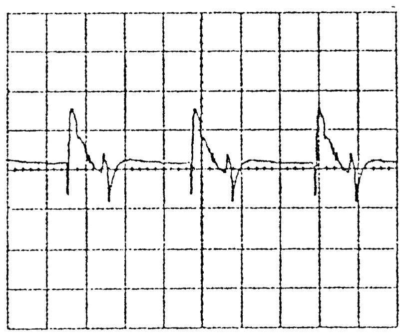
HIGH VOLTAGE CONTROL CIRCUIT *Fig-23*



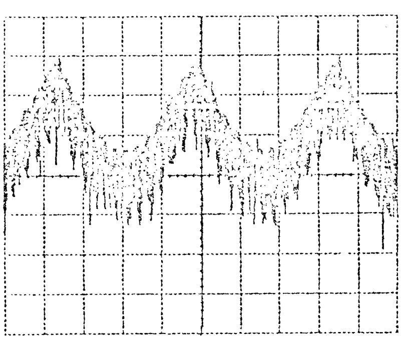
17' HITA	R622	K
17' TOSHI	R622	K
20' HITA	R622	K
17' NEC	R622	K

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh = 31KHz	I1	HV FEEDBACK
	I2	HV FEEDBACK
	I3	SAWTOOTH WAVEFORM
	I4	PWM DRIVE SIGNAL
	I5	HV FEEDBACK
	I6	SOURCE VOLTAGE

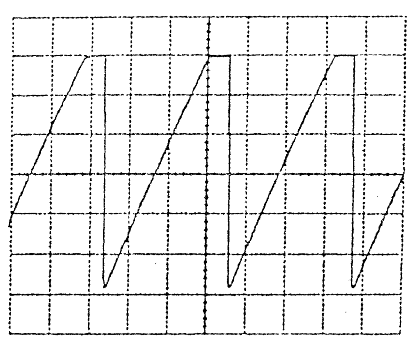
I2 1.2 Vpp



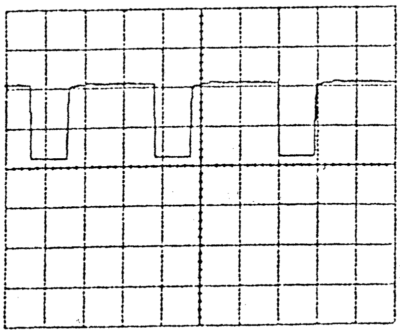
I1 0.42 Vpp



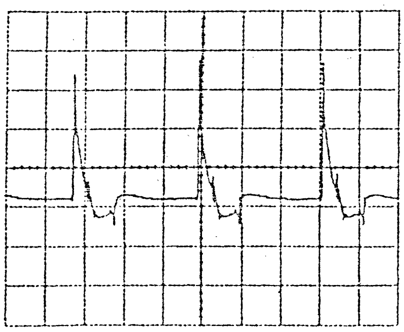
I3 12 Vpp



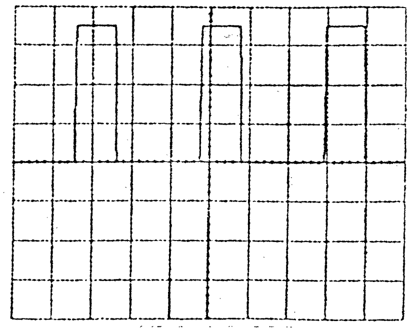
I4 24 Vpp



I5 2 Vpp



I6 173 Vpp



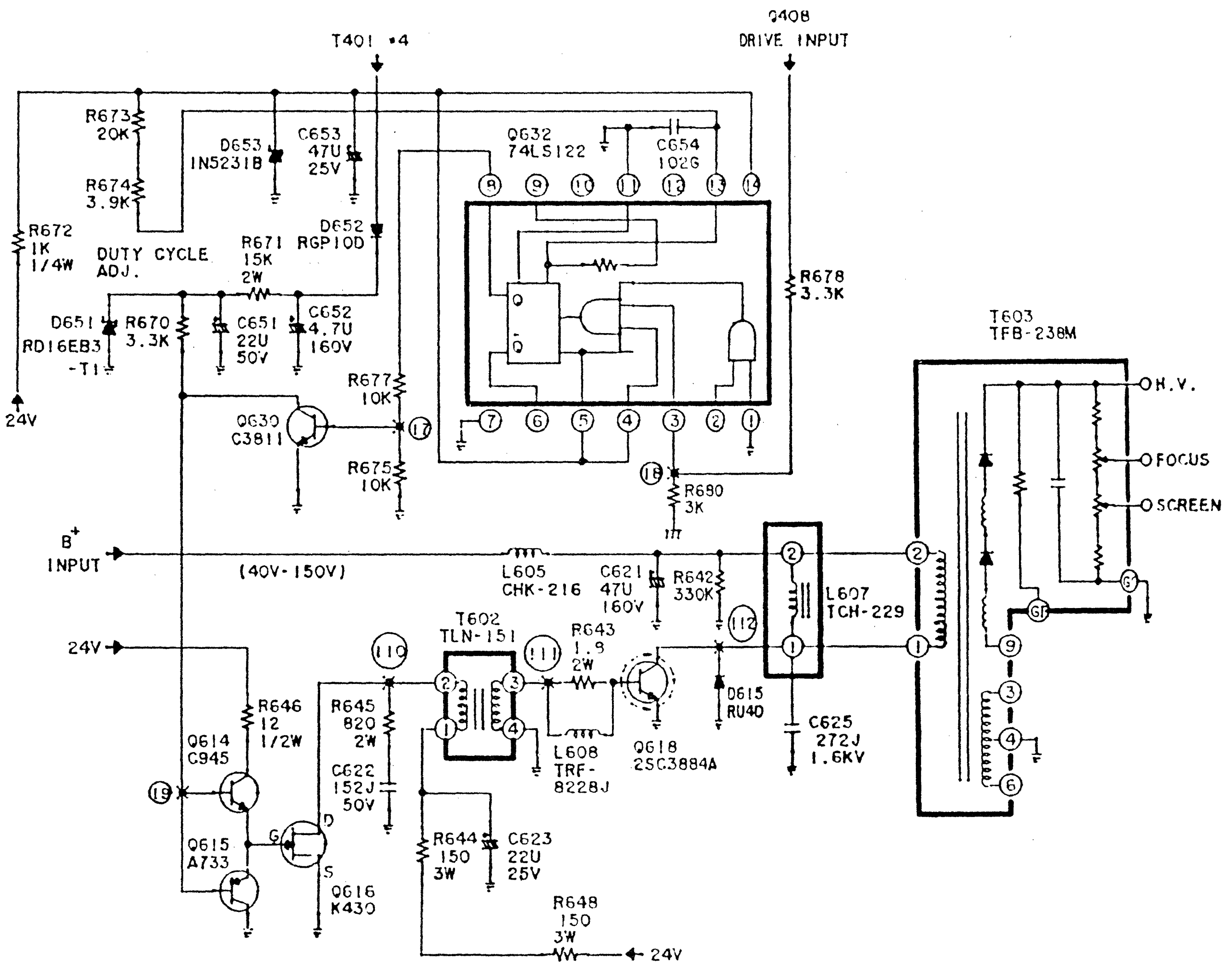
3.24 HIGH VOLTAGE (HV.) GENERATOR

(Refer to circuit diagram Fig-24)

The drive signal from Q408 and Q409 is fed to pin 3 of Q632 to generate a constant width of drive waveform in order to drive Q618 via Q630, Q614, Q615, Q616 and T602.

The HV. generating circuit uses the same principle as the horizontal deflection stage. The base-drive circuit (see horizontal deflection circuit)includes a current on

HIGH VOLTAGE GENERATOR *Fig-24*



the winding between pins 3 and 4 of T602 which is sufficient to switch Q618. The flyback pulse thus produced across pins 1 and 2 of T603 is transformed up to the high voltage. The basic flyback comprises Q618, T603 primary winding, C625 and damping diode D615.

The high voltage is dependent on the amplitude and frequency of the flyback pulse. The frequency is set to the horizontal scan rate. Therefore the high frequency operating mode would generate a higher voltage if regulation measure were not taken.

Network L604–C615–C621 is a decoupling circuit, R667 is a fusible protection resister. D610 and D609 are initial turn diodes, to prevent transient instability on power up.

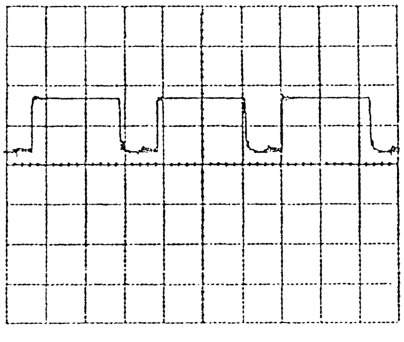
D611 is a fly-wheel diode. When Q612 is on, voltage +175V will supply to pin 2 of T603 via L604, simultaneously the energy will store in the choke L604. When Q612 is off, the energy which originally store in L604 will discharge via D611 to C615.

This regulation system also maintains good picture geometry compensating for high voltage stress effects during extreme changes in beam current.

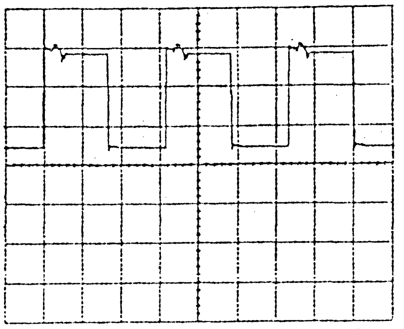
The horizontal flyback pulse on secondary winding pin 4 of T401 provide +16V supply lines to Q630 via the diodes D652, R671 and zener diode D651 to ensure the high voltage generating circuit shut down while horizontal deflection circuit is not working properly.

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	I7	OSC VOLTAGE OUTPUT
	I8	OSC VOLTAGE INPUT
	I9	HV DRIVE INPUT
	I10	HV DRIVE OUTPUT
	I11	BASE VOLTAGE
	I12	COLLECTOR VOLTAGE

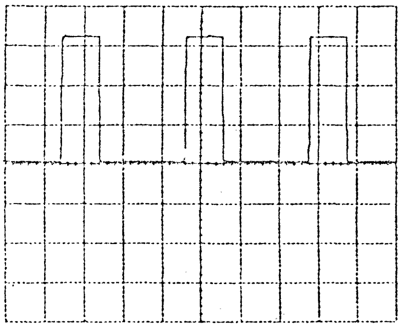
I7 0.7 Vpp



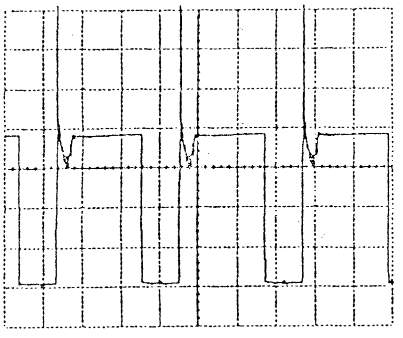
I8 5 Vpp



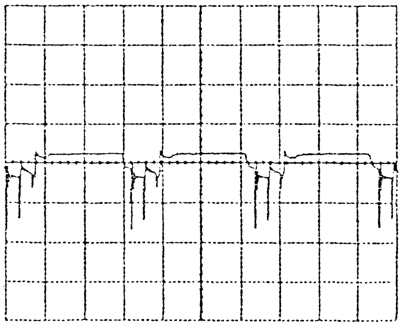
I9 16 Vpp



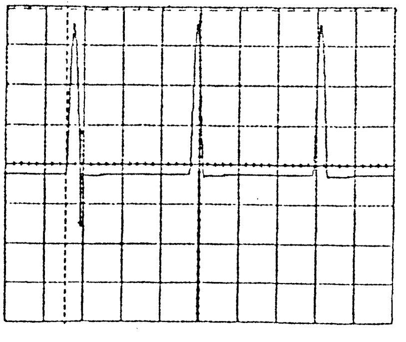
I10 20 Vpp



I11 10 Vpp



I12 800 Vpp



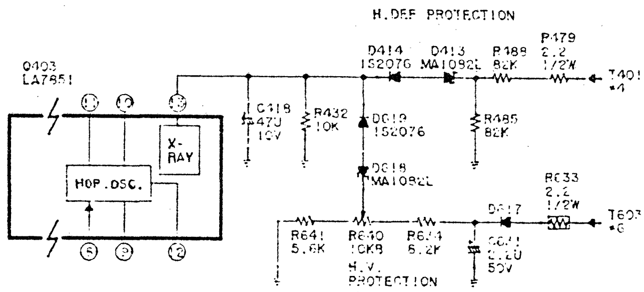
3.25 HIGH VOLTAGE PROTECTION CIRCUIT

(Refer to circuit diagram Fig-25)

The high voltage protection circuit triggers when the voltage is grossly over voltage and liable to cause harmful X-ray emissions from the CRT. The winding on T603 (pin 6) produces a flyback pulse train of amplitude proportional to the final anode voltage. This is DC-restored by D617–C631. Potential divider R634–R641 and R640 determines the protection voltage, in the normal operation region, D618–D619 is off. About the upper limit, the DC-restored voltage is sufficient to cause zener diode D618 to conduct, pin 13 of Q403 is triggered, Q403 is held off.

Pin 13 is also controlled by horizontal deflection output pin 4 of T401 via D413–D414. Potential divider R487–R488 determines the protection voltage.

HIGH VOLTAGE PROTECTION CIRCUIT *Fig-25*



3.26 SYNC. SIGNAL (HOR. AND VERT. SYNC.) PROCESSOR

The product is designed to compatible with workstation, computer or adapter card having the different sync. signal such as G+SYNC., COMPOSITE SYNC. or SEPARATE SYNC. signals.

```
G+SYNC. -------> SYNC./VIDEO ------------------> ID1 CKT. ----------------->ID1
                 SEPARATOR       |                Q557
                 Q052, Q053      |
                      ------> SYNC. SW.
                      |         Q551
                      |          |
                      |          |                H/H+V
                 SYNC. MODE      |         ---> POLARITY
                 DETECTION       |         |      DETECTION
                 D507, C552      |         |        |
                      |          |         |        |
                      |          |         |        |-------------------> H POLARITY
                      |          |         |        |
                      |          |         |      Q562b
                      |          |         |        |
                      |          ------------------>|-------------------> CLAMP PULSE
                      |                    |        |
H+V BUFFER -----------------------------------^   H SYNC.
H --> Q562a                                       BUFFER
                                                  Q553
                                                    |-------------------> H SYNC.
                                                    |
                                                    |---> Q515a ---------> H SYNC.
                                                    |                      (MICRO)
                                                    |
                                                  V SYNC.
V ----------------------------------------------> SEPARATOR -----> ID2 -----> ID2
                                                  Q553, Q552        CKT.
                                                  Q562c             Q515b
                                                    |
                                                    |
                                                  V POLARITY -------------> V POLARITY
                                                  DETECTION --------------> V SYNC.
                                                  Q556, Q559
                                                  Q562d
```

The following signals are the possible sync. input signals.

(1) SYNC. ON GREEN :
NEGATIVE POLARITY

(2) COMPOSITE SYNC. :
POSITIVE/NEGATIVE POLARITY

(3) SEPARATE SYNC. :
POSITIVE/NEGATIVE POLARITY

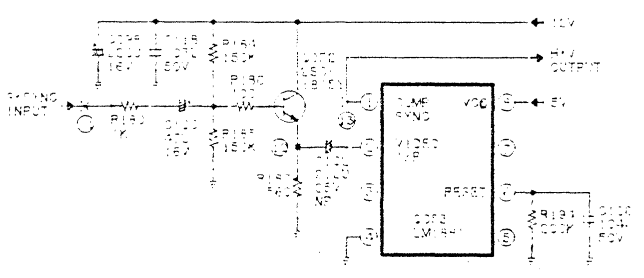
G+SYNC. (GREEN+SYNC.) SIGNAL

(Refer to circuit diagram Fig-26)

The sync. signal is separated from green signal via buffer stage Q052 and video sync. separator LM1881.

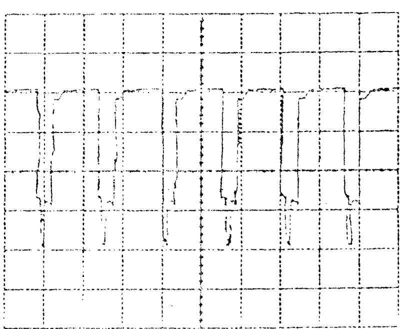
The sync signal is consists of vertical sync. and horizontal sync. Then it is fed to the base of sync. amplifier Q553 via R580–R581–Q556.

G+SYNC. SEPARATOR CIRCUIT *Fig-26*

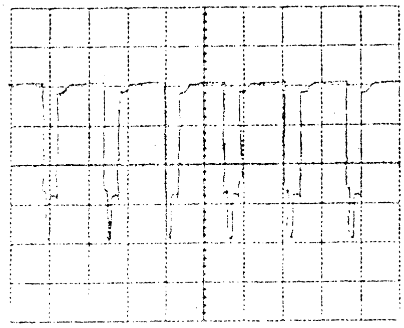


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=64KHz	J1	G+SYNC.
	J2	BUFFER OUTPUT
	J3	SYNC. OUTPUT

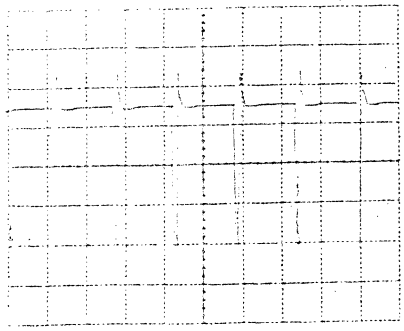
J1 1 Vpp



J2 0.8 Vpp



J3 4.5 Vpp

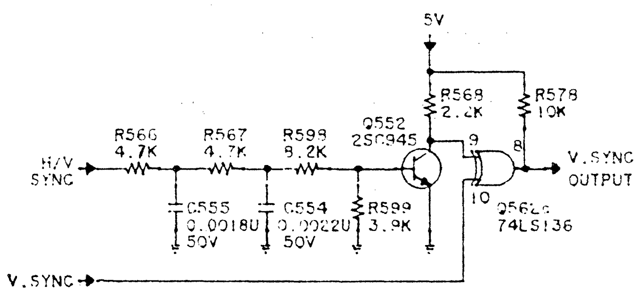


NETWORK R566–C555–R567–C554–R598–R599–Q552 is the V. SYNC. SEPARATOR circuit. Note that the network values are chosen to be a low-pass filter. The output from the low-pass filter is fed to pin 9 of Q562c.

(Refer to circuit diagram Fig-27)

The vertical sync. is derived from pin 11 of Q562d via V SYNC. SEPARATOR circuit and V SYNC. POLARITY DETECTION circuit.

VERTICAL SYNC. SEPARATOR CIRCUIT *Fig-27*



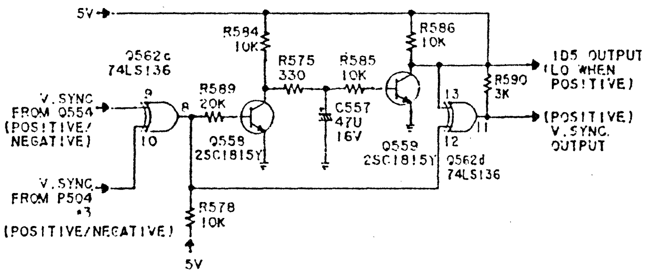
3.29 V SYNC. POLARITY DETECTION CIRCUIT

(Refer to circuit diagram Fig-29)

Low-pass filter network of R589–Q556–R575–C557–R585–Q559 extracts vertical sync. polarity by removing the horizontal pulses.

When positive vertical sync. input. The output of the circuit is low (0V). When negative vertical sync. input. The output of the circuit is high (+5V). EXOR gate Q562d with the pulse train to provide a "Normalized", POSITIVE-GOING sync. signal, the positive vertical sync. is derived from pin 11 of Q562d.

V SYNC. POLARITY DETECTION CIRCUIT *Fig-29*



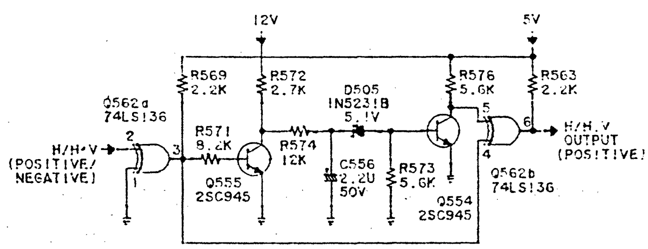
COMPOSITE SYNC. (H+V)/H SIGNAL
The composite sync. or H sync. is fed to pin 2 of the buffer stage Q562a via pin 2 of P504, in order to get the positive sync from the output stage (pin 6 of Q562b), the H SYNC. POLARITY DETECTION circuit is introduced. The output of the polarity detection signal is fed to EXOR gate Q562b to get the positive H+V or horizontal sync. on pin 6, no matter the input polarity of the vertical sync. (on pin 4) is.

SEPARATE SYNC. (H/V) SIGNAL

(Refer to circuit diagram Fig-30)

The horizontal sync. is fed to buffer stage Q562a via pin 2 of P504 and then fed to the H SYNC. POLARITY DETECTION to get the positive horizontal sync.
The vertical sync is fed to pin 10 of buffer stage Q562c via pin 3 of P504, the output of the buffer is fed to V SYNC. POLARITY DETECTION circuit to get the positive vertical sync. from pin 11 of Q562d.

H. SYNC POLARITY DETECTION CIRCUIT *Fig-30*



When G+SYNC. signal, COMPOSITE SYNC. signal and SEPARATE SYNC. signal are input from the computer simultaneously. To prevent undesirable changes in picture stability, a SYNC. SWITCH and the network R570–C553–D506–D507–C552–R557–Q551 are introduced.

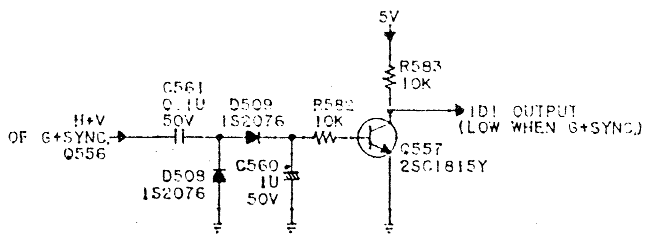
(Refer to circuit diagram Fig-32)

When G+SYNC. signal and COMPOSITE SYNC. are coming together, the SYNC. SWITCH should set at "OFF" position.

When G+SYNC. signal and SEPARATE SYNC. are coming together, the SYNC. SWITCH should set at "OFF" position.

When only COMPOSITE SYNC. signal is input to the monitor Q551 is on, the noise coming from the green channel via Q556 will be grounded.

SYNC. CIRCUIT *Fig-32*

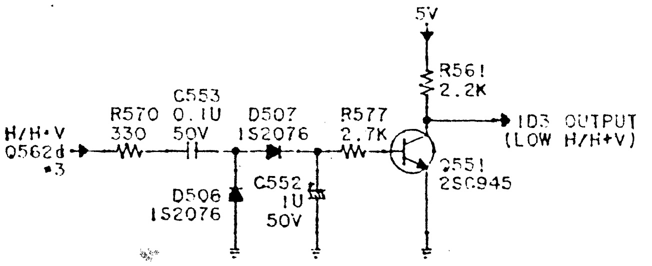


ID1/ID2 DETECTION CIRCUIT
The mode of the sync. signal for the microprocessor is detected by the ID1, ID2 DETECTION circuit, and fed to pins 13, 14 of Q512.

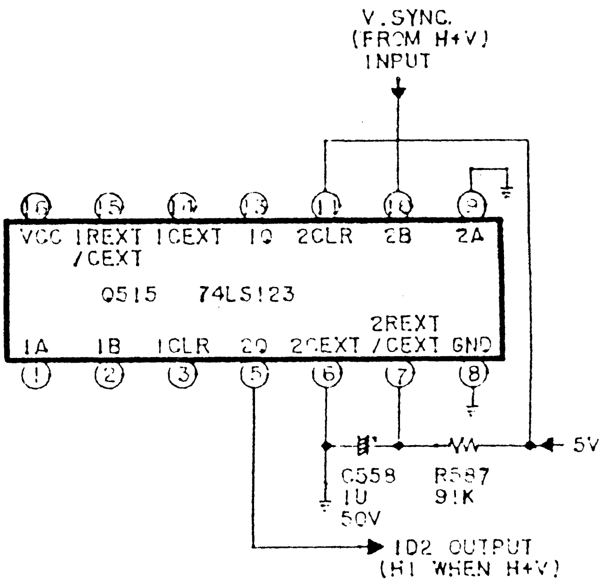
(Refer to circuit diagram Fig-33/34)

	ID1	ID2
G+SYNC.	LO	HI
H+V	HI	HI
SEPARATE	HI	LO

ID1 CIRCUIT *Fig-33*



ID2 CIRCUIT *Fig-34*



3.35 MICROPROCESSOR CONTROL CIRCUIT

(Refer to circuit diagram Fig-35)

TMP47C432AN is a CMOS 4-bit microprocessor for display monitor which realizes auto-scan function. Providing a variety of functions such as auto-measurement function of H SYNC. and V SYNC. to match with different signals.

Without the SYNC. signal input, the microprocessor will not output any instruction.

MEMORY

A electrically erasable CMOS EEPROM Q513 (MSM16911) is introduced and connected as a 128x8 serial memory to store the H PHASE, H SIZE, V SIZE, V CENTER, DPC control data.

Pins 9, 10, 11, 35, 36 of Q512 are connected to pins 2, 3, 1, 4, 7 of Q513 respectively.

There are 26 MEMORY LOCATION for the user to store the control data which are 9 FACTORY SETTING and 17 USER SETTING.

The "No." of the memory location is defined by the microprocessor.

The output of Q512 contains H PHASE, H SIZE, V SIZE, V CENTER, DPC control signals on pins 1, 2, 4, 12, 41 and horizontal MODE signals H0, H1, H2 on pins 22, 23, 24 respectively.

PWM SIGNAL OUTPUT

Each pin outputs the pulse width modulated (PWM) signal in 64 levels in accordance with 6-bit data, this output is controlled by ANALOG UP/DOWN key which is mounted on control panel.

Each output then being send to R–C network (R501–R597–R506–Q501–R511–C504. ie. H PHASE control for instance.) to generate the control signal. Thus each control signal has 64 different dc voltage increased from 0V to 12V.

The DPC control signal is fed to pin 1of P502 via buffer stage Q564a and network Q563–R545–C571–R546–C572–R550–C573.

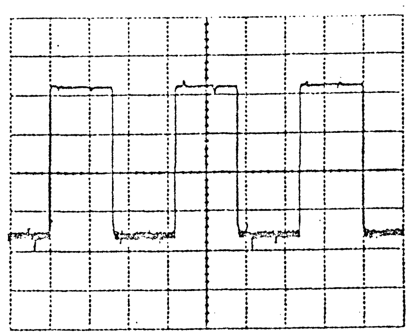
MODE SIGNAL

H0, H1, H2, these pins are used to output the H-sync. mode in accordance with H-sync. frequency, the data for H-sync. frequency division is selected. These output are fed to main circuit via buffer Q507, Q508 and Q509 to control the horizontal oscillation circuit, horizontal linearity circuit and CS capacitors.

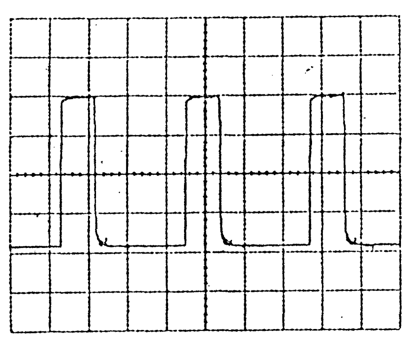
H0 is high when H-sync. is from 28.0KHz to 40.8KHz
H1 is high when H-sync. is from 40.8KHz to 53.6KHz
H2 is high when H-sync. is from 53.6KHz to 66.0KHz

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	M1–M5, M13	PWM SIGNAL
	M8–M12	CLOCK SIGNAL
	M6, M7	OSC SIGNAL

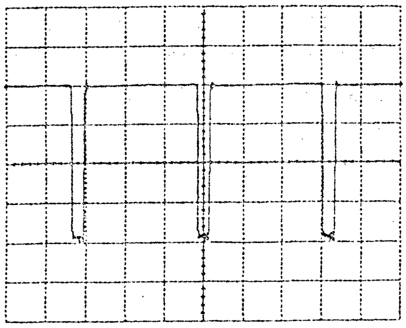
M1 0.7 Vpp



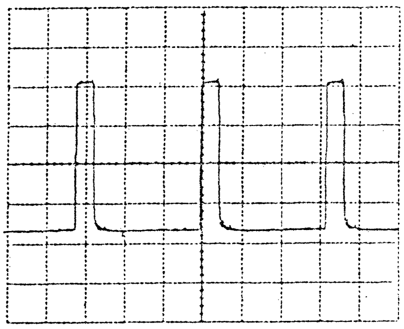
M2 0.7 Vpp



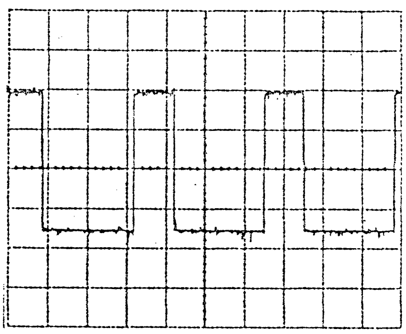
M3 0.7 Vpp



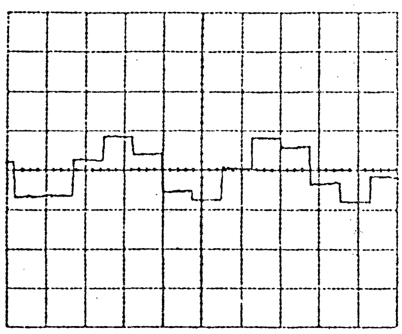
M4 0.7 Vpp



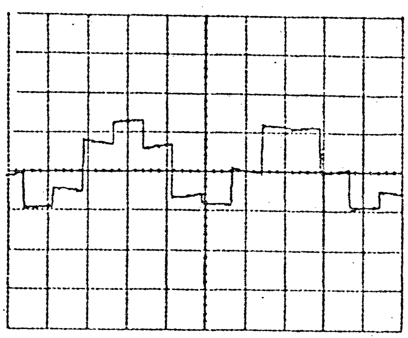
M5 0.7 Vpp



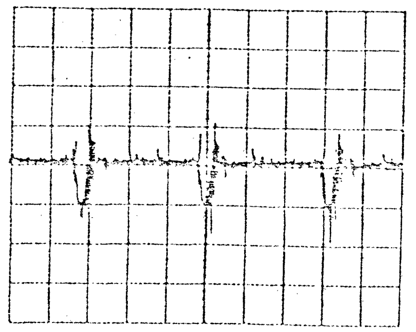
M6 4 Vpp



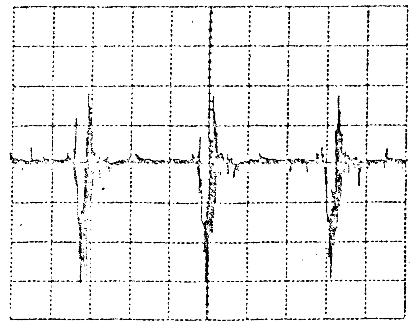
M7 5 Vpp



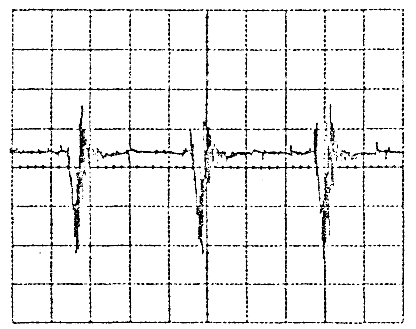
M8 0.15 Vpp



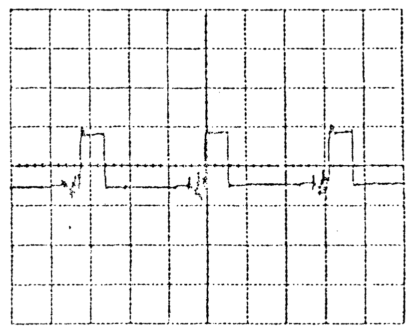
M9 0.25 Vpp



M10 0.2 Vpp

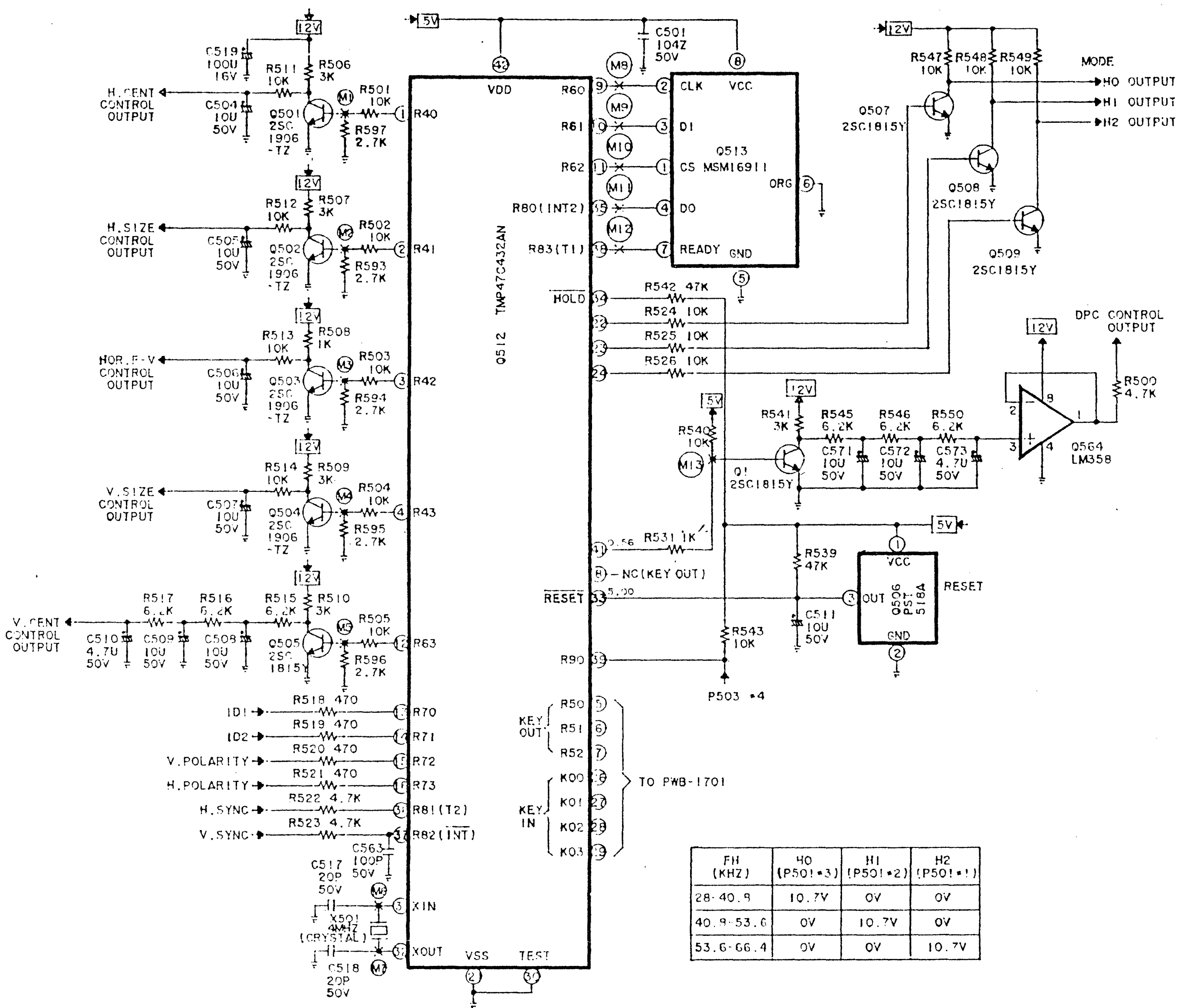


M11 5 Vpp



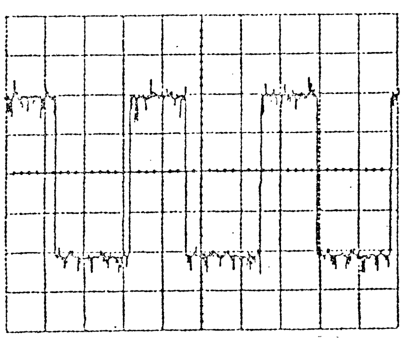
M12 0.2 Vpp

MICROPROCESSOR CONTROL CIRCUIT *Fig-35*



FH (KHZ)	H0 (P501•3)	H1 (P501•2)	H2 (P501•1)
28-40.9	10.7V	0V	0V
40.9-53.6	0V	10.7V	0V
53.6-66.4	0V	0V	10.7V

M13 4.2 Vpp

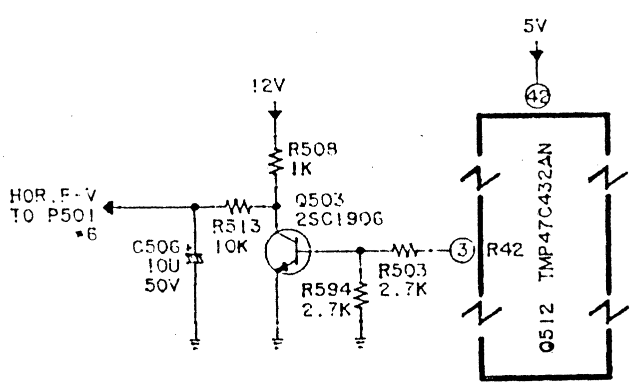


3.36 H. F/V (FREQUENCY TO VOLTAGE OUTPUT) CIRCUIT

(Refer to circuit diagram Fig-36)

Pin 3 of Q512 outputs a PWM (Pulse Width Modulation) signal which is proportional to H-sync. frequency. It outputs the pulse width modulated signal in 64 levels in accordance with 6-bit data.

H. F/V CIRCUIT *Fig-36*



3.37 UP/DOWN CONTROL CIRCUIT

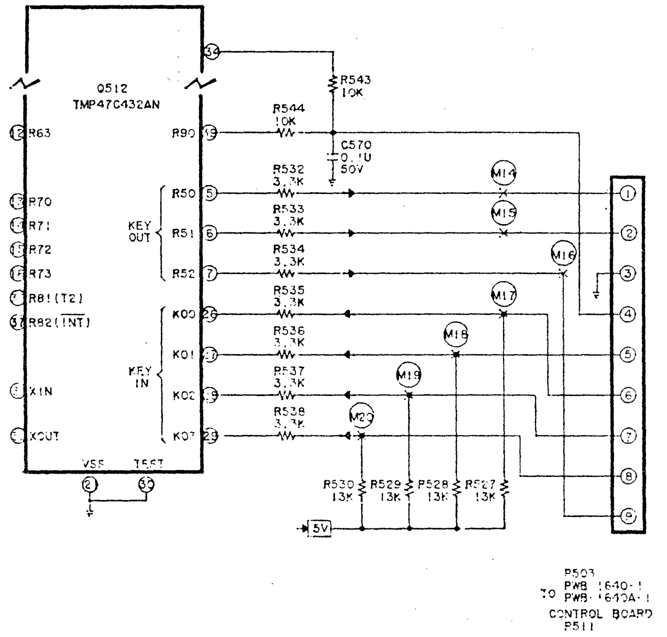
(Refer to circuit diagram Fig-37)

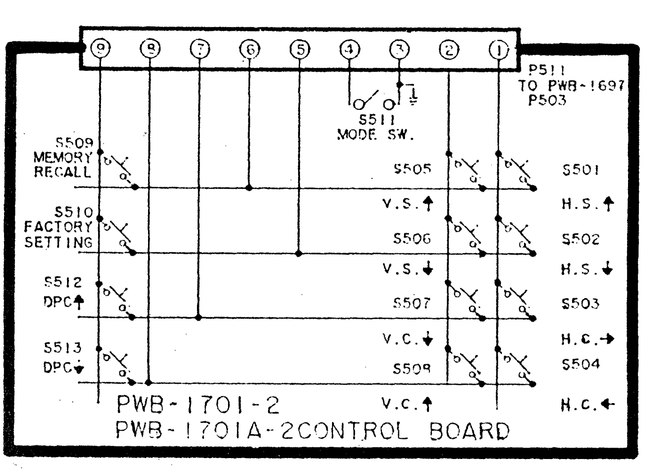
There are 5 pairs of UP/DOWN key mounted on control panel which is connected to the microprocessor pins 5, 6, 7, 26, 27, 28, 29.

Pins 5, 6, 7 are key scan output,it output key-scan signal to external key matrix. The key scan operation is performed when the signal state is active "low".

Pins 26, 27, 28, 29 are key return input, they return signal from external matrix, the key-scan operation is performed when the signal state is active "LOW".

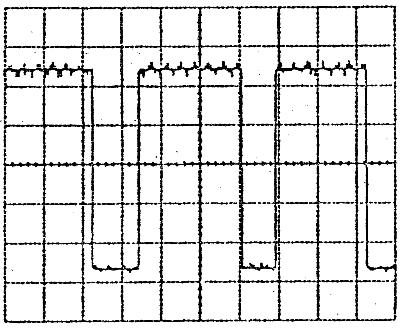
UP/DOWN CONTROL CIRCUIT *Fig-37*



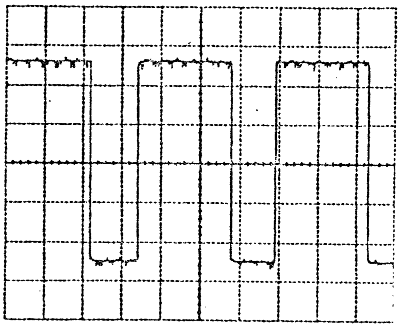


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	M14-M20	CLOCK SIGNAL

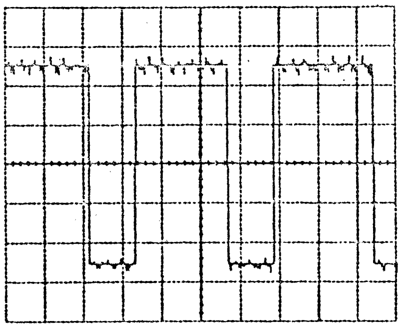
M14 5 Vpp



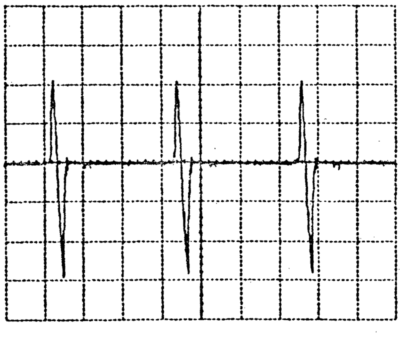
M15 5 Vpp



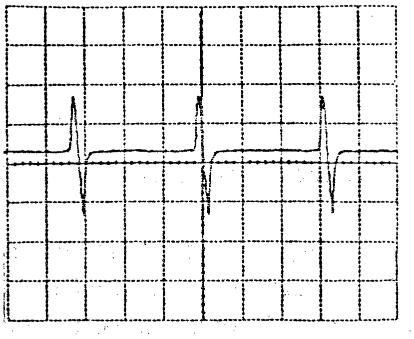
M16 5 Vpp



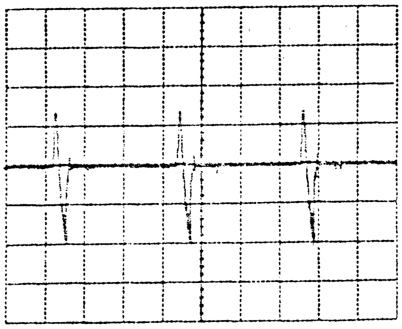
M17 1 Vpp



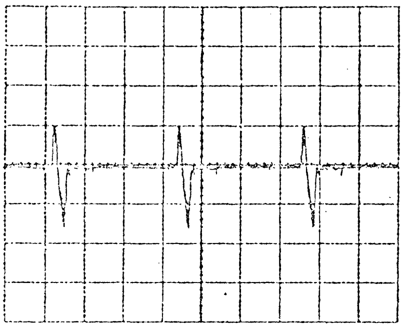
M18 1.5 Vpp



M19 0.7 Vpp



M20 0.5 Vpp



Pins 31, 32 are CLOCK INPUT and CLOCK OUTPUT, a clock generating circuit is built into the processor, so if a resonator X501 (4MHz) is connected to the clock I/O pins a 4MHz clock signal can be obtained.

Pin 42 is supply voltage pin, it connect to +5V power supply.
Pin 21 is ground pin, it connect to 0V power supply.

SYSTEM RESET
Pin 33 is RESET pin, it connect to pin 3 of RESET IC Q506.

Function of Q506 (Monolithic IC PST518A) is accurately resetting the system after detecting voltage at the time of switching power on and instance power off in the microprocessor circuit.

Pin 13 is the G+SYNC. signal detection pin for Q512. When G+SYNC. signal input, this pin is "LOW".

Pin 14 is the H+V signal detection pin for Q512. When H+V signal input, this pin is "HIGH".

A multivibrators Q515b is introduced to achieve the detection function. Once the vertical sync on pin 1 of Q515b is greater than 40Hz, pin 5 of Q515b is "HIGH", the values of C558-R587 are selected so as to re-trigger the multivibrators.

	ID1	ID2	ID3
G+SYNC.	LO	HI	—
H+V	HI	HI	LO
SEPARATE	HI	LO	LO

	ID4	ID5
H SYNC. +	LO	—
H SYNC. −	HI	—
V SYNC. +	—	LO
V SYNC. −	—	HI

Pin 15 is the V POLARITY DETECTION input for Q512. When the polarity of vertical sync. is positive, this pin is "LOW".

(Refer to circuit diagram Fig-29)

Pin 16 is the H POLARITY DETECTION input for Q512. When the polarity of horizontal sync. is positive, this pin is "LOW".

(Refer to circuit diagram Fig-30)

Pin 36 is the input of horizontal synchronous signal, whose polarity is positive.

In order to get a constant width of horizontal sync. pulse, MULTIVIBRATORS Q515a is introduced, horizontal sync. is fed to signal (pulse is 6 us) is fed to pin 36 of Q512, the width of the output signal on pin 13 of Q515a is decided by R559–C516.

Pin 37 is the input of vertical synchronous signal whose polarity is positive.

3.38 VOLTAGE SUPPLY

(Refer to circuit diagram Fig-38)

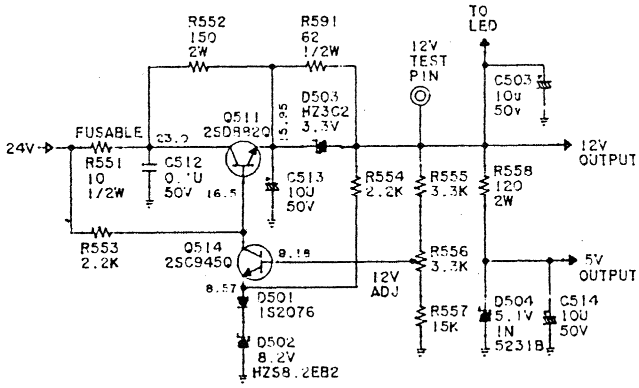
The voltage supply of the micro board has its own regulator which differ from the regulator of the main board.

The +12V and +5V supply lines to the microprocessor circuit are fed via the network Q511–Q514–D503–D501–D502–D504 and some discrete components.

R556 allows fine adjustment to make the "TEST PIN" voltage at +12V. The +5V is derived from +12V via zener diode D504-R558 and C154.

The power (12V) of the LED is fed from pin 2 of P505 via R731.

MICRO BOARD POWER SUPPLY CIRCUIT *Fig-38*



3.39 VIDEO PREAMPLIFIER

(Refer to circuit diagram Fig-39)

The video amplifier consists of preamplifier M51399P, output stage and cutoff adjustment circuit.

PREAMPLIFIER

There are three identical video preamplifier (Q002, Q062, Q122) being used to generate the video signal.

The RED channel preamplifier for example:

The input video signal (0.7V peak) is buffered by emitter follower Q001. The output of which is AC coupled (C012–R013) to pin 1 of the preamplifier Q002.

The positive clamp signal is fed to pin 12 of Q002 to restore the DC-level at the preamplifier output (pin 8). Only the pedestal electric potential undergoes sampling by the pin 12 clamp pulse.

Pin 9 is the DC-level input for the clamp circuit. The DC-level is restored via external capacitor (Hold capacitor) C006.

Therefore as a result of this, the pedestal electric potential on pin 8 is held, according to the pin 9 electric potential.

The video signal which is output from pin 8 is amplified and turned around by the attached circuit and having been attenuated by the resistor divider R016–R012, it is fed back to pin 11 again.

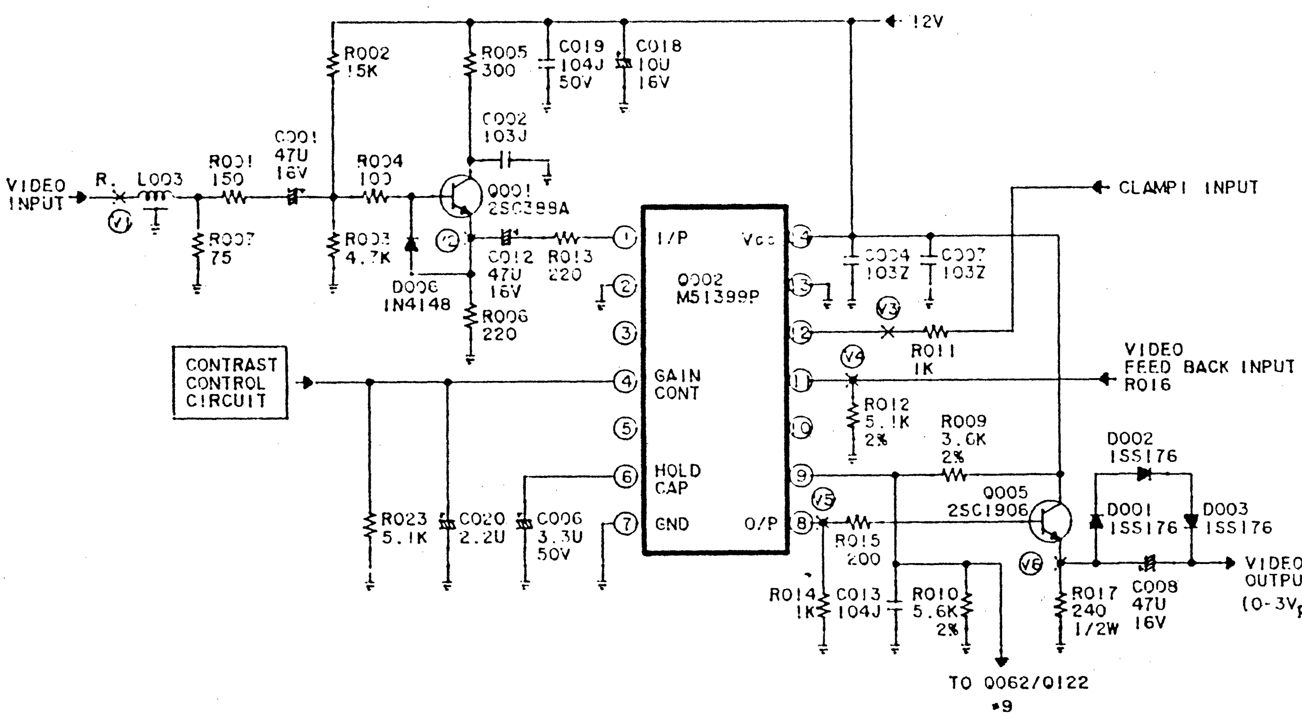
The signal voltage on pin 8 is typically 3.5V peak at maximum channel gain. It is fed to the output stage (Q003–Q006) via buffer Q005.

C008 is AC coupling capacitor, D001–D002–D003 are dc-bias diodes.

Pin 4 is the gain control of the preamplifier Q002.

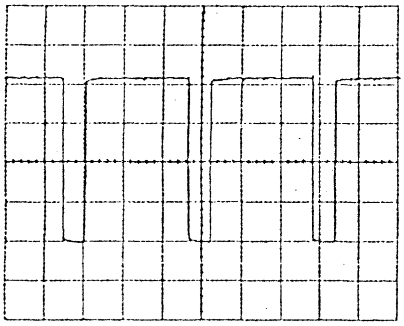
The supply voltage on pin 14 is 12V.

RED VIDEO PREAMPLIFIER CIRCUIT *Fig-39*

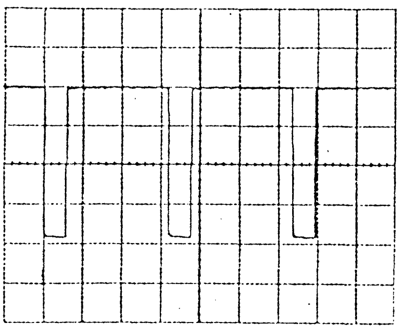


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	V1	R INPUT
	V2	BUFFER OUTPUT
	V3	CLAMP INPUT
	V4	FEEDBACK INPUT
	V5	VIDEO OUTPUT
	V6	BUFFER OUTPUT

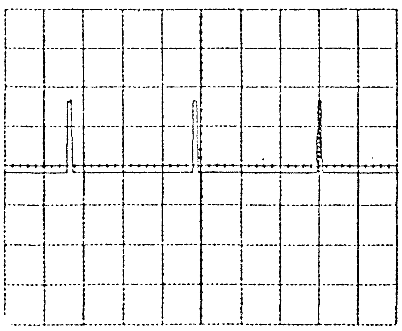
V1 0.8 Vpp



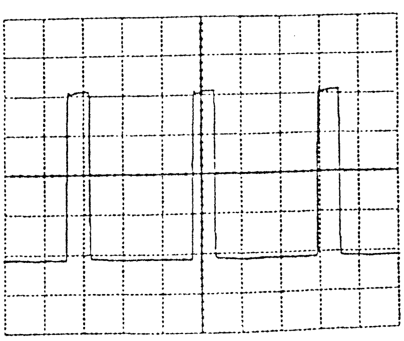
V2 0.8 Vpp



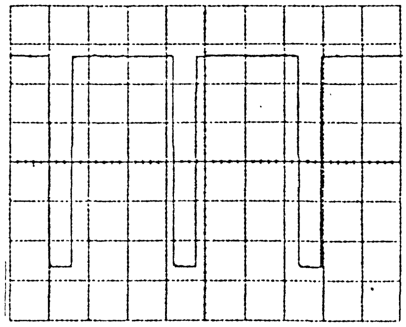
V3 4 Vpp



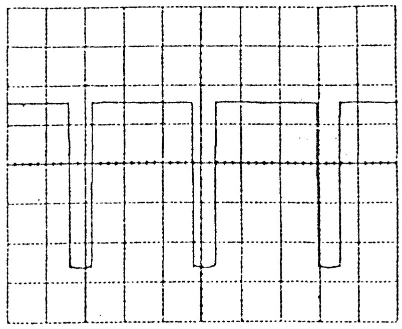
V4 4.2 Vpp



V5 2.8 Vpp



V6 2.3 Vpp



3.40 VIDEO OUTPUT STAGE

(Refer to circuit diagram Fig-40)

The output signal to the cathode is provided by cascade amplifier Q003–Q006. The gain of this stage is approximates to 16. L001 and L002 are peaking coils for high frequency video response. C022 and R042 are emitter peakings.

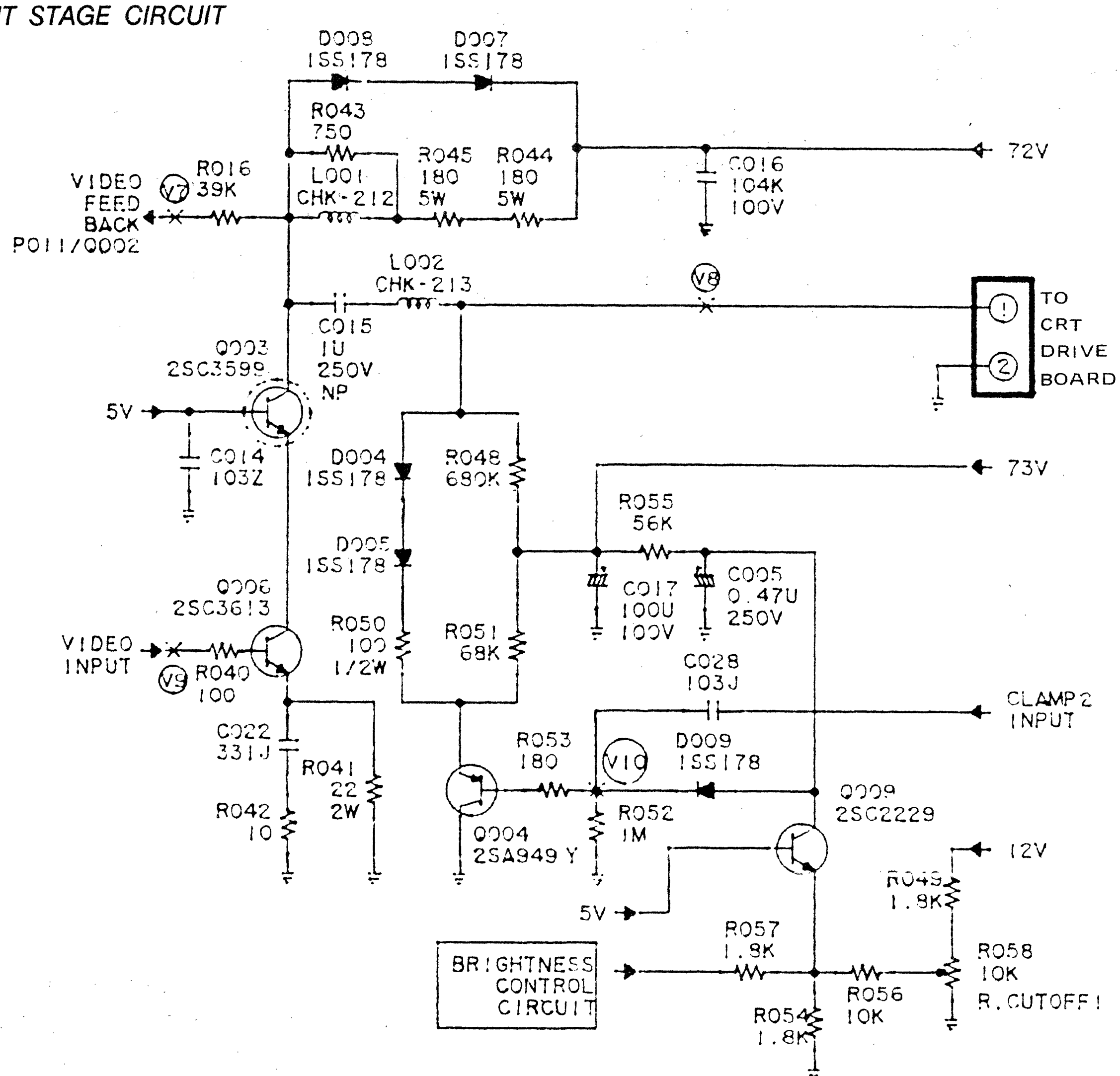
Though a circuit is complicated, it is possible to choose kinds of CRT to set arbitrary DC voltage, thus C015 is used to make the output circuit be a AC coupling system.

The cathode is DC clamped by network D004–D005–Q004–C028–R053–R048–R051–R052. The DC clamping or CUTOFF1 level at the cathode is set by potentiometer R058 (R118, R178 for green and blue). The B+ of the potentiometer is provided by +12V.

Network Q009–R057–R054–R056–R058, along with Green and Blue channel equivalents, enable the color point of the monitor to optimized during set up.

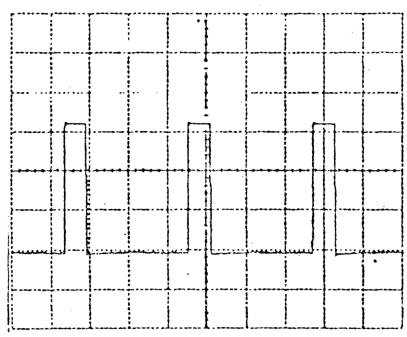
The potentiometers R058–R118-R178 (CUTOFF1) and R119–R179 (CUTOFF2), enable the background of the monitor to be adjusted during set up.

OUTPUT STAGE CIRCUIT *Fig-40*

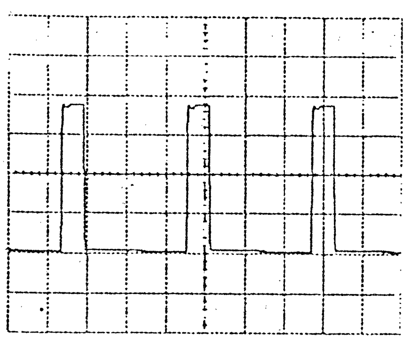


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	V7	VIDEO FEEDBACK
	V8	VIDEO OUTPUT
	V9	VIDEO INPUT
	V10	CLAMP INPUT

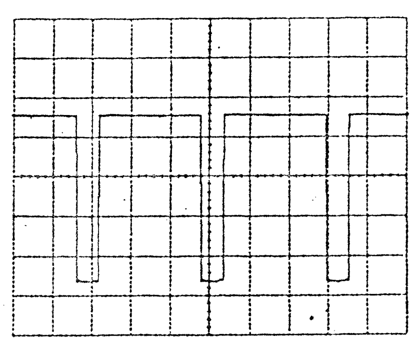
V8 43 Vpp



V7 3.8 Vpp



V9 2.3 Vpp



3.41 BRIGHTNESS CONTROL

(Refer to circuit diagram Fig-41)

The brightness control is achieved by varying the CUTOFF voltage of the CRT.

The reference voltage is derived from pin 4 of P721 via voltage divider R155–R722–R724, the reference voltage is buffered by Q056 and fed to R, G, B CUTOFF circuit via R057, R119, R179 respectively.

BLUE CUTOFF circuit for instance:

The CUTOFF voltage is controlled by Q124–Q129, the higher voltage on the emitter of Q129 the higher voltage on the base of Q124, also the higher voltage (CUTOFF voltage) on the emitter of Q124.

The brightness control potentiometer R722 is mounted on the control panel. The control signal is fed to the base of Q056 via pin 4 of P008.

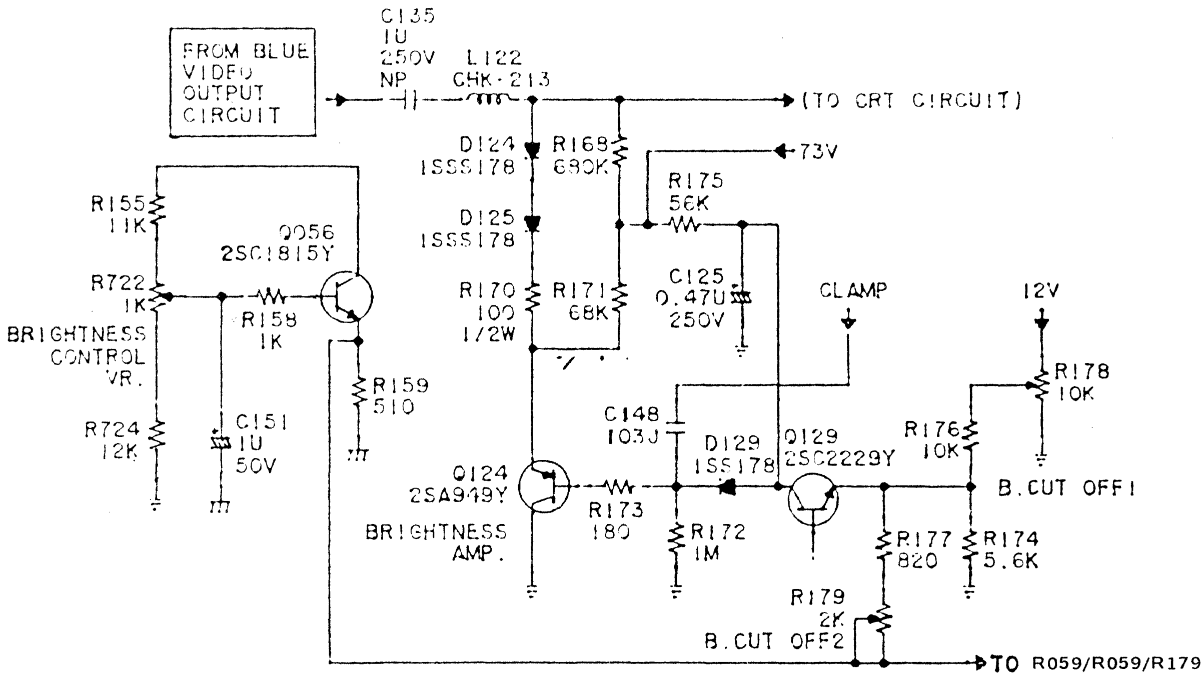
Thus if have any voltage change on pin 4 of P008, the brightness of the CRT will be changed.

The transistor Q124–Q129 modulates the black level of the video signal with the clamp signal.

The level (CUTOFF) of modulation is set by the ratio of R179–R177–R176–R175 and the user brightness control.

R179–R175, along with the RED and GREEN channel equivalents, enable the color point of the monitor to optimized during set up.

BRIGHTNESS CONTROL/BLUE CUT OFF CIRCUIT *Fig-41*



3.42 CONTRAST CONTROL

(Refer to circuit diagram Fig-42)

The contrast control is achieved by varying the video amplitude of the output signal.

BLUE channel for instance:

The video amplitude of the preamplifier (Q122) is controlled by the voltage of pin 4. The higher dc voltage on pin 4 gives the bigger amplitude on video output (pin 8).

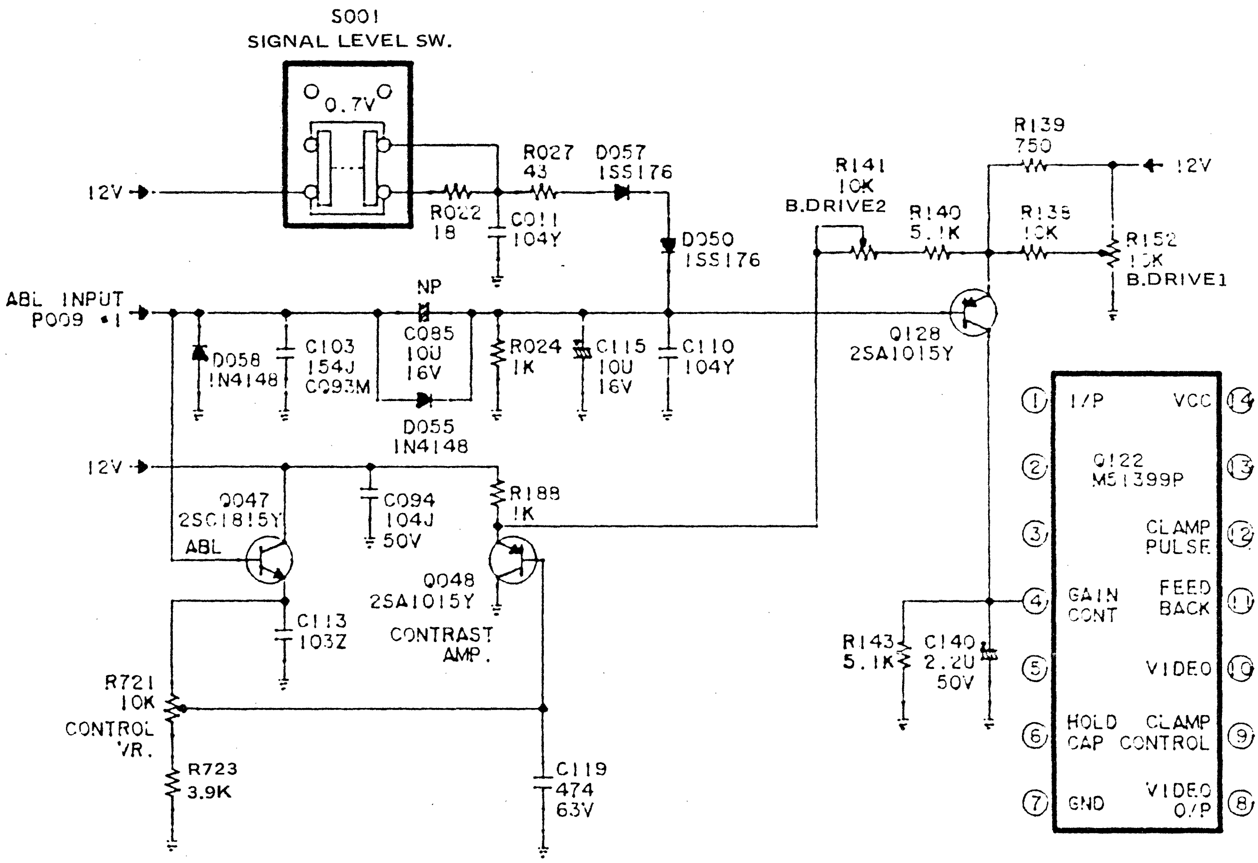
The contrast control circuit is implemented by Q047, Q048 and Q128. Q047 is the ABL control stage, Q048 and Q128 are the buffer stages for contrast control signal.

The control signal is fed to pin 1 of P008 via the emitter of Q047 and resistor divider R721-R723, then fed to pin 4 of Q122 via Q048 and Q128.

The higher voltage on pin 1 of P008 gives the higher dc voltage on pin 4 of Q122. Naturally gives the bigger amplitude for the output and more colorful picture on the screen.

Potentiometer R141 and R152 are the GAIN control for the preamplifier Q122, also enable the color point of the monitor optimized during set up.

CONTRAST CONTROL/BLUE PREAMPLIFIER CIRCUIT *Fig-42*



3.43 ABL (AUTOMATIC BRIGHTNESS LIMIT) CIRCUIT

(Refer to circuit diagram Fig-42/43)

The ABL circuit in fact is a voltage feedback circuit which varies the gain of all three video channels simultaneously. The negative feedback signal is proportional to the anode current of the CRT.

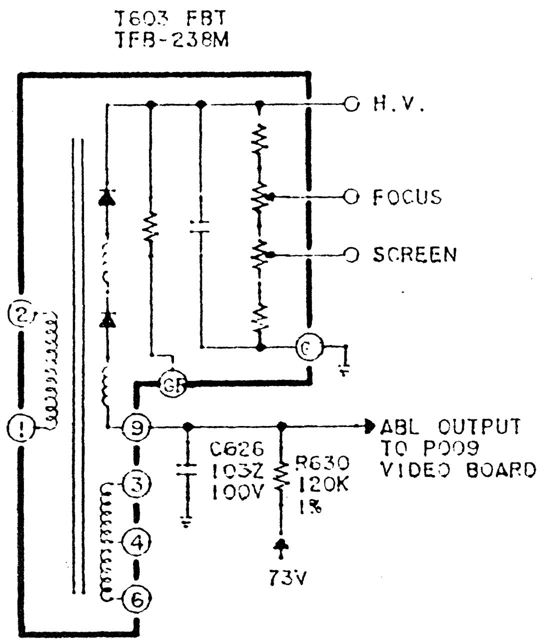
The voltage on pin 9 of T603 is the voltage drop of +73V via R630. The component value is selected so as to limit the maximum current of the CRT. (400μA approximately)

The signal is fed to the base of ABL control stage Q047 via pin 1 of P009. The higher voltage on pin 1, means the darker of the picture, the lower voltage on pin 1, means the brighter of the picture. So via Q047, this signal will control video gain and limit the CRT current automatically.

The ABL signal is also fed to the base of Q008–Q068–Q128 via C085–D055 to get stable ABL function.

D508 is negative pulse by-pass diode.

ABL CIRCUIT *Fig-43*



3.44 SIGNAL LEVEL CONTROL SWITCH

(Refer to circuit diagram Fig-42)

The value of R022 is chosen so that the maximum channel gain is the same, no matter the video input signal is 0.7V or 1.0V.

3.45 CLAMP SIGNAL

(Refer to circuit diagram Fig-45)

The CLAMP signal for the video amplifier and background circuit is generated by multivibrators Q051.
The triggering signal is fed to pin 2 of Q051a via pin1 of Q053 for G+SYNC. signal.
Pin 1 Q051a is the Sync. mode detection input.

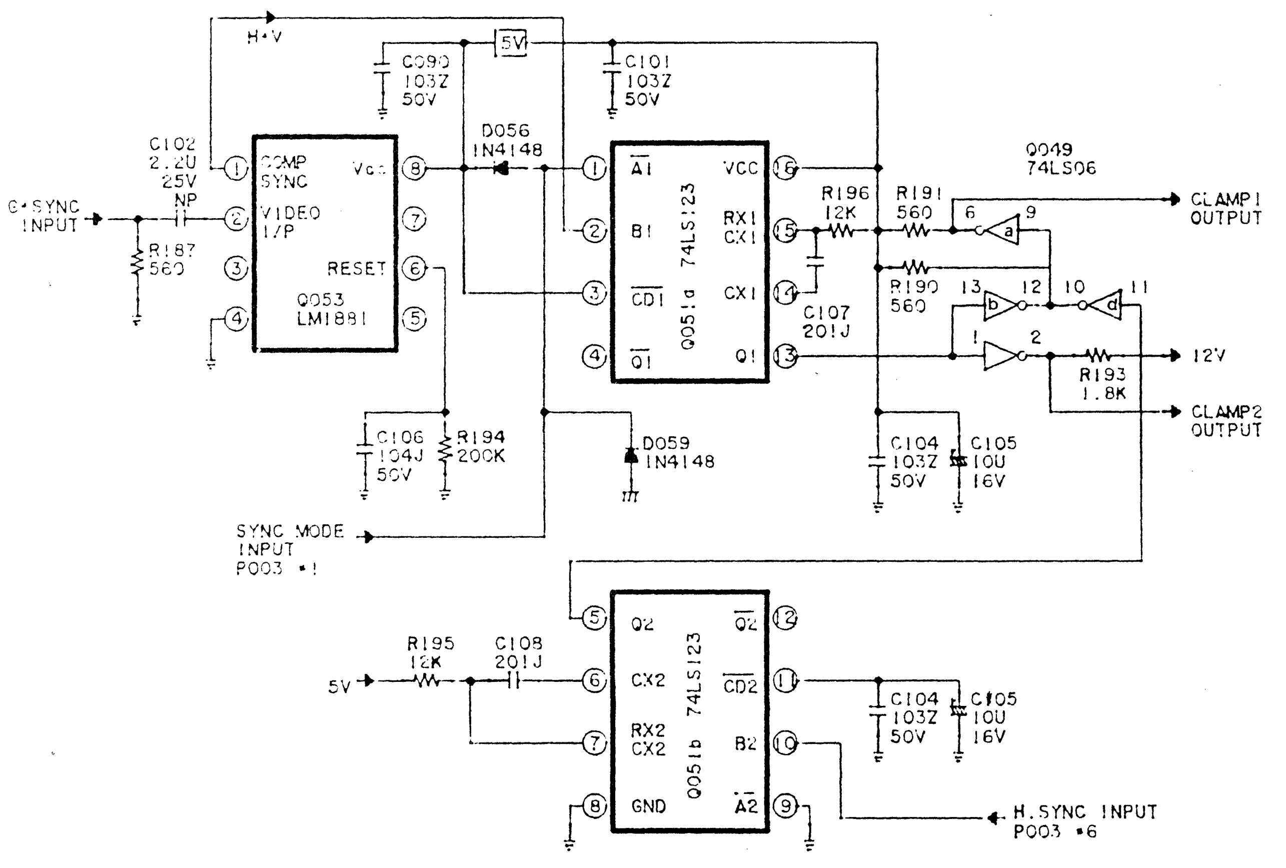
When G+SYNC. signal inputs, this pin is "LOW". When H+V or SEPARATE signal inputs, this pin is "HIGH". Pins 12, 2 of Q049b and Q049C are at FLOATING (open) state.

Pin 13 is the output of Q051a, clamp (CLAMP 1) signal is fed to pin 12 of video amplifier Q002 (Q062, Q122, respectively) via inverters Q049a and Q049b.

The clamp (CLAMP2) signal is fed to CUTOFF circuit via Q049c and C028.

For the COMPOSITE SYNC. or SEPARATE SYNC. signal input, the clamp (CLAMP 1) signal is generated from Q051b and the triggering signal is fed to pin 10 of Q051b via pin 6 of P003, Pin 5 is the output of Q051b, this clamp signal is fed to pin 12 of video amplifier Q002 (Q062, Q122, respectively) via inverters Q049a and Q049d.

CLAMP SIGNAL CIRCUIT *Fig-45*

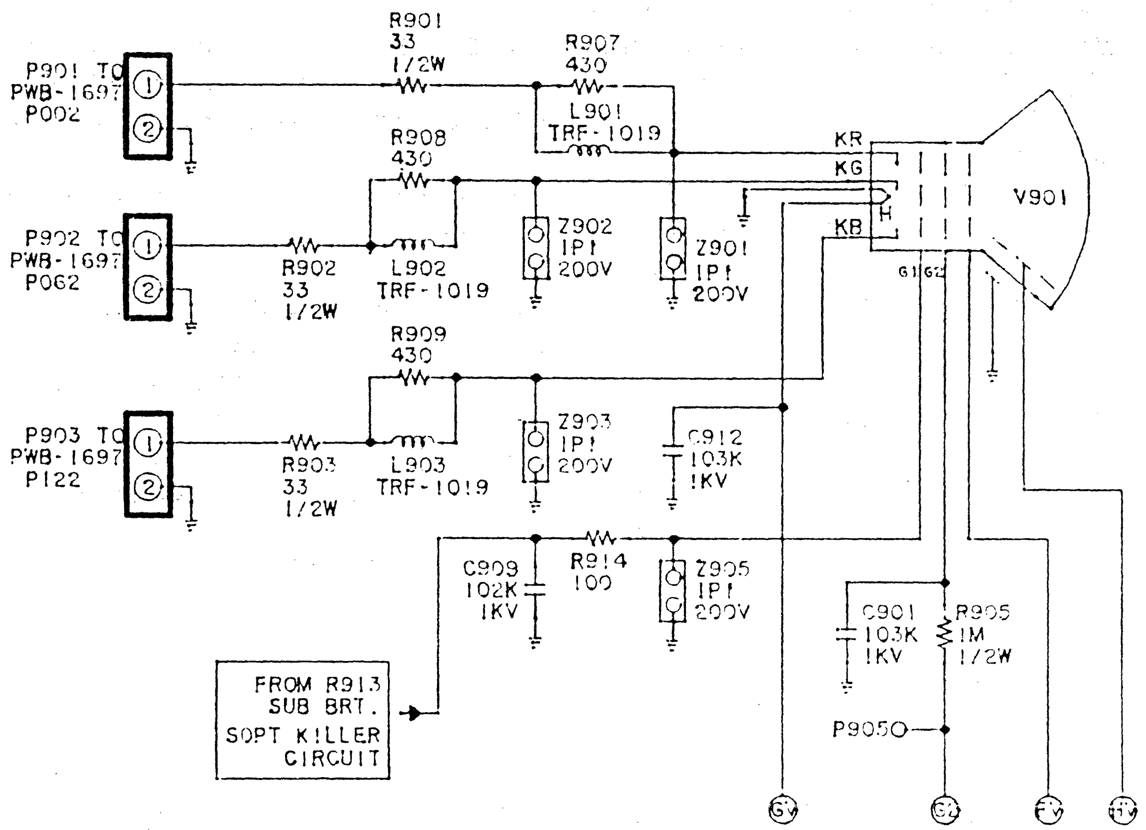


3.46 CRT DRIVE CIRCUIT

(Refer to circuit diagram Fig-46)

The output of the RED video signal is fed to the CRT (KR) via pin 1 of P901. R907 and L901 are output peakings.
Z901 is Spark gap whose spark voltage is 200V is used for preventing high voltage discharge from the CRT to the video amplifier. It may cause the damage during the CRT discharge.

R901 is surge absorbing resistor, it prevent short-circuiting of video amplifier's output in low impedance condition with decrease of surge voltage after the spark gap works.



3.47 SPOT KILLER CIRCUIT

(Refer to circuit diagram Fig-47)

The spot killer circuit is introduced. In order to eliminate the SPOT damage on the screen of the CRT while power is on or off.

The circuit supplied of −189V is provided by the zener diode chain D903 to D908.

When power is on, +24V and −189V will charge C911 via D902.

Totally will have −213V voltage charge on C911. At this moment Q901 is off.

When power is off, the positive end of C911 is grounded, Q901 is on, −213V will fed to G1 of CRT via Q901 to achieve the SPOT KILLER purpose.

Potentiometer R907 is used as SUB. BRIGHT for the monitor.

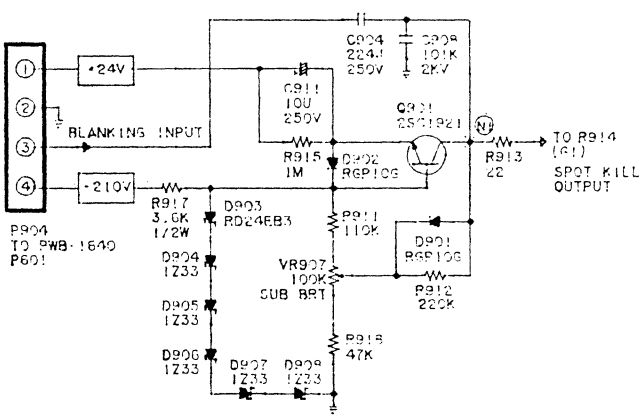
The BLANKING signal is fed to G1 via pin 3 of P904 and C904.

The HEATER VOLTAGE +6V is fed to the CRT via pins 1, 3 of P907.

The HIGH VOLTAGE +26KV is fed to the anode of the CRT.

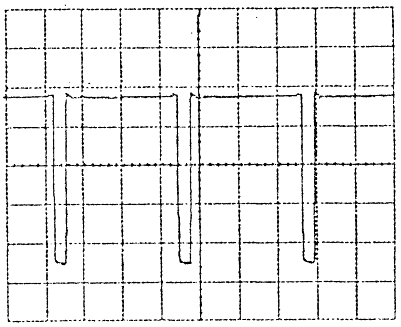
The DYNAMIC FOCUS VOLTAGE is also fed to the CRT via the dynamic focus circuit.

SPOT KILLER CIRCUIT *Fig-47*

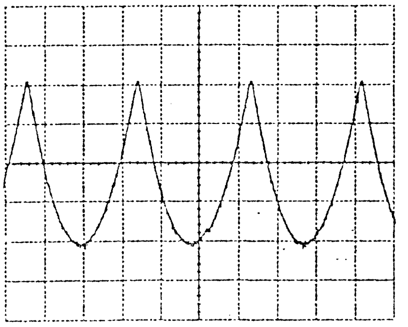


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	N1	BLANKING VOLTAGE

N1 24 Vpp



T2 8.2 Vpp



3.48 DYNAMIC FOCUS CIRCUIT

FOR DYNAMIC FOCUS MODEL ONLY
(SUCH AS PB8520SV/MD6A/MD7A/
CM-17MBD/20MBD)

In order to get the optimum focus, the focus voltage must be changed for each beam landing position. This is called dynamic focus. The optimum focus voltage waveform is parabolic both horizontally as well as vertically. Dynamic focus is normally achieved by shaping, processing and amplifying the waveform of both deflection currents.

FOCUS

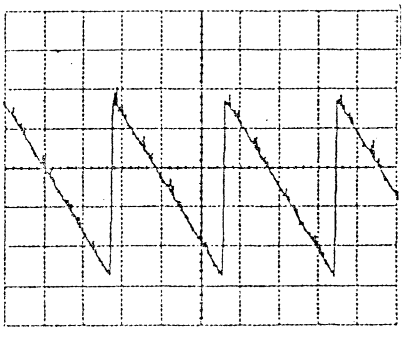
Focus 1 should be adjusted so that the vertical lines become narrowest in all over the screen.

Focus 2 should be adjusted so that the horizontal lines become narrowest in all over the screen.

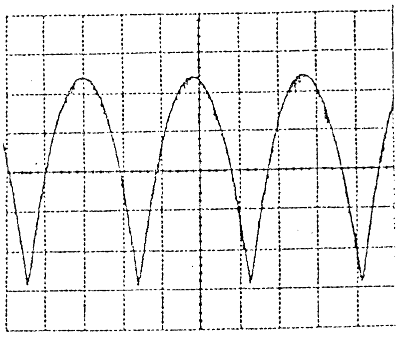
Network Q705–Q706 is cascade amplifier, C709–R733 is used to apply an AC voltage to the focus electrode.

TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	T1	V SAWTOOTH SIGNAL INPUT
	T2	V PARABOLA SIGNAL INPUT
	T3	BASE SIGNAL
	T4	V PARABOLA SIGNAL OUTPUT

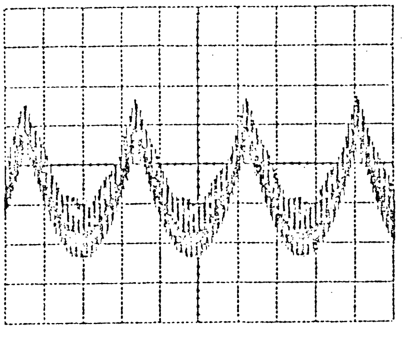
T1 2.5 Vpp



T3 5.2 Vpp



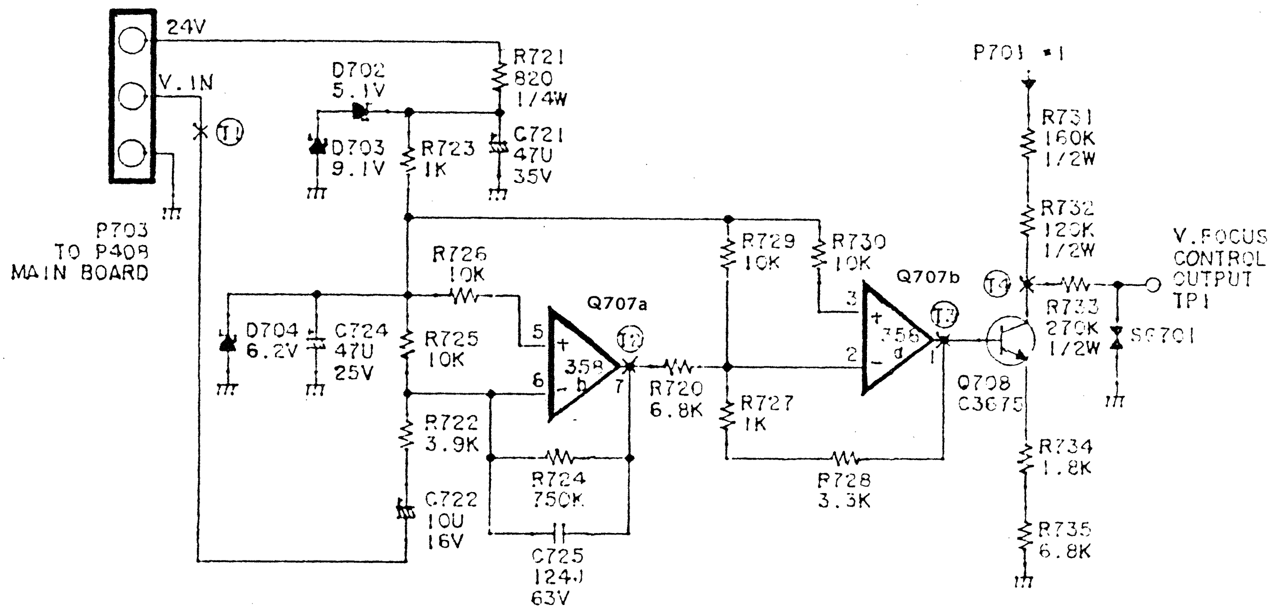
T4 200 Vpp



3.49 VERTICAL PARABOLA SIGNAL GENERATOR

(Refer to circuit diagram Fig-49)

The ramp voltage produced across R312 is integrated by Q707a via pin 2 of P703 and the resulting parabola is amplified by Q707b, the resulting parabola is used to provide vertical focusing. A single transistor amplifier Q708 performs the basic function. The level of vertical parabola signal is controlled by R722–R724–R727–R728 of the amplifiers.



3.50 HORIZONTAL PARABOLA SIGNAL GENERATOR

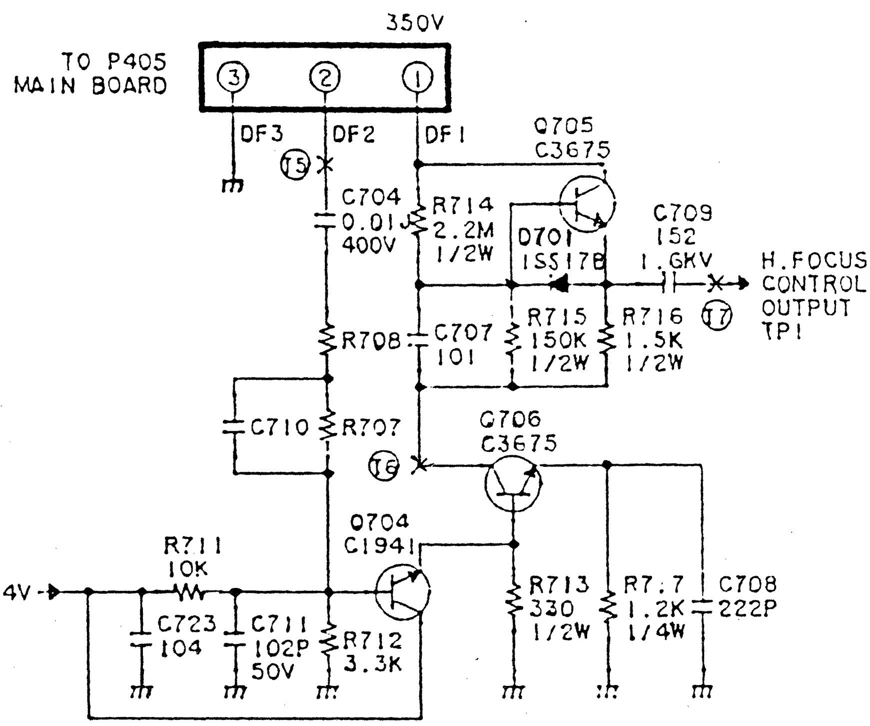
(Refer to circuit diagram Fig-50)

The horizontal parabola is taking from horizontal deflection current waveform C430 via pin 2 of P405, the waveform being shaped, processed, amplified by Q704, Q705 and Q706 then fed to the focus electrode via C709.

The module supplies of +350V is provided (pin 1 of P701) by C434 and fusible resistor R478. R483 and R484 are discharge resistor of C434. The level of horizontal parabola signal is controlled by C704–R708–C710–R707 at the input to the amplifier.

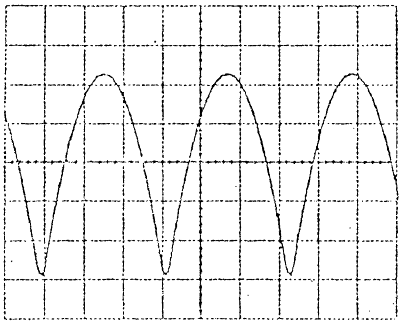
The horizontal and vertical parabola signal are summing at TP1.

HORIZONTAL PARABOLA SIGNAL GENERATOR *Fig-50*

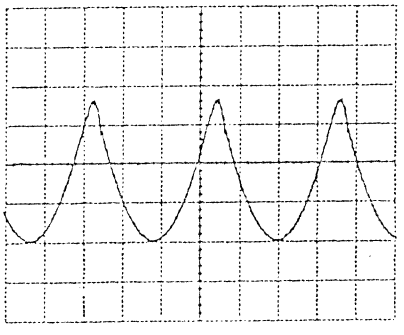


TEST CONDITION	TEST POINT	TEST POINT NAME
Fh=31KHz	T5	H PARABOLA SIGNAL INPUT
	T6	COLLECTOR SIGNAL
	T7	H PARABOLA SIGNAL OUTPUT

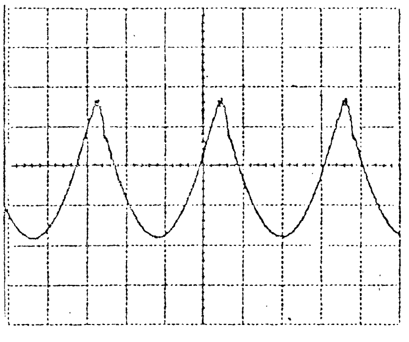
T5 27 Vpp



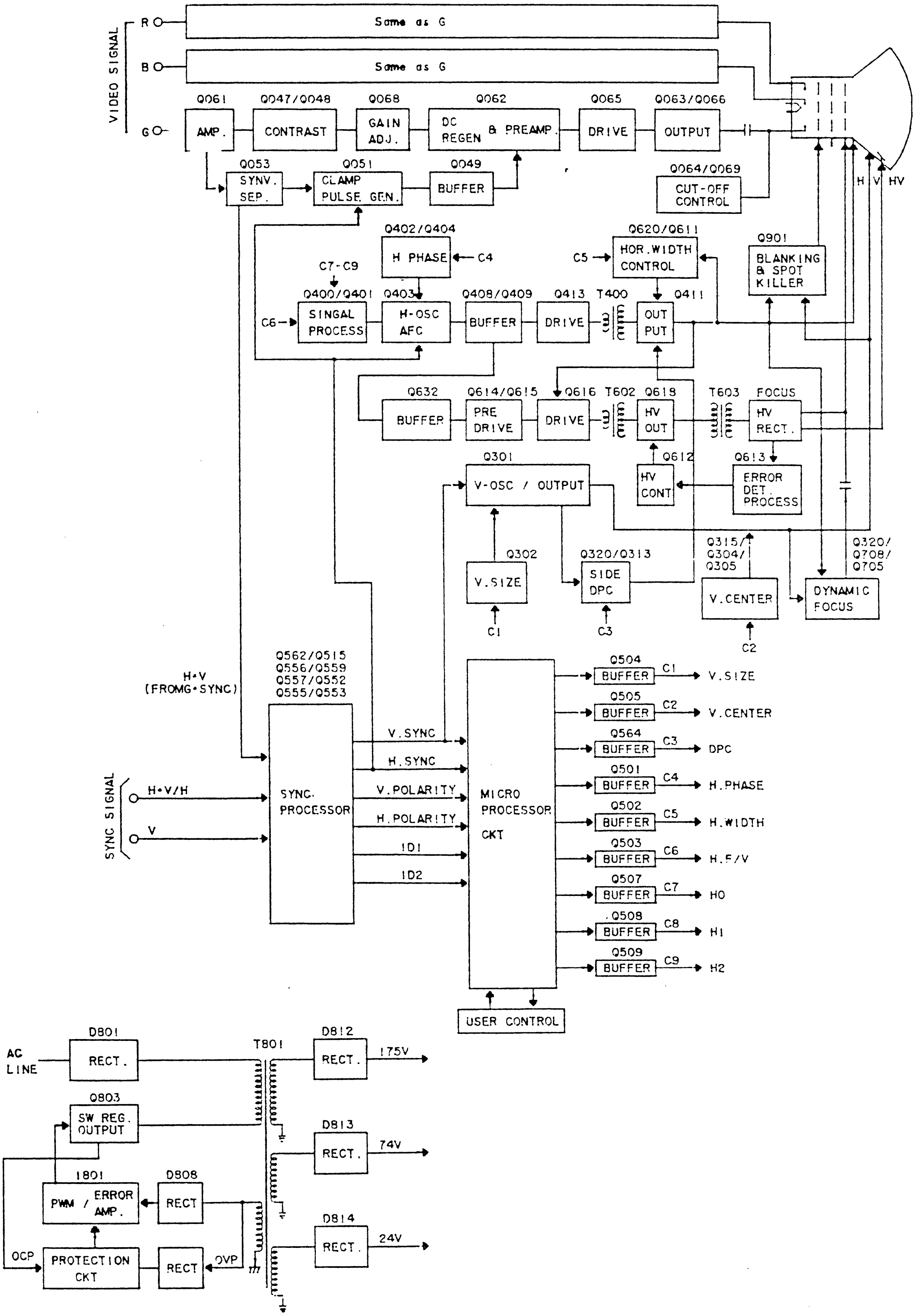
T6 180 Vpp



T7 180 Vpp



4. FLOW CHART



VIDEO SIGNAL
R
B
G
Same as G
Same as G
Q061
AMP.
Q047/Q048
CONTRAST
Q068
GAIN ADJ.
Q062
DC REGEN & PREAMP.
Q065
DRIVE
Q063/Q066
OUTPUT
Q053
SYNV. SEP.
Q051
CLAMP PULSE GEN.
Q049
BUFFER
Q064/Q069
CUT-OFF CONTROL
H
V
HV
Q402/Q404
H PHASE
C4
C7-C9
Q620/Q611
HOR.WIDTH CONTROL
C5
Q901
BLANKING & SPOT KILLER
Q400/Q401
SINGAL PROCESS
C6
Q403
H-OSC AFC
Q408/Q409
BUFFER
Q413
DRIVE
T400
Q411
OUT PUT
Q632
BUFFER
Q614/Q615
PRE DRIVE
Q616
DRIVE
T602
Q618
HV OUT
T603
FOCUS
HV RECT.
Q612
HV CONT
Q613
ERROR DET. PROCESS
Q301
V-OSC / OUTPUT
Q302
V.SIZE
C1
Q320/Q313
SIDE DPC
C3
Q315/ Q304/ Q305
V.CENTER
C2
Q320/ Q708/ Q705
DYNAMIC FOCUS
H•V (FROMG•SYNC)
Q562/Q515 Q556/Q559 Q557/Q552 Q555/Q553
SYNC. PROCESSOR
SYNC SIGNAL
H•V/H
V
V.SYNC
H.SYNC
V.POLARITY
H.POLARITY
ID1
ID2
MICRO PROCESSOR CKT
USER CONTROL
Q504
BUFFER
C1
V.SIZE
Q505
BUFFER
C2
V.CENTER
Q564
BUFFER
C3
DPC
Q501
BUFFER
C4
H.PHASE
Q502
BUFFER
C5
H.WIDTH
Q503
BUFFER
C6
H.F/V
Q507
BUFFER
C7
H0
Q508
BUFFER
C8
H1
Q509
BUFFER
C9
H2
AC LINE
D801
RECT.
Q803
SW REG. OUTPUT
T801
D812
RECT.
175V
D813
RECT.
74V
D814
RECT.
24V
I801
PWM / ERROR AMP.
D808
RECT
OCP
PROTECTION CKT
RECT
OVP

5. *SIGNAL IDENTIFICATION TABLE*

THERE ARE TOTALLY 26 MEMORY LOCATIONS STORING THE CONTROL DATA.
9 LOCATIONS FOR THE FACTORY SETTING DATA & 17 SPARE LOCATIONS FOR THE USER TO STORE THE EXTRA MODE'S DATA.

1. MODE SWITCH "OFF"

	H	V	MODE	FACTORY SETTING MEMORY LOCATION	USER MEMORY LOCATION
A. Fh < 32.89 KHz					
(1) Fv < 74.4 Hz					
SEPARATE					
	+	−	VGA350	1	10
	−	+	VGA400	2	11
	−	−	VGA480	3	12
COMPOSITE			PGC	4	13
SEPARATE	+	+	USER1	NULL	14
SYNC. ON GREEN			USER1	NULL	14
(2) Fv > 74.4 Hz			USER1	NULL	14
B. 32.89 KHz < Fh < 39.91KHz					
(1) Fv < 74.4Hz					
SEPARATE SYNC.			800 × 600	5	15
SYNC. ON GREEN			MACII	6	16
COMPOSITE SYNC.			USER2	NULL	17
(2) Fv > 74.4Hz					
SIGNAL EXCEPT SEPARATE SYNC.			USER2	NULL	17
SEPARATE SYNC.			8514A	7	18
C. 39.91KHz < Fh < 49.92KHz					
SIGNAL EXCEPT SYNC. ON GREEN			USER3	NULL	19
SYNC. ON GREEN			1024 × 768	8	20
D. 49.92KHz < Fh					
SIGNAL EXCEPT SYNC. ON GREEN			USER4	NULL	21
SIGNAL ON GREEN			1280 × 1024	9	22

2. MODE SWITCH "ON"

	MODE	FACTORY SETTING MEMORY LOCATION	USER MEMORY LOCATION
A. Fh < 32.89KHz	USER5	NULL	23
B. 32.89KHz < Fh < 39.91KHz	USER6	NULL	24
C. 39.91KHz < Fh < 49.92KHz	USER7	NULL	25
D. 49.92KHz < Fh	USER8	NULL	26

TABLE OF CONTENTS

6. TROUBLE SHOOTING

6.1 NO RASTER

```
                         NO
LED  LIT ---------------------------------> CHECK SMP (PWB-1641)
   |                                         SEE ITEM 6.3
   |  YES
   |
CHECK  175V              NG
   |    73V ----------------------------> CHECK SMP (PWB-1641)
   |    24V                               SEE ITEM 6.3
   |
   |  OK
CHECK HV. ------------------------------> CHECK PIN 2 OF T603
OPERATION                                 (40V TO 150V)
   |                     NG
   |------------------------------------> CHECK H. OSC, H. DEF, HV CIRCUIT
   |  OK
   |
CHECK 6V -------------------------------> MEASURE ON THE CRT BOARD (PWB-1643)
   |                                      PINS 1, 3 OF P907
   |                     NG
   |------------------------------------> Q315, Q207, R204, R206
   |  OK                                  FAILURE
   |
CHECK CRT ------------------------------> HEATER NOT LIT ----------------> CONNECTOR P907
HEATER                                                                     FAILURE
   |
   |
HEATER LIT
   |
   |
TURN SCREEN
VR CLOCKWISE
   |
   |
CHECK SCREEN ---------------------------> (300 - 700V)
VOLTAGE
   |                     TOO LOW
   |------------------------------------> SCREEN UNIT
   |                                      C901, R905
   |  OK                                  FBT T603
   |                                      FAILURE
CRT OR
ASSOCIATED
CIRCUIT
FAILURE
   |
   |
  END
```

6.2 NO RASTER (HV./DEF PROTECTION CIRCUIT FAILURE)

* SET THE INPUT HORIZONTAL FREQUENCY AT 64KHZ

CHECK HV./DEF PROTECTION ----> THE HIGH VOLTAGE PROTECTION CIRCUIT MAKES AN AUDIBLE NOISE DURING OPERATION

NO ----> CHECK HV & DEF CIRCUIT SEE ITEM 6.4/6.5

YES

CHECK OUTPUT PULSE ----> CONNECT 2700PF/1600V CAPACITOR AT PINS 1, 4 OF T603
CONNECT 2700PF/1600V CAPACITOR AT PINS 2, 5 OF T401
TO DECREASE THE OUTPUT PULSE

OK

RASTER ----> CHECK HV & DEF CIRCUIT
SEE ITEM 6.4/6.5

NO

HV. PROTECTION AUDIBLE NOISE

YES ----> HV & DEF PROTECTION CIRCUIT ----> D618, R641, R640, C631
D414, D413, R432, C418
FAILURE

NO

CHECK HV & DEF CIRCUIT
SEE ITEM 6.4/6.5

END

6.3 POWER START NG (SMP PWB-1641 FAILURE)

```
                                       YES
LED LIT -------------------------------------------------------> CHECK HOR. DEF/ HV. CIRCUIT
     |
     | NO
     |
CHECK POWER ---------------------------------------------------> S801, P801, S820
SELECTOR & SW.                                                   (110V-SHORT; 220V-OPEN)
     |
     | OK
     |
CHECK OUTPUT --------------------------------------------------> PINS 2, 3, 4 TO 1 SHORT?
CIRCUIT                                                          D812, D813, D814
     |
     |
CHECK VOLTAGE -------------------------------------------------> PINS 7, 2 OF T801
     |                                                           370V (APPROX.)
     |                                 NO
     |---------------------------------------------------------> F801, R808 OPEN?
     |                                                           R850, R851, R860, R861 SHORT?
     | YES                                                       I801
     |
CHECK START UP ------------------------------------------------> PIN 7 OF I801
VOLTAGE                                                          < 10V
     |
     | YES
     |
CHECK START UP ------------------------------------------------> R809, R810, D804
CIRCUIT                                                          D806, R812, C808, C809
     |
     | OK
     |
CHECK OVP. ----------------------------------------------------> Q802 (A, K) SHORT?
PROTECTION                                                       D810, D809, C815, R824
CIRCUIT                                                          R825, C816, R826, R817
     |
     | OK
     |
CHECK OCP. PROTECTION CIRCUIT ---------------------------------> R828, R822, C818
     |
     |
CHECK OSC. CIRCUIT --------------------------------------------> C812, R815, C811
     |
     |
CHECK VOLTAGE -------------------------------------------------> R821, D808, C817, R823
FEEDBACK CKT.                                                    R820, R818, R819, R818, C813
     |
     |
CHECK I801
     |
     |
CHECK OUTPUT --------------------------------------------------> R813, D811, Q803, R828
CIRCUIT                                                          R829, C814, D807, T801
     |
     |
CHECK OUTPUT CONNECTOR ----------------------------------------> P802
     |
     |
    END
```

6.4 NO RASTER (H.DEF FAILURE)

```
INPUT 64KHz
SYNC SIGNAL
      |
      |
CHECK H. DEF. ------------------------------------> COLLECTOR OF Q411
OUTPUT PULSE                                        (800 – 1000Vp-p) (SEE ITEM 6.5)
      |
      |                     OK
      |-------------------------------------------> HV. CKT FAILURE
      | NG
      |
CHECK VOLTAGE ------------------------------------> Q611, R666, D608, D606
SUPPLY CKT.                                         R479, D411
      |
      |
CHECK PWM ----------------------------------------> PIN 2 OF T600
GENERATOR                                           SQUARE WAVEFORM
      |                                             20Vp-p
      |                     NO
      |-------------------------------------------> R607, Q607, Q608, Q606a
      |                                             Q602, Q601, D600, Q603, Q605
      | YES                                         D605, C603, D602, D603
      |
CHECK FEEDBACK -----------------------------------> USING 16V VOLTAGE TO SIMULATE
CIRCUIT                                             THE FEEDBACK VOLTAGE (ON PIN 3 OF Q620a)
      |                                             MEASURE THE WAVEFORM (PIN 2 OF T600)
      |                                             THE WAVEFORM WILL CHANGE WHEN
      |                                             16V (VIA 10 Kohm RESISTOR) TOUCH
      |                                             PIN 3 OF Q620a.
      |                     NO
      |-------------------------------------------> Q620a, Q620b, R602, D601
      |
      | YES
      |
CHECK HOR. DEF. ----------------------------------> H. DY, L402, L405, C428
CIRCUIT                                             C429, C430
      |
      |
CHECK DPC BOARD ----------------------------------> GROUNDING TRACK
PWB-1732                                            IF BREAK, THE PARABOLA SIGNAL
      |                                             WILL GET TO H1, H2 SIGNAL LINE
      |                                             VIA PINS 5, 6 OF P310
      |                                             THIS WILL CAUSE THE HOR. OSC
      |                                             UNSTABLE AND DAMAGE THE Q411.
      |
CHANGE A NEW
2SC4288A
AND POWER ON
      |
      |
     END
```

6.5 NO RASTER (HV. CKT. FAILURE)

```
INPUT 64KHz
SYNC SIGNAL
     |
     |
CHECK DEF. -------------------------------> COLLECTOR OF Q411
OUTPUT PULSE                                (800-1000Vp-p)
     |
     |                  NG
     |-------------------------------------> H. DEF. CKT FAILURE
     | OK                                   (SEE ITEM 6.4)
     |
CHECK VOLTAGE ----------------------------> Q612, R667, D609, D610
SUPPLY CKT.
     |
     |
CHECK PWM --------------------------------> PIN 2 OF T601
GENERATOR                                   SQUARE WAVEFORM
     |                                      20Vp-p
     |                  NO
     |
     |-------------------------------------> R613, Q609, Q610, Q606b
     |                                      Q602, Q601, D600, Q604, Q605
     | YES                                  D605, C603, D602, D603
     |
CHECK FEEDBACK ---------------------------> USING 16V VOLTAGE TO SIMULATE
CIRCUIT                                     THE FEEDBACK VOLTAGE (ON PIN 5
     |                                      OF Q613b) OR (PIN GR OF T603).
     |                                      MEASURE THE WAVEFORM (PIN 2 OF T601)
     |                                      THE WAVEFORM WILL CHANGE WHEN
     |                                      16V (VIA 10Kohm RESISTOR) TOUCH PIN 5 OF Q613b.
     |                  NO
     |-------------------------------------> Q613a, Q613b, R616, D604
     |
     | YES
     |
CHECK HV. CKT. ---------------------------> T603, C625, D615, L607
CIRCUIT
     |
     |
CHECK DPC BOARD --------------------------> GROUNDING TRACK
PWB-1732                                    IF BREAK, THE PARABOLA SIGNAL
     |                                      WILL GET TO H1, H2 SIGNAL LINE
     |                                      VIA PINS 5, 6 OF P310
     |                                      THIS WILL CAUSE THE HOR. OSC
     |                                      UNSTABLE AND DAMAGE THE Q411.
CHANGE A NEW
2SC4288A
AND POWER ON
     |
     |
    END
```

6.6 SPECIAL CONDITION

1. Q411 (2SC4288A) DEFECT WHEN POWER ON.
2. Q411 (2SC4288A) DEFECT DURING 30 MINUTES WARM UP.
3. Q618 (2SC3894) DEFECT WHEN POWER ON.
4. Q618 (2SC3894) DEFECT DURING 30 MINUTES WARM UP.

POSSIBLE SITUATION

SURGE VOLTAGE

The transistor defect when power on. The problem usually come from the SURGE VOLTAGE on the collector, the SURGE VOLTAGE which is much higher than the transistor rating. It break through the transistor junction among collector, base and emitter.

DRIVE CURRENT

The transistor defect during warm up. The problem usually come from the lack of enough DRIVE CURRENT on the base, the lack of enough DRIVE CURRENT, caused the increasing of the impedance (collector to emitter) of the transistor.

Finally the THERMO-RUN-AWAY happened inside the transistor.

Both of the situation will damage the transistor causing the short circuit between collector, base or emitter.

6.7 Q411 (2SC4288) DAMAGED DUE TO THE SURGE VOLTAGE

```
TAKE OUT Q411
FROM MAIN BOARD
& POWER ON
      |
      |
INPUT 64KHz
SYNC. SIGNAL
      |
      |
      |
CHECK VOLTAGE -----------------------------> Q611, R666, D608, D606
SUPPLY CKT.
      |
      |
      |
CHECK PWM ---------------------------------> PIN 2 OF T600
GENERATOR                                    SQUARE WAVEFORM
      |                                      20Vp-p
      |                  NO
      |------------------------------------> R607, Q607, Q608, Q606a
      |                                      Q602, Q601, D600, Q603, Q605
      | YES                                  D605, C603, D602, D603
      |
CHECK FEEDBACK ----------------------------> USING 16V VOLTAGE TO SIMULATE
CIRCUIT                                      THE FEEDBACK VOLTAGE (ON PIN 3 OF Q620a)
      |                                      MEASURE THE WAVEFORM (PIN 2 OF T600)
      |                                      THE WAVEFORM WILL CHANGE WHEN
      |                                      16V (VIA 10Kohm RESISTOR) TOUCH PIN 3 OF Q620a.
      |                  NO
      |------------------------------------> Q620a, Q620b, R602, D601
      |
      | YES
      |
CHECK HOR. DEF. ---------------------------> H. DY, L402, L405, C428
CIRCUIT                                      C429, C430
      |
      |
      |
CHECK DPC BOARD ---------------------------> GROUNDING TRACK
PWB-1732                                     IF BREAK, THE PARABOLA SIGNAL
      |                                      WILL GET TO H1, H2 SIGNAL LINE
      |                                      VIA PINS 5, 6 OF P310
      |                                      THIS WILL CAUSE THE HOR. OSC
      |                                      UNSTABLE AND DAMAGE THE Q411.
      |
CHANGE A NEW
2SC4288A
AND POWER ON
      |
      |
      |
     END
```

6.8 Q411 (2SC4288A) DAMAGED DUE TO THE DRIVE CURRENT

TAKE OUT Q411&POWER ON

INPUT 64KHz SYNC. SIGNAL

CHECK H. SIZE PRESET R481 ---> SEE ALIGNMENT

CHECK AT WHAT FREQ. IT DAMAGED ---> 31KHZ, 48KHz, 64KHz

CHECK BASE COMPONENT ---> R464, R465, D404, R467, T400 & ITS SOLDERING

CHECK MODE SIGNAL H0, H1, H2 ---> H0 HIGH; 28K-40.8KHz
H1 HIGH; 40.8K-53.6KHz
H2 HIGH; 53.6K–66KHz

CHECK DUTY CYCLE SWITCH ---> Q423b, R472, R437, R438

CHECK DRIVE COMPONENT ---> THE WAVE ON PIN 2 OF T400 SQUARE WAVEFORM 24Vp-p

NO ---> Q413, Q408, Q409
R456, R455, R454
Q422a, C421

YES

CHECK VOLTAGE SUPPLY CKT. ---> R666, Q611

CHANGE NEW Q411& POWER ON

END

6.9 Q618 (2SC3884A) DAMAGED DUE TO THE SURGE VOLTAGE

TAKE OUT Q618 FROM MAIN BOARD & POWER ON

INPUT 64KHz SYNC. SIGNAL

CHECK HV. ADJ. & CIRCUIT ------> ADJUST R626 FULLY COUNTERCLOCKWISE
R625, R627, C618, D612

CHECK VOLTAGE SUPPLY CKT. ------> Q612, R667, D609, D610

CHECK PWM GENERATOR ------> PIN 2 OF T601
SQUARE WAVEFORM
20Vp-p

NO ------> R607, Q609, Q610, Q606b
Q602, Q601, D600, Q604, Q605
D605, C603, D602, D603

YES

CHECK FEEDBACK CIRCUIT ------> USING 16V VOLTAGE TO SIMULATE
THE FEEDBACK VOLTAGE (ON PIN 5 OF Q613b)
MEASURE THE WAVEFORM (PIN 2 OF T601)
THE WAVEFORM WILL CHANGE WHEN
16V (VIA 10Kohm RESISTOR) TOUCH PIN 5 OF Q613b.

NO ------> Q613a, Q613b, R616, D604
R621, R622, C620, C629

YES

CHECK HV. OUTPUT CIRCUIT ------> T603, L607, C625, D615

CHECK DPC BOARD PWB-1732 ------> GROUNDING TRACK
IF BREAK, THE PARABOLA SIGNAL
WILL GET TO H1, H2 SIGNAL LINE
VIA PINS 5, 6 OF P310
THIS WILL CAUSE THE HOR. OSC
UNSTABLE AND DAMAGE THE Q411.

CHANGE A NEW 2SC3884A AND POWER ON ------> READJUST HIGH VOLTAGE (26KV)

END

6.10 Q618 (2SC3884A) DAMAGED DUE TO THE DRIVE CURRENT

TAKE OUT
Q618 & POWER ON

INPUT 64KHz SYNC. SIGNAL

CHECK 5V VOLTAGE ————> R672, D653, C653

CHECK 16V VOLTAGE ————> THIS VOLTAGE IS FED FROM H. DEF CKT
PIN 4 OF T401
D652, R671, D651, R670, C651, C652

CHECK BASE COMPONENT ————> R643, L608
& ITS SOLDERING

CHECK MODE
SIGNAL H0, H1, H2 ————> H0 HIGH; 28K–40.8KHz
H1 HIGH; 40.8K–53.6KHz
H2 HIGH; 53.6K–66KHz

CHECK DUTY CYCLE CIRCUIT ————> Q632, R678, R680, C654, R673, R674

CHECK DRIVE COMPONENT ————> THE WAVE ON PIN 2 OF T602
SQUARE WAVEFORM 24Vp-p

NO ————> Q630, Q614, Q615, Q616, R646
R645, C622, R644, C623, R648

YES

CHECK VOLTAGE SUPPLY CKT. ————> R667, Q612

CHANGE NEW
Q618 & POWER
ON

END

6.11 NO VIDEO

CHECK SIGNAL & CONNECTOR	RED, GREEN, BLUE SIGNAL LEVEL 0.7Vp-p
CHECK 73V 12V 6V	PIN 2 OF P009 (PWB-1697) PIN 3 OF P010 PIN 2 OF P010
CHECK INPUT SIGNAL	PIN 1 OF Q002, Q062, Q122 Q001, Q061, Q121
CHECK GAIN CONTROL CIRCUIT	PIN 4 OF Q002, Q062, Q122 (0V TO 10V) R721, R723, P721 (PWB-1701-2) Q047, Q048, Q008, Q068, Q128 (PWB-1697)
CHECK CLAMP PULSE	PIN 12 OF Q002, Q062, Q122 POSITIVE PULSE 5Vp-p Q051a, Q051b, Q049 Q049a–Q049d
CHECK FEEDBACK CIRCUIT	R016, R076, R136 (39 Kohm 2%) R012, R072, R132 (5.1 Kohm 2%)
CHECK DC BIAS	BASE OF Q003, Q063, Q123 8.2V
CHECK PREAMPLIFIER	Q002, Q062, Q122 Q005, Q065, Q125
CHECK OUTPUT TRANSISTOR	Q003, Q006, Q063, Q066 Q123, Q126

END

6.12 ABNORMAL VIDEO ON CRT SCREEN

(TOO BRIGHT OR TOO DARK)

CHECK R, G, B VIDEO OUTPUT ——> MEASURE ON THE VIDEO PCB PWB-1697 PIN 1 OF P002, P062, P122

CHECK 6V ——> PIN 2 OF P010

NG ——> Q315, Q207, R204, R206 (PWB-1701) FAILURE

OK

CHECK G1 VOLTAGE ——> G1 OF PWB-1643 (–50V TO –100V)

NG ——> Q901, VR907, D903 TO D908 (PWB-1643) R635, D614 (PWB-1701A) FAILURE

OK

CHECK VIDEO AMP ——> PWB-1697 SEE ITEM 6.9

CHECK 12V 73V ——> LOW OR 0V. SEE ITEM 6.30 CONNECTOR P009, P010 FAILURE

OK

CHECK SCREEN VOLTAGE ——> TOO LOW SCREEN UNIT C901, R905 T603, CRT, FAILURE

——> 300 – 700V, CRT FAILURE

END

6.13 ABNORMAL WHITE BALANCE & TRACKING

- --> ABNORMAL BRIGHTNESS CONTROL --> Q056, Q004 (PWB-1697)
  Q064, Q069
  Q124, Q129
  Q009, P008
  R722 (PWB-1701)
- --> ABNORMAL CONTRAST CONTROL --> Q047, Q048 (PWB-1697)
  Q008, Q068
  Q128, Q002
  Q062, Q122
  P008
  R721 (PWB-1701)
- --> READJUST WHITE BALANCE --> REFER TO THE ALIGNMENT PROCEDURE

6.14 NO BLANKING

ie : VISIBLE RETRACE LINE ON THE BACKGROUND RASTER

CHECK BLANKING CIRCUIT

- --> Q322, Q323, C340, Q321
  D321, D320, Q324, R351
  R303, D302
  MAIN BOARD (PWB-1701)
- --> C904, C908
  CRT BOARD (PWB-1643)
- --> READJUST G2 VOLTAGE

6.15 POOR FOCUS

FOR THE SINGLE FOCUS TUBE THE FOCUS IS NOT SO CLEAR AS THE DOUBLE FOCUS TUBE. (PLEASE MAKE SURE WHAT TUBE BEING USED BEFORE DOING THE ALIGNMENT)

```
SINGLE FOCUS
      |
      |----------------------------> READJUST FOCUS
      |
      |----------------------------> CHECK G1 & HIGH VOLTAGE
      |                              SEE ALIGNMENT
      |
      |----------------------------> FOCUS CONTROL PACK
      |                              CRT
      |                              FAILURE
      |
     END
```

```
DOUBLE FOCUS
      |
      |----------------------------> READJUST FOCUS
      |                              SEE ALIGNMENT
      |
      |----------------------------> CHECK G1 & HIGH VOLTAGE
      |                              SEE ALIGNMENT
      |
      |----------------------------> FOCUS CONTROL PACK
      |                              FOCUS LEAD
      |                              CRT
      |                              FAILURE
      |
     END
```

6.16 IMPURITY

```
         POWER SW OFF & ---------------------------------------> LET THE POSISTOR
         WAIT 5 MINUTES                                          COOL DOWN
              |
              |
              |
              |
         POWER SW ON &
         PRODUCE FULL
         WHITE PATTERN
         ON SCREEN
              |
              |
              |                  NO EFFECT
              |------------------------------------------------> R802, CONNECTOR P803
              |                                                  DEGAUSSING FAILURE
              |
              |
         PUSH S803
         MANUAL DEGAUSSING
              |
              |
              |                  NO EFFECT
 -------------+------------------------------------------------> S803, R804 FAILURE
 |            |
 |            |
 |            |
 |       MAKE SURE THAT THE
 |       MONITOR IS DISTANCE ----------------------------------> NO MAGNETIC FIELD
 |       FROM ANY STRONG                                         INTERFERENCE
 |       MAGNETIC FIELD
 |            |
 |            |
 |            |
 |            |
 |       USING THE SERVICE
 |       DEGAUSSING COIL
 |       TO GET RID OF THE
 |         IMPURITY
 |            |
 |            |
 |            |
 |            |
 |       READJUST PURITY
 |         MAGNET
 |            |
 |            |
 |            |
 ------------>| OK
              |
              |
              |
             END
```

6.17 NO VERTICAL DEFLECTION

A BRIGHT HORIZONTAL LINE ON THE SCREEN

CHECK DEF. YOKE & CONNECTOR ——> P301

CHECK VOLTAGE SUPPLY ——> PIN 14 OF Q301
24V FOR NEC, HITACHI TUBE
24.5V FOR TOSHIBA TUBE

CHECK VERT. FEEDBACK CKT. ——> R310, C309, R312, R307
R308, C308

CHECK VERT. LINEAR CKT. ——> R311, C313, C305, R306

CHECK PUMP UP VOLTAGE ——> PIN 2 OF Q310
D301, C302

CHECK VERT. HEIGHT CKT. ——> R314, R316

CHECK OSC. CKT ——> C304, D303, R341, R302

CHECK VERT AMPLIFIER ——> Q301 (TDA-1675A)

END

6.18 ABNORMAL VERTICAL HEIGHT

```
CHECK 24V                                          MEASURE PIN 3 P406
   |                                               ON PWB-1701
   |
   |
   |                      TOO LOW
   |------------------------------------------> SEE SMP ITEM 6.3
   |
   |
   | OK
   |
   |                      TOO LOW
CHECK 16V -----------------------------------> R201, Q202, R203, R205
   |                                            C202 FAILURE
   |
   | CHECK
   |
   |
   |-------------------> VERTICAL SIZE          Q302, C312, Q303, R314
   |                     CIRCUIT                  R346, R316, R345
   |
   |
   |
   |-------------------> VERTICAL OSC           D303, C304, R302
   |
   |
   |
   |-------------------> DEF. CIRCUIT           R312, C309, C302, D301
   |                                            R309, C307, DY
   |                                            FAILURE
   |
   L-------------------> READJUST               V. HEIGHT
                                                SEE ALIGNMENT



V. MODE                                         FAILURE CONDITION :
   |                                            TOO SMALL AT PARTICULAR MODE
   |
   |
   L-----------------------------------------> CHECK SYNC. SIGNAL INPUT
   |                                            VIDEO BOARD (PWB-1697)
   |                                            H+V, H/V, G+SYNC.
   |
   |
   L-----------------------------------------> CHECK MICROPROCESSOR Q512
                                                MODE DETECTION CIRCUIT
                                                PINS 13, 14, 15, 16, 36, 37
```

6.19 ABNORMAL VERTICAL LINEARITY

READJUST VERT. LINEARITY → R311 CHECK R306, C305, R305

CHECK OUTPUT CIRCUIT → R309, C307, R313, C309 R312, C306

CHECK FEEDBACK CIRCUIT → R310, C307, C308, R307

CHECK VERT. HEIGHT CKT. → R314, R316, R345, R346 Q303, Q302a, Q302b

CHECK PUMP UP CIRCUIT → D301, C302, C303

CHECK VERT. AMPLIFIER → Q301

END

6.20 DPC NOT WORK

READJUST DPC CONTROL ——> S512, S513 (PWB-1701-2)

READJUST DPC PRESET VR. ——> R343

CHECK DPC PARABOLA SIGNAL ——> PIN 3 OF P310

OK

NG

CHECK PARABOLA AMP
Q313, R368, C320
R340, R339, R334

CHECK PARABOLA GENERATOR
Q320, R337, R336
R330, C321, R331

END

CHECK DPC CONTROL BOARD ——> R382-R392
R370-R381

CHECK 16V

CHECK OP AMP ——> Q350a–Q350d
Q351a–Q351d
Q352a–Q352d

CHECK CONNECTOR
P310

END

6.21 ABNORMAL HORIZONTAL WIDTH

```
READJUST H. SIZE
UP/DOWN CONTROL
      |
      |
      |
CHECK H. SIZE SIGNAL ----------------------------> MICRO BOARD (PWB-1697-2)
      |                                            PIN 2 P502
      |                                            (0V TO 12V)
      |
CHECK H. SIZE PRESET R481 -----------------------> SEE ALIGNMENT
      |                                            ITEM 2.3
      |
      |
CHECK MODE SIGNAL -------------------------------> H0, H1, H2
      |                                            (PWB-1701)
      |
      |
CHECK 16V ---------------------------------------> Q202
      |                                            (PWB-1701)
      |
      |
CHECK HOR. --------------------------------------> Q414, Q417, Q418
LINEARITY CIRCUIT                                  Q412, Q420, Q421
      |                                            RY401, L402, L405
      |                                            (PWB-1701)
      |
CHECK CS CAPACITOR ------------------------------> C428, C429, C430
      |                                            (PWB-1701)
      |
      |
CHECK H. SIZE -----------------------------------> Q422, Q620a, Q620b
ADJ. CIRCUIT                                       Q606a, Q607, Q608
      |                                            T600, Q611, D607
      |                                            (PWB-1701)
      |
CHECK HIGH --------------------------------------> HV: 26KV
VOLTAGE CIRCUIT
      |
      |
      |
CHECK INPUT SIGNAL
VIDEO DISPLAY TIMING
      |
      |
      |
CHECK DEF YOKE
      |
      |
      |
     END
```

6.22 CENTERING

HORIZONTAL RASTER CENTERING

CHECK HORIZONTAL
RASTER CENTERING

- → SELECT P202, P203, P204 (BOTH DIRECTION)
  FOR OPTIMUM HOR. CENTERING
- → HORIZONTAL RASTER CENTERING
  R223, D206, D207, L202(PWB-1701)
  C209, R224, R225, T201
  CONNECTOR P202, P203, P204, P403

6.23 PICTURE CENTERING (HOR. PHASE)

HOR. CENTERING
CIRCUIT

- → HOR. CENTERING CIRCUIT
  Q402a, C415, Q404, Q423, C412
  C404, R428, C413, R451, D402
  D403, R446, R445
  (PWB-1701)
- → MICROPROCESSOR H. PHASE
  Q501, C504, R511, R506, R501
  R597, P501 (PWB-1697-2)
- → CHECK F/V CIRCUIT
  Q400, C440 (PWB-1701)
  Q400a-Q400c
  Q401a-Q401c
- → CHECK HOR. SYNC. CIRCUIT (PWB-1701)
  Q407, R436, R429, R426, R427
- → CHECK HOR. AFC CIRCUIT (PWB-1701)
  C438, R430, R431
  C408, C407
- → READJUST HOR. CENTERING
  (SEE ALIGNMENT)
- → READJUST HOR. OSC (FREE-RUN)
  R422, R413, R420 (PWB-1701)

6.24 VERTICAL RASTER CENTERING

CHECK VERTICAL
RASTER CENTERING

- → READJUST VERT. CENTERING CONTROL BOARD S507, S508 (PWB-1640-1)
- → VERT. CENTERING CIRCUIT Q315, D305, D306, Q304 Q305, R320, R321 (PWB-1701A)
- → MICROPROCESSOR BOARD VERT. CENTERING CIRCUIT Q505, R517, R516, R515 C510, C509, C508, R505 P502 (PWB-1697-2)

6.25 LACK OF STABLE VERTICAL SYNCHRONIZATION

VERTICAL

CHECK INPUT FREQUENCY ————> 45Hz TO 100Hz

CHECK SIGNAL SYNC. TYPE ————> G+SYNC., H+V, H/V

CHECK SYNC. SW. ————> G+SYNC. (SW. OFF)
S001
H+V (SW. ON)
H/V (SW. ON)
CONNECTOR P003 (PWB-1697)

CHECK SYNC. CIRCUIT ————> R301, C301
CONNECTOR P401 (PWB-1701)
P504 (PWB-1697-2)

CHECK VERT. SEPARATOR

INTEGRATED CKT. ————> Q553, Q552, Q562c
Q556, Q559, Q562d

G+SYNC. ————> Q052, Q053, Q556, Q551
(PWB-1697-2)

H+V ————> Q562a, Q555, D505
Q554, Q562b
(PWB-1697)

H/V ————> Q562a, Q555, D505
Q554, Q562b
(PWB-1697)

CHECK VERT. OSC ————> Q301 (PWB-1701)

END

6.26 LACK OF STABLE HORIZONTAL SYNCHRONIZATION

HORIZONTAL

CHECK INPUT FREQUENCY ——> 28KHz TO 65KHz

CHECK SIGNAL SYNC. TYPE ——> G+SYNC., H+V, H/V

CHECK SYNC. SW. S001 ——> G+SYNC. (SW. OFF)
H+V (SW. ON)
H/V (SW. on)
CONNECTOR P003 (PWB-1697)

CHECK SYNC. AMP ——> Q407, R436, R429
R426, R427, C403
CONNECTOR P401 (PWB-1701)

CHECK SYNC. SEPARATOR

- G+SYNC. ——> Q052, Q053, Q556, Q551 (PWB-1697-2)
- H+V ——> Q562a, Q555, D505, Q562b (PWB-1697)
- H/V ——> Q553, Q552 (PWB-1697)

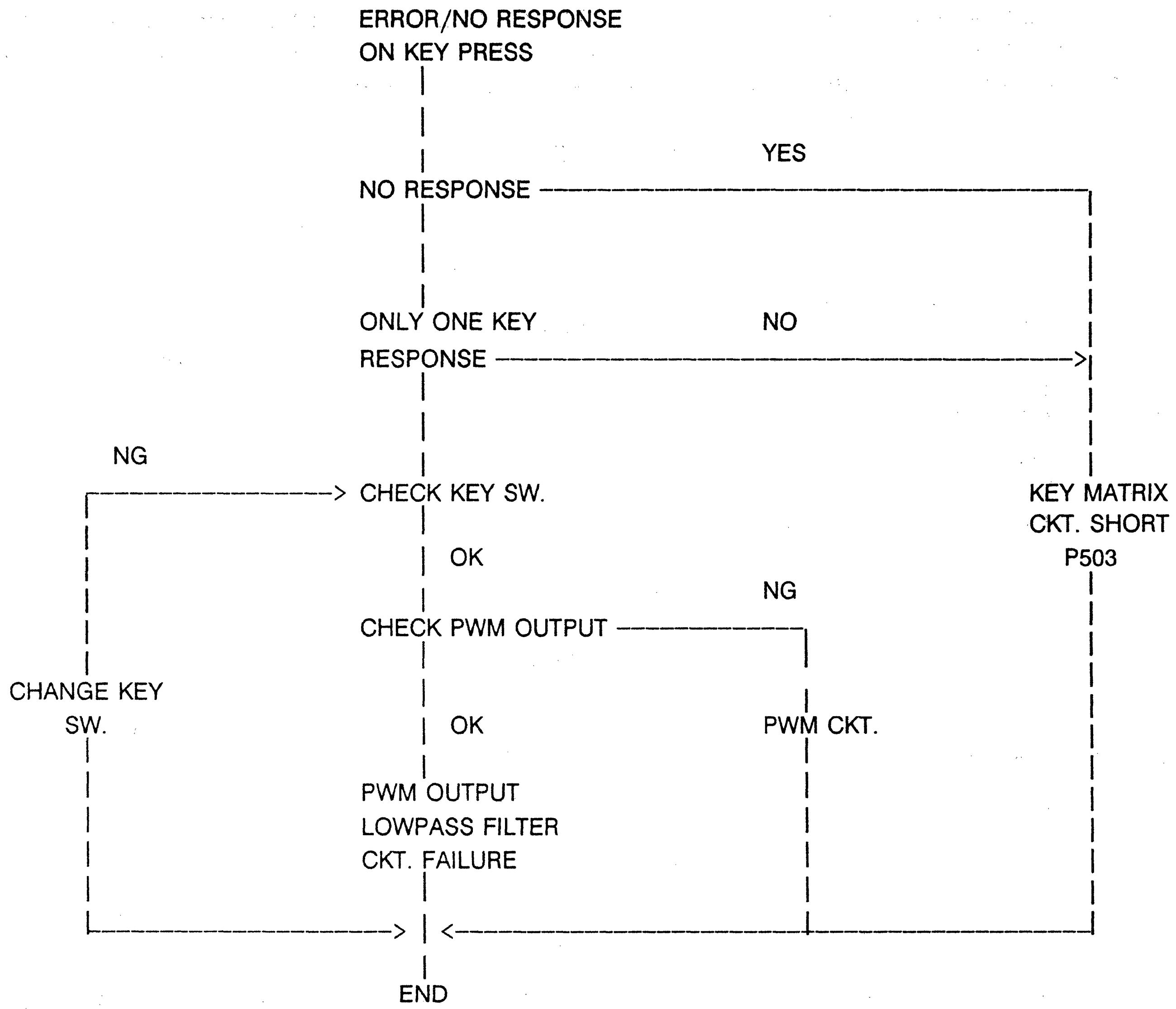
READJUST HOR. OSC ——> R422, R414, R420
(PWB-1701)
SEE ALIGNMENT

CHECK HOR. OSC ——> Q403 (PWB-1701)

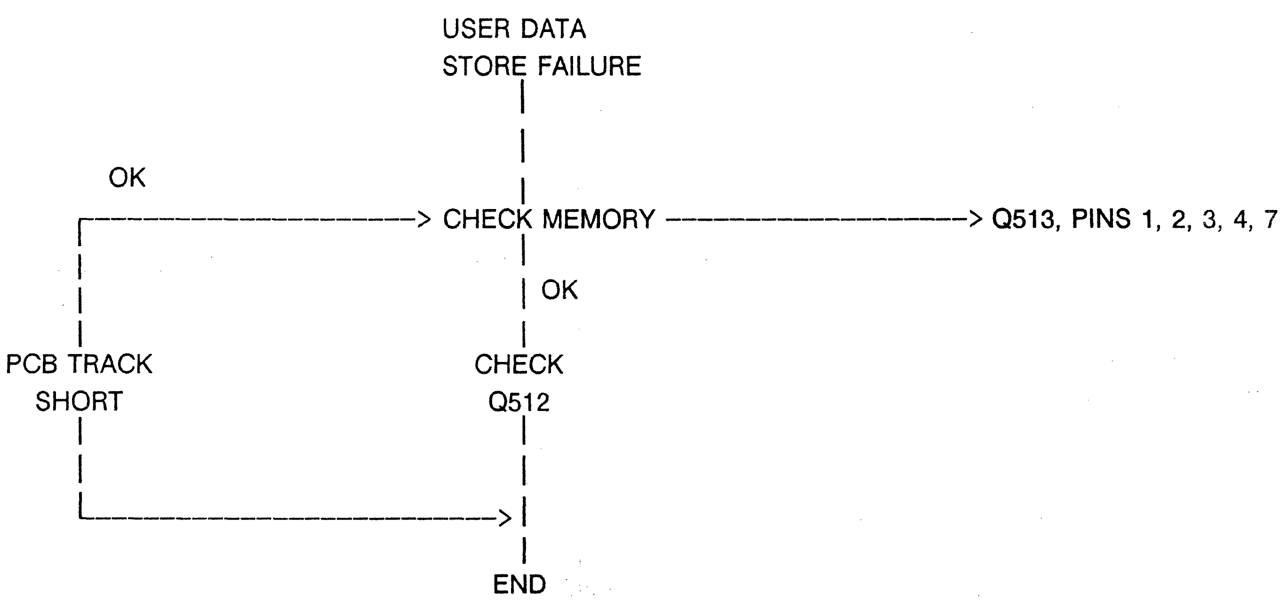
CHECK H. F/V CIRCUIT

END

6.27 NO KEY RESPONSE (MICRO BOARD FAILURE)



6.28 USER DATA STORE FAILURE (MICRO BOARD FAILURE)



6.29 USER DATA BEING CHANGED (MICRO BOARD FAILURE)

ie : If have any problem on the ID1, ID2, H. POLARITY or V. POLARITY circuit, the microprocessor will take the different input signals as the same signal and give them the same memory address. So the original data which is written before will be changed at the second-time writing.

```
                                  USER DATA
                                  BEING CHANGED
                                      |
                                      |
                      NG              |
      ------------------------------ CHECK ID1 ------------------> Q557, C561, D508
      |                               |                            D509, R582, C560
      |                               |
ID1 DETECTION CKT.                    |  OK
      |                               |
      |                               |
      ------------------------------->|
                                      |
                                      |
                      NG              |
      ------------------------------ CHECK ID2 ------------------> R587, C558, Q515
      |                               |
      |                               |
ID2 DETECTION CKT.                    |  OK
      |                               |
      |                               |
      ------------------------------->|
                                      |
                                      |
                      NG              |
      ------------------------------ H. POLARITY ----------------> Q555, Q554, R574
      |                              CORRECT                       C556, D505, R573
      |                               |
 H. POLARITY                          |
DETECTION CKT.                        |  OK
      |                               |
      |                               |
      ------------------------------->|
                                      |
                                      |
                                      |
      ------------------------------ V. POLARITY ----------------> Q558, Q559, R575
      |                              CORRECT                       C557, R585
      |                               |
 V. POLARITY                          |
DETECTION CKT.                        |
      |                               |
      |                               |
      ------------------------------->|
                                      |
                                     END
```

6.30 MAIN BOARD LOW VOLTAGE (+12V, +6V) FAILURE

```
12V VOLTAGE
   |
   |
   |
CHECK SQUARE ----------------------------> GATE OF Q206 TO GROUND
WAVEFORM                                   36Vp-p
   |
   |                  OK
   |---------------------------------------> T201, R208, C206, C207, D209
   |
   | NG
   |
CHECK SQUARE ----------------------------> PIN 1 OF Q204a
WAVEFORM                                   24Vp-p
   |                  OK
   |---------------------------------------> Q205, R236, R220
   |                                         R218, C204, R219
   |
CHECK Vf --------------------------------> PIN 3 OF Q203a
   |                                       DC 6.9V
   |                  OK
   |---------------------------------------> Q204a, R211, R210, R212
   |                                         C206, C207
   | NG
   |
CHECK D202, D203
   |
   |
   |
  END


6V VOLTAGE
   |
   |
   |---------------------------------------> CHECK Q315b, Q207
   |
   |
   |---------------------------------------> CHECK R204, R206, R228
   |                                         R231, R232, R229, R230, C210
   |
CHECK OUTPUT
CONNECTOR
P206, SHORT?
   |
   |
   |
  END
```

7. REPLACEMENT PARTS LIST

WARNING : Replacement parts which have special characteristics important to safety should be replaced only with types identical to those in the original circuit or specified in the parts list. Before replacing any of these components. Read carefully the product safety precaution. Do not degrade the safety of the display through improper servicing.

ABBREVIATIONS :

RESISTOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
CF	Carbon Film	F	± 1%
CC	Carbon Composition	G	± 2%
MOF	Metel Oxide Film	J	± 5%
FU	Fusible	K	± 10%
MF	Metel Film	M	± 20%
VR	Variable Resistor		
CR	Cement Resistor		

CAPACITOR

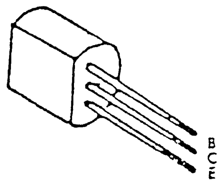
PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
CE	Ceramic	F	± 1%
EL	Elecrolytic	G	± 2%
PO	Polyester	J	± 5%
TA	Tantalum	K	± 10%
PP	Polypropylene	M	± 20%
ME	Metallized	P	+ 100% – 0%
BL	Barrier Layer	Z	+ 80% – 20%

7.1 Different Model Parts List

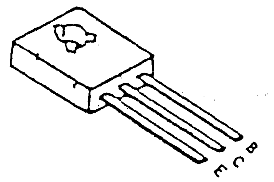
CKT NO. \ CCRT	TOSHIBA 17" M41KMK26XX12 M41KJF26XX12	NEC 17" M41KMG23XX03	HITACHI 17" M41KKL80X12 M41KVZ80X12	HITACHI 20" M48KAY80X01
MAIN PCB	PWB-1640	PWB-1640A	PWB-1640A	PWB-1701A
T401	TLN-155A	TLN-155	TLN-155	TLN-155
T603	TFB-230A/B	TFB-238M/T	TFB-128M/T	TFB-238M/T
L402	TLH-224	TLH-251	TLH-224	TLH-224
C309	1000 μF 25V	1000 μF 25V	2200 μF 25V	2200 μF 25V
C423/C424	2700PF 1600V	2700PF 1600V	3300PF 1600V	2700PF 1600V
C428	0.22μ 250V	0.22μ 250V	0.33μ 250V	0.33μ 250V
C429	0.68μ 250V	0.68μ 250V	0.82μ 250V	0.82μ 250V
C430	0.33μ 400V	0.33μ 400V	0.47μ 400V	0.39μ 400V
R306	33K	33K	100K	100K
R330	150K	100K	100K	100K
R334	8.2K	8.2K	5.1K	8.2K
R622	300K	165K	165K	165K
R625	6.8K	5.6K	5.6K	5.6K
R630	160K	120K	120K	110K
C707 (1)	NULL	100PF 500V	120PF 500V	100PF 500V
C710 (1)	NULL	56PF 50V	56PF 50V	150PF 50V
R707 (1)	NULL	12K	11K	8.2K
R708 (1)	NULL	5.6K	SHORT	SHORT
R712 (1)	NULL	3.3K	3K	3.3K
R805 (2)	SCK-053/054	SCK-053/054	SCK-053/054	SCK-054
V901A (3)	CVT3210-1801-T	HPS0380-01-100	HPS0380-01-110	HPS0380-01-110
S511 (4)	SSSU022NB1	SSSU022NB1	SSSU022NB1	SSSU022NC1
LED	CSL-300G1BT	CSL-300G1BT	CSL-300G1BT	SE6322AK

* D410, C434, R478, R483, R484, P405, P408, Dynamic PCB Assembly will be cancelled for Toshiba 17" CRT.
(1) Parts on dynamic focus PCB.
(2) Parts on power PCB.
(3) Parts on CRT drive PCB.
(4) Parts on control PCB.

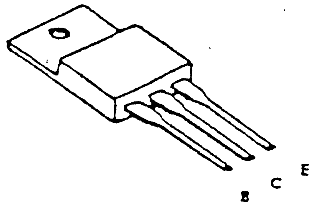
MODEL \ CKT NO.	R802 (2)	R804 (2)
UL/CSA (U.S.A.)	14Ω	8Ω
TUV (Germany)	20Ω	18Ω



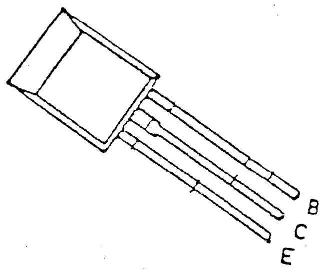
2SA 733
2SC 1685
2SC 1921
2SC 388A
2SA 949-Y
2SC 1906-TZ
2SA 1015Y
2SC 2229Y
2SC 1815Y
2SC 945Q



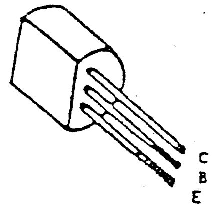
2SC 3599
2SC 3613
2SD 882Q
2SB 772



2SB 861WC
2SC 3675

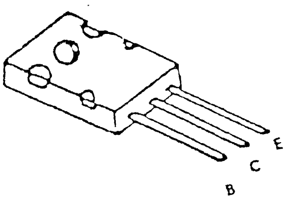


2SC 1941L

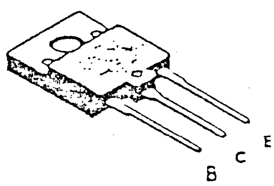


2SC 3811

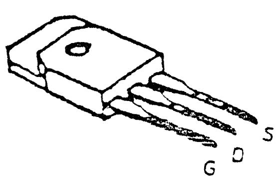
E: EMITTER
B: BASE
C: COLLECTOR
G: GATE
D: DRAIN
S: SOURCE



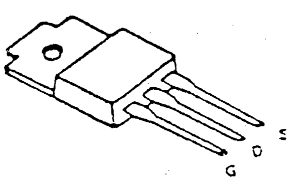
2SC 4288



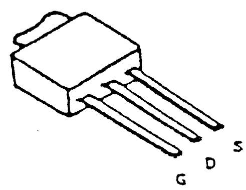
2SC 3884



2SK 727
2SK 794



2SK 758
2SK 1035



2SK 430

SYMBOL	PARTS NO.	DESCRIPTION		

*** POSISTORS ***

R802	5101110200	POSISTOR	PTH451C
R804	5101103800	THERMISTOR	PTH451A
R805	5101109700	THERMISTOR	5 OHM L 3A
R860 R861	5101110010	VARISTOR	V140LA2

*** FUSIBLE RESISTORS ***

R201/R478/R607	5133147903	R, FUSIBLE	4.7J	1/2W
R223/R479/R633/R635	5133122903	R, FUSIBLE	2.2J	1/2W
R551	5133110003	R, FUSIBLE	10	J 1/2W
R666	5133122903	R, FUSIBLE	2.2	J 1/2W
R667	5133101003	R, FUSIBLE	1	J 1/2W
R808	5133350803	R, FUSIBLE	0.5	J 2W
R812	5133839003	R, FUSIBLE	39	J 1/4W
R821	5133868903	R, FUSIBLE	6.8	J 1/4W

*** RESISTORS ***

R016/R076	5131739028	R, METAL	39KF	1/4W
R017/R077/R137	5130224107	R, METAL MINI	240	J 1/2W
R041/R101/R161	5130422003	R, METAL MINI	22	J 2W
R044/R045/R104/R105	5130718100	R, METAL MINI	180	J 5W
R050/R110	5113210190	R, CARBON	100	M 1/2W
R164/R165	5130718100	R, METAL MINI	180	J 5W
R182	5130339103	R, METAL MINI	390	J 1W
R189	5142891195	R, CARBON	910	J 1/4W
R195/R196	5131712028	R, METAL	12K	F 1/4W
R204/R206	5130239807	R, METAL MINI	0.39	J 1/2W
R208	5130447803	R, METAL MINI	0.47	J 2W
R217/R371/R602/R829	5142822395	R, CARBON	22K	J 1/4W
R224	5130310103	R, METAL MINI	100	J 1W
R225	5130333003	R, METAL MINI	33	J 1W
R227	5130468003	R, METAL MINI	68	J 2W

SYMBOL	PARTS NO.	DESCRIPTION		
R309	5130222907	R, METAL MINI	2.2	J 1/2W
R312	5142412990	R, CARBON	1.2	J 1/2W
R313	5142422290	R, CARBON	2.2K	J 1/2W
R320/R552	5130415103	R, METAL MINI	150	J 2W
R321	5130410103	R, METAL MINI	100	J 2W
R365	5142410090	R, CARBON	10	J 1/2W
R368/R444/R494/R820	5142810395	R, CARBON	10K	J 1/4W
R370	5142882295	R, CARBON	8.2K	J 1/4W
R414	5142830395	R, CARBON	30K	J 1/4W
R421	5142836395	R, CARBON	36K	J 1/4W
R446	5130333103	R, METAL MINI	330	J 1W
R452	5130427103	R, METAL MINI	270	J 2W
R455	5130412903	R, METAL MINI	1.2	J 2W
R456/R558/R831/R833	5130412103	R, METAL MINI	120	J 2W
R463	5142822195	R, CARBON	220	J 1/4W
R464/R465	5154416924	R, CEMENT	1.6	J 5W
R466	5130333103	R, METAL MINI	330	J 1W
R467/R643	5130418903	R, METAL MINI	1.8	J 2W
R468	5142468190	R, CARBON	680	J 1/2W
R471/R721	5142882195	R, CARBON	820	J 1/4W
R473	5130322103	R, METAL MINI	220	J 1W
R483/R484	5142847495	R, CARBON	470K	J 1/4W
R591	5130262007	R, METAL MINI	62	J 1/2W
R613	5142422090	R, CARBON	22	J 1/2W
R622		R, METAL	SEE TABLE	F 1/4W
R630		R, CARBON	SEE TABLE	J 1/4W
R635	5142810495	R, CARBON	100K	J 1/4W
R644/R648	5130515103	R, METAL MINI	150	J 3W
R645	5130482103	R, METAL MINI	820	J 2W
R646	5142412090	R, CARBON	12	J 1/2W
R653	5142810495	R, CARBON	100K	J 1/4W
R662	5142875395	R, CARBON	75K	J 1/4W
R671	5130415303	R, METAL MINI	15K	J 2W
R672/R822	5142810295	R, CARBON	1K	J 1/4W
R707/R834	5142812395	R, CARBON	12K	J 1/4W
R708	5142856295	R, CARBON	5.6K	J 1/4W
R714	5142422590	R, CARBON	2.2M	J 1/2W

SYMBOL	PARTS NO.	DESCRIPTION		
R715	5142415490	R, CARBON	150K	J 1/2W
R716	5142415290	R, CARBON	1.5K	J 1/2W
R731	5142416490	R, CARBON	160K	J 1/2W
R732	5142412490	R, CARBON	120K	J 1/2W
R733	5142427490	R, CARBON	270K	J 1/2W
R801	5142447490	R, CARBON	470K	J 1/2W
R803	5130522103	R, METAL MINI	220	J 3W
R806/R807	5130310403	R, METAL MINI	100K	J 1W
R809/R810	5130439303	R, METAL MINI	39K	J 2W
R811	5130547303	R, METAL MINI	47K	J 3W
R813/R817	5142812095	R, CARBON	12	J 1/4W
R815	5142891295	R, CARBON	9.1K	J 1/4W
R816	5142875495	R, CARBON	750K	J 1/4W
R819	5142818295	R, CARBON	1.8K	J 1/4W
R823/R826	5142815295	R, CARBON	1.5K	J 1/4W
R824	5130282107	R, METAL MINI	820	J 1/2W
R825	5142410190	R, CARBON	100	J 1/2W
R827/R835	5154525225	R, CEMENT	2.5K	J 7W
R828	5130327803	R, METAL MINI	0.27	J 1W
R830/R912	5142822495	R, CARBON	220K	J 1/4W
R832	5142856395	R, CARBON	56K	J 1/4W
R901/R902/R903/R454	5142433090	R, CARBON	33	J 1/2W
R905	5112210590	R, CARBON	1M	K 1/2W
R907/R908	5142843195	R, CARBON	430	J 1/4W
R911	5142811495	R, CARBON	110K	J 1/4W
R913	5142822095	R, CARBON	22	J 1/4W
R914	5142810195	R, CARBON	100	J 1/4W
R915	5142810595	R, CARBON	1M	J 1/4W
R917	5142436290	R, CARBON	3.6K	J 1/2W
R918	5142847395	R, CARBON	47K	J 1/4W

*** VARIABLE RESISTORS ***

R032/R058/R081/R092	5162161920	VR	B10K
R118/R141/R152/R178	5162161920	VR	B10K
R119/R179/R481	5162161220	VR	B2K

SYMBOL	PARTS NO.	DESCRIPTION		
R211	5162161020	VR	B1K	
R311	5162172810	VR	B100K	
R314	5162173580	VR	B500K	
R343/R626	5162161720	VR	B5K	
R413	5162172180	VR	B20K	
R420	5162171970	VR	B10K	
R422	5162171770	VR	B5K	
R556	5162161520	VR	B3.3K	
R640	5162161920	VR	B10K	
R721	5160807219	VR	B10K	
R722	5160807160	VR	B1K	
R818	5162470820	VR	B500	
VR907	5162162880	VR	B100K	

***** SPARK GAP *****

SG701	5202201400	SPARK GAP	DC500V	
Z901/Z902/Z903	5202201991	SPARK GAP	DC200V	
Z905	5202202300	SPARK GAP	DC300V	

***** CAPACITORS *****

C001/C012/C008/C061	5293347091	C, ELEC MINI	47UF	M 16V
C002/C007/C062/C067	5275110391	C, METAL CF93M	10000PF	J 63V
C003/C063	5213333191	C, ELEC	330UF	M 16V
C004/C014/C064/C074	5231310391	C, CERAMIC CK45	10000PF	K 50V
C005/C065/C125	5214447812	C, ELEC	0.47UF	M 250V
C006/C066/C126	5213633991	C, ELEC	3.3UF	M 50V
C011/C013/C019/C073	5275110491	C, METAL CF93M	0.1UF	J 63V
C015/C075/C135	5271110501	C, METAL CF93M	1UF	J 100V
C016/C076/C136	5221410401	C, POLY, CQ93M	0.1UF	J 100V
C017/C111	5216110112	C, ELEC (105C)	100UF	M 100V
C018/C105/C115/C321	5213610091	C, ELEC	10UF	M 50V
C020/C080/C140/C440	5213622991	C, ELEC	2.2UF	M 50V
C022/C082	5247033191	C, CERAMIC CC45	330PF	J 50V

SYMBOL	PARTS NO.	DESCRIPTION		
C028/C088/C148/C451	5221110391	C, POLY, CQ93M	10000PF	J 50V
C068/C072/C100/C121	5293347091	C, ELEC MINI	47UF	M 16V
C078/C138/C411	5213347112	C, ELEC	470UF	M 16V
C085	5210503591	C, ELEC NP	10UF	M 16V
C090/C101/C104/C113	5231310391	C, CERAMIC CK45	10000PF	K 50V
C094/C106/C110/C133	5275110491	C, METAL CF93M	0.1UF	J 63V
C098	5213322191	C, ELEC	220UF	M 16V
C102	5210500491	C, ELEC NP	2.2UF	M 25V
C103	5275110491	C, METAL CF93M	0.15UF	J 63V
C107/C108	5242220191	C, CERAMIC CC45	200PF	J 50V
C112	5215310191	C, ELEC (105C)	100UF	M 16V
C116	5215322112	C, ELEC (105C)	220UF	M 16V
C118/C124/C134/C160	5231310391	C, CERAMIC CK45	10000PFK	50V
C119/C410	5275147491	C, METAL CF93M	0.47UF	J 63V
C122/C127	5275110391	C, METAL CF93M	10000PF	J 63V
C128/C132	5293347091	C, ELEC MINI	47UF	M 16V
C151	5293601091	C, ELEC MINI	1UF	M 50V
C201/C205/C211/C420	5231310391	C, CERAMIC CK45	10000PF	K 50V
C202/C210/C308/C639	5213447091	C, ELEC	47UF	M 25V
C203/C352/C353/C354	5236310491	C, BARRIER CG45X	0.1UF	Z 50V
C204/C212/C306/C400	5231310291	C, CERAMIC CK45	1000PF	K 50V
C206/C207	5213447112	C, ELEC	470UF	M 25V
C208	5231333291	C, CERAMIC CK45	3300PF	K 50V
C209	5213422191	C, ELEC	220UF	M 25V
C216/C721	5213547091	C, ELEC	47UF	M 35V
C301	5231368191	C, CERAMIC CK45	680PF	K 50V
C302	5213622112	C, ELEC	220UF	M 50V
C303/C312/C418/C552	5213601091	C, ELEC	1UF	M 50V
C304	5275133491	C, METAL CF93M	0.33UF	J 63V
C305/C313	5222110491	C, POLY, CQ92M	0.1UF	J 50V
C307	5222522401	C, POLY, CQ92M	0.22UF	K 100V
C309	5213410212	C, ELEC	1000UF	M 25V
C310/C421	5213510191	C, ELEC	100UF	M 35V
C311	5222210491	C, POLY, CQ92M	0.1UF	K 50V
C314/C414	5210503591	C, ELEC NP	1.0UF	M 50V
C320	5214110091	C, ELEC	10UF	M 100V
C323/C510/C573	5213647991	C, ELEC	4.7UF	M 50V

SYMBOL	PARTS NO.	DESCRIPTION		
C340	5214201091	C, ELEC	1UF	M 160V
C341	5231322191	C, CERAMIC CK45	220PF	K 50V
C355/C409/C416/C501	5236310491	C, CERAMIC CC45	0.1UF	Z 50V
C401/C654	5227510291	C, POLY, CQ93T	1000PF	G 100V
C402	5227518291	C, POLY, CQ93T	1800PF	G 100V
C403/C412/C601	5242210191	C, CERAMIC CC45	100PF	J 50V
C404	5242227191	C, CERAMIC CC45	270PF	J 50V
C405	5221118291	C, POLY, CQ93M	1800PF	J 50V
C406	5210201591	C, TANTALUM	1.0UF	K 35V
C407	5227515291	C, POLY, CQ93T	1500PF	G 100V
C408	5221168291	C, POLY, CQ93M	6800PF	J 50V
C413	5242218191	C, CERAMIC CC45	180PF	J 50V
C415/C452	5210201191	C, TANTALUM	0.22UF	K 35V
C417/C603/C711/C818	5231310291	C, CERAMIC CK45	1000PF	K 50V
C422/C708	5231322291	C, CERAMIC CK45	2200PF	K 50V
C423/C424 A, C, D	5223727202	C, POLY, CQ93T	2700PF	J 1600V

*** CAPACITORS ***

C424/C423 B, E	5223733202	C, POLY, CQ93T	3300PF	J 1600V
C426	5232356191	C, CERAMIC CK45	560PF	K 500V
C427/C825	5232368191	C, CERAMIC CK45	680PF	K 500V
C428 B, D, E	5223433401	C, POLY, CQ93T	0.33UF	J 250V
C428 A, C	5223422401	C, POLY, CQ93T	0.22UF	J 250V
C429 B, D, E	5223482401	C, POLY, CQ93T	0.82UF	J 250V
C429 A, C	5223468401	C, POLY, CQ93T	0.68UF	J 250V
C430 A, C	5223533401	C, POLY, CQ93T	0.33UF	J 400V
C430 B, E	5223547401	C, POLY, CQ93T	0.47UF	J 400V
C430 D	5223539401	C, POLY, CQ93T	0.39UF	J 400V
C432/C433/C602/C607	5231310391	C, CERAMIC CK45	10000PF	K 50V
C434	5270747301	C, METAL CF93T	47000PF	J 630V
C435	5216301091	C, ELEC (105C)	1UF	M 200V
C436/C438/C503/C504	5213610091	C, ELEC	10UF	M 50V
C505/C506/C507/C508	5213610091	C, ELEC	10UF	M 50V
C509/C511/C513/C514	5213610091	C, ELEC	10UF	M 50V
C512/C515/C553/C561	5236310491	C, CERAMIC CC45	0.1UF	Z 50V

SYMBOL	PARTS NO.	DESCRIPTION		
C516	5222110291	C, POLY, CQ92M	1000PF	J 50V
C517/C518	5247020091	C, CERAMIC CC45	20PF	J 50V
C519	5213310191	C, ELEC	100UF	M 16V
C554	5222122291	C, POLY, CQ92M	2200PF	J 50V
C555	5222118291	C, POLY, CQ92M	1800PF	J 50V
C556/C631	5213622991	C, ELEC	2.2UF	M 50V
C557	5213347091	C, ELEC	47UF	M 16V
C558/C560/C637	5213601091	C, ELEC	1UF	M 50V
C562	5231810391	C, CERAMIC CK45	10000PF	Z 50V
C563	5231327291	C, CERAMIC CK45	2700PF	K 50V
C564/C565	5231327191	C, CERAMIC CK45	270PF	K 50V
C570/C809/C816	5236310491	C, CERAMIC CC45	0.1UF	Z 50V
C571/C572/C722	5213610091	C, ELEC	10UF	M 50V
C600/C604	5242222091	C, CERAMIC CC45	22PF	J 50V
C605/C611/C651	5213622091	C, ELEC	22UF	M 50V
C606	5275122491	C, METAL CF93M	0.22UF	J 63V
C608/C614/C615	5214422012	C, ELEC	22UF	M 250V
C609	5216233991	C, ELEC (105C)	3.3UF	M 160V
C610	5216210001	C, ELEC (105C)	10UF	M 160V
C612/C629	5231310391	C, CERAMIC CK45	10000PF	K 50V
C613/C618	5221147301	C, POLY, CQ93M	47000PF	J 50V
C619	5272127301	C, METAL CF93M	27000PF	J 250V
C620	5221112291	C, POLY, CQ93M	1200PF	J 50V
C621	5216004901	C, ELEC (105C)	47UF	M 160V
C622	5231315291	C, CERAMIC CK45	1500PF	K 50V
C623	5213422091	C, ELEC	22UF	M 25V
C625	5223727202	C, POLY, CQ93T	2700PF	J 1600V
C626	5227310391	C, POLY, CQ93T	10000PF	J 100V
C628/C911	5214410012	C, ELEC	10UF	M 250V
C632/C638/C723	5275110491	C, METAL CF93M	0.1UF	J 63V
C633	5272122401	C, METAL CF93M	0.22UF	J 250V
C634	5231312291	C, CERAMIC CK45	1200PF	K 50V
C635	5221156301	C, POLY, CQ93M	56000PF	J 50V
C636	5231347191	C, CERAMIC CK45	470PF	K 50V
C640/C643	5213522112	C, ELEC	220UF	M 35V
C652	5214247991	C, ELEC	4.7UF	M 160V
C653/C724	5213447091	C, ELEC	47UF	M 25V

SYMBOL	PARTS NO.	DESCRIPTION		
C704	5223510301	C, POLY, CQ93T	10000PF	J 400V
C707	5232310191	C, CERAMIC CK45	100PF	K 500V
C709	5223715201	C, POLY, CQ93T	1500PF	J 1600V
C710	5242256091	C, CERAMIC CC45	56PF	J 50V
C725	5275110491	C, METAL CF93M	0.12UF	J 63V
C801/C828	5270106601	C, METAL CF99M	0.68UF	M 250VAC
C802/C803	5230102701	C, CERAMIC CK45	4700PF	M 400V
C805/C806	5210306800	C, ELEC (105C)	470UF	M 200V
C807	5223656201	C, POLY, CQ93T	5600PF	J 630V
C808	5215410191	C, ELEC (105C)	100UF	M 25V
C811	5293622991	C, ELEC MINI	2.2UF	M 50V
C812	5221147291	C, POLY, CQ93M	4700PF	J 50V
C813	5232322191	C, CERAMIC CK45	220PF	K 500V
C814	5248556100	C, CERAMIC CC45	560PF	K 2KV
C815/C817	5215610091	C, ELEC (105C)	10UF	M 50V
C819/C908	5234310101	C, CERAMIC CK45	100PF	K 2KV
C820	5216410101	C, ELEC (105C)	100UF	M 250V
C822	5232327191	C, CERAMIC CK45	270PF	K 500V
C823	5216122112	C, ELEC (105C)	220UF	M 100V
C824	5216147012	C, ELEC (105C)	47UF	M 100V
C826	5210403501	C, ELEC	1000UF	M 35V
C827	5213633112	C, ELEC	330UF	M 50V
C901/C912	5233510301	C, CERAMIC CK45	10000PF	M 1KV
C904	5270322401	C, METAL CF93T	0.22UF	J 250V
C909	5233510201	C, CERAMIC CK45	1000PF	M 1KV

* SUBSCRIPT A FOR 17" TOSHIBA TUBE M41KMK26XX12
* SUBSCRIPT B FOR 17" HITACHI TUBE M41KKL80X12
* SUBSCRIPT C FOR 17" NEC TUBE M41KMG23XX03
* SUBSCRIPT D FOR 20" HITACHI TUBE M48KAY80X01
* SUBSCRIPT E FOR 17" HITACHI TUBE M41KVZ80X12

*** DIODES ***

D001/D002/D003/D050	6613004934	DIODE, SWITCHING	1SS133
	6130051300	DIODE, SWITCHING	1SS176

SYMBOL	PARTS NO.	DESCRIPTION	
D004/D005/D007/D008	6613001531	DIODE, SWITCHING	1SS131
	6613005730	DIODE, SWITCHING	1SS178
D006/D054/D055/D056	6613003032	DIODE, SWITCHING	1N4148-TD
D009/D064/D065/D067	6613001531	DIODE, SWITCHING	1SS131
	6613005730	DIODE, SWITCHING	1SS178
D046/D053/D131/D206	6613002244	DIODE, SWITCHING	RGP10D-G23
D051/D413/D502/D600	6615013130	DIODE, ZENER	HZS8.2EB
D057/D061/D062/D063	6613004934	DIODE, SWITCHING	1SS133
	6130051300	DIODE, SWITCHING	1SS176
D058/D060/D066/D126	6613003032	DIODE, SWITCHING	1N4148-TD
D068/D069/D124/D125	6613001531	DIODE, SWITCHING	1SS131
	6613005730	DIODE, SWITCHING	1SS178
D121/D122/D123	6130051300	DIODE, SWITCHING	1SS176
	6613004934	DIODE, SWITCHING	1SS133
D127/D128/D129	6613001531	DIODE, SWITCHING	1SS131
	6613005730	DIODE, SWITCHING	1SS178
D202/D704	6615006631	DIODE, ZENER	05AZ6.2Z
	6615009756	DIODE, ZENER	HZ6C2-TD
D203/D204/D205/D302	6613003032	DIODE, SWITCHING	1N4148-TD
D207/D404/D408/D409	6613002244	DIODE, SWITCHING	RGP10D-G23
D208/D407/D651	6615005235	DIODE, ZENER	HZ16-2-TD
	6615005234	DIODE, ZENER	RD16EB3-T1
D209/D607/D611/D813	6611027700	DIODE, RECTIFIER	UF5404
D301	6611007240	DIODE, RECTIFIER	IN4002RL
D303	6615002400	DIODE, ZENER	HZ4C3
D305	6615009720	DIODE, ZENER	RD11EB3-T1
	6615011531	DIODE, ZENER	05AZ11Z
D306/D504/D505/D653	6615003101	DIODE, ZENER	1N5231B
D320/D321/D402/D403	6613003032	DIODE, SWITCHING	1N4148-TD
D330	6615019032	DIODE, ZENER	MA4180H-TA
	6615023230	DIODE, ZENER	1N5248B
D401/D605	6615005830	DIODE, ZENER	HZ12A1-TD
D406/D417/D451/D601	6613003032	DIODE, SWITCHING	1N4148-TD
D410/D614/D805	6611012801	DIODE, RECTIFIER	RGP10M
D411/D617	6611013243	DIODE, RECTIFIER	RGP15G
D414/D501/D506/D507	6613001730	DIODE, SWITCHING	1S2076-TD
D415/D416	6611013041	DIODE, RECTIFIER	RGP15M

SYMBOL	PARTS NO.	DESCRIPTION	
D503	6615016432	DIODE, ZENER	HZ3C2-TD
D508/D509/D619	6613001730	DIODE, SWITCHING	1S2076-TD
D602/D603/D604/D606	6613003032	DIODE, SWITCHING	1N4148-TD
D608/D609/D610/D612	6613003032	DIODE, SWITCHING	1N4148-TD
D613/D620/D652	6613002244	DIODE, SWITCHING	RGP10D-G23
D615	6611029642	DIODE, RECTIFIER	RU4D-V1
D618	6615013130	DIODE, ZENER	HZS8.2EB
D621/D701/D804/D806	6613003032	DIODE, SWITCHING	1N4148-TD
D702	6615012235	DIODE, ZENER	05AZ5.1Z
D703	6615005405	DIODE, ZENER	RD9.1EB3
D711	6618001300	DIODE, ZENER	CSL-300G1BT
D801	6611009000	DIODE, RECT. BRIDGE	DSSB60
	6611000601	DIODE, RECT. BRIDGE	RBV-606
D807	6611017441	DIODE, RECTIFIER	RGP10K
D808	6613003032	DIODE, SWITCHING	1N4148-TD
D809	6615018830	DIODE, ZENER	RD18EB2-T1
D810	6613002238	DIODE, SWITCHING	1N4935
	6613002234	DIODE, SWITCHING	RGP10D-G3
D811	6615022834	DIODE, ZENER	05AZ15Z
	6615022831	DIODE, ZENER	RD15ESAB3-T1
D812	6611032340	DIODE, RECTIFIER	UF5408
	6611032341	DIODE, RECTIFIER	2NU41-TPA1
D813	6611027744	DIODE, RECTIFIER	3GU41-TPA1
D814	6611015600	DIODE, RECTIFIER	BYW29-200A
	6611029040	DIODE, RECTIFIER	RUR-820
D901/D902	6613002245	DIODE, SWITCHING	RGP10D-G23
D903	6615011333	DIODE, ZENER	1N5252B
D904/D905/D906/D907	6615013831	DIODE, ZENER	HZ33-2-TD
D908	6615013831	DIODE, ZENER	HZ33-2-TD

*** INTEGRATED CIRCUIT ***

I801	6644063102	IC, LINEAR	UC3842AN
	6644063102	IC, LINEAR	SG3842M
	6644063103	IC, LINEAR	CS3842A
Q002/Q062/Q122	6644007400	IC, VIDEO AMP	M51399P

SYMBOL	PARTS NO.	DESCRIPTION	
Q049	6646000701	IC, INVERTER	SN7406N
Q051/Q515	6646007016	IC, DIGITAL	SN74LS123N
Q053	6644070300	IC, LINEAR	LM1881
Q202	6640005202	VOLTAGE REGULATOR	LM317T
Q203/Q302/Q315/Q320	6644008103	IC, OP AMP	LM358P
Q204/Q606	6644042400	IC, CMPARATORS	LM393N
	6644042404	IC, CMPARATORS	TA75393P
Q301	6644045203	IC, VERT AMP	TDA1675A
Q350/Q351/Q352	6644025600	IC, CMPARATORS	UPC339C
Q400	6644042900	IC, OP AMP	HA17324
	6644026100	IC, OP AMP	TA75902P
Q401/Q423	6645011500	IC, MOS SW.	UPD4066BC
	6645011100	IC, MOS SW.	TC4066BP
Q402/Q422/Q564/Q613	6644008103	IC, OP AMP	LM358P
	6644008102	IC, OP AMP	UPC358C
Q403	6644060200	IC, HOR OSC	LA7851
Q506	6644069800	IC, RESET	PST518A
Q512	6647015602	IC, LSI CPU	TMP47C432AN
Q513	6647003500	IC, MEMORY	MSM16911
Q562	6646049900	IC, EXOR	SN74LS136N
Q620	6644008103	IC, OP AMP	LM358P
	6644008102	IC, OP AMP	UPC358C
Q632	6646021000	IC, DIGITAL	74LS122N
Q707	6644007100	IC, OP AMP	NE5532N
	6644008103	IC, OP AMP	LM358P
	6644008102	IC, OP AMP	UPC358C

*** TRANSISTORS ***

Q001/Q061/Q121	6621005035	TR, NPN HF	2SC388ATM
Q003/Q063/Q123	6621003600	TR, NPN HF	2SC3599E
Q004/Q064/Q124	6623004501	TR, PNP HF	2SA949-Y
Q005/Q065/Q125/Q501	6621014530	TR, NPN HF	2SC1906
Q006/Q066/Q126	6621035500	TR, NPN HF	2SC3613
Q008/Q048/Q068/Q128	6623002050	TR, PNP HF	2SA1015Y
Q009/Q069/Q129	6621014635	TR, NPN HF	2SC2229Y

SYMBOL	PARTS NO.	DESCRIPTION	
Q047/Q052/Q056/Q505	6621015332	TR, NPN HF	2SC1815Y
Q205/Q313/Q324/Q407	6621011102	TR, NPN HF	2SC945QA
Q206/Q611/Q612	6626004000	TR, FET MOS	2SK758
Q207/Q305	6622018001	TR, PNP HF	2SD882P
Q303/Q323/Q404/Q409	6623003431	TR, PNP HF	2SA733Q-T
Q304	6624001300	TR, PNP HF	2SB772
Q321/Q630	6621035930	TR, NPN HF	2SC3811Q
Q322	6621019330	TR, NPN HF	2SC1685-R
Q408/Q412/Q414/Q417	6621011102	TR, NPN HF	2SC945QA
Q410	6624007400	TR, PNP LF	2SB861WC
Q411	6621002800	TR, NPN HF	2SC4288A
Q413/Q616	6625003200	TR, FET MOS	2SK430
Q418/Q514/Q551/Q552	6621011102	TR, NPN HF	2SC945QA
Q420/Q421	6625004600	TR, FET MOS	2SK1035
Q502/Q503/Q504/Q516	6621014530	TR, NPN HF	2SC1906
Q507/Q508/Q509/Q557	6621015332	TR, NPN HF	2SC1815Y
Q511	6622018000	TR, PNP HF	2SD882Q
Q553/Q556	6621014530	TR, NPN HF	2SC1906
Q554/Q555/Q602/Q605	6621011102	TR, NPN HF	2SC945QA
Q558/Q559/Q563	6621015332	TR, NPN HF	2SC1815Y
Q601/Q603/Q604/Q608	6623003431	TR, PNP HF	2SA733Q-T

*** TRANSISTORS ***

Q607/Q609/Q614	6621011102	TR, NPN HF	2SC945QA
Q610/Q615	6623003431	TR, PNP HF	2SA733Q-T
Q618	6621005400	TR, NPN HF	2SC3884A
Q704	6621032700	TR, NPN HF	2SC1941L
Q705/Q706/Q708	6621036600	TR, NPN HF	2SC3675
Q803	6626002200	TR, FET MOS	2SK794
	6626000900	TR, FET MOS	2SK727
Q901	6621013800	TR, NPN HF	2SC1921
X501	6699000904	CRYSTAL	4MHZ

SYMBOL	PARTS NO.	DESCRIPTION	
V901	5051228200	17" CCRT (HITACHI) M41KKL80X12	DOUBLE FOCUS
V901	5051229700	17" CCRT (HITACHI) M41KVZ80X12	DOUBLE FOCUS
V901	5051228210	17" CCRT (NEC) M41KMG23XX03	DOUBLE FOCUS
V901	5051228211	17" CCRT (TOSHIBA) M41KMK26XX12	SINGLE FOCUS
V901	5051226600	17" CCRT (TOSHIBA) M41KJF26XX12	SINGLE FOCUS
V901	5051227700	20" CCRT (HITACHI) M48KAY80X01	DOUBLE FOCUS

*** SWITCH/CONNECTORS/FUSE ***

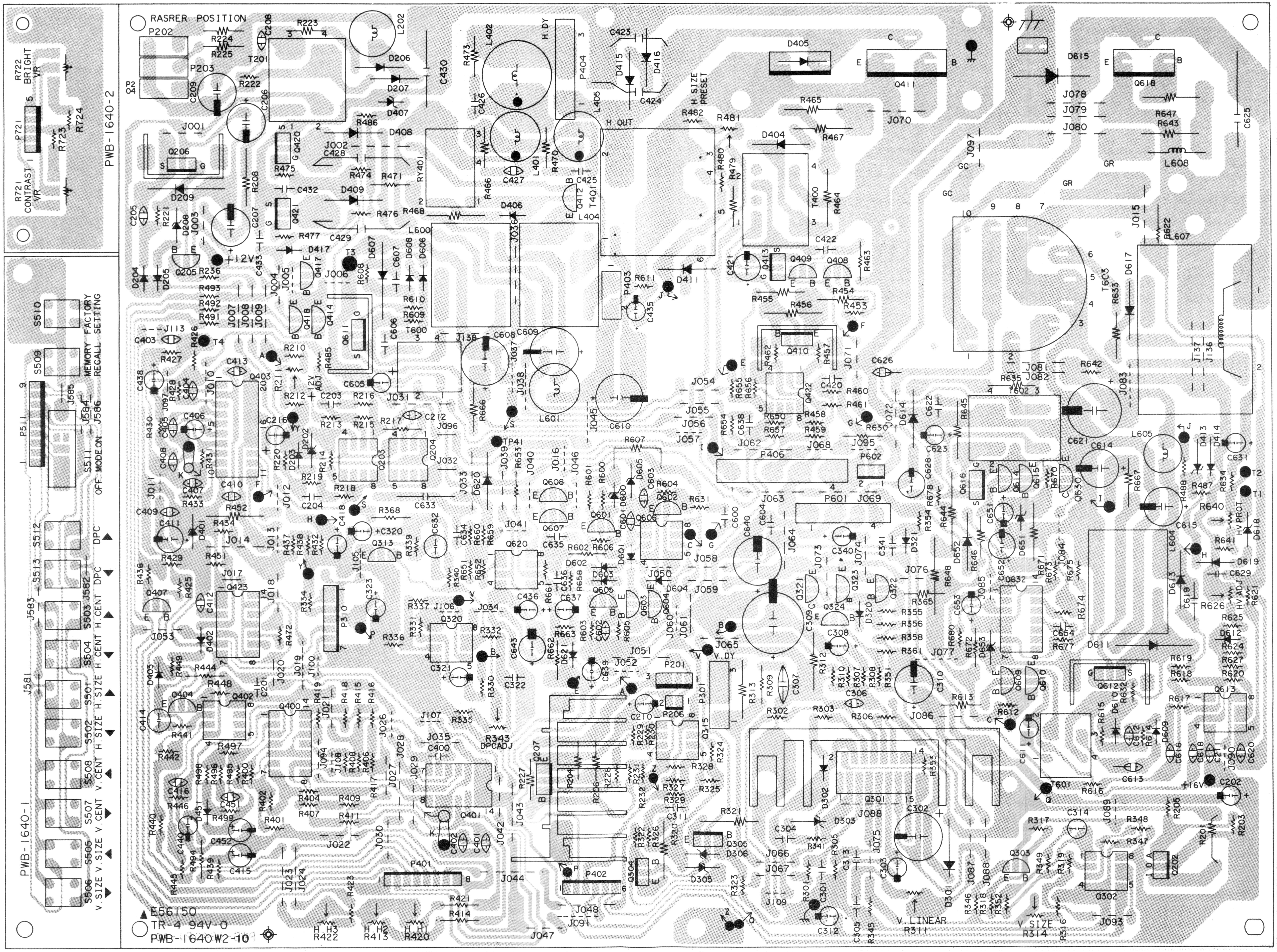
F801	5054425031	FUSE	250V/2.5A
P001/P004/P005/P061	5056309806	CONNECTOR (BNC)	17-104IA
P121	5056309806	CONNECTOR (BNC)	17-104IA
P006	5056309108	CONNECTOR (MACII)	(7+8) P FEMALE
P007	5056309109	CONNECTOR (VGA)	(3X5) P FEMALE
P601	5057404325	SIGNAL CABLE	D/D SUB 180MM
RY401	5054600103	RELAY, DC24V/1A	AC250V/10A
S001/S002	5054519922	SWITCH, SLIDE DPDT	DC30V/0.1A
S501/S502/S503/S504	5054512951	SWITCH, TACT SPST	DC12V/50MA
S505/S506/S507/S508	5054512951	SWITCH, TACT SPST	DC12V/50MA
S509/S510/S512/S513	5054512951	SWITCH, TACT SPST	DC12V/50MA
S511	5054519909	SWITCH, SLIDE DPDT	DC30V/0.1A
S801	5054524434	SWITCH, PUSH DPST	AC250V 5A/80A
S802	5054524414	SWITCH, SLIDE DPDT	AC125/250V 5A
S803	5054524455	SWITCH, PUSH PULL	AC250V 4A/32A
V901A (NEC)	5056306719	SOCKET, CRT	HPS0380-01-100
V901A (HITACHI)	5056306709	SOCKET, CRT	HPS0380-01-110
V901A (TOSHIBA)	5056306722	SOCKET, CRT	CVT3210-1801-T

*** COILS & TRANFORMERS ***

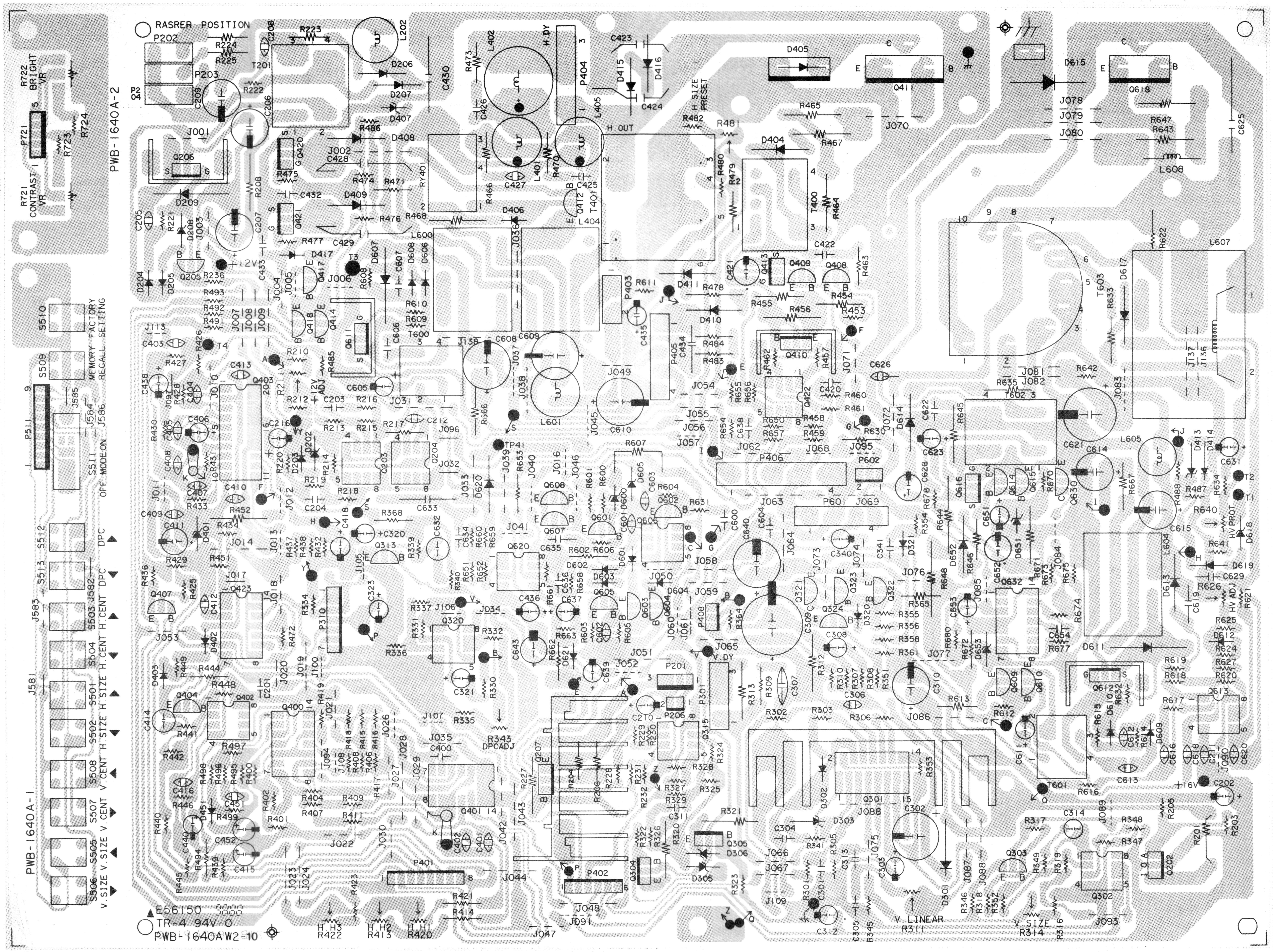
L001/L061/L121	5062121200	COIL, RF CHOKE	CHK-212
L002/L062/L122	5062121300	COIL, RF CHOKE	CHK-213
L202	5062121800	COIL, CHOKE	CHK-218
L402	5062225100	COIL, H LINEARITY	TLH-251
L402	5062222400	COIL, H LINEARITY	TLH-224

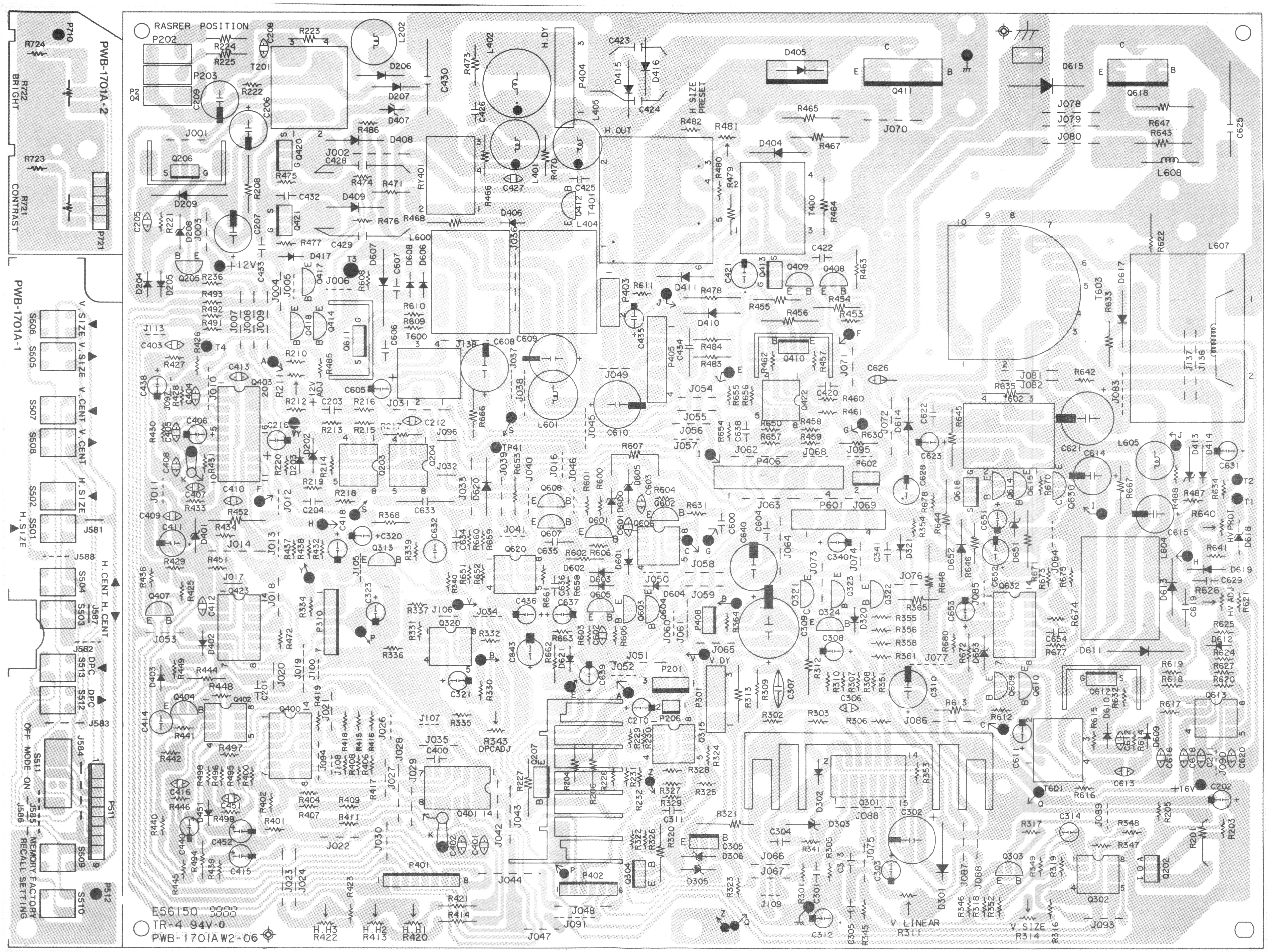
SYMBOL	PARTS NO.	DESCRIPTION	
L404/L600/L604	5062121700	COIL, CHOKE	CHK-217
L405	5062220700	COIL, H LINEARITY	TLH-207
L601/L605	5062117600	COIL, CHOKE	CHK-176
L607	5062222900	COIL, H CHOKE	TCH-229
L608	5064422925	COIL, PEAKING	TRF-8229J
L803	5062202300	COIL, CHOKE	TLN-2026
L804	5062119000	COIL, CHOKE	CHK-190
L805	5062123000	COIL, CHOKE	CHK-230
L811	5061107401	FILTER EMI	TNF-001
L901/L902	5062102500	COIL, RF CHOKE	TRF-1019
L901	5060118700	COIL, DEGAUSSING	TSB-187
T201	5061348800	TRANS, SWITCHING	TPW-488
T400/T602	5062415100	TRANS, H DRIVE	TLN-151
T401	5062415500	TRANS, H DEFL.	TLN-155
T600/T601	5061348700	TRANS, SWITCHING	TPW-487
T603	5062623813	TRANS, FLYBACK	TFB-238M
T801	5061348300	TRANS, POWER	TPW-483

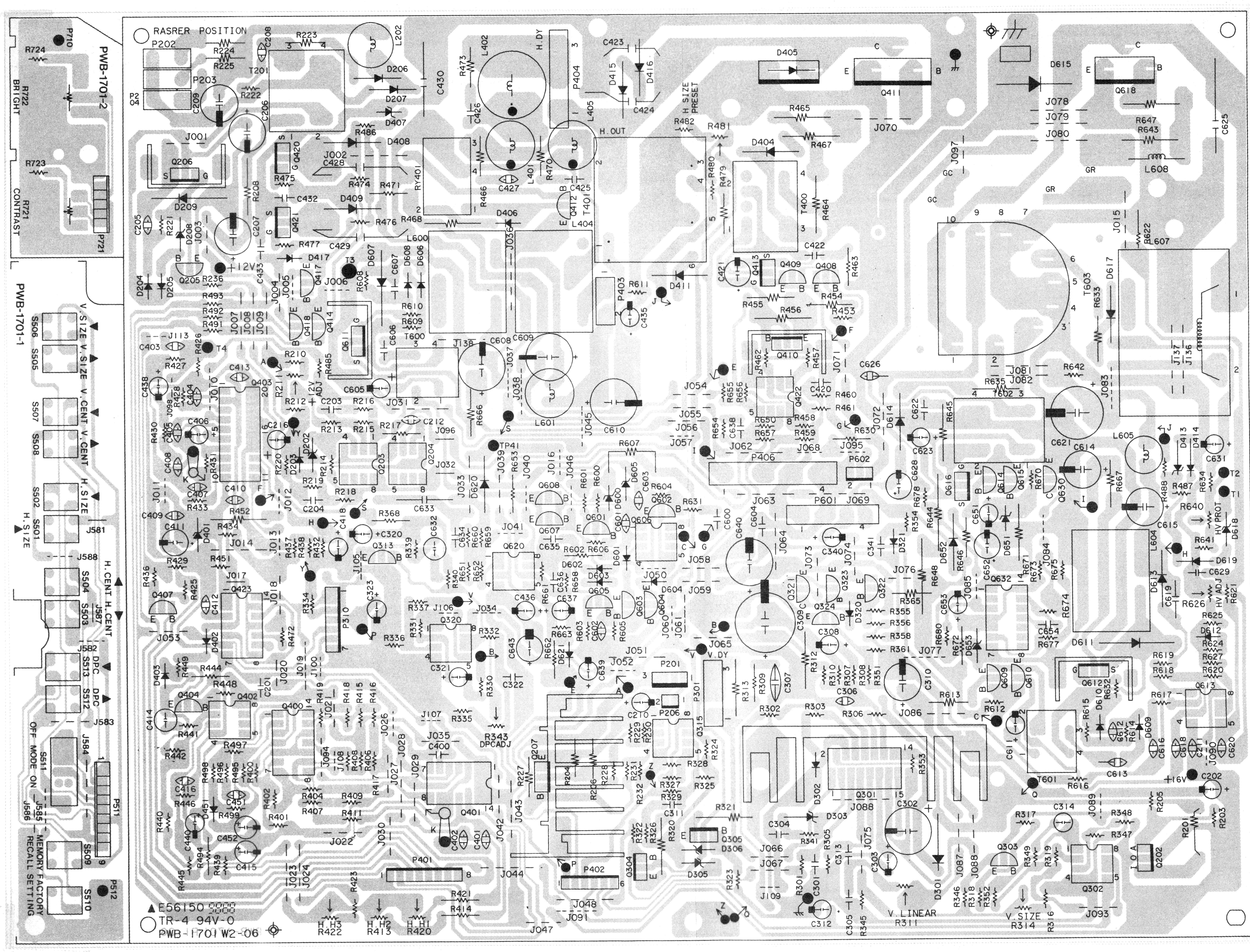
8. PCB LAYOUT



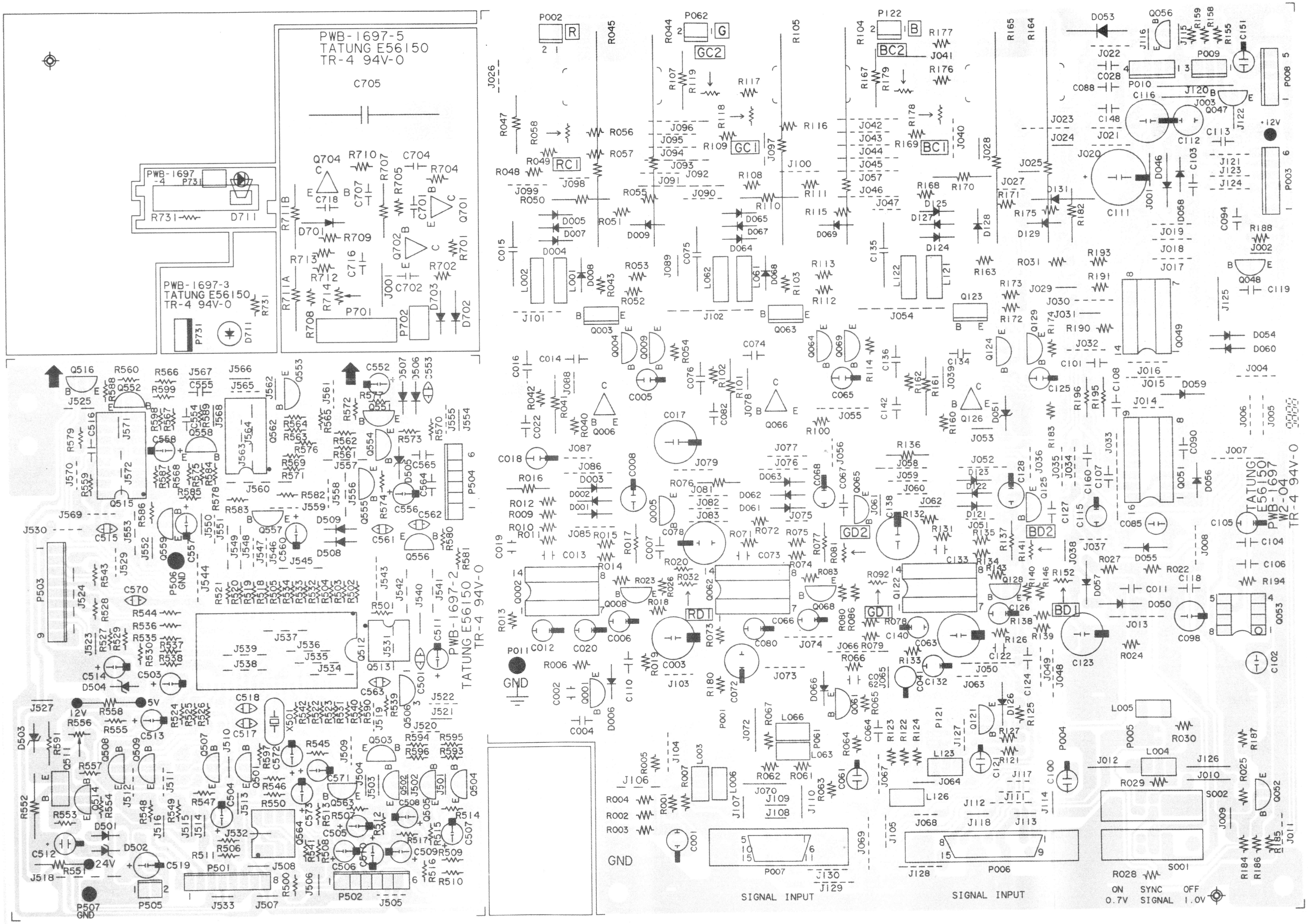
RASRER POSITION
R722 BRIGHT VR
R721 CONTRAST VR
PWB-1640-2
H.DY
H.OUT
H SIZE PRESET
MEMORY FACTORY RECALL SETTING
OFF MODE ON
DPC
H.CENT
H.SIZE
V.CENT
V.SIZE
PWB-1640-1
+12V
12V ADJ
DPCADJ
V.DY
HV PROT
HV ADJ
+16V
V.LINEAR
V.SIZE
H.H3
H.H2
H.H1
E56150
TR-4 94V-0
PWB-1640W2-10

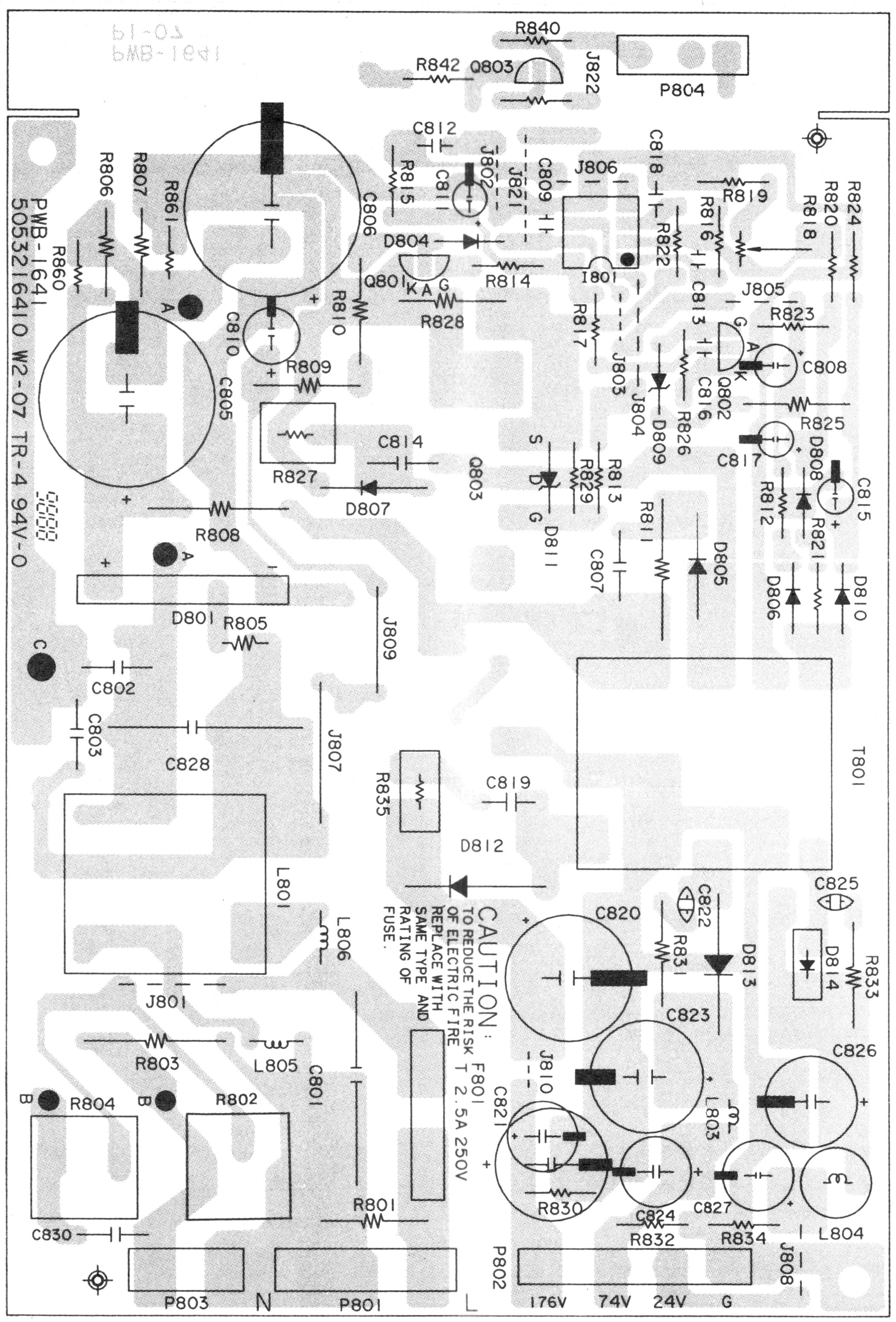
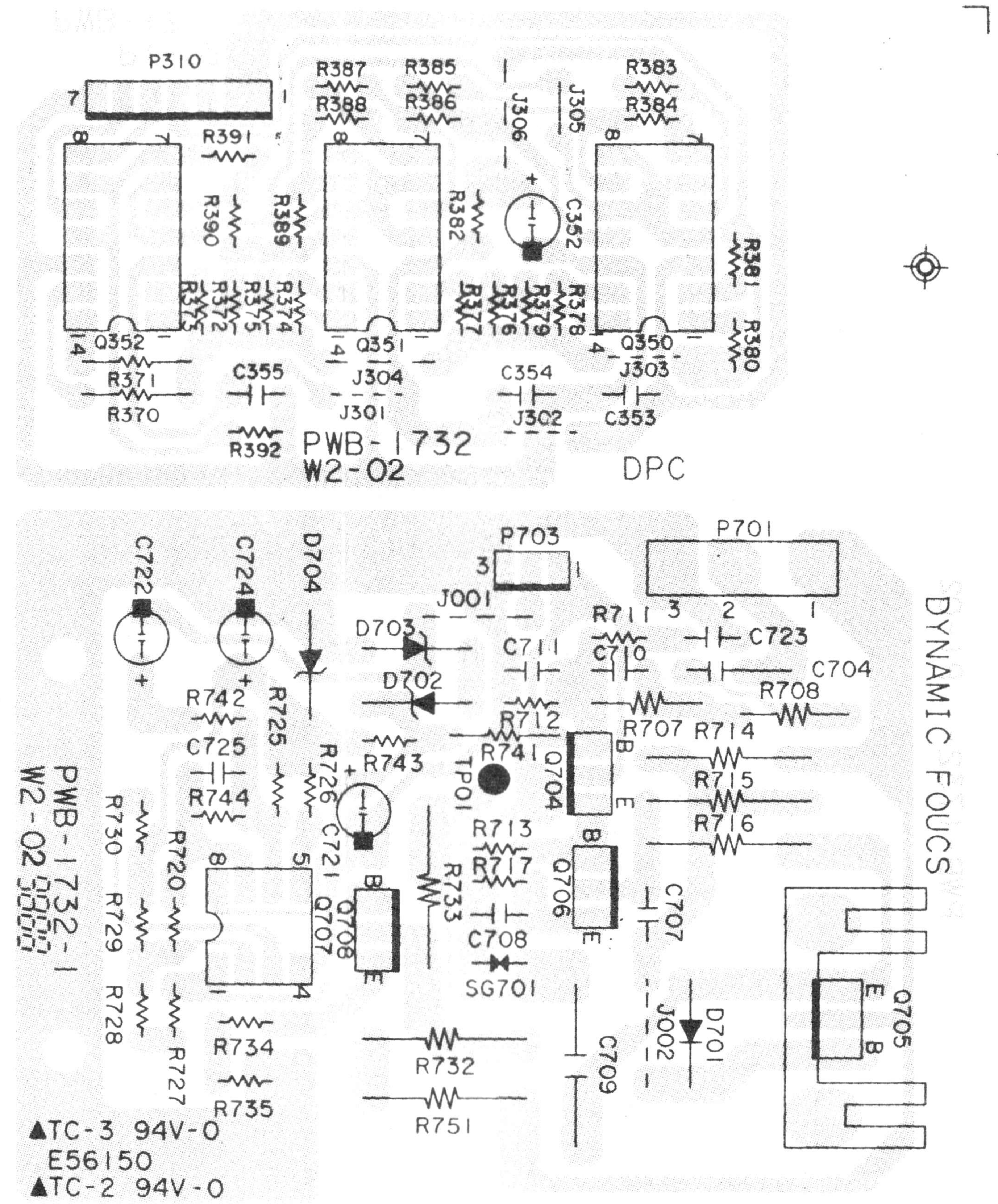
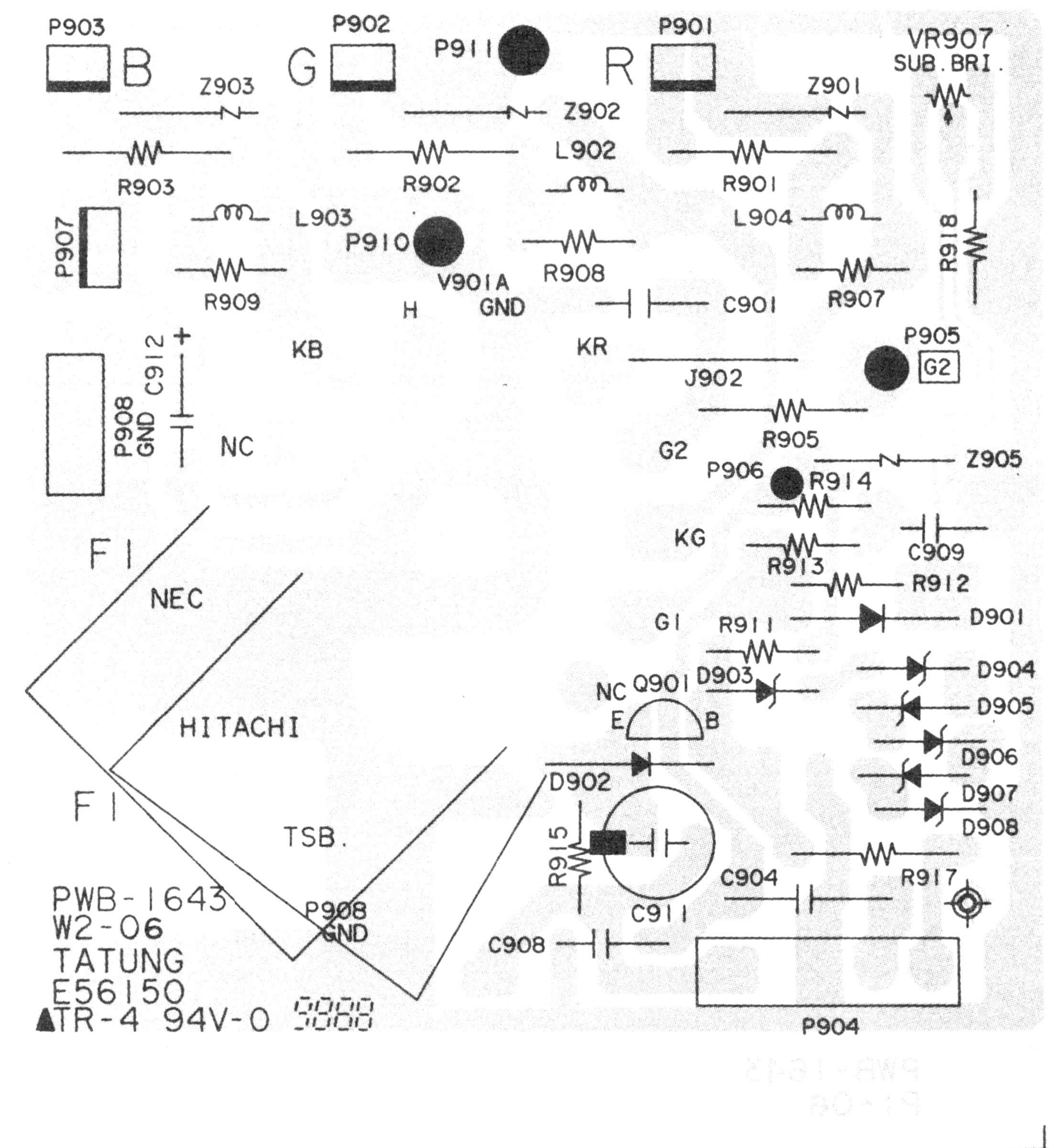






PWB-1701-2
PWB-1701-1
RASRER POSITION
H SIZE PRESET
V. LINEAR
V. SIZE
DPCADJ
▲E56150
TR-4 94V-0
PWB-1701W2-06


PWB-1697-5
TATUNG E56150
TR-4 94V-0
PWB-1697-4
PWB-1697-3
TATUNG E56150
TR-4 94V-0
PWB-1697-2
TATUNG E56150
TR-4 94V-0
TATUNG E56150
PWB-1697
W2-04
TR-4 94V-0
GND
SIGNAL INPUT
SIGNAL INPUT
ON 0.7V
SYNC SIGNAL
OFF 1.0V
+12V
5V
12V
24V


PWB-1641
5053216410 W2-07 TR-4 94V-0
CAUTION:
TO REDUCE THE RISK OF ELECTRIC FIRE REPLACE WITH SAME TYPE AND RATING OF FUSE.
F801
T 2.5A 250V
T801
L801
P804
P803
P801
P802
N
L
176V
74V
24V
G

PWB-1732
W2-02
DPC
DYNAMIC FOUCS
PWB-1732-1
W2-02
▲TC-3 94V-0
E56150
▲TC-2 94V-0

P903
B
P902
G
P911
R
P901
VR907
SUB.BRI.
NEC
HITACHI
TSB.
PWB-1643
W2-06
TATUNG
E56150
▲TR-4 94V-0

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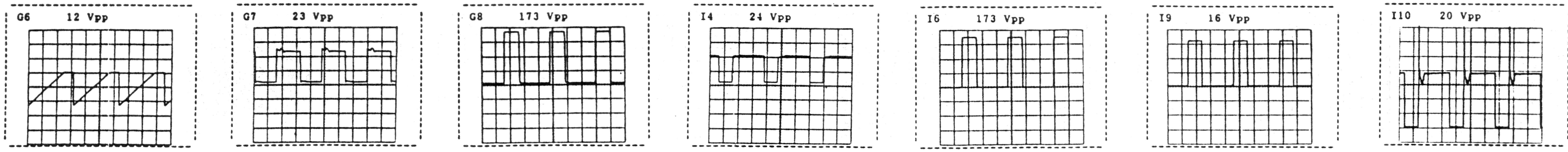
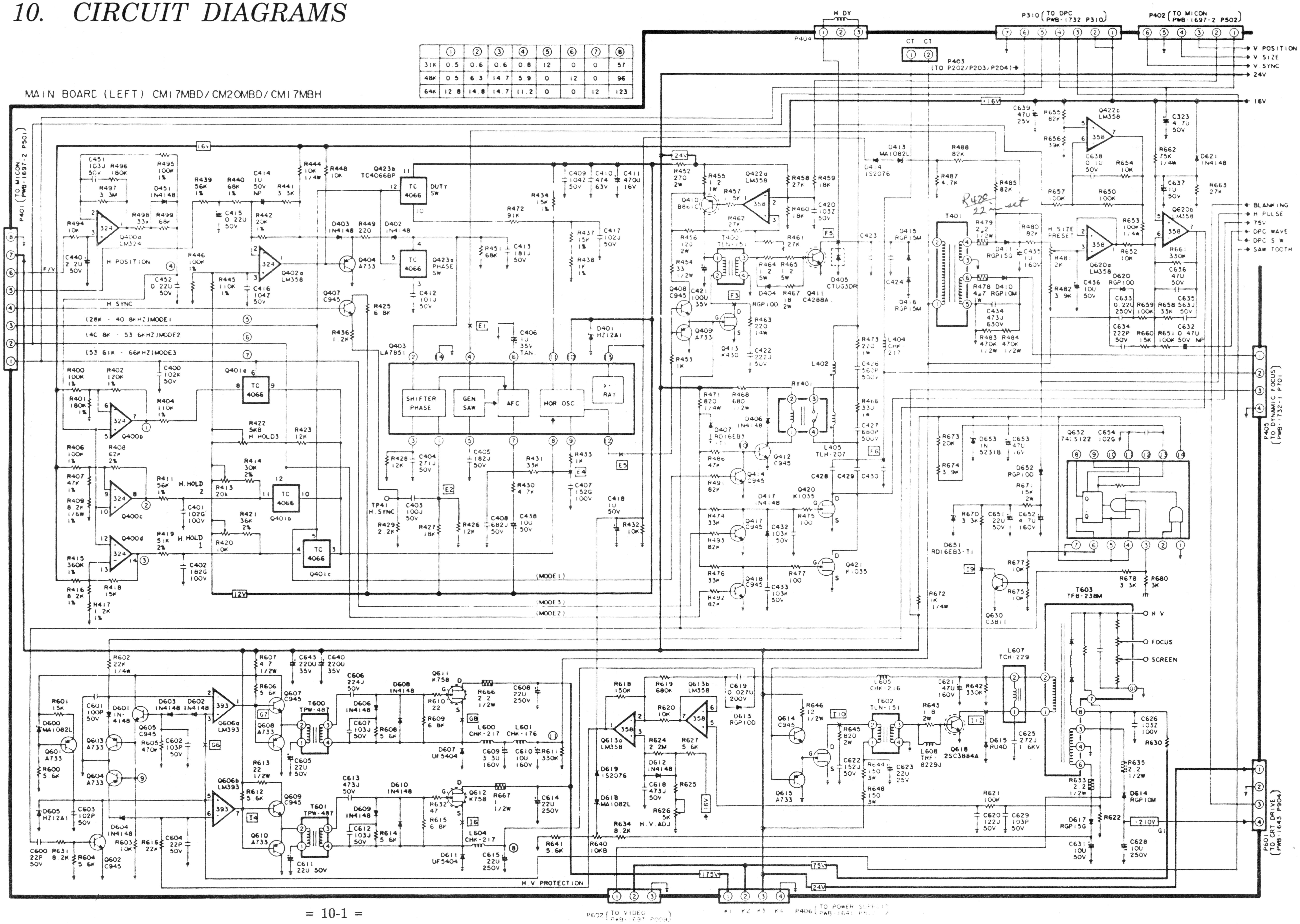
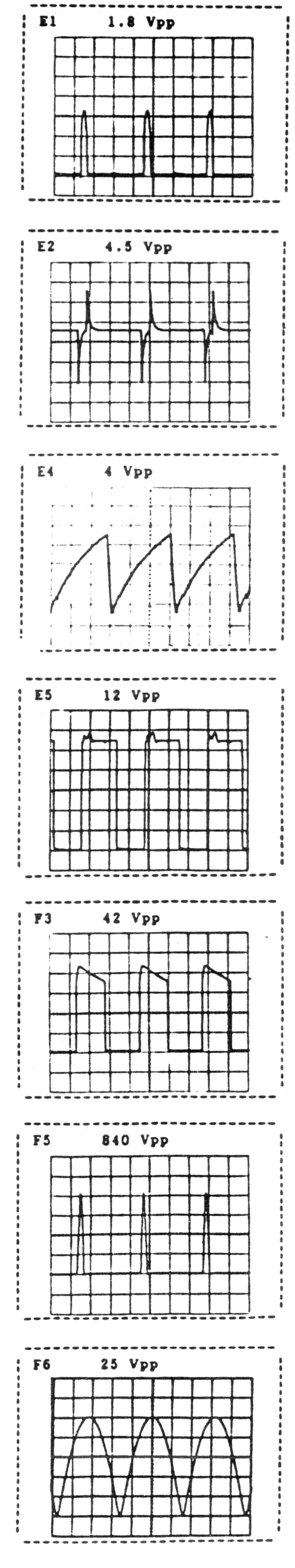
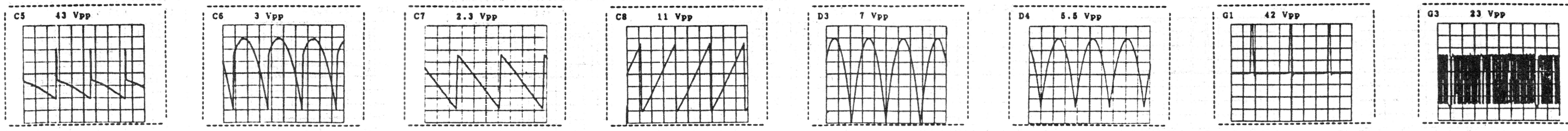


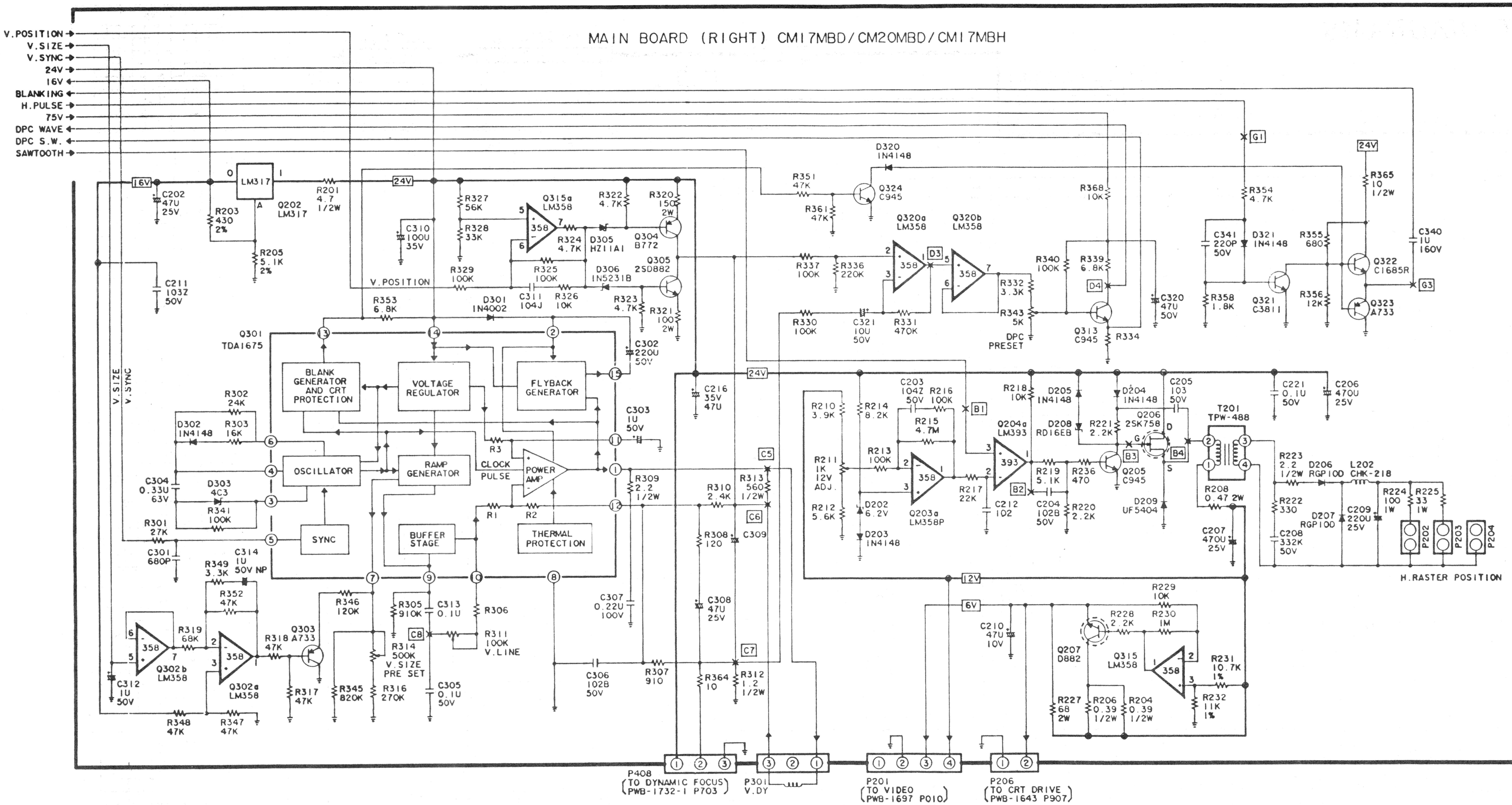
10. CIRCUIT DIAGRAMS

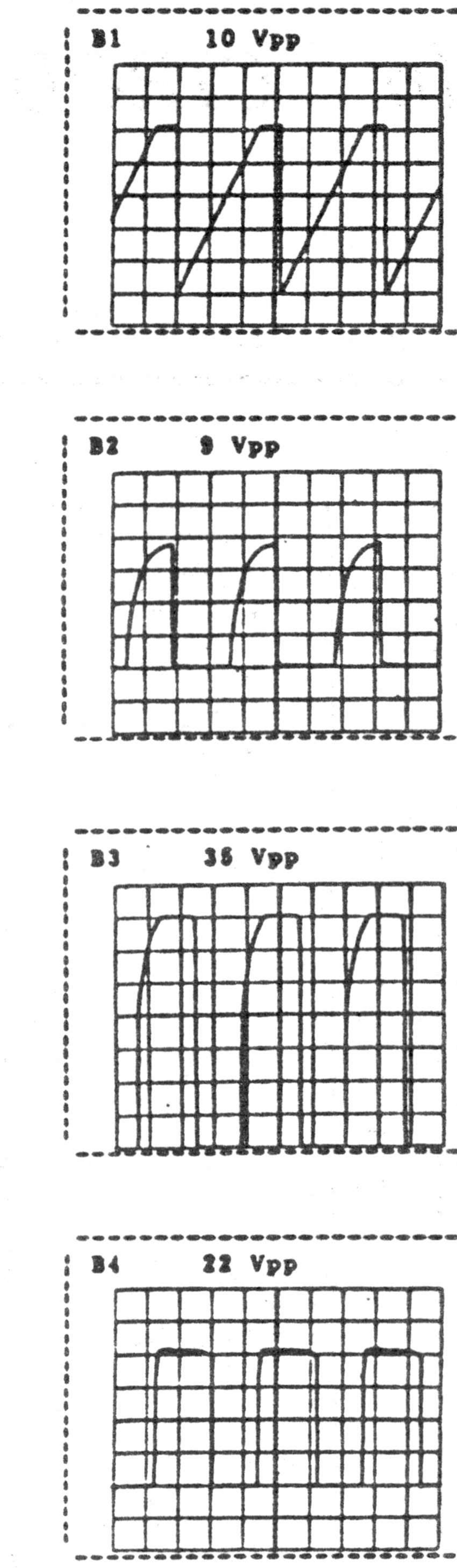
	①	②	③	④	⑤	⑥	⑦	⑧
31K	0.5	0.6	0.6	0.8	12	0	0	57
48K	0.5	6.3	14.7	5.9	0	12	0	96
64K	12.8	14.8	14.7	11.2	0	0	12	123

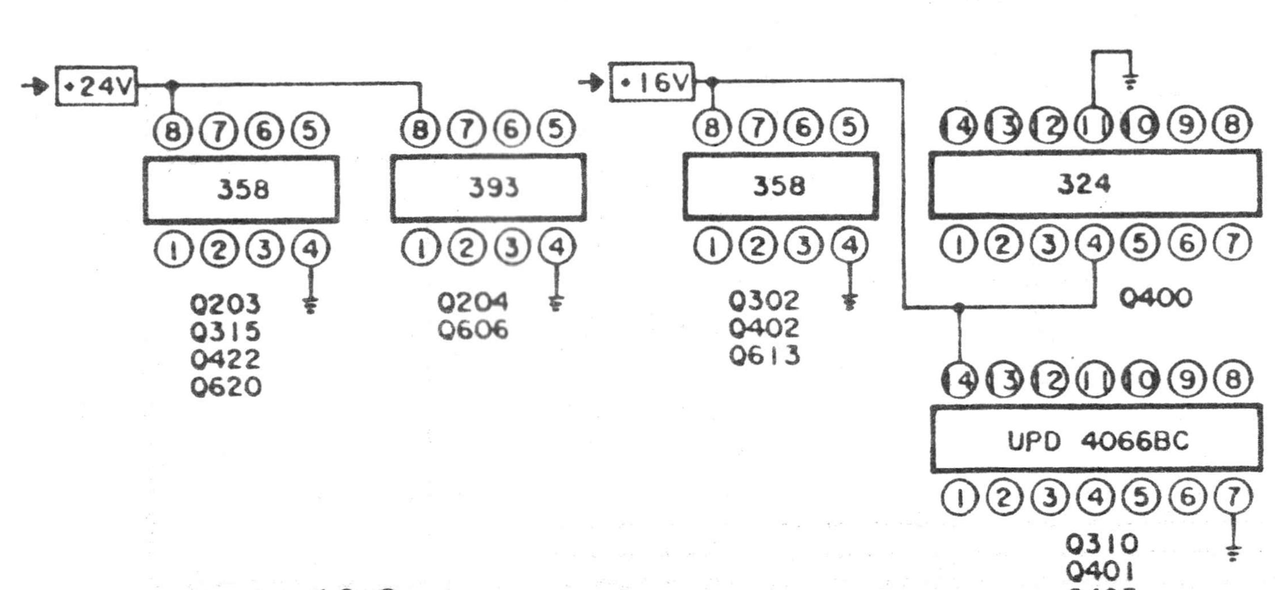










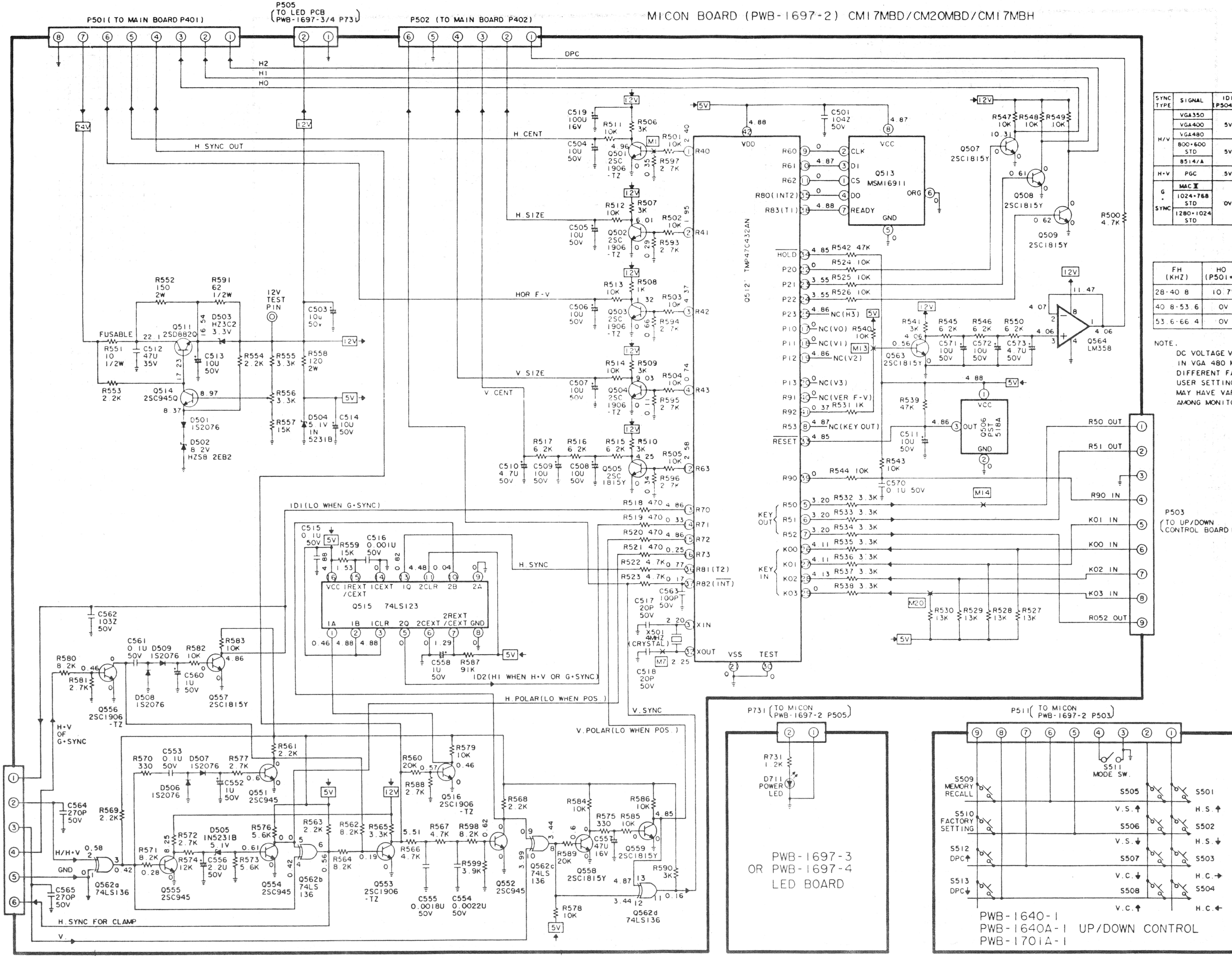


CRT	C423 C424	L402	C430	C428	C429	R630	R622	C309	R306	R334	PCB	T401	T603	R625	R337	HOR. WIDTH PRESET	B+	G1
TSB 17" M41KJF26XX12 M41KMK26XX12	PPN 2700P 1600V	TLH-224	PPN 0.33U 400V	0.22U 250V	0.68U 250V	160K	300K	1000U	33K	8.2K	1640	155A	230A/B	6.8K	150K	122V	24.5V	-90V
NEC 17" M41KMG23XX03	PPN 2700P 1600V	TLH-251	PPN 0.33U 400V	0.22U 250V	0.68U 250V	120K	165K	1000U	33K	8.2K	1640A	155	238M/T	5.6K	100K	124V	24V	-90V
HIT 17" M41KKL80X12	PPN 3300P 1600V	TLH-224	PPN 0.47U 400V	0.33U 250V	0.82U 250V	120K	165K	2200U	100K	5.1K	1640A	155	238M/T	5.6K	100K	95V	24V	-60V
HIT 17" M41KVZ80X12	PPN 3300P 1600V	TLH-224	PPN 0.47U 400V	0.33U 250V	0.82U 250V	120K	165K	2200U	100K	5.1K	1640A	155	238M/T	5.6K	100K	95V	24V	-60V
HIT 20" M48KAY80X01	PPN 2700P 1600V	TLH-224	PPN 0.39U 400V	0.33U 250V	0.82U 250V	110K	165K	2200U	100K	8.2K	1701A	155	238M/T	6.8K	100K	114V	24V	-70V

NOTE. R478/R483/R484/D410/C434/P405/P408 WILL BE CANCELLED IF TOSHIBA 17" CRT IS USED


VIDEO BOARD
(PWB-1697)
CM17MBD
CM20MBD
CM17MBH
BRIGHTNESS
CONTROL BOARD
PWB-1640-2
PWB-1640A-2
PWB-1701A-2
V1 0.8 Vpp
V2 0.8 Vpp
V3 4 Vpp
V4 4.2 Vpp
V5 2.8 Vpp
V6 2.3 Vpp
V8 43 Vpp

MICON BOARD (PWB-1697-2) CM17MBD/CM20MBD/CM17MBH

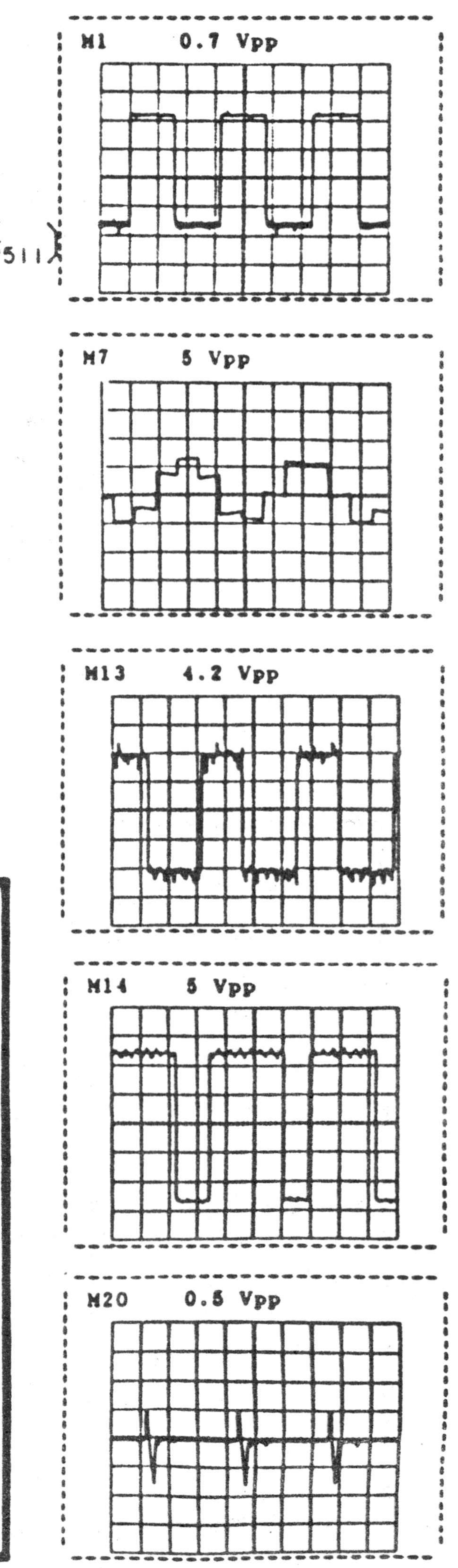


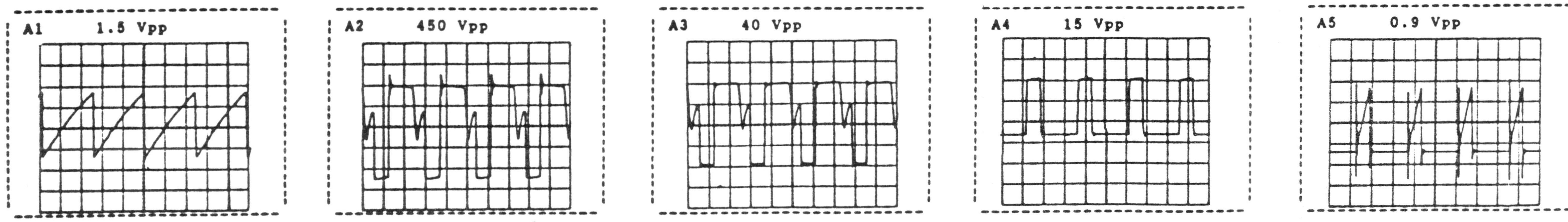
SYNC TYPE	SIGNAL	ID1 (P504•1)	ID2 (Q515•5)	H POLAR (Q562•5)	V POLAR (Q562•13)
H/V	VGA350	5V	0V	0V	5V
	VGA400			5V	0V
	VGA480			5V	5V
	800•600 STD	5V	0V	———	———
	8514/A				
H•V	PGC	5V	5V	———	———
G•SYNC	MAC II	0V	5V	———	———
	1024•768 STD				
	1280•1024 STD				

FH (KHZ)	H0 (P501•3)	H1 (P501•2)	H2 (P501•1)
28-40.8	10.7V	0V	0V
40.8-53.6	0V	10.7V	0V
53.6-66.4	0V	0V	10.7V

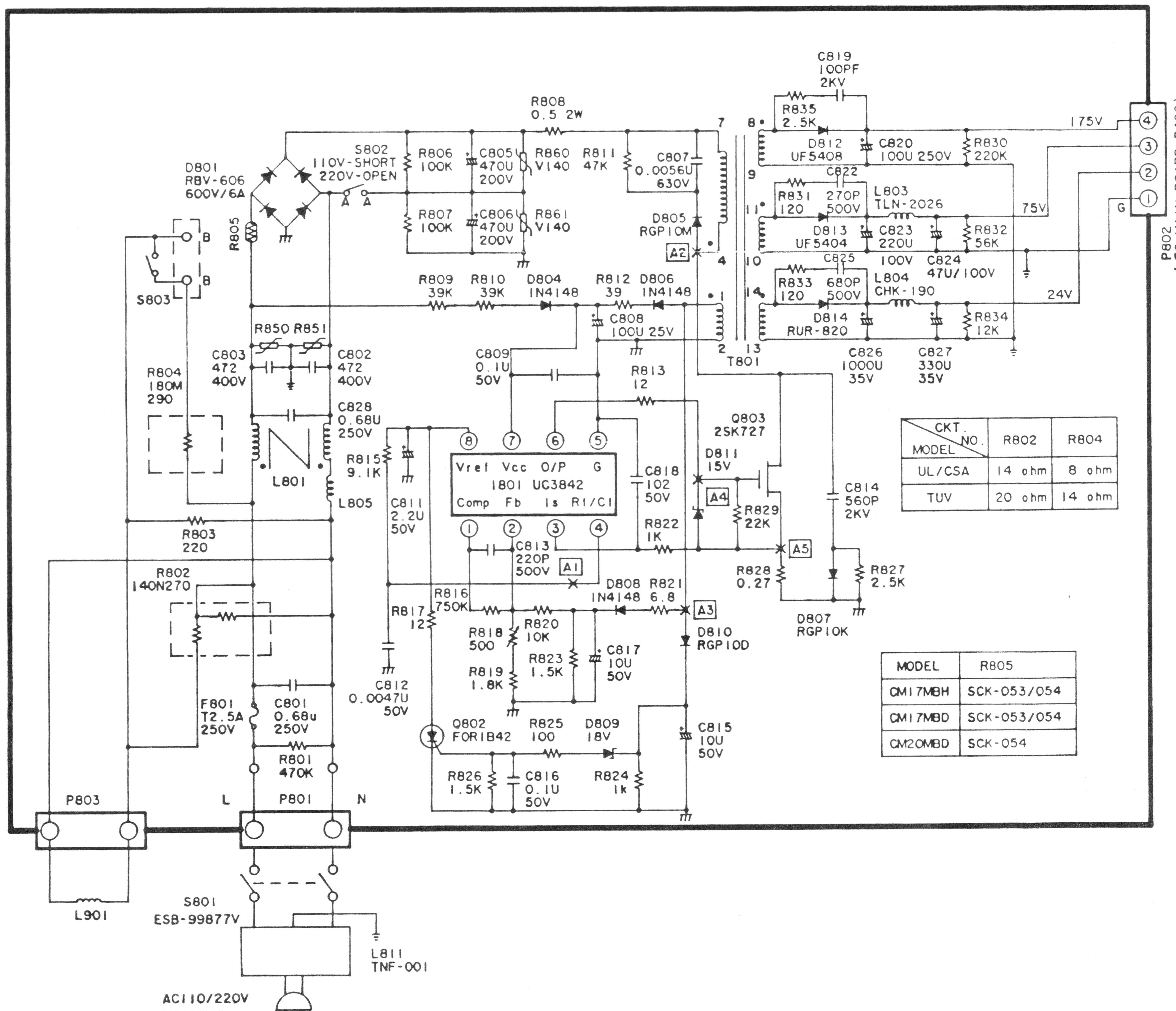
NOTE.

DC VOLTAGE VALUES ARE MEASURED IN VGA 480 MODE. DUE TO DIFFERENT FACTORY SETTING AND USER SETTING, SOME OF THESE VALUES MAY HAVE VARIATIONS AMONG MONITOR SETS





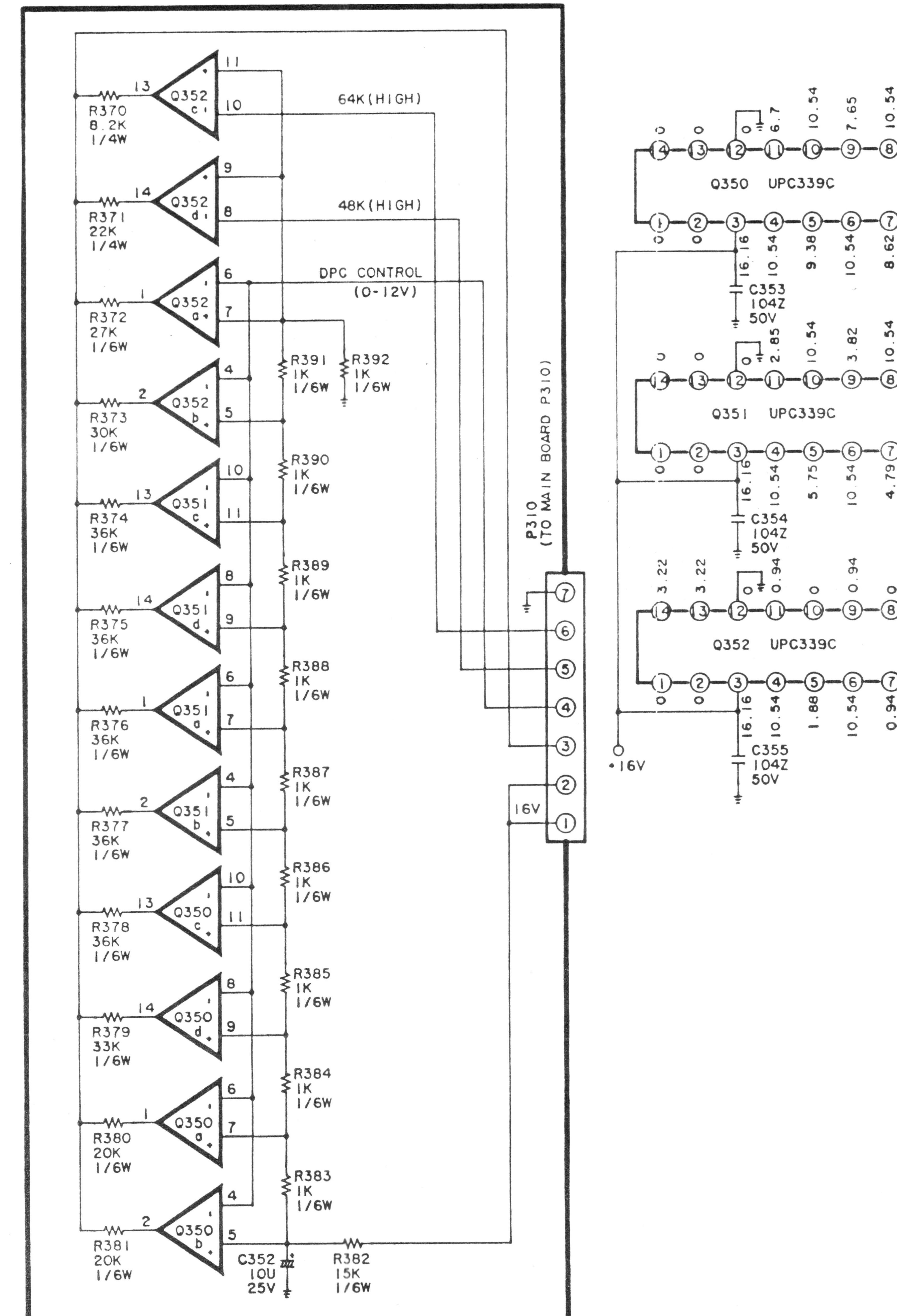
POWER SUPPLY BOARD (PWB-1641) CM17MBD/CM20MBD/CM17MBH



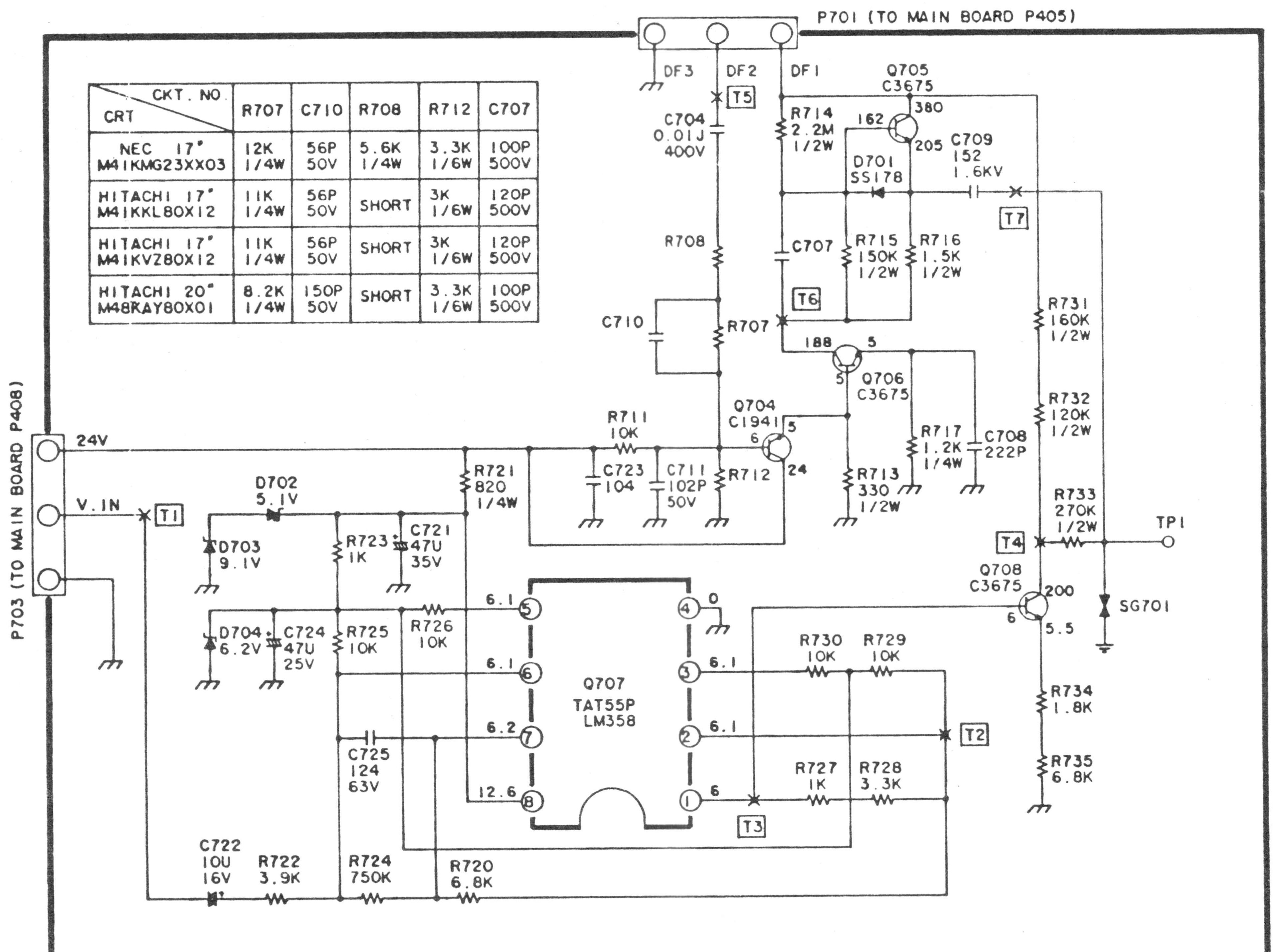
CKT. NO. / MODEL	R802	R804
UL/CSA	14 ohm	8 ohm
TUV	20 ohm	14 ohm

MODEL	R805
CM17MBH	SCK-053/054
CM17MBD	SCK-053/054
CM20MBD	SCK-054

DPC BOARD (PWB-1732) CM17MBD/CM20MBD/CM17MBH

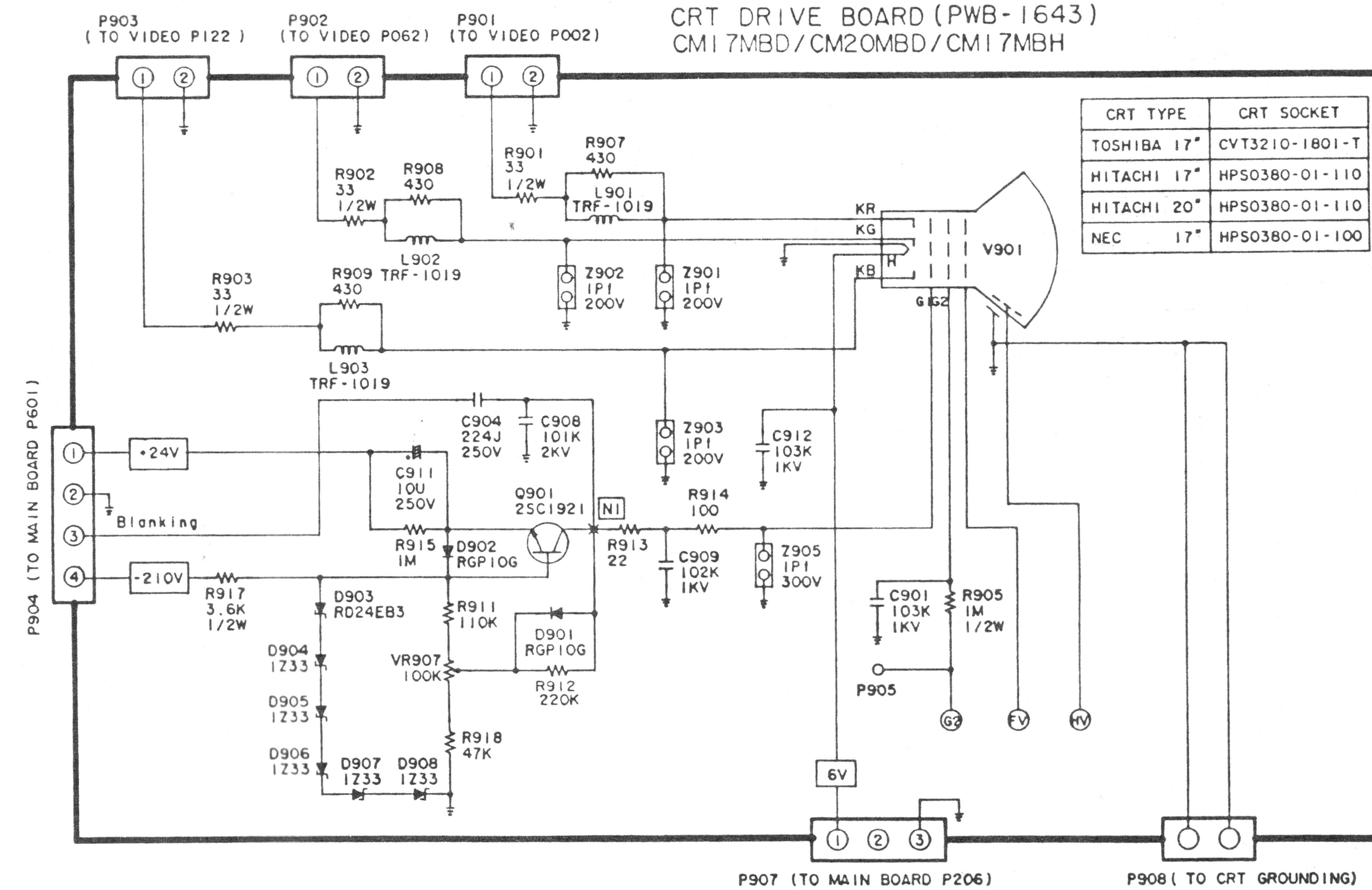


DYNAMIC FOCUS (PWB-1732-1) CM17MBD/CM20MBD



CKT. NO / CRT	R707	C710	R708	R712	C707
NEC 17" M41KMG23XX03	12K 1/4W	56P 50V	5.6K 1/4W	3.3K 1/6W	100P 500V
HITACHI 17" M41KKL80X12	11K 1/4W	56P 50V	SHORT	3K 1/6W	120P 500V
HITACHI 17" M41KVZ80X12	11K 1/4W	56P 50V	SHORT	3K 1/6W	120P 500V
HITACHI 20" M48RAY80X01	8.2K 1/4W	150P 50V	SHORT	3.3K 1/6W	100P 500V

CRT DRIVE BOARD (PWB-1643)
CM17MBD/CM20MBD/CM17MBH



CRT TYPE	CRT SOCKET
TOSHIBA 17"	CVT3210-1801-T
HITACHI 17"	HPS0380-01-110
HITACHI 20"	HPS0380-01-110
NEC 17"	HPS0380-01-100

S/N: 5035110639