HITACHI

MODEL VM-900
VIDEO MONITOR

SERVICE MANUAL

Hitachi Denshi, Ltd.
TOKYO, JAPAN

CONTENTS

NOTICE

This Service Manual describes the most typical product of this model. If there are any specific differences between this Manual and the servicing unit, please contact Hitachi Denshi sales office in your area.

PRODUCT SAFETY NOTICE

(1) X-RAY RADIATION

The primary source of X-ray radiation in this monitor is the picture tube. The tube used in this monitor is especially constructed to limit X-ray radiation emission. For continued X-ray radiation protection, the replacement tube must be the same type as the original, Hitachi approved one.

(2) PRODUCT SAFETY NOTE

Many electrical and mechanical parts in this monitor have special safety related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, etc.

Electrical components having such features are identified by marking with a ⚠ on the schematic diagram and parts list in this manual. The use of a substitute replacement component which does not have the same safety characteristics as the Hitachi recommended replacement one, shown in the parts list in this manual, may create shock, fire, X-ray-radiation or other hazards.

MODEL VM-900
VIDEO MONITOR
Service Manual

1. GENERAL

The Hitachi VM-900 is a solid state 9-inch video monitor designed to display the video signal from Hitachi CCTV cameras or other signal sources. With most sophisticated considerations on circuitry, outstanding performance and reliability are achieved.

2. SPECIFICATIONS

Video input	Composite video signal	
	1.0 Vp-p, sync negative	
Scan standard	U,C: 525/60 fields/sec	
	E,K: 625/50 fields/sec	
Input impedance	75 Ω or high	
Resolution	Horizontal	500 lines
	Vertical	300 lines
Deflection linearity	Within 2%	
High voltage	10 kV	
CRT	9-inch, 90° deflection	
	9VASP4 or equivalent	
Ambient temperature	-10 to +50°C (14 to 122°F)	
Power supply	U: 120 V AC, 60 Hz	
	C: 120 V AC, 60 Hz	
	E: 220 V AC, 50 Hz	
	K: 240 V AC, 50 Hz	
Power consumption	28 W	
External dimensions	244 (W) x 233 (H) x 235 (D)mm	
Weight	Approx. 6.1 kg	

* Design specifications and performance are subject to change without notice due to product improvement.

3. CIRCUIT DESCRIPTION

3. 1 General

The circuit of VM-900 includes blocks as shown in Fig. 3-1.

POWER REGULATOR ① supplies regulated 12 V B+ voltage for the whole unit. VIDEO AMP. ② amplifies input video signal to the amplitude needed to drive the CRT cathode. SYNC SEP ③ separates sync pulse from composite video signal to synchronize the generation of vertical/horizontal sawtooth current. AFC ④ comverts frequency error to DC control voltage for the frequency control of horizontal oscillation. VERTICAL DEF. ⑤/HORIZONTAL DEF. ⑥ generates sawtooth current flowing through yoke to perform vertical/horizontal deflection of CRT electron beam. Also, by the use of FBT, HORIZONTAL DEF. ⑥ generates 10.0 kV high voltage to supply CRT anode voltage and 135 V voltage to supply video biasing voltage.

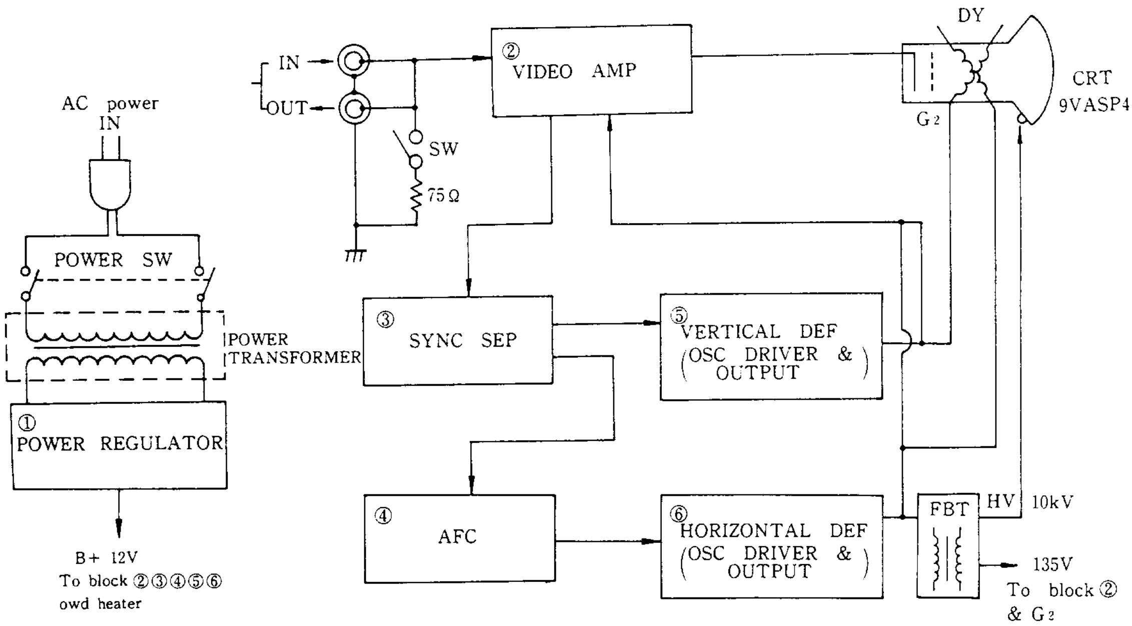


Fig. 3-1 Simplified Block Diagram

Detailed operation of each block will be explained in the following paragraphs. Please refer to schematic diagram when necessary.

3. 2 Power regulator

Power regulator is used to stabilize B+ voltage (+12 V DC) against AC line variation $\triangle Vi$, load current variation $\triangle I_L$ and temperature variation $\triangle T$.

Refer to Fig. 3-2, suppose there is a variation $+\triangle Vi$ of unregulated DC voltage, B+ may suffer a change $+\triangle Vo$. The base voltage Vb1 of Q601 follows $+\triangle Vo$ and rises up. This will tend to reverse-bias the emitter junction of Q601 and decrease the collector current Ic1 of Q601 (or base current Ib2 of Q602). Accordingly the collector current IC2 of Q602 decreases and Vce2 tends to increase. Hence the input variation $+\triangle Vi$ is mostly absorbed by $+\triangle Vce2$ to oppose the increase $+\triangle Vo$ of B+ voltage.

Stabilization against load current and temperature is achieved by the low output resistance and TH601 respectively. (See Fig. 3-2).

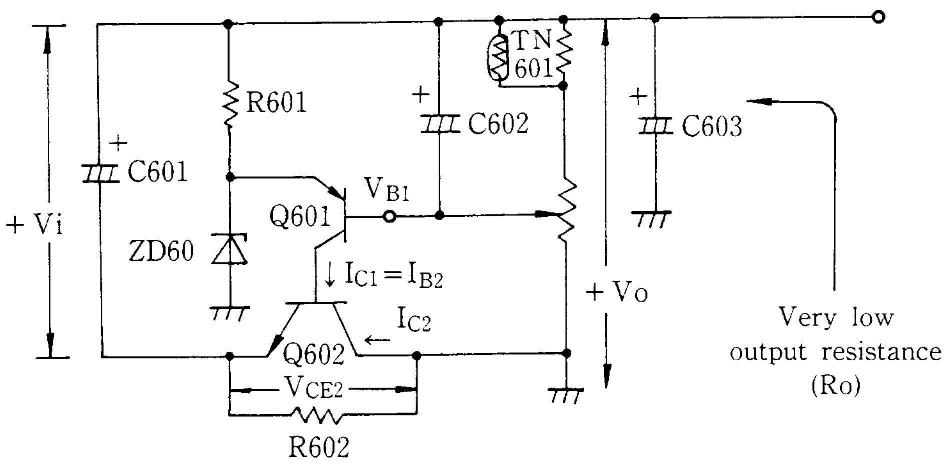


Fig. 3-2 Regulator Circuit

R607 and D601 are used to perform protection in case that B+ voltage is suddenly shorted to ground. Refer to Fig. 3-3, at the moment of short circuit, the charge in C602 tends to flow through BE junction of Q601. Large current impulse (Ie1 and Ib2) flows through Q601 and Q602 until C602 is fully discharged. To protect Q601 and Q602 against possible damage due to such current impulse, D601 and R607 are employed to bypass the discharging of C602 and shorten the impulse period.

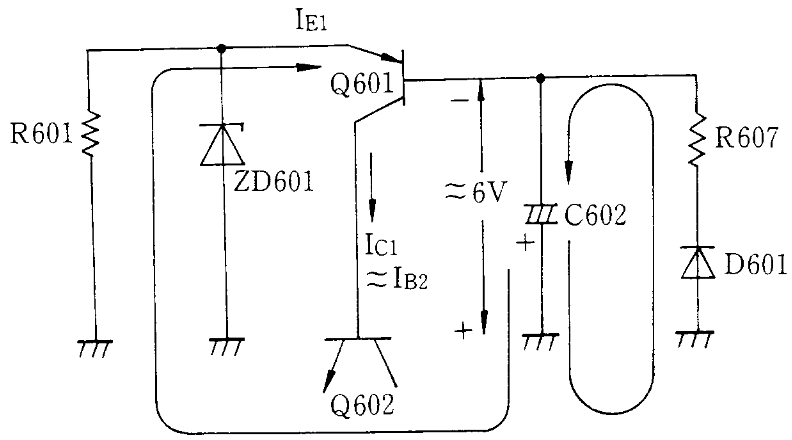


Fig. 3-3 Protection Action for Power Regulator

3. 3 Video amplifier

Video amplifier consists of 3 stages. The 1st stage (Q101) is an emitter follower which transmits input signal with voltage gain ≈1 and applies video signal to sync separation circuit and the following stages with very low output resistance. Also, its high input resistance (≈6 k ohm) permits loop-through operation. Hence the emitter follower serves as a buffer stage.

The combination of the 2nd and 3rd stages (Q103 and Q102) forms a cascode amplifier. (Refer to Fig. 3-4). A cascode amplifier is the series combination of common-emitter and common-base amplifiers. It features both wideband amplification and high gain. L101 and L102 serve as parallel and series peaking coils respectively.

Refer to Fig. 3-5, the response profile becomes flat up to 6 MHz due to the compensation of L101 and L102. C106 is used for gain compensation at high frequency.

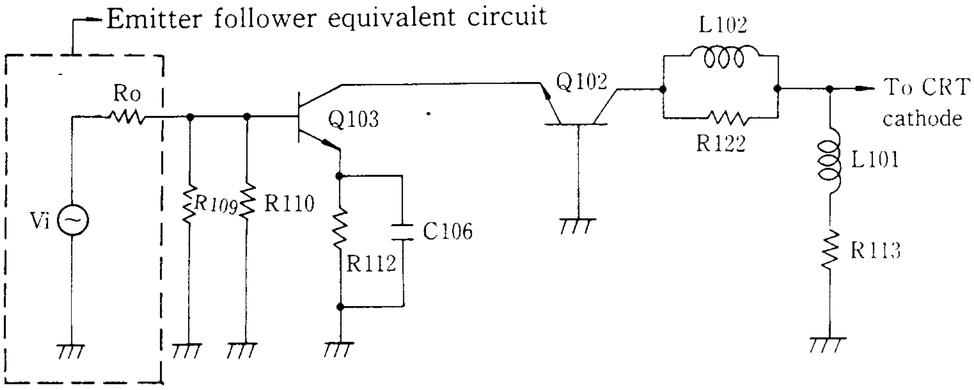


Fig. 3-4   Small Signal Equivalent Circuit for Cascode Amplifier

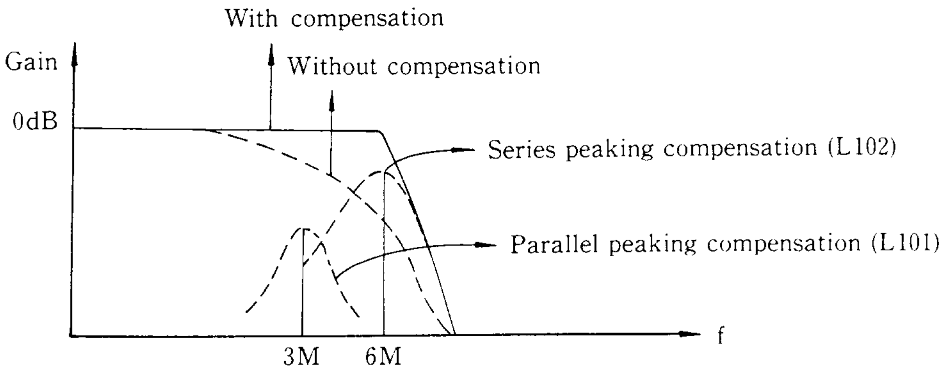


Fig. 3-5   Video Response Profile

Spot killer circuit (refer to Fig. 3-6) is used to cut off beam to prevent the spot burning at power off.
When power is switched on, C109 is charged up to nearly 135 V and SR101 goes to its cutin point. (about 0.4 V across anode and cathode). Hence G1 voltage is about 0.4 V. When power is switched off, C418 is discharged through R423 immediately. Since R118 (10 M ohm) slows down discharging rate of C109, -135 V appears at the anode of SR101 and cuts off SR101. Thus negative bias of G1 and cathode rejects electron beam current immediately after power is off until C109 is fully discharged.
SR102 is conducting at power on so as to improve the regulation of middle

voltage (135 V) with C418 and C111 in parallel. When power is switched off SR102 is cut off to improve the spot-killing action by separating C418 and C111 to lower down voltage at positive side of C109 quickly.

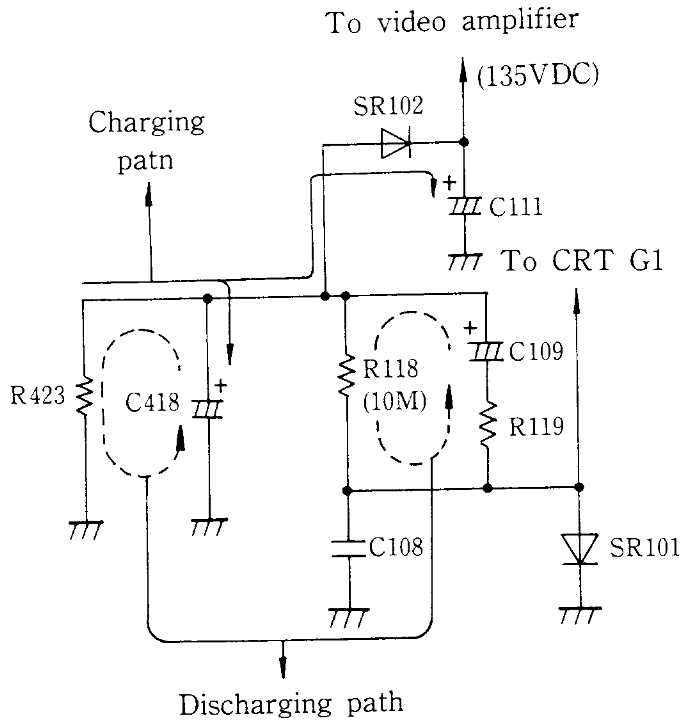


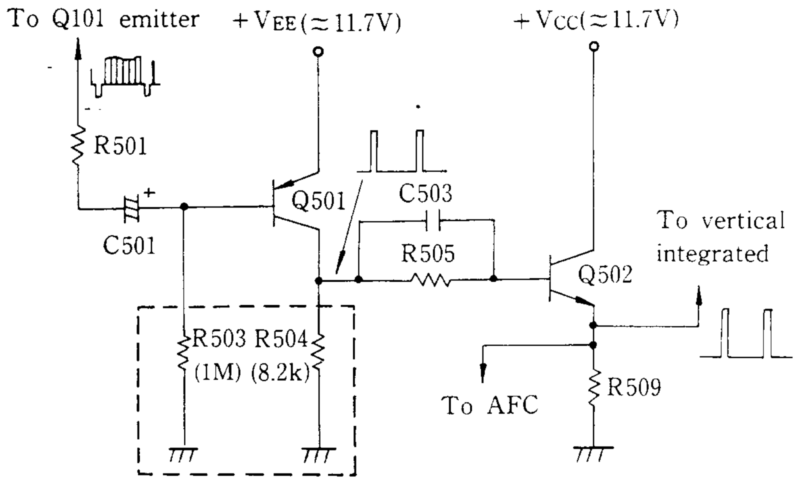
Fig. 3-6 Spot Killer Circuit

3. 4 Sync separation

By the proper design of biasing condition, Q501 separates sync pulse from composite video signal with high sensitivity. (Refer to Fig. 3-7). Owing to large base current Q501 enters into saturation region during retrace period. During scan period Q501 goes to cutoff region. Such saturation-cutoff alternate transition generates stable pulse at the collector of Q501 in synchronization with input video signal.

The second stage (Q502) is an emitter follower. Because of low output resistance of emitter follower sufficient sync pulse with little distortion is available for AFC circuit to perform better AFC operation.

Parallel combination of R505 and C503 is used for waveshaping.



Such biasing condition gives high sensitvity of sync separation.

Fig. 3-7 Sync Separation Circuit

3. 5 AFC circuit

Single-pulse type AFC circuit is used. (Refer to Fig. 3-8). Horizontal sync pulse (positive polarity) is differentiated and detected by the equivalent network as shown in Fig. 3-9. A positive pulse from horizontal output is integrated to a sawtooth waveform by the integrator as shown in Fig. 3-8. The resulting sawtooth waveform is called "comparison signal" to compare its frequency with sync pulse. The equivalent network for comparison signal transmission is shown in Fig. 3-10. By superposition principle the detected sync pulse and comparison signal are superimposed as V1 and V2 shown in Fig. 3-11(a), (b). The amplitude difference between V1 and V2 is due to phase difference between comparison signal and sync pulse as shown in Fig. 3-11(c) and (d). Such amplitude difference is converted to a DC voltage level variation at Q401 base through the integration operation of a integrator as shown in Fig. 3-8. Another integration path through R430, TH401, R404, R410 and C406 is employed for the stability of oscillation frequency against temperature variation. Automatic frequency control for the oscillation stage is achieved by the base voltage control of Q301. This is principle of AFC operation and will be explained in 7. HORIZONTAL DEFLECTION.

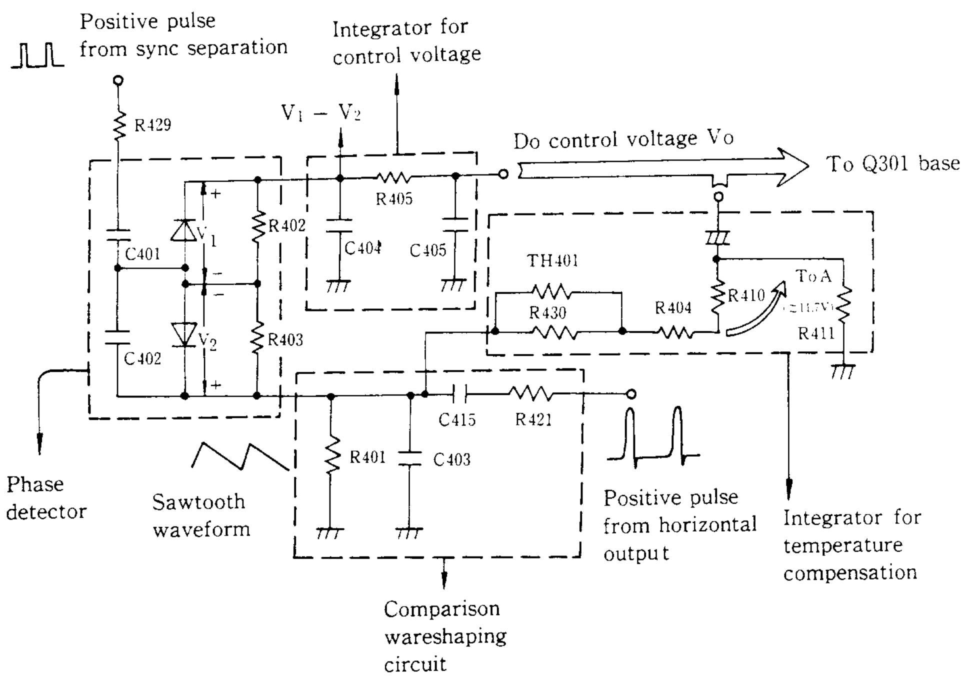


Fig. 3-8 AFC Circuit

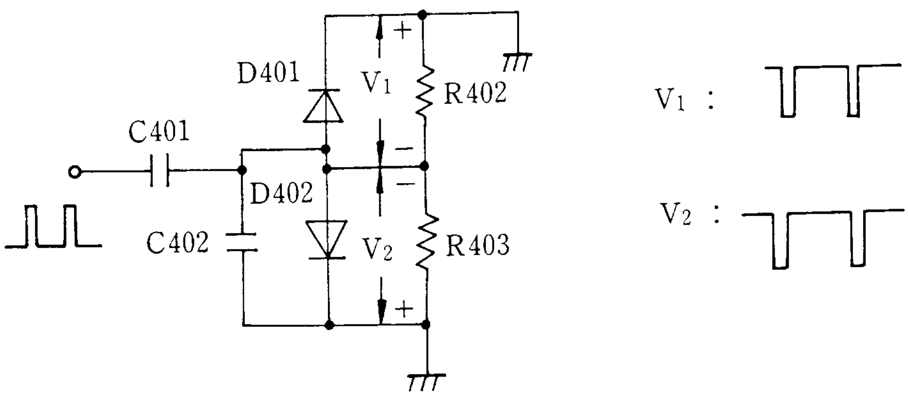
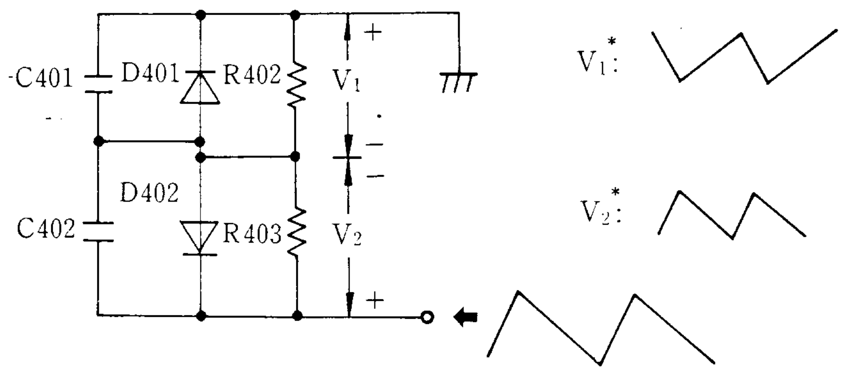


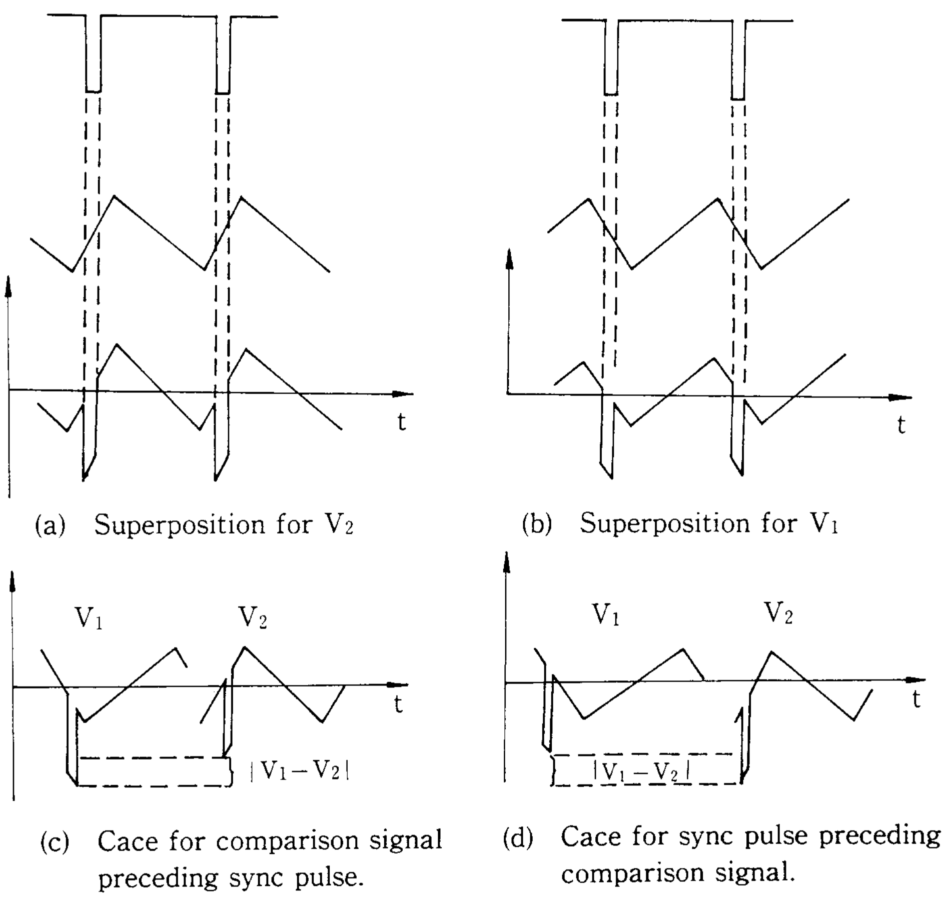
Fig. 3-9 Equivalent Network for Differentiation and Detection of Horizontal Sync Pulse



Comparison signal

* V1 and V2 have the same amplitude because of the symmetry of circuitry.

Fig. 3-10 Equivalent Network for Comparison Signal Transmission



(a) Superposition for V_2

(b) Superposition for V_1

(c) Cace for comparison signal preceding sync pulse.

(d) Cace for sync pulse preceding comparison signal.

Fig. 3-11 Superposition Principle for AFC Phase Detection

3. 6 Vertical deflection

Vertical sync pulse from sync separator is integrated by the integration circuit to synchronize vertical oscillation frequency. Nevertheless horizontal sync pulse is attenuated because of its narrow pulse width (5 μs) in comparison with vertical sync pulse. (190 μs) (Refer to Fig. 3-12).

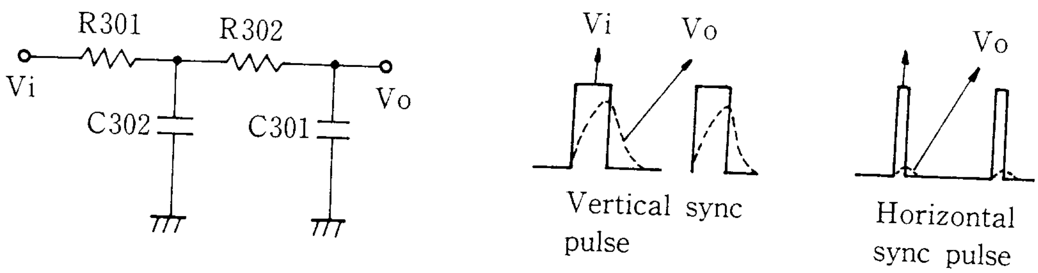


Fig. 3-12 Vertical Integrator

The vertical oscillation is achieved by the ON-OFF transition of Q301. (Refer to Fig. 3-13). When Q301 is off, C303 is charged with the base voltage (Vb) of Q301 rising up. C304 and C305 are also charged with the emitter voltage (Ve) of Q301 falling down. Hence the emitter junction of Q301 tends to be forward-biased. Q301 is switched on as soon as Vbe attains beyond cutin voltage. Then C303 is discharged through base and emitter of Q301 and R306 with the base voltage (Vb) falling down. C304 and C305 are also discharged through collector and emitter of Q301 with the emitter voltage (Ve) rising up. Hence the emitter junction of Q301 tends to be reverse-biased. As soon as Q301 is switched off, next cycle of vertical oscillation starts.

Positive feedback from output is necessary for stabilization of oscillation. Obviously, base voltage of Q301 is controlled by the positive feedback as well as charging/discharging of Q301. (Refer to Fig. 3-13). Then ON-OFF transition of Q301 is achieved through base voltage control.

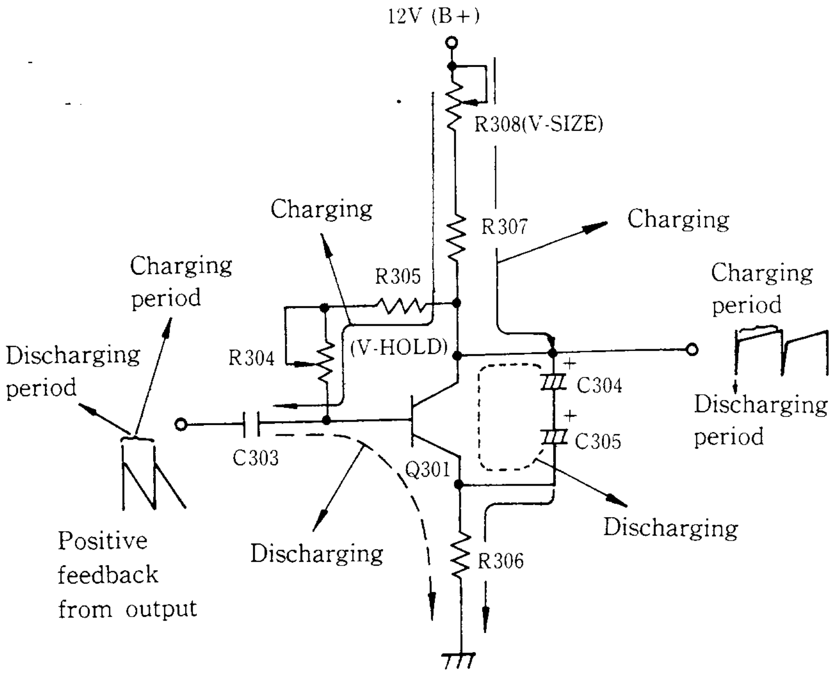


Fig. 3-13 Vertical Oscillator Stage

The driver stage (Q302) is a phase-inverter. It also performs amplification so that sufficient level is available to drive the last SEPP stage. The voltage feedback from Q302 emitter to the oscillation stage makes a modification of sawtooth waveform at Q301 collector through the operation of integration. (Refer to Fig. 3-14). It improves vertical linearity.

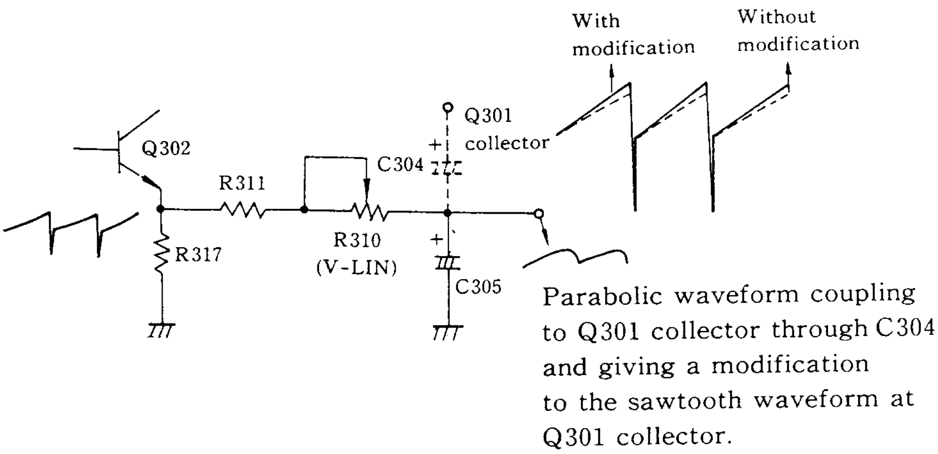


Fig. 3-14 Circuit Description of Vertical Waveshaping Modification

The SEPP stage (Q303 and Q304) leads to well-matching with yoke, low harmonic distortion and high efficiency by class-AB operation.
The current feedback from yoke to Q301 emitter improves the stability of gain.
C307 blocks DC component of signal. For AC component it acts as short-circuited. Then the output of SEPP couples to the input for the purpose of voltage cancellation. (Refer to Fig. 3-15). Also, because of bootstraping action the input resistance of SEPP becomes very large to match the driver stage.

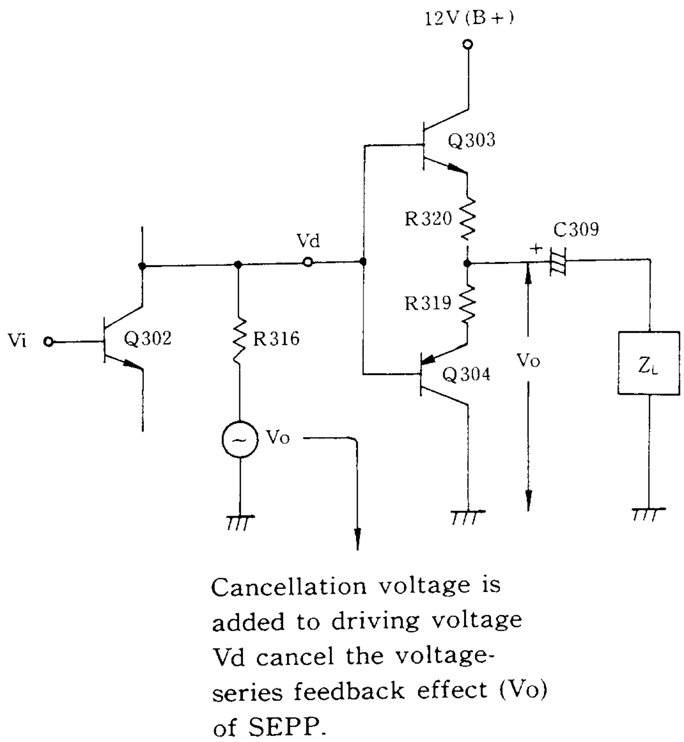


Fig. 3-15 Analytical Simplified Circuit for Vertical SEPP Stage.

DC negative feedback from middle point of SEPP to base of Q302 (refer to Fig. 3-16) supplies DC biasing voltage of Q302 and improves the stability of middle point voltage V_N of SEPP.
C308 across B, C terminals of Q302 is used to attenuate high frequency signal transmission to the output stage, especially horizontal sync component transmission.

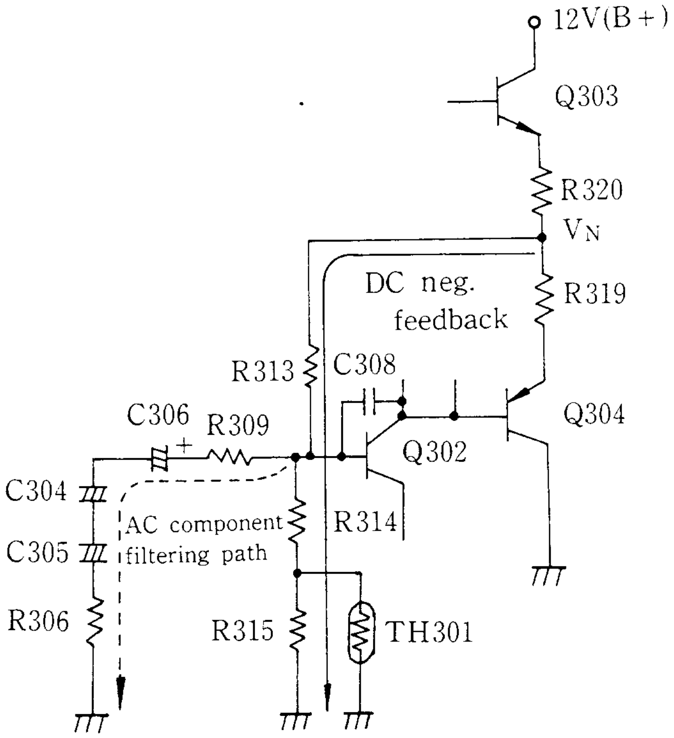


Fig. 3-16 DC Negative Feedback Circuit for Vertical Deflection

3. 7 Horizontal deflection

Hartley oscillator is used for horizontal oscillation.
(Refer to Fig. 3-17). With the saturation-cutoff transition of Q401 a periodic square wave is available at the collector. The saturation-cutoff transition is achieved by charging/discharging of C407 and L-C resonance between C408 and L401. Hence oscillation frequency is variable through the adjustment of L401 (H-SUB.HOLD) to alter the L-C resonance period. Also, it is controlled by the discharging period of C407. When Q401 is at saturation, C407 is charged by the base current flow of Q401. When Q401 is cut off, C407 starts to discharge through R412 toward NODE P as shown in Fig. 3-17. Thus the voltage at NODE P controls the discharging period of C407, i,e., the oscillation frequency. (Refer to Fig. 3-18). In case that comparison signal precedes sync pulse the resulting control voltage Vo appeared

at NODE P tends to prolong discharging period of C407, i.e., to slow down the oscillation. In case that sync pulse precedes comparison signal, Vo tends to shorten the discharging period and speed up the oscillation. Thus AFC operation is achieved. Moreover, the oscillation frequency can be altered by adjusting R408 (H-HOLD) to vary the voltage level at NODE P. (Refer to Fig. 3-19).

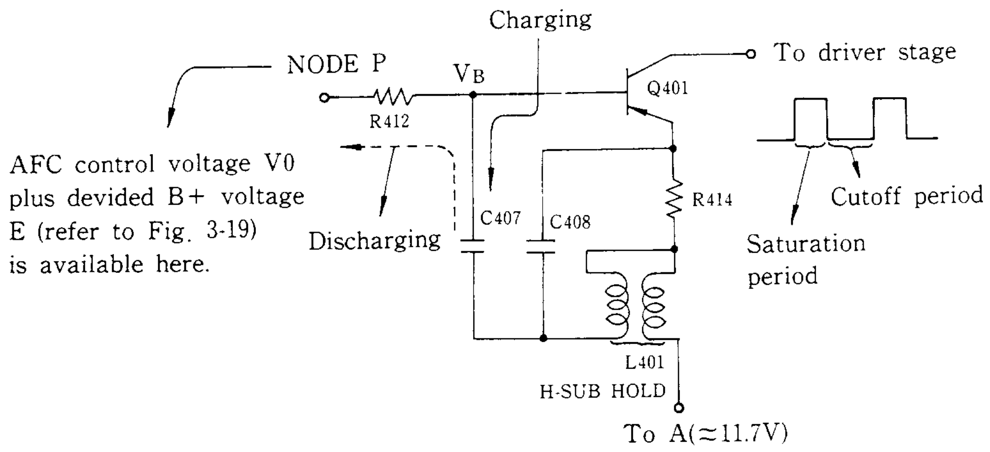


Fig. 3-17 Hartley Oscillator for Horizontal Deflection

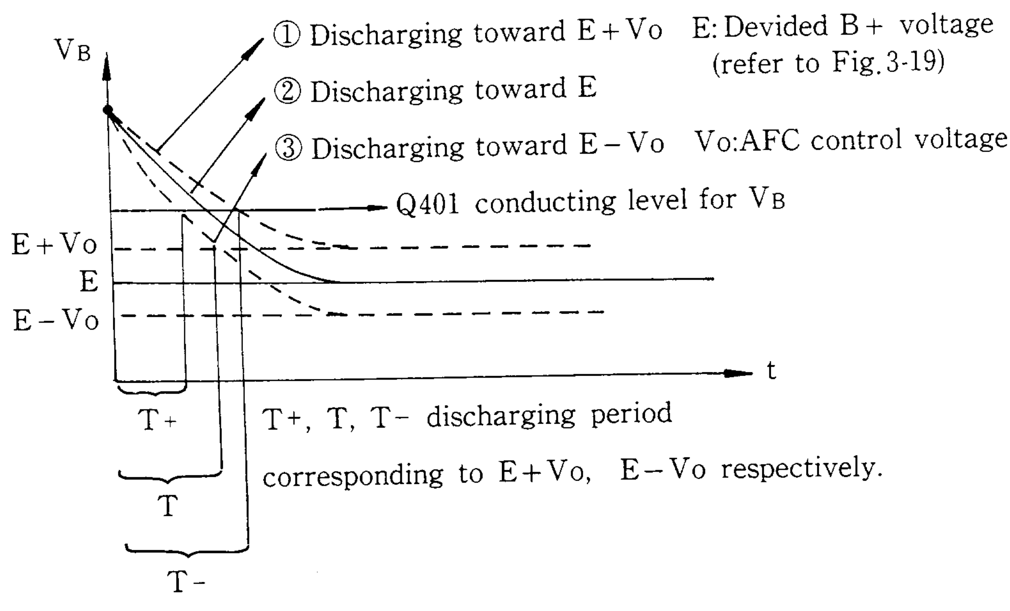


Fig. 3-18 Frequency-control Principle for AFC and H-HOLD

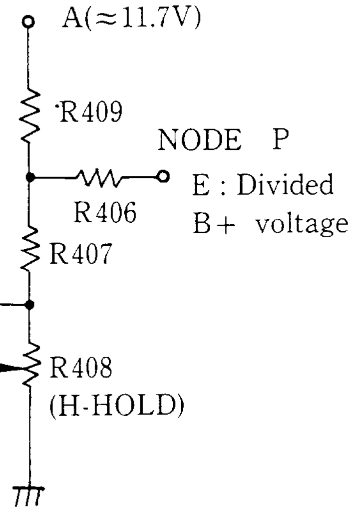


Fig. 19 H-HOLD Adjustment Circuit

Driver circuit exists between oscillator stage and output stage. By the action of driver transistor (Q402) together with driver transformer (T401) square wave of sufficient voltage is available to drive the output stage. Driver circuit also serves as a buffer stage. It prevents disturbance from output to oscillation stage and improves the stability of oscillation frequency.

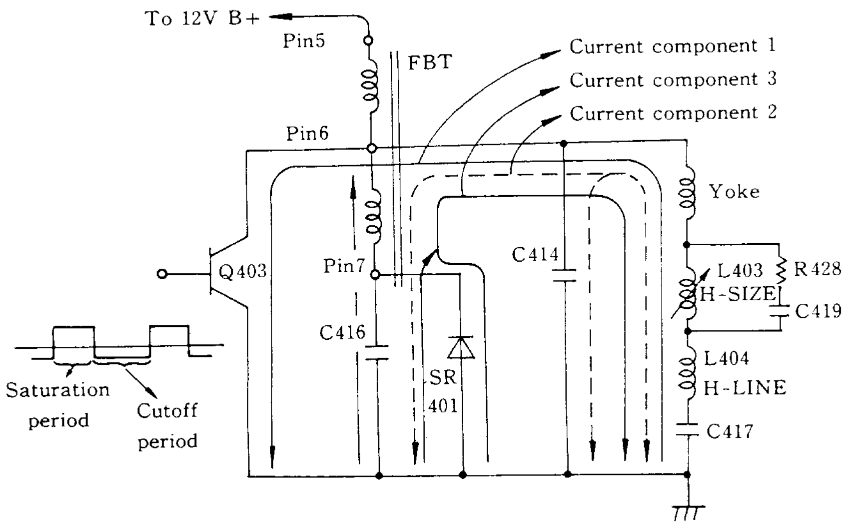
The periodic square wave from driver stage controls the ON-OFF transition (saturation-cutoff) of Q403. Refer to Fig. 3-20, when Q403 is switched on, ramp current (component 1) flows through yoke. When Q403 is switched off, an L-C-R damping oscillation (component 2) takes place until the induced voltage at PIN 7 of FBT can afford to switch SR401 on. Then another ramp current (component 3) flows through yoke in the opposite direction. Next cycle of square wave comes to switch Q403 on again and next cycle of sawtooth current starts.

Series combination of C419 and R428 across L403 is used to improve the riging phenominum appeared on the left edge of scanning raster.

C417, resonant with inductor, is used for S-correction of sawtooth current.

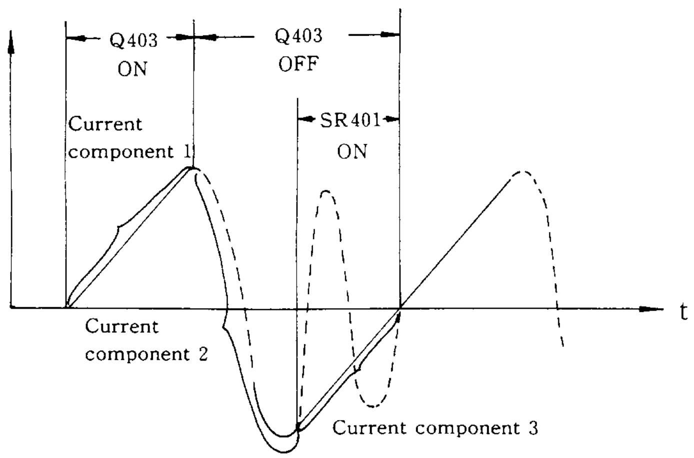
L402 is a choke inductor to prevent power circuit from AC current decoupling.

L404 has a permanent magnet in it and is a polar device. L404 compensates the nonsymmetry of horizontal linearity since it has nonlinear inductance characteristic by the addition of magnet.



* C417, resonant with yoke plus L404 plus L403, gives an s-correction during current component 1 and 3.
* C416, resonant with FBT inductance between Pin6 and Pin7, gives an extra s-correction during current component 1 and 3.

(a) Analytic horizontal output circuit



(b) Sawtooth current components

Fig. 3-20 Horizontal Output Stage

3. 8 FBT

During retrace period there is a 84 Vp-p pulse generated at the collector of Q403, i.e., PIN 6 of FBT. Such pulse induces a high voltage pulse (about 10.0 kV) and a middle voltage pulse (about 135 V) at anode cap and PIN 4 respectively. (Refer to Fig. 3-21). Each induced pulse is generated with the addition of harmonics of the horizontal pulse to flatten its waveshape and improve the regulation. (Refer to Fig. 3-22).
The reason why the resonant capacitor C416 is connected to PIN 7 instead of PIN 6 is to take advantege of the inductance between PIN 6 and PIN 7. By the resonance between this inductance and C416 during scan period extra S-correction of sawtooth current is obtained and linearity is more improved. (Refer to Fig. 3-20(a)).

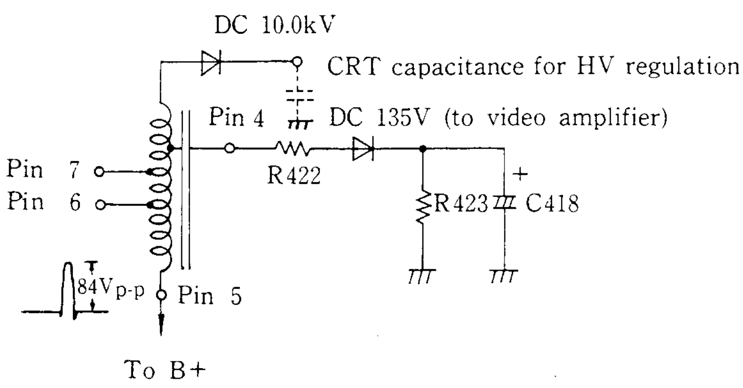


Fig. 3-21 FBT Circuit

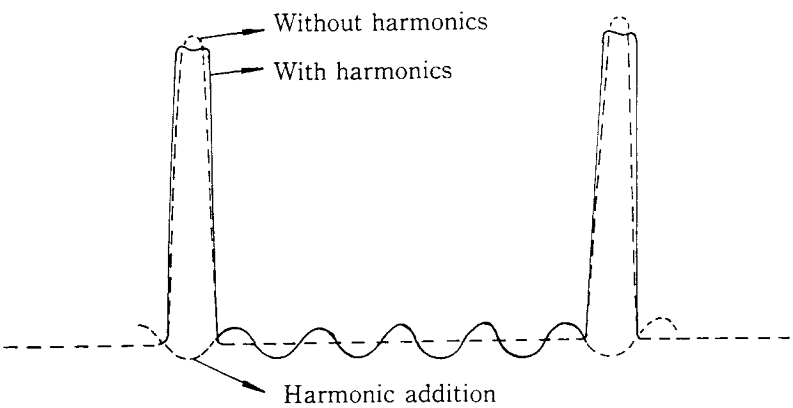


Fig. 3-22 Effect of Harmonic Addition to Induced FBT Pulses

4. ADJUSTMENT PROCEDURE

4. 1 General

To adjust the monitor to its optimum condition of operation, the following adjustment procedure is necessary. For precise adjustment the steps should be proceeded as following sequence. Please refer to Fig. 4-1 for component location.

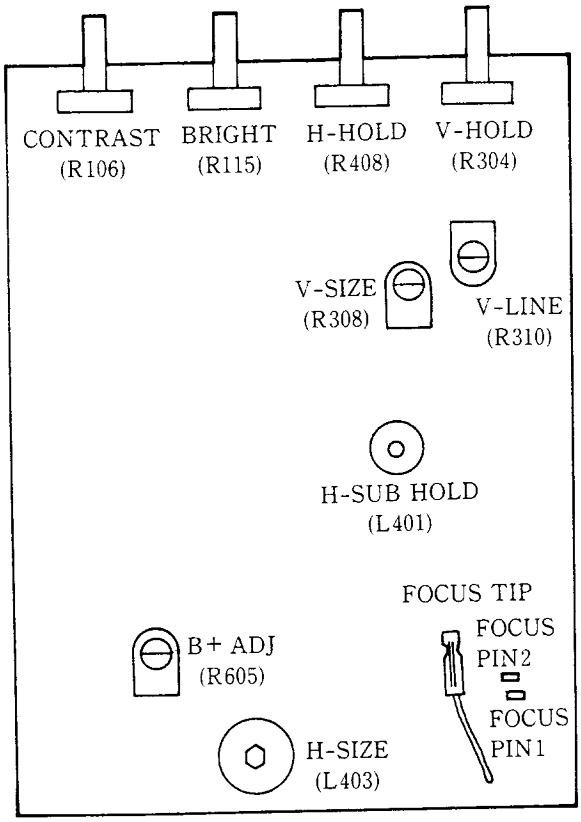


Fig. 4-1 Component Location

4. 2 B+ voltage adjustment

Switch on the monitor and warm it up for about 5 minutes. Check if B+ voltage is 12 $\pm$ 0.5 V. If not, adjust R605 to obtain 12 $\pm$ 0.5 V B+ voltage.

4. 3 Coarse adjustment

Set SLIDE-SWITCH at the rear to 75 ohm position. Then connect video signal to the monitor. Set the H-HOLD control (R408) to its central position and see if the picture is synchronously stable. If not, adjust H-SUB. HOLD (L401) as well as V-HOLD control (R304) to obtain a stable picture.

4. 4 Vertical scan size adjustment

Turn BRIGHT and CONTRAST to their maximum. Adjust V-SIZE (R308) to obtain a picture height 10 % more than the CRT viewing area.

4. 5 Vertical linearity adjustment

Adjust V-LINE (R310) to obtain a picture with optimum vertical linearity.

4. 6 Horizontal scan size adjustment

Turn BRIGHT and CONTRAST to their maxima. Adjust H-SIZE (L-403) to obtain a picture width 10 % over the CRT viewing area.

4. 7 Horizontal frequency adjustment

Disconnect the input video signal from the monitor. Turn the H-HOLD control (R408) to its central position. Adjust H-SUB. HOLD (L401) until the free running frequency attains the standard horizontal sync frequency of video signal (15750 Hz or 15625 Hz).

A less precise adjustment is to connect video signal in and adjust H-SUB. HOLD with H-HOLD set at central position to get a point that picture does not roll horizontally at the moment of power on.

4. 8 Interlace adjustment

Connect video signal. Turn the V-HOLD control (R304) left and right until optimum interlace is obtained.

4. 9 Focus option

Connect FOCUS TIP to FOCUS PIN 1 and FOCUS PIN 2 alternatively and see which will obtain optimum focus.

4. 10 Picture centering

Rotate two pieces of centering magnets located at the back of the yoke to adjust the picture position to the center of the CRT viewing area. For more precise centering, loosen the clamp screw of the yoke and rotate it to obtain a tilted picture to see the symmetricness when adjusting. (Refer to Fig. 4-2/4-3). After adjustment, yoke should be pushed as forward as possible and rotated to proper position. Then fasten the clamp screw.

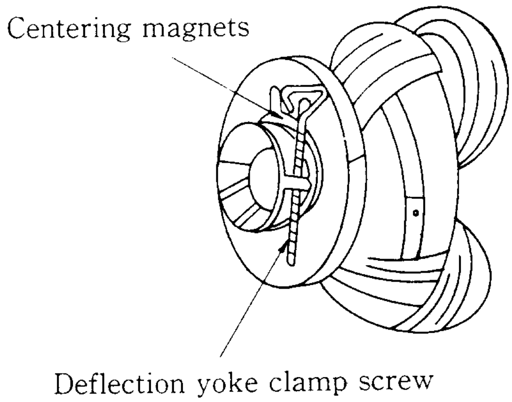


Fig. 4-2 Deflection Yoke

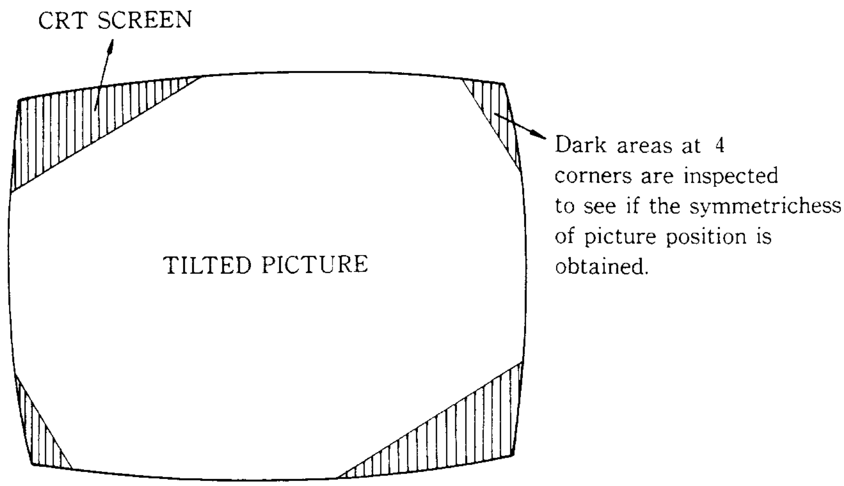


Fig. 4-3 More Precise Picture Centering

5. TROUBLESHOOTING

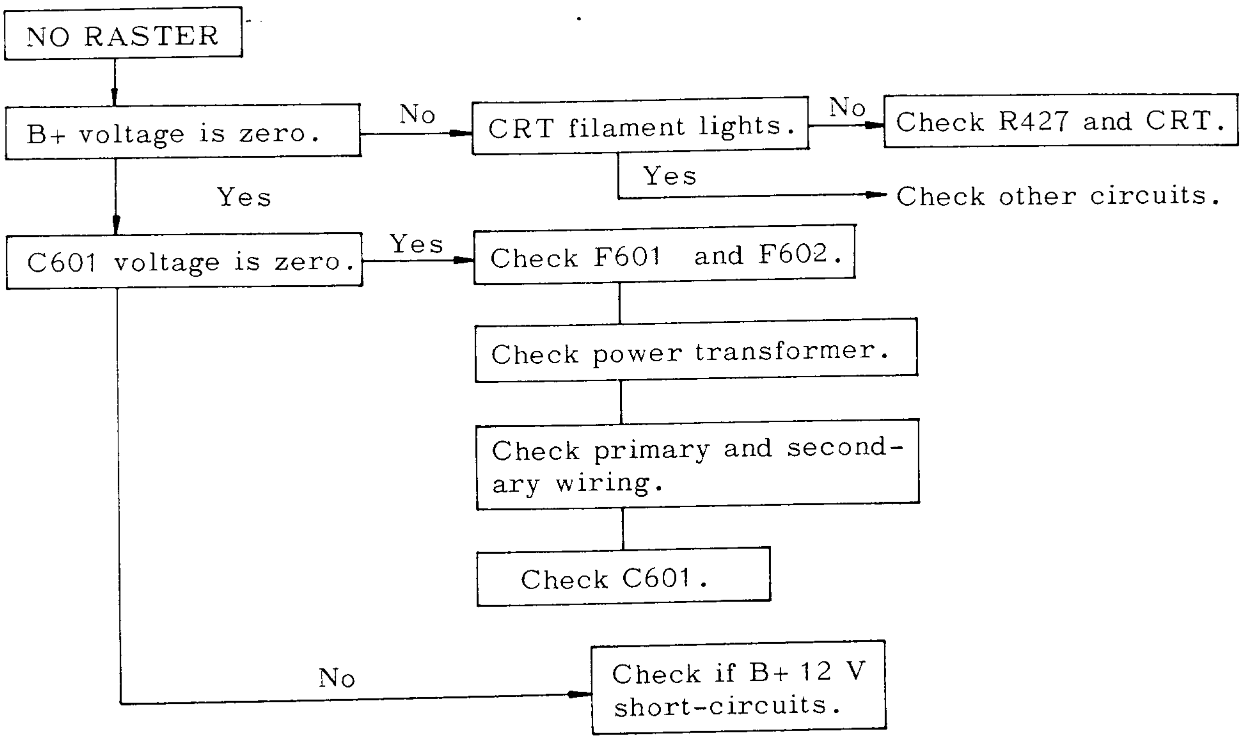
5. 1 General troubleshooting description

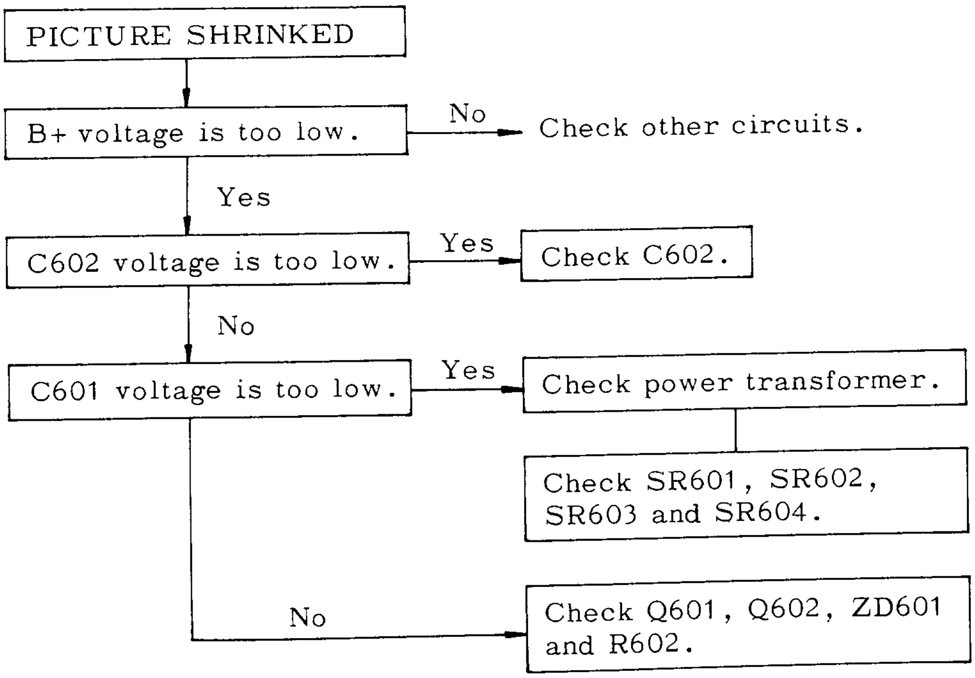
The symbol "O" indicates possible trouble location. As for detailed trouble-shooting, refer to the following flow-charts.

Trouble / Circuit	No raster	No picture (Raster exists)	Picture shrinked	Retrace line appeared	No vertical deflection	No horizontal deflection	No Synchronization	No vertical Synchronization	No horizontal synchronization
Power Regulator	O		O						
Video Amplifier	O	O		O					
Sync. Separation							O	O	O
AFC									O
Vertical Deflection			O		O			O	
Horizontal Deflection	O	O	O			O			O
FBT Circuit	O	O	O						
Blanking Circuit				O					

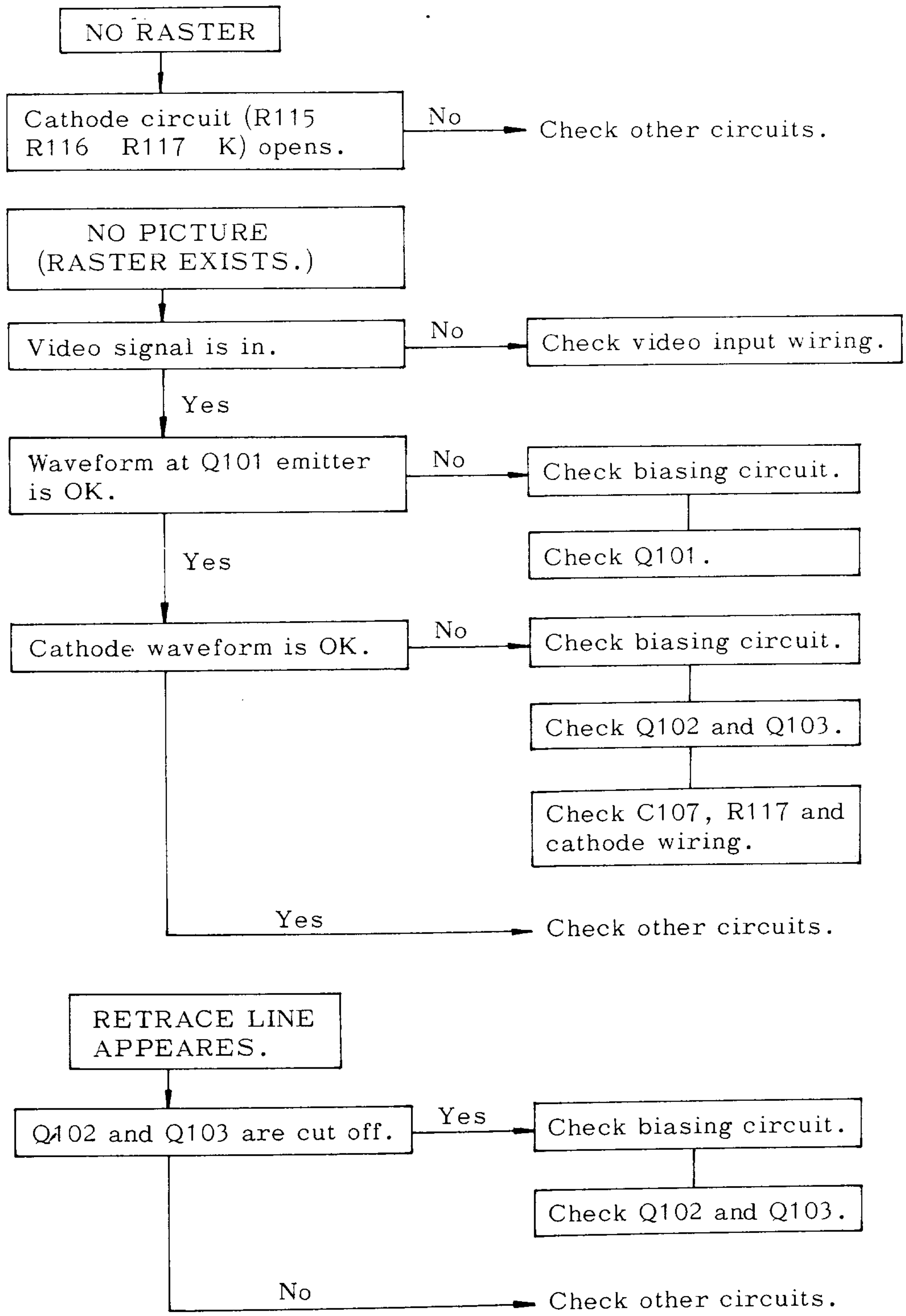
Table 5-1. General Troubleshooting Description

5. 2 Power regulator

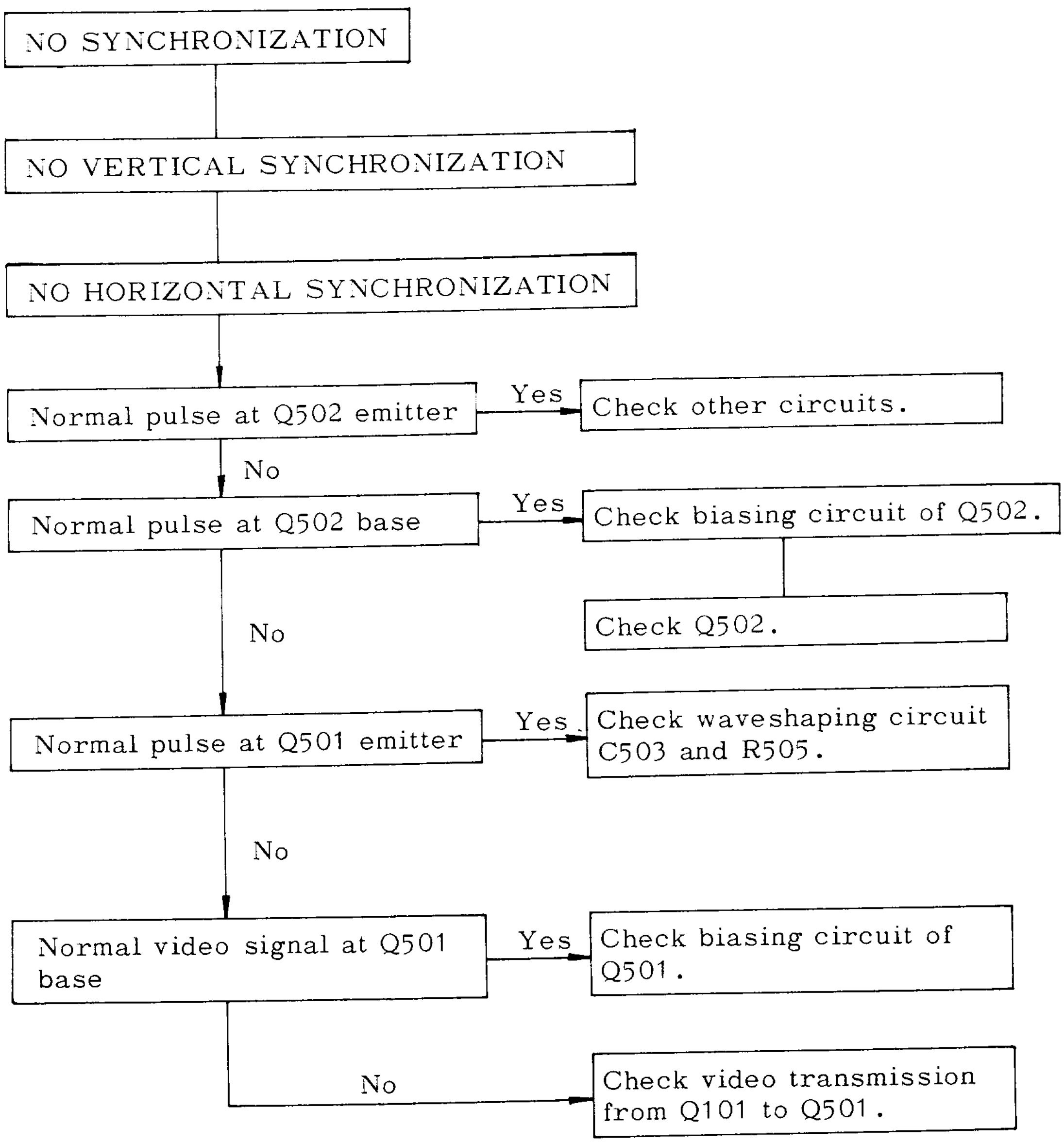




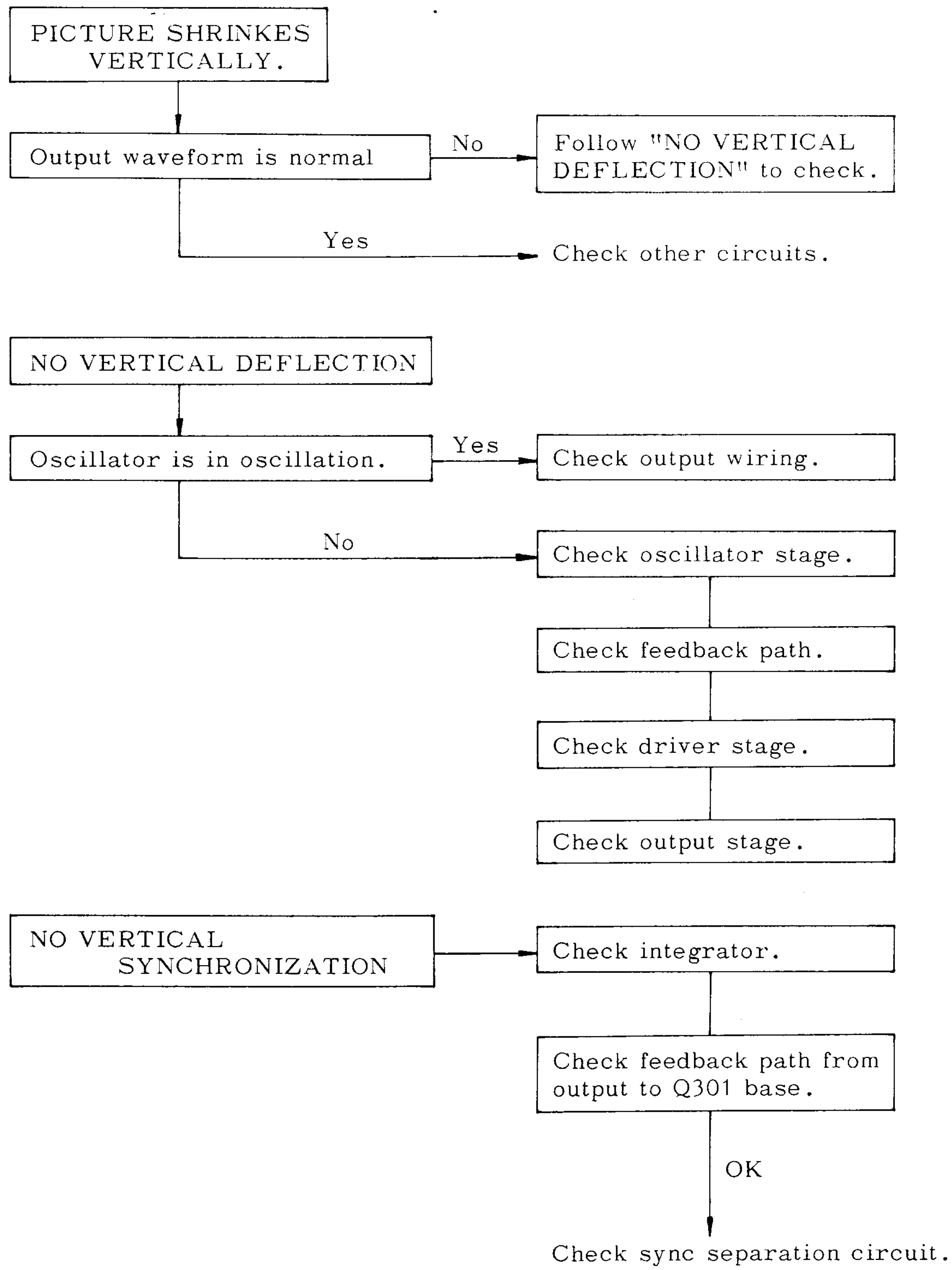
5. 3 Video amplifier



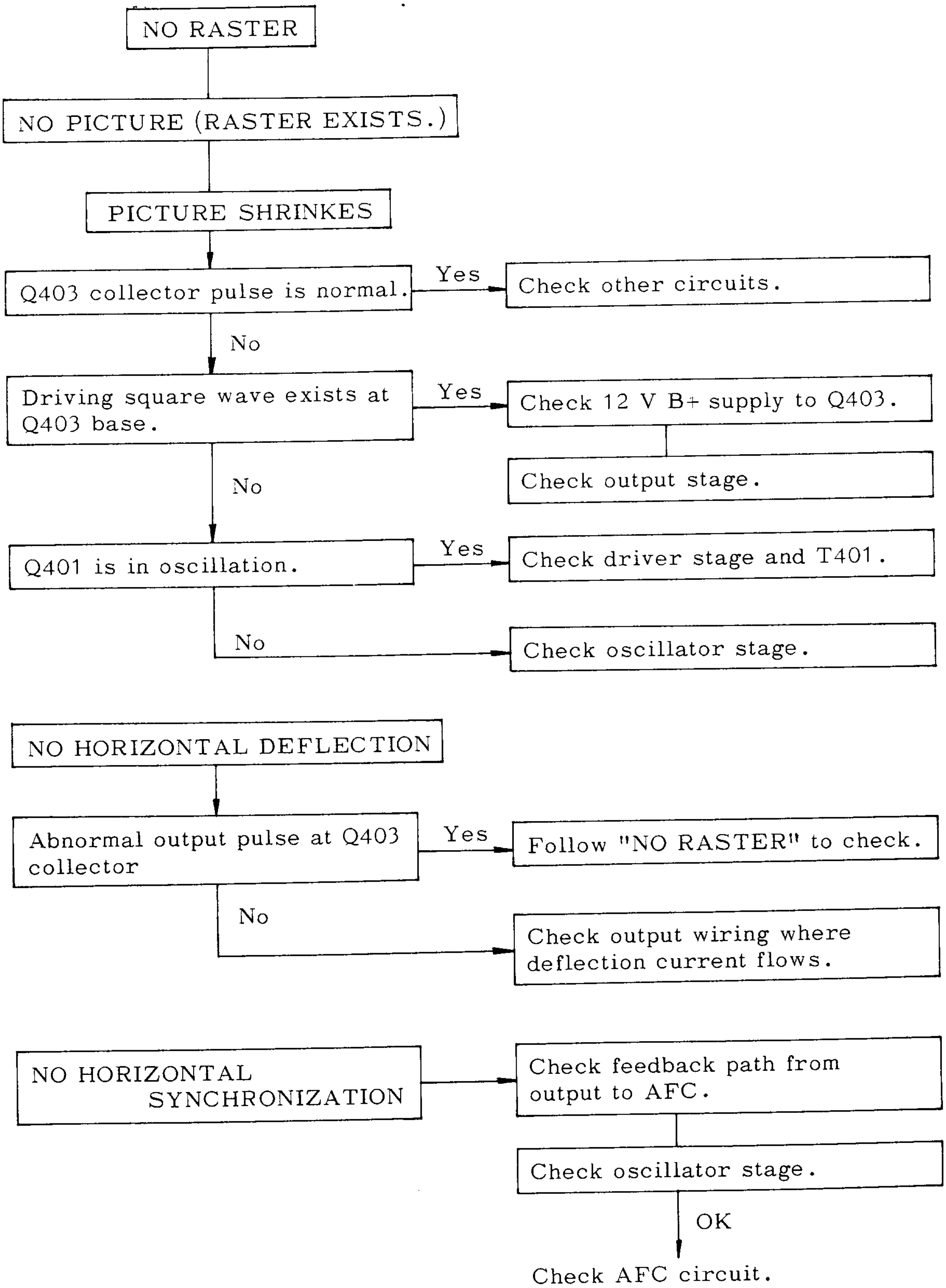
5. 4 Sync separation



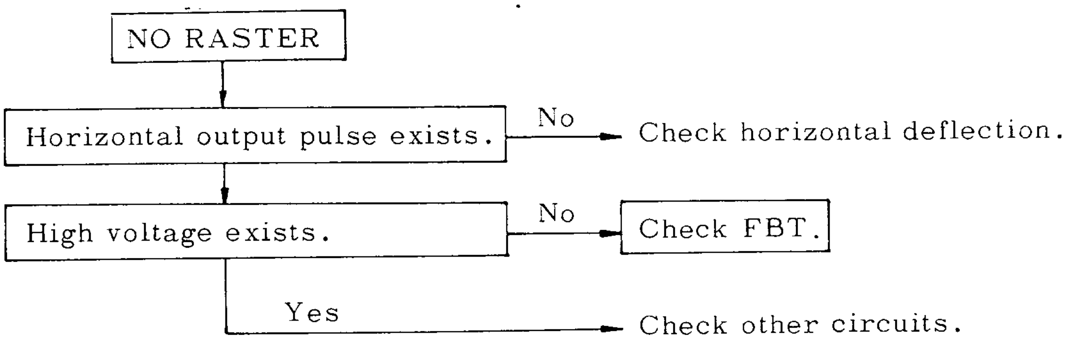
5. 5 Vertical deflection

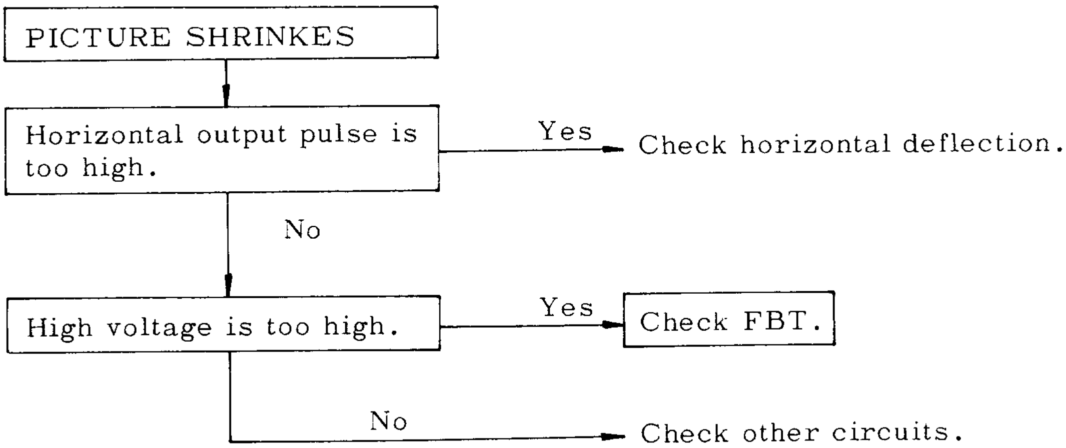


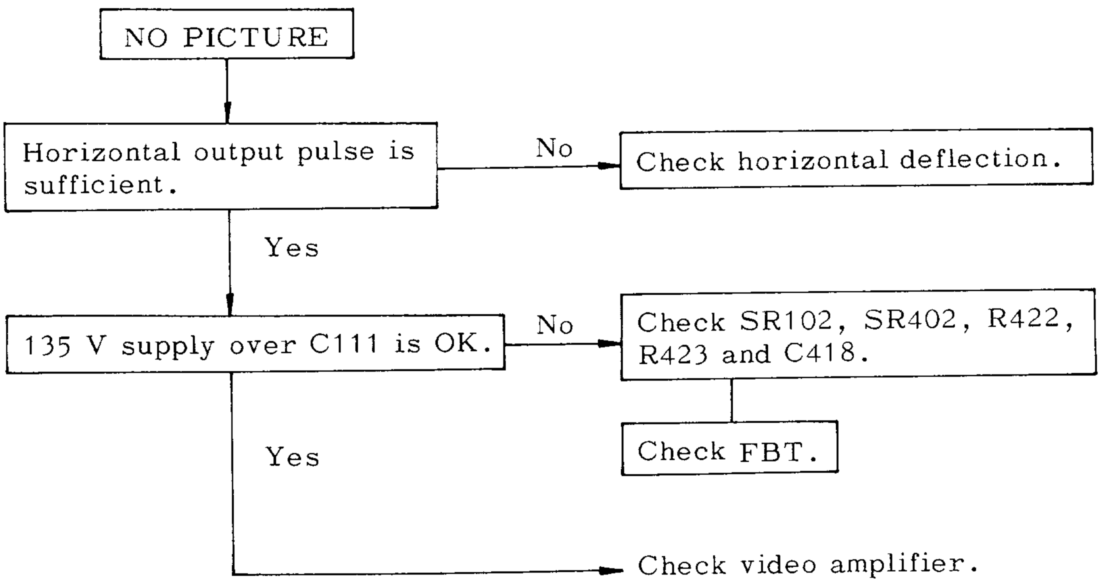
5. 6 Horizontal deflection



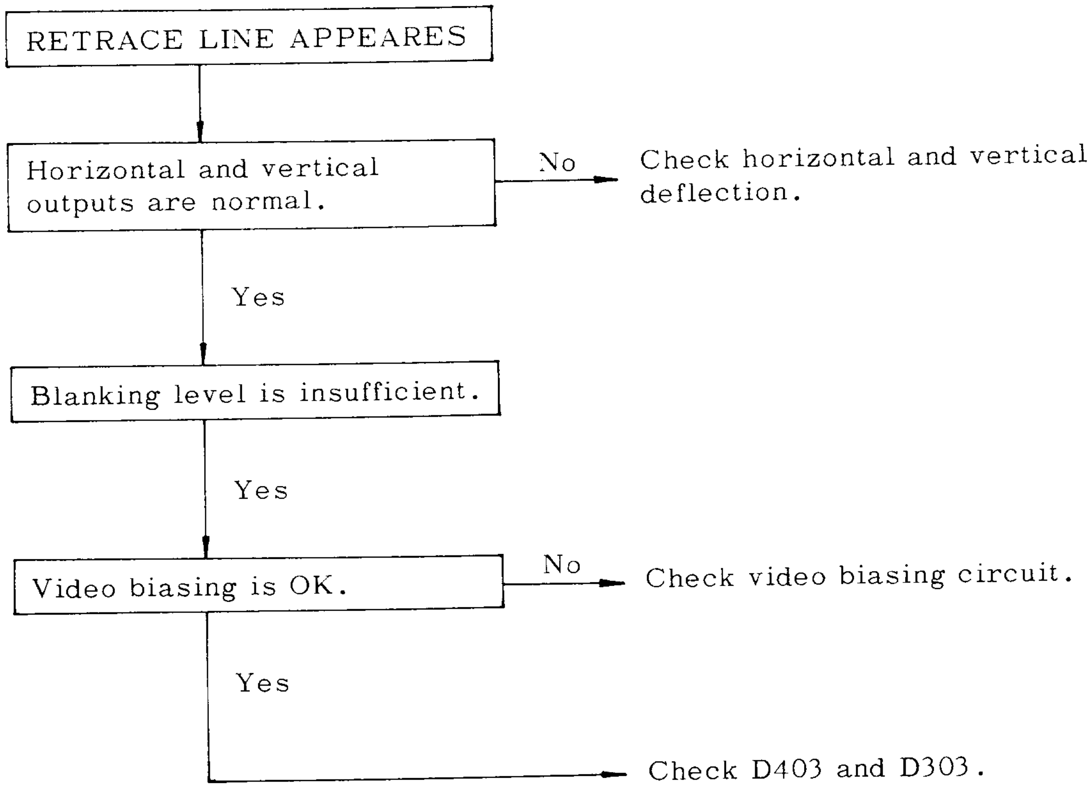
5. 7 FBT circuit







5. 8 Blanking circuit



6. MODIFICATION PROCEDURE

1. Vertical 50 field/60 field interchange procedure

   Replace of 3 components is necessary to change 50 field circuit (Chassis No. VM-9B) to 60 field circuit (Chassis No. VM-9A) or vise versa.

Field \ Component	C306	R305	R307
50	10μF, KU	18 k ohm	12 k ohm
60	4.7μF, KU	15 k ohm	10 k ohm

Table 6-1 Components to be replaced for 50 field/60 field interchange

After above modification the following adjustments are necessary. (Refer to SECTION 4)

(1) Vertical Scan Size Adjustment
(2) Vertical Linearity Adjustment
(3) Interlace Adjustment
(4) Picture Centering
(5) Change the chassis number of the serial label which is on the bottom of the unit. (VM-9A ↔ VM-9B)

2. Selection of AC power line voltage (VM-900E/K only)

   A universal (100V/120V/220V/240V selectable) power transformer is used for VM-900E/K model. Inside cabinet there are voltage selecting tip and pins located on the heat sink of Q602 (power regulating transistor) at the transformer side of monitor. Refer to Fig. 6-1, connect TIP to PIN 1,2,3, or 4 according to correct power line voltage marked on the label.

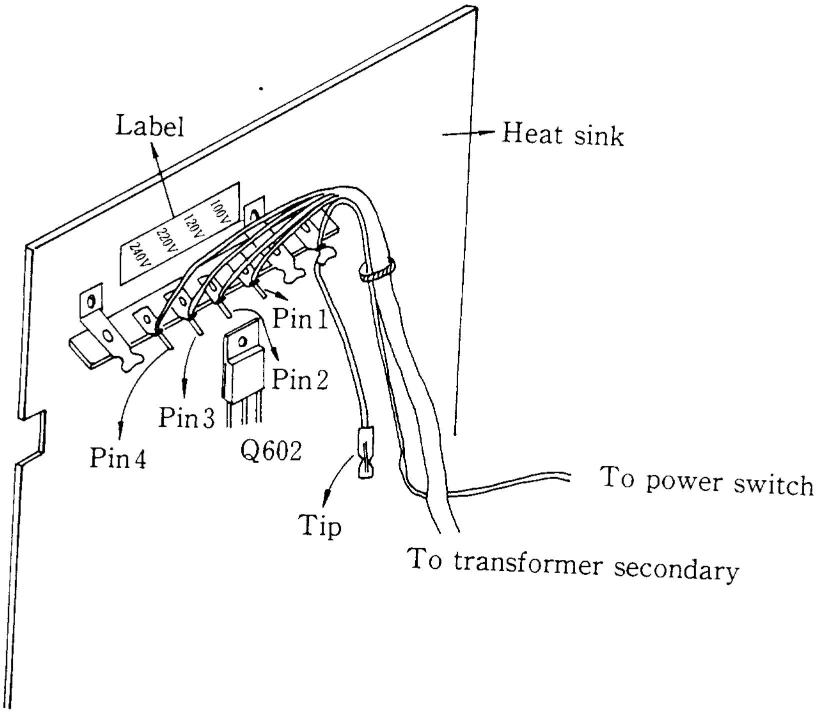


Fig. 6-1 Location of Voltage Selecting TIP and PINs

7. PICTURE TUBE REPLACEMENT (Refer to page 39)

1. Remove the five screws securing the rear cover, and remove the rear cover (19).
2. Remove the cabinet (3) by removing the four screws at the lower sides of the cabinet.
3. Remove the mask (1) by removing the four screws securing the mask.
4. Discharge high voltage of the anode cap.
5. Remove the component on the picture tube, the anode cap, the deflection yoke and the picture tube socket.
6. Remove the four tube securing nuts.
7. Replace the tube with the same type one.
8. Reassemble the monitor by reversing the above order of procedure.
9. Make the adjustments according to item 4. ADJUSTMENT PROCEDURE.

8. MAIN PCB REPLACEMENT (Refer to page 39)

1. Remove the five screws on the rear cover, and remove the rear cover (19).

   Note: Adjustments (Refer to item 4. ADJUSTMENT PROCEDURE) can be applied.

   Remove the cabinet to facilitate the adjustment.

2. Remove four screws securing the cabinet, and remove the cabinet.
3. Remove the three screws on the PC board and remove the stopper of the PC board holder (17).
4. Move the PC board towards right side (viewed from rear).

   The PC board holder (18) may be released. Pull out the PC board from the chassis (9).

   Note: Now the monitor can be operated in this condition.

   Troubleshooting and repair can be easily done.

   (Refer to item 5. TROUBLESHOOTING.)

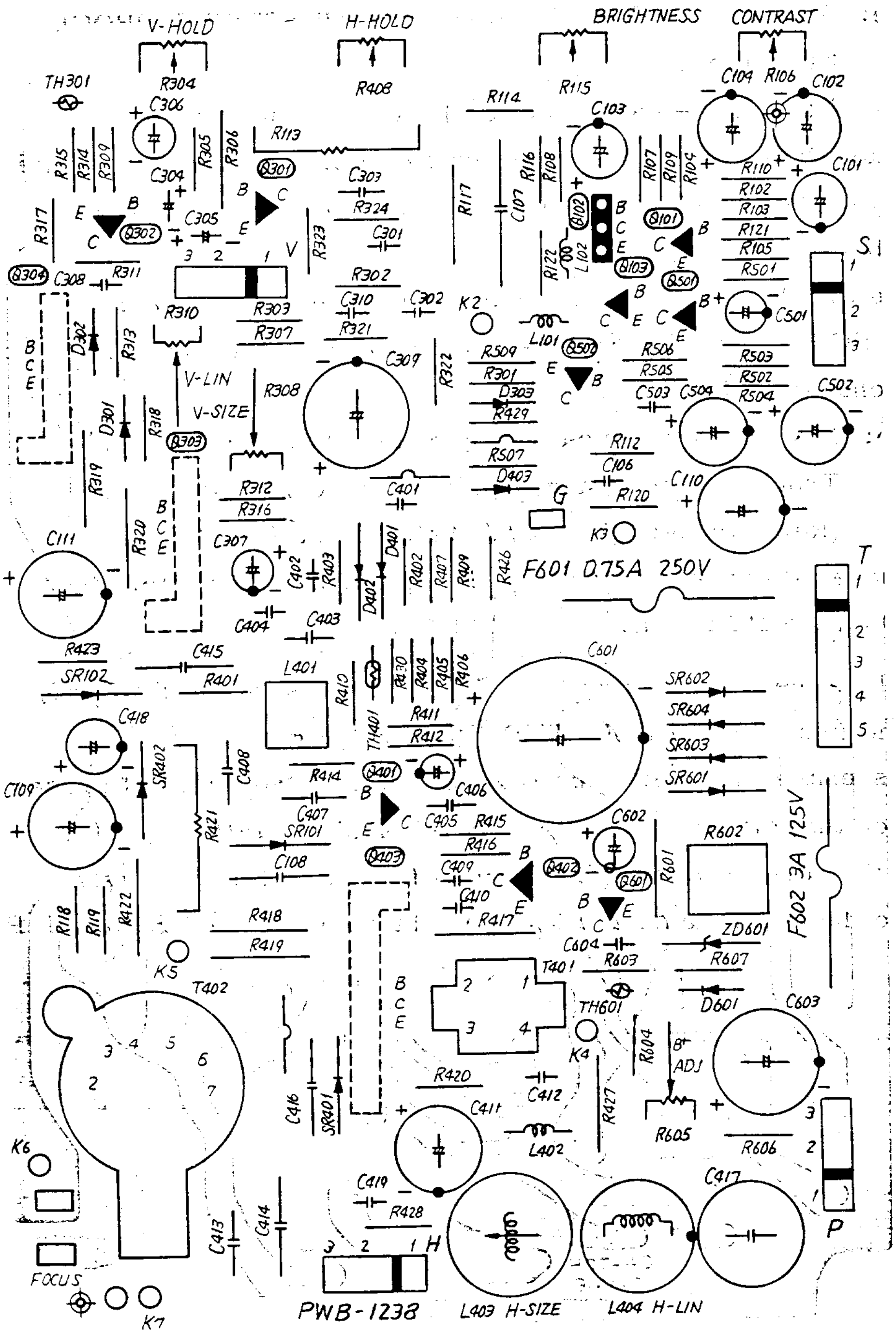
5. Remove all connectors (S, P, H, V, G and T connectors/socket/anode cap) on the PC board.
6. Replace the PC board with the PC board of same field (50/60), referring to the item 6. MODIFICATION PROCEDURE.
7. Reassemble the monitor by reversing the above order of procedure.
8. Check that all the connectors are securely installed.

   Put the control side of the PC board to the slit of the mask.

   Make the adjustments according to the item 4. ADJUSTMENT PROCEDURE.

9. ELECTRICAL PARTS ARRANGEMENT

MAIN PCB



10. ELECTRICAL PARTS LIST

PRODUCT SAFETY NOTICE

Components marked with a ⚠ have special characteristics important to safety. Before replacing any of these components, read carefully the "PRODUCT SAFETY NOTICE" of this manual. Do not degrade the safety of this monitor through improper servicing.

MAIN PCB

Part Code	Symbol	Description	Remarks
		Transistors	
HTC0148	Q 101	2SC458C	
HTC0652		or 2SC945Q	
HTC0650	⚠102	2SC1514-05	
HTC0057	103	2SC1213C	
HTC0148	Q 301	2SC458C	
HTC0652		or 2SC945Q	
HTC0148	302	2SC458C	
HTC0652		or 2SC945Q	
HTC0045	303	2SC1162C	
HTA0164	304	2SA715C	
EHQ0002	XQ 303/304	Heat Sink (49) RAD-P-088A	
HTA0085	Q 401	2SA673C	
HTC0057	402	2SC1213C	
HTC0651	⚠403	2SC2373	
EHQ0003	XQ 403	Heat Sink (18) RAD-P-1063	
HTA0192	Q 501	2SA1015Y	
HTA0251		or 2SA733Q	
HTC0148	502	2SC458C	
HTC0652		or 2SC945Q	
HTA0085	Q ⚠601	2SA673C	
HTA0252		or 2SA673D	
		Diodes	
HDN0098	D 301	1N4148	
"	302	"	
"	303	"	
HDN0099	D 401	1N34A	
"	402	"	
HDN0098	403	1N4148	
HDN0098	D 601	1N4148	
HDR0164	SR ⚠101	RP1D-5004	
"	⚠102	"	
HDR0164	SR ⚠401	RP1D-5004	
"	⚠402	"	
HDG0041	SR ⚠601	G2B	
"	⚠602	"	
"	⚠603	"	
"	⚠604	"	
HDE0049	ZD ⚠601	EQA01-06S	
		Thermistors	
HZK0002	TH ⚠301	5KD5	
HZK0002	⚠401	5KD5	
HZD0002	⚠601	D2BS	

Part Code	Symbol	Description	Remarks
		Resistors	
RCR3028	R 102	Carbon 1/4W 100Ω ±5%	
RCR3080	103	" " 15kΩ "	
RCR3084	104	" " 22kΩ "	
RCR3044	105	" " 470Ω "	
RDX0021	106	Rotary Var. 1/5W 500ΩB ±20%	CONTR
RCR3056	107	Carbon 1/4W 1500Ω ±5%	
RCR3052	108	" " 1000Ω "	
RCR3076	109	" " 10kΩ "	
RCR3062	110	" " 2700Ω "	
	111	Not Used	
RCR3018	112	Carbon 1/4W 39Ω ±5%	
RMX0004	⚠113	Metal 2W 3900Ω "	
RCR4068	114	Carbon 1/4W 180kΩ "	
RDX0022	115	Rotary Var. 1/5W 250kΩB ±20%	BRIGHT
RCR4110	116	Carbon 1/4W 560kΩ ±5%	
RCR3161	117	" 1/2W 1200Ω "	
RCX0099	⚠118	" 1/4W 10MΩ ±10%	
RCR3092	⚠119	" " 47kΩ ±5%	
RCR3030	120	" " 120Ω "	
RCR3016	121	" " 33Ω "	
RCR3076	122	" " 10kΩ "	
RCR3088	R 301	Carbon 1/4W 33kΩ ±5%	
RCR3084	302	" " 22kΩ "	
RCR3068	303	" " 4700Ω "	
RDX0023	304	Rotary Var. 1/5W 100kΩB ±20%	V-HOLD
RCR3080	305	Carbon 1/4W 15kΩ ±5%	60F
RCR3082	305	" " 18kΩ "	50F
RSX0001	306	Solid 1/2W 1Ω "	
RCR3076	307	Carbon 1/4W 10kΩ "	60F
RCR3078	307	" " 12kΩ "	50F
RDX0025	308	Semi-fixed 1/5W 10kΩB ±20%	V-SIZE
RCR3032	309	Carbon 1/4W 150Ω ±5%	
RDX0026	310	Semi-fixed 1/5W 500ΩB ±20%	V-LINE
RCR3034	311	Carbon 1/4W 180Ω ±5%	
RCR3032	312	" " 150Ω "	
RCR3092	313	" " 47kΩ "	
RCR3074	314	" " 8200Ω "	
"	315	" " " "	
RCR3044	316	" " 470Ω "	
RCR4043	317	" " 5.6Ω "	
RCR3044	318	" " 470Ω "	
RCR4939	319	" 1/2W 1Ω "	
RCR4939	320	" " " "	
RCR3030	321	" 1/4W 120Ω "	
RCR3042	322	" " 390Ω "	
RCR3066	323	" " 3900Ω "	
RCR3052	324	" " 1000Ω "	
RCR3074	R 401	Carbon 1/4W 8200Ω ±5%	
RCR3072	402	" " 6800Ω "	
"	403	" " " "	
RCR3064	404	" " 3300Ω "	
"	405	" " " "	
RCR3080	406	" " 15kΩ "	
"	407	" " " "	
RDX0024	⚠408	Rotary Var. 1/5W 50kΩE ±20%	H-HOLD
RCR3076	409	Carbon 1/4W 10kΩ ±5%	
RCR3056	410	" " 1500Ω "	
RCR3070	411	" " 5600Ω "	
RCR3066	412	" " 3900Ω "	
	413	Not Used	
RCR3024	414	Carbon 1/4W 68Ω ±5%	
RCR3036	415	" " 220Ω "	
RCR3028	416	" " 100Ω "	
RCR3147	417	" 1/2W 330Ω "	
RCX0100	⚠418	" " 22Ω "	
RCX0100	⚠419	" " " "	
RCR3030	420	" 1/4W 120Ω "	
RMX0005	⚠421	Metal 2W 1200Ω "	
RSX0002	⚠422	Solid 1/2W 180Ω ±10%	
RCR4068	423	Carbon 1/4W 180kΩ ±5%	
	424	Not Used	

Part Code	Symbol	Description	Remarks
	R 425	Not Used	
RCR3062	426	Carbon 1/4W 2700Ω ±5%	
RSX0003	△427	Solid 1/2W 10Ω ±10%	
RCR3024	428	Carbon 1/4W 68Ω ±5%	
RCR3042	429	" " 390Ω "	
RCR3060	430	" " 2200Ω "	
RCR3030	R 501	Carbon 1/4W 120Ω ±5%	
	502	Not Used	
RCR4051	503	Carbon 1/4W 1MΩ ±5%	
RCR3074	504	" " 8200Ω "	
RCR3060	505	" " 2200Ω "	
RCR3028	506	" " 100Ω "	
RCR3004	507	" " 10Ω "	
	508	Not Used	
RCR3048	509	Carbon 1/4W 680Ω ±5%	
RCR3145	R 601	Carbon 1/2W 270Ω ±5%	
RWX0015	△602	Cement 10W 22Ω "	
RCR3042	△603	Carbon 1/4W 390Ω "	
RCR3056	△604	" " 1500Ω "	
RDX0027	△605	Semi-fixed 1/5W 1000ΩB ±20%	B+ADJ
RCR3056	△606	Carbon 1/4W 1500Ω ±5%	
RCR3004	607	" " 10Ω "	
		Capacitors	
CEX0184	C 101	Elyc 16V 33µF +50 -10%	
CEC0165	102	" " 220µF "	
CEC0170	103	" " 47µF "	
CEC0165	104	" " 220µF "	
	105	Not Used	
CCC1182	106	Ceramic 50V 1000pF ±10%	
CQX0264	△107	Metallized Polyester 250V 0.68µF "	
CQX0258	△108	Polypropylene 200V 0.1µF ±20%	
CEX0551	△109	Elyc " 10µF +50 -10%	
CEX0161	110	" 6.3V 1000µF "	
CEX0551	△111	" 200V 10µF "	
CQX0265	C 301	Polyester 50V 0.0068µF ±5%	
CQX0266	302	" " 0.0027µF "	
CQX0267	303	" " 0.082µF "	
CEX0557	△304	Tantal 10V 22µF ±20%	
"	△305	" " "	
CEX0554	△306	KU-Type Elyc 16V 4.7µF "	60F
CEX0555	△306	" " 10µF "	50F
CEC0158	307	Elyc 10V 47µF +50 -10%	
CCU0113	308	Ceramic 50V 560pF ±10%	
CEX0181	309	Elyc 16V 1000µF +50 -10%	
CQX0268	310	Polyester 50V 0.01µF ±5%	
CQX0269	C 401	Polyester 50V 0.0039µF ±5%	
CQA0006	402	" " 0.0033µF ±10%	
CQX0270	403	" " 0.022µF ±5%	
CQA0011	404	" " " ±10%	
CQA0013	405	" " 0.047µF "	
CEC0160	406	Elyc 16V 10µF +75 -10%	
CQX0259	△407	Polypropylene 200V 0.01µF ±5%	
CQX0260	△408	" " 0.047µF "	
CCX0161	409	Ceramic 50V " +80 -20%	
CCC1030	410	" " 0.01µF +80 -20%	
CEC0171	411	Elyc 16V 470pF +50 -10%	
CQA0011	412	Polyester 50V 0.022µF ±10%	
	413	Not Used	
CQX0261	△414	Polypropylene 400V 0.056µF ±5%	
CQX0262	△415	" 200V " ±10%	
CQX0263	△416	" 400V 0.068µF ±5%	
CEX0556	△417	Elyc Non-polar 25V 13µF ±10%	
CEX0552	△418	Elyc 250V 1µF +75 -10%	
CCC1030	419	Ceramic 50V 0.01µF +80 -20%	
CEC0191	C 501	Elyc 50V 1µF +75 -10%	
CEC0161	502	" 16V 100µF +50 -10%	
CQA0009	503	Polyester 50V 0.01µF ±10%	
CEC0165	504	Elyc 16V 220µF +50 -10%	

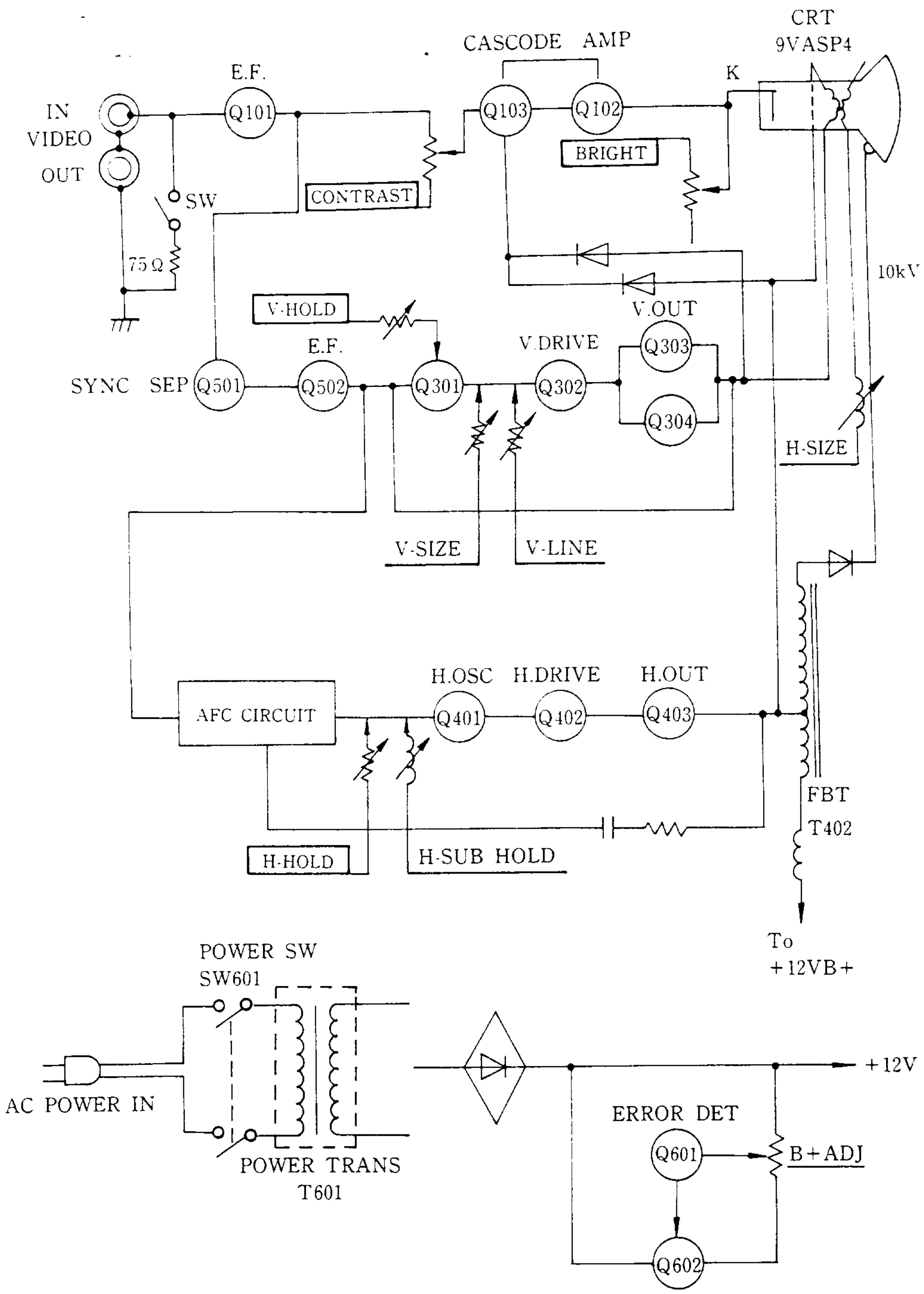
Part Code	Symbol	Description	Remarks
CEX0553	C △601	Elyc 25V 3300µF +50 -10%	
CEC0164	602	" 16V 22µF "	
CEX0181	603	" " 1000µF "	
CCC1030	604	Ceramic 50V 0.01µF +80 -20%	
		Coils	
TLE0025	L 101	Peaking 150µH ±10%	
TLE0023	102	" 120µH "	
TLX0171	L △401	Horizontal Osc (54) COIL-H-HOLD-1009	H-SUB. HOLD
TLF0041	△402	Filter 27µH ±10%	
TLX0172	△403	H-Size Coil (82) COIL-H-SIZE-1006	H-SIZE
TLX0173	△404	H-Linear Coil (21) COIL-H-LINE-1016	
		Transformers	
TTX0062	T △401	H Drive (88) TRANS-H-OPT-236	
TTX0063	△402	FBT (36) TRANS-FB-1058	
		Plugs	
JBX1808	S	3P (48) PLUG-025A	
"	P	3P "	
"	H	3P "	
"	V	3P "	
JBX1809	T	4P (14) PLUG-026B	
JBX1810	G	1P (71) LUG-032	
"	F1	1P "	
"	F2	1P "	
JBX1815	XF	Focus Tip (61) TIP-002	
		Fuses	
EFG0606	F △601	0.75A 250V UL	
EFG0607	△602	3A 125V UL	
EFG0608	△XF601/602	Fuse Clip (55) HOLD-FS-021	2 pcs
JSX0013		CRT Socket 7P (53) SO-052	
EZZ0056	SG △101	Spark Gap AG-20	

CHASSIS

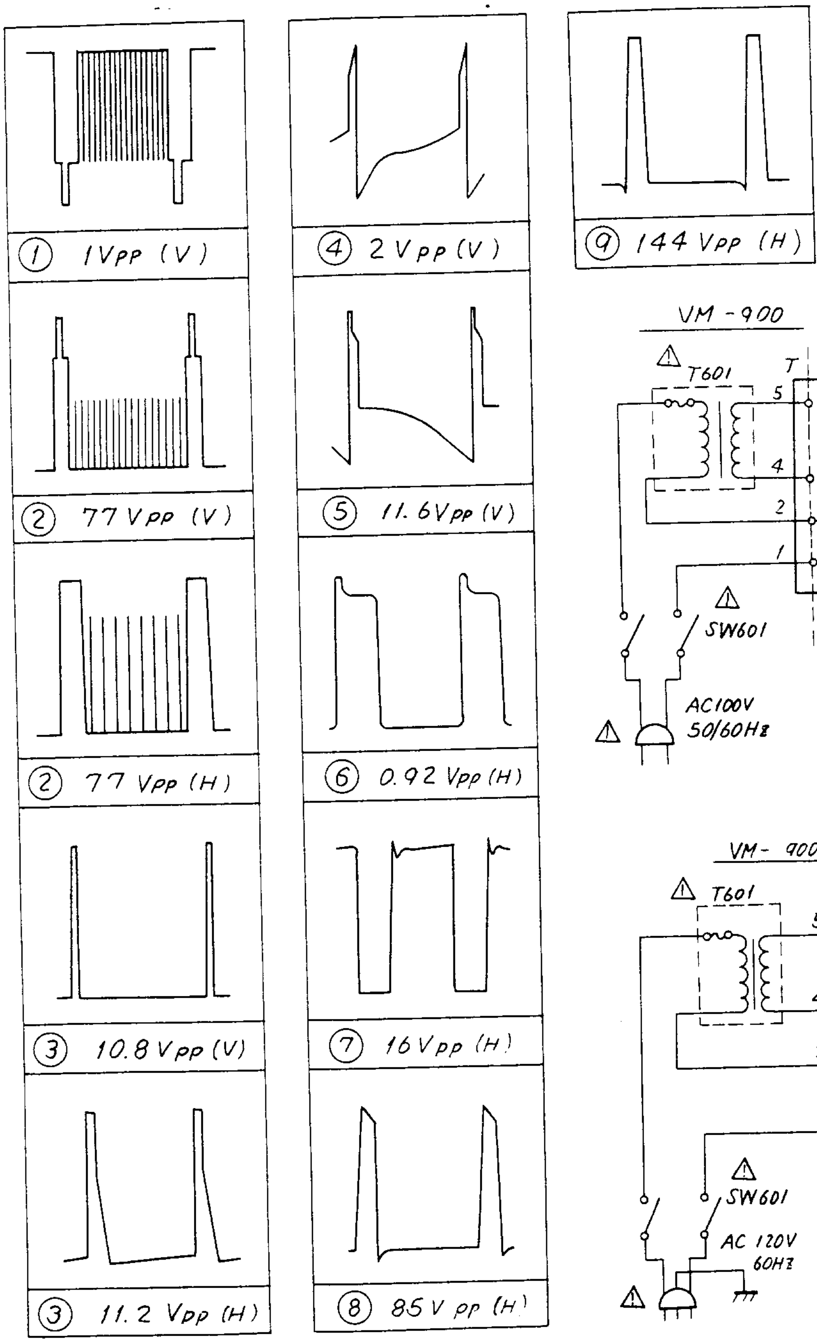
Part Code	Symbol	Description	Remarks
DPX0069	△CRT	9VASP4 UL CSA	
		Transistor	
HTD0125	Q △602	2SD1133C	
EHQ0004	XQ 602	Heat Sink (11) RAD-P-1086	
		Resistor	
RCR3025	R 101	Carbon 1/4W 75Ω ±5%	
TLX0174	△DY	Deflection Yoke (28) COIL-DEF-1052	
		Transformer	
TTX0064	T △601	Power (with "T" Socket) (27) TRNS-POWER-1089	U,C
TTX0065	△601	" (") (01) TRNS-POWER-1484	J
TTX0066	△601	" (") (60) TRNS-POWER-1485	E, K
		Switches	
SSV1072	SW 101	75-High, Slide (54) SW-S-1029	
SSS0104	△601	Power, See-Saw (80) SW-SE-1003	

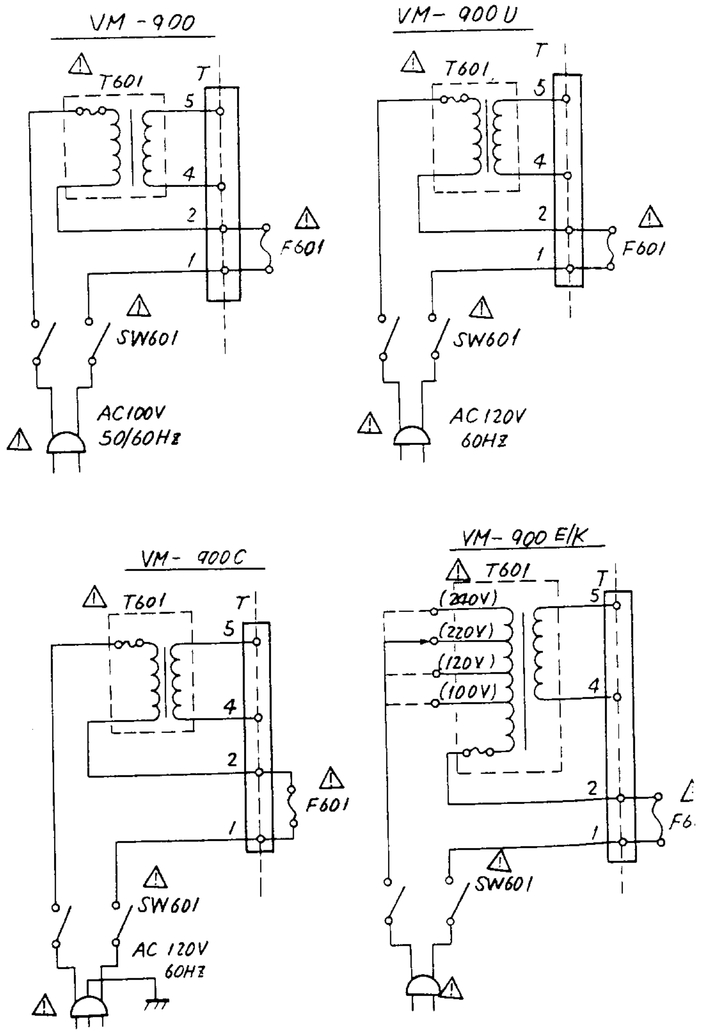
Part Code	Symbol	Description	Remarks
		Connectors	
JMH0054	J 101	M-type (11) CNC-1004	
"	102	" "	
		Sockets	
JBX1811	S	"S" Mark, with wiring 3P (84) SO-076A-167	J101/102
JBX1812	P	"P" " " 3P (17) SO-076A-166	Q602
JBX1813	H	"H" " " 3P (62) SO-076A-168	H-DY
JBX1814	V	"V" " " 3P (40) SO-076A-169	V-DY
JBX1816	(G)	Chassis Ground Tip, with wiring (61) TIP-002	
		Power Cord	
BBZ0241	⚠	UL Type (28) CORD-AC-052B	U
BBZ0242	⚠	CSA Type (37) CORD-AC-1018	C
BBZ0243	⚠	J Type (24) CORD-AC-003A	J
BBZ0244	⚠	E/K Type (89) CORD-AC-018A	E/K
ERR0082	⚠	Cord Bush U Type (20) STOP-CORD-1004	U
ERR0083	⚠	" C Type (53) STOP-CORD-1006	C
ERR0084	⚠	" J, E/K Type (81) STOP-CORD-1005	J, E/K
ETB0437		Voltage Selecting Lug(28) LUG-1056	E/K only
JSX0014		Voltage Selecting Tip (61) TIP-002	"

11. BLOCK DIAGRAM

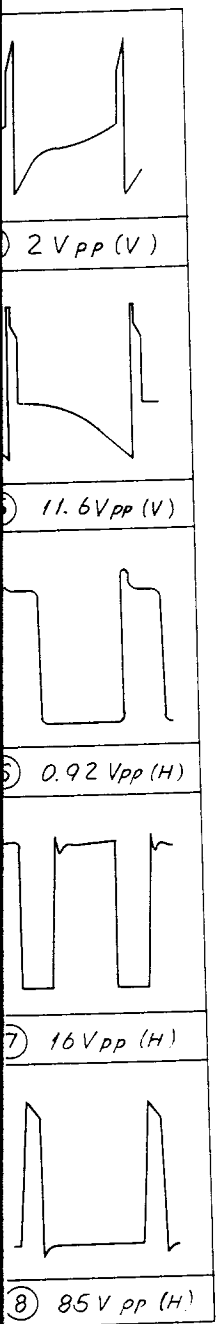


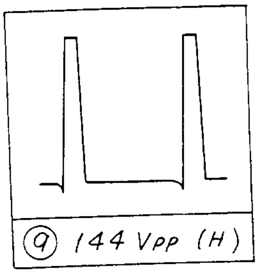
12. SCHEMATIC DIAGRAM

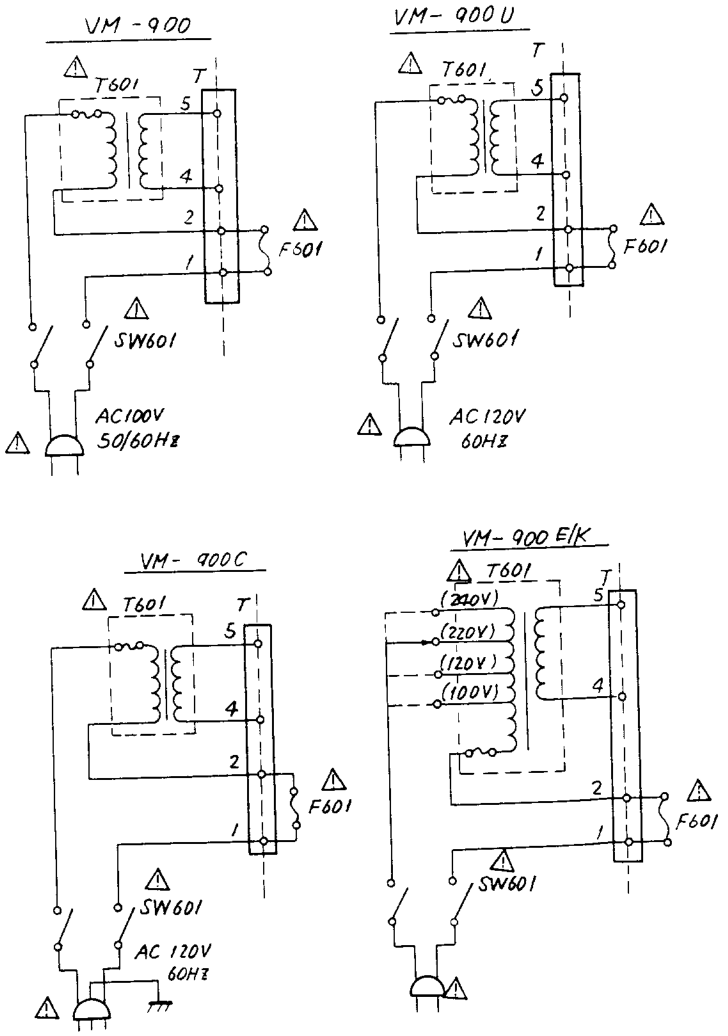


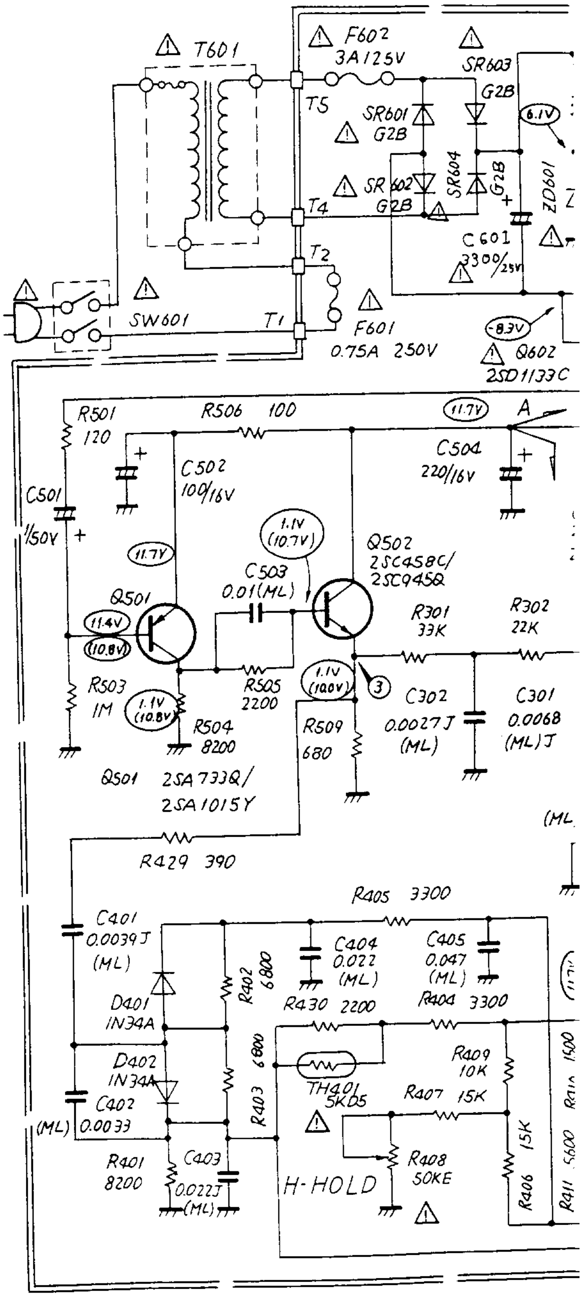


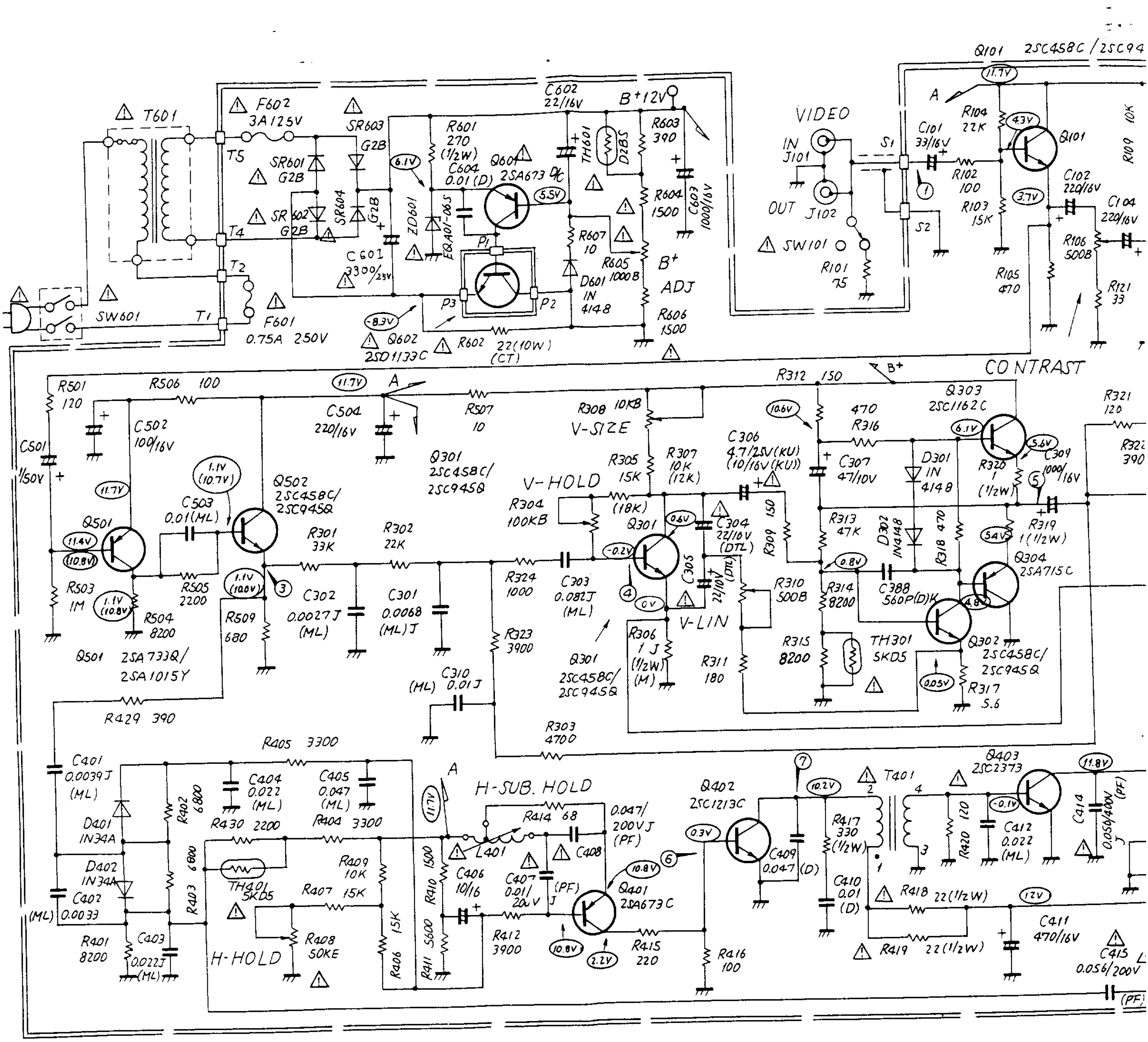
AGRAM


2 Vpp (V)
11.6Vpp (V)
0.92 Vpp (H)
7 16 Vpp (H)
8 85 V pp (H)

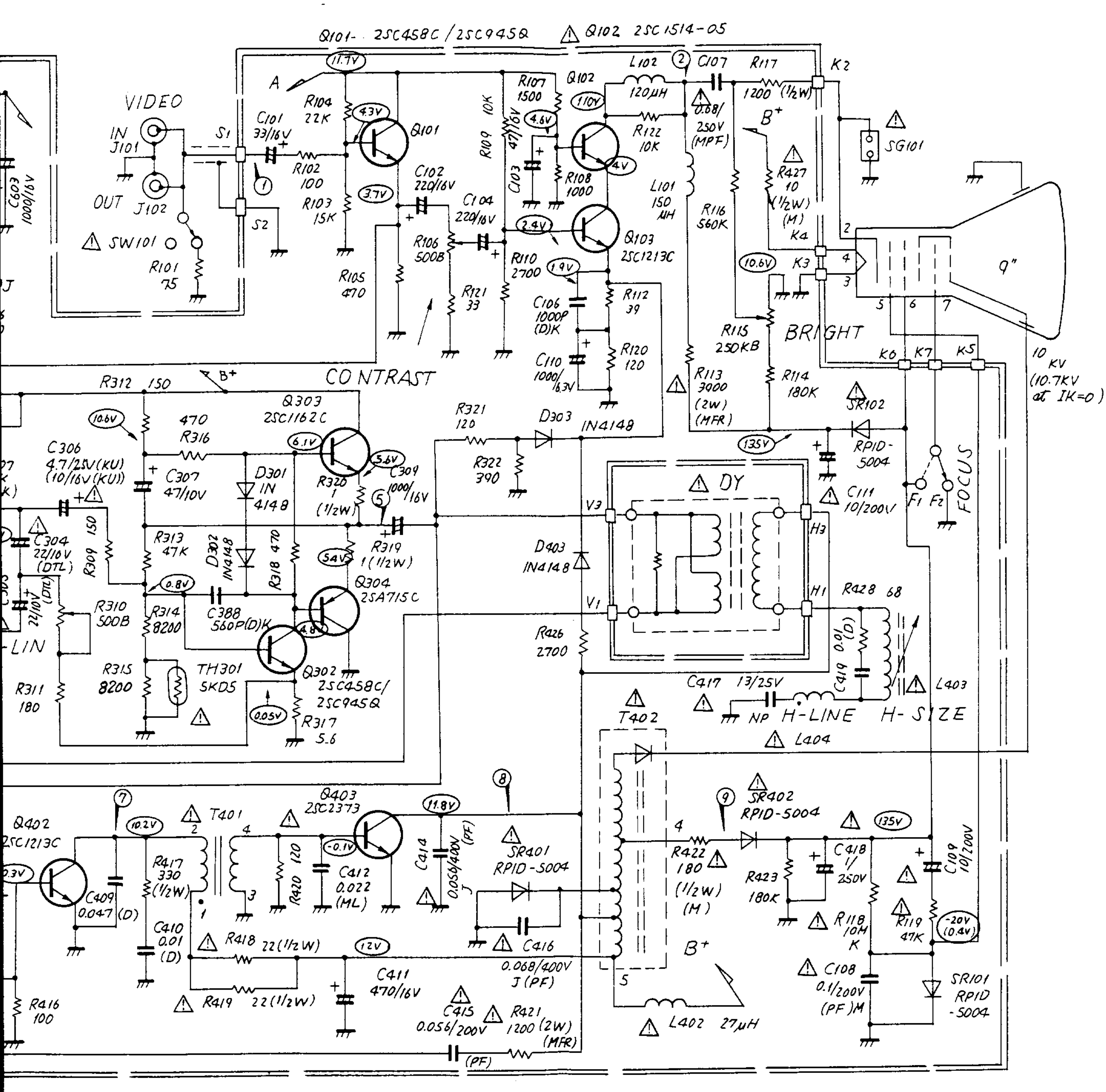

9 144 Vpp (H)


VM-900
T601
T
5
4
2
1
F601
SW601
AC100V
50/60Hz
VM-900U
T601
T
5
4
2
1
F601
SW601
AC 120V
60Hz
VM-900C
T601
T
5
4
2
1
F601
SW601
AC 120V
60Hz
VM-900 E/K
T601
(240V)
(220V)
(120V)
(100V)
T
5
4
2
1
F601
SW601


T601
F602
3A125V
SR603
G2B
T5
SR601
G2B
SR602
G2B
SR604
G2B
T4
ZD601
C601
3300/25V
T2
T1
SW601
F601
0.75A 250V
Q602
2SD1133C
R501
120
R506 100
(11.7V)
A
C504
220/16V
C502
100/16V
C501
1/50V
1.1V
(10.7V)
(11.7V)
Q502
2SC458C/
2SC945Q
C503
0.01(ML)
Q501
(11.4V)
(10.8V)
R301
33K
R302
22K
R503
1M
1.1V
(10.8V)
R505
2200
1.1V
(10.0V)
3
C302
0.0027J
(ML)
C301
0.0068
(ML)J
R504
8200
R509
680
Q501 2SA733Q/
2SA1015Y
R429 390
R405 3300
C401
0.0039J
(ML)
C404
0.022
(ML)
C405
0.047
(ML)
R402
6800
D401
1N34A
R430 2200
R404 3300
D402
1N34A
R403 6800
TH401
5KD5
R409
10K
R407 15K
C402
0.0033
(ML)
R401
8200
C403
0.022J
(ML)
H-HOLD
R408
50KE
R406 15K
R411 5600



T601
F602 3A125V
SR603 G2B
SR601 G2B
SR602 G2B
SR604
T5
T4
T2
T1
SW601
F601 0.75A 250V
C601 3300/25V
ZD601 EQA01-08S
R601 270 (1/2W)
C604 0.01(D)
Q601 2SA673
Q602 2SD1133C
R602 22(10W) (CT)
C602 22/16V
B+12V
TH601 D2BS
R603 390
C603 1000/16V
R604 1500
R605 1000B
R607 10
D601 1N 4148
B+ ADJ
R606 1500
VIDEO
IN J101
OUT J102
SW101
R101 75
S1
S2
Q101 2SC458C/2SC94
C101 33/16V
R102 100
R103 15K
R104 22K
R105 470
R106 500B
R121 33
C102 220/16V
C104 220/16V
R109 10K
R501 120
R506 100
C501 1/50V
C502 100/16V
C504 220/16V
R507 10
Q501
Q502 2SC458C/2SC945Q
C503 0.01(ML)
R503 1M
R504 8200
R505 2200
R509 680
Q501 2SA733Q/2SA1015Y
R301 33K
R302 22K
C302 0.0027J (ML)
C301 0.0068 (ML)J
R308 10KB V-SIZE
R305 15K
R307 10K (12K)
V-HOLD
R304 100KB (18K)
Q301 2SC458C/2SC945Q
C306 4.7/25V(KU) (10/16V(KU))
C304 22/16V (DTL)
C305 22/10V
R309 150
R310 500B
V-LIN
R324 1000
C303 0.082J (ML)
R323 3900
R306 1J (1/2W) (M)
R311 180
R312 150
B+
CONTRAST
Q303 2SC1162C
R316 470
C307 47/10V
D301 1N 4148
R320 1 (1/2W)
C309 1000/16V
R319 1(1/2W)
R313 47K
D302 1N4148
R318 470
R314 8200
C388 560P(D)K
Q304 2SA715C
Q302 2SC458C/2SC945Q
R315 8200
TH301 5KD5
R317 5.6
R321 120
R322 390
C310 0.01J (ML)
R303 4700
R429 390
R405 3300
C401 0.0039J (ML)
C404 0.022 (ML)
C405 0.047 (ML)
D401 1N34A
R402 6800
R430 2200
R404 3300
D402 1N34A
R403 6800
TH401 5KD5
R409 10K
R407 15K
R408 50KE
H-HOLD
R406 15K
C402 0.0033 (ML)
R401 8200
C403 0.022J (ML)
H-SUB. HOLD
R414 68
0.047/200VJ (PF)
L401
C408
R410 1500
R411 5600
C406 10/16
C407 0.01/20V (PF) J
R412 3900
Q401 2SA673C
R415 220
Q402 2SC1213C
C409 0.047(D)
R416 100
T401
R417 330 (1/2W)
C410 0.01 (D)
R418 22(1/2W)
R419 22(1/2W)
Q403 2SC2373
R420 120
C412 0.022 (ML)
C414 0.056/400V J (PF)
C411 470/16V
C415 0.056/200V
(PF)



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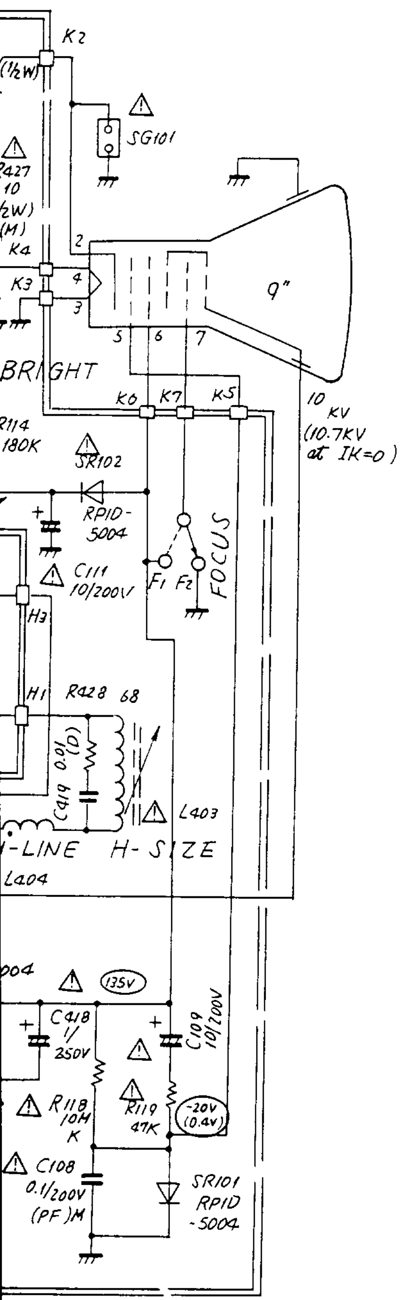


—— PRODUCT SAFETY NOTICE ——

Components marked with ⚠ have special characteristics important to safety. Before replacing any of these components read carefully the "PRODUCT SAFETY NOTICE" of service manual. Do not degrade the safety of the MONITOR through improper servicing.

—— Fundamental Schematic Diagram ——

Differences may be found between this schematic diagram and the servicing unit due to various improvements made here after.

—— NOTES ——

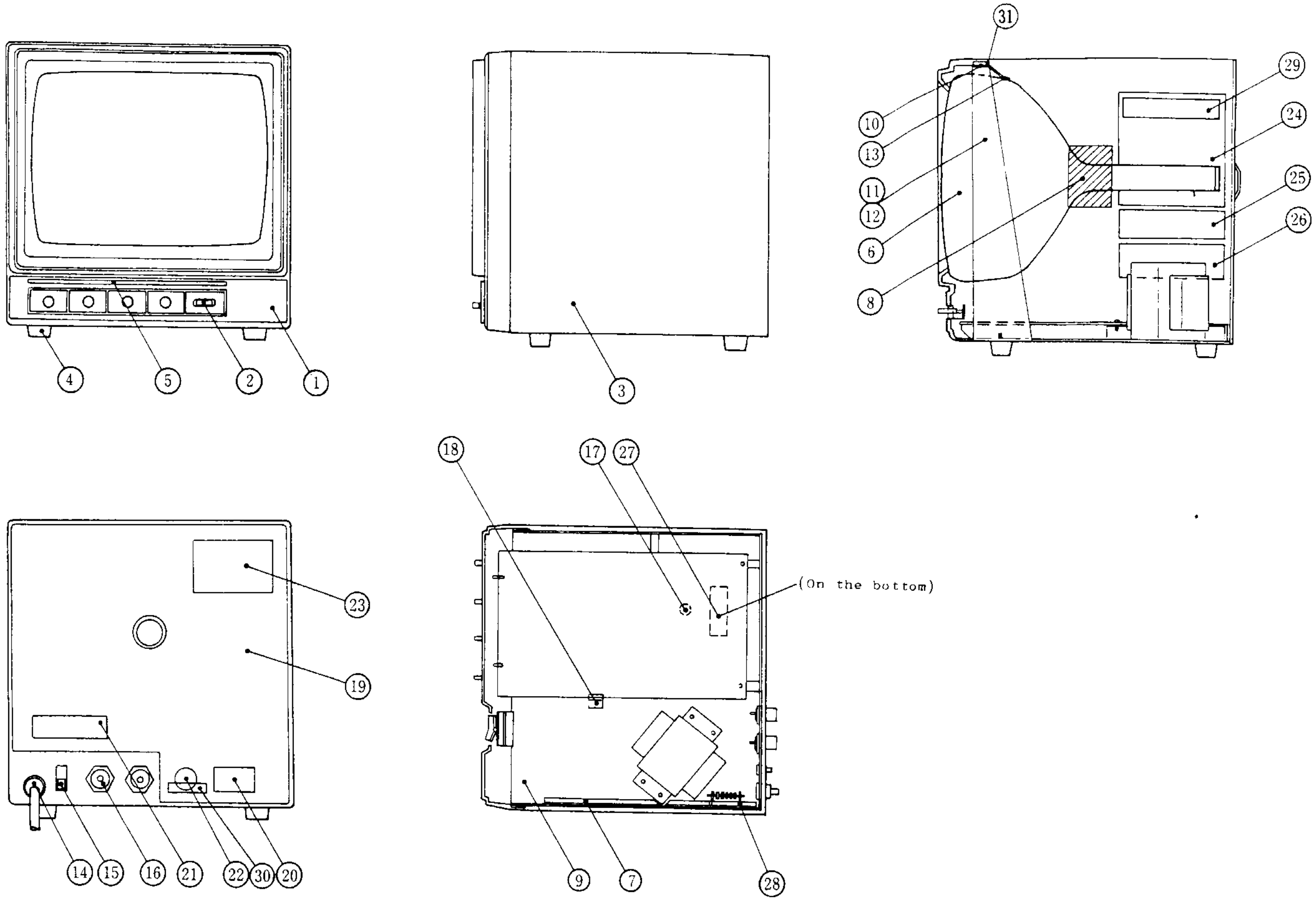
1. All marked voltages are taken under 1.0Vp-p video input (0.3Vp-p sync). Voltage values in parentheses are taken under no signal input.
2. All resistor values are in ohms. K=1,000, M=1,000,000
   Unspecified : Carbon film, ±5%, 1/4W
   (M) : Carbon solid. J: ±5%, unspecified : ±10%
   (MFR) : Metal film, ±5%
   (CT) : Cement wire-wound, ±5%
3. All capacitors are in μF, P represents PF.
   (ML) : Mylar, J: ±5%, unspecified : ±10%
   (D) : Ceramic, K: ±10%, unspecified : $^{+80}_{-20}$ %
   (PF) : Polyproplene, J: ±5%, M: ±20% unspecified : ±10%
   (MPF) : Motalized Mylar, ±10%
   (DTL) : TANTAL, ±20%
4. Compoment Values in ( ) are used for circuit of 50 fields.

	R305	R307	C306
60F	15KΩ	10KΩ	4.7μF. KU
50F	18KΩ	12KΩ	10μF. KU

VIDEO MONITOR, VM-900
SCHEMATIC DIAGRAM

13. MECHANICAL PARTS LIST AND EXTERNAL VIEW

Part Code	Symbol	Description	Sampo Parts Code	Qty	Remarks
297922A	△ 1	Mask, Front	MASK-1042-ASSY	1	
-	2	Switch, Power	-	1	
297923A	△ 3	Cabinet	ANG-HOLD-1054	1	J type
297923B	△	" (U)	ANG-HOLD-1054-U	1	U "
297923C	△	" (C)	ANG-HOLD-1054-C	1	C "
297923D	△	Cabinet (E,K)	ANG-HOLD-1054-E/K	1	E,K type
8364262A	△ 4	Foot	CUSHION-1050	4	
8364263A	5	Mask Plate	DEC-P-1381	1	
-	6	Picture Tube	-	1	
-	7	Heat Sink	RAD-P-1086	1	
-	8	Deflection Yoke	-	1	
297924A	△ 9	Chassis(J-50F, E,K)	ANG-PWB-1034-B -50	1	(50F) J,E,K type
297924D	△	Chassis (J-60F)	ANG-PWB-1034-B -60	1	J(60F) "
297924B	△	Chassis (U)	ANG-PWB-1034	1	U type
297924C	△	Chassis (C)	ANG-PWB-1034-A	1	C "
3165854A	△ 10	CRT Bracket (UP)	ANG-CRT-1022	1	
3165855A	△ 11	CRT Bracket(R)	ANG-CRT-1021	1	
3165856A	△ 12	CRT Bracket(L)	ANG-CRT-1020	1	
8364264A	△ 13	CRT Ground	EARTH-P-1014	1	
-	14	Cord Stop	-	1	
-	15	Switch, 75Ω-High	-	1	
-	16	Connector, M-type	-	1	
8364265A	△ 17	PCB Holder	CUSHION-1057	1	
8364266A	△ 18	PCB Holder	ANG-FIX-1164	1	
3165857B	△ 19	Cover, Rear(J)	ANG-FIX-1146-J	1	J type
3165857C	△	" , " (U)	ANG-FIX-1146-U	1	U "
3165857D	△	" , " (C)	ANG-FIX-1146-C	1	C "
3165857E	△	" , " (E, K)	ANG-FIX-1146-E/K	1	E,K "
-	20	Name Plate	-	1	
8364267A	21	Label, UL (1)	LABEL-1469	1	U type
8364268A		" , CSA (1)	LABEL-1657	1	C "
-	22	" , UL Mark	-	1	U "
8364269A	23	" , BRH	LABEL-1661	1	U "
8364270A	24	" , UL (2)	LABEL-1631	1	U "
8368291A	△ 25	Label, CSA (2)	LABEL-1249	1	C "
8368292A	26	Label, CSA Fuse	LABEL-1659	1	C "
8368293A	27	Label, SER. (50F)	LABEL-1629	1	J,E,K "
8368294A		Label, SER. (60F)	LABEL-1636	1	J,U,C "
-	28	Voltage Selecting Lug	-	1	
8368295A	29	Label, X-Ray	LABEL-1667	1	E,K type
4C38796A	30	Label, 60F	-	1	J(60F) "
4C38796B		Label, 50F	-	1	J(50F) "
8369950A	△ 31	Mask Bracket	ANG-FIX-1182	2	



VIDEO MONITOR, VM-900
EXTERNAL VIEW