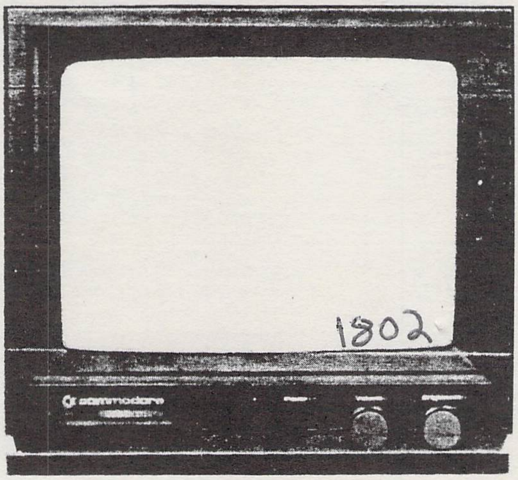
CM–141
SERVICE MANUAL



PN 314004-02

commodore

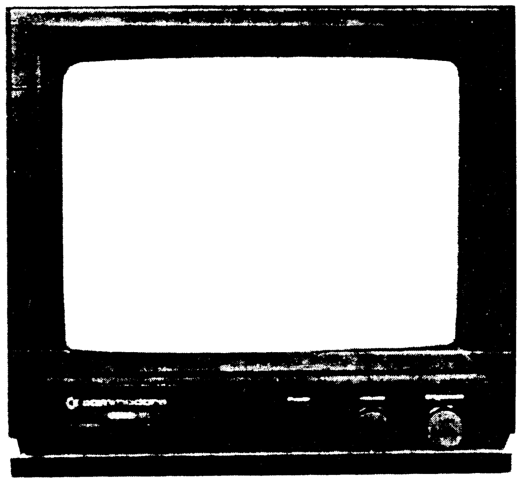
COLOR VIDEO MONITOR

JULY 1984

Commodore Business Machines, Inc.
1200 Wilson Drive, West Chester, Pennsylvania 19380 U.S.A.

CM–141
SERVICE MANUAL

CAUTION
Before servicing this chassis, it is important that service technician read the "Safety Precaution" and Product Safety Notices" in this service manual.



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SPECIFICATIONS

1. **SYSTEM** .... NTSC TV SYSTEM (With luminance and chrominance signal separate INPUT).

2. **CPT**
   *Type .... TV Grade CRT, Slit type screen
   *Size & Deflection Angle .... 13", 90° deflection angle
   *Neck Diameter .... 29.1 mm

3. **INPUT**
   3-1. Video Input
   Signal Type: Color video composite signal.
   Input Level: 1.0 Vp-p (Negative synchronous signals)

   3-2 Commodore Video Input
   1) Luminance Signal Input
   Signal Type .... Composite video signal
   Input Level 1.0Vp-p
   2) Chrominance Signal Input
   Signal Type .... NTSC chrominance signal
   Input Level 1.0Vp-p

   3-3 Audio
   *Input Signal .... 0.4V RMS max.

   3-4 Input Impedance
   *Video .... 75 ohm
   *Audio .... 10K ohm min.

4. **Input Terminal** .... RCA pin jack

5. **Horizontal Scanning Frequency** .... 15.75 KHz

6. **Vertical Scanning Frequency** .... 60 Hz

7. **Video Amplifier Type** .... Linear

8. **Horizontal Resolution (at center)** .... 270 lines

9. **Commendable Display Area** .... 235 × 190 (8 × 8 dot)

10. **Outside Controls**
    *Front Controls .... Volume, Brightness
    *Rear Controls .... Tint, Color, Contrast, H-Position, V-Hold
    *Side Controls .... Power ON/OFF

11. **Audio Output Power (Option)** .... 1.2 watts.

12. **Power Input** .... (AC) 120V, 60 Hz 0.8A

IMPORTANT SERVICE SAFETY PRECAUTION

Service work should be performed only after you are thoroughly familiar with all of the following safety checks and servicing guidelines.

WARNING

1. No modification of any circuit should be attempted for continued safety.
2. Disconnect the AC plug from the AC outlet before replacing parts.
3. Semiconductor heat sinks should be regarded as potential shock hazards when the chassis is operating.
4. The chassis in this receiver is hot. (connected to one side of the AC line).
   Use an isolation transformer between the line cord and power receptacle, when servicing this chassis.

SERVICING OF HIGH VOLTAGE SYSTEM AND PICTURE TUBE

When servicing the high voltage system, remove the static charge by connecting a 10K ohm Resistor in series with an insulated wire (such as a test probe) between the chassis and the anode lead. (AC line cord should be disconnected from AC outlet.)

1. Picture tube in this receiver employs integral implosion protection.
2. Replace with tube of the same type number for continued safety.
3. Do not lift picture tube by the neck.
4. Handle the picture tube only when wearing shatter-proof goggles and after discharging the high voltage completely.

X-RADIATION AND HIGH VOLTAGE LIMITS

1. Be sure your service personnel are aware of the procedures and instructions covering X-radiation. The only potential sources of X-ray in current solid state TV receivers is the picture tube. However, the picture tube does not emit measurable X-ray radiations if the high voltage is kept at factory-set levels.
   It is only when high voltage is excessive that X-radiation is capable of penetrating the shell of the picture tube including the lead in glass material. The important precaution is to keep the high voltage at factory-set levels.
2. It is essential that servicemen have available at all times an accurate high voltage meter. The calibration of this meter should be checked periodically.
3. High voltage should always be kept at rated valueno higher. Operation at higher voltages may cause a failure of the picture tube or high voltage circuitry and, also, under certain conditions, may produce radiation in excess of desirable levels. When the high voltage regulator is operating properly there is no possibility of an X-radiation problem. Every time a color chassis is serviced, the brightness should be tested while monitoring the high voltage with a meter to be certain that the high voltage does not exceed the specified value and that it is regulating correctly.

X-RADIATION AND HIGH VOLTAGE LIMITS (Continued)

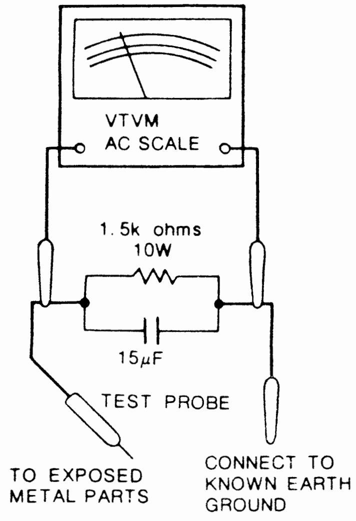
5. Do not use a picture tube other than that specified or make unrecommended circuit modifications in the high voltage circuitry.
6. When trouble shooting and taking test measurements on a receiver with an excessive high voltage, avoid being unnecessarily close to the receiver. Do not operate the receiver longer than is necessary to locate the cause of excessive voltage.

BEFORE RETURNING THE RECEIVER (Fire & Shock Hazard)

Before returning the receiver to the user, perform the following safety checks.

1. Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the receiver.
2. Inspect all protective devices such as non-metallic control knobs, insulating fishpapers, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacity networks, mechanical insulators etc.
3. To be sure that no shock hazard exists, check for leakage current in the following manner.
   - Plug the AC line cord directly into a 120 volt AC outlet. (Do not use an isolation transformer for this test.)
   - Using two clip leads, connect a 1.5K ohm, 10 watt resistor paralleled by a 0.15uF capacitor in series with all exposed metal cabinet parts and a known earth ground, such as water pipe or conduit.
   - Use a VTVM or VOM with 1000 ohm per volt, or higher, sensitivity to measure the AC voltage drop across the resistor (See Diagram).
   - Move the resistor connection to earth exposed metal part having a return path to the chassis (antenna, metal cabinet, screw heads, knobs and control shafts, escutcheon, etc.) and measure the AC voltage drop across the resistor.
     All checks must be repeated with the AC line cord plug connection reversed. (If necessary, a non-polarized adapter plug must be used only for the purpose of completing these checks.) Any reading of 0.3 volt RMS (this corresponds to 0.2 milliamp. AC.) or more is excessive and indicates a potential shock hazard which must be corrected before returning the receiver to the owner.

IMPORTANT SERVICE SAFETY PRECAUTION (Continued)



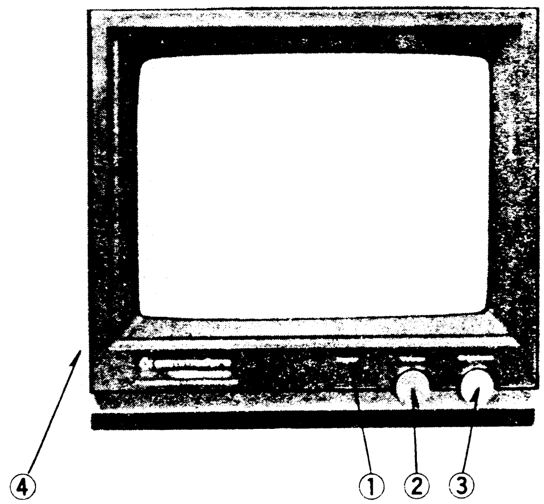
SAFETY NOTICE

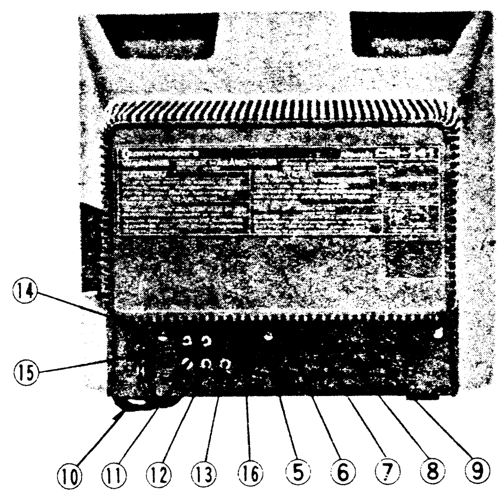
Many electrical and mechanical parts in television receivers have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them be necessarily increased by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this manual; electrical components having such features are identified by "Ⓢ"and shaded areas in the Replacement Parts Lists and Schematic Diagrams. For continued protection, replacement parts must be identical to those used in the original circuit. The use of a substitute replacement part which does not have the same safety characteristics as the factory recommended replacement parts shown in this service manual, may create shock, fire, X-radiation or other hazards.

MAJOR CIRCUIT FEATURES

1. Newly developed components.
   Hybrid-IC type STR 470A serves the stable B^+ output against input and load variations.
   In application of this reliable component, the power circuit has merits as listed:
   a. No adjustment for B^+ (DC115) output is necessary.
   b. Simplification of the circuit.
   c. No voltage setting against the variation of main power voltage is necessary.
2. MSI (Medium Scale Intergrated Circuit)
   This Monitor Consists of 3 MSIs.
   Each MSI is provided with the function of the conventional circuits, which enables it to improve reliability and stability of picture quality by reducing the number of parts and adjusting points.
3. Low Loss Vertical Output Circuit.
   The power loss in the vertical output circuit is reduced by changing over from high voltage to low voltage in the front and back halves of the scanning period.
4. High voltage Circuit
   FBT (flyback transformer) is multi-single type, that is, high voltage rectifier diodes are connected, between high voltage winding, and these are sealed.
   This FBT decreases the variation of picture size and reduces the dragging of the picture. The raised high voltage improves focussing to make picture quality better.

FRONT AND BACK VIEW





DESCRIPTION	OUT GOING STATUS
1. POWER INDICATER	
2. VOLUME	
3. BRIGHTNESS	
4. POWER SWITCH	OFF
5. TINT	CENTER
6. COLOR	CENTER
7. CONTRAST	CENTER
8. H. POSITION	—

DESCRIPTION	OUT GOING STATUS
9. V. HOLD	—
10. POWER CORD	—
11. VIDEO	—
12. LUMA	—
13. CHROMA	—
14. AUDIO-1	—
15. AUDIO-2	—
16. SIGNAL SELECT	—

CIRCUIT DESCRIPTIONS

1. POWER SUPPLY

This Monitor power supply is switching mode power supply (SMPS) that is consist of switching IC (IC901), SMPS TRANSFORMER (T901), pulse TRANSFORMER (T902) and associated component. The Basic theory of the SMPS is the circuit of Blocking Oscillation and by turning ON, OFF of STRA470A, the secondary of the SMPS TRANS is applied the pulse, instant +115V DC that pulse is rectifired is abtains.

All other operating voltage and pulse are drived from the secondary winding of the high voltage transformer (also called FBT, T703).

2. STAṘT UP CIRCUIT

An initial start-up circuit provides drive to the horizontial output stage when the set is initially turned on.

This circuit consists of Q703 and associated components. It proveds the initial voltage necessary to activate IC701 and provides a drive pulse to the horizontal drive transistor Q701.

Once the FBT-drived voltages operational, D708 is forward-biased and D701 is reverse-biared, providing +45V DC to IC701 and Q701. Switching voltage supply circuit like this results in saving power consumption.

3. HORIZONTAL DEFLECTION SYNCHRONIZATION AND VERTICAL

Integrated circuit IC701 performs the horizontal synchronization (also called horizontal oscillator).

A horizontal rate output pulse is coupled from IC701 pin 15 to horizontal driver Q701. The driver stage drives the horizontal output Q702.

Horizontal synchronization signal is derived from composite video signal which coupled to IC701 pin. 10.

Vertical synchronization signal is derived from composite signal at IC701 pin 8 and coupled to pin 7 through R601.

4. HORIZONTAL AFC AND OSCILLATION LIMITTER

AFC circuit is consists of phase detection circuit of IC701 and Q704, associated component. Oscillation limit circuit is necessary to prevent from excessive high voltage. This circuit is located in IC701 and controls the oscillator to maintain the control signal in correct frequency and phase with the horizontal sync signal.

5. X-RAY PROTECTION CIRCUIT

The X-ray protection circuit is consists of D703, R731 (Hold, Down) R729, R730 and associated component that connected to pin 16 of IC701. A pulse from FBT pin 6 is rectified by D705. Under normal operating conditions, the resultant voltage maintains at specified value.

If a malfunction causes excessive high voltage, the amplitude of pulse from FBT increases, causing a corresponding increase in D703 which results in vosltage increase at pin 16 of IC701. Voltage increase at IC701 pin 16 makes X-ray protection circuit conduct and horizontal oscilation operation no longer function.

The circuit will latch as above and the instrument is necessary to turn off for at least 30 seconds to function again.

6. VERTICAL OSCILLATION/DRIVE CIRCUIT

Vertical oscillation and drive circuit are located in IC701. R603, R605, R606, C604 and R604 which connected at IC701 pin 6 are time constant circuit that determine the vertical oscillation frequency. Vertical size control function is performed by R604, causing the negative feed back to change.

7. VERTICAL OUTPUT

Q601 and Q602 are SRPP (SHUNT REGULATED PUSH PULL) vertical output circuit.

45V-supply through D604, D605, C608 is the main voltage supply line.

R620, C613, D603 is pump up circuit which supplies sufficient current driving the first half of vertical scan.

8. HORIZONTAL DRIVE CIRCUIT

To obtain horizontal drive pulses from IC701 pin 15, the horizontal oscillator must be working.

Horizontal drive pulses from IC701 pin 15 are applied to horizontal driver Q701. B^+ for Q701 is is supplied from 45V line through D708. During initial receiver turn-on before the FBT—DRIVED SUPPLY VOLTAGE ARE DEVELOPED, Q701 is supplied initial B^+ from the regulated 115 volt line through R736.

9. HORIZONTAL OUTPUT

Horizontal drive pulses from Q701 are coupled through T703 to the bare of horizontal output Q702. Q702 is biased on when the beam is at about mid-screen.

The charge stored on C724, C729 causes current to flow through the horizontal yoke winding and Q702 to ground. When the beam reaches the right side of the screen, Q702 is turned off and the current in the yoke is directed into C719, C720. At the same time current flows into C719, C720 from the regulated B^+ via the FBT primary winding.

Due to resonance, the current then reverses and flows back through the horizontal yoke winding into C724, C729. This action defects the electron beam back to the +115V regulated B^+.

10. PINCUSHION CORRECTION

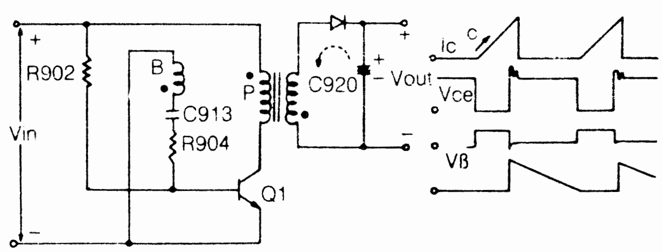
Pincushion correction circuit is T702 and its associated components.

Horizontal yoke current is increased or decreased in response to vertical parabola pulse.The circuit of Q751, Q752, T751 and associated component, is for improving high voltage transicent response.

11. POWER SUPPLY DETAIL DESCRIPTIONS

RCC (RINGING CHOKE CONVERTER)

1. Basic circuit and its operation



a) Q1 is biased by the starting resistor R902 and Q1 becomes ON.
b) Induced voltage will appear at base drive winding "B". And the loop current thru C913, R904, Q1B-E and "B" is added on bias current made by starting resistor.
c) Collector current of Q1 is increased making linear curves.
d) At this moment, there is induced voltage at secondary winding but it is blocked by D909.
e) Collector current is increased but it is limited because base current is constant. The limited current, threshold point is $H_{fe} \times$ Ib. Q1 is n until collector current reaches this point.

f) During Q1 is ON, input voltage Vin is added on the primary winding P. But, it is added on Q1 C-E suddenly.
g) At same time, inverted voltage appears at "B" which will bias Q1 B-E reversely and Q1 is OFF.
h) The energy charged in P is discharged by the secondary winding S thru D909.
i) Q1B-E biased reversely.
j) The energy is discharged thru D909 and when Id is zero, starting current by R902 makes Q1 on again.
Repeating from (a).

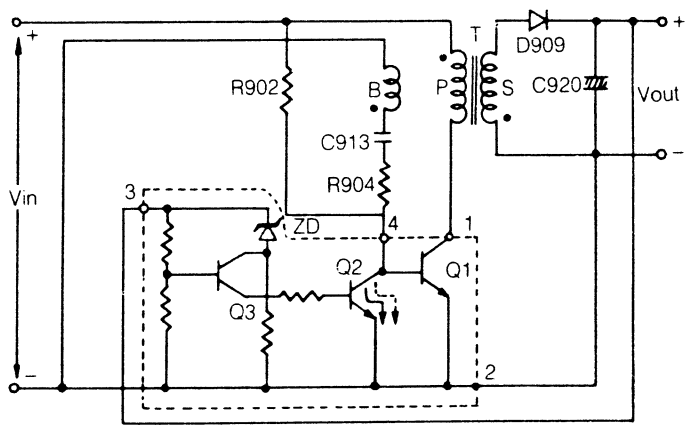
(In the actual case, restart is made by leakage inductance of the transformer and after starting by R902, switching of Q1 is kept continuously without R902.)

here:

- Energy charged in P is 1/2 $\times$ LI^2
- The curves of collector current at increasing is soft if inductance is large. The larger, the softer.
- Natural foldback characteristics is given to this circuit against over load and output short, so, additional protection circuit is not needed.

2. Operation circuit

(1) The operation circuit has function for voltage regulation in addition to the basic circuit.
When the output voltage is going to increase, base drive current is going to decrease, so that Q1 is switched off during small collector current and the output voltage is regulated.

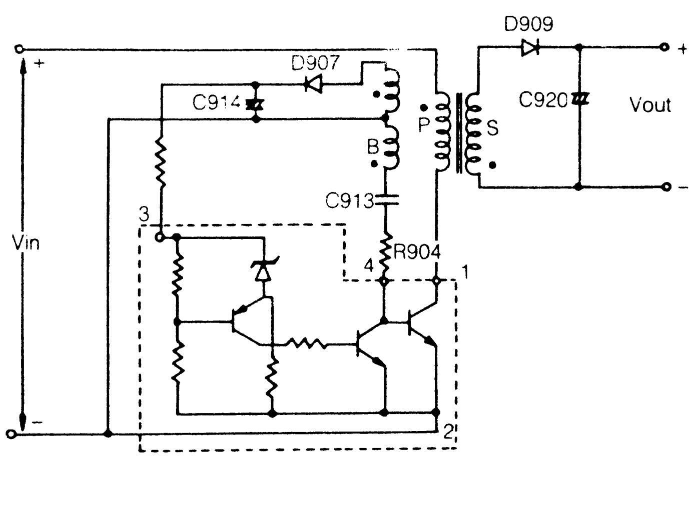


If the output voltage is going to exceed rated voltage, Q3 is switched on and Q2 is switched on and base current for Q1 is proportionately decreased. Voltage regulation is done like this.

$$\text{Switching frequency F is } \frac{\text{Vin}}{\text{Iout} \times \text{L}} \times k$$

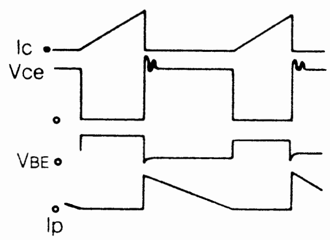
proportionate to input voltage and reversely proportionate to output current and inductance.

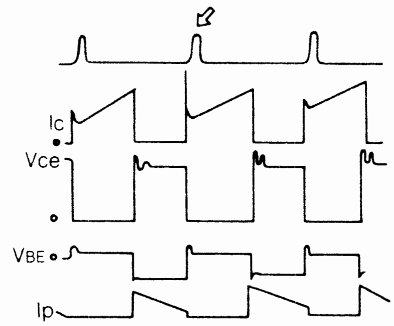
(2) If the output voltage is directly detected, the regulation accuracy is improved. But the secondary will not be insulated from primary. (Hot chassis) In order to make cold chassis, voltage detecting winding is to be added. The output voltage is regulated indirectly and secondary will be insulated from primary.
When this detecting winding is added, the winding construction is to be considered to get coupling characteristics. Split each winding into two and construct sandwich windings to improve load regulation.



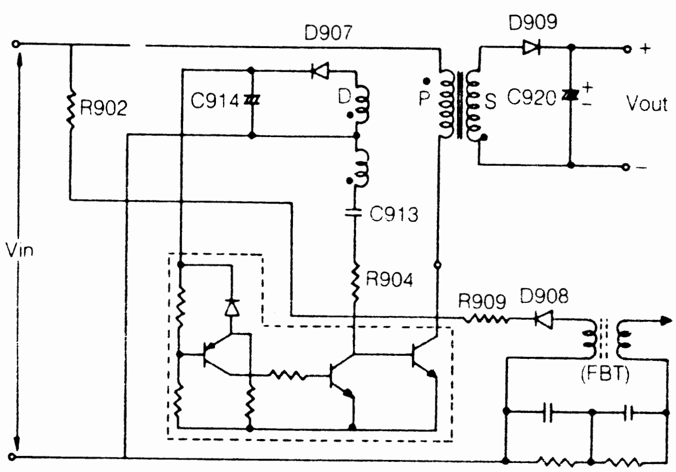
(3) it is possible to use the former SMPS at free running frequency as mentioned above. But it is also possible to lock the switching frequency to horizontal frequency.
In the latter case, frequency is constant and only Ton is changed. This is pulse Width MOdulation (PWM). If this is applied to CTV, the time of switch on is met to blanking time of CRT and noise suppression is easier than free frequency.
If locking to some frequency is needed, the primary inductance shall be determined so that the free running frequency before locking may be smaller than the horizontal frequency even if at worst case. (Worst case means that Vin is maximum and Io is minimum. The Fo will be the highest during free running without locking.)

(4) The wave shape of voltage and current at free Fo and locking respectively.

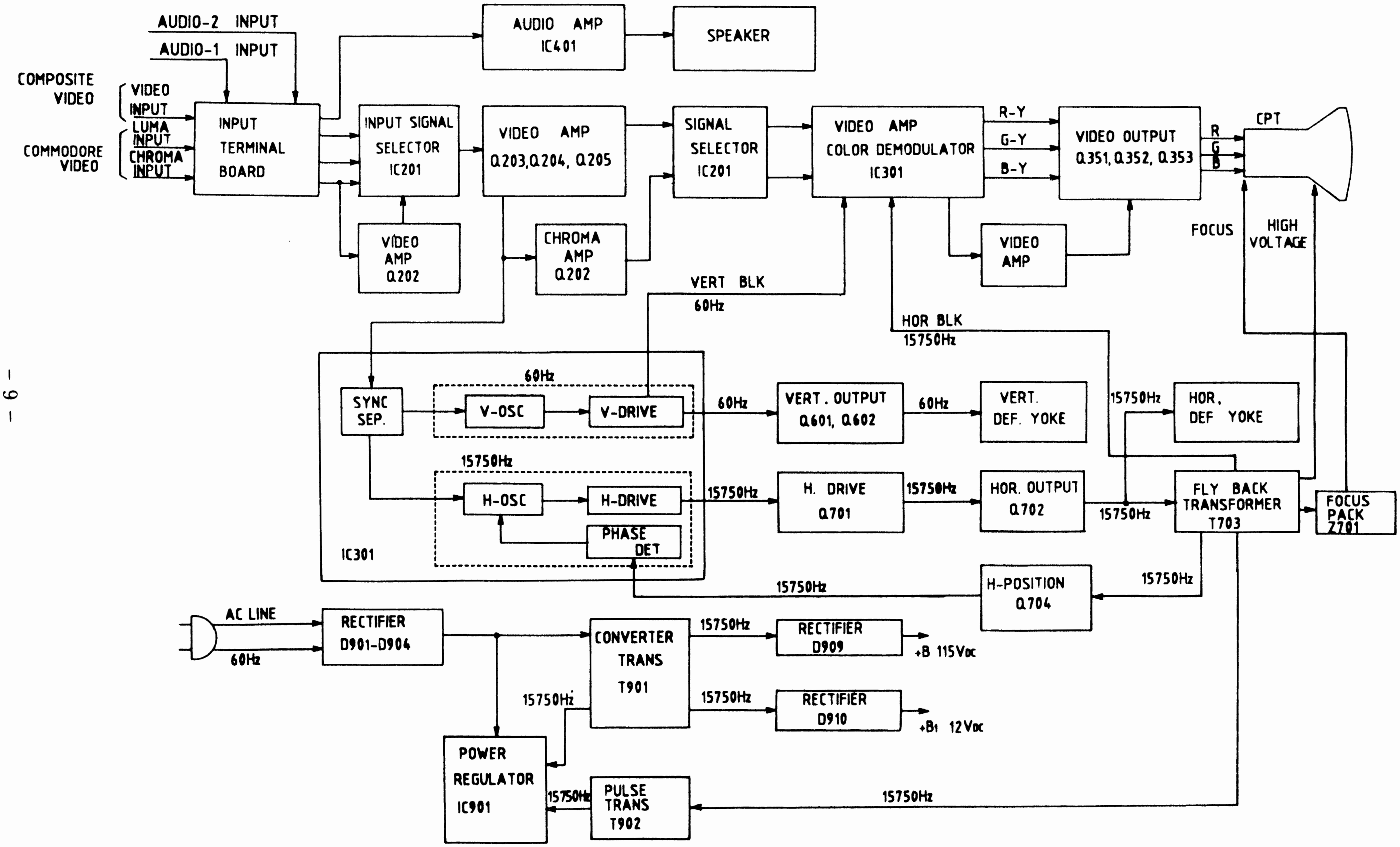




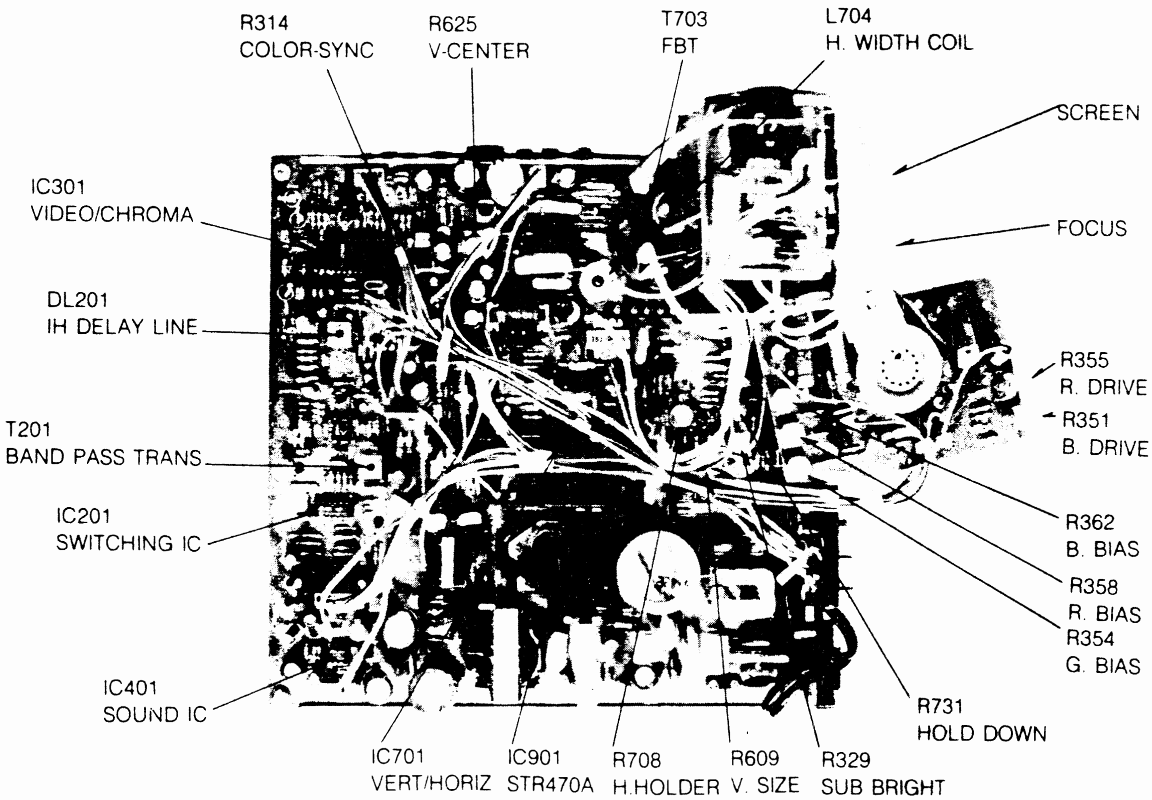
(5) Operation circuit for frequency locking.



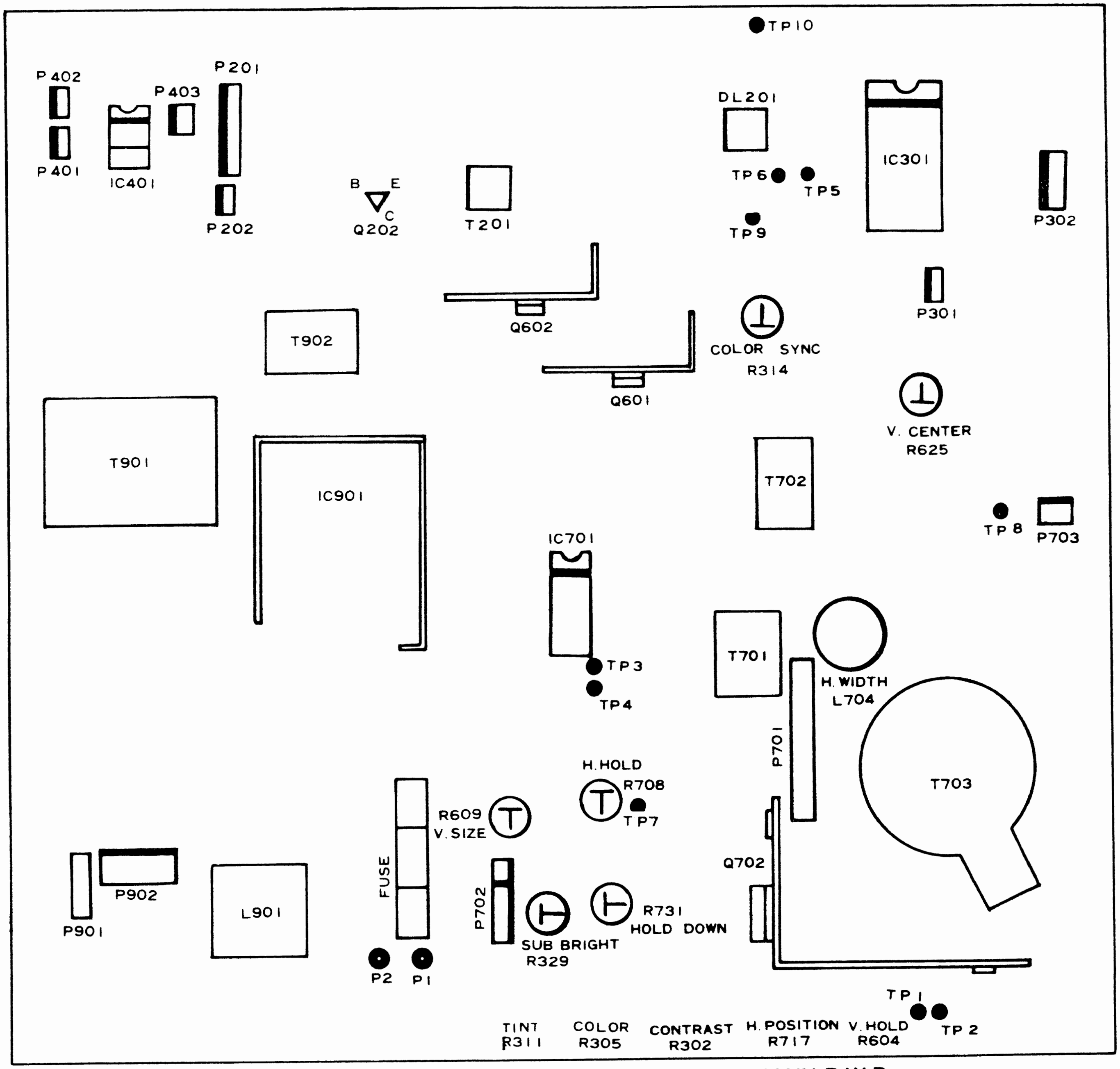
BLOCK DIAGRAM



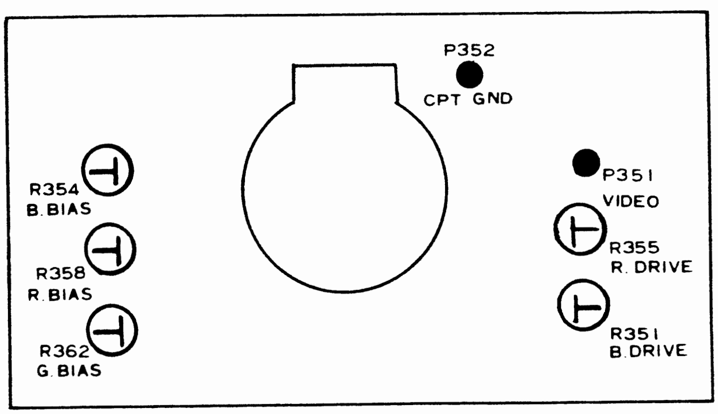
CHASSIS TOP VIEW



COMPONENT AND TEST POINT LOCATION



MAIN P.W.B.



C.P.T. P.W.B.

INSTALLATION AND SERVICE ADJUSTMENTS

1. GENERAL INFORMATIONS

All adjustments are thoroughly checked and corrected when the monitor leaves the factory. Therefore the monitor should operate normally and produce proper colour and pictures upon installation. However, serveral minor adjustments may be required depending on the particular location in which the monitor is operatede. This monitor is shipped completely in cardboard carton. Carefully draw out the monitor from the carton ad remove all packing materials.

Plug the power cord into a convenient 120 volts 60 Hz AC power outlet. Never connect to direct current or any other power outlet or frequency.

Check and adjust all the customer controls such as BRIGHTNESS, CONTRAST, and COLOUR Fint Controls to obtain natural colour or B/W picture.

2. AUTOMATIC DEGAUSSING

A degaussing coil is mounted around the picture tube so that external degaussing after moving the monitor is normally unnecessary, providing the monitor is properly degaussed upon installation. The degaussing coil operates for about 1 second after the power to the monitor is switched ON. If the set is moved or faced in a different direction, the power switch must be switched off at least 10 minutes in order that the automatic degaussing circuit operates properly.

Should the chassis or parts of the cabinet become magnetized to cause poor colour purity, use an external degaussing coil. Slowly move the degaussing coil around the faceplate of the picture tube, the sides and front of the monitor and slowly withdraw the coil to a distance of about 2 meters before disconnecting it from AC source. If colour shading still persists, perform the COLOUR PURITY ADJUSTMENT and CONVERGENCE ADJUSTMENTS procedures, as mentioned later.

3. HIGH VOLTAGE CHECK

CAUTION: There is no HIGH VOLTAGE ADJUSTMENT on this chassis. The +115 volt power supply must be properly adjsuted to insure the correct high voltage.

1. Connect an accurate high voltage meter to the second anode of the picture tube.
2. Turn on the move. Set the BRIGHTNESS and CONTRAST Controls to minimum (zero beam current).
3. High voltage will be measured below 25KV.
4. Rotate the BRIGHTNESS Control to both extremes to be sure the high voltage does not exceed the limit of 25 KV under any conditions.

4. FS CIRCUIT CHECK (Hold down)

The Fail Safe (FS) circuit check is indispensable for the final check in the servicing checking should be done following the steps below.

1. Turn the power S/W ON and adjust customer controls for normal operation
2. Connect a VTVM between TP7 (the cathode of D703) and the chassis ground.
3. Adjust Brightness, contrast, color volume for mechanical minimum.
4. Adjust Hold down VR (R731) on the main Board for the voltage at TP7 (the cathode voltage of D703) is 10.3±0.02V DC.
5. After the adjustment of the voltage, fix the Hold down VR (R731) with silicon bond.
6. Check the set is in hold down mode when the voltage of TP7 (the cathode voltage of D703) is 13.2V +0.5, −0V.
7. if this monitor is not the Fail Safe (FS), repeat steps 1 through 5.

5. HORIZONTAL OSCILLATOR ADJUSTMENT

If there is an indication of unstable horizontal sync., adjust the HORIZONTAL HOLD COntrol (R708). Adjust the HORIZONTAL HOLD Control to the centre of the pull-in range.

6. VERTICAL OSCILLATOR ADJUSTMENT

If the picture moves up or down on the screen, adjust the VERTICAL HOLD Control (R604) at the back of the monitor until there is a single image without vertical movement.

7. VERTICAL SIZE ADJUSTMENT

VerticalSize Control (R609) on MAIN Board changes the size of the picture or pattern, having an equal effect on the top and bottom. Make final adjustment for V-size of picture is 190 mm.

8. FOCUS ADJUSTMENT

Adjust FOCUS Control on FOCUS PACK Z701 for well defined scanning lines in the 1/4 and 3/4 point of the screen.

9. HORIZONTAL WIDTH ADJUSTMENT

Adjust the Horizontal width control coil (L704) by turning it with a hexagonal adjusting tool so that the width of the picture (DATA DISPLY AREA) is 240 mm.

10. COLOUR SYNC. ADJUSTMENT

1. Tune in a colour program and warm up for five minutes.
2. Connect terminal TP5 (the pin 8 of the IC301) and TP6 with a short jumper wire.
3. Then the colour stripes will appear on the screen when the adjustment is incorrect. Adjust the colour sync. VR (R314) so that the colour bar pattern stand still.
4. Remove the short jumper wire.

11. COLOUR PURITY ADJUSTMENT

NOTE: Before attempting any purity adjustments, the monitor should be operated for at least fifteen minutes.

1. Receive a video signal (raster) to the video input terminal.
2. Demagnetize the picture tube and cabnet using a degaussing coil.
3. Turn the CONTRAST and BRIGHTNESS Controls to maximum.
4. Adjust RED and BLUE CUT OFF controls (R358 and R354) to provide only a green raster. Advance the GREEN CUT OFF Control (R362) if necessary.
5. Loosen the clamp screw holding the yoke, and slide the yoke backward or forward to provide vertical green belt (zone) in the picture screen.
6. Remove the rubber Wedges.
7. Rotate and spread the tabs of the purity magnet (See figure 13) around the neck of the picture tube until a green belt is obtained in the center of the screen. And at the same time, center the raster vertically by adjusting the magnet.
8. Move the yoke slowly forward or backward until a uniform, green screen is obtained. Tighten the clamp screw.
9. Check the purity of the red and blue raster by adjusting the CUT OFF Controls.
10. tighten the clamp screw of the yoke temporarily.
11. Obtain a white raster; referring to "CRT GRAY SCALE ADJUSTMENT".
12. Proceed with convergence adjustment.

12. SUB-BRIGHTNESS ADJUSTMENT

1. Supply white color with a computer to the video input terminal.
2. Turn the contrast to be MAXIMUM with the contrast volume (fully clockwise) and BRIGHTNESS to be MINIMUM with the Bright Volume (fully count clock wise).
3. Adjust the Sub-Bright Volume (R239) to cutt off the picture slightly.

13. VERTICAL CENTER ADJUSTMENT

Adjust the V-Center Control (R625), so that the center of picture is the same as the mechanical center of color picture tube.

14. BAND PASS TRANS ADJUSTMENT (T201)

1. Supply a video signal to the video input terminal.
2. Connect oscilloscope probe to the base of Q202.
3. Turn the core of T201 so that the 3.58 MHz signal is maximized.

15. 3.58 MHz TRAP (DL201)

1. Supply a video signal to the video input terminal.
2. connect oscilloscope probe to the pin 27 of IC301.
3. Turn the core of PL201 so that the 3.58 MHz signal is minimized.

16. WHITE BALANCE ADJUSTMENT

1. Remove the input signal.
2. Remove the connector of the P351.
3. Short the terminal TP1 and TP2 with a jumber wire.
4. Turn the screen control fully counterclockwise.
5. By rotating the RED, GREEN, and BLUE bias controls (R358, R354, R362) counter clockwise from the maximum, set them to the 1/3 position.
6. Set the RED and BLUE DRIVE CONTROLS (R355, R351) to the mid-position.
7. Turn on the Monitor.
8. Rotate the SCREEN CONTROL gradually clockwise until the first horizontal line appears
9. Set the line to be white color with the other two Bias Controls (Except the first color Bias Control).
10. By Rotating the screen volume counter clockwise, adjust for the point that the horizontal line appears faintly.
11. Remove a jumper wire between terminals TP1 and TP2.
12. Adjust the RED and BLUE DRIVE CONTROLS to obtain proper white balanced picture in high light areas.
13. Rotate the BRIGHTNESS and CONTRAST CONTROLS to obtain dark gray raster. Then check the white balance in low brightness. If the white balance is not proper, retouch the BIAS CONTROLS and DRIVE CONTROLS to obtain a good white balance in both low and high light area.

17. CONVERGENCE ADJUSTMENTS

NOTE: Before attempting any convergence adjustments, the receiver should be operated for at least fifteen minutes.

Contre Convergence Adjustment

1. Supply crosshatch pattern with a color bar signal generator to the video input.
2. Adjust the BRIGHTNESS and CONTRAST Controls for well defined pattern.
3. Adjust two tabs of the 4-Pole Magnets to change the angle between them (See figure 2) and superimpose red and blue vertical lines in the center area of the picture screen. (See figure 2).
4. Turn the both tabs at the same time keeping the angel constant to superimpose red and blue horizontal lines at the centre of the screen. (See figure 3)
5. Adjust two tabs of 6-Pole Magnets to superimpose red/blue line and green one, adjusting the angle affects the vertical lines and rotating both magnets affects the horizontal lines.
6. Repeat adjustments 3,4,5 with understanding red, green and blue movement, because 4-Pole Magnets and 6-Pole Magnets have mutual affection and it makes dots movement complex.

- **Circumference Convergence Adjustment**

1. Loosen the clamping screw of deflection yoke to allow the yoke to tilt.
2. Put a wedge as shown in figure 1 temporarily. (Do not remove cover paper on adhesive part of the wedge.)
3. Tilt front of the deflection yoke up or down to obtain better convergence in circumference. (See figure 1 push the mounted wedge into the space between picture tube and the yoke to fix the yoke temporarlly.
4. Put other wedge into bottom space and remove the cover paper to stick.
5. Tilt front of the yoke right or left to obtain better convergence in circumference. (See figure 1)
6. Keep the yoke position and put another wedge in eighter upper space. Remove cover paper and stick the wedge on picture tube to fix the yoke.
7. Detach the temporarily mounted wedge and put it in another upper space. Stick it on picture tube to fix the yoke.
8. After fixing three wedges, recheck overall convergenc. Tighten the screw firmly to fix the yoke and check the yoke is firm.
9. Stick 3 adhesive tapes on wedges as shown in figure 1.

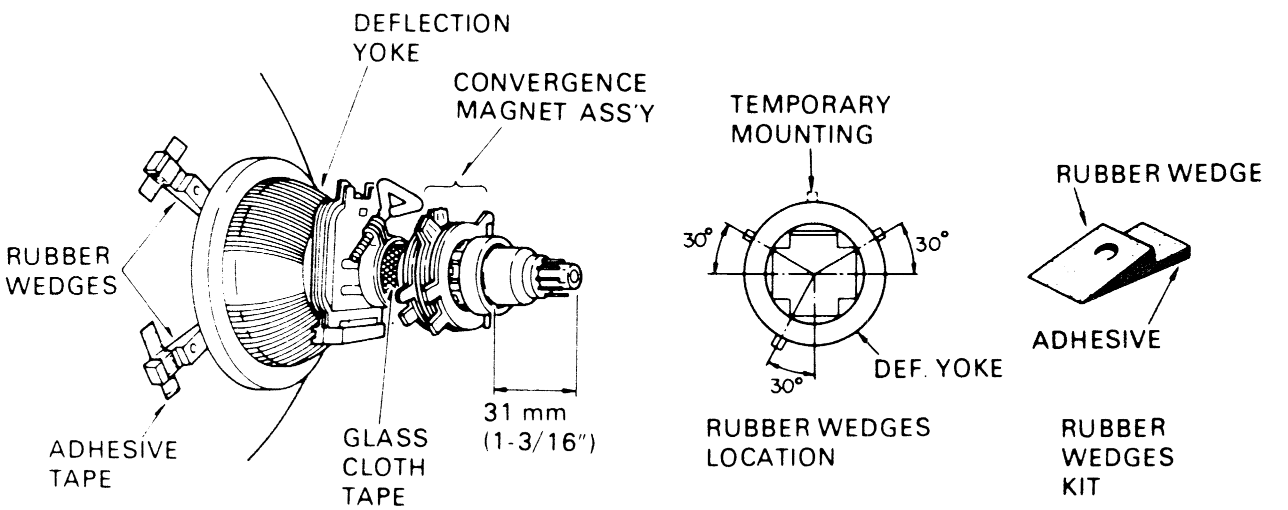


FIGURE 1.

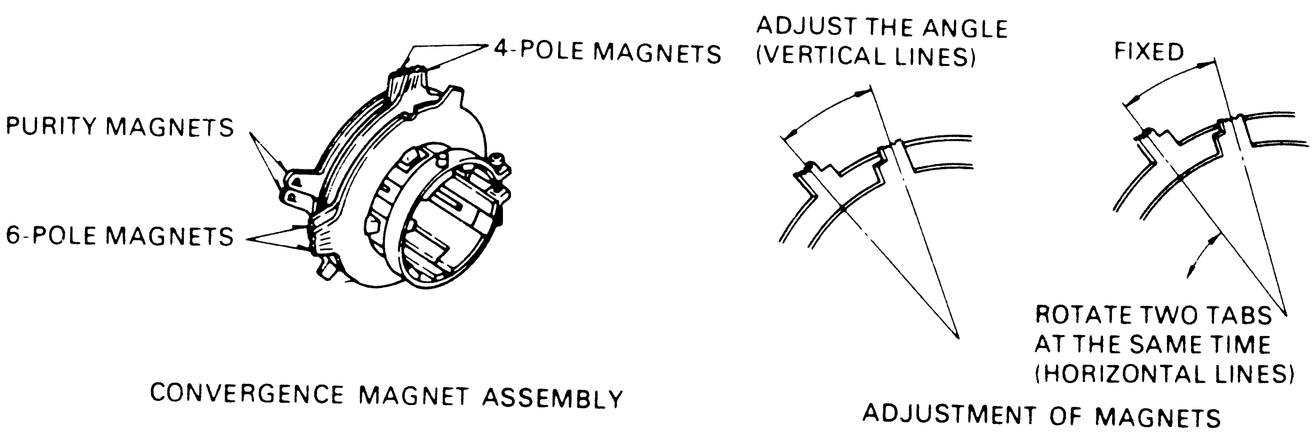
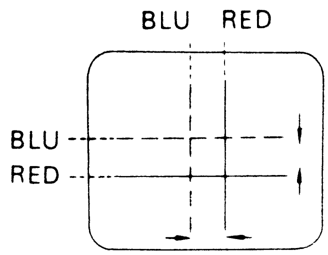
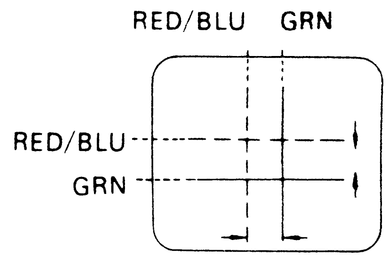


FIGURE 2.

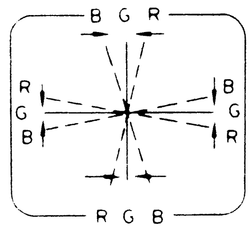


4-POLE MAGNETS MOVEMENT

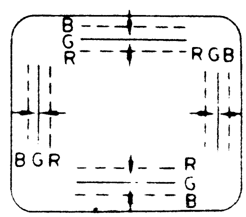


6-POLE MAGNETS MOVEMENT

Centre Convergence by Convergence Magnets



INCLINE THE YOKE UP (OR DOWN)



INCLINE THE YOKE RIGHT (OR LEFT)

Circumference by DEF Yoke

FIGURE 3. DOT MOVEMENT PATTERN

REPLACEMENT PARTS LIST

CAUTION: Before replacing any these components, read carefully the "SAFETY PRECAUTION" on page 3. Do not degrade the safety of the receiver through improper servicing.

ABBREVIATIONS: Capacitors .... CC: ceramic (TC), CE: Chemical, CK: Ceramic (Hi-K), MPP: Metalized Polypropylens, BP: Bipolor, CQ: Myler, PE: Polyester, PP: Polypropylene
Resistors .... RD: Carbon Film, RS: Metal Oxide Film, RN: Metal Film, RV: Variable
RF: Fusing, SR: Semifix

(All CC and plastic Capacitors are ±5%, 50 Volts and all resistor, ±5%, 1/8W unless other wise noted).
Ⓢ : Recommend Service Parts

1. MAIN PWB

LOCATION NUMBER	PART NO.	DESCRIPTION
		RESISTOR
R201		RD, 1/8W, 75 ohm
R202		RD, 1/8W, 100 ohm
R203		RD, 1/8W 100 ohm
R204		RD, 1/8W 30 ohm
R205		RD, 1/8W 47 ohm
R206		RD, 1/8W 360 ohm, G
R207		RD, 1/8W 330 ohm
R208		RD, 1/8W 330 ohm
R209		RD, 1/8W 68 ohm
R210		RD, 1/8W 82 ohm
R211		RD, 1/8W 5.6K
R212		RD, 1/8W 5.6K
R213		RD, 1/8W 5.6K
R214		RD, 1/8W 10K
R215		RD, 1/8W 10K
R216		RD, 1/8W 10K
R217		RD, 1/8W 33K
R218		RD, 1/8W 33K
R219		RD, 1/8W 33K
R220		RD, 1/8W 1K
R221		RD, 1/8W 47K
R222		RD, 1/8W 1K
R223		RD, 1/8W 470 ohm
R224		RD, 1/8W 1K
R225		RD, 1/8W 39K
R226		RD, 1/8W 1.8K
R227		RD, 1/8W 1.8K
R228		RD, 1/8W 3.6K
R229		RD, 1/8W 3.6K
R230		RD, 1/8W 33K
R231		RD, 1/8W 68K
R232		RD, 1/8W 33K
R233		RD, 1/8W 4.7K
R234		RD, 1/8W 27K
R235		RD, 1/8W 330 ohm
R236		RD, 1/8W 1K
R238		RD, 1/8W 150 ohm
R239		RD, 1/2W 82 ohm
R240		RD, 1/2W 1.5K
R301		RD, 1/8W 2.4K
R302 Ⓢ		RV, 10KB
R303		RD, 1/8W 8.2K
R304		RD, 1/8W 5.1K
R305 Ⓢ		RV, 10KB
R306		RD, 1/8W 15K

LOCATION NUMBER	PART NO.	DESCRIPTION
R307		RD, 1/8W 820 K
R308		RD, 1/8W 22 ohm
R309		RD, 1/8W 1.2K
R310		RD, 1/8W 15K
R311 Ⓢ		RV, 10KB
R312		RD, 1/8W 5.1K
R313		RD, 1/8W 1.5K
R314 Ⓢ		SR-19R 47KB
R315		RD, 1/8W 200K
R316		RD, 1/8W 1K
R317		RD, 1/8W 1K
R318		RD, 1/8W 5.6K
R319		RD, 1/8W 5.6K
R320		RD, 1/8W 180 ohm
R322		RD, 1/8W 470 ohm
R323		RD, 1/8W 8.2K
R324		RD, 1/8W 2.2K
R325		RD, 1/8W 560 ohm
R326		RD, 1/8W 51K
R328		RD, 1/8W 15K
R329 Ⓢ		SR-19R 4.7KB
R330		RD, 1/8W 330 ohm
R331		RD, 1/8W 330 ohm
R332		RD, 1/8W 330 ohm
R333		RD, 1/8W 3.3K
R334		RD, 1/8W 3.3K
R335		RD, 1/8W 3.3K
R336		RD, 1/8W 4.7K
R337		RD, 1/8W 100 ohm
R338		RD, 1/8W 560 ohm
R339		RD, 1/8W 33 ohm
R340		RD, 1/8W 100K
R601		RD, 1/8W 8.2K
R602		RD, 1/8W 120 ohm
R603		RD, 1/8W 4.3K
R604 Ⓢ		RV, 5KA
R605		RD, 1/8W 3.9K
R606		RD, 1/8W 8.2K
R607		RD, 1/2W 560 ohm
R608		RD, 1/8W 22K
R609 Ⓢ		SR-19R 470B
R610		RD, 1/8W 270 ohm
R611		RD, 1/8W 2.2K
R612		RD, 1/2W 5.1 ohm
R613		RS, 1W 560 ohm
R614		RD, 1/2W 270 ohm

PRODUCT SAFETY NOTE: Components shaded have special characteristics important to safety. Before replacing any of these components, read carefully the PRODUCT SAFETY NOTICE of this service manual. Dont degarde the safety of the receiver through improper servicing.

LOCATION NUMBER	PART NO.	DESCRIPTION
R615		RD, 1/8W 8.2K
R616		RD, 1/8W 12K
R617		RD, 1/8W 470 ohm
R618		RS, 1W 10 ohm
R619 Ⓢ		RF, 1/2W 10 ohm
R620		RN, 1W 4.7 ohm
R621		RS, 1W 51 ohm
R622 Ⓢ		RF, 1W 5.1 ohm
R623		RD, 1/2W 1K
R624		RD, 1/2W 2.2K
R625 Ⓢ		SR-19R 4.7KB
R627		RD, 1/2W 5.1 ohm
R628		RD, 1/8W 5.6 K
R631		RD, 1/8W 1K
R632		RD, 1/8W 10K
R630		RS, 1W 15K ohm
R701		RD 1/8W 120 ohm
R702		RD, 1/8W 56K
R703		RD, 1/8W 1K
R704		RD, 1/8W 68K
R705		RD, 1/8W 15K
R706		RD, 1/8W 10K
R707		RD, 1/8W 10K
R708 Ⓢ		SR-19R 10KB
R709		RD, 1/8W 47 ohm
R710		RD, 1/8W 470 ohm
R711		RD, 1/8W 4.7K
R712		RD, 1/8W 82 ohm
R713		RD, 1/8W 47K
R714		RD, 1/8W 1K
R715		RD, 1/8W 22K
R716		RD, 1/8W 12K
R717 Ⓢ		RV, 10KB
R718		RD, 1/8W 8.2K
R719		RD, 1/8W 4.7K
R720		RS, 1W 4.7K
R721		RN 1/2W 0.47 ohm
R723		RD, 1/2W 150K
R724		RD, 1/2W 1K
R725		RD, 1/8W 270K
R726		RD, 1/8W 6.8K
R727		RD, 1/8W 390 ohm
R728		RD, 1/2W 5.6 ohm
R729		RD, 1/8W 1K
R730		RD, 1/8W 1K
R731 Ⓢ		SR-19R 2.2KB
R732		RS, 1W 820 ohm
R733		RD, 1/8W 82K
R734		RS, 1/2W 1.5K
R735		RD, 1/8W 39K
R736		RD, 1/2W 220 ohm
R737		RS, 1W 1.8K
R741		RD, 1/8W 5.6K
R738		RS, 1W 1K
R401		RD, 1/8W 6.8K
R403		RD, 1/8W 150K
R404		RD, 1/8W 47K

LOCATION NUMBER	PART NO.	DESCRIPTION
R405		RD, 1/8W 120K
R406		RD, 1/2W 5.6 ohm
R411		RD, 1/8W 1.2K
R901 Ⓢ		RWR, 10W 3.3 ohm
R902		RD, 1/2W 150K
R903 Ⓢ		RS, 5W 10K
R904		RS, 1W 220 ohm
R906 Ⓢ		RC, 1/2W 2.2M
R907 Ⓢ		RC, 1/2W 2.2M
R908		RN, 1/2W 0.47 ohm
R909		RS, 1W 56 ohm
TH901		THERMITOR PTH 631-04 BF7 ROM140
		CAPACITOR
C201		CE, 10uF 16V
C202		CE, 10uF 16V
C203		CE, 10uF 16V
C204		CK, 103pF +80%, −20%
C205		CK, 103pF +80%, −20%
C206		CE, 10uF 16V
C207		CC, 39pF ±5%
C208		CE, 10uF 16V
C210		CK, 103pF +80%, −20%
C211		CK, 103pF +80%, −20%
C212		CK, 103pF +80%, −20%
C213 Ⓢ		BP, 10uF 16V
C214		CE, 10uF 16V
C215		CE 220uF 16V
C217		CK, 103pF +80%, −20%
C218		CE, 47uF 16V
C301		CK, 103pF +80%, −20%
C302		CK, 103pF +80%, −20%
C303		CE, 1uF 50V
C304		CE, 1uF 50V
C305		CE, 1uF 50V
C306		CC, 39pF ±5%
C307		CK, 103pF +80%, −20%
C308		CE, 1uF 50V
C309		CC, 22pF ±5%
C310		CC, 27pF ±5%
C311		CE, 10uF 16V
C312		CQ, 333pF ±10%
C313		CC, 470pF ±5%
C314		CK, 470pF ±5%
C315		CE, 1uF 50V
C316		CK, 103pF +80%, −20%
C317		CE, 220uF 16V
C318		CE, 4.7uF 50V
C319		CK, 103pF +80%, −20%
C320		CE, 10uF 16V
C321		CE, 10uF 16V
C322		CE, 0.47uF 50V
C323		CC, 270pF ±5%
C324		CC, 270pF ±5%
C325		CC, 270pF ±5%

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LOCATION NUMBER	PART NO.	DESCRIPTION
C401		CE, 2.2uF 50V
C402		CE, 4.7uF 50V
C403		CE, 220uF 16V
C404		CC, 100pF ±5%
C405		CE, 47uF 16V
C406		CE, 220uF 16V
C407		CE, 1000uF 16V
C408		CQ, 104pF ±10%
C409		CK, 103pF +80%, −20%
C601		CE, 1uF 50V
C602		CQ, 223pF ±10%
C603		CQ, 473pF ±10%
C604 Ⓢ		PE, 682pF ±5%
C605 Ⓢ		TANTAL 1uF 25V
C606		CE, 330uF 16V
C607		CQ, 153pF ±10%
C608		CE, 100uF 50V
C609 Ⓢ		CE, 10uF 50V
C610 Ⓢ		CE, 3.3uF 50V
C611		CE, 33uF 16V
C612		CE, 6.8uF 160V
C613 Ⓢ		PP, 333pF ±10% 200V
C614		CE, 100uF 50V
C615		CE, 330uF 16V
C616		CE, 100uF 16V
C617		CQ, 103pF ±10%
C618		CE, 220uF 160V
C619		CE, 1000uF 25V
C620		CE, 180pF ±10%
C631		CE, 47uF 16V
C701		CE, 1uF 50V
C702		CC, 270pF ±5%
C703 Ⓢ		PE, 153pF ±10%
C704 Ⓢ		PE, 682pF ±10%
C705		CE, 1uF 50V
C706 Ⓢ		PP, 562pF ±10% 200V
C707		CC, 270pF ±5%
C708		CK, 103pF +80%, −20%
C709		CE, 22uF 16V
C710		CE, 33uF 16V
C711		CK, 103pF +80%, −20%
C712		CQ, 333pF ±10%
C713		CK, 270pF ±10% 500V
C714		CK, 820pF ±10% 500V
C715		CC, 82pF ±5%
C716		CK, 560pF ±10%
C717 Ⓢ		PP, 223pF ±10% 200V
C718		CE, 33uF 25V
C719 Ⓢ		MPP, 682pF ±5% 1.2KV
C720 Ⓢ		PP, 222pF ±5% 1.6KV
C721 Ⓢ		CE, 33uF 160V (H.R)
C722		CQ, 103pF ±10%
C723		BP, 1uF 50V
C724		PP, 270pF ±5% 200V
C727		CE, 4.7uF 250V
C728		CC, 470pF ±5%
C729 Ⓢ		PP, 333pF ±10% 200V

LOCATION NUMBER	PART NO.	DESCRIPTION
C901 Ⓢ		MPP, 0.1uF ±20% 125V
C902 Ⓢ		MPP, 0.1uF ±20% AC 125V
C903		CK, 472pF ±10%
C904		CK, 472pF ±10%
C905		CK, 472pF ±10%
C906		CK, 472pF ±10%
C907 Ⓢ		CE, 560uF 200V
C909		CE, 10uF 250V
C910 Ⓢ		PP, 272pF ±10% 600V
C911 Ⓢ		PP, 123pF ±5% 630V
C912 Ⓢ		CK, 470pF ±10%, 2KV
C913 Ⓢ		PE, 154pF ±20%, 100V
C914		CE, 10uF 160V
C915		CK, 102pF ±10% 1KV
C917		CK, 102pF ±10% 500V
C918 Ⓢ		AC125V 472pF UL/CSA
C919 Ⓢ		AC125V 472pF UL/CSA
C920 Ⓢ		CE, 220uF 160V
C921		CE, 1000uF 25V
C922		CK, 332pF ±10% 500V
C930		AC125V 4700pF ULCSA
C931		CE, 10uF 100V
TRANSISTOR AND DIODE		
Q201 Ⓢ		KTC 1815-O/Y
Q202 Ⓢ		KTC 1959-O/Y
Q203 Ⓢ		KTC 1815-O/Y
Q204 Ⓢ		KTC 1815-O/Y
Q205 Ⓢ		KTC 1815-O/Y
Q301 Ⓢ		KTC 562TM-O/Y
Q601 Ⓢ		MJE 9730
Q602 Ⓢ		MJE 9730
Q701 Ⓢ		KTC 2068-FA-1
Q702 Ⓢ		2SD1453
Q703 Ⓢ		KTC 2229-O/Y
Q704 Ⓢ		KTC 1959-O/Y
D201 Ⓢ		KDS 1555
D202 Ⓢ		KDS 1555
D203 Ⓢ		KDS 1555
D204 Ⓢ		KDS 1555
D205 Ⓢ		KDS 1555
D206 Ⓢ		KDS 1555
D207 Ⓢ		LED RED (SLP-162B)
D601 Ⓢ		KDS 1555
D602 Ⓢ		KDS 1555
D603 Ⓢ		RH-1ZV
D604 Ⓢ		1N 4002
D605 Ⓢ		RH-1AV

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LOCATION NUMBER	PART NO.	DESCRIPTION
D606		IN4004
D607		RU-1V
D608 Ⓢ		IN4002
D609 Ⓢ		KDS 1555
D610 Ⓢ		RD, 9.1EB
D611 Ⓢ		KDS1555
D701 Ⓢ		KDS 1553
D702 Ⓢ		VARISTOR RVDFV-212
D703 Ⓢ		RD, 11E-B2 (ZENER)
D704 Ⓢ		RD, 11E-B2 (ZENER)
D705 Ⓢ		SIB-01-01V
D706 Ⓢ		KDS 1553
D707 Ⓢ		RH-1MV
D708 Ⓢ		IN4002
D709 Ⓢ		KDS 1555
D901 Ⓢ		IN4005GP
D902 Ⓢ		IN4005GP
D903 Ⓢ		IN4005GP
D904 Ⓢ		IN4005GP
D905 Ⓢ		RGP10G
D906 Ⓢ		RGP10G
D907 Ⓢ		RGP10G
D908 Ⓢ		RGP10G
D909 Ⓢ		RGP10G
D910 Ⓢ		RGP10G
D921 Ⓢ		RGP10G
D922 Ⓢ		RGP10G
	COIL AND TRANS	
L201 Ⓢ		COIL PEAKING 15uH
L202 Ⓢ		COIL PEAKING 3.3uH
L301 Ⓢ		COIL CHOKE 15mH
L302 Ⓢ		COIL PEAKING 20uH
L303 Ⓢ		COIL PEAKING 56uH
L304 Ⓢ		COIL PEAKING 22uH
L305 Ⓢ		COIL PEAKING 22uH
L306 Ⓢ		COIL PEAKING 22uH
L701 Ⓢ		CORE FERRITE
L702 Ⓢ		CORE FERRITE
L704 Ⓢ		COIL. H. WIDTH
L705 Ⓢ		COIL. H. LIN
L706 Ⓢ		COIL CHOKE 100uH
L901 Ⓢ		COIL LINE FILTER
L902 Ⓢ		COIL CHOKE 10.3uH
L904 Ⓢ		COIL FERRITE
L905 Ⓢ		COIL CHOKE 1.04uH
L906 Ⓢ		COIL HCOKE 10.3uH
T703 Ⓢ		F.B.T.
T201 Ⓢ		COIL BAND PASS TRANS
T701 Ⓢ		TRANS. H. DRIVING
T702 Ⓢ		TRANS. SIDE PCC
T901 Ⓢ		TRANS. CONVERTER
T902 Ⓢ		TRANS PULSE

LOCATION NUMBER	PART NO.	DESCRIPTION
	I.C.	
IC201 Ⓢ		MC14053B
		HD 140553B
IC301 Ⓢ		HA 11431
IC401 Ⓢ		uPC 575C2
IC701 Ⓢ		HA 11423
IC901 Ⓢ		STR 470A
	MISCELLANEOUS	
FOCUS PACK		MURATA
X301		OSCILLATOR CRYSTAL
R402		RESISTOR VAR VM10A 10KA
R327		RESISTOR VAR 2KB
S901		SWITCH POWER
L951		COIL DEGAUSSING
F901		FUSE 125V 3A
2. C.P.T PWB		
	RESISTOR	
R351 Ⓢ		SR-29D 330B
R352		RD, 1/8W 160 ohm
R353		RD, 1/8W 1K
R354 Ⓢ		SR-19R 4.7 KB
R355 Ⓢ		SR-29D 330B
R356		RD, 1/8W 160 ohm
R357		RD, 1/8W 1K
R358 Ⓢ		SR-19R 4.7KB
R359		RD, 1/8W 160 ohm
R360		RD, 1/8W 160 ohm
R361		RD, 1/8W 1K
R362 Ⓢ		SR-19R 4.7KB
R363		RD, 1/8W 33K
R364		RD, 1/8W 33K
R366		RS, 3W 7.5K
R367		RS, 3W 7.5K
R368		RS, 3W 7.5K
R369 Ⓢ		RF, 2W 1.2 ohm
	CAPACITOR	
C352		CK, 222pF ±10%, 2KV
C353		CK, 102pF ±10%
C354		CK, 102pF ±10%
C355		CK, 102pF ±10%
C351		CE, 2.2uF/250V
	TRANSISTOR	
Q351 Ⓢ		KTC2068

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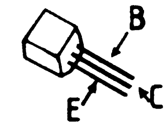
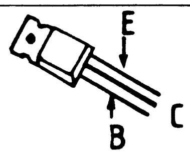
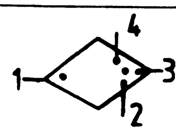
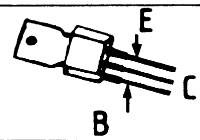
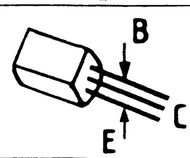
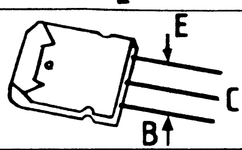
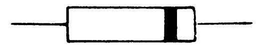
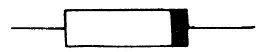
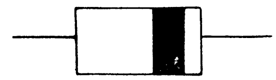
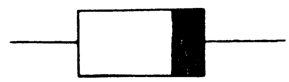
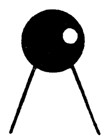
LOCATION NUMBER	PART NO.	DESCRIPTION
Q352 Ⓢ		KTC 2068
Q353 Ⓢ		KTC 2068
	COIL	
L351 Ⓢ		COIL PEAKING 56uH
L352 Ⓢ		COIL PEAKING 56uH
L353 Ⓢ		COIL PEAKING 56uH
L354 Ⓢ		COIL PEAKING 56uH
	SPARK GAP	
SG351		SPARK GAP
SG352		SPARK GAP
SG353		SPARK GAP
	MISCELLANEOUS	
		SOCKET C.P.T
3. H.V.C PWB		
	RESISTOR	
R751		RS, 1W 4.7K
R752		RN, 1/2W 0.47 ohm
R753		RN, 1/2W 0.47 ohm
	CAPACITOR	
C751		CK, 270pF ±10% 500V
C752		CK, 820pF ±10% 500V
C753		CC, 82pF ±5%
C754 Ⓢ		PP, 274pF/200V ±5%
C755 Ⓢ		PE, 154pF ±20%
	TRANSISTOR	
Q751 Ⓢ		KTC 2068 FA-1
Q752 Ⓢ		KTC 2233
	TRANS	
T751		TRANS. H. DRIVING
4. PICTURE TUBE		
C.P.T Ⓢ		370 FCB22-TC04
D.Y		KYS 60037

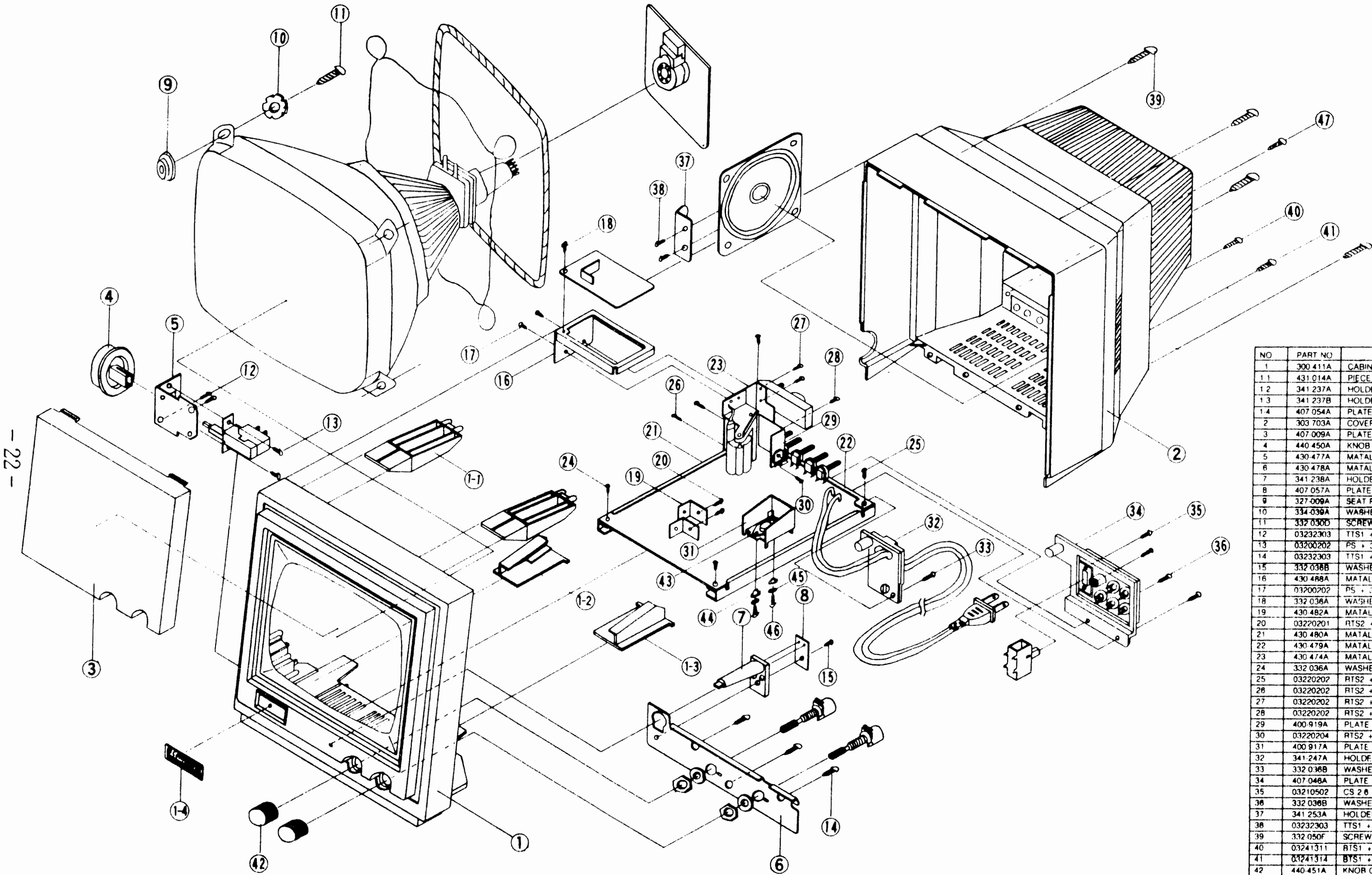
LOCATION NUMBER	PART NO.	DESCRIPTION

TERMINAL VIEW OF SEMICONDUCTOR

DESCRIPTION	FIGURE
KTC1959/KTA562 KTC1815 O/Y	
2SD1138C KTC2233	
STR470A	
KTC2068/ 2068-FA-1	
KTC2229 O/Y	
2SD1453	

DESCRIPTION	FIGURE
KDS1553 KDS1555 RD11E-B2	
1N4002/1N4004 1N4005GP RGP10G	
RU-1AV/RU-1V RH-1ZV/RH-1MV RD9.1EB SIB-01-01V	
VARISTOR RVDFV-212	

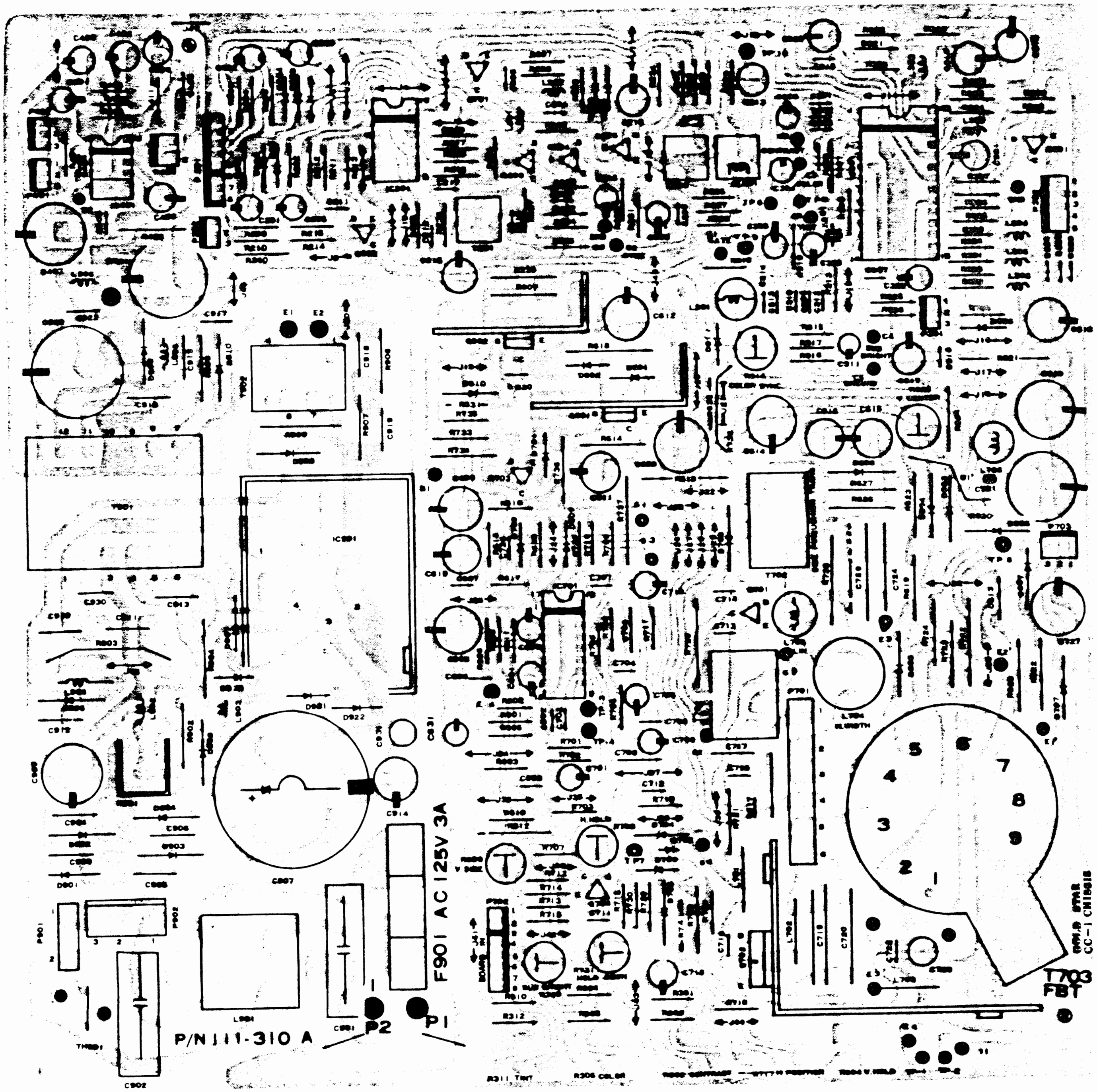
MECHANICAL DISASSEMBLIES



NO	PART NO	NAME	MATERIAL	Q'TY
1	300 411A	CABINET ASSY	LUCKY ABS AF 303	1
1-1	431 014A	PIECE, ADHESIVE	LUCKY ABS AF 303	2
1-2	341 237A	HOLDER, PWB	LUCKY ABS AF 303	1
1-3	341 237B	HOLDER, PWB	LUCKY ABS AF 303	1
1-4	407 054A	PLATE COMMODORE		1
2	303 703A	COVER ASSY, BACK	LUCKY ABS AF 303	1
3	407-009A	PLATE, FRONT	RESIN, SANC 2490	1
4	440-450A	KNOB POWER PUSH	LUCKY ABS AF 303	1
5	430-477A	MATAL, S/W POWER		1
6	430-478A	MATAL, VOLUME FIX		1
7	341-238A	HOLDER LAMP	LUCKY ABS AF 303	1
8	407-057A	PLATE ASSY LAMP		1
9	327-009A	SEAT RUBBER		4
10	334-039A	WASHER CPT FIXING		4
11	332 030D	SCREW HEXAGON HEAD		4
12	03232303	TTS1 + 4 × 12		2
13	03200202	PS + 3 × 6		2
14	03232303	TTS1 + 4 × 12		3
15	332 036B	WASHER, SCREW		1
16	430-488A	MATAL PWB FIX		1
17	03200202	PS + 3 × 6		2
18	332 036A	WASHER SCREW		1
19	430-482A	MATAL HEAT SINK FOR V-OUT		3
20	03220201	RTS2 + 3 × 6A		3
21	430 480A	MATAL, PWB FIX (R) (L)		2
22	430-479A	MATAL, PWB FIX		1
23	430 474A	MATAL, FBT FIX		1
24	332 036A	WASHER, SCREW		2
25	03220202	RTS2 + 3 × 8		2
26	03220202	RTS2 + 3 × 8		2
27	03220202	RTS2 + 3 × 8		2
28	03220202	RTS2 + 3 × 8		2
29	400-919A	PLATE ASSY, HEAT SINK		1
30	03220204	RTS2 + 3 × 10		1
31	400 917A	PLATE ASSY, HEAD SINK		1
32	341-247A	HOLDER, PWB CORD	P P CHISSO 2038	1
33	332-036B	WASHER, SCREW		2
34	407-046A	PLATE ASSY TERMINAL	LUCKY ABS AF 303	1
35	03210502	CS 2.6 × 5 (BK)		2
36	332 036B	WASHER, SCREW		2
37	341 253A	HOLDER SPEAKER		1
38	03232303	TTS1 + 4 × 12A		2
39	332-050F	SCREW TAPPINGS 4 × 16		4
40	03241311	BTS1 + 4 × 16		1
41	03241314	BTS1 + 4 × 20		1
42	440-451A	KNOB CONTROL	LUCKY ABS AF 303	2
43	430-483A	MATAL, TR FIX		1
44	334-038A	WASHER INSULATION		2
45	03200205	PS + 3 × 12		2
46	03401102	RW 3A		2
47	332-016M	SCREW, WASHER		1

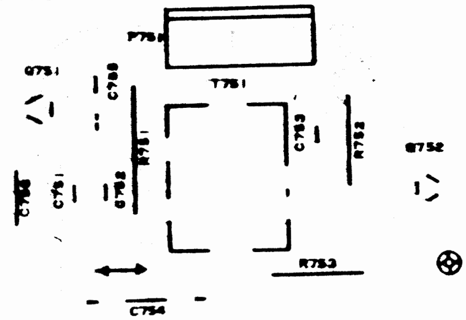
PRINTED CIRCUIT BOARD

1. MAIN BOARD

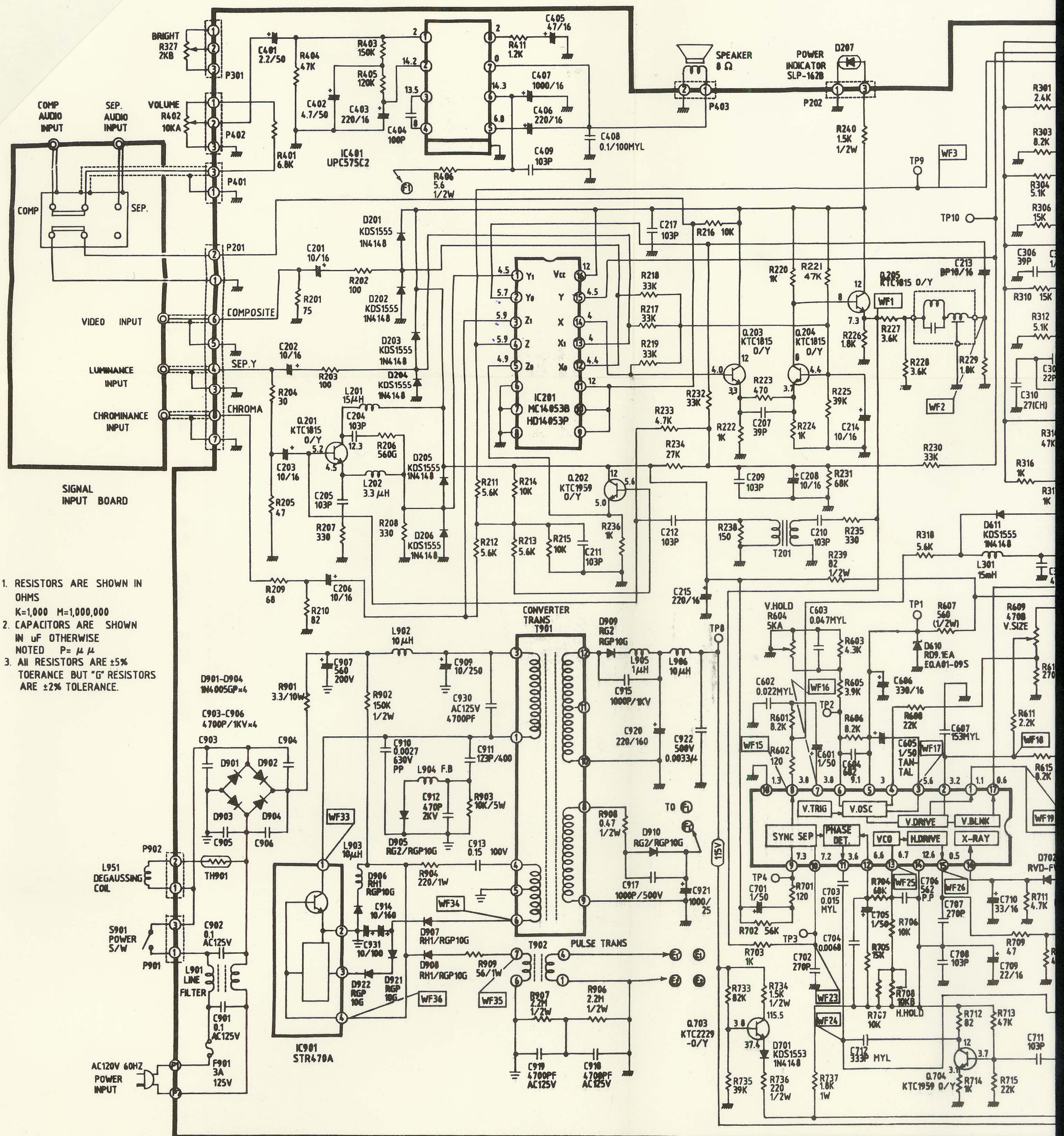


2. C.P.T P.W.B

3. H.V.C P.W.B.

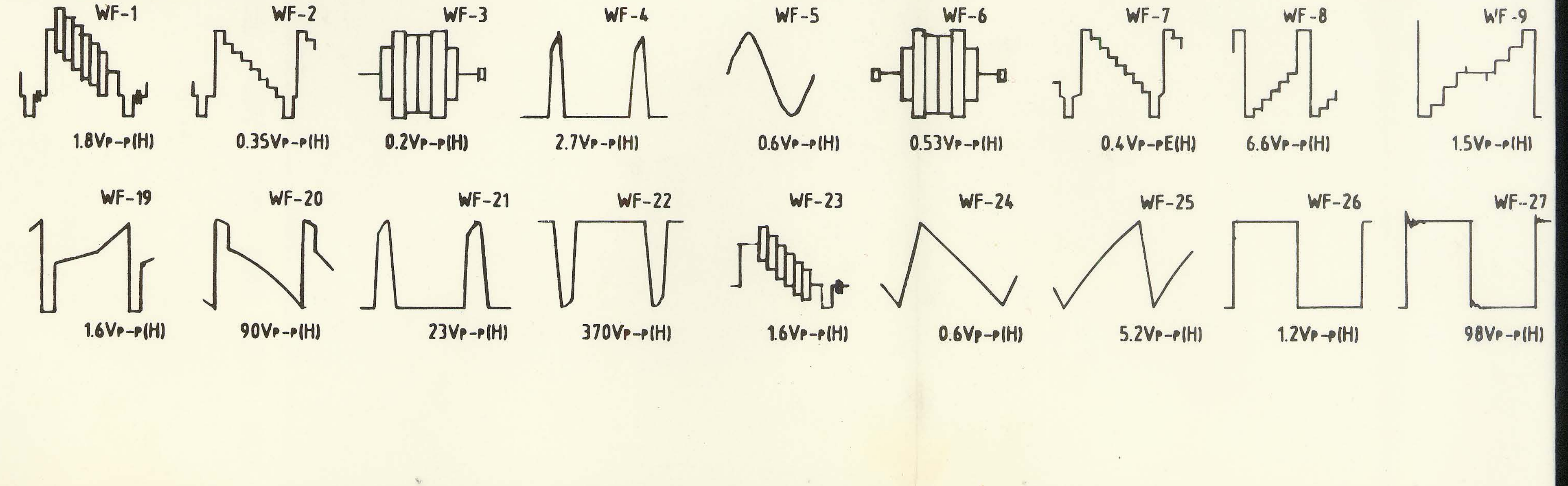


SCHEMATIC DI

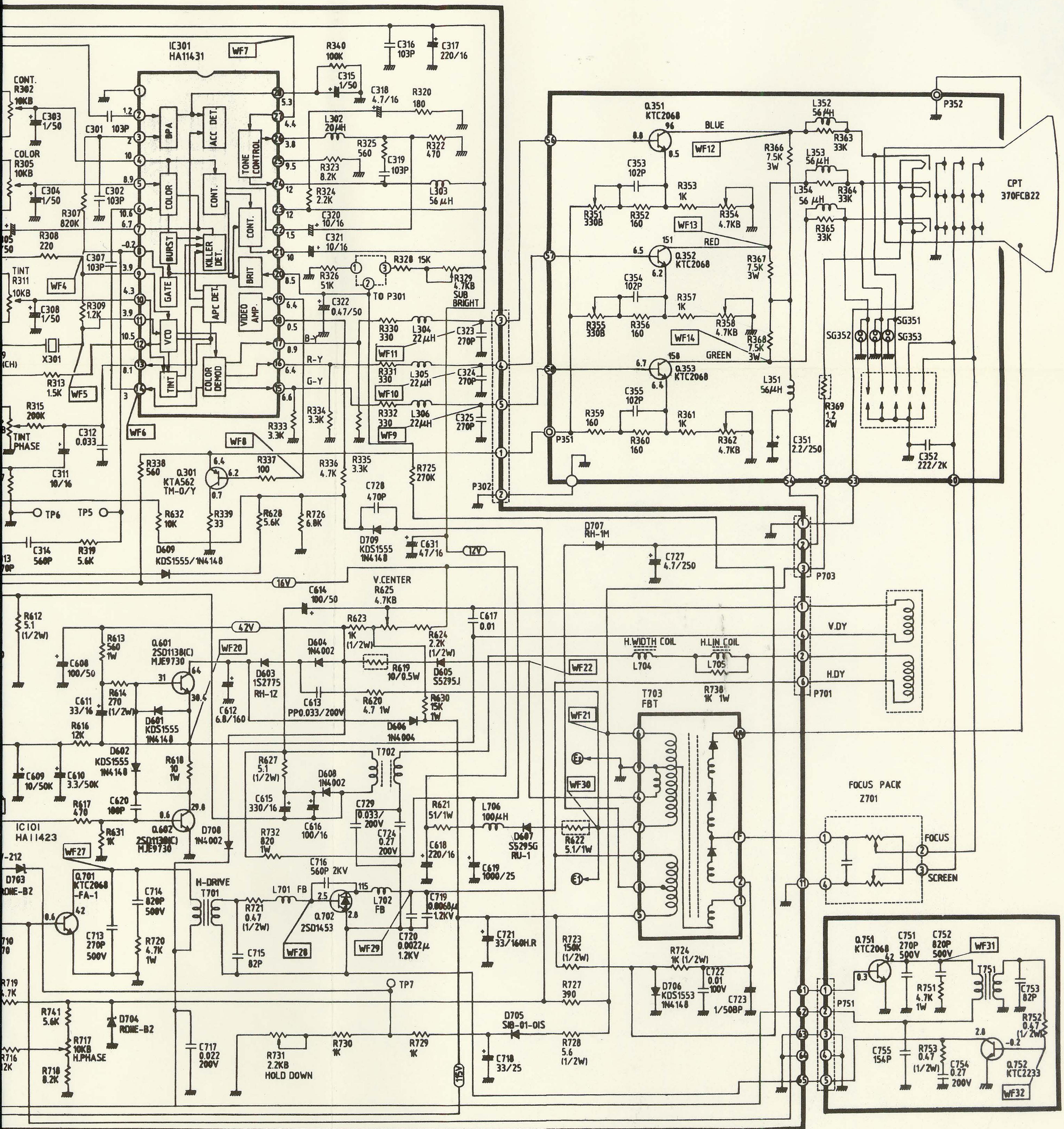


1. RESISTORS ARE SHOWN IN OHMS
K=1,000 M=1,000,000
2. CAPACITORS ARE SHOWN IN uF OTHERWISE NOTED P= μ μ
3. All RESISTORS ARE ±5% TOERANCE BUT "G" RESISTORS ARE ±2% TOLERANCE.

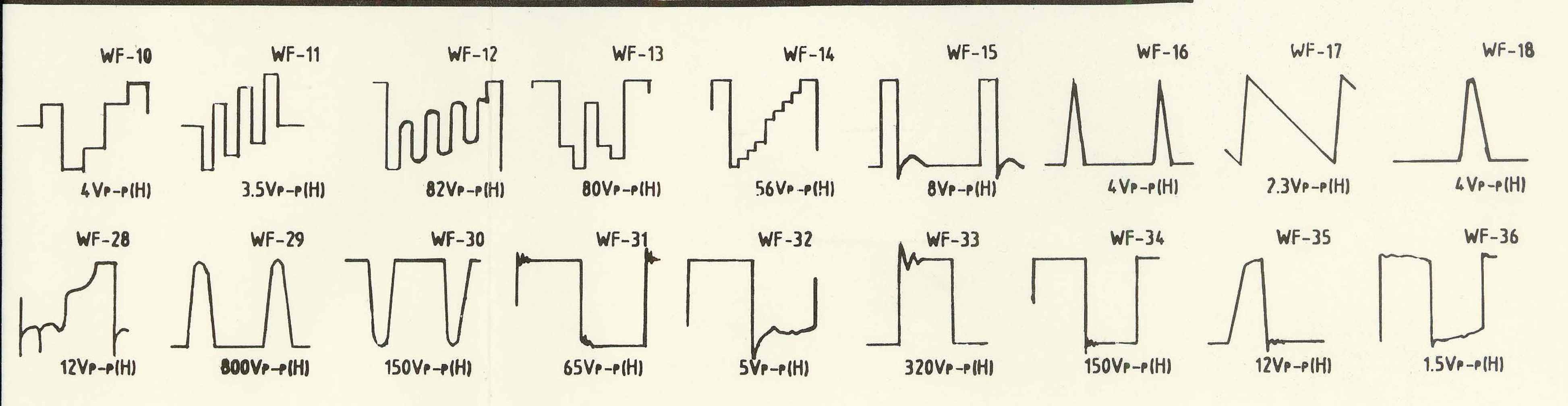
WAVE FROM



AGRAM CM-141



IC301
HA11431
CPT
370FCB22
FOCUS PACK
Z701
T703
FBT
H-DRIVE
T701
IC101
HA11423
V.DY
H.DY



WF-10
4Vp-p(H)
WF-11
3.5Vp-p(H)
WF-12
82Vp-p(H)
WF-13
80Vp-p(H)
WF-14
56Vp-p(H)
WF-15
8Vp-p(H)
WF-16
4Vp-p(H)
WF-17
2.3Vp-p(H)
WF-18
4Vp-p(H)
WF-28
12Vp-p(H)
WF-29
800Vp-p(H)
WF-30
150Vp-p(H)
WF-31
65Vp-p(H)
WF-32
5Vp-p(H)
WF-33
320Vp-p(H)
WF-34
150Vp-p(H)
WF-35
12Vp-p(H)
WF-36
1.5Vp-p(H)