SHARP IMAGE
ELECTRONICS, INC.

MANUAL: SI-327

27" VIDEO DISPLAY MONITOR

9834 Glenoaks Blvd.
Sun Valley, California 91325

(800) 448-8100, ext. 272
(818) 767-8855
FAX (818) 767-5311

TABLE OF CONTENTS

27" COLOR SPECIFICATIONS

CRT

- 27" A68ACTOOX
- P22 phosphor
- Dot pitch : 0.82 mm

INPUT SIGNALS

- Video : RGB Analog 1V-5V p-p
  (adjustable with gain control)
  1 K ohm - 6 K ohm input impedance
- Sync : TTL positive or negative going,
  seperate or composite.
  Input impedance : 5 K ohms for positive
  going sync : 5 K ohms for negative going
  sync.

HORIZONTAL SCAN

- Width : Adjustable with just one coil to accommodate
  active video from 40 usec to 50 usec.
- Frequency : 15.1 k Hz to 16.8 k Hz standard : higher
  scan frequencies avaliable
- Linearity : +/- 7%

PICTURE SIZE REGULATION

- 3 %

VERTICAL SCAN

- frequency : 47 Hz to 65 Hz
- Linearity : +/- 7 %

GEOMETRIC DISTORTION

- +/- 3%

VIDEO CHARACTERISTICS

- Bandwidth (-3db) : 12 MHz typical
- Rise Time : Less than 50 nanoseconds

MECHANICAL

- The standard 27" monitor is available as a kit - without a frame. Custom frames can be furnished.

USER ADJUSTABLE CONTROLS AND ADJUSTMENTS

- Brightness, Gain, Horizontal Hold, Horizontal Size, Horizontal Raster Position, Horizontal Video Position, Vertical Hold, Vertical Size, Vertical Raster Position, Focus. Custom Control Location available.

POWER INPUT

- 120 VAC +10% -15%, 50-60 Hz, 85W (max). Isolation transformer required : furnished with monitor as an option.

RESOLUTIONS

- 27" 560 Pixels X 240 Lines

WARNINGS

1. Power Up Warning -
   An isolation transformer must be used between the AC supply and the AC plug of the monitor before servicing, testing, or operating the monitor since the chassis and the heat sink are directly connected to one side of the AC line which could present a shock hazard.
   Before servicing is performed, read all the precautions labelled on the CRT and chassis.
2. High Voltage -
   This monitor contains HIGH VOLTAGES deprived from power supplies capable of delivering LETHAL quantities of energy. Do not attempt to service until all precautions necessary for working on HIGH VOLTAGE equipment have been observed.
3. CRT Handling -
   Care must be taken not to bump or scratch the picture tube as this may causes the picture tube to implode resulting in personal inquiry. Shatter proof goggles must be worn when handling the CRT. High voltage must be completely discharged before handling . Do not handle the CRT by the neck.
4. PRODUCT SAFETY NOTICE
   W A R N I N G : For continued safety replace safety critical components only with manufacturer recommended parts.

   For replacement purposes, use the same type or specified type of wire and cable, assuring the positioning of the wires is followed (especially for H.V. and power supply circuits).
   Use of alternative wiring or positioning could result in damage to the monitor or in a shock or fire hazard.

USER ADJUSTMENTS

1. BRIGHTNESS CONTROL RV 503

   This control has been preset at the factory. However, when the video signal is applied to the monitor, a slight adjustment may be desired. Adjust this control such that the illumination is just barely extinguished from portions of the display which should be black.

2. FOCUS CONTROL

   Adjust the focus control, located on the high voltage unit, for maximum over-all definition and fine pircure detail.

3. HORIZONTAL HOLD CONTROL RV 401

   With the monitor being driven with the display signal, adjust the horizontal hold control until the picture stops sliding horizontally. Do not use the horizontal hold control for horizontal centering.

   Note : If the sync signal is composite, use the horizontal sync input of the same polarity as the composite sync signal.

4. HORIZONTAL VIDEO SHIFT CONTROL RV 404

   Use this control to center the picture horizontally.

5. HORIZONTAL RASTER POSITION ADJUSTMENT RV 402

   If the picture is off center horizontally (long dimension of picture tube), some compensation can be made by moving the horizontal raster position adjustment RV 402.

6. HORIZONTAL SIZE COIL L404

   The horizontal size coil is a hexagonal tuning tool adjustment. This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct horizontal proportions .

7. VERTICAL HOLD CONTROL RV 201

   Adjust this control until the picture stops rolling and it locks in vertically.

8. VERTICAL SIZE CONTROL RV 203

   This control must be adjusted slowly, if necessary, until the picture or test pattern attains the correct vertical proportions.

9. VERTICAL RASTER POSITION CONTROL RV 202

   If the video is off center vertically, (short dimension of picture tube) some compensation can be made by turning the vertical raster position control.

10. BIAS CONTROLS ON NECK BOARD VR 701, VR 702, VR 703
Use this controls to uniform the color.

WHITE BALANCE

1. Equipment Required : An oscilloscope with a DC coupled mode in the vertical amplifier.
2. Referring to Fig. 1 and 3, do the following adjustments in subdued light after degaussing and setting the purity of the CRT.
3. Ground the R/G/B video inputs. Apply sync signals to the sync inputs.
4. Set all three bias controls, VR 701, VR 702, and VR 703 to their midpoint of rotation.
5. Connect the oscilloscope to the collector of a video output transistor Q 701, Q 702, or Q 703 or to the end of R 707, R 708, or R 709.
6. If this white balance procedure is required because the CRT or neck board was replaced, then leave the gain control at its original setting. If the contrast gain control is known to be grossly out of adjustment, then set it to its center of rotation. Adjust the brightness control RV 504 to obtain the waveform . Now remove the scope probe.
7. Slowly turn the screen control CW until the raster is just visible. The color of this raster is called the lead color gun. DO NOT adjust its associated gain control. It must remain fully CCW.
8. Adjust the screen control CCW until the raster is just extinguished.
9. Adjust the brightness control for a bright raster but not maximum brightness. Adjust the bias controls, if necessary, for best neutral white.

Note :

All of the following procedures have been performed at the factory and should require no further attention. If the monitor is serviced for any reason, it should be observed afterward to determine whether any of these procedures need to be perforemd again.

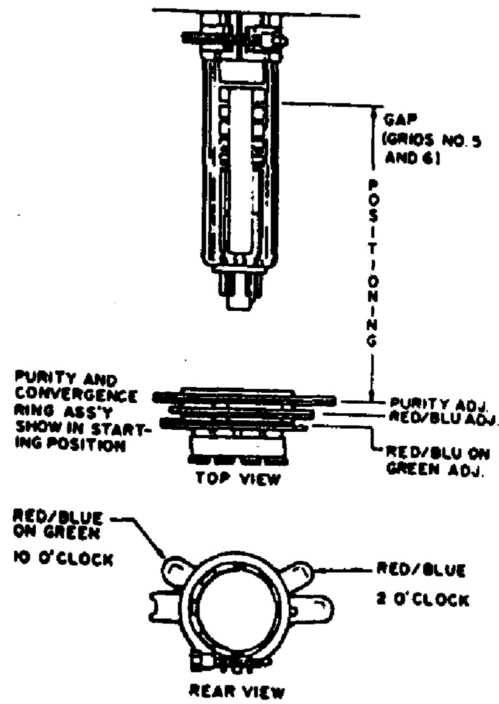


Fig. 1

OUTLINE OF CONVERGENCE AND SET-UP PROCEDURE

Degaussing :

Demagnetize the shadow mask and all surrounging metal parts with an external degaussing coil.

Purity :

Adjust the purity magnets and the yoke position.

Static Convergence :

Converge Red and Blue on Green in the center of the screen.

Dynamic Convergence :

Converge Red and Blue at the edges of the screen.

White Balance :

Set Gray and White brightness tracking.

Note : Purity and convergence adjustment interact.

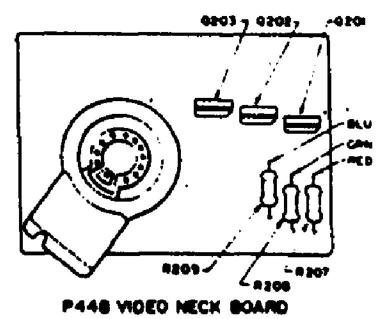


Fig. 2

DEGAUSSING

The monitor is equipped with an automatic degaussing circuit. However, if the CRT shadow mask has become excessively magnetized, it may be necessary to degauss it with a manual coil. Do not switch the coil OFF while the raster shows any effect from the coil.

COLOR PURITY ADJUSTMENT

1. For best results, it is recommended that the purity adjustment be made in the final monitor location. If the monitor will be moved, perform this adjustment with it facing

west or east. The monitor must have been operating 15 minutes prior to this procedure.

2. On picture tubes with a 22.5 mm neck diameter, set the ring assembly on the CRT neck with the center line of the purity ring-pair over the gap between grids No5. and 6. See Fig. 1 (For picture tubes with a 29 mm neck, use the gap between grids No3 and 4 Fig.3)

3. Make certain that the magnetic ring-pairs are in their correct starting position before beginning this procedure. The correct starting position for the purity ring-pair is not necessarily the one shown in Fig. 1,3. The correct starting position will vary from ring assemblies from one manufacturer to another. It will be necessary to determine the correct starting position -also known as the zero correction position.

   Fig.1,3 show a ring assembly in which each of the rings of the purity ring-pair has two-one long and one short. With some ring assemblies of this type, the zero correction position is with the long tab of one ring aligned with the short tab of the other ring. On other ring assemblies of this type, the zero correction position is with the long tab of one ring aligned with the long tab of the other ring. The way to determine which is by trying one of these orientations and then rotating the two rings together, as a pair, without changing their orientation with respect to each other. If this rotation of the ring-pair causes no change in the purity, then it is the zero correction position. If the purity does change, then try the other orientation.

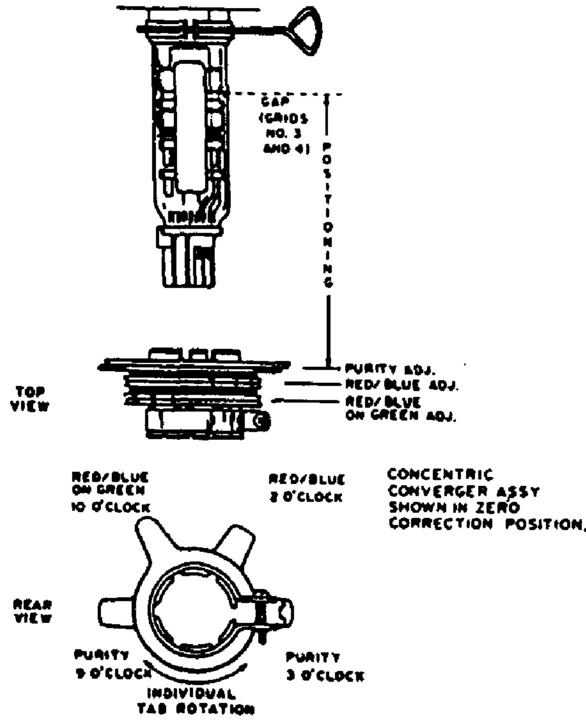


Fig. 3

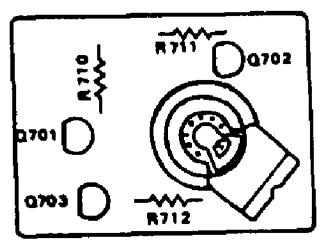


Fig. 4

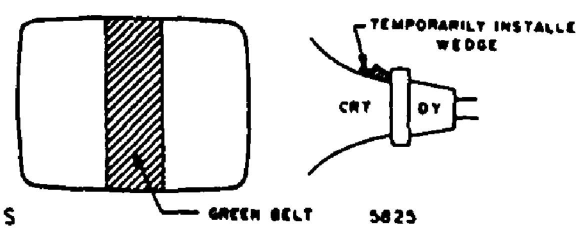


Fig. 5

A third type of ring assembly has only one tab on each of the two purity rings. The zero correction position for this type of assembly is with the tabs of the two purity rings aligned with each other and pointing up toward the anode contact of the CRT.

The correct starting positions for the other ring pairs are shown in Fig. 1,3. For the other type of ring assembly (not shown), the correct starting position for the other two ring-pairs is with all of the tabs aligned with each other and pointing up, toward the anode contact of the CRT.

4. Vertical raster position control must be at the center of its rotation.
5. Remove the R-G-B signal from the monitor.
6. Pull the Deflection Yoke backward so that the Green belt will appear. (See Fig. 5)
7. Decrease the horizontal width of the raster, if necessary, in order to be able to see the right and left edges of the raster.
8. Move the two Purity Magnets with respect to each other in order to center the Green belt on the raster horizontally.
9. Push the Deflection Yoke forward gradually and fix it at the place where the Green screen becomes uniform throughout.
10. Turn the bias control and confirm that each color is uniform.
11. If the color is not uniform, re-adjust it, moving the Purity Magnets slightly.
12. Turn all three bias controls fully counterclockwise (CCW). Slowly turn up (CW) the red bias control until a Red raster is just barely visible.
13. Slowly turn up the bias controls such that their associated colors, mixing with the red, results in a White or Gray raster.
14. Confirm that the white or gray color is uniform throughout the screen.
15. Insert a wedge temporarily as shown in Fig. 5 and adjust the angle of the Deflection Yoke.

STATIC CONVERGENCE ADJUSTMENT

4-pole Magnets and 6-pole Magnets are for static convergence.

1. A cross hatch signal should be connected to the monitor.
2. A pair of 4-pole Convergence Magnets is provided and adjusted to converge the blue and red beams (See Fig.7).

When the Pole opens to the left and right 45° symmetrically, the magnetic field maximizes. Red and blue beams move to the left and right (See Fig. 6) Variation of the angle between the tabs adjusts the convergence of red and blue vertical lines.

3. When both 4-Pole convergence Magnet Tabs are rotated as a pair, the convergence of the red and blue horizontal lines is adjusted.
4. A pair of 6-Pole Convergence Magnets is also provided and adjusted to converge the magenta (red + blue) to green beams (See Fig. 7) . When the Pole opens to the left and right 30 symmetrically, the magnetic field is maximized. Red and blue beams both move to the left and right (See Fig. 6) . Variation of the opening angle adjusts the convergence of magents to green vertical lines.
5. When both 6-pole Convergence Magnet Tabs are rotated as a pair, the convergence of magenta to green horizontal lines is adjusted.

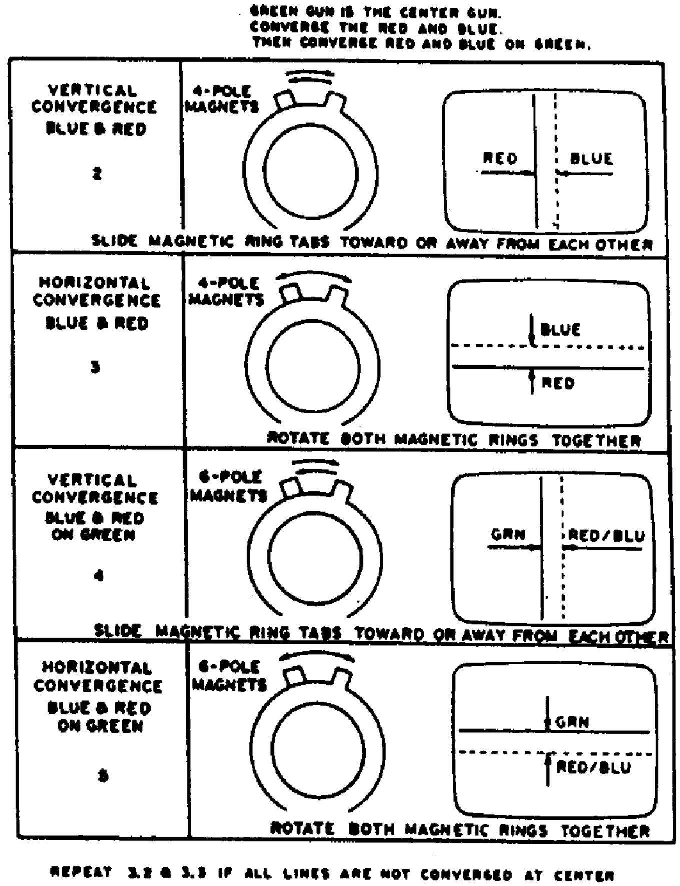


Fig. 6

PRECISE ADJUSTMENT OF DYNAMIC CONVERGENCE

1. Feed a cross-hatch signal to the monitor.
2. Insert wedge temporarily and fix the Deflection Yoke so as to obtain the best circumference convergence (See Fig. 9 and 10).
   Note : The wedges may need to be moved during adjustments.
3. Insert three rubber wedges to the position as shown in
   Note :
   1) Tilting the angle of the yoke up and down adjusts the crossover of both vertical and horizontal red and blue lines. See Fig.9.

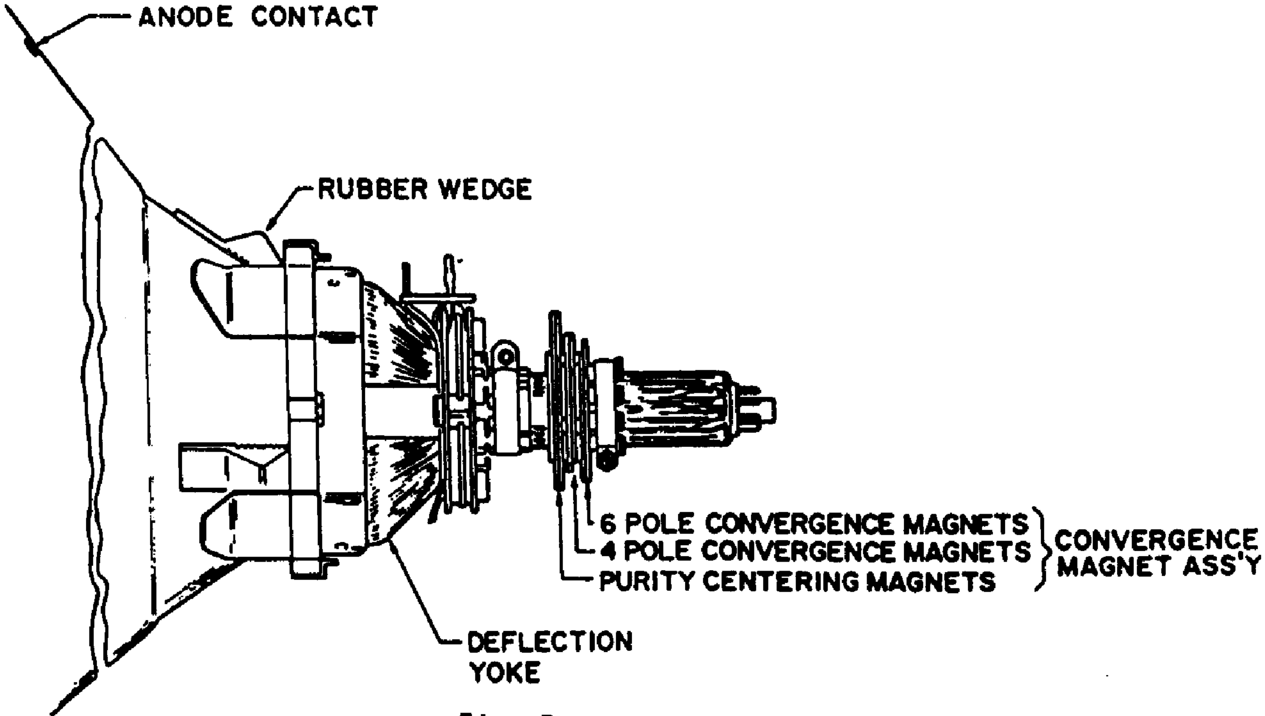


Fig. 7

2) Tilting the angle of the yoke sideways adjusts the parallel convergence of both horizontal and vertical lines at the edges of the screen. See Fig 10.
3) Use three rubber wedges (tapered rubber wedges are used for a purpose).
4) The position of each rubber wedge is shown in fig. 8.
5) DO NOT force the permanent wedges in. They are to be inserted until they just make contact with the yoke-after the yoke has been positioned.
6) Fix the three permanent rubber wedges with chloroprene rubber adhesive.
7) After the adhesive has dried enough to hold the wedges in place, carefully remove the temporarily installed wedge.

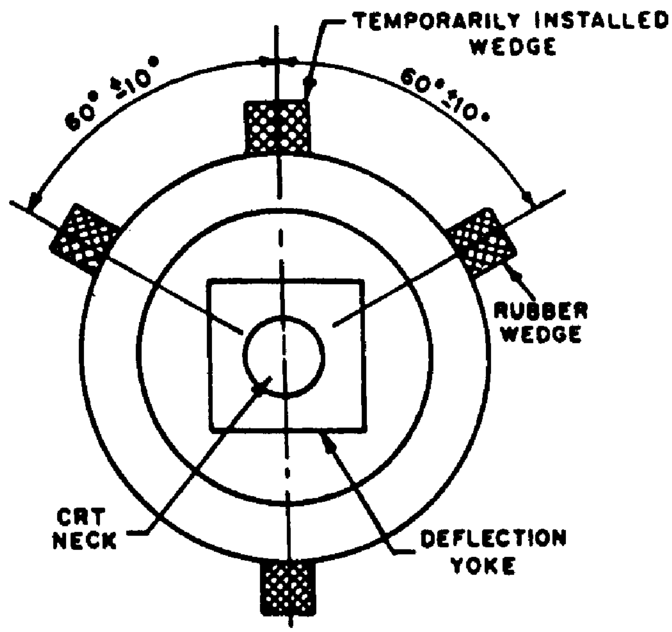
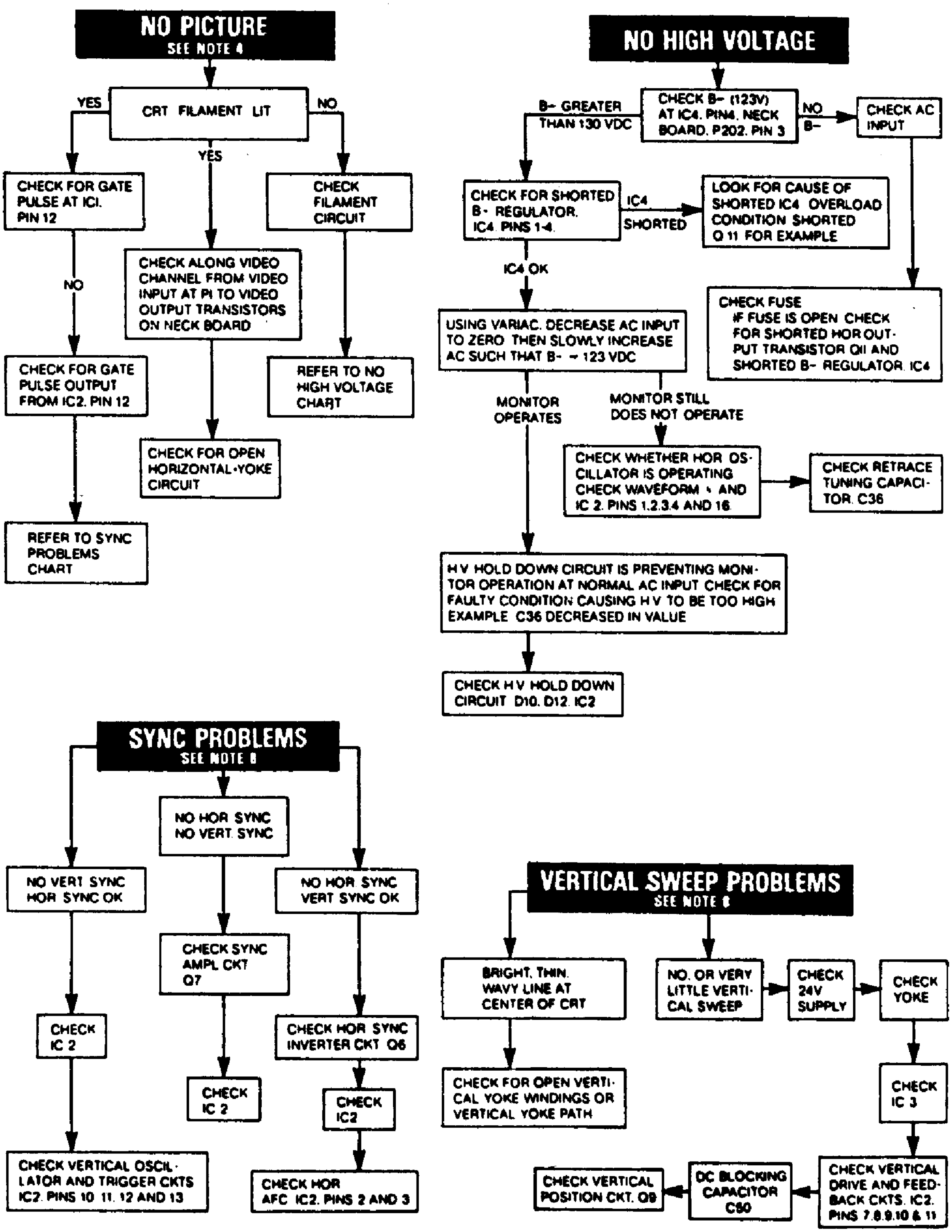


Fig. 8

TROUBLESHOOTING CHART



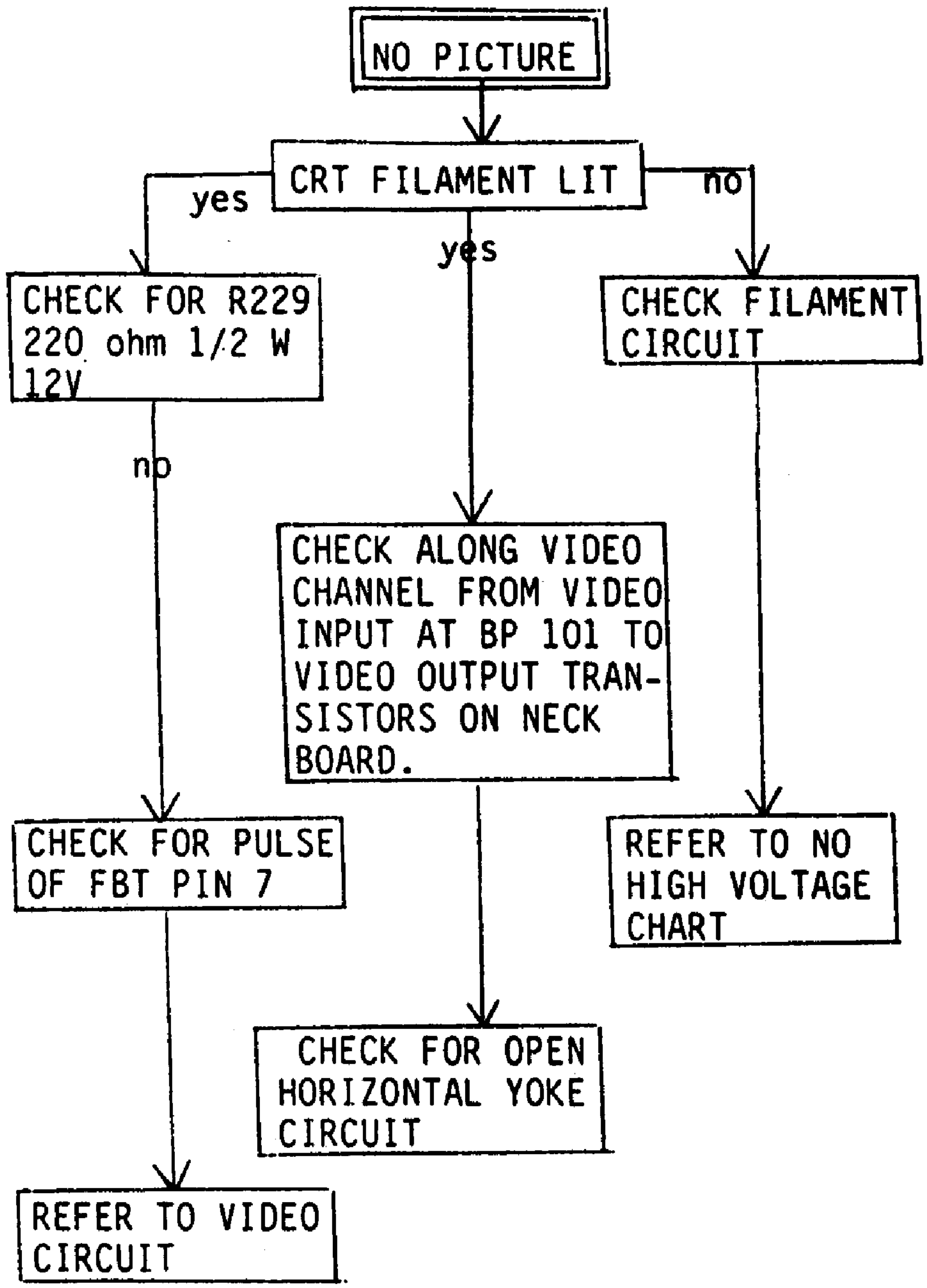
TROUBLESHOOTING NOTES

1. The trouble shooting chart mentions specific components to be checked. It is intended that the entire circuit associated with these components be checked.
2. This chart is a guide to servicing rather than a complete list of each component that could fail.
3. The bias controls on the neck board have been preset at the factory. When servicing the monitor for a lack of video, do not adjust any of these controls unless it is suspected that the problem is a result of these controls having been tampered with. Otherwise do not adjust these controls ; if they are so severely out of adjustment that there is a lack of video, then there is something malfunctioning.
4. All monitors are equipped with automatic deguassing coils which demagnetize the picture tube everytime the monitor is turned on after being off for a minimum of 20 minutes. Should any part of the chassis become magnetized it will be necessary to degauss the affected area with a manual degaussing coil. Move the coil slowly around the CRT face area and all surrounding metal parts. Then slowly withdraw for a distance of 6 feet before turning off.
5. Horizontal vs. Vertical

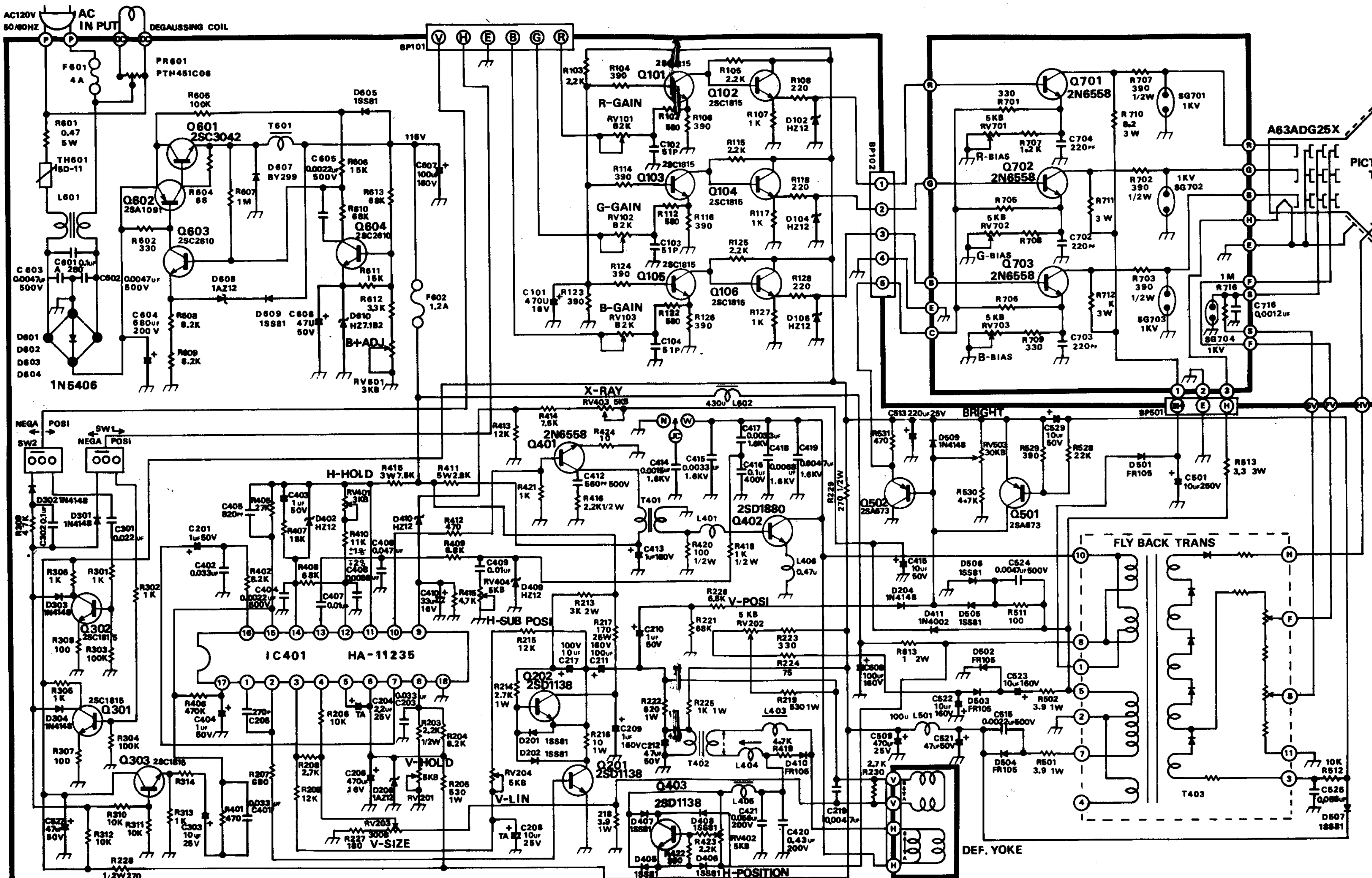
   Some models have the picture tube mounted vertically rather than horizontally. That is, the picture tube is mounted in the frame such that the long dimension of the tube is up and down. Other than the physical orientation of the picture tube, there is no electrical difference between these models and their horizontal counterparts. The same circuits, the vertical circuits, produce and control deflection along the short dimension of the tube in all models.

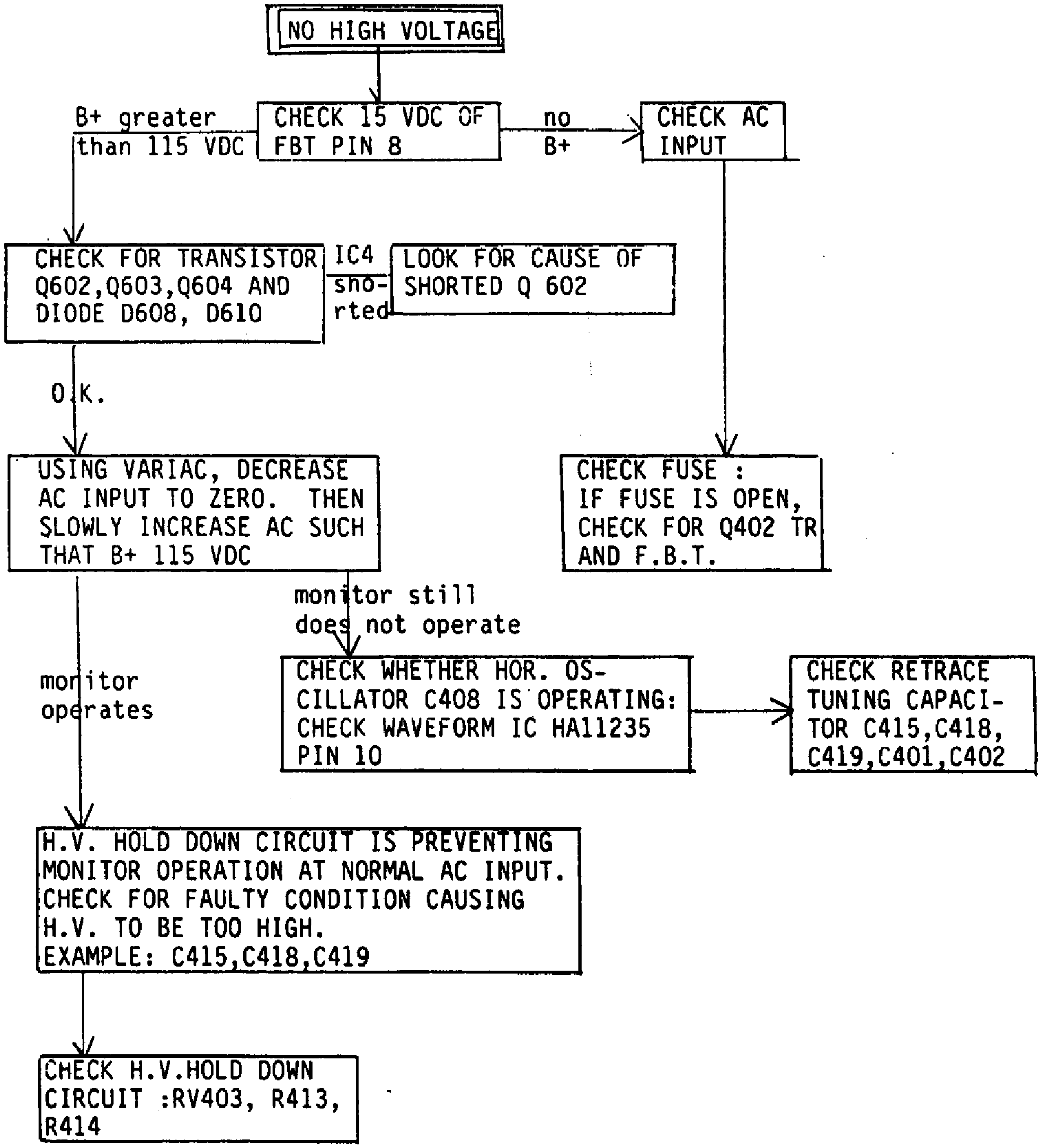
   The same circuits, the horizontal circuits, produce and control deflection along the long dimension of the tube in all models.

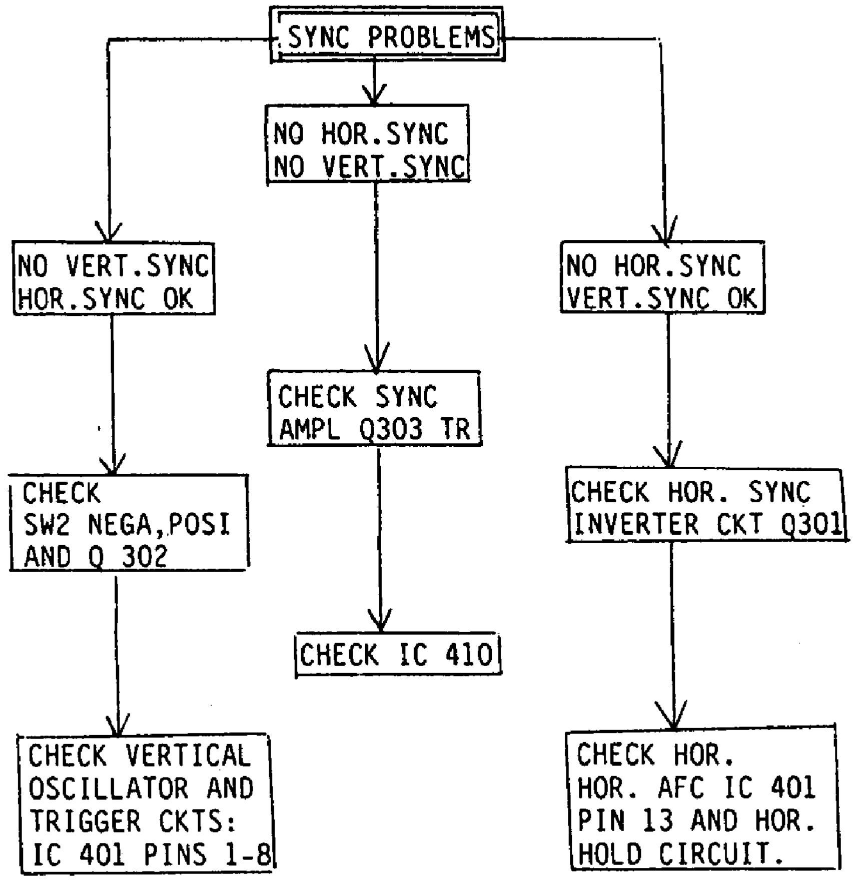
TROUBLESHOOTING CHART

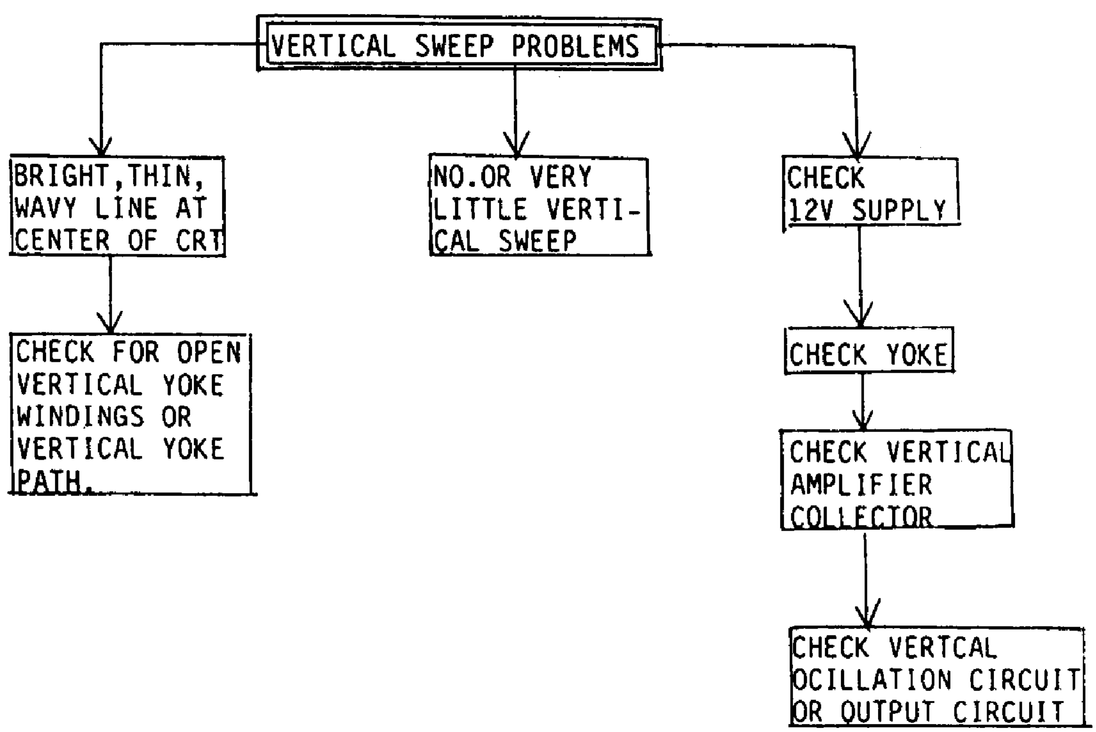


SCHEMATIC DIAGRAM




NO HIGH VOLTAGE
CHECK 15 VDC OF FBT PIN 8
B+ greater than 115 VDC
no B+
CHECK AC INPUT
CHECK FOR TRANSISTOR Q602,Q603,Q604 AND DIODE D608, D610
IC4 sho-rted
LOOK FOR CAUSE OF SHORTED Q 602
O.K.
USING VARIAC, DECREASE AC INPUT TO ZERO. THEN SLOWLY INCREASE AC SUCH THAT B+ 115 VDC
CHECK FUSE : IF FUSE IS OPEN, CHECK FOR Q402 TR AND F.B.T.
monitor still does not operate
monitor operates
CHECK WHETHER HOR. OS-CILLATOR C408 IS OPERATING: CHECK WAVEFORM IC HA11235 PIN 10
CHECK RETRACE TUNING CAPACI-TOR C415,C418, C419,C401,C402
H.V. HOLD DOWN CIRCUIT IS PREVENTING MONITOR OPERATION AT NORMAL AC INPUT. CHECK FOR FAULTY CONDITION CAUSING H.V. TO BE TOO HIGH. EXAMPLE: C415,C418,C419
CHECK H.V.HOLD DOWN CIRCUIT :RV403, R413, R414


SYNC PROBLEMS
NO HOR.SYNC NO VERT.SYNC
NO VERT.SYNC HOR.SYNC OK
NO HOR.SYNC VERT.SYNC OK
CHECK SYNC AMPL Q303 TR
CHECK SW2 NEGA,POSI AND Q 302
CHECK HOR. SYNC INVERTER CKT Q301
CHECK IC 410
CHECK VERTICAL OSCILLATOR AND TRIGGER CKTS: IC 401 PINS 1-8
CHECK HOR. HOR. AFC IC 401 PIN 13 AND HOR. HOLD CIRCUIT.


VERTICAL SWEEP PROBLEMS
BRIGHT,THIN, WAVY LINE AT CENTER OF CRT
NO.OR VERY LITTLE VERTI-CAL SWEEP
CHECK 12V SUPPLY
CHECK FOR OPEN VERTICAL YOKE WINDINGS OR VERTICAL YOKE PATH.
CHECK YOKE
CHECK VERTICAL AMPLIFIER COLLECTOR
CHECK VERTCAL OCILLATION CIRCUIT OR OUTPUT CIRCUIT

VIDEO INTERFACE AND OUTPUT

The red, green and blue video inputs come into the monitor at BP 101. Isolation and attenuation is provided by emitter followers Q101, Q103, Q105.
The red, green and blue signals go into emitter followers of Q101, Q103, Q105 via gain control RV101, RV102, RV103. The gain controls signal of DV voltage input of video signal.
The signal deprived from the horizontal and vertical sweep circuits provides the blanking of the video for Q 502 during retrace in response to blanking pulses.

The brightness is varied by varying the DC level at Q701, Q702, Q703 emitter. The video outputs are provided via R701, R702 and R703 and they are amplified by the video output stages Q701,Q702,Q703 before being applied to the cathodes of the CRT.

SYNC

Sync is applied at BP 101 horizontal, vertical sync. Positive sync is inverted to negative sync by SW 1, SW 2. Composite sync should be applied only to the horizontal sync input of the appropriate polarity. Positive sync is inverted by Q301 and Q302 then applied through D305, D306 and R310 to the sync amplifier Q303. The sync amplifier output is applied through R314, C303 and R401 to pin 15 of IC 401. Pin 15 is the sync composite input.

The sync separator extracts the horizontal and vertical sync from each other - providing horizontal sync to the horizontal AFC circuit in the IC. This vertical sync comes into pin 7 via R402, C201 from pin 16 and used for triggering the vertical oscillator.

HORIZONTAL OSCILLATOR AND OUTPUT

The horizontal AFC circuit of IC 401 receives a horizontal sync input from the horizontal sync separator and a feedback signal at pin 13, derived from the horizontal output. Slight differences in frequency and phase of the two signals will cause the AFC to generate a correction voltage at pin 14.
The horizontal oscillator in IC 401 has its free running frequency determined by the RC time constant of C408, R410 and R 401, the horizontal hold control. The horizontal hold control varies the horizontal frequency by varing the RC time constant.
Slight correction in frequency is provided by a correction voltage which comes from pin 14 through R408.
The oscillator output at pin 10 is amplified and shaped by the horizontal drive stage Q401. The drive signal is then coupled to the base circuit of the horizontal output transistor Q402 by the horizontal drive transformer T401. T401 is used for impedance transformation to provide the Q402 base circuit with the low impedance source that it requires.
The horizontal output transistor Q402 is operated as a switch. It is either on or off. It is turned on and off at the scan rate which is determined by the horizontal oscillator frequency. A yoke current with a sawtooth waveform is needed to deflect the beam linearly acroos the CRT . The beam begins at the center of the CRT and is deflected from center to right. This center-to-right deflection occurs when Q 402 is turned on. The deflection yoke coupling polypropylene film capacitor (p-p) C402 begins to discharge through the yoke ; the discharge current causes the beam to be deflected to the right CRT edge. At this time, Q402 is turned off, and the current provided by C420 stops.

As the current falls to zero, a voltage is induced across the yoke windings as the magnetic field collapses ; an oscillation is produced by the yoke windings and C415, C418, C419, the retrace tuning capacitor. During the first half cycle of oscillation, the induced voltage is impressed on the collector of Q402, C415, C418, C419 and the primary of they flyback transformer T403. This induced voltage is stepped up by the flyback transformer's secondary winding. This high voltage is then rectified and applied to the high voltage anode of the CRT. When this induced voltage occurs, the electron beam is deflected from the right edge of the CRT face to the left edge. This is called retrace. During the second half cycle of the oscillation (of C415, C418, C419 and yoke winding), the voltage at the Q 402 collector tries to go negative or below ground. When this happens, the damper diode (include in same package with Q 402) becomes forward biased. The conduction of the damper diode allows energy stored in the horizontal system to decay linerity to zero, thus allowing the beam to return to the center of the CRT face.

The focus voltage and the screen , G2,voltage are obtained from the anode voltage with a resistor divider network within the T403 assembly. AFC feedback signal privides horizontal AFC feedback to the pin 13 through C417, C416, C418 and R409. This signal is also used to move video position into right or left via C409.

The signal from the auxiliary winding at pin 7 of T 403 is rectified by d 504 and filtered to provide the +12 VDC supply for the video interface and sync circuits. The auxiliary winding of pin 5 produces a signal which is rectified by D503 and filtered to produce the heater voltage via R 513 for the vertical output circuit.

An auxiliary winding (pinl) filtered by D501 provides video output circuit Q 701, Q702 and Q 703 collector.

The horizontal linearity coil L403 is a magnetically biased coil which shapes the yoke current for optimum linearity. The horizontal size coil L404 is a variable series inductor which is used to vary the horizontal size of the display.

HIGH VOLTAGE HOLD-DOWN CIRCUIT

The high voltage hold down circuit is part of the main PC board of this monitor. The +12 V DC supply is sensed via D10. Since the +12 V DC supply is flyback pulse derived, the +12V DC supply will rise as the high voltage rises. If the +12 V DC exceeds a threshold which is set with RV 403, then D410 will conduct, thereby providing drive to IC 401, pin 9-holddown input of deflection oscillator IC. The drive being applied to pin 9 causes the horizontal oscillator within the IC to shut down - thus preventing the generation of high voltage. The horizontal oscillator will remain in its OFF state, even if the input to IC 401 pin 9 is removed, unless and until AC power is removed from the monitor input. The power may then be reapplied.

VERTICAL OSCILLATOR AND OUTPUT

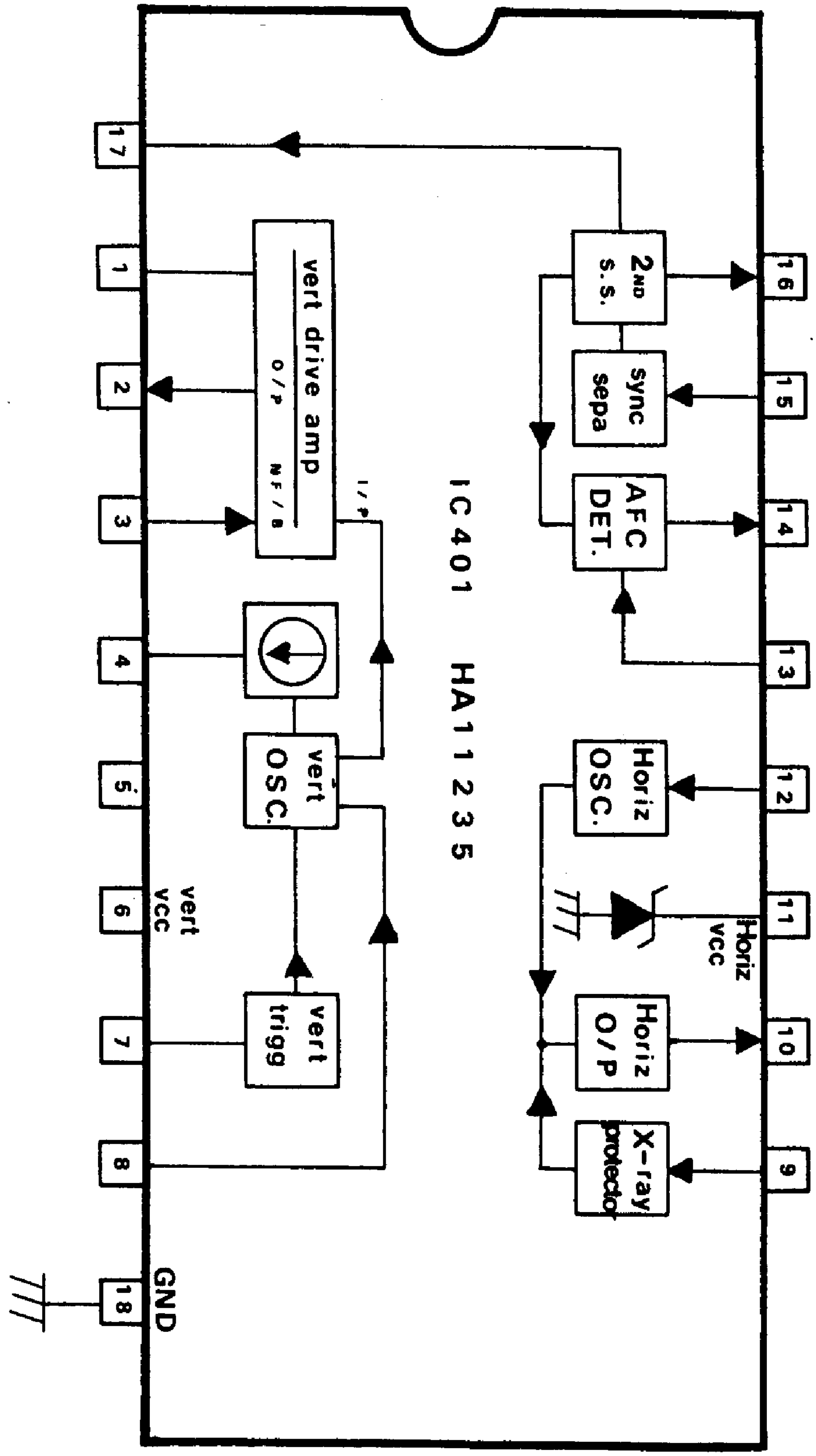
The composite sync signal is applied to IC 401 pin 15. Sync signal is separated in the IC and extracts only vertical sync signal to pin 16 so that the signal is applied to vertical trigger input at pin 7 through R 402 , C201.
The vertical oscillator frequency is controlled by vertical hold control and input at pin 8. IC 401, pin 2 output supplies signal to vertical output transistor Q201 base. Output current from Q 201 flows through the yoke to cause vertical deflection. During upward deflection, current flows out of C211, through the yoke, and into C211 discharging through the yoke in the opposite direction and back into Q 201 TR. AC feedback is provided to Q 201 through the wiper of the vertical size control RV 203 to IC 401, pin 4 in order to control the drive amplitude. DC feedback at IC 401 pin 3 maintains good vertical linearity at all sizes.
DC current from the +24V supply flows through R223, R219 and through the yoke to provide downward raster shift. Some of this DC

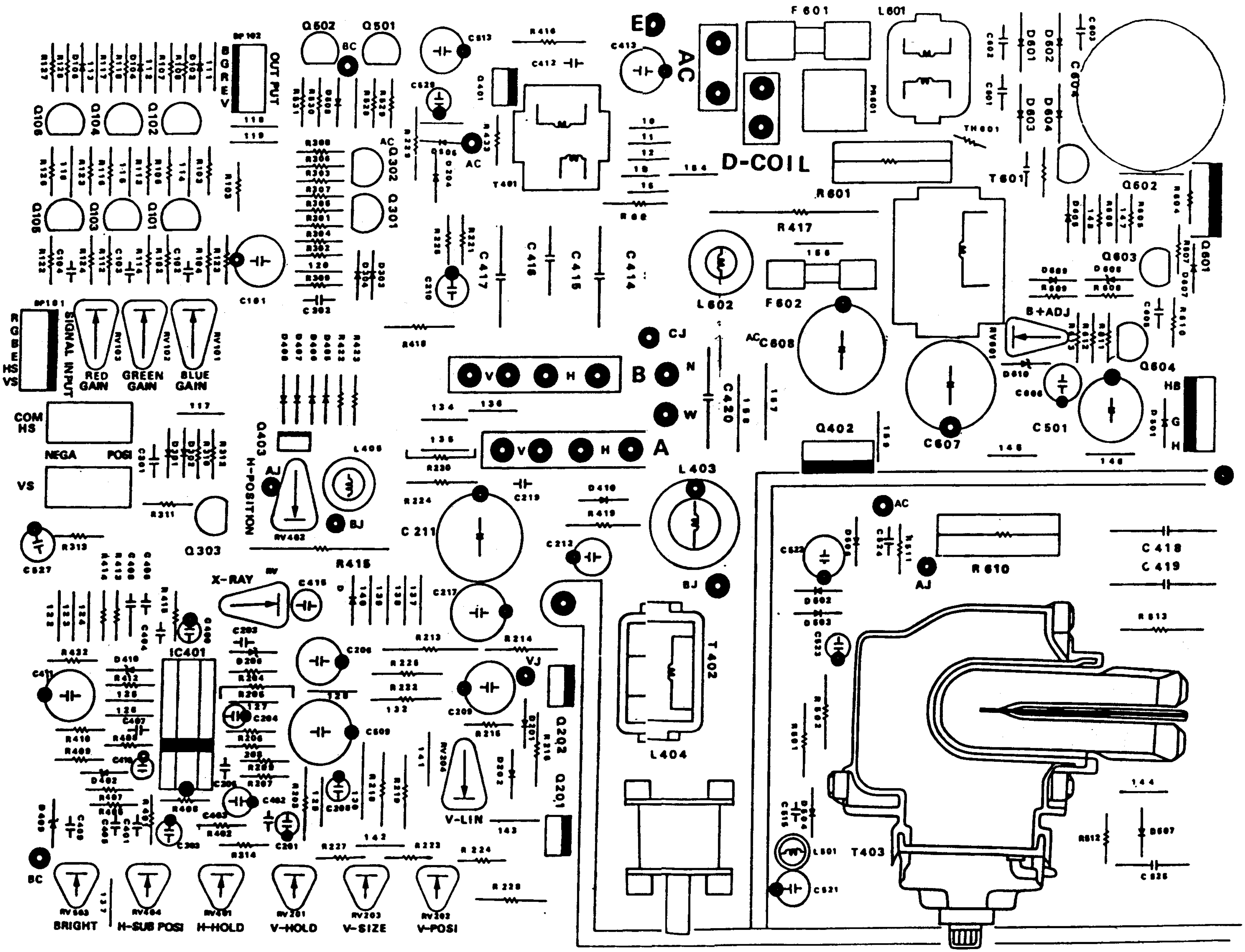
current is diverted from the yoke through the -12V R224. The amount of this current which is diverted from the yoke can be varied by varying the current by adjusting RV 202, the vertical position control, thus providing manual adjustment of the vertical position of the display. The drive signal at the yoke is also used to furnish the vertical blanking input to Q 502, C 210, R 226, D 204.

AUTOMATIC DEGAUSSING ADG

The ADG circuit automatically demagnetizes the CRT. This circuit is activated only when the monitor is initially powered up after having been off for at least 20 minuates. PR 601 is a positive temperature coefficient device. When it is cold, it has a vary low resistance. As it gets warm, its resistance increases. If PR 601 of the monitor is cold when AC power is applied, then PR 601 with a low resistance allows high current to pass through degaussing coil. As current flows through PR 601, it heats up and eventually has a very high resistance, allowing very little current to flow through it. The process of initially having a large current through the degaussing coil is what produces the degaussing action. The degaussing current decays to zero before the CRT warms up, so the degaussing is completed before the picture comes on.

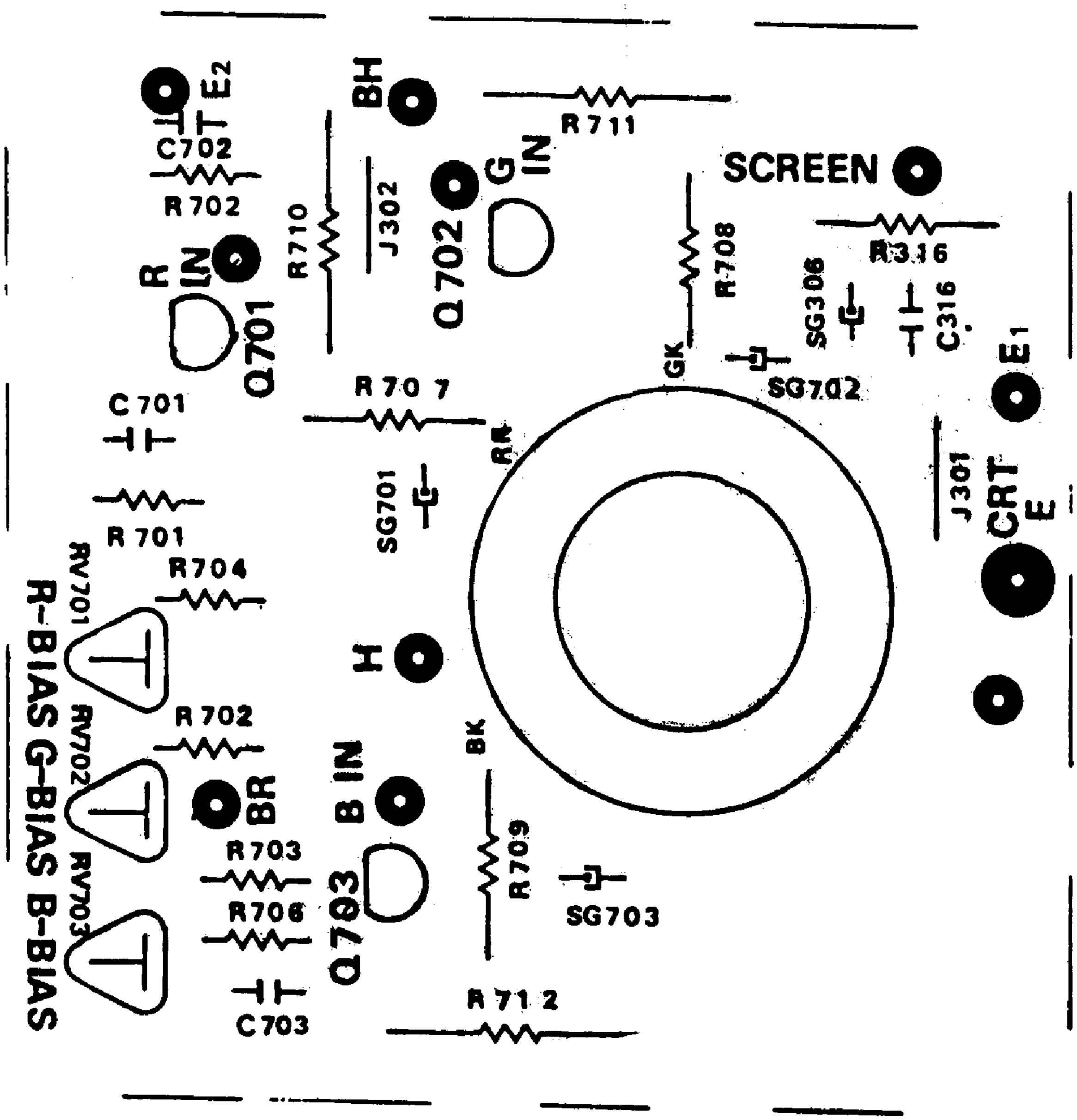
IC 401


IC 401 HA11235
2ND S.S.
sync sepa
AFC DET.
Horiz OSC.
Horiz VCC
Horiz O/P
X-ray protector
vert drive amp
O/P
NF/B
I/P
vert OSC.
vert trigg
vert VCC
GND
17
1
2
3
4
5
6
7
8
18
16
15
14
13
12
11
10
9



MAIN PC BOARD LAYOUT

CRT **P.C. BOARD LAYOUT**



Ref. No	Part No	Description
	RESISTORS	
R102	R004 – 681	680ohm ¼W Carbon
R103	R004 – 222	2.2Kohm ¼W Carbon
R104	R004 – 391	390ohm ¼W Carbon
R105	R004 – 222	2.2Kohm ¼W Carbon
R106	R004 – 391	390ohm ¼W Carbon
R107	R004 – 102	1Kohm ¼W Carbon
R108	R004 – 221	220ohm ¼W Carbon
R112	R004 – 681	680ohm ¼W Carbon
R114	R004 – 391	390ohm ¼W Carbon
R115	R004 – 222	2.2Kohm ¼W Carbon
R116	R004 – 391	390ohm ¼W Carbon
R117	R004 – 102	1Kohm ¼W Carbon
R118	R004 – 221	220ohm ¼W Carbon
R122	R004 – 681	680ohm ¼W Carbon
R123	R004 – 391	390ohm ¼W Carbon
R124	R004 – 391	390ohm ¼W Carbon
R125	R004 – 222	2.2Kohm ¼W Carbon
R126	R004 – 391	390ohm ¼W Carbon
R127	R004 – 102	1Kohm ¼W Carbon
R128	R004 – 221	220ohm ¼W Carbon
R203	R004 – 222	2.2Kohm ½W Carbon
R204	R004 – 822	8.2Kohm ½W Carbon
R205	R004 – 531	530ohm 1W Carbon
R206	R004 – 103	10Kohm ¼W Carbon
R207	R004 – 681	680ohm ¼W Carbon
R208	R004 – 272	2.7Kohm ¼W Carbon
R209	R004 – 123	12Kohm ¼W Carbon
R213	020 – 330	3Kohm Metal Oxide
R214	R004 – 272	2.7Kohm ¼W Carbon
R215	R004 – 123	12Kohm ¼W Carbon
R216	0010 – 100	10ohm 1W Metal Oxide
R217	N250 – 171	170ohm 25W Cement
R218	0010 – 039	3.9 ohm 1W Metal Oxide
R219	0010 – 531	530 ohm 1W Metal Oxide
R221	R004 – 683	68Kohm ¼W Carbon
R222	0010 – 621	620ohm 1W Metal Oxide
R223	R004 – 331	330ohm ¼W Carbon
R224	R004 – 750	750ohm ¼W Carbon
R225	R010 – 102	1Kohm 1W Metal Oxide
R226	R004 – 682	6.8Kohm ¼W Carbon
R227	R004 – 181	180ohm ¼W Carbon
R228	R002 – 271	270ohm ½W Carbon
R229	R002 – 271	270ohm ½W Carbon
R230	0010 – 272	2.7Kohm 1W Metal Oxide

Ref. No	Part No	Description
R301	R004 – 102	1Kohm ¼W Carbon
R302	R004 – 102	1Kohm ¼W Carbon
R303	R004 – 104	100Kohm ¼W Carbon
R304	R004 – 104	100Kohm ¼W Carbon
R305	R004 – 102	1Kohm ¼W Carbon
R306	R004 – 102	1Kohm ¼W Carbon
R307	R004 – 101	100ohm ¼W Carbon
R308	R004 – 101	100ohm ¼W Carbon
R309	R004 – 493	47Kohm ¼W Carbon
R310	R004 – 103	10Kohm ¼W Carbon
R311	R004 – 103	10Kohm ¼W Carbon
R312	R004 – 103	10Kohm ¼W Carbon
R313	R004 – 102	1Kohm ¼W Carbon
R314	R004 – 151	150ohm ¼W Carbon
R316	R002 – 105	1Mohm ½W Carbon
R401	R004 – 471	470ohm ¼W Carbon
R402	R004 – 822	8.2Kohm ¼W Carbon
R405	R004 – 273	27Kohm ¼W Carbon
R406	R004 – 474	470Kohm ¼W Carbon
R407	R004 – 183	18Kohm ¼W Carbon
R408	R004 – 683	68Kohm ¼W Carbon
R409	R004 – 682	6.8Kohm ¼W Carbon
R410	R004 – 113	11Kohm ¼W 1% Carbon
R411	R004 – 752	7.5Kohm 3W Metal Oxide
R412	R004 – 471	470ohm ¼W Carbon
R413	R004 – 123	12Kohm ¼W Carbon
R414	R004 – 752	7.5ohm ¼W Carbon
R415	R004 – 472	4.7ohm ¼W Carbon
R416	R002 – 222	2.2Kohm ½W ¼Carbon
R417	0050 – 282	2.8Kohm 5W Metal Oxide
R418	R002 – 102	1K ohm ½W Carbon
R419	0010 – 472	4.7K 1W Metal Oxide
R420	R002 – 101	100ohm ½W Carbon
R421	R004 – 102	1Kohm ¼W Carbon
R422	R004 – 391	390ohm ¼W Carbon
R423	R004 – 222	2.2Kohm ¼W Carbon
R424	R004 – 100	10ohm ¼W Carbon
R501	0010 – 039	3.90ohm 1W Carbon
R511	R002 – 101	100ohm ½W Carbon
R512	R004 – 103	10Kohm ¼W Carbon
R513	0030 – 033	3.3ohm 3W Metal Oxide
R528	R004 – 223	22Kohm ¼W Carbon
R529	R004 – 391	390ohm ¼W Carbon
R530	R004 – 472	4.7Kohm ¼W Carbon

Ref. No	Part No	Description
R531	R004 – 471	470ohm ¼W Carbon
R601	N050 – N47	0.47ohm 5W Cement
R602	F004 – 331	330ohm fuseble/R
R604	F004 – 680	68ohm fuseble/R
R605	R004 – 104	100Kohm ¼W Carbon
R606	R004 – 153	15Kohm ¼W Carbon
R607	R004 – 105	1Mohm ¼W Carbon
R608	R004 – 822	8.2kohm ¼W Carbon
R609	R004 – 822	8.2kohm ¼W Carbon
R610	R004 – 683	68Kohm ¼W Carbon
R612	R004 – 332	3.3Kohm ¼W Carbon
R613	0020 – 001	1ohm 2W FUSEELE Metal Oxide
R701	R004 – 122	1.2Kohm ¼W Carbon
R702	R004 – 122	1.2Kohm ¼W Carbon
R703	R004 – 122	1.2ohm ¼W Carbon
R704	R004 – 331	330ohm ¼W Carbon
R705	R004 – 331	330ohm ¼W Carbon
R706	R004 – 331	330ohm ¼W Carbon
R707	R002 – 391	390ohm ½W Carbon
R708	R002 – 391	390ohm ½W Carbon
R709	R002 – 391	390ohm ½W Carbon
R710	0020 – 822	8.2Kohm 2W Metal Oxide
R711	0020 – 822	8.2Kohm 2W Metal Oxide
R712	0020 – 822	8.2Kohm 2W Metal Oxide

SEMI – FIXED RESISTORS

Ref. No	Part No	Description
RV101	F92R – 502	5Kohm B Red
RV102	F92R – 502	5Kohm B Green
RV103	F92R – 502	5Kohm B Blue
RV201	F17W – 502	5Kohm B
RV202	F17W – 502	5Kohm B
RV203	F17W – 301	30ohm B
R204	F17W – 502	5Kohm B
R401	F17W – 302	3Kohm B
R402	F17W – 503	50Kohm B
R403	F92R – 502	5Kohm B
R404	F92R – 502	5Kohm B
R601	F92R – 302	3Kohm B
R701	F17W – 202	2Kohm B Red
R702	F17W – 202	2Kohm B Green
R703	F17W – 202	2Kohm B Blue

CAPACITORS

Ref. No	Part No	Description
C101	E016 – 477	470UF 16V Electrolytic
C102	C050 – 510	51PF 50V Ceramic
C103	C050 – 510	51PF 50V Ceramic
C104	C050 – 510	51PF 50V Ceramic
C201	E050 – 105	1UF 50V Electrolytic
C203	M050 – 333	0.033UF 50V Mylar
C204	TA25 – 225	2.2 UF 25V Tantal
C205	C050 – 271	270 PF 50V Ceramic
C206	E016 – 477	470UF 16V Electrolytic
C207	E025 – 477	470UF 25 Electrolytic
C208	TA25 – 106	10UF 25V Tantal
C209	E160 – 106	10UF 160V Electrolytic
C210	E050 – 105	1UF 50V Electrolytic
C211	E160 – 107	100UF 160V Electrolytic
C212	E050 – 476	47UF 50V Electrolytic
C217	E160 – 106	10UF 160V Electrolytic
C219	M500 – 472	0.0047 UF 500V Ceramic
C302	M050 – 104	0.1UF 50V Mylar
C301	M050 – 223	0.022UF 50V Mylar
C303	E025 – 106	10UF 25V Electrolytic
C316	C152 – 102	0.001 UF 1.5V Ceramic
C401	M050 – 333	0.033 UF 50V Mylar
C402	M050 – 333	0.003 UF 50V Mylar
C403	E050 – 105	1UF 50V Electrolytic
C404	C500 – 222	0.0022 500V Ceramic
C405	C050 – 821	820PF 50V Ceramic
C406	M050 – 103	0.01UF 50V Mylar
C407	M050 – 103	0.01UF 50V Mylar
C408	M050 – 562	0.0056UF 50V Mylar Tin
C409	M050 – 103	0.01UF 50V Mylar
C410	E016 – 336	33UF 16V Electrolytic
C411	E016 – 227	220UF 16V Electrolytic
C412	C50 – 561	560PF 500V Ceramic
C413	E160 – 105	1UF 160V Electrolytic
C414	X – 162 – 152	0.0015UF 1.6V P – P
C415	X – 162 – 332	0.0033UF 1600V P – P
C416	X200 – 104	0.1UF 200V P – P
C417	X162 – 332	0.0033UF 1600V P – P
C418	X162 – 682	0.0068UF 1600V P – P
C419	X162 – 472	0.0047UF 1600V P – P
C420	X20 – 434	0.43UF 200V P – P
C421	X200 – 563	0.056UF 200V P – P
C501	E250 – 106	10UF 250V Electrolytic
C513	E025 – 227	220UF 25V Electrolytic
C515	C500 – 222	0.0022UF 500V Ceramic

Ref. No	Part No	Description
C521	E050 – 476	47UF 50V Electrolytic
C522	E160 – 106	10UF160V Electrolytic
C523	E160 – 106	10UF 160V Electrolytic
C524	C500 – 472	0.0047UF 500V Cement
C525	X200 – 563	0.056UF 200V P – P
C529	E160 – 106	10UF 160V Electrolytic
C530	C500 – 222	0.0022UF 500V Electrolytic
C527	E050 – 476	47UF 50V Electrolytic
C602	C500 – 472	0.0047UF 500V Ceramic
C603	C500 – 472	0.0047UF 500V Ceramic
C604	E200 – 687	680UF 200V Electrolytic
C605	C500 – 222	0.0022UF 500V Ceramic
C606	E050 – 476	470UF 50V Electrolytic
C607	F160 – 107	100UF 160V Electrolytic
C608	F160 – 107	100UF 160V Electrolytic
C609	C500 – 222	0.0022UF 500V Ceramic
C601	C250 – 103	0.01UF AC 250V Ceramic
C701	C050 – 271	270PF 50V Ceramic
C702	C050 – 271	270PF 50V Ceramic
C703	C050 – 271	270PF 50V Ceramic

SEMICONDUCTORS

Ref. No	Part No	Description
D102	D1Z – 012	05Z12Y Zener Diode
D104	D1Z – 012	05Z12Y Zener Diode
D106	D1Z – 012	05Z12Y Zener Diode
D201	D1S – 081	1SS81 Diode
D202	D1S – 081	1SS81 Diode
D204	D1S – 148	1N4148 Diode
D206	D1S – 012	05Z12Y Zener Diode
D229	D1S – 012	1AZ12Y Zener Diode
D301	D1S – 148	1N4148 Diode
D302	D1S – 148	1N4148 Diode
D303	D1S – 148	1N4148 Diode
D304	D1S – 148	1N4148 Diode
D401	D1F – F02	FR 105 Diode
D402	D1S – N71	HZ7HB1 Zener Diode
D405	D1S – 081	1SS81 Diode
D406	D1S – 081	1SS81 Diode
D407	D1S – 081	1SS81 Diode
D408	D1S – 081	1SS81 Diode
D409	D1Z – 012	05Z12Y Zener Diode
D410	D1Z – 012	05Z12Y Zener Diode
D412	D1R – 002	1N4002 Diode
D501	D1F – F02	FR105 Diode
D502	D1F – F02	FR105 Diode
D503	D1F – F02	FR105 Diode
D504	D1F – F02	FR105 Diode
D505	D1S – 081	1SS81 Diode
D506	D1S – 081	1SS81 Diode
D507	D1S – 081	1SS81 Diode
D509	D1S – 148	1N4148 Diode
D601	D1R – 406	1N5406 Diode
D602	D1R – 406	1N5406 Diode
D603	D1R – 406	1N5406 Diode
D604	D1R – 406	1N5406 Diode
D605	D1S – 081	1SS81 Diode
D607	D1Z – 012	1AZ12Y Zener Diode
D608	D1Z – 012	1AZ12Y Zener Diode
D609	D1S – 081	1SS81 Diode
D610	D1Z – N71	HZ7. 1B1 Zener Diode
D607	DIS – 399	BY – 399 Diode

TRANSISTORS

Ref. No	Part No	Description
Q101	S2N – 815	2SC1815Y Transistor
Q102	S2N – 815	2SC1815Y Transistor
Q103	S2N – 815	2SC1815Y Transistor
Q104	S2N – 815	2SC1815Y Transistor
Q105	S2N – 815	2SC1815Y Transistor
Q106	S2N – 815	2SC1815Y Transistor
Q201	S2N – 138	2SD1138Y Transistor
Q202	S2N – 138	2SD1138Y Transistor
Q301	S2N – 815	2SC1815Y Transistor
Q302	S2N – 815	2SC1815Y Transistor
Q303	S2N – 815	2SC1815Y Transistor
Q401	S2N – 514	2SC1514Y Transistor
Q402	S2N – 880	2SD1880Y Transistor
Q403	S2N – 138	2SD1138Y Transistor
Q501	S2N – 673	2SA673Y Transistor
Q502	S2N – 673	2SA673Y Transistor
Q601	S2N – 306	2SC3306Y Transistor
Q602	S2N – 091	2SC1091Y Transistor
Q603	S2N – 610	2SC2610Y Transistor
Q604	S2N – 610	2SC2610Y Transistor
Q701	S2N – 514	2SC1514Y Transistor
Q702	S2N – 514	2SC1514Y Transistor
Q703	S2N – 514	2SC1514Y Transistor

Ref. No	Part No	Description
	ICS	
IC 401	IHI-S35	HA11235
	TRANSFORMER & COILS	
T401	T610-002	Transformer Horiz Drive
T403	T610-110	Flyback Transformer
T601	T610-210	Pulse Transformer
L403	L610-010	Horiz Linerity Coil
L404	L610-020	Horiz Width Coil
L405	L610-002	Horiz Position Coil
L406	L610-003	Horiz Coil
L501	L610-101	Power Choke Coil
L601	L610-100	Line Filter Coil
L602	L610-431	Power Choke Coil
T402	T610-111	Side Pincushion Transformer
	MISCELLANEOUS	
CS701	U290-012	CRT. Socket
F601	U125-004	Fuse 4Amp 125V
F602	U125-N12	Fuse 1.2Amp 125V
PR601	PR06-140	Posistor PTH 451Co6 BG080 N
TH601	TH08-013	THERMISTOR 8D-13
	Color Picture Tube	
PD401	PT63-544	CRT & DY