

Service Manual

Datatrain DC353S and DC355S Monitors

DataTrain

A division of:

Roland DG Canada Inc.

Vancouver:	13880 Mayfield Place, Richmond, BC, V6V 2E4	(604) 273-4453
Toronto:	346 Watline Ave., Mississauga, ON, L4Z 1X2	(416) 890-7568
Montreal:	3469 Rue Ashby, St Laurent, PQ, H4R 2K3	(514) 332-6371

CONTENTS

SPECIFICATIONS	3
IMPORTANT SERVICE SAFETY PRECAUTIONS	4
THEORY OF OPERATION	6
1. Power Supply	6
2. Main Board	6
DISASSEMBLY INSTRUCTIONS	8
BLOCK DIAGRAM	9
ALIGNMENT INSTRUCTIONS	10
TROUBLESHOOTING GUIDE	15
WIRING DIAGRAM AND PARTS LOCATION	19
PRINTED CIRCUIT BOARDS (Top and Bottom Views)	20
CABINET EXPLODED VIEW	28
CABINET PARTS LIST	29
ELECTRICAL PARTS LIST	31
SCHEMATIC DIAGRAM	51
WAVEFORMS	53
SEMICONDUCTOR LEAD IDENTIFICATION	54

SPECIFICATIONS

DESCRIPTION	NOMINAL	LIMIT
1. Power input	AC 220V 50HZ	
2. Power consumption	90W	+10%, -30%
3. CRT	14" 90° deflection. Non-glare. 0.31 dot pitch	
4. Input signal		
a) Video	Mode 1 ; R, G, B, I separate TTL - Level. positive. Mode 2 ; R, G, B, r, g, b separate TTL - Level. positive	2.4-5.0Vp-p
b) Synchronous	Mode 1 ; H, V - Sync TTL - Level. positive. Mode 2 ; H - Sync TTL - Level. positive. V - Sync TTL - Level. negative.	
5. Resolution	Mode 1 ; 640 dots x 200 Lines (16 colors) Mode 2 ; 640 dots x 350 Lines (64 colors)	
6. Synchronous		
a) Horizontal	Mode 1 ; 15.75kHz (overscan) Mode 2 ; 21.8kHz (underscan)	±0.3kHz ±0.3kHz
b) Vertical	50 - 60 Hz	
7. Display size	9.84" x 6.69" (250mm x 170 mm)	+4/-2mm
8. Linearity		7% Max.
9. High voltage	22kV	±0.5kV

NOTE: Nominal specs represent the design specs; all units should be able to approximate these — some will exceed and some may drop slightly below these specs.

Limit specs represent the absolute worst condition which still might be considered acceptable; in no case should a unit perform to less than within any limit spec.

IMPORTANT SERVICE SAFETY PRECAUTIONS

Service work should be performed only by qualified service technicians who are thoroughly familiar with all of the following safety checks and servicing guidelines:

WARNING

1. For continued safety, do not attempt to modify the circuit.
2. Disconnect the AC power before servicing.
3. Semiconductor heat sinks are potential shock hazards when the chassis is operating.

SERVICING THE 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. (The AC line cord should be disconnected from the AC outlet.)

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

X-RADIATION AND HIGH VOLTAGE LIMITS

1. Be sure all service personnel are aware of the procedures and instructions covering X-radiation. The only potential source of X-ray in a current solid-state display monitor is the picture tube. However, the picture tube does not emit measurable X-ray radiation if the high voltage is as specified in the "high-voltage check" instructions.
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 below the maximum level specified.
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 the rated value — no 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.

4. 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.
5. Do not use a picture tube other than that specified or make unrecommended circuit modifications to the high voltage circuitry.
6. When troubleshooting and taking test measurements on a display monitor with excessively high voltage, avoid being unnecessarily close to the display monitor. Do not operate the display monitor longer than is necessary to locate the cause of excessive voltage.

BEFORE RETURNING THE DISPLAY MONITOR

Fire and Shock Hazard

Before returning the display monitor to the user, perform the following safety checks:

1. Inspect all lead dress to make certain that the leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the display monitor.
2. Inspect all protective devices such as nonmetallic control knobs, insulating materials, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacitor 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 1.5k ohm, 10 watt resistor paralleled by a 0.15 μ F capacitor in series with all exposed metal cabinet parts and a known earth ground, such as electrical conduit or electrical ground connected to earth ground.
 - Use a SSVM or VOM with 1000 ohms per-volt or higher sensitivity to measure the AC voltage drop across the resistor. (See Figure 1.)

Connect the resistor connection to all exposed metal parts having a return path to the chassis (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 nonpolarized 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 display monitor to the user.

SAFETY NOTICE

Many electrical and mechanical parts in display monitors have special safety-related characteristics. These characteristics often pass unnoticed and the protection afforded by them cannot necessarily be obtained by using replacement components rated for higher voltage, wattage, etc.

Replacement parts that have these special safety characteristics are identified in this manual; electrical components having such features are identified by a Δ and shaded in the Replacement Parts Lists and Schematic Diagram. For continued protection, replacement parts must be identical to those used in the original circuit. The use of a substitute replacement part that does not have the same safety characteristics as specified in this service manual, may create shock, fire, X-radiation or other hazards.

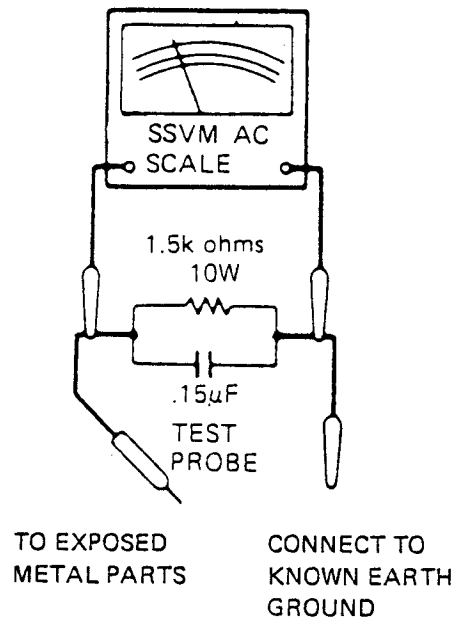


Figure 1. Leakage Current Test Circuit

THEORY OF OPERATION

GENERAL

is a high-resolution color display using a 0.31 pitch CRT with etched faceplate. It uses six TTL-level color input signals and separate sync signals. It can operate in either 200 or 350-line mode.

The switching is automatic and based on the polarity of vertical sync.

DESCRIPTION

1. Power Supply

This is a constant-frequency quasi-bridge switched-mode power supply of flyback type. The output voltage regulation is achieved by means of variable duty cycle. The control circuit IC911 monitors the voltage at pin 13 of MM912 and regulates the duty cycle so that this voltage is kept constant. The output voltages can be varied by means of VR911.

Q915 and Q916 act as switches. D924 and D925 form the rest of the quasibridge circuit. R933, C930 and D921 form a DIAC oscillator which is used to start the power supply.

When the power-supply starts R932 and D923, turn off the DIAC oscillator.

Output Voltages:	Pin No.	V
	M1/1	12
	M1/2	GND
	M1/3	6.2
	M1/4	Heater GND
	M2/1	153
	M2/3	55
	M2/4	GND
	M2/5	20

IMPORTANT: When replacing the power supply, make sure that the green/yellow ground wire is properly attached to the main chassis frame. When replacing the fuse, make sure that the fuse is of the same type and rating as the original.

2. Main Board

2-1. Vertical Oscillator/Amplifier IC411

IC411 (TDA 2653A) Includes the Following Functions.

- o Vertical oscillator
- o Ramp generator
- o Linearity control
- o Output amplifier

There are two vertical height controls: RT1 and RT2. RT1 is for the 200 line mode and RT2 for the 350 line mode. The potentiometers are automatically selected by analog switch IC511.

2-2. Horizontal Combination IC311 (TDA2593) IC311 Includes the Following Functions.

- o Horizontal oscillator
- o Phase-locked loop for frequency and phase comparison.
- o Phase locked loop to compensate various delay times of the horizontal output transistor.
- o Driver stage.

The sync signal is input to pin 9 and the horizontal flyback pulse to pin 6. These two signals are compared and the circuit is locked to a correct frequency and phase. Analog switch IC312 uses the mode signal to switch the horizontal oscillator to 15.7KHz or 22 KHz mode.

2-3. Horizontal Output Stage Q362

Q362 is a horizontal output switch, which is closed during the scan period and opened during the fly-back. It receives a drive signal from IC311 via Q361 and M361.

The flyback time is determined by the resonance of C366 and the deflection yoke.

The additional energy to compensate for the losses in the circuit is driven via L363.

C363 makes the necessary S-correction. Because of the losses in the deflection yoke, a linearity correction is required. This is achieved by L362, which is a saturating choke.

The saturation is controlled by means of adjustable permanent magnet rings.

2-4. Horizontal Width Control Stage Q511

The amount of energy fed to the horizontal output stage is controlled by Q511. It is simply a linear series regulator. D513 forms a reference voltage. This voltage and a rectified flyback voltage are compared in an error amplifier Q512, which controls Q511. In this way a very stable picture width is achieved. Pincushion correction is achieved by adding a parabolic waveform to the reference voltage. This

parabola is formed by integrating a vertical sawtooth in the first stage of IC512. The second stage of IC512 inverts the parabola. Analog switch IC511 takes care of the width correction between the two deflection frequencies.

2-5. High-Voltage Generator Q214

A voltage of 22kV for the CRT is generated by a flyback generator which is synchronized to the horizontal frequency in order to avoid jitter. High-voltage transformer M213 provides an output voltage of about 7kV, which is fed to a tripler. The focus voltage is also divided in the tripler from the anode voltage resulting in a good focus tracking.

Anode voltage is regulated against the variations in the beam current. IC211/Q213 form a series regulator with a feedback from the focus voltage divider. D214 is a reference diode. R225 and Q231 with its peripheral components limit the average beam current to 300 μ A max.

IC211 is also used for X-ray protection. In case of abnormally high voltage, the X-ray protection circuit periodically shuts down the high-voltage generator. D219 is used as a reference for this purpose.

2-6. CRT Socket Board.

Functions: G2 voltage alignment VR1

2-7. Video Amplifier

Video card receives six TTL-level color signals in the high-resolution mode and three color signals plus an intensity bit in the medium-resolution mode. These input bits plus mode bit address a multiplexer (IC102).

Six bits of the contents of each memory location are used to determine the color. The outputs of the multiplexer (IC102) are designated R0, B0, G0 and R1, B1, G1, R0, B0 and G0 are LSBs; R1, G1 and B1 are MSBs.

The brightness control in the front has an effect on both MSB and LSB, while contrast controls only LSB. The consequence of this is that contrast works as a HUE control.

The front contrast control can be made effective by pulling out the knob. Otherwise the HUE is in a normalized position, which is determined by RT4 in the rear panel. The background brightness can be slightly varied by RT3 in the rear panel.

Pin	16 Color(Mode 1)	64 Color(Mode 2)
1	Shield GND	Ground
2	Shield GND	R0
3	R1	R1
4	G1	G1
5	B1	B1
6	Intensity	G0
7	Unused	B0
8	Horiz Sync	Horiz Sync
9	Vert Sync (+)	Vert Sync (—)

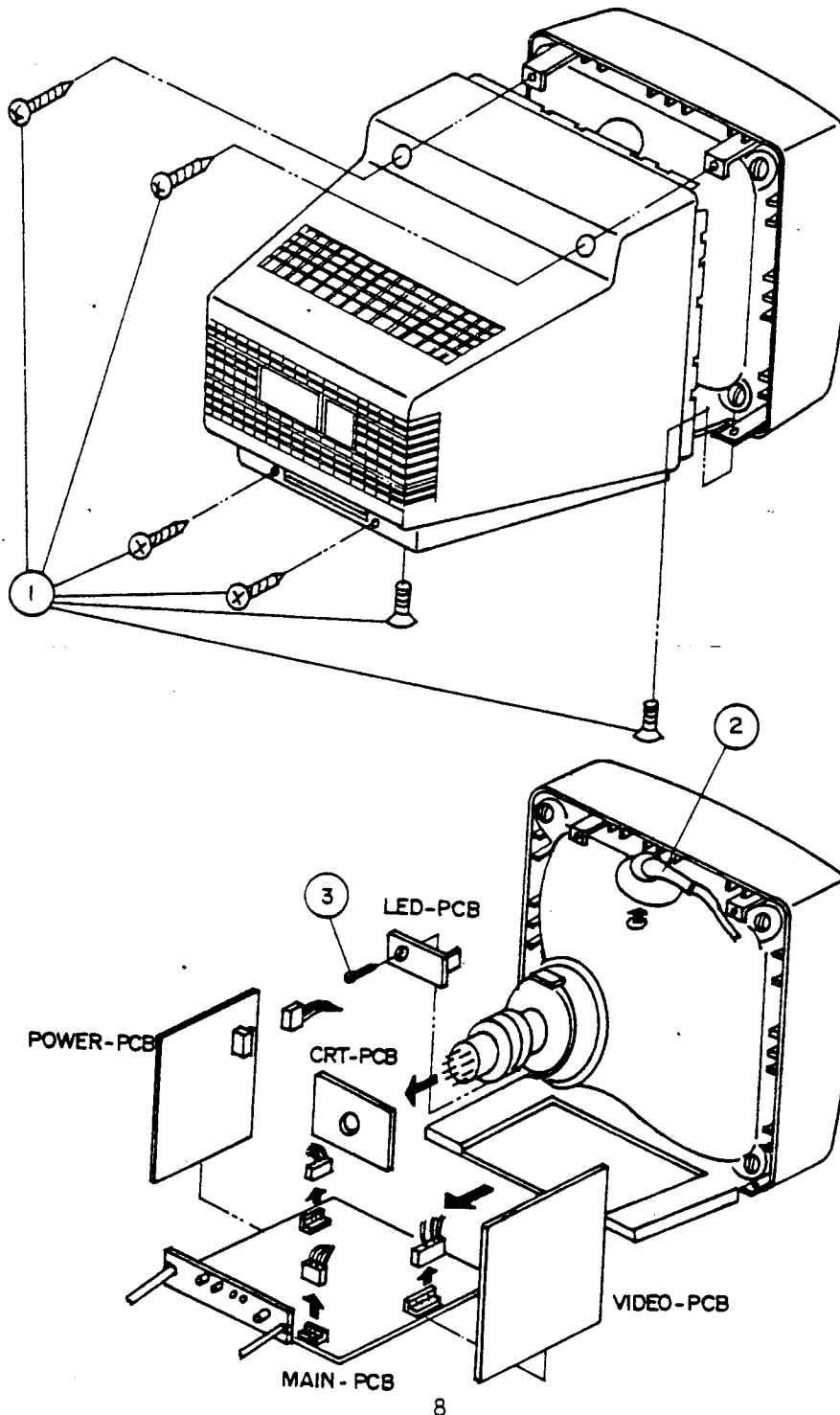
Signal cable pin connections.

DISASSEMBLY INSTRUCTIONS

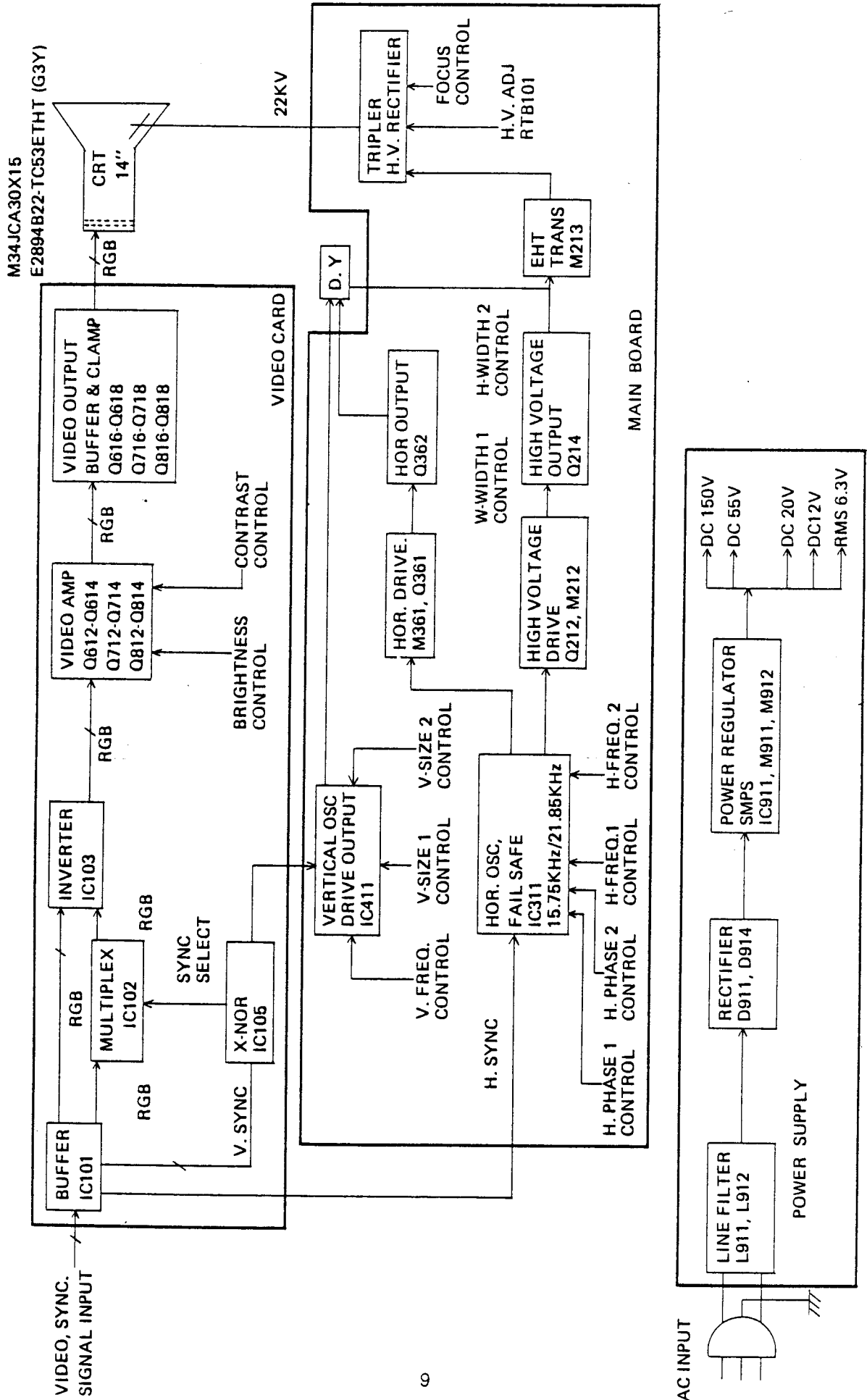
1. Remove the 6 screws ① retaining the rear cabinet.
2. (1) Remove the CRT's anode cap ② from the CRT.
(2) Remove the CRT-PCB after disconnecting the ground connector.
(3) Disconnect all of the connectors from the PCBs.
(4) Remove the video-PCB and power-PCB from the main-PCB.
(5) Remove the main-PCB and LED-PCB from the front cabinet.

3. Remove the screw ③ from the front cabinet to remove the LED-PCB.

NOTE: Refer to the EXPLODED VIEW for a more detailed disassembly procedure.

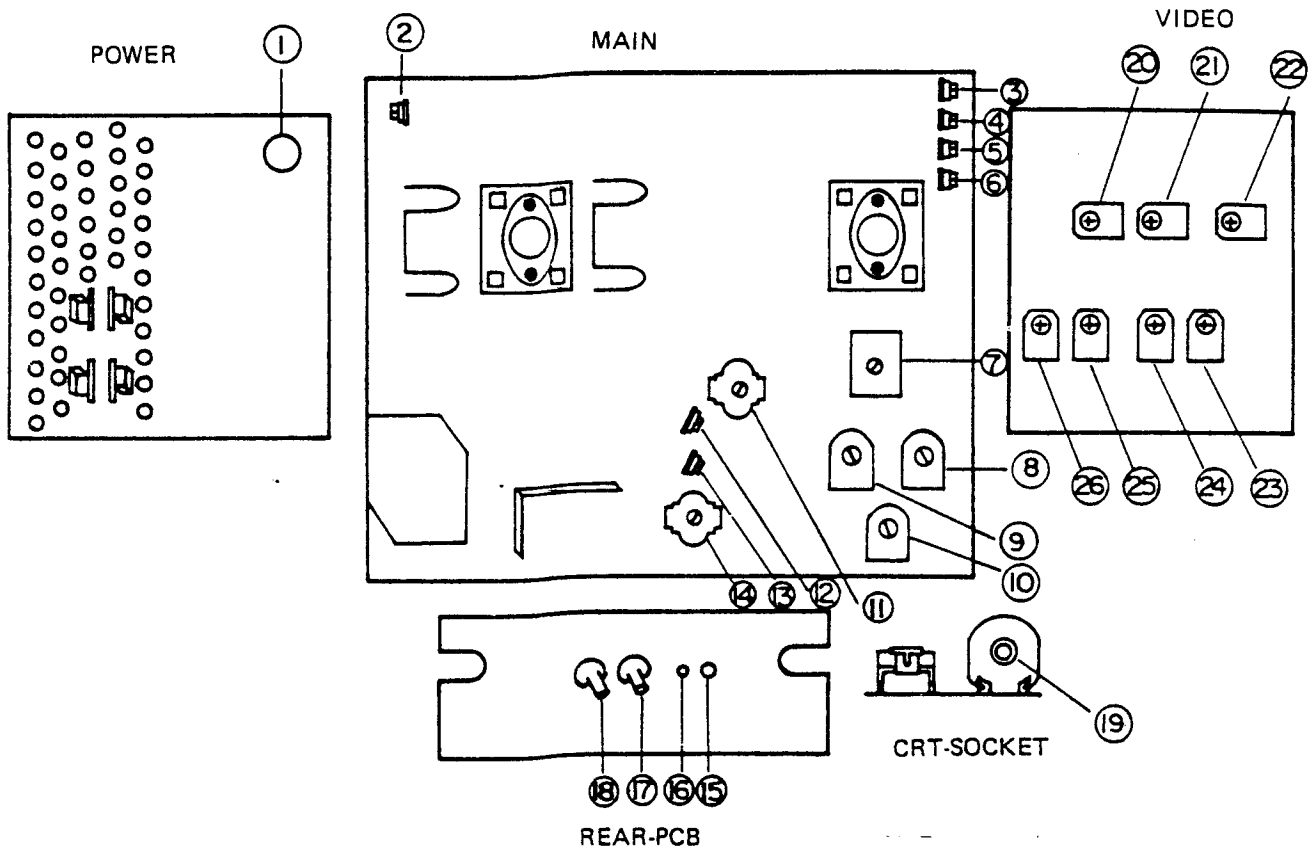


BLOCK DIAGRAM



ALIGNMENT INSTRUCTIONS

• ADJUSTMENT POINT/PARTS LOCATION



NO.	REF. NO.	CONTROL FUNCTION	NO.	REF. NO.	CONTROL FUNCTION
1	VR911	POWER SUPPLY VOLTAGE (153V)	14	VR413	V-CENTERING
2	VR212	ANODE VOLTAGE (22kV)	15	RT4	SUB-CONTRAST
3	VR312	H-FREQ. MODE 1	16	RT3	SUB-BRIGHTNESS
4	VR313	H-FREQ. MODE 2	17	RT2	V. SIZE MODE 2
5	VR314	H-PHASE. MODE 1	18	RT1	V. SIZE MODE 1
6	VR315	H-PHASE. MODE 2	19	VR1	G2 VOLTAGE
7	L362	HORIZONTAL LINEARITY	20	VR814	G-CUT OFF VOLTAGE
8	VR513	H-WIDTH. MODE 1	21	VR714	B-CUT OFF VOLTAGE
9	VR512	H-WIDTH. MODE 2	22	VR614	R-CUT OFF VOLTAGE
10	VR515	PINCUSHION	23	VR812	G-MSB
11	VR362	H-CENTERING	24	VR813	G-LSB
12	VR412	V-FREQ.	25	VR712	B-MSB
13	VR414	VERTICAL LINEARITY	26	VR713	B-LSB

• ALIGNMENTS AFTER REPAIRING PARTS ON PCB LEVEL

PCB Level Alignment	Power PCB	Main PCB	Video PCB	CRT PCB	CRT
Ext. Degaussing	0	0	0	0	0
Power S. Output Voltage	0				
Vertical Freq.		0			
Horizontal Freq.		0			
Anode Voltage		0	x	x	0
Focus		0	x	x	0
Hor Centering		0			0
Hor. Linearity		0			0
Pincushion		0			0
Width		0			0
Vertical Cent.		0			0
Vertical Lin.		0			0
Height 1	x	0			0
Height 2	x	0			0
White X/Y		0	0	0	0
CRT Tilt					0
Convergence		x			0

0 = Alignment Items x = Check Items

• ALIGNMENT PROCEDURE (Unit Facing East)

1. Power Supply Output Voltage

Connect a DVM to connector M2 pin 1. Adjust the voltage to 153V by means of ① VR911.

2. Vertical Frequency

Connect a frequency counter across the vertical deflection coil and adjust the frequency to 45Hz by means of ⑫ VR421. The signal cable must be disconnected from the computer.

3. Horizontal Frequency

Use a crosshatch pattern. Short-circuit connector B5 pin 1 to ground. Use ④ VR313 in the High-Res. Mode and ③ VR 312 in the Med-Res. Mode to get the crosshatch in an upright position remove the short.

4. Horizontal Centering

Increase background brightness to show the raster. Use ⑥ VR315 in the high-resolution mode to center the crosshatch within the raster. Use ⑦ VR362 to center the raster. Centering tolerance should be $\pm 2\text{mm}$. Use ⑤ VR314 to center the crosshatch in the medium-resolution mode.

5. Anode Voltage

Adjust the best overall focus. Measure the anode voltage from the CRT anode CAP. Adjust anode voltage to 22kV using ② VR212. Check the focus and readjust if necessary.

6. Horizontal Linearity

High-resolution mode. Crosshatch pattern. Adjust ⑦ L362 for maximum picture width. Then slowly back until the squares are equal in width.

7. Pincushion

Straighten the side lines with ⑩ VR515.

8. Width

Adjust the data area width to 9.84" ($250 \pm 2\text{mm}$) using ⑨ VR512 in the high-resolution mode and using ⑧ VR513 in the medium-resolution mode.

9. Vertical Centering

Center the data area with ⑭ VR413.

10. Vertical Linearity

Adjust the squares equal in height with ⑬ VR414.

11. Height 1 (200 Lines)

Adjust data-area height to 6.7" ($170 \pm 2\text{mm}$) with ⑬ RT1.

12. Height 2 (350 Lines)

Switch to 350 line mode. Adjust data-area height to 6.7" ($170 \pm 2\text{mm}$) with ⑰ RT2.

13. White X/Y

White data area, high-resolution mode. Turn the brightness to the minimum position. Connect the DVM to each CRT cathode (200 V/DC range). Use respective potentiometers ② VR614, ① 714, and ② 814 to adjust a voltage of 110V to each cathode. Turn the G2 control to a position where the raster just disappears.

Disconnect the vertical deflection yoke (connector B3). Turn ⑰ VR1 so that the horizontal line just disappears. Notice the color of the line. Connect the vertical deflection yoke.

Place the sensor of the color analyzer on the center of the screen. Turn the brightness clockwise to a point where the reading of the analyzer is reliable. Use two potentiometers out of ② VR614 and ② 814 to achieve the correct color coordinates ($X=0.281$, $Y=0.311$). You should not change the voltage of the most sensitive color any more (color of the horizontal line). White data area, gray 1 (MSB only). Pull out the contrast knob and turn the contrast to maximum. Adjust ② VR813 and ② VR713 to achieve the correct color coordinates. Push down the contrast knob.

Brown data area. Adjust ⑮ RT4 to set the data area brown.

14. CRT Tilt Adjustment

Use a cross-hatch pattern. Adjust the CRT with fastening screws so that dimensions A and B, measured from bezel edge, are separately equal. (Fig. 2, Below)

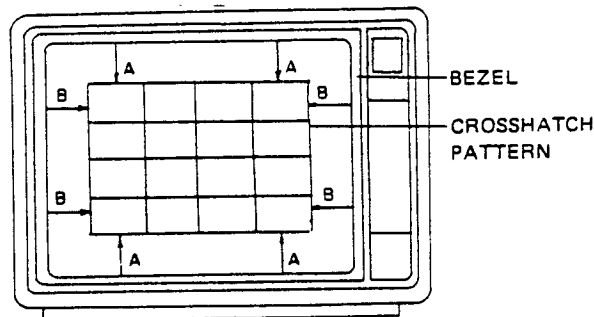


Fig. 2.

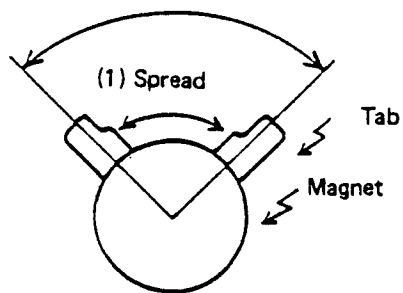
15. Static Convergence Adjustment

Use a cross-hatch pattern. Convergence error should not be over 0.5mm. Preheat monitor at least 15 minutes.

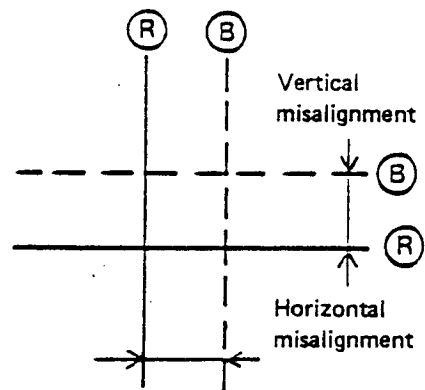
Turn the CRT to face east and degauss it.

A. Alignment of (R) and (B) with the 4-pole magnet

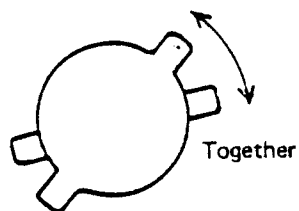
(2) Movable in spread condition



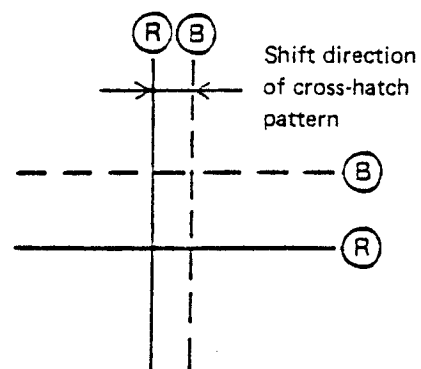
O-MAGNETIC
FIELD



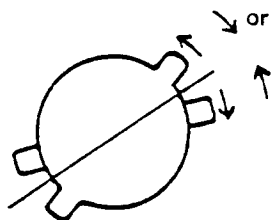
Vertical direction



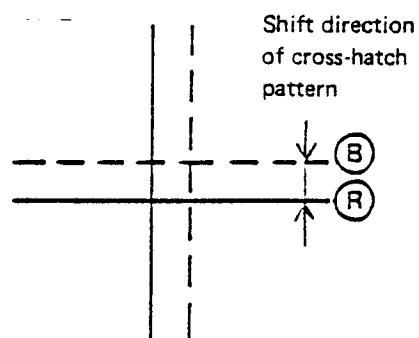
MOTION (1)



Horizontal direction

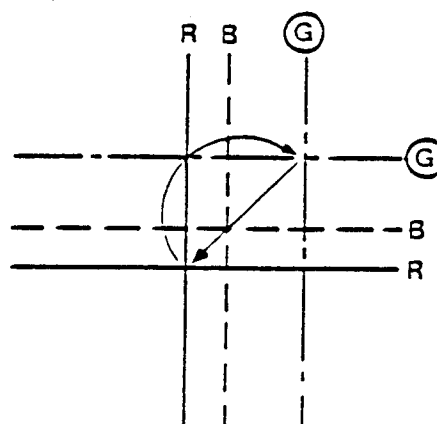


MOTION (2)

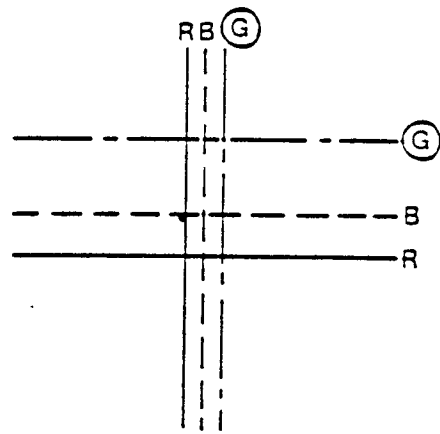


B. Alignment of (R) and (B) with (G) (6-pole magnet)

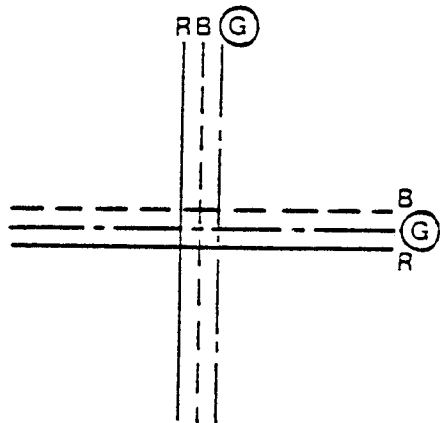
O-MAGNETIC
FIELD



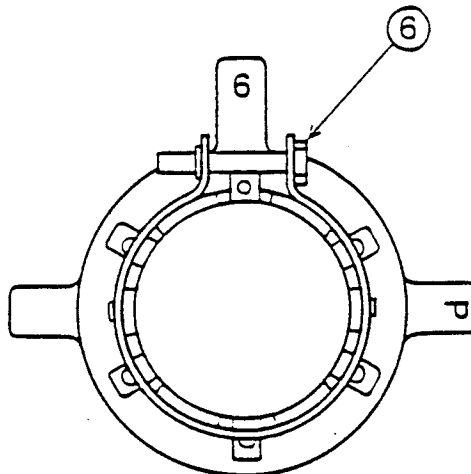
MOTION (1)



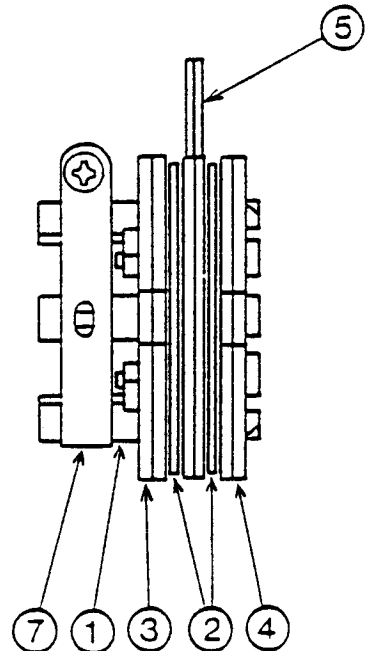
MOTION (2)



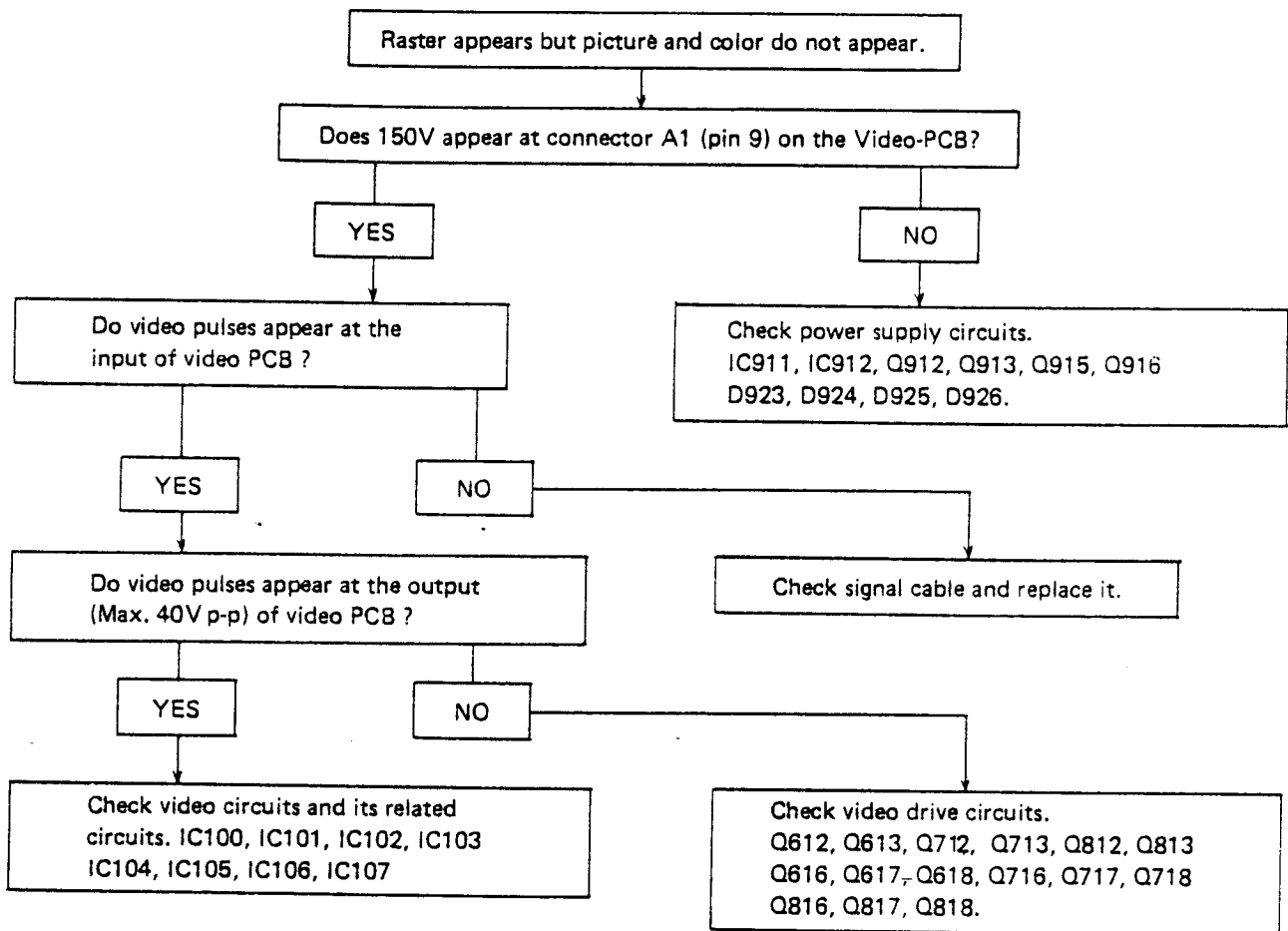
Convergence Purity Magnet

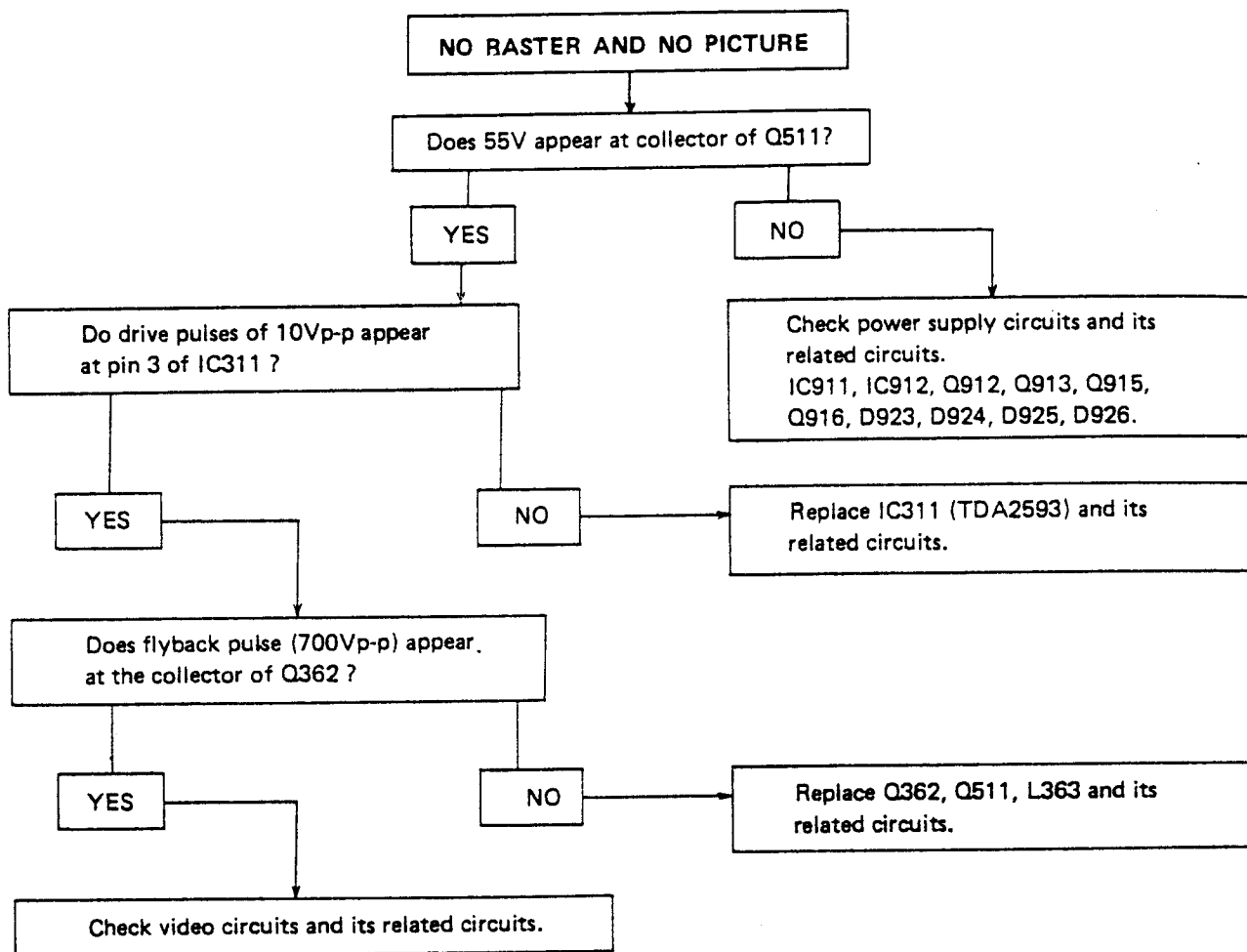


1. Holder
2. Spacer
3. Purity magnet
4. 4 pole magnet
5. 6 pole magnet
6. Setup bolt
7. Band



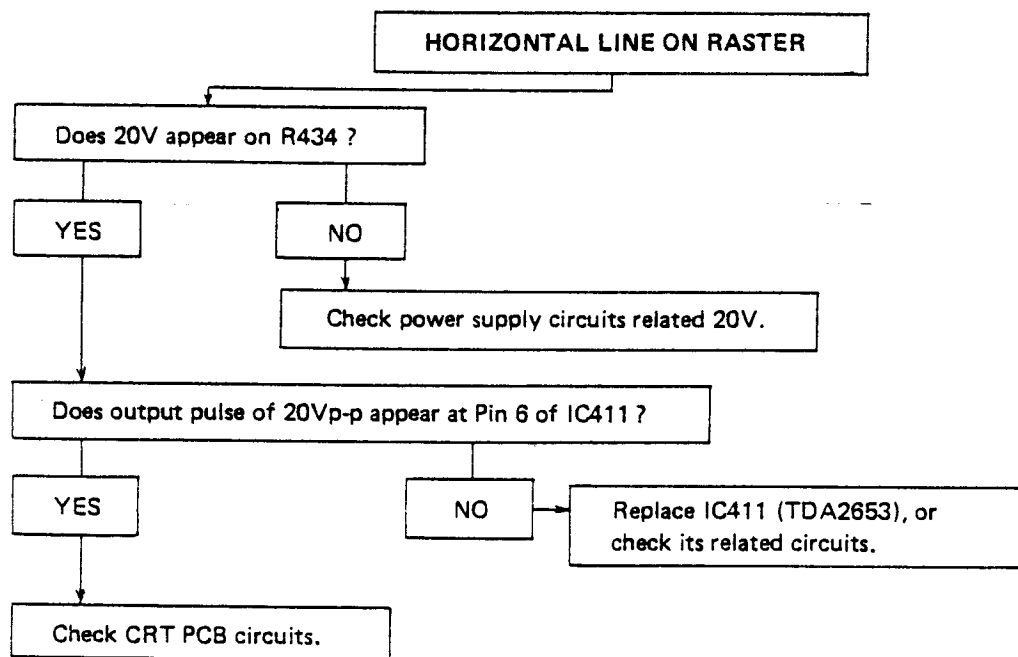
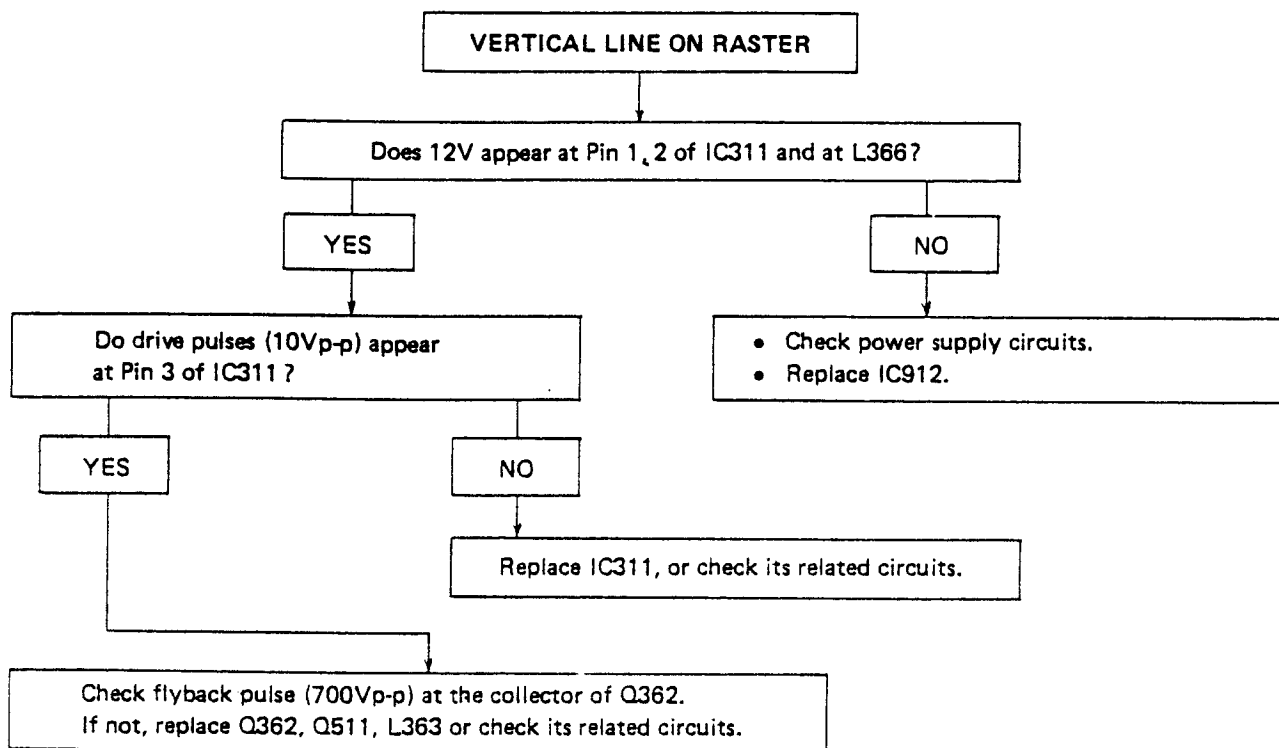
TROUBLESHOOTING GUIDE

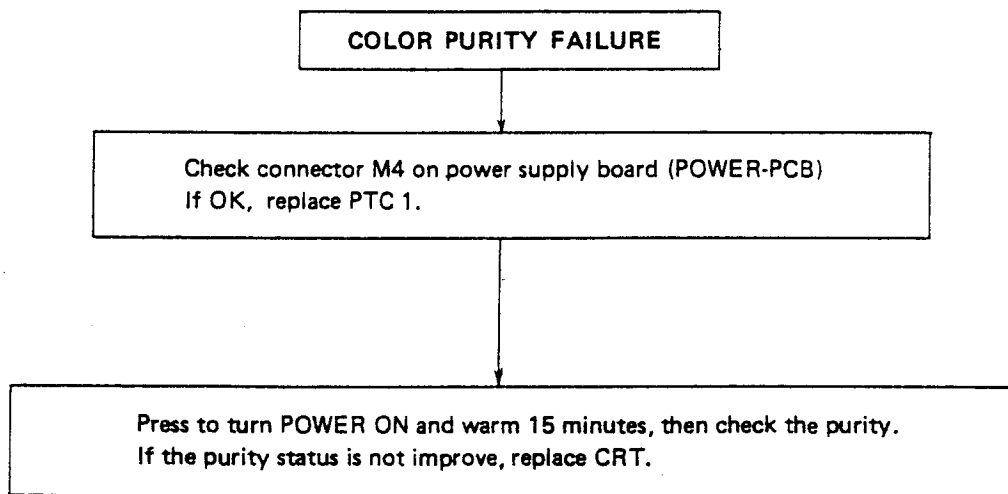




CIRCUITS TO BE CHECKED:

1. No raster appears
 - Power circuits
 - Horizontal sync circuits
 - Protector circuits (Related IC311 Pin 4)
2. A high voltage develops but no raster appears.
 - Video output circuits.
3. A high voltage is not developed.
 - High voltage circuits.





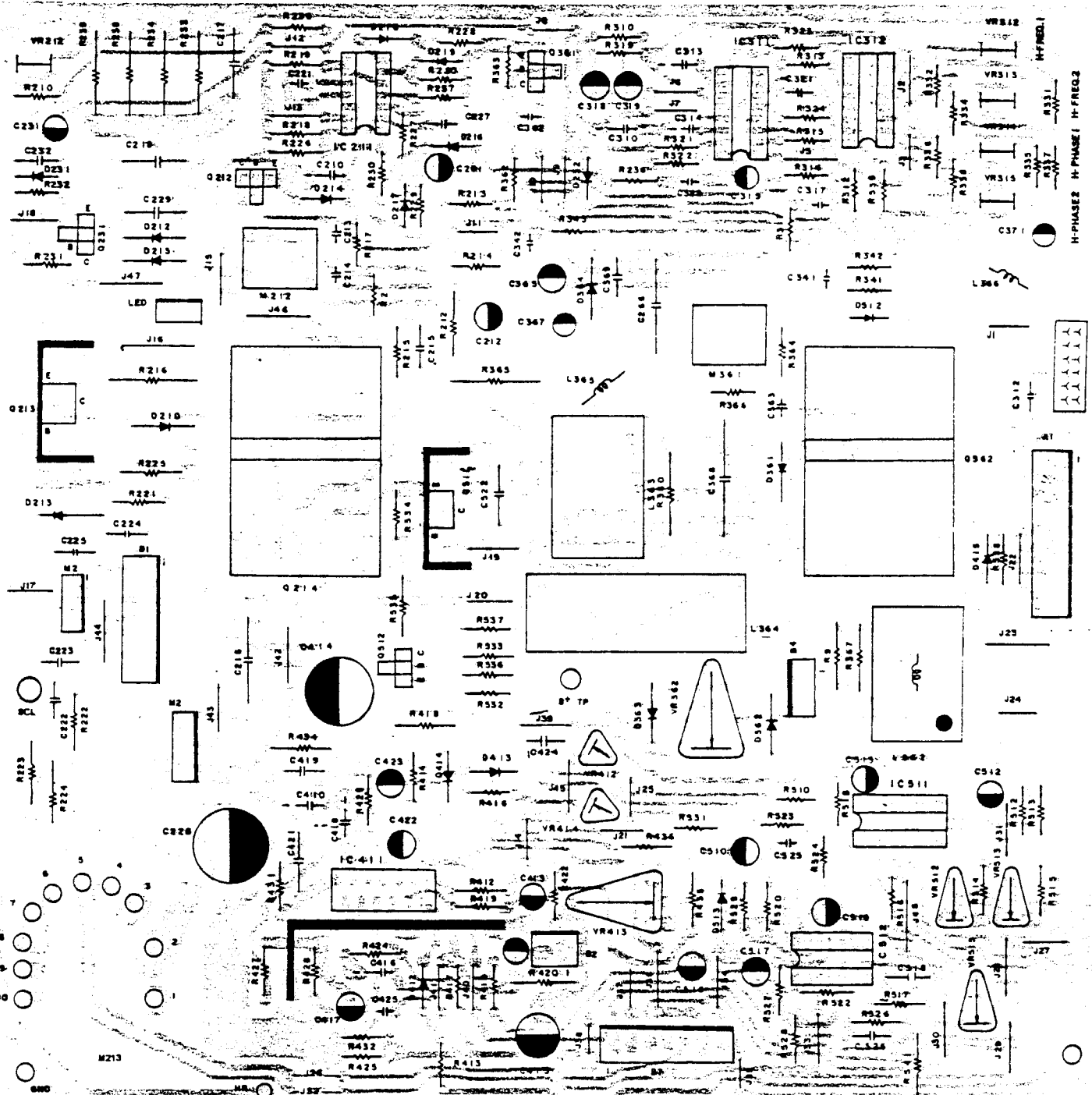
NOTE: If color purity is not normal, manual degauss should be done by mandatory method using the manual degaussing coil before inspecting.

CONTENTS

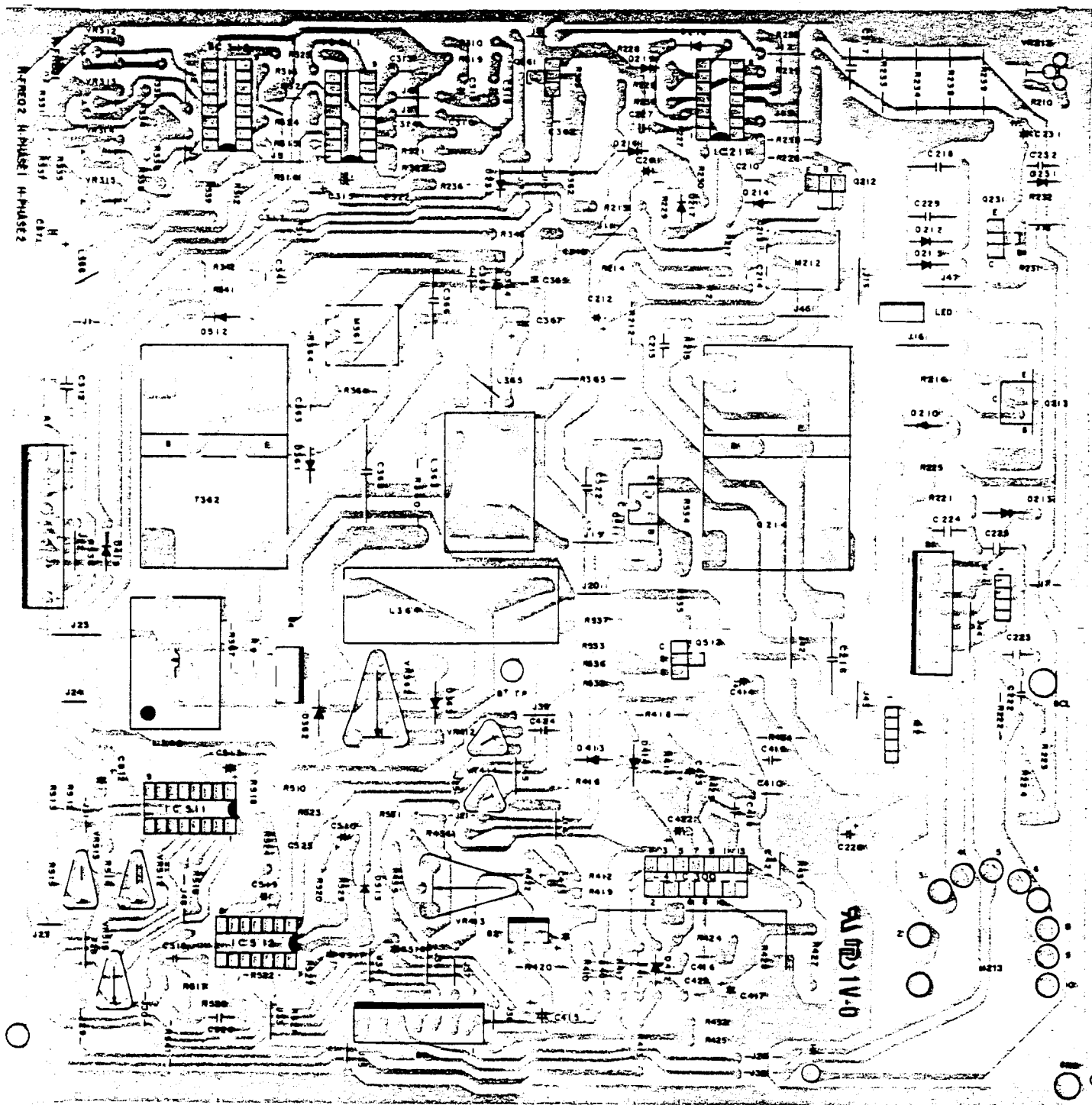
SPECIFICATIONS	3
IMPORTANT SERVICE SAFETY PRECAUTIONS	4
THEORY OF OPERATION	6
1. Power Supply	6
2. Main Board	6
DISASSEMBLY INSTRUCTIONS	8
BLOCK DIAGRAM	9
ALIGNMENT INSTRUCTIONS	10
TROUBLESHOOTING GUIDE	15
WIRING DIAGRAM AND PARTS LOCATION	19
PRINTED CIRCUIT BOARDS (Top and Bottom Views)	20
CABINET EXPLODED VIEW	28
CABINET PARTS LIST	29
ELECTRICAL PARTS LIST	31
SCHEMATIC DIAGRAM	51
WAVEFORMS	53
SEMICONDUCTOR LEAD IDENTIFICATION	54

PRINTED CIRCUIT BOARD(Top and Bottom Views)

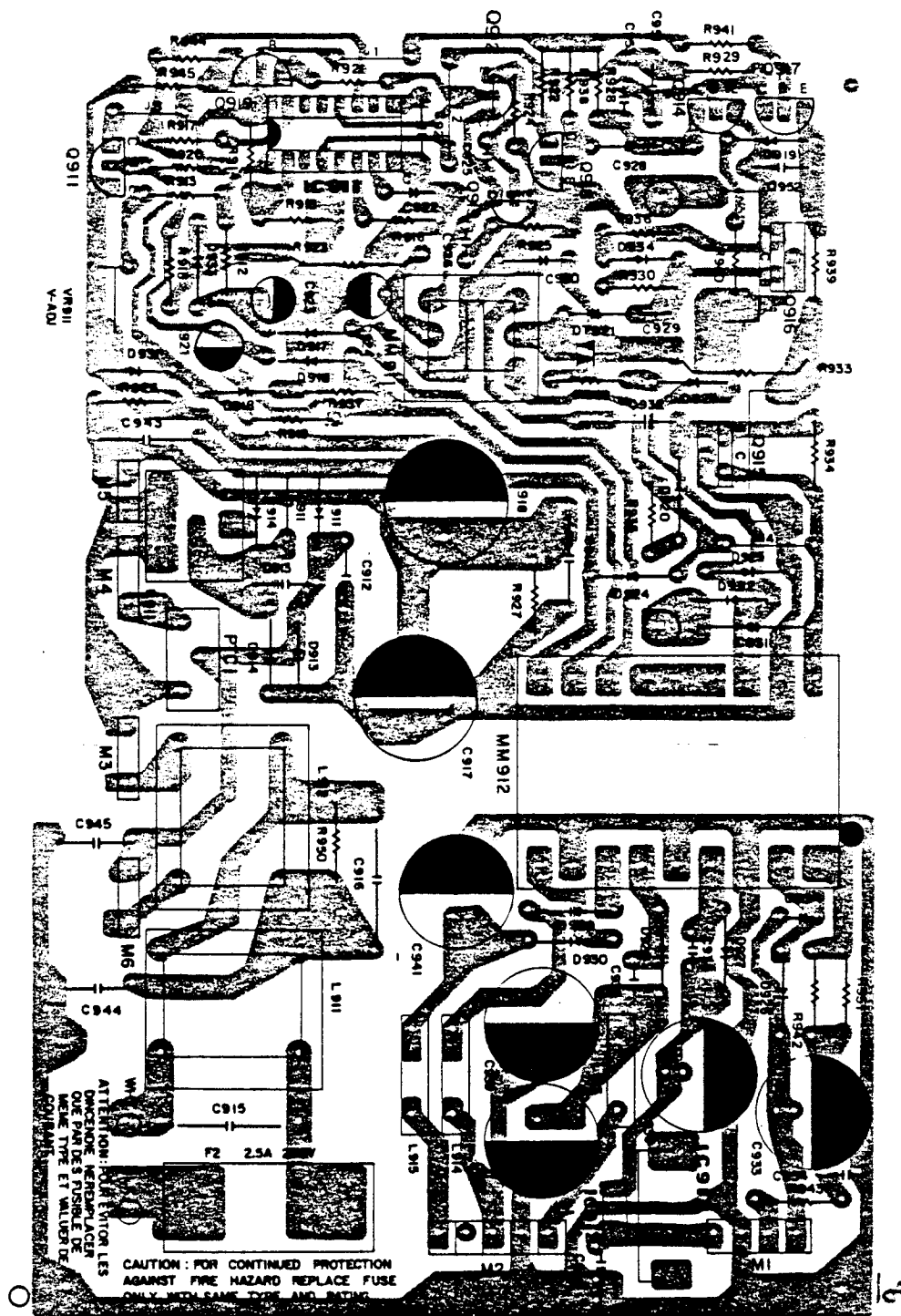
Main PCB (Top View)



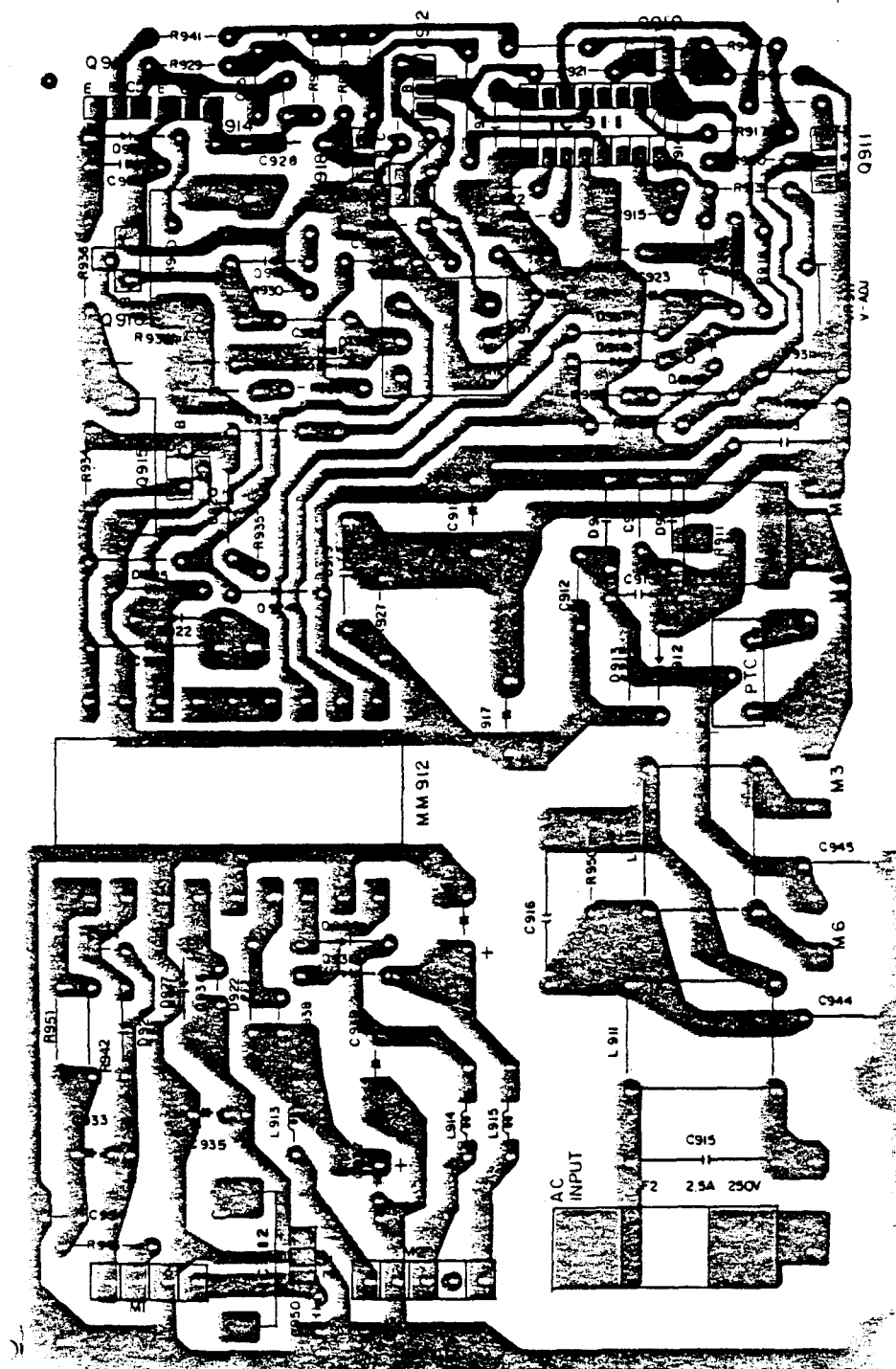
Main PCB (Bottom View)



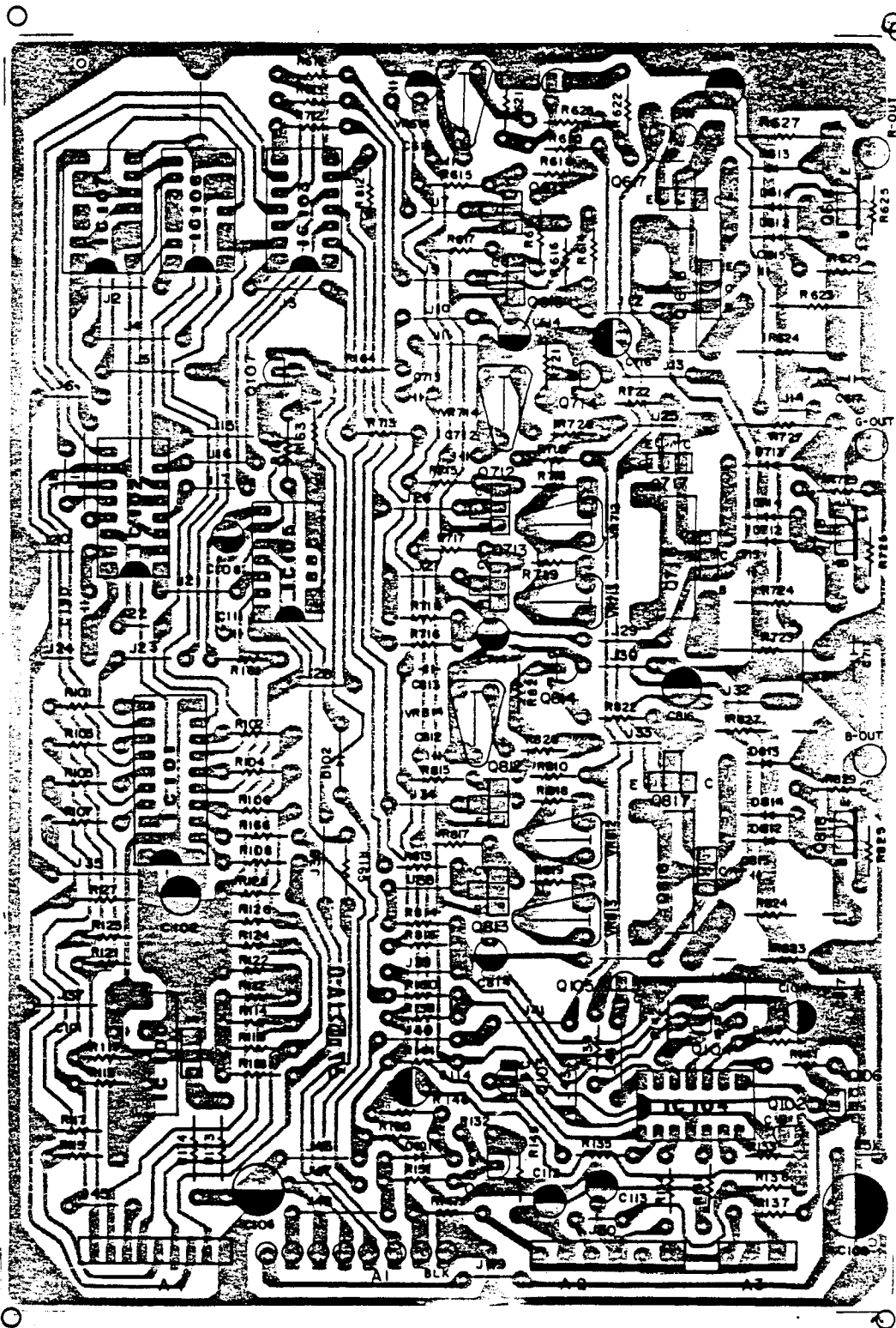
Power PCB (Top View)

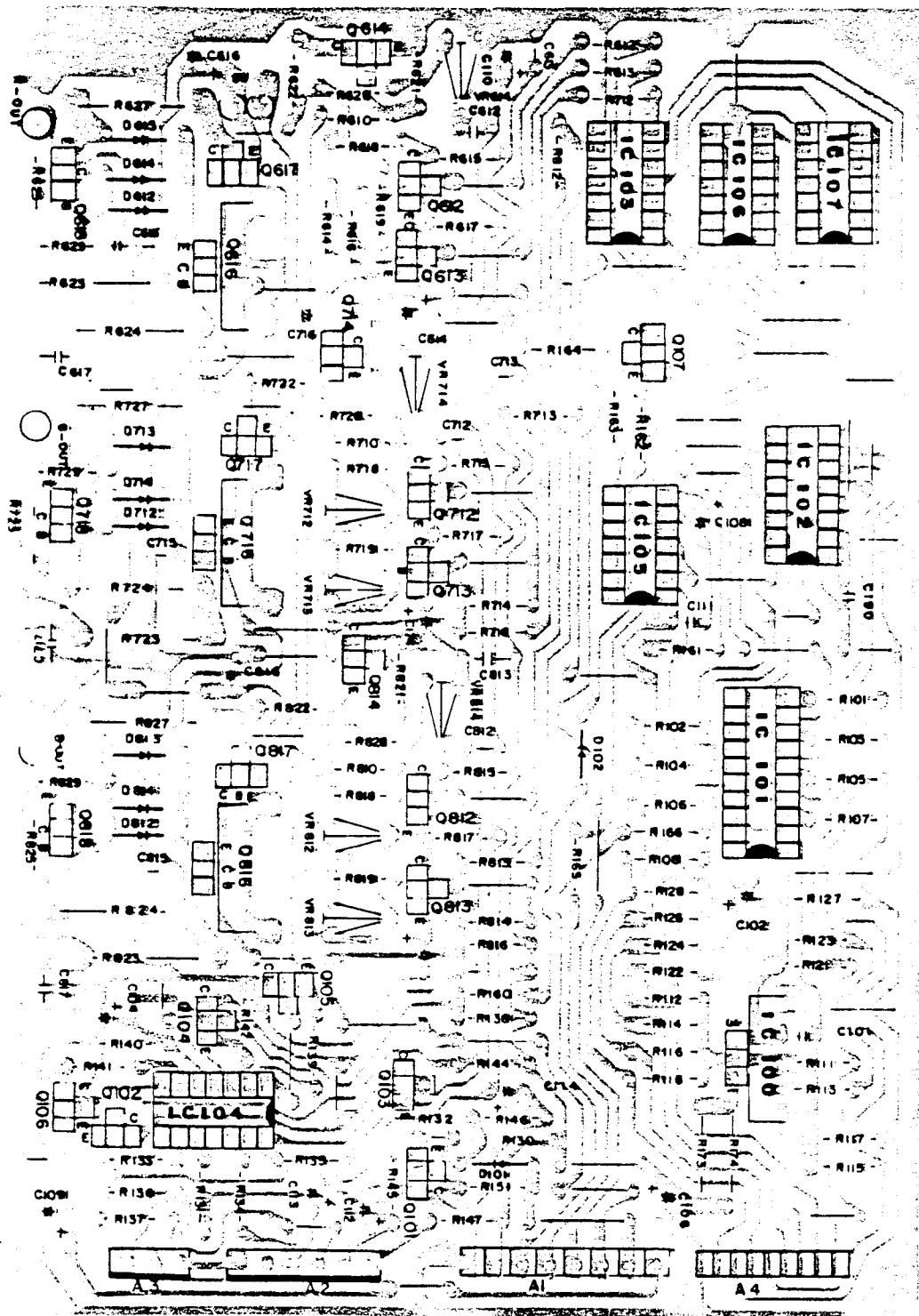


Power PCB (Bottom View)

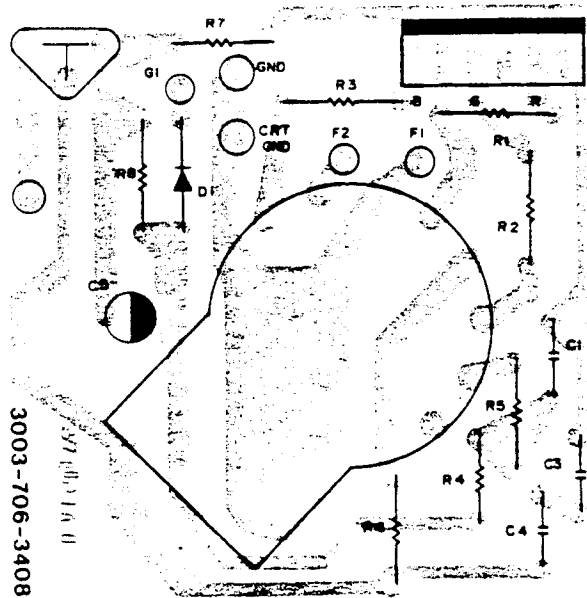


Video PCB (Top View)

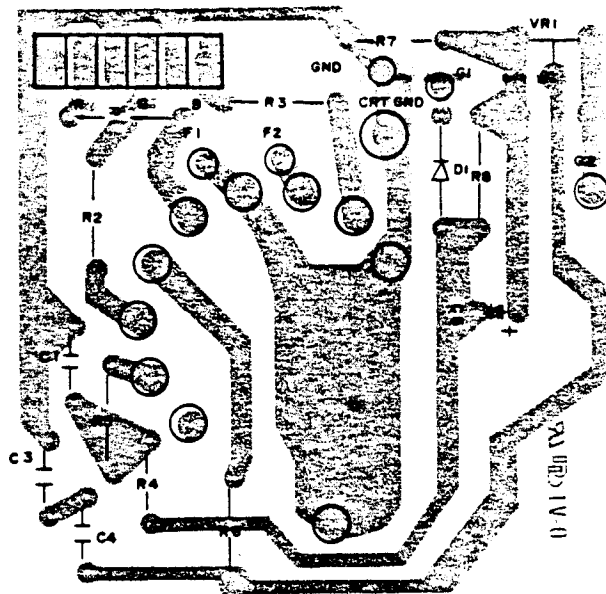




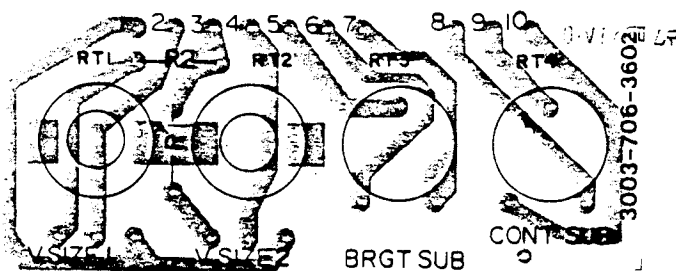
CRT Socket PCB (Top View)



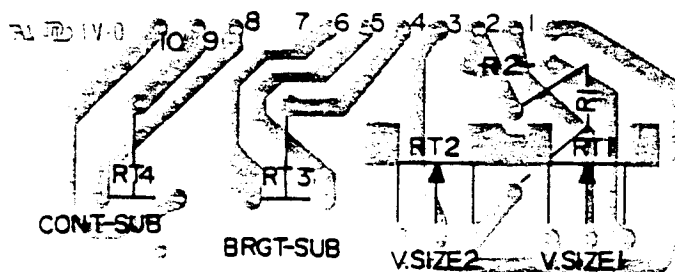
CRT Socket PCB (Bottom View)



Rear PCB (Top View)



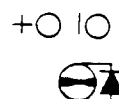
Rear PCB (Bottom View)



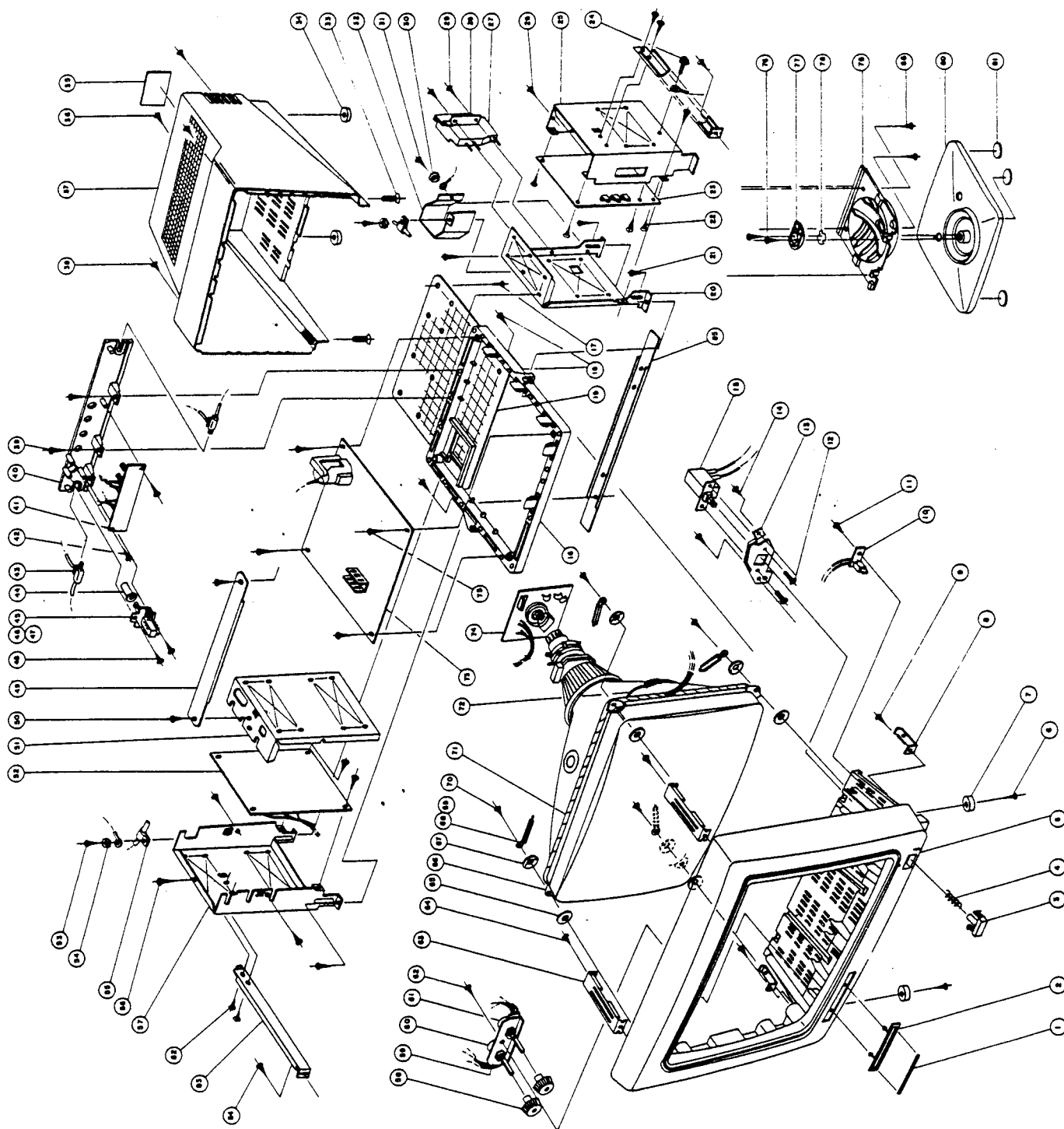
LED PCB (Top View)



LED PCB (Bottom View)



CABINET EXPLODED VIEW



CABINET PARTS LIST

REF. NO	DESCRIPTION	RS PART NO.	MFR'S PART NO.
1	Badge—Brand		8023-700-610
2	Holder—Badge, ABS, BLK		6603-703-810
3	Knob—Power, ABS, BGE		7624-709-410
4	Spring—Power		6674-715-210
5	Cabinet—Front, ABS, BGE		6001-866-020
6	Screw—Tap, RH 2S—4Y12 ZNY		7148-540-121
7	Foot—Rubber, Grey		8464-701-130
8	Support Bottom		6613-712-110
9	Screw—Tap, RH		7148-540-161
10	ASSY—LED		0C904-000-118
11	Screw—Tap, RH		7148-530-102
12	Screw—RH		7008-130-061
13	Bracket—Power		6614-725-510
14	Screw—Tap, RH		7148-530-102
15	Switch—Push		3529-702-710
16	Frame—Main, PCB		6021-101-911
17	Screw—Tap, RH		7148-540-122
18	Screw—Tap, TH		7128-540-122
19	Shield—Main, PCB		4542-702-910
20	Bracket Power, U		6611-701-810
21	Screw—Tap, TH		7128-540-122
22	Screw—Tap, RH		7148-530-081
23	ASSY—Video, PCB		0C905-000-115
24	Screw—M, HEX		7093-700-130
25	Bracket—Power, L		6611-701-910
26	Screw—Tap, RH		7148-530-081
27	Tripler		2859-113-110
28	Bracket—Focus		6614-722-410
29	Screw—Tap, RH		7148-530-081
30	Washer—Tooted		7328-103-001
31	Screw—Tap, RH		7148-530-081
32	Shield—FBT		4543-702-220
33	Screw—FH		7018-140-102
34	Foot—1453		8464-702-610
35	Label—Rating		8033-713-010
36	Screw—Tap, FH		7118-540-152
37	Cover—Rear		6001-867-010
38	Screw—Tap, TH		7128-540-122
39	Screw—Tap, TH		7128-540-122
40	Terminal—Board		3301-700-210
41	ASSY—Contro, PCB		9202-806-930
42	Screw—Tap, RH		7148-530-102
43	Holder—AC Cord		6603-703-010

SPECIFICATIONS

DESCRIPTION	NOMINAL	LIMIT
1. Power input	AC 220V 50HZ	
2. Power consumption	90W	+10%, -30%
3. CRT	14" 90° deflection. Non-glare. 0.31 dot pitch	
4. Input signal		
a) Video	Mode 1 ; R, G, B, I separate TTL - Level. positive. Mode 2 ; R, G, B, r, g, b separate TTL - Level. positive	2.4-5.0Vp-p
b) Synchronous	Mode 1 ; H, V - Sync TTL - Level. positive. Mode 2 ; H - Sync TTL - Level. positive. V - Sync TTL - Level. negative.	
5. Resolution	Mode 1 ; 640 dots x 200 Lines (16 colors) Mode 2 ; 640 dots x 350 Lines (64 colors)	
6. Synchronous		
a) Horizontal	Mode 1 ; 15.75kHz (overscan) Mode 2 ; 21.8kHz (underscan)	±0.3kHz ±0.3kHz
b) Vertical	50 - 60 Hz	
7. Display size	9.84" x 6.69" (250mm x 170 mm)	+4/-2mm
8. Linearity		7% Max.
9. High voltage	22kV	±0.5kV

NOTE: Nominal specs represent the design specs; all units should be able to approximate these — some will exceed and some may drop slightly below these specs.

Limit specs represent the absolute worst condition which still might be considered acceptable; in no case should a unit perform to less than within any limit spec.

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
44	Knob—Green, Color		7624-503-210
45	Bracket—Green		6614-725-610
46	Switch—Push		3529-702-710
47	Screw—PH		7008-130-061
48	Screw—TAP, RH		7148-530-102
49	Bracket—Holder		6613-713-110
50	Screw—Tap, TH		7128-540-122
51	Bracket, Video, U		6611-702-010
52	ASSY Power, PCB		0090S-000-114
53	Screw Tap, TH		7128-540-122
54	Washer Power, PCB		7328-103-001
55	Clamp—Cable		6634-704-210
56	Screw—Tap, RH		7148-530-081
57	Bracket—Video, L		6611-702-110
58	Knob—VR		7623-707-610
59	Bracket—Control		7613-711-910
60	VR—Round, Brightness		1201-102-005
61	VR—Round, Contrast		1201-102-038
62	Screw—Tap, RH		7148-540-161
63	Bracket—Mounting		6613-714-110
64	Screw—Tap, RH		7148-540-161
65	Washer—Gum, CRT		6834-701-110
66	CRT + DY		2019-231-320
67	Washer—Spring		7334-700-710
68	Clamper—Wire		6834-703-810
69	Tube—Hishi		0659-422-100
70	Screw—Tap, RH		7154-700-410
71	Coil—Degaussing		2479-013-610
72	Ground-CRT, ASSY		3054-221-910
73	ASSY—Main, PCB		0C905-000-113
74	ASSY—CRT, Socket PCB		0C904-000-090
75	Screw—Tap, TH		7128-540-122
76	Screw—Tap, RH		7148-530-161
77	Stand—Stopper		8301-700-910
78	Washer—Stand		3934-703-310
79	Stand—Top		8301-701-510
80	Stand—Base		8301-701-610
81	Rubber—Feet, Stand		6834-702-210
82	Screw—Tap, RH		7148-540-081
83	Bracket—Guide		6613-715-710
84	Screw—Tap, RH		7148-540-161
85	Bracket—Bottom		6613-715-610
86	Screw—Tap, TH		7128-540-202

ELECTRICAL PARTS LIST

PRODUCT SAFETY NOTE: Components marked with a Δ have special characteristics important to safety. Before replacing any of these components, read carefully the SAFETY NOTICE on page 4 of this service manual. Do not degrade the safety of the product through improper servicing. Components marked with a Δ are related to the X-ray protection circuit.

Note: Unless otherwise specified

1. All the capacitance of the polypropylene capacitors, M-polyesters and electrolytic capacitors are indicated in " μF ".
2. All the capacitance of the ceramic capacitors are indicated in " pF ".
3. All the resistance are indicated in " Ω ".

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
73	ASSY-PCB, Main		0C905-000-1130
CAPACITORS			
C210	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C211	Not Used		
C212	Electrolytic, CE04W (T) 50V 1, $\pm 20\%$		1608-906-1090
C213	Ceramic Temp, CC45 (T) SL 50V 100, $\pm 5\%$		1407-017-1018
C214	Ceramic HK, CK45 (T) F 50V 4700, $+80/-20\%$		1417-344-4727
C215 Δ	M, Polyester, CF922M 250V 0.022, $\pm 5\%$		1517-383-2235
C216	M, Polyester, CF922M 250V 2.2, $\pm 5\%$		1517-383-2299
C217 Δ	M, Polyester, CF922M 100V 0.47, $\pm 5\%$		1517-323-4743
C218 Δ	M, Polypropylene, CF922M 1600V 0.0033, $\pm 5\%$		1518-373-3324
C219	Not Used		
C220	Electrolytic, CE04W (T) 50V 4.7, $\pm 20\%$		1608-906-4790
C221	Ceramic HK, CK45 (T) B 50V 2200, $\pm 10\%$		1417-318-2221
C222 Δ	M, Polyester, CF922M 630V 0.022, $\pm 5\%$		1517-353-2272
C223 Δ	M, Polyester, CF922M 680V 0.022, $\pm 5\%$		1517-353-2272
C224	M, Polyester, CF922M 630V 0.022, $\pm 5\%$		1517-353-2272
C225	M, Polyester, CF922M 630V 0.022, $\pm 5\%$		1517-353-2272
C226	Not Used		
C227	Ceramic HK, CK45 B 50V 4700, $\pm 10\%$		1416-318-4729
C228	Electrolytic, CE04W 200V 47, $\pm 20\%$		1803-915-4706
C229 Δ	M, Polypropylene, DKR 1600V 0.0022, $\pm 5\%$		1518-373-2222
C230	Not Used		
C231	Electrolytic, CE04W (T) 35V 22, $\pm 20\%$		1608-905-2205
C232	M, Polyester, CF922M 100V 0.22, $\pm 5\%$		1517-323-2248
C233			
I	Not Used		
C260			
C261	Electrolytic, CE04W (T) 50V 4.7, $\pm 20\%$		1608-906-4794
C262			
I	Not Used		
C309			
C310	M. Polyester, CF922 250V 0.01, $\pm 5\%$		1517-383-1036
C311	Not Used		
C312	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C313	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C314	P. Polypropylene CQ922M 100V 0.0047, $\pm 5\%$		1503-523-4720

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
C315	Electrolytic, CE04W (T) 16V 100, $\pm 20\%$		1608-903-1019
C316	M. Polyester, CF922 250V 0.01, $\pm 5\%$		1517-383-1036
C317	Ceramic HK, CK45 (T) B 500V 1000, $\pm 10\%$		1417-468-1026
C318	Electrolytic, CE04W (T) 50V 4.7, $\pm 20\%$		1608-906-4794
C319	Electrolytic, CE04W (T) 50V 0.47, $\pm 20\%$		1608-906-0475
C320	Not Used		
C321	M. Polyester, CF922M 250V 0.022, $\pm 5\%$		1517-383-2235
C322	Ceramic HK, CK45 (T) F50V 0.22, $-80/-20\%$		1417-344-2231
C323			
I	Not Used		
C359			
C360	Ceramic HK, CK45 (T) B 500V 4700, $\pm 10\%$		1417-468-4720
C361	Not Used		
C362	Ceramic Temp, CC45 (T) SL 50V 330, $\pm 5\%$		1407-017-3319
C363	Ceramic HK, CK45 (T) F 50V 4700, $+80/-20\%$		1417-344-4727
C364	Not Used		
C365	Electrolytic, CE04W (T) 50V 1, $\pm 20\%$		1608-906-1090
C366 Δ	M. Polypropylene, CF922M 1600V 0.0095, $\pm 5\%$		1518-373-9528
C367 Δ	Electrolytic, CE04W (T) 63V 22, $\pm 20\%$		1608-907-2201
C368 Δ	Polypropylene, CQ922M 160V 2.7, $\pm 5\%$ (WIMA)		1507-533-2747
C369 Δ	Polypropylene, CQ922M 400V 0.1, $\pm 5\%$ (SNY)		1507-543-1044
C370	Not Used		
C371	Electrolytic, CE04W (T) 16V 100, $\pm 20\%$		1608-903-1019
C372			
I	Not Used		
C409			
C410	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C411			
I	Not Used		
C412			
C413	Electrolytic, CE04W (T) 50V 4.7, $\pm 20\%$		1608-906-4794
C414	Electrolytic, CE04W 40V 1000, $\pm 20\%$		1603-916-1023
C415	Electrolytic, CE04W 16V 2200, $\pm 20\%$		1609-401-5307
C416	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C417	Electrolytic, CE04W (T) 35V 10, $\pm 20\%$		1608-905-1006
C418	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C419	M. Polyester, CF922 100V 0.1, $\pm 5\%$		1517-323-1049
C420	Not Used		
C421	M. Polyester, CF922M 100V 0.47, $\pm 5\%$		1517-323-4743
C422	Electrolytic, CE04W 40V 100, $\pm 20\%$		1603-916-1014
C423	Electrolytic, CE04W (T) 35V 10, $\pm 20\%$		1608-905-1006
C424	M. Polyester, CF922M 100V 0.047, $\pm 5\%$		1517-323-4734
C426	Ceramic Temp, CC45 (T) SL 50V 270, $+80/-20\%$		1407-017-2712
C427			
I	Not Used		
C509			
C510	Electrolytic, CE04W (T) 35V 10, $\pm 20\%$		1608-905-1006

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
C511	Not Used		
C512	Electrolytic, CE04W 100V 22, $\pm 20\%$		1603-908-2209
C513	Electrolytic, CE04W (T) 50V 4.7, $\pm 20\%$		1608-906-4794
C514			
I	Not Used		
C515			
C516	Electrolytic, CE04W (T) 50V 4.7, $\pm 20\%$		1608-906-4794
C517	Electrolytic, CE04W (T) 35V 10, $\pm 20\%$		1608-905-1006
C518	M. Polyester, CF922M 100V 0.047, $\pm 5\%$		1517-323-4734
C519	Electrolytic, CE04W (T) 35V 47, $\pm 20\%$		1608-905-4700
C520			
I	Not Used		
C521			
C522	M. Polyester, CF922M 100V 0.1, $\pm 5\%$		1517-323-1094
C523	Ceramic HK, CD45 (T) F 50V 0.033, $+80/-20\%$		1417-344-3333
COILS			
L362	Linearity, FU0464,		2449-722-0105
L363 Δ	Choke, Input, FJ0480,		2429-054-0101
L364 Δ	Centering, FJ0482,		2489-700-1107
L365 Δ	Choke, 90 μ H,		2429-053-0108
L366	Choke, 90 μ H,		2429-053-0108
CONNECTORS			
A1	Wafer, B9P-VH		3344-131-0801
B1	Wafer, B7P-VH		3344-131-0704
B2	Wafer, B2P-VH (2P 3.96MM)		3344-131-0102
B4	Wafer, B3P-VH (3P 3.96MM)		3344-131-0209
B6	Wafer, B2P-VH (2P 3.96MM)		3344-131-0102
B7	Wafer, B7P-VH		3344-131-0704
M1	Wafer, B4PS-VH		3344-131-0616
M2	Wafer, B5PS-VH		3344-131-0519
DIODES			
D210 Δ	RGP 10G		2169-206-1009
D211	Not Used		
D212 Δ	BY228		2169-210-3002
D213 Δ	BA159 (ITT)		2169-210-1701
D214 Δ	Zener, ZPD5.1/BZX83C5V1		2169-404-5103
D215 Δ	RGP 10G		2169-206-1009
D216 $\blacktriangle$	IN4148		2169-301-4105
D217	IN4148		2169-301-4105
D218	IN4148		2169-301-4105
D219 $\Delta \blacktriangle$	Zener, ZPD6.8/BZX83C6VB		2169-400-6004
D220	Not Used		
D221	Not Used		

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D222 	Not Used		
D230			
D231	IN4148		2169-301-4105
D232	IN4148		2169-301-4105
D233 	Not Used		
D360			
D361	RGP 15M		2169-306-4207
D362 Δ	RGP 10G		2169-206-1009
D363 Δ	RGP 10G		2169-206-1009
D364	RGP 10G		2169-206-1009
D365 	Not Used		
D411			
D412	IN4148		2169-301-4105
D413	IN4002		2169-201-0601
D414	IN4002		2169-201-0601
D415	IN4148		2169-301-4105
D416 	Not Used		
D511			
D512	BAS11/BAV21		2169-201-0106
D513	ZENER, ZPD6.2/BZX83C6V2		2169-404-6200
ICs			
IC211 $\blacktriangle$	OP AMP, LM324N		2119-401-3609
IC212 	Not Used		
IC310			
IC311 $\Delta\blacktriangle$	Linear, TDA2593 (TFK/TOM)		2119-101-1903
IC312	C-MOS/HCF-4053BE		2109-303-3805
IC313 	Not Used		
IC410			
IC411 $\Delta\blacktriangle$	Linear, TDA2653A		2119-101-3000
IC412 	Not Used		
IC510			
IC511	C-MOS, HEF4053B/HCF4053BE		2109-303-3805
IC512	OP AMP, LM324N		2119-401-3609
RESISTORS			
R2	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R3			
I	Not Used		
R8			
R9	Carbon, RD 1/2W 1k, $\pm 5\%$		1018-377-1020
R10			
I	Not Used		
R209			
R210 Δ	Carbon, RD 1/4W 62k, $\pm 5\%$		1018-277-6239
R211	Not Used		
R212	Carbon, RD 1/2W 270, $\pm 5\%$		1018-377-2715
R213	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R214	Carbon, RD 1/4W 180, $\pm 5\%$		1018-217-1818
R215 Δ	Carbon, RD 1/4W 27, $\pm 5\%$		1018-217-2707
R216 Δ	Metal Oxide, RS 1P 10, $\pm 5\%$		1045-427-1000
R217	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R218	Carbon, RD 1/4W 56k, $\pm 5\%$		1018-277-5632
R219	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R220	Carbon, RD 1/4W 3.3k, $\pm 5\%$		1018-277-3322
R221 Δ	Carbon, RD 1/2W 2.2k, $\pm 5\%$		1018-377-2229
R222 Δ	Carbon, RD 1/2W 560k, $\pm 5\%$		1018-377-5640
R223 Δ	Carbon, RD 1/2W 560k, $\pm 5\%$		1018-377-5640
R224 Δ	Carbon, RD 1/2W 560k, $\pm 5\%$		1018-377-5640
R225	Carbon, RD 1/4W 180k, $\pm 5\%$		1018-277-1845
R226	Carbon, RD 1/4W 220, $\pm 5\%$		1018-277-2211
R227	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R228	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R229	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1058
R230	Carbon, RD 1/4W 2.2k, $\pm 5\%$		1018-277-2220
R231	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R232	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R233 Δ	Metal, Oxide, ERG-2ANJ 2.7K(T), $\pm 20\%$		1043-577-2722
R234 Δ	Metal, Oxide, ERG-2ANJ 2.7K(T), $\pm 20\%$		1043-577-2722
R235	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R236	Carbon, RD 1/4W 1.2k, $\pm 5\%$		1018-277-1225
R237	Carbon, RD 1/4W 220, $\pm 5\%$		1018-277-2211
R238	Metal, Oxide, ERG-2ANJ 2.7K (T) $\pm 20\%$		1043-577-2722
R239			
I	Not Used		
R309			
R310	Carbon, RD 1/4W 1.8k, $\pm 5\%$		1018-277-1827
R311	Not Used		
R312	Carbon, RD 1/4W 2.7k, $\pm 5\%$		1018-277-2752
R313	Carbon, RD 1/4W 6.8k, $\pm 5\%$		1018-277-6822
R314	Not Used		
R315	Carbon, RD 1/4W 22, $\pm 5\%$		1018-277-2203
R316	Carbon, RD 1/4W 10, $\pm 5\%$		1018-277-1003

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R317	Carbon, RD 1/4W 47k, $\pm 5\%$		1018-277-4734
R319 Δ	Carbon, RD 1/4W 3.3k, $\pm 5\%$		1018-277-3322
R320	Not Used		
R321	Carbon, RD 1/4W 68k, $\pm 5\%$		1018-277-6831
R322	Metal Film, RM 1/4W 12k, $\pm 20\%$		1048-275-1233
R323	Metal Film, RM 1/4W 15k, $\pm 20\%$		1048-275-1534
R324	Metal Film, RM 1/4W 10k, $\pm 5\%$		1048-277-1035
R325			
I	Not Used		
R330			
R331	Carbon, RD 1/4W 33k, $\pm 5\%$		1028-277-3331
R332	Carbon, RD 1/4W 27k, $\pm 5\%$		1018-277-2734
R333	Not Used		
R334	Carbon, RD 1/4W 220k, $\pm 5\%$		1018-277-2248
R335	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
R336	Carbon, RD 1/4W 27k, $\pm 5\%$		1018-277-2734
R337	Carbon, RD 1/4W 22k, $\pm 5\%$		1018-277-2239
R338	Carbon, RD 1/4W 4.7k, $\pm 5\%$		1018-277-4725
R339			
I	Not Used		
R359			
R360 Δ	Metal Oxide, ERG-2ANJ 56 (T), $\pm 20\%$		1045-577-5602
R361	Not Used		
R362	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R363	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R364	Carbon, RD 1/4W 180, $\pm 5\%$		1018-277-1818
R365	Metal Oxide, RS 1P 180, $\pm 5\%$		1045-427-1815
R366	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R367 Δ	Carbon, RD 1/2W 1k, $\pm 5\%$		1018-377-1020
R368			
I	Not Used		
R409			
R410	Carbon, RD 1/4W 15k, $\pm 5\%$		1018-277-1535
R411	Not Used		
R412	Carbon, RD 1/2W 33k, $\pm 5\%$		1018-377-3330
R413	Carbon, RD 1/4W 4.7k, $\pm 5\%$		1018-277-4725
R414	Carbon, RD 1/4W 33K, $\pm 5\%$		1018-277-3331
R415			
I	Not Used		
R416			
R417	Carbon, RD 1/4W 3.3k, $\pm 5\%$		1018-277-3322
R418 Δ	Fusible, FMR 1/2P 1.2, $\pm 20\%$		1058-327-1292
R419	Carbon, RD 1/4W 18k, $\pm 5\%$		1018-277-1836
R420	Carbon, RD 1/2W 270, $\pm 5\%$		1018-377-2715
R421	Unused		
R422	Carbon, RD 1/4W 22k, $\pm 5\%$		1018-277-2239

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R423	Not Used		
R424	Carbon, RD 1/4W 2.2, $\pm 5\%$		1018-277-2293
R425	Carbon, RD 1/4W 1, $\pm 5\%$		1018-277-1094
R426	Not Used		
R427	Carbon, RD 1/4W 220k, $\pm 5\%$		1018-277-2248
R428	Carbon, RD 1/4W 12k, $\pm 5\%$		1018-277-1234
R429	Carbon, RD 1/4W 1.2M, $\pm 5\%$		1018-277-1252
R430	Not Used		
R431	Carbon, RD 1/4W 39k, $\pm 5\%$		1018-277-3933
R432	Carbon, RD 1/4W 1, $\pm 5\%$		1018-277-1094
R433	Not Used		
R434 Δ	Fusible, FMR 1/2P 0.56, $\pm 5\%$		1058-327-0561
R435	Carbon, RD 1/2W 220, $\pm 5\%$		1018-377-2210
R436	Carbon, RD 1/2W 390, $\pm 5\%$		1018-377-3914
R437			
I	Not Used		
R509			
R510	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R511	Not Used		
R512	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
R513	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
R514	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R515	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R516	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R517	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R518	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
R519	Not Used		
R520	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R521	Not Used		
R522	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
R523	Carbon, RD 1/4W 1M, $\pm 5\%$		1018-277-1058
R524	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
R525	Not Used		
R526	Carbon, RD 1/4W 1M, $\pm 5\%$		1018-277-1058
R527	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R528	Carbon, RD 1/4W 33k, $\pm 5\%$		1018-277-3331
R529	Carbon, RD 1/4W 82k, $\pm 5\%$		1018-277-8239
R530	Not Used		
R531	Carbon, RD 1/4W 820, $\pm 5\%$		1018-277-8211
R532	Carbon, RD 1/4W 2.2k, $\pm 5\%$		1018-277-2220
R533	Carbon, RD 1/4W 2.2k, $\pm 5\%$		1018-277-2220
R534	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R535	Carbon, RD 1/2W 220, $\pm 5\%$		1018-377-2210
R536	Carbon, RD 1/4W 330, $\pm 5\%$		1018-277-3313
R537	Carbon, RD 1/4W 56k, $\pm 5\%$		1018-277-5632
R538	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R539	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R540	Not Used		
R541	Carbon, RD 1/4W 100k, $\pm 5\%$		1018-277-1049
TRANSFORMERS			
M212 Δ	Horiz, Drive, FM0494		2849-030-4109
M213 $\Delta \blacktriangle$	EHT, FCT-1415AL and		2859-111-2104
M214	Tripler, FCT-1400		2859-113-2100
M360	Not Used		
M361 Δ	Horiz, Drive, FM0494,		2849-030-4109
TRANSISTORS			
Q212	KSC1008-Y		2149-301-4309
Q213 $\Delta \blacktriangle$	MJE13005		2149-302-8205
Q214 Δ	BU208		2149-302-8108
Q215			
I	Not Used		
Q230			
Q231	BC237B		2139-302-3108
Q232			
I	Not Used		
Q360			
Q361	KSC1008-Y		2149-301-4309
Q362 Δ	BUX32B		2149-302-8506
Q363			
I	Not Used		
Q510			
Q511	TIP30B		2149-302-8700
Q512	KSC1008-Y		2149-301-4309
SEMI-FIXED VARIABLE RESISTORS			
VR212 Δ	Semi, CET 117A-B25k		1241-110-0077
VR213			
I	Not Used		
VR311			
VR312	Semi, CET 117A-B50k		1241-110-0059
VR313	Semi, CET 117A-B50k		1241-110-0059
VR314	Semi, CET 117A-B50k		1241-110-0059
VR315	Semi, CET 117A-B50k		1241-110-0059
VR316			
I	Not Used		
VR361			

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
VR362	Wire, Wound, 68810-003 3W 68"S"		1296-101-0015
VR363			
I	Not Used		
VR411			
VR412	Semi, CET 117A-B10k		1241-110-0086
VR413	Wire, Wound, 68810-003 3W 1k		1296-101-0024
VR414	Semi, CET 117A-B500k		1241-110-0068
VR415			
I	Not Used		
VR511			
VR512	Semi, CET 92A-B5k		1241-108-0034
VR513	Semi, CET 92A-B5k		1241-108-0034
VR514	Not Used		
VR515	Semi, CET 92A-B10k		1241-108-0070
23	ASS'Y-PCB, POWER		0C905-000-1140
CAPACITORS			
C911 Δ	Ceramic AC, ECK-D3A-332KBN 1KV, ±20%		1461-121-8077
C912 Δ	Ceramic AC, ECK-D3A-332KBN 1KV, ±20%		1461-121-8077
C913 Δ	Ceramic AC, ECK-D3A-332KBN 1KV, ±20%		1461-121-8077
C914	Not Used		
C915 Δ	M, Paper, PME271M610 0.1μF, ±20%		1535-829-1048
C916 Δ	M, Paper, PME271M610 0.1μF, ±20%		1535-829-1048
C917 Δ	Electrolytic, CE04W 250V 220 (HS), ±20%		1603-910-2215
C918 Δ	Electrolytic, CE04W 250V 220 (HS), ±20%		1603-910-2215
C919 Δ	M, Polyester, CF922M 250V 0.22, ±5%		1517-383-2244
C920	Not Used		
C921 Δ	Electrolytic, CE04W (T) 35V 47, ±20%		1608-905-4700
C922 Δ	M, Polyester, CF922 250V 0.01, ±5%		1517-383-1036
C923 Δ	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C924 Δ	Electrolytic, CE04W (T) 50V 1, ±20%		1608-906-1090
C925 Δ	Ceramic TEMP, CC45 (T) SL 50V 100, ±5%		1407-017-1018
C926 Δ	Ceramic, HK, CK45 (T) B 500V 1000, ±10%		1417-468-1026
C927 Δ	M. Polyester, CF922 250V 0.01, ±5%		1517-383-1036
C928 Δ	M. Polyester, CF922M 100V 0.22, ±5%		1517-323-2248
C929 Δ	M. Polyester, DF922 63V 0.47, ±5%		1517-313-4742
C930 Δ	M. Polyester, CF922M 250V 0.033, ±5%		1517-383-3337
C931 Δ	Polypropylene CF922M 1600V 0.0012, ±5%		1518-373-1227
C932 Δ	M. Polyester, CF922 63V 0.47, ±5%		1517-313-4742
C933	Electrolytic, CE04W 16V 2200, ±20%		1609-401-5307
C934	Ceramic HK, CK45 (T) B 500V 330, ±10%		1417-468-3318
C935	Electrolytic, CE04W 25V 1000, ±20%		1609-401-7200
C936	Ceramic, HK, CK45 (T) B 500V 330, ±10%		1417-468-3318
C937	Electrolytic, CE04W 25V 1000, ±20%		1609-401-7200
C938	Ceramic HK, CK45 (T) B 500V 330, ±10%		1417-468-3318

IMPORTANT SERVICE SAFETY PRECAUTIONS

Service work should be performed only by qualified service technicians who are thoroughly familiar with all of the following safety checks and servicing guidelines:

WARNING

1. For continued safety, do not attempt to modify the circuit.
2. Disconnect the AC power before servicing.
3. Semiconductor heat sinks are potential shock hazards when the chassis is operating.

SERVICING THE 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. (The AC line cord should be disconnected from the AC outlet.)

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

X-RADIATION AND HIGH VOLTAGE LIMITS

1. Be sure all service personnel are aware of the procedures and instructions covering X-radiation. The only potential source of X-ray in a current solid-state display monitor is the picture tube. However, the picture tube does not emit measurable X-ray radiation if the high voltage is as specified in the "high-voltage check" instructions.

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 below the maximum level specified.

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 the rated value — no 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.

4. 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.
5. Do not use a picture tube other than that specified or make unrecommended circuit modifications to the high voltage circuitry.
6. When troubleshooting and taking test measurements on a display monitor with excessively high voltage, avoid being unnecessarily close to the display monitor. Do not operate the display monitor longer than is necessary to locate the cause of excessive voltage.

BEFORE RETURNING THE DISPLAY MONITOR

Fire and Shock Hazard

Before returning the display monitor to the user, perform the following safety checks:

1. Inspect all lead dress to make certain that the leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the display monitor.
2. Inspect all protective devices such as nonmetallic control knobs, insulating materials, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacitor 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 1.5k ohm, 10 watt resistor paralleled by a 0.15 μ F capacitor in series with all exposed metal cabinet parts and a known earth ground, such as electrical conduit or electrical ground connected to earth ground.
 - Use a SSVM or VOM with 1000 ohms per-volt or higher sensitivity to measure the AC voltage drop across the resistor. (See Figure 1.)

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
C939	Electrolytic, CE04W 63V 220, ±20%		1603-907-2215
C940	Not Used		
C941	Electrolytic, CE04W 200V 47, ±20%		1603-915-4706
C942	Not Used		
C943 △	M. Polyester, CF922M 250V 0.22, ±5%		1517-383-2244
C944 △	Ceramic, AC, DE 7100F 222MVAI, ±20%		1461-137-8067
C945 △	Ceramic, AC, DE 7100F 222MVAI, ±20%		1461-137-8067
C946			
I	Not Used		
C949			
C950 △	M. Polyester, CF922 100V 0.1, ±5%		1517-323-1049
C951	M. Polyester, CF922 100V 0.1, ±5%		1517-323-1049
C952 △	M. Polyester, CF922 250V 0.1, ±5%		1517-383-1046
C953 △	Ceramic, HK, CK45 (T) B 50V 3300 ±5%		1417-317-3320
C954	Ceramic, HK, CK45 (T) B 50V 3300 ±5%		1416-467-4720
FUSE AND CLIP			
F911 △	Fuse Clip, PBP3 0.4T SN Fuse, 2.5A/250V, 31.8mm, S-Blow		3164-700-1118 4709-084-8300
COILS			
L911 △	RFI Choke, FJ0481		2429-056-0107
L912 △	RFI Choke, FJ0481		2429-056-0107
L913 △	Choke, 15μH		2429-055-0104
L914 △	Choke, 15μH		2429-055-0104
L915 △	Choke, 15μH		2429-055-0104
CONNECTORS			
M1	PWR, M1, Assy, JSTVHR-4N(130)		3054-616-9101
M2	PWR, M2, Assy, JSTVHR-5N (135)		3054-617-4109
M3	Wafer, B3PS-VH, SW-S1		3344-131-0218
M4	Wafer, B3PS-VH, D-Coil		3344-131-0218
DIODES			
D911 △	BY133/GP		2169-306-4304
D912 △	BY133/GP		2169-306-4304
D913 △	BY133/GP		2169-306-4304
D914 △	BY133/GP		2169-306-4304
D915	Not Used		
D916 △	RGP 10G		2169-206-1009
D917 △	RGP 10G		2169-206-1009
D918 △	IN4148		2169-301-4105

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D919 Δ	BA159 (1TT)		2169-210-1701
D920 Δ	1N4148		2169-301-4105
D921 Δ	BTB-4		2169-901-0400
D922 Δ	BA159 (T)		2169-210-1774
D923 Δ	BA159 (T)		2169-210-1774
D924 Δ	BA159 (T)		2169-210-1774
D925 Δ	BA159 (T)		2169-210-1774
D926	RGP 15J (T)		2169-206-1771
D927	RGP 15J (T)		2169-206-1771
D928	RGP 15J		2169-206-1708
D929	RGP 15J		2169-206-1708
D930 Δ	RGP 15J		2169-206-1708
D931 Δ	1N4148		2169-301-4105
D932	Not Used		
D933 Δ	1N4002		2169-201-0601
D934 Δ	1N4148		2169-301-4105
ICs			
IC911 Δ	Linear, CA3524E		2119-501-3501
IC912	Regulator, MC7812CT		2119-601-1306
POSISTOR			
PTC1 Δ	PTH451CO2BG200N270		2199-603-1201
RESISTORS			
R911 Δ	Cement, Wire, RP 10P 4.7, $\pm 5\%$		1039-727-4795
R912 Δ	Carbon, RD 1/4W 15k, $\pm 5\%$		1018-277-1535
R913 Δ	Carbon, RD 1/4W 2.2k, $\pm 5\%$		1018-277-2220
R914 Δ	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R915 Δ	Carbon, RD 1/4W 2.7k, $\pm 5\%$		1018-277-2725
R916 Δ	Carbon, RD 1/4W 2.7k, $\pm 5\%$		1018-277-2725
R917 Δ	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R918 Δ	Carbon, RD 1/4W 820, $\pm 5\%$		1018-277-8211
R919 Δ	Carbon, RD 1/4W 47k, $\pm 5\%$		1018-277-4734
R920 Δ	Carbon, RD 1/4W 47k, $\pm 5\%$		1018-277-4734
R921 Δ	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R922 Δ	Carbon, RD 1/4W 2.2k, $\pm 5\%$		1018-277-2220
R923 Δ	Metal, Oxide, ERG-2ANJ270 (T), $\pm 20\%$		1043-577-2713
R924 Δ	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R925 Δ	Carbon, RD 1/4W 180, $\pm 5\%$		1018-277-1818
R926 Δ	Carbon, RD 1/4W 220k, $\pm 5\%$		1018-277-2248
R927 Δ	Carbon, RD 1/4W 220k, $\pm 5\%$		1018-277-2248

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R928 Δ	Carbon, RD 1/4W 220k, $\pm 5\%$		1018-277-1021
R929 Δ	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1030
R930 Δ	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1021
R931 Δ	Carbon, RD 1/4W 1k, $\pm 5\%$		1043-927-2723
R932 Δ	Metal, Oxide, RS 7P 2.7k $\pm 5\%$		1018-277-6813
R933 Δ	Carbon, RD 1/4W 680, $\pm 5\%$		1043-577-1046
R934 Δ	Metal, Oxide, ERG-2ANJ 100K (T), $\pm 20\%$		1018-277-1021
R935 Δ	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-2202
R936 Δ	Carbon, RD 1/4W 22, $\pm 5\%$		1018-277-2202
R937 Δ	Carbon, RD 1/4W 4.7k, $\pm 5\%$		1018-277-4725
R938 Δ	Carbon, RD 1/4W 47k, $\pm 5\%$		1018-277-4734
R939 Δ	Carbon, RD 1/2W 680k, $\pm 5\%$		1018-377-6849
R940 Δ	Carbon, RD 1/4W 10, $\pm 5\%$		1018-277-1003
R941 Δ	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R942 Δ	Fusible, FMR 1/2 (T) 1.2, $\pm 5\%$		1058-377-1297
R943 Δ	Fusible, FMR 1/2P 0.56, $\pm 5\%$		1058-327-0561
R944 Δ	Carbon, RD 1/4W 4.7k, $\pm 5\%$		1018-277-4725
R945 Δ	Carbon, RD 1/4W 4.7k, $\pm 5\%$		1018-277-4725
R946			
I	Not Used		
R949			
R950 Δ	Composition, RC1/2T 330k, $\pm 10\%$		1028-378-3347
R951 Δ	Fusible, FMR1/2(T) 1.2, $\pm 5\%$		1058-377-1297
TRANSFORMERS			
MM911 Δ	Horiz, Drive, FM0492		2849-030-5104
MM912 Δ	Switch Mode, EER49 x 42 or Switch Mode, FM0490		2879-001-3100 2899-003-220
TRANSISTORS			
Q911 Δ	BC237B NPN, Silicon or KSC945-Y		2139-302-5108 2139-302-7409
Q912 Δ	KSC1008-Y		2149-301-4309
Q913 Δ	KSC1008-Y		2149-301-4309
Q914 Δ	BC237B or KSC945-Y		2139-302-5108 2139-302-7409
Q915 Δ	MJE13005		2149-302-8205
Q916 Δ	MJE13005		2149-302-8205
Q917 Δ	BC307B		2139-101-3000
Q918 Δ	BC237B or KSC945-Y		2139-302-5108 2139-302-7409
Q919 Δ	BC307B		2139-101-3000
SEMI-FIXED VARIABLE RESISTOR			
VR911 Δ	CET 92A B1K/VG086MLI 1K		1241-108-0113

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
23	ASS'Y-PCB, Video		OC905-000-1150
CAPACITORS			
C101	Ceramic HK, CK45 (T) F 50V 10000, +80/-20%		1417-344-1032
C102	Electrolytic, CE04W (T) 35V 22, ±20%		1608-905-2205
C103	Not Used		
C104	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C105	Not Used		
C106	Electrolytic, CE04W (T) 16V 100, ±20%		1608-903-1019
C107	Not Used		
C108	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C109	Electrolytic, CE04W 350V 2.2, ±20%		1609-403-6706
C110	Electrolytic, CE04W (T) 35V 22, ±20%		1608-905-2205
C111	Electrolytic, CE04W (T) F 50V 0.01, +80/-20%		1417-344-1032
C112	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C113	Electrolytic, CE04W (T) 35V 10, ±20%		1608-095-1006
C114	Electrolytic, CE04W (T) 35V 22, ±20%		1608-905-2205
C115			
	Not Used		
C611			
C612	Ceramic, HK, CK45 (T) F 50V 1000, +80/-20%		1417-344-1032
C613	Ceramic, HK, CK45 (T) F 50V 10000, +80/-20%		1471-344-1032
C614	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C615	M. Polyester, MK2 0.1UF63V DC (105°C), ±20%		1517-521-1041
C616	Electrolytic, CD04W (T) 35V 22, ±20%		1608-805-2205
C617	M. Polyester, CF922M 250V 0.033, ±5%		1517-393-3337
C618			
	Not Used		
C711			
C712	Ceramic, HK, CK45 (T) F 50V 10000, +80/-20%		1417-344-1032
C713	Ceramic, HK, CK45 (T) F 50V 10000, +80/-20%		1417-344-1032
C714	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C715	M. Polyester, MK2 0.1UF63V DC (105°C), ±20%		1517-521-1041
C716	Electrolytic, CE04W (T) 35V 22, ±20%		1608-905-2205
C717	M. Polyester, CF922M 250V 0.033, ±5%		1517-393-3337
C718			
	Not Used		
C811			
C812	Ceramic, HK, CK45 (T) F 50V 10000, +80/-20%		1417-344-1032
C813	Ceramic, HK, CK45 (T) F 50V 10000, +80/-20%		1417-344-1032
C814	Electrolytic, CE04W (T) 35V 10, ±20%		1608-905-1006
C815	M. Polyester, MK2 0.1UF63V DC (105°C), ±20%		1517-521-1041
C816	Electrolytic, CD04W (T) 35V 22, ±20%		1608-905-2205
C817	M. Polyester, CF922M 250V 0.033, ±5%		1517-393-3337

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
CONNECTORS			
A1	Video Ass'y, JST VHR-9N		3054-616-5201
A2	Pin Base, JST BGP-VH (GP 3.96MM)		3344-131-0403
A3	Wafer, B3P-VH (3P 3.96MM)		3344-131-0209
A4	Wafer, B9P-SHF/AA		3344-150-7106
H1	RGB Cable Ass'y, JST VHR-6N		3054-616-8206
DIODES			
D101	1N4148		2169-301-4105
D102	1N4148		2169-301-4105
D103			
I	Not Used		
D611			
D612	1N4148		2169-301-4105
D613	1N4148		2169-301-4105
D614			
I	Not Used		
D711			
D712	1N4148		2169-301-4105
D713	1N4148		2169-301-4105
D714			
I	Not Used		
D811			
D812	1N4148		2169-301-4105
D813	1N4148		2169-301-4105
ICs			
IC100	Regulator, MC7805CT		2119-601-0602
IC101	TTL, SN74LS244N		2109-101-2408
IC102	TTL, SN74LS157N		2109-101-5801
IC103	TTL, SN74LS05		2109-101-9005
IC104	OP AMP, LM324N		2119-401-3609
IC105	CMOS, HCF-4077BE		2109-303-3601
IC106	TTL, SN74LS02N		2109-101-0301
IC107	SN74LS27		2109-302-1006
RESISTORS			
R101	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R102	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R103	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R104	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R105	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R106	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
D716 I D811 D812 D813	Not Used 1N4148 1N4148		 2169-301-4105 2169-301-4105
ICs			
IC100 IC101 IC102 IC103 IC104 IC105 IC106 IC107	Regulator, MC7805CT TTL, SN74LS244N TTL, SN74LS157N TTL, SN74LS05 OP AMP, LM324N CMOS, HCF-4077BE TTL, SN74LS02N SN74LS27		2119-601-0602 2109-101-2408 2109-101-5801 2109-101-9005 2119-401-3609 2109-303-3601 2109-101-0301 2109-302-1006
RESISTORS			
R101 R102 R103 R104 R105 R106 R107 R108 R109 I R110 R111 R112 R113 R114 R115 R116 R117 R118 R119 I R120 R121 R122 R123 R124 R125	Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Carbon, RD 1/4W 100, ±5% Not Used Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Carbon, RD 1/4W 1.2k, ±5% Not Used Carbon, RD 1/4W 680, ±5% Carbon, RD 1/4W 680, ±5% Carbon, RD 1/4W 680, ±5% Carbon, RD 1/4W 680, ±5% Not Used		1018-277-1012 1018-277-1012 1018-277-1012 1018-277-1012 1018-277-1012 1018-277-1012 1018-277-1012 1018-277-1012 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-1225 1018-277-6813 1018-277-6813 1018-277-6813 1018-277-6813

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R151	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R152			
I	Not Used		
R159			
R160	Carbon, RD 1/4W 56k, $\pm 5\%$		1018-277-5632
R161	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R162	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R163	Carbon, RD 1/4W 10k, $\pm 5\%$		1018-277-1030
R164	Not Used		
R165	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R166	Carbon, RD 1/4W 1k, $\pm 5\%$		1018-277-1021
R167			
I	Not Used		
R172			
R173	Carbon, RD 1/4W 33, $\pm 5\%$		1018-377-3303
R174	Carbon, RD 1/4W 33, $\pm 5\%$		1018-377-3303
R175			
I	Not Used		
R179			
R180	Carbon, RD 1/4W 12k, $\pm 5\%$		1018-277-1234
R181	Not Used		
R182			
I	Not Used		
R609			
R610	Carbon, RD 1/4W 3.3k, $\pm 5\%$		1018-277-3322
R611	Not Used		
R612	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R613	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R614	Carbon, RD 1/4W 1.5k, $\pm 5\%$		1018-277-1526
R615	Metal, Film, RM 1/4W 464, $\pm 1\%$		1048-275-0052
R616	Carbon, RD 1/4W 1.5k, $\pm 5\%$		1018-277-1526
R617	Metal, Film, RM 1/4W 464, $\pm 1\%$		1048-275-0052
R618	Metal, Film, RM 1/4W 1.78k, $\pm 1\%$		1048-275-0061
R619	Metal, Film, RM 1/4W 1.78k, $\pm 1\%$		1048-275-0061
R620	Not Used		
R621	Carbon, RD 1/4W 820, $\pm 5\%$		1018-277-8211
R622	Carbon, RD 1/4W 560, $\pm 5\%$		1018-277-5614
R623	Metal, Oxide, ERG-2ANJ 2.7k (T), $\pm 20\%$		1043-577-2722
R624	Metal, Oxide, ERG-2ANJ 2.7k (T), $\pm 20\%$		1043-577-2722
R625	Carbon, RD 1/4W 68, $\pm 5\%$		1018-277-6804
R626	Metal, Oxide, ERG-2ANJ 15K (T), $\pm 20\%$		1043-577-1539
R627	Not Used		
R628	Carbon, RD 1/4W 330, $\pm 5\%$		1018-277-3313

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
R629	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R710	Carbon, RD 1/4W 3.3k, $\pm 5\%$		1018-277-3322
R711	Not Used		
R712	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R713	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R714	Carbon, RD 1/4W 1.5k, $\pm 5\%$		1018-277-1526
R715	Metal, Film, RM 1/4W 470, $\pm 5\%$		1048-277-4711
R716	Carbon, RD 1/4W 1.5k, $\pm 5\%$		1018-277-1526
R717	Metal, Film, RM 1/4W 470, $\pm 5\%$		1048-277-4711
R718	Metal, Film, RM 1/4W 1k, $\pm 1\%$		1048-275-1020
R719	Metal, Film, RM 1/4W 1k, $\pm 1\%$		1048-275-1020
R720	Not Used		
R721	Carbon, RD 1/4W 820, $\pm 5\%$		1018-277-8211
R722	Carbon, RD 1/4W 560, $\pm 5\%$		1018-277-5614
R723	Metal, Oxide, ERG-2ANJ 2.7k (T), $\pm 20\%$		1043-577-2722
R724	Metal, Oxide, ERG-2ANJ 2.7k (T), $\pm 20\%$		1043-577-2722
R725	Carbon, RD 1/4W 68, $\pm 5\%$		1018-277-6804
R726	Metal, Oxide, ERG-2ANJ 15k (T), $\pm 20\%$		1043-577-1539
R727	Not Used		
R728	Carbon, RD 1/4W 330, $\pm 5\%$		1018-277-3313
R729	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012
R730			
I	Not Used		
R809			
R810	Carbon, RD 1/4W 3.3k, $\pm 5\%$		1018-277-3322
R811	Not Used		
R812	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R813	Carbon, RD 1/4W 470, $\pm 5\%$		1018-277-4716
R814	Carbon, RD 1/4W 1.5k, $\pm 5\%$		1018-277-1526
R815	Metal, Film, RM 1/4W 470, $\pm 5\%$		1048-277-4711
R816	Carbon, RD 1/4W 1.5k, $\pm 5\%$		1018-277-1526
R817	Metal, Film, RM 1/4W 470, $\pm 5\%$		1048-277-4711
R818	Metal, Film, RM 1/4W 1k, $\pm 1\%$		1048-275-1020
R819	Metal, Film, RM 1/4W 1k, $\pm 1\%$		1048-275-1020
R820	Not Used		
R821	Carbon, RD 1/4W 820, $\pm 5\%$		1018-277-8211
R822	Carbon, RD 1/4W 560, $\pm 5\%$		1018-277-5614
R823	Metal, Oxide, ERG-2ANJ 2.7k (T), $\pm 20\%$		1043-577-2722
R824	Metal, Oxide, ERG-2ANJ 2.7k (T), $\pm 20\%$		1043-577-2722
R825	Carbon, RD 1/4W 68, $\pm 5\%$		1018-277-6804
R826	Metal, Oxide, ERG-2ANJ 15k, (T), $\pm 20\%$		1043-577-1539
R827	Not Used		
R828	Carbon, RD 1/4W 330, $\pm 5\%$		1018-277-3313
R829	Carbon, RD 1/4W 100, $\pm 5\%$		1018-277-1012

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
TRANSISTORS			
Q101	BC307B		2139-101-3000
Q102	BC237B		2139-302-5108
Q103	BC237B		2139-302-5108
Q104	BC237B		2139-302-5108
Q105	BC307B		2139-101-3000
Q106	BC307B		2139-101-3000
Q107	BC237B		2139-302-5108
Q108			
I	Not Used		
Q611			
Q612	MPS2369		2159-301-2304
Q613	MPS2369		2159-301-2304
Q614	BC237B		2139-302-5108
Q615	Not Used		
Q616	KSC1507-O		2139-301-2304
Q617	MPS2369		2159-301-2304
Q618	KSC1507-O		2139-301-2304
Q619			
I	Not Used		
Q711			
Q712	MPS2369		2159-301-2304
Q713	MPS2369		2159-301-2304
Q714	BC237B		2139-302-5108
Q715	Not Used		
Q716	KSC1507-O		2139-301-2304
Q717	MPS2369		2159-301-2304
Q718	KSC1507-O		2139-301-2304
Q719			
I	Not Used		
Q811			
Q812	MPS2369		2159-301-2304
Q813	MPS2369		2159-301-2304
Q814	BC237B		2139-302-5108
Q815	Not Used		
Q816	KSC1507-O		2139-301-2304
Q817	MPS2369		2159-301-2304
Q818	KSC1507-O		2139-301-2304
SEMI-FIXED RESISTORS			
VR614	Semi, 63000-000B470PREH, 470		1246-101-1316
VR615			
I	Not Used		
VR711			

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
VR712	Semi, 63000-000B2.2KPREH		1246-101-1325
VR713	Semi, 63000-000B2.2KPREH		1246-101-1325
VR714	Semi, 63000-000B470PREH		1246-101-1316
VR715			
I	Not Used		
VR811			
VR812	Semi, 63000-000B2.2KPREH		1246-101-1325
VR813	Semi, 63000-000B2.2KPREH		1246-101-1325
VR814	Semi, 63000-000B470 PREH		1246-101-1316
16	ASS'Y-PCB, CRT Socket		OC904-000-0900
CAPACITORS			
C1	M. Polyester, CF922M 630V 0.022, ±5%		1517-353-2232
C2	Not Used		
C3	M. Polyester, CF922M 630V 0.022, ±5%		1517-353-2232
C4	M. Polyester, CF922M 630V 0.022, ±5%		1517-353-2232
C5	Electrolytic, CE04W 350V 2.2, ±20%		1609-403-6706
COIL			
21 Δ	Coil-Degaussing, DCR; 210MM L; 19MH		2479-013-6109
CONNECTORS AND OTHERS			
B1	Grid, Cable Ass'y JST VHR-7N (365)		3045-616-3101
B2	Vert, DY Ass'y JST VHR-2N (310)		3054-616-6106
B3	Not Used		
B4	Hor, DY Ass'y JST VHR-3N (310)		3054-617-0109
H1	Pin Base, JST BGP-VH (6P 3.96MM)		3344-131-0403
D1	Diode-1N4007		2169-201-1208
15	Ground CRT Ass'y, 3/16/0. 12%1190 Wire TBC		3054-221-9101
H5	Pin-GT, 14.2MM 2.35P1		3124-700-8104
H4 Δ	Socket-CRT, HPS0145-01-500		3354-704-0107
RESISTORS			
R1	Composition, RC 1/2W 330, ±5%		1028-378-3310
R2	Composition, RD 1/2W 330, ±5%		1028-378-3310
R3	Composition, RC 1/2W 330, ±5%		1028-378-3310
R4	Carbon, RD 1/4W 150k, ±5%		1018-277-1544
R5	Composition, RC 1/2W 1k, ±10%		1028-378-1028
R6	Composition, RD 1/2W 10k, ±10%		1028-378-1037
R7	Carbon, RD 1/2W 680k, ±5%		1018-377-6849
R8	Carbon Film, RD 1/2W 4.7, ±5%		1018-377-4751
VR1	Vr-Semi, 60302-052 B1M-P		1246-101-1282

Connect the resistor connection to all exposed metal parts having a return path to the chassis (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 nonpolarized 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 display monitor to the user.

SAFETY NOTICE

Many electrical and mechanical parts in display monitors have special safety-related characteristics. These characteristics often pass unnoticed and the protection afforded by them cannot necessarily be obtained by using replacement components rated for higher voltage, wattage, etc.

Replacement parts that have these special safety characteristics are identified in this manual; electrical components having such features are identified by a Δ and shaded in the Replacement Parts Lists and Schematic Diagram. For continued protection, replacement parts must be identical to those used in the original circuit. The use of a substitute replacement part that does not have the same safety characteristics as specified in this service manual, may create shock, fire, X-radiation or other hazards.

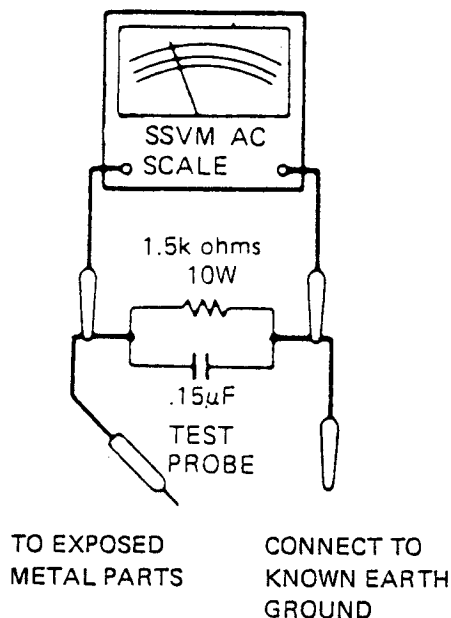
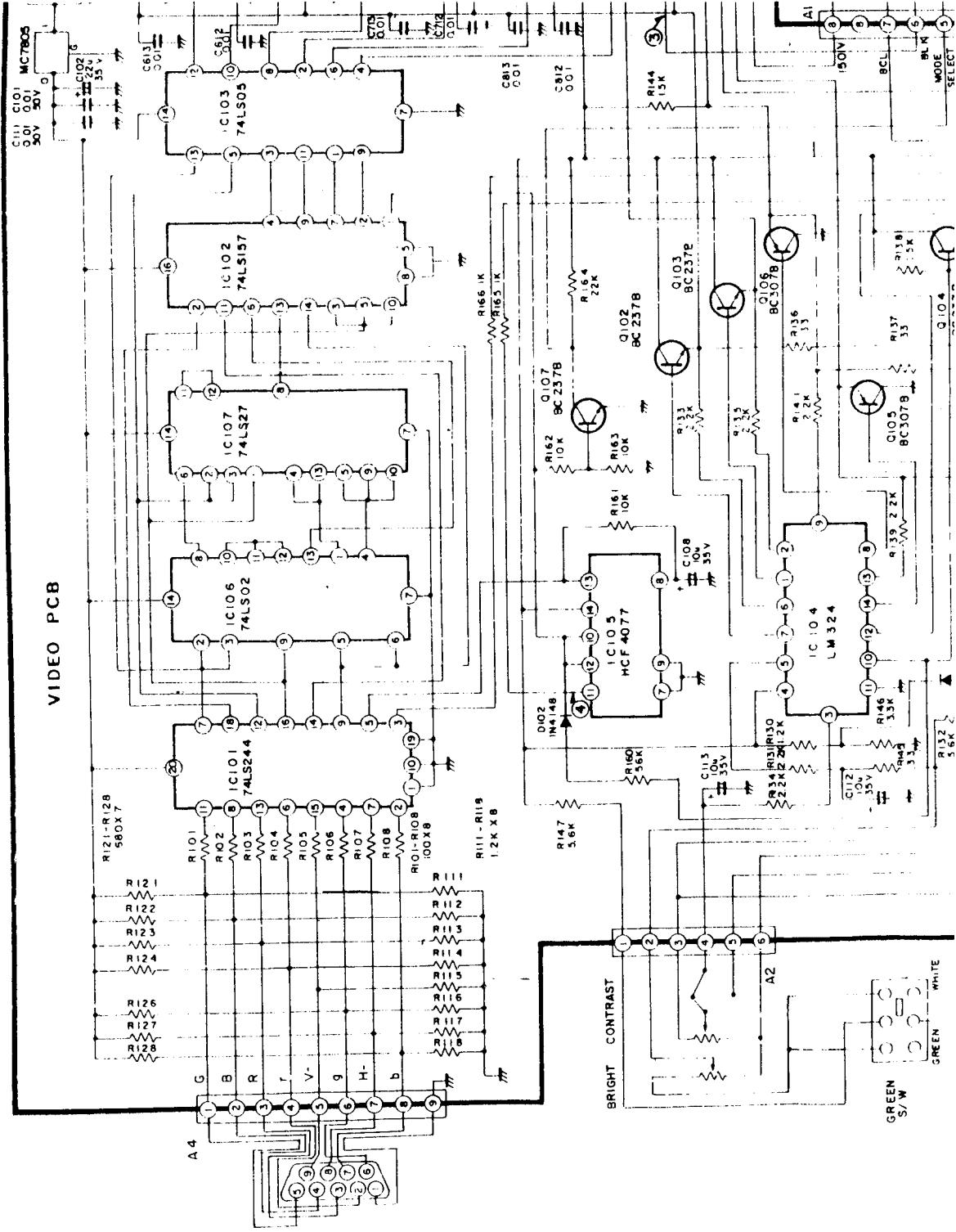


Figure 1. Leakage Current Test Circuit

REF. NO.	DESCRIPTION	RS PART NO.	MFR'S PART NO.
43	ASS'Y—Terminal Board		0C906-000-0280
CONNECTORS			
A3 B7	Sub Cont Ass'y, JST VHR-3N (330) Rear Ass'y, JST VHR-7N (120) Power SW Ass'y, JST VHR-4N (400)		3054-616-710 3054-617-3104 3054-616-1101
RESISTORS			
R1 R2	Carbon, RD 1/4W 1k, ±5% Carbon, RD 1/4W 1k, ±5%		1018-277-1021 1018-277-1021
VARIABLE RESISTORS			
RT1 RT2 RT3 RT4	Round, SGL, 18RN03-20SQ-B1k, Round, SGL, 18RN03-20SQ-B1k Semi, 60224-001B10k-S Semi, 60224-001B10k-S		1201-105-9012 1201-105-9012 1246-101-1273 1246-101-1273
10	ASS'Y—PCB, LED		0C905-000-1180
	Connector, LED ASS'Y, JST VHR-2N (500) LED, KLG 208E		3054-617-2109 2309-110-0907
	ASS'Y—CONTROL		9202-806-9305
SWITCHES			
S3	Push ESB 8213V, Power ON-OFF Push, NPB—PB 21S, Green		3529-702-7102 3529-101-0085
CONNECTORS			
	Control Ass'y, JST VHR-6N (580) Ass'y Green SW, S1P—LV (540)		3054-617-5104 3054-616-2106
CONTROL			
	VR, 18SN 20F, B10K (TAP), Contrast VR, 18SN 20F, B10K, Bright		1201-102-0322 1201-102-0054
CRT + DY			
66 ▲▲	CRT + DY, M34JCA 30 x 15		2109-231-3203

WARNING THIS MONITOR CONTAINS SAFETY CRITICAL COMPONENTS. ALL PARTS SHOWN IN THE SHADED AREAS OF THE SCHEMATIC MUST BE REPLACED WITH IDENTICAL PARTS. SAFETY CRITICAL PARTS MUST BE REPLACED WITH IDENTICAL PARTS. COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PART NUMBER MAY BE USED FOR REPLACEMENTS.



SCHEMATIC DIAGRAM

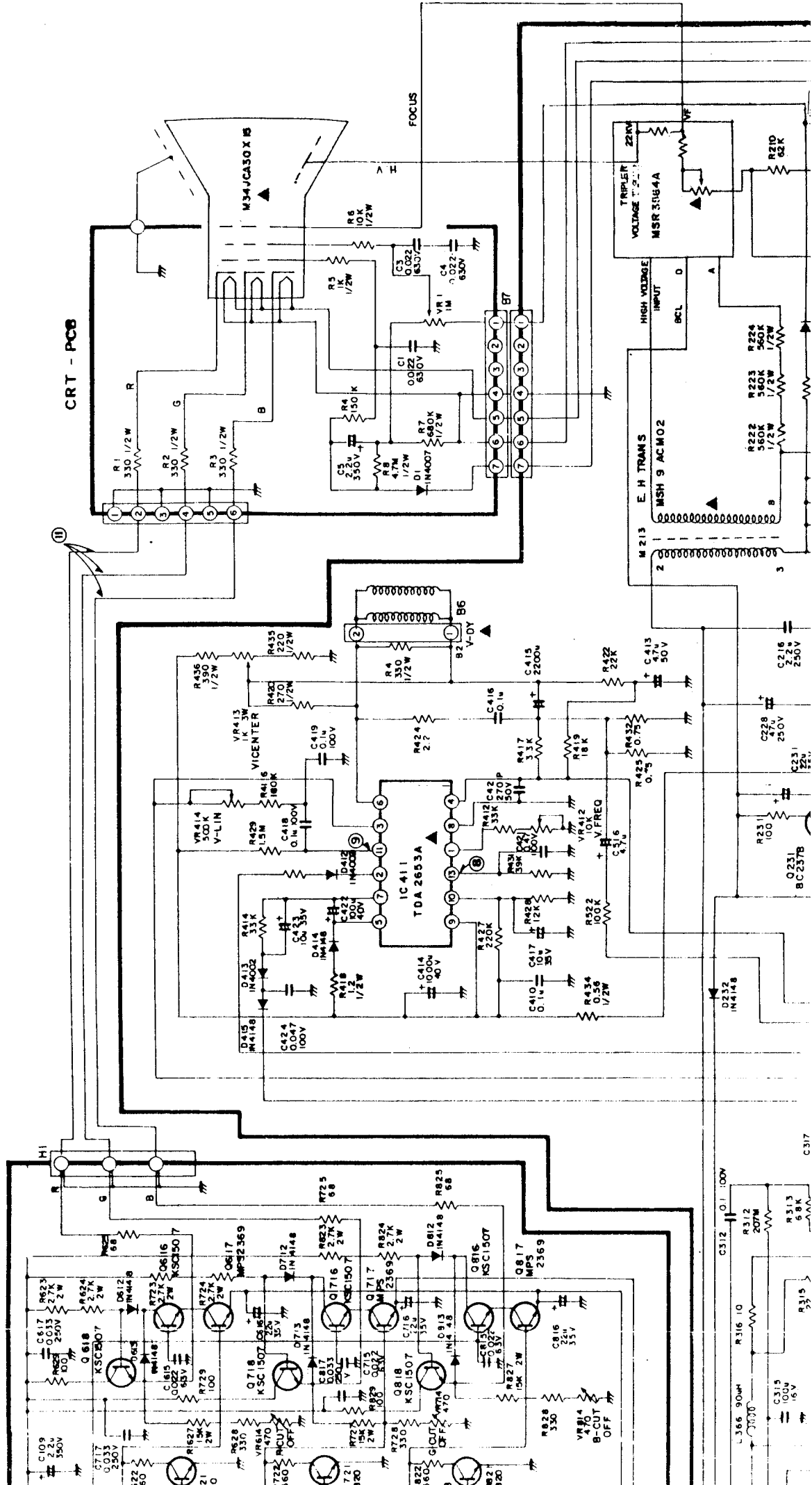
NOTE: 1. ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED.
2. ALL CAPACITOR VALUES ARE IN P.F. UNLESS OTHERWISE INDICATED.
3. ALL CAPACITOR VALUES ARE IN P.F. UNLESS OTHERWISE INDICATED.
4. ALL CAPACITOR VALUES ARE IN P.F. UNLESS OTHERWISE INDICATED.
5. THIS SCHEMATIC DIAGRAM IS SUBJECT TO CHANGE WITHOUT NOTICE FOR
FURTHER IMPROVEMENT.

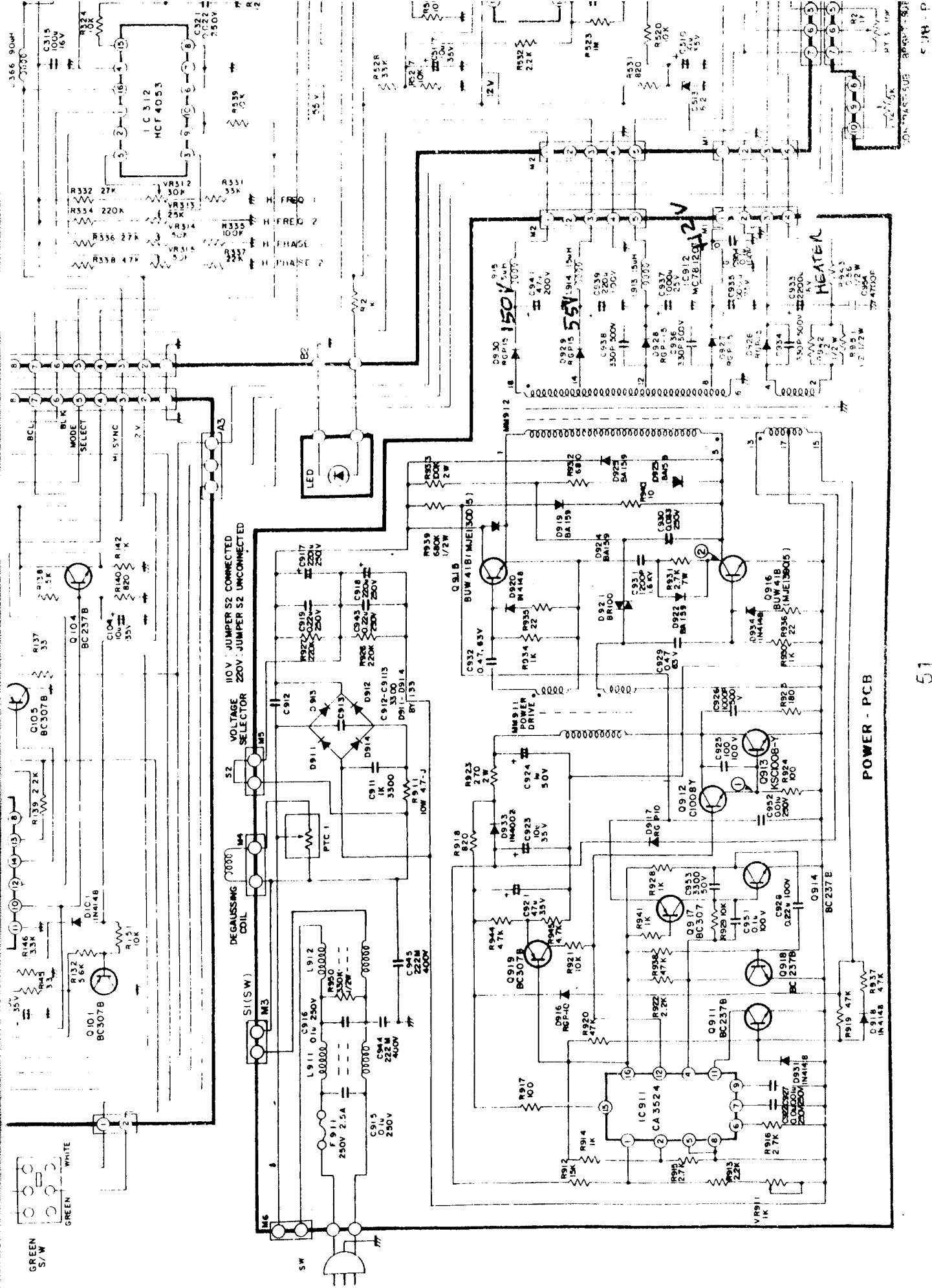
NOTES

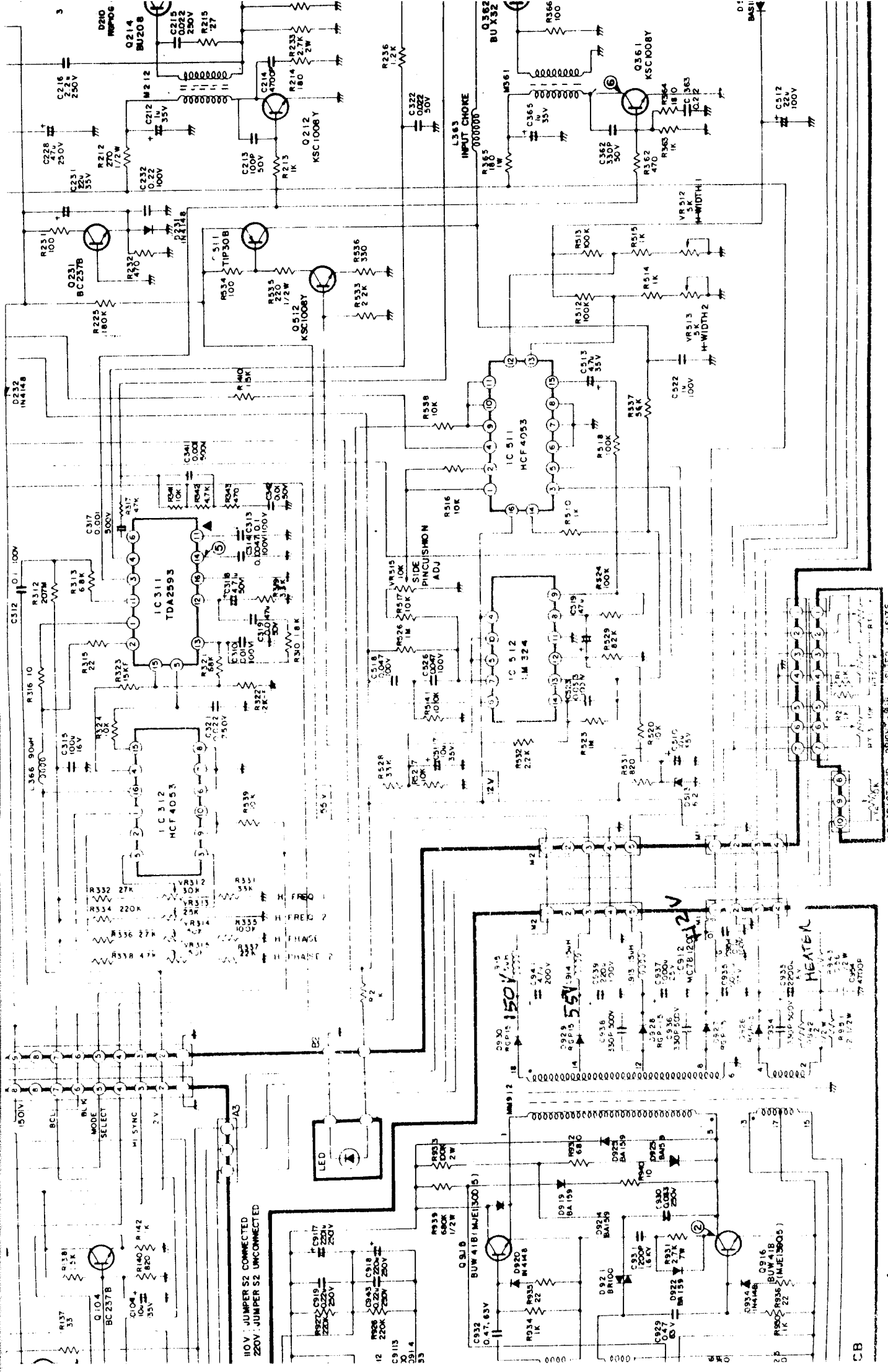
1. RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED.
2. ALL RESISTORS ARE 1/2W EXCEPT WHERE OTHERWISE INDICATED.
3. ALL CAPACITORS ARE 50V EXCEPT WHERE OTHERWISE INDICATED.
4. CAPACITOR VALUES ARE IN P.F. UNLESS OTHERWISE INDICATED.
5. THIS SCHEMATIC DIAGRAM IS SUBJECT TO CHANGE WITHOUT NOTICE FOR
FURTHER IMPROVEMENT.

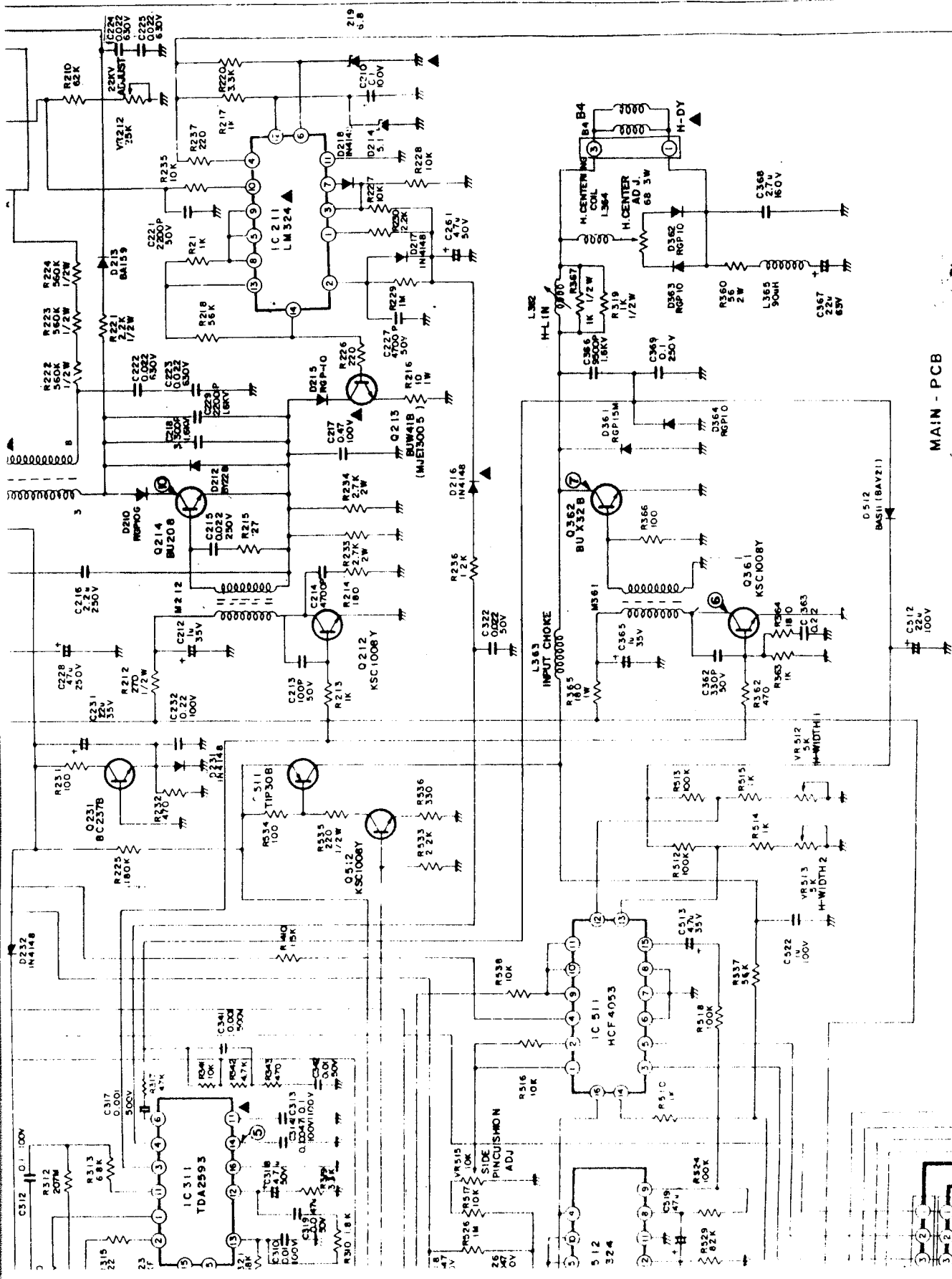
SHADED COMPONENTS: SAFETY RELATED PARTS

▲ MARK: X-RAY RELATED PARTS









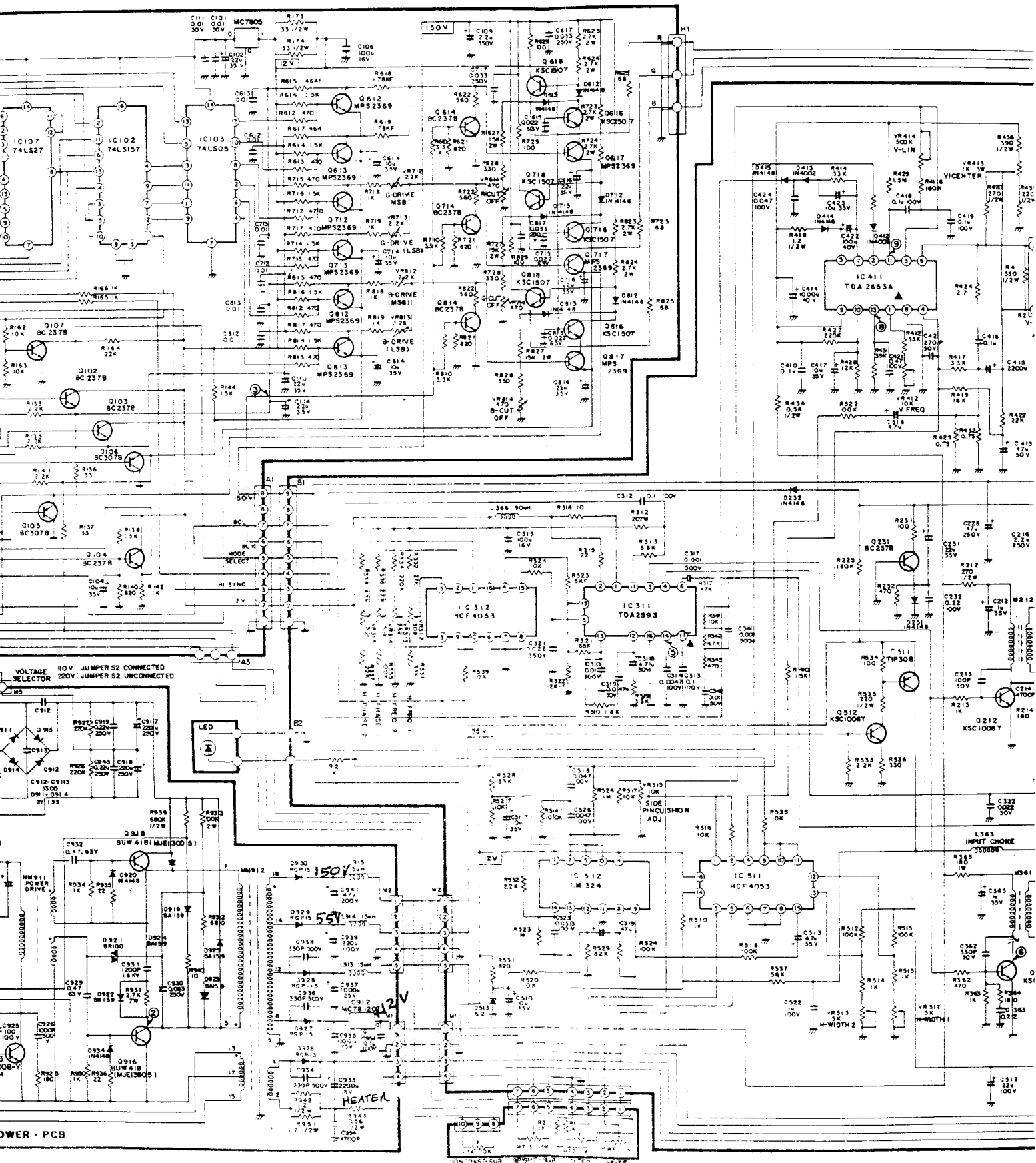
SCHEMATIC DIAGRAM

WARNING THIS MONITOR CONTAINS SAFETY CRITICAL COMPONENTS.
ALL PARTS SHOWN IN THE SHADED AREAS OF THE SCHEMATIC ARE
SAFETY CRITICAL. CONTINUOUS SAFETY REPLACE SAFETY CRITICAL
COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
REFER TO PARTS LIST FOR EXACT REPLACEMENTS.

AVERTISSEMENT CE MONITEUR CONTIEN DES COMPOSANTS
DANGEREUX POUR LA SECURITE. TOUS LES COMPOSANTS DANGEREUX
SONT MARQUES EN ZONE OMBRAGEE. REMPLACEZ TOUJOURS LES
COMPOSANTS DANGEREUX SEULEMENT AVEC DES COMPOSANTS
RECOMMANDES PAR LE FABRICANT. POUR PLUS D'INFORMATIONS
CONSULTEZ LA NOMENCLATURE DES PIECES POUR
OBTENIR LES RECOMMANDATIONS EXACTES.

NOTES

1. RESISTOR VALUES ARE IN OHMS, Ω , K=1000, M=1,000,000.
2. ALL RESISTORS ARE 1/4W EXCEPT WHERE OTHERWISE INDICATED.
3. ALL CAPACITORS ARE 50V EXCEPT WHERE OTHERWISE INDICATED.
4. CAPACITOR VALUES ARE μ F UNLESS OTHERWISE INDICATED μ F.
5. THIS SCHEMATIC DIAGRAM IS SUBJECT TO CHANGE WITHOUT NOTICE FOR
FURTHER IMPROVEMENT.



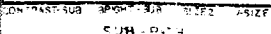
LE RECEPTEUR EST EQUIPE DE COMPOSANTS
TELEPHONES EN PIECES INDICÉES DANS
LE MANUEL D'UTILISATION POUR LA SECURITE
DE SECURITE DE L'APPAREIL NE
DOIT PAS FONCTIONNER EST POUR
LE RECOMMANDER PAR LE
NOMENCLATURE DES PIECES POUR
ECHANGE EXACTES

```

1 RESISTOR VALUES ARE IN OHMS. Q. K=1,000Q. M=1,000,000Q
2 ALL RESISTORS ARE 1/4W EXCEPT WHERE OTHERWISE INDICATED.
3 ALL CAPACITORS ARE 50V EXCEPT WHERE OTHERWISE INDICATED.
4 CAPACITOR VALUES ARE uF UNLESS OTHERWISE INDICATED uSUF=10^-6 F
5 THIS SCHEMATIC DIAGRAM IS SUBJECT TO CHANGE WITHOUT NOTICE FOR
  FUJITEC 74-023-01-01

```

▲ MARK X-RAY RELATED PARTS.



THEORY OF OPERATION

GENERAL

is a high-resolution color display using a 0.31 pitch CRT with etched faceplate. It uses six TTL-level color input signals and separate sync signals. It can operate in either 200 or 350-line mode.

The switching is automatic and based on the polarity of vertical sync.

DESCRIPTION

1. Power Supply

This is a constant-frequency quasi-bridge switched-mode power supply of flyback type. The output voltage regulation is achieved by means of variable duty cycle. The control circuit IC911 monitors the voltage at pin 13 of MM912 and regulates the duty cycle so that this voltage is kept constant. The output voltages can be varied by means of VR911.

Q915 and Q916 act as switches. D924 and D925 form the rest of the quasibridge circuit. R933, C930 and D921 form a DIAC oscillator which is used to start the power supply.

When the power-supply starts R932 and D923, turn off the DIAC oscillator.

Output Voltages:	Pin No.	V
	M1/1	12
	M1/2	GND
	M1/3	6.2
	M1/4	Heater GND
	M2/1	153
	M2/3	55
	M2/4	GND
	M2/5	20

IMPORTANT: When replacing the power supply, make sure that the green/yellow ground wire is properly attached to the main chassis frame. When replacing the fuse, make sure that the fuse is of the same type and rating as the original.

2. Main Board

2-1. Vertical Oscillator/Amplifier IC411

IC411 (TDA 2653A) Includes the Following Functions.

- o Vertical oscillator
- o Ramp generator
- o Linearity control
- o Output amplifier

There are two vertical height controls: RT1 and RT2. RT1 is for the 200 line mode and RT2 for the 350 line mode. The potentiometers are automatically selected by analog switch IC511.

2-2. Horizontal Combination IC311 (TDA2593) IC311 Includes the Following Functions.

- o Horizontal oscillator
- o Phase-locked loop for frequency and phase comparison.
- o Phase locked loop to compensate various delay times of the horizontal output transistor.
- o Driver stage.

The sync signal is input to pin 9 and the horizontal flyback pulse to pin 6. These two signals are compared and the circuit is locked to a correct frequency and phase. Analog switch IC312 uses the mode signal to switch the horizontal oscillator to 15.7KHz or 22 KHz mode.

2-3. Horizontal Output Stage Q362

Q362 is a horizontal output switch, which is closed during the scan period and opened during the fly-back. It receives a drive signal from IC311 via Q361 and M361.

The flyback time is determined by the resonance of C366 and the deflection yoke.

The additional energy to compensate for the losses in the circuit is driven via L363.

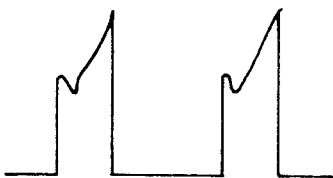
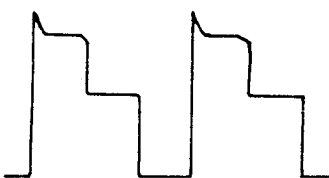
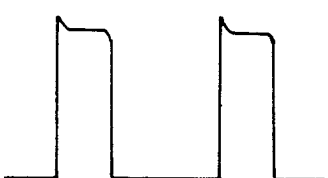
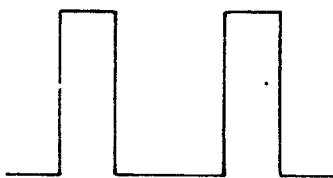
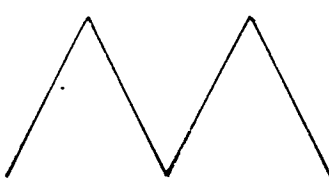
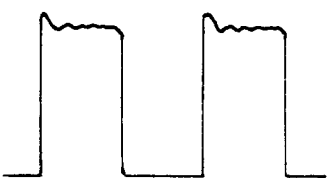
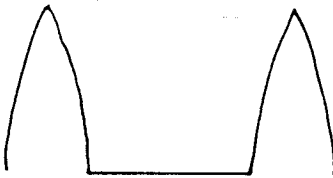
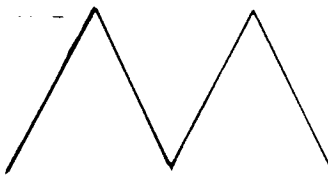
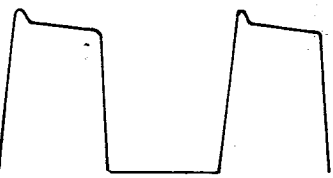
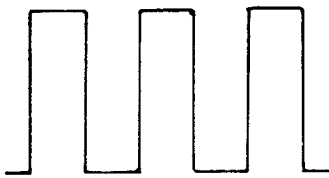
C363 makes the necessary S-correction. Because of the losses in the deflection yoke, a linearity correction is required. This is achieved by L362, which is a saturating choke.

The saturation is controlled by means of adjustable permanent magnet rings.

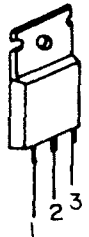
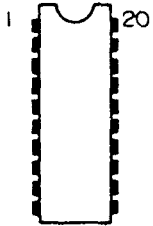
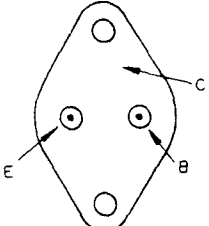
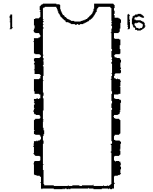
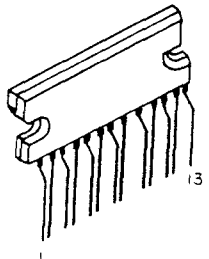
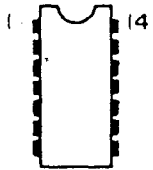
2-4. Horizontal Width Control Stage Q511

The amount of energy fed to the horizontal output stage is controlled by Q511. It is simply a linear series regulator. D513 forms a reference voltage. This voltage and a rectified flyback voltage are compared in an error amplifier Q512, which controls Q511. In this way a very stable picture width is achieved. Pincushion correction is achieved by adding a parabolic waveform to the reference voltage. This

WAVEFORMS

 POWER SUPPLY ① 50Vp-p	 POWER SUPPLY ② 370Vp-p	 VIDEO P.C 8 ③ 12Vp-p
 VIDEO ④ 5Vp-p	 VERTICAL ⑤ 3.5Vp-p	 HORIZONTAL ⑥ 25Vp-p
 HORIZONTAL ⑦ 700Vp-p	 ⑧ 2.5Vp-p	 ⑨ 5.5Vp-p
 HORIZONTAL ⑩ 700Vp-p	 VIDEO ⑪ 40Vp-p	

SEMICONDUCTOR LEAD IDENTIFICATION

PARTS	DESCRIPTION	REF. NO.	PARTS	DESCRIPTION	REF. NO.
	BC3078 BC237B	Q919, Q917, Q105 Q106, Q101 Q911, Q918, Q914 Q107, Q614, Q714 Q814, Q103, Q102 Q104, Q231		MPS2369	Q617, Q717, Q612, Q613, Q713, Q812, Q817 Q712 Q813
	KSC1008-Y	Q912, Q913 Q512, Q212, Q361		MC7805CT MC7812CT	IC100 IC912
	MJE13005 TIP30B KSC1507-O	Q213, Q916, Q915 Q511 Q616, Q716, Q816 Q618, Q718, Q818		SN74LS244N	IC101
	BUX32B BU208	Q362 Q214		SN74LS157N CA3524E HCF4053BE/ HEF4053B TDA2593	IC102 IC911 IC511, IC312 IC311
	TDA2653A	IC411		SN74LS27N SN74LS02N SN74LS05N HCF4077BE LM324N	IC107 IC106 IC103 IC105 IC104, IC512 IC211