ORDER NO. KME8110001C1

Service Manual

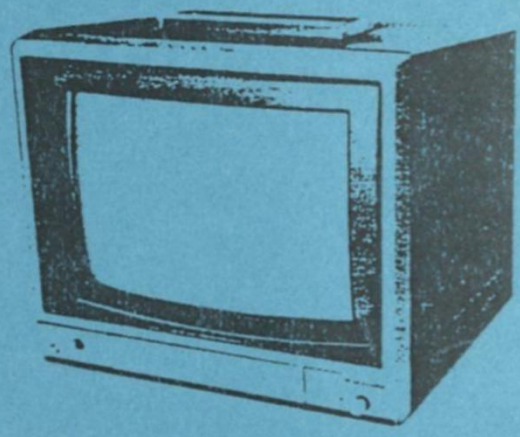
Color Video Monitor

CT-110MA/CT-110MCA

Chassis

No. NMX-K6NA (CT-110MA)
No. NMX-K6NB (CT-110MCA)

Main Manual



The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this service manual.

Specifications

Power Input:	120 volts, 50/60 Hz, AC
Power Consumption:	58 watts average 0.9 amperes max.
Video Input (Bridging):	1.0Vp-p ± 10% High or 75Ω switchable BNC type bridging and 8-pin connectors
Audio Input (Bridging):	RCA type bridging and 8-pin connectors
Semiconductors:	20 transistors 27 diodes 1 posistor
Integrated Circuits:	2
Anode Voltage:	24.0 kV ± 1 kV (at zero beam current)
Sound Output:	0.9-watts (10% distortion) Maximum 1.2 watts
Speaker:	3 inches Round Type 16Ω, voice Coil
Automatic Circuits:	Automatic Frequency and Phase Control Horizontal Automatic Frequency Control Automatic degaussing Automatic Voltage Regulator Automatic Beam Limiter Automatic Color Control
Picture Tube:	290KB22 52 Square inches 10 inches measured diagonally 90° deflection Quintrix II, In-Line
Dimensions:	Height: 10-¾ inches (275 mm) Width: 11-¾ inches (297 mm) Depth: 12-¾ inches (323 mm)
Weight:	22 lbs. (10.0 kg)

Panasonic

Specifications are subject to change without notice.

Panasonic Company
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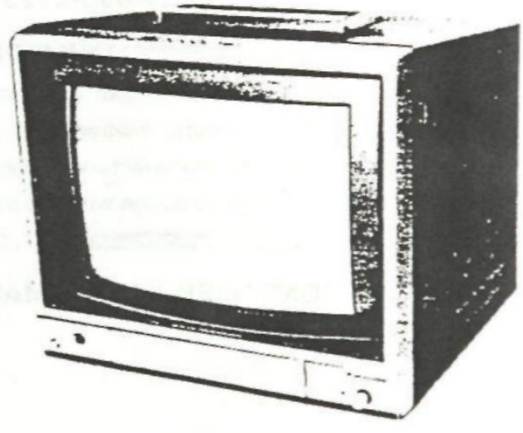

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CONTENTS

THIS MODEL COMPLIES WITH DHHS RULES 21 CFR SUBCHAPTER J APPLICABLE AT DATE OF MANUFACTURE.

IMPORTANT SAFETY NOTICE

There are special components used in Panasonic Video Monitor set which are important for safety. These parts are shaded on the schematic diagram and on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X-RADIATION, shock, fire, or other hazards. Do not modify the original design without permission of Matsushita Electric.

ABBREVIATIONS USED IN THIS MANUAL

ABL	Automatic Beam Limiter
APC	Automatic Phase Control
DY	Deflection Yoke
OTL	Transformerless Output
SEPP	Single Ended Push-Pull Circuit
ACC	Automatic Color Control
AVR	Automatic Voltage Regulator
CRT	Cathode Ray Tube
FBT	Flyback Transformer
HAFC	Horizontal Automatic Frequency Control
SCS	Silicon-Controlled Switch
VCO	Voltage-Controlled Oscillator

SAFETY PRECAUTIONS

GENERAL GUIDELINES

1. It is advisable to insert an isolation transformer in the power line and AC supply before servicing a hot chassis.
2. When servicing, observe the original lead dress; especially the lead dress in the high voltage circuits. If a short circuit is found, replace all parts which have been overheated or damaged by the short circuit.
3. After servicing, see to it that all the protective devices such as insulation barriers, insulation papers, shields, and isolation R-C combinations, are properly installed.
4. Before turning the monitor on, measure the resistance between B+ line and chassis ground. Connect ⊖ side of an ohmmeter to the B+ lines, and ⊕ side to chassis ground. Each line should have more resistance than specified, as follows:

B+ Line	Minimum Resistance
116V	25kΩ
24V	200Ω
12V	150Ω

5. When the monitor is not to be used for a long period of time, unplug the power cord from the AC outlet.
6. Potentials, as high as 24.0 kV are present when this monitor is in operation. Operation of the monitor without the rear cover involves the danger of a shock hazard from the monitor power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high-voltage equipment. Always discharge the anode of the picture tube to the monitor chassis before handling the tube.
7. After servicing, make the following leakage current checks to prevent the customer from being exposed to shock hazards.

LEAKAGE CURRENT COLD CHECK (See figure 1.)

1. Unplug the AC cord and connect a jumper between the two prongs on the plug.
2. Turn on the monitor's power switch.
3. Measure the resistance value, with an ohmmeter, between the jumpered AC plug and each exposed metallic cabinet part on the monitor, such as screw-heads, antennas, control shafts, handle bracket, etc.
   When the exposed metallic part has a return path to the chassis, the reading should be between 240 kΩ and 5.2 MΩ.
   When the exposed metal does not have a return path to the chassis, the reading must be ∞.

LEAKAGE CURRENT HOT CHECK (See Figure 1.)

1. Plug the AC cord directly into the AC outlet. Do not use an isolation transformer for this check.
2. Connect a 1.5 kΩ, 10 watts resistor, in parallel with a 0.15 μF capacitor, between each exposed metallic part on the set and a good earth ground such as a water pipe, as shown in figure 1.
3. Use an AC voltmeter, with 1000 ohms/volt or more sensitivity, to measure the potential across the resistor.
4. Check each exposed metallic part, and measure the voltage at each point.
5. Reverse the AC plug in the AC outlet and repeat each of the above measurements.
6. The potential at any point should not exceed 0.75 volts RMS. A leakage current tester (Simpson Model 229 or equivalent) may be used to make the hot checks, leakage current must not exceed 1/2 milliamp. In case a measurement is out side of the limits specified, there is a possibility of a shock hazard, and the monitor should be repaired and rechecked before it is returned to the customer.

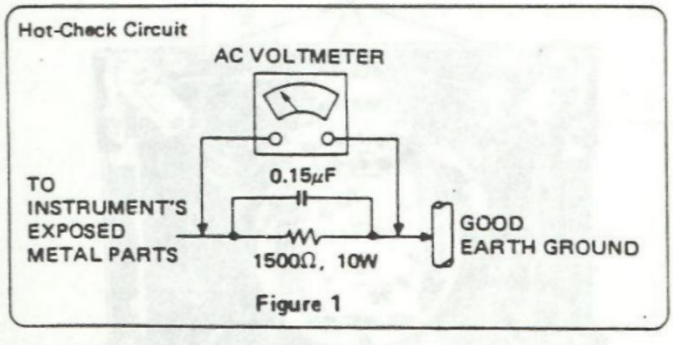


Figure 1

X-RADIATION

WARNING: 1. The potential source of X-Radiation in TV sets is the High Voltage section and the picture tube.

2. When using a picture tube test jig for service, make sure the jig is capable of handling 25.0 kV without causing X-Radiation.

NOTE: It is important to use an accurate, periodically calibrated high voltage meter.

1. Turn the Bright and the Panabrite controls fully counter-clockwise.
2. Set the SERVICE switch to SERVICE.
3. Measure the High Voltage. The upper meter (electro-static type) reading should indicate 24 kV ± 1.0 kV.
   If the upper meter indication is out of tolerance, immediate service and correction is required to prevent the possibility of premature component failure.
4. To prevent an X-Radiation possibility, it is essential to use the specified picture tube.
5. To prevent exposure to X-Radiation, the picture tube shield must be kept in place with power applied to the set.

HORIZONTAL OSC. DISABLE CIRCUIT TEST

SERVICE WARNING: This test must be made as a final check before the set is returned to the customer.

1. With rear cover removed, supply nominal 120 V AC to the set and turn on the power switch.
2. Adjust the customer controls to normal position.
3. Short the collector and the emitter of Q801 with a jumper wire.
   Confirm that the picture tube screen blacks out (horizontal oscillation stops).
4. If this does not occur, the Horizontal OSC. Disable Circuit is not operating.
   Follow the Horizontal Oscillator Disable Circuit Repair Procedures before the set is returned to customer.

HORIZONTAL OSC. DISABLE CIRCUIT REPAIR PROCEDURE

1) Connect a DC voltmeter between the cathode of D504 and chassis ground of the main circuit board. If nearly 20 V is not present on the cathode, find the cause. Check R527, D504 and C519.
2) Connect a DC voltmeter between the cathode of D505 and chassis ground of the main circuit board. If nearly 11.0 V is not present on the cathode, find the cause. Check R518, R519 and D506.
3) Repeat step 2) procedure. If nearly 11.0 V is present on the cathode, check IC401, R520, C525 and D505.
4) Carefully check above specified parts, and related cirucits and parts. When the circuit is repaired, try the horizontal oscillator disable circuit test again.

DISASSEMBLY INSTRUCTIONS

BACK CABINET REMOVAL

1. Remove 7 Ⓐ screws shown in figure 2.
2. Pull the cabinet toward you.

TOP CABINET REMOVAL

1. Remove OFF-ON Volume knob on the front panel and place the set with the picture tube face down.
2. Remove 8 Ⓑ screws and then carefully pull the top panel upward as shown in figure 3.

SPEAKER BLOCK REMOVAL

1. Disconnect a coupler Ⓒ and remove 5 Ⓓ screws shown in figure 4.
2. Pull off the speaker block from the chassis bracket.

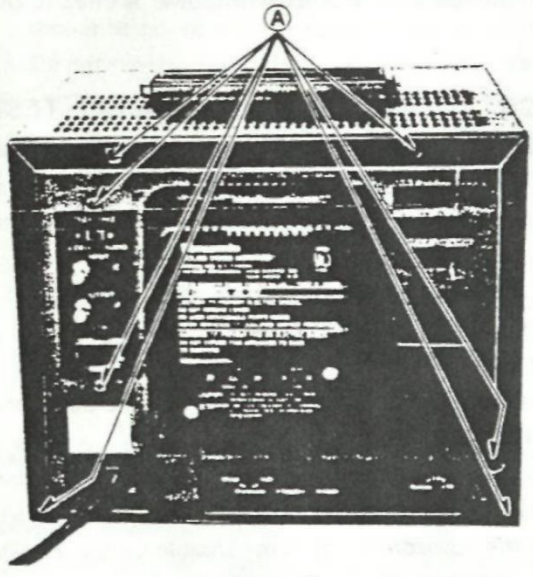


Figure 2

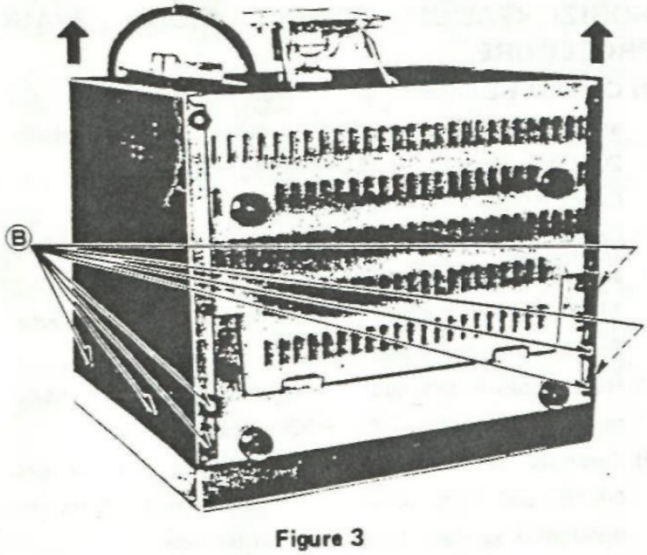


Figure 3

CHASSIS REMOVAL

1. Disconnect C-Board and anode lead from CRT, 6 couplers from A-Board, 1P lug terminal from chassis bracket and 1P connector from C-Board.
2. Then slowly slide the chassis backward and remove from the rails.

CRT REMOVAL

1. Remove 4 Ⓔ screws and remove CRT off as shown in figure 5.

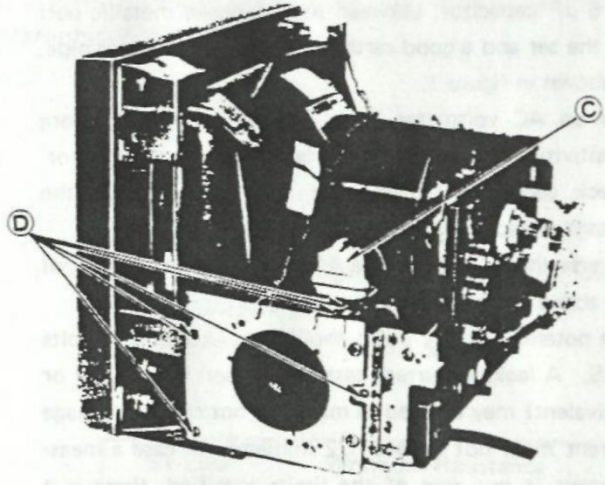


Figure 4

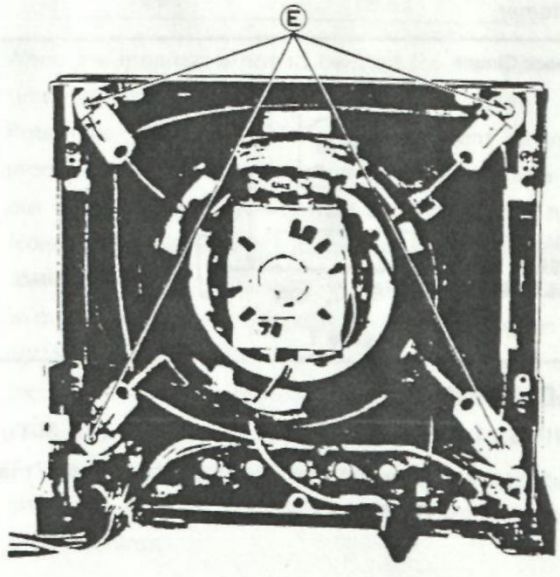
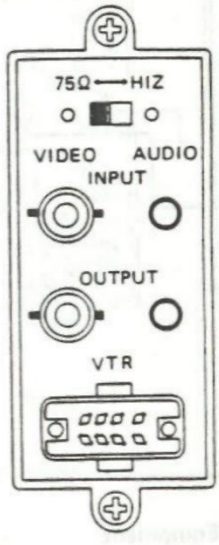


Figure 5

GENERAL CONNECTION & APPLICATIONS

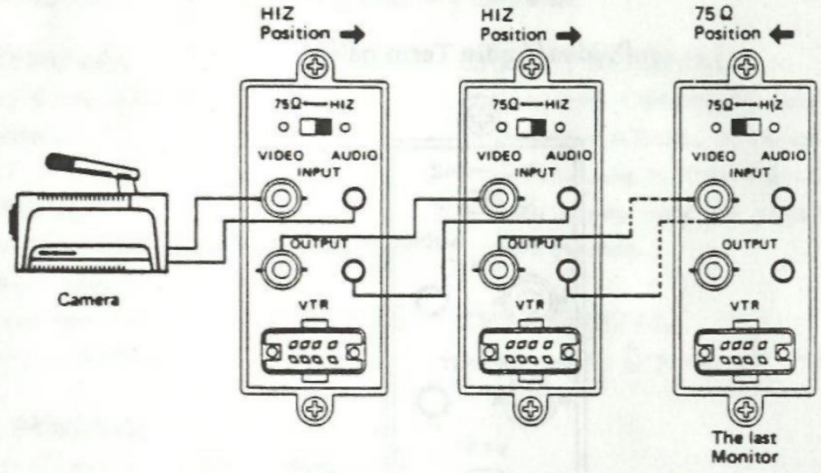
[Video/Audio Terminals]



Signal level and Terminal impedance

Terminal \ Item		Level	Impedance	Remarks
VIDEO	INPUT	1Vp-p	75Ω/HIZ	Video Signal includes Sync. Signal
	OUTPUT	1Vp-p	75Ω/HIZ	
AUDIO	INPUT	0 dB	10 kΩ	1V rms = 0 dB 400 Hz
	OUTPUT	0 dB	10 kΩ	
AUDIO/VIDEO	VTR	1Vp-p	75Ω	Video and Audio Signal
		0 dB	20 kΩ	

[75Ω-HIZ Switch]



[Application with other equipment]

Terminal	VTR/LINE Selector Position	Signal	Equipment	Remarks
INPUT	LINE	Line-in Signal from other equipment	VTR/Video Camera	Line-in and line-out connectors are bridged. (connected in parallel)
OUTPUT	LINE	Line-in Signal	Monitor or VTR	When this connector is not used, then termination select switch should be set to 75 ohms position. When another monitor's line-in is connected to this monitor's line-out connector, the termination select switch should be set to HIZ position. The last monitor in the series of monitors should then have it's switch set to 75 ohms.
VTR (8-pins)	VTR	Video/Audio Signal in/out from/to VTR	½ inch VTR, ½, ¾ inch VCR and VHS VCR	

[Connectors]

Video Input (Bridging) : More than 1.0Vp-p, High impedance or 75Ω switchable, BNC-type bridging and 8-pin connectors.
Audio Input (Bridging) : RCA-type and 8-pin connectors
Video/Audio Output : BNC-type video and RCA-type audio connectors.

FIELD ALIGNMENT OF VIDEO MONITOR

Note: Use Video pattern Generator for following alignments. (Video input should read 1.0Vp-p)

A. WITHOUT TEST EQUIPMENT

Alignment can be accomplished by general procedures. The following describes simple alignment methods that do not require extensive service shop test equipment.

VERTICAL HEIGHT ADJUSTMENT

Adjust Vertical Height control (R402) until the picture or test pattern is symmetrical from top to bottom.

COLOR PURITY ADJUSTMENT

(See figure 6, 7, 8 and 10.)

1. Operate the monitor for 20 minutes, with the Bright control at maximum to warm up the CRT.
2. Degauss the monitor fully by using an external degaussing coil.
3. Roughly adjust the convergence. (See page 8.)
4. Apply black and white pattern.
5. Turn the Red and Blue Cut-Off controls fully counterclockwise to obtain a green field. Adjust the R. Drive controls if the green field cannot be obtained.
6. Loosen the deflection yoke clamp screw and move the deflection yoke as close to the purity magnet as possible.
7. Loosen the purity magnet clamp (See figure 7) and adjust the purity magnet to set the vertical green raster precisely at the center of the screen. (See figure 8.) Then tighten the clamp.
8. Slowly move the deflection yoke forward and adjust for the best overall green screen.
9. Tighten the deflection yoke clamp screw.
10. Produce a blue and red raster with the Cut-Off controls and observe that good purity is obtained on the respective field.
11. Observe that a uniform white raster is obtained by adjusting the R.G.B. Cut-Off controls. If the screen is not uniformly white, repeat the above procedure.

COLOR TEMPERATURE ADJUSTMENT

(See figure 9 and 10.)

1. Use a black and white video pattern.
2. Turn the R, G, and B Cut-Off controls fully counterclockwise, and then turn each forward (clockwise) 90°.
3. Turn the Screen Control (R550) fully counterclockwise and set Service Switch to the Service position.
4. Turn the Screen Control clockwise slowly, until any one of the R, G, or B lines just becomes visible. (See figure 9.)

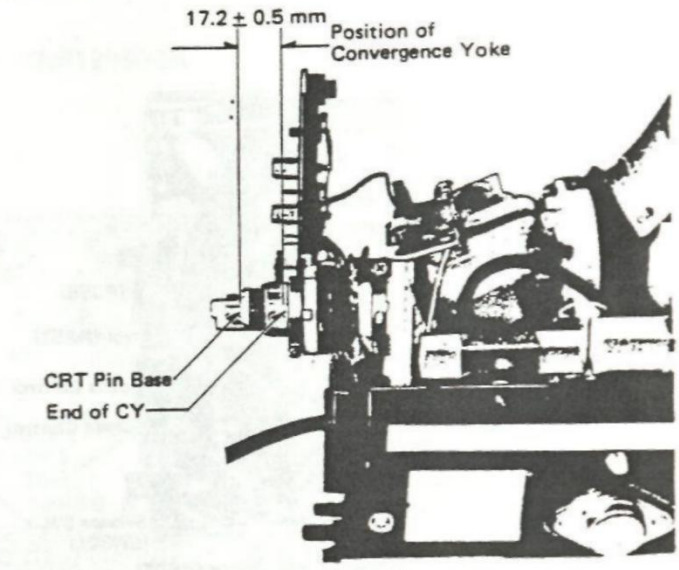


Figure 6

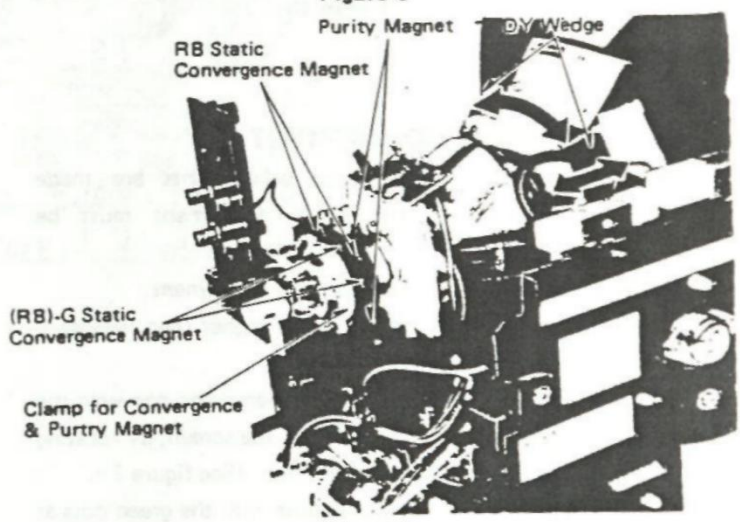


Figure 7

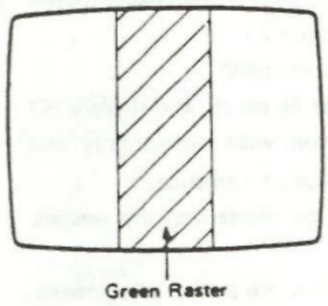


Figure 8

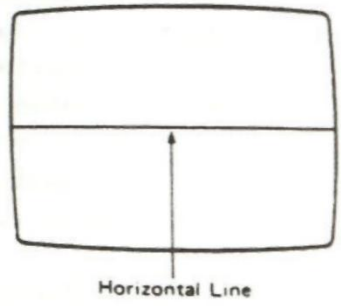


Figure 9

5. Turn the other two Cut-Off controls (for the colors which did not appear on the screen) slowly clockwise, so they also become just visible.
   (Adjust one control and color line at a time.)
6. Set the Service Switch in the Normal position.
7. Turn the Bright and Panabrite controls to maximum.
8. Adjust the drive controls to obtain a white raster at maximum brightness.

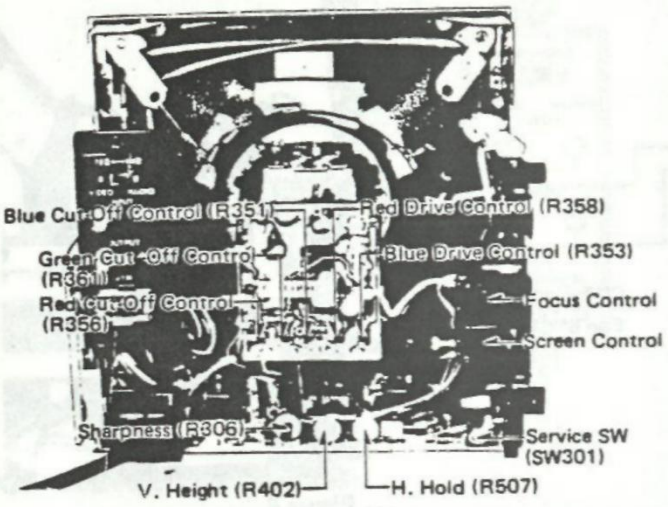


Figure 10

CONVERGENCE ADJUSTMENT

Note: Before any convergence adjustments are made vertical neight and focus adjustment must be completed.

1. Use a dot pattern to complete this adjustment.
2. The brightness level should be no higher than necessary to obtain a clear pattern.
3. Loosen the convergence magnet clamp and converge the red and blue dots at the center of the screen, by rotating the R-B Static Convergence Magnet. (See figure 7.)
4. Align the converged red/blue dots with the green dots at the center of the screen, by rotating the (RB)-G Static Convergence Magnet. (See figure 7.)
5. Tighten the convergence magnet clamp.
6. Remove the DY wedges (see figure 7) and slightly tilt (do not rotate) the deflection yoke horizontally and vertically to obtain good overall convergence.
7. Secure the deflection yoke by reinserting the wedges. (See figure 11.)
8. If purity error is found, repeat the purity adjustments.

NOTE:

1. Wedge A shown in figure 11 should be fixed within a range of 0° ~ 30° to the left of the vertical line as shown.
2. After inserting wedge A, insert wedges B and C. The wedges should be set 120° apart from each other.
3. Be certain that the three wedges are firmly fixed and the Deflection Yoke is tightly clamped in place. Otherwise the Deflection Yoke may shift its position and cause a loss of convergence and purity.

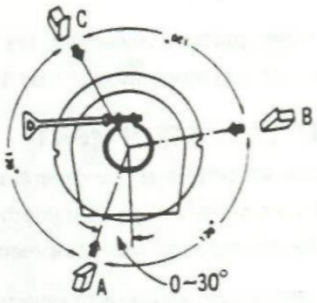


Figure 11

B. WITH TEST EQUIPMENT

When measuring voltage with a VTVM, be sure to use the test points located at the conductor side of the circuit boards. Use an isolation transformer for these.

POWER LINE VOLTAGE (116V) ADJUSTMENT

1. Connect a voltmeter between TP91 and ground.
2. Adjust R809 to obtain a reading of 116.0 V ± 0.5 V.

HIGH VOLTAGE ADJUSTMENT

1. Adjust color temperature. (See color temperature adjustment.)
2. Slide the Service Switch to the Service position.
3. Use an electrostatic type high voltage meter to confirm that the high voltage is within the range of 24.0 kV ± 1.0 kV.
4. If the high voltage is out of tolerance, adjust R809 until the high voltage is within tolerance without over or under going B+ voltage tolerance.

Note: Be cartain that B+ is 116.0 V ± 0.5 V with beam current at zero during the High Voltage Adjustment.

ABL ALIGNMENT

This is factory aligned. Usually no further alignment is required in the field. However, when the A-Board, or CRT is replaced, the following alignment is necessary.

1. Set the monitor to receive a cross hatch pattern from a video signal generator.
2. Set Bright and Panabrite controls at each click position.
3. Connect the DC voltmeter between TP86 and TP87 (positive lead of the voltmeter to TP87 and negative lead to TP86.)
4. Adjust the ABL control (R313) to obtain a voltmeter reading of 6.0 V ± 0.2 V.

GENERAL ALIGNMENT

Note: Use Video Pattern Generator for following alignments. (Video input should read 1.0 Vp-p.)

ALIGNMENT OF SUB CONTRAST

1. Use a color bar signal.
2. Set Color control (R605) fully counterclockwise.
3. Connect an oscilloscope to TP48 of C-Board. (TNP12950ZA)
4. Adjust the SUB-CONT control (R303) to obtain 1.7 V p-p ± 0.1 Vp-p from the white level to pedestal level. (See figure 12.)

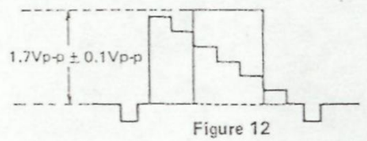


Figure 12

APC ALIGNMENT

Preliminary Steps (See figure 13)

1. Use a color bar signal.
2. Set Color Control (R605), Bright Control (R309) and Panabrite Control (R304) in a fully clockwise position.
3. Set Tint Control (R603) to mid-position.
4. Connect a jumper between terminal ⑯ and terminal ⑰ of IC601.
5. Connect a 15 kΩ resistor between terminal ⑱ of IC601 and +12 V Line.

Alignment Procedure

1. Adjust APC Control (C607) to just sync the color b
2. Remove the jumper between terminal ⑯ and terminal ⑰ of IC601.
3. Remove the 15 kΩ resistor between terminal ⑱ of IC601 and +12 V Line.

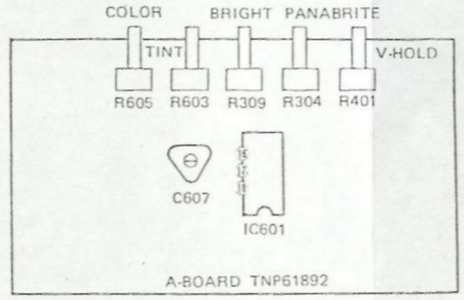


Figure 13

HORIZONTAL HOLD ALIGNMENT

Alignment Procedure

1. Use a black and white video pattern.
2. Turn Horizontal-Hold Control VR (R507) on main circuit board fully counterclockwise.
3. Short R529 with jumper wire.
4. Turn the VR (R507) slowly clockwise and set at the point where horizontal hold just pulls-in.
5. Disconnect jumper wire.

CIRCUIT EXPLANATION

HORIZONTAL OSC. DISABLE CIRCUIT

1. Under normal operating conditions, zener diode (D505) is cut OFF due to its low cathode voltage.
2. When the pulse amplitude applied to diode D504 increases, it raises the cathode voltage of zener diode D505. As a result, D505 conducts.
3. The conduction of D505 increases pin ⑤ voltage of IC401. This causes the Horizontal Oscillator Circuit to stop and the high voltage is reduced to zero.

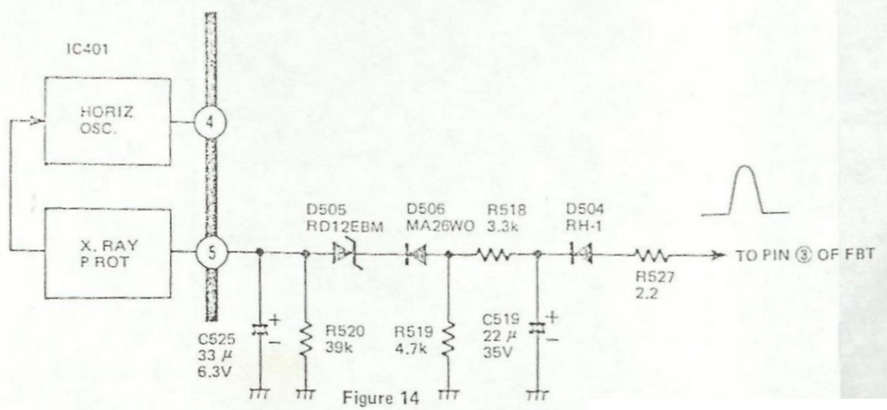
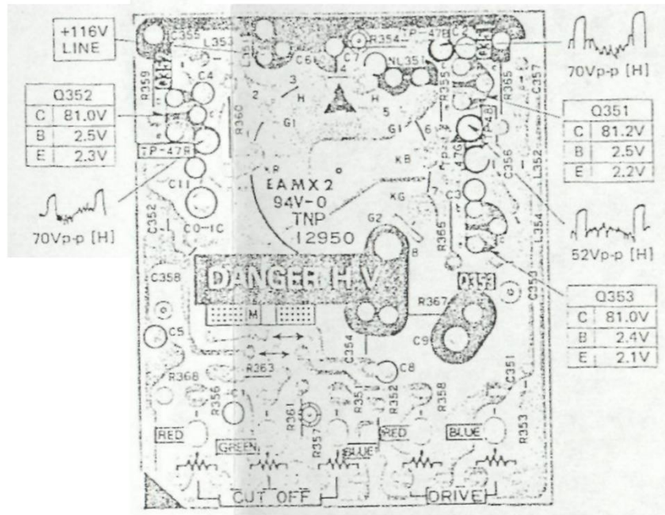


Figure 14

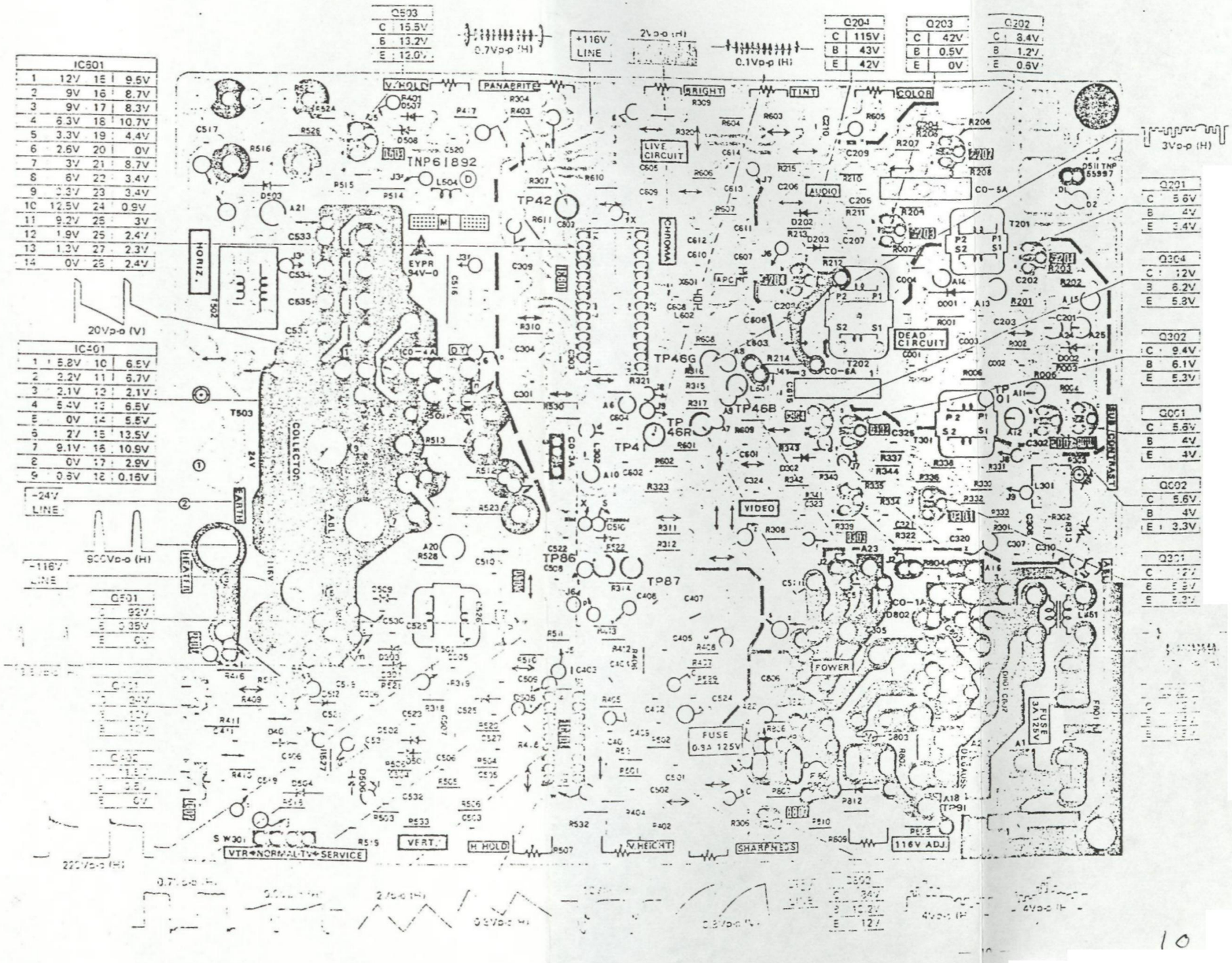
CONDUCTOR VIEWS

C-BOARD TNP12950ZA

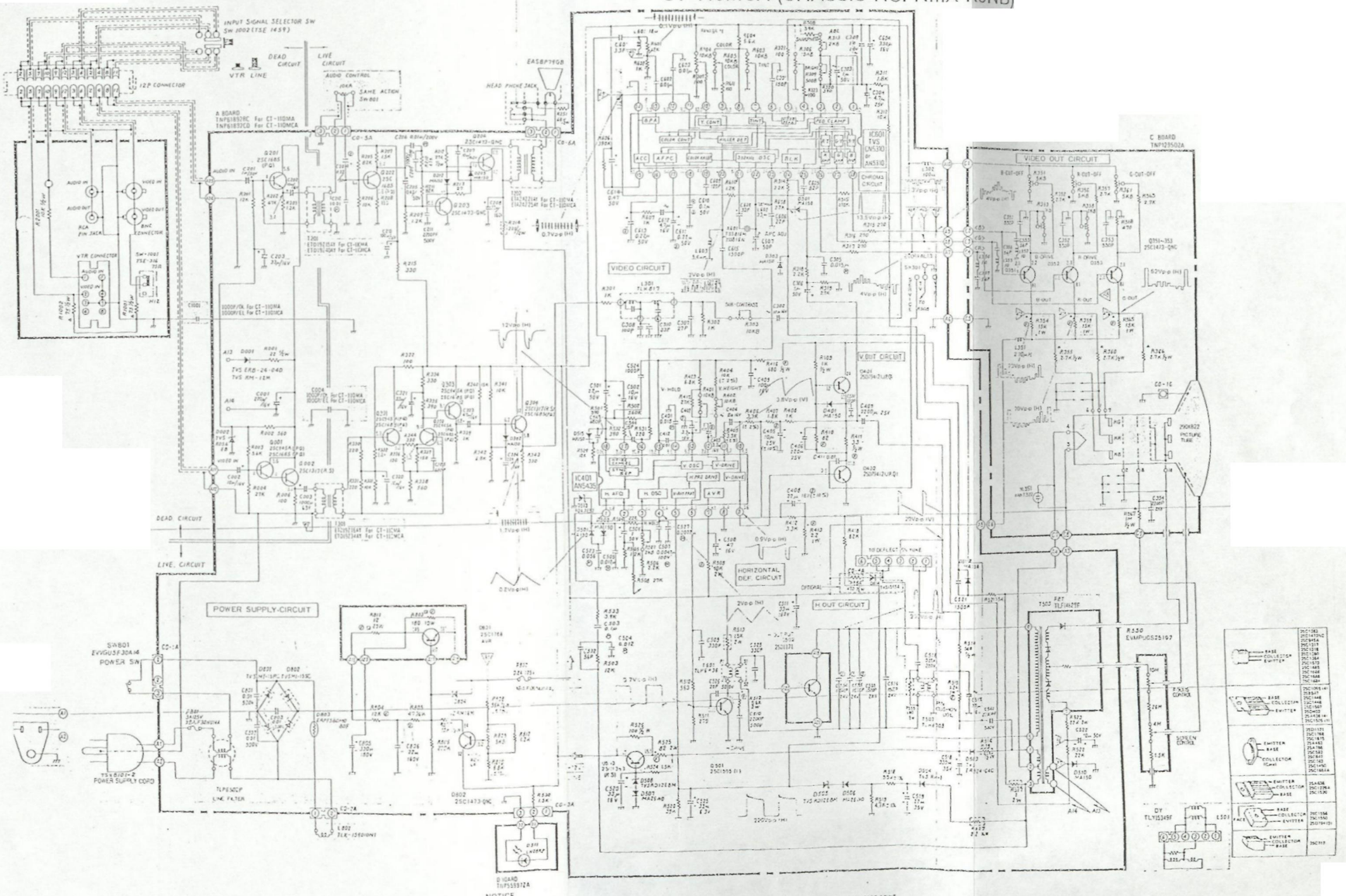


D-BOARD TNP55997ZA

A-BOARD · TNP61892BC FOR CT-110MA
TNP61892CD FOR CT-110MCA



SCHEMATIC DIAGRAM FOR MODELS CT-110MA (CHASSIS NO. NMX-K6NA) CT-110MCA (CHASSIS NO. NMX-K6NB)



NOTICE

1. RESISTOR
All resistors are carbon 1/4W resistor, unless otherwise noted the following marks.
Unit of resistance is OHM (Ω), (K = 1,000, M = 1,000,000)
Ω : Solid resistor
+ : Metal oxide resistor
Ω : Wire wound resistor
T : Non-inflammable resistor
: Thermistor
: Fuse resistor
: Cement

2. CAPACITOR
All capacitors are ceramic 50V capacitor, unless otherwise noted the following marks. Unit of capacitance is μF, unless otherwise noted.
: Polyester capacitor
: Polystyrene capacitor
: Electrolytic capacitor

4. TEST POINT
: Test point position.

5. VOLTAGE MEASUREMENT
Voltage is measured by a VTVM receiving color bar signal, when all controls are set to the maximum position.

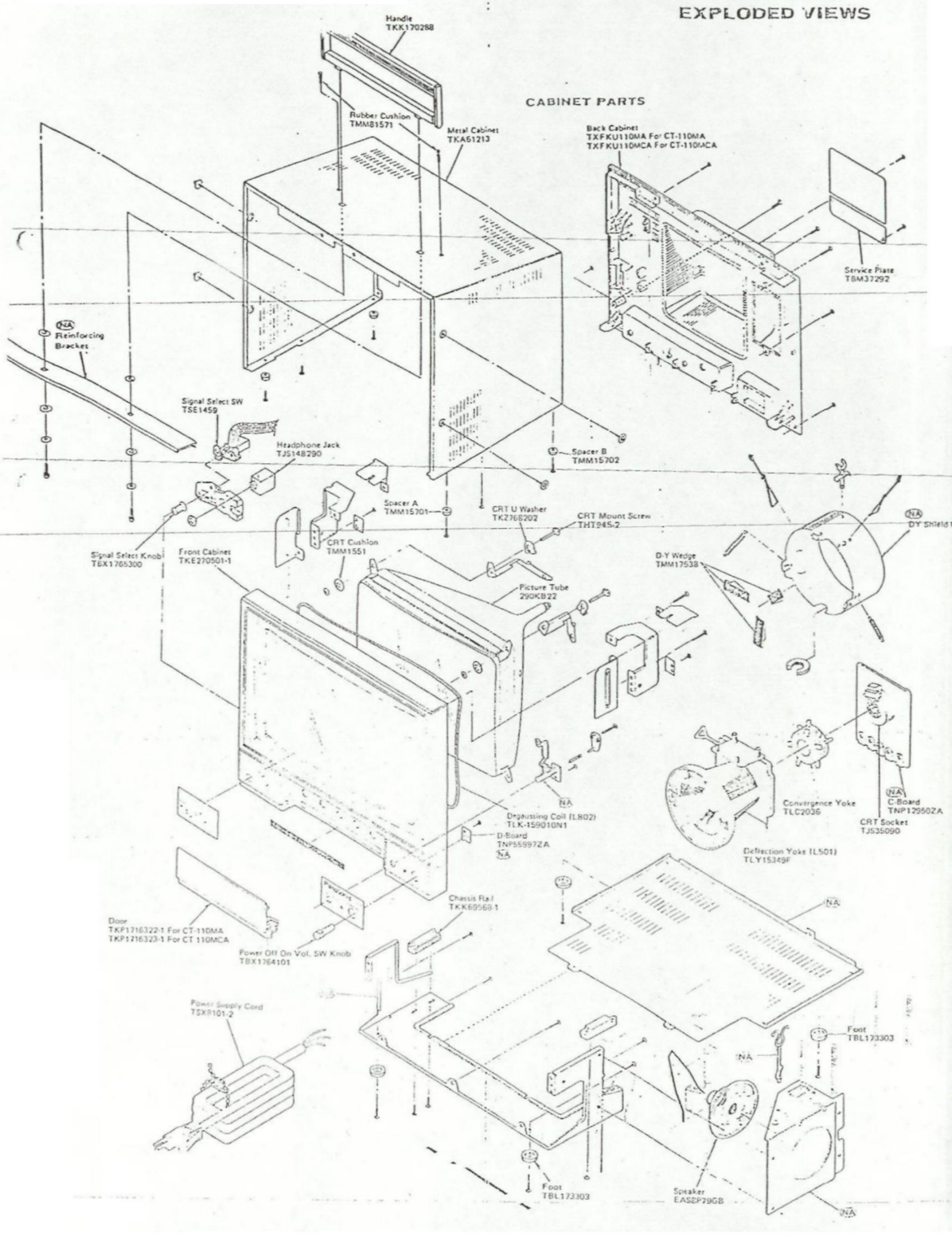
6. When wide mark (/) is found, connections easily found along with the direction of an arrow.

This schematic is the latest at the time of printing.

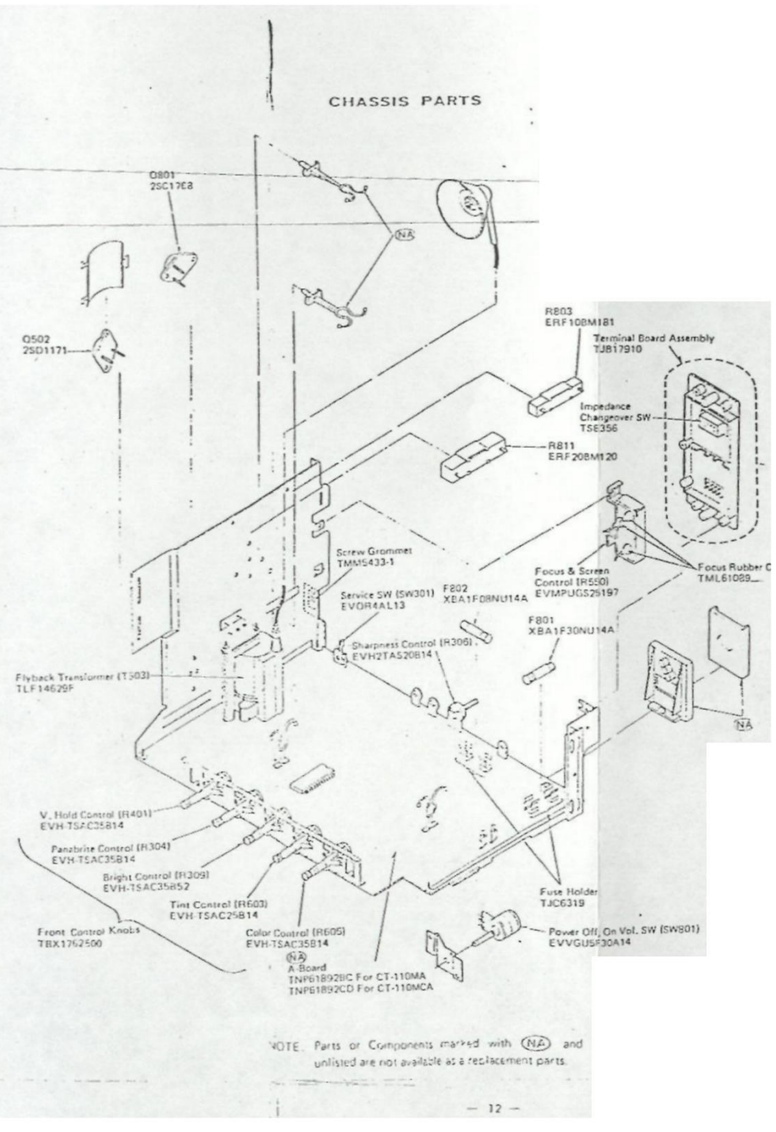
Printed in Japan

EXPLODED VIEWS

CABINET PARTS



CHASSIS PARTS



NOTE: Parts or Components marked with (NA) and unlisted are not available as a replacement parts.

REPLACEMENT PARTS LIST

Important Safety Notice

Components identified by shaded area have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

Note: TNP61892BC (A-Board), TNP61892CD (A-Board), TNP12950ZA (C-Board) and TNP55997ZA (D-Board) are not available as a complete printed circuit board.

Ref. No.	Part No.	Description
	RESISTORS	
R001	ERD50TJ220	C 22ohm J 1/2W
R002	ERD25TJ561	C 560ohm J 1/4W
R003	ERD25TJ562	C 5.6Kohm J 1/4W
R004	ERD25TJ273	C 27Kohm J 1/4W
R006	ERD25TJ101	C 100ohm J 1/4W
R201	ERD25TJ123	C 12Kohm J 1/4W
R202	ERD25TJ473	C 47Kohm J 1/4W
R203	ERD25TJ122	C 1.2Kohm J 1/4W
R205	ERD25TJ823	C 82Kohm J 1/4W
R206	ERD25TJ103	C 10Kohm J 1/4W
R207	ERD25TJ152	C 1.5Kohm J 1/4W
R208	ERD25TJ151	C 150ohm J 1/4W
R209	ERD25TJ122	C 1.2Kohm J 1/4W
R210	ERD25TJ473	C 47Kohm J 1/4W
R211	ERD25TJ823	C 82Kohm J 1/4W
R212	ERD50TJ273	C 27Kohm J 1/2W
R213	ERD25TJ270	C 27ohm J 1/4W
R214	ERQ12HJ221	F 220ohm J 1/2W
R215	ERD25TJ331	C 330ohm J 1/4W
R251	ERD50TJ680	C 68ohm J 1/2W
R301	ERD25TJ102	C 1Kohm J 1/4W
R302	ERD25TJ102	C 1Kohm J 1/4W
R303	EVLS0MA00B14	CONTROL B 10Kohm
R304	EVHTLAF25B14	CONTROL B 10Kohm
R306	EVH2TAS20B14	CONTROL B 10Kohm
R307	ERD25TJ101	C 100ohm J 1/4W
R308	ERD25TJ392	C 3.9Kohm J 1/4W
R309	EVHTLAF25B52	CONTROL B 500ohm
R311	ERD25TJ182	C 1.8Kohm J 1/4W
R312	ERD25TJ103	C 10Kohm J 1/4W
R313	EVLS0MA00B23	CONTROL B 2Kohm
R314	ERD25TJ222	C 2.2Kohm J 1/4W
R315	ERD25TJ271	C 270ohm J 1/4W
R316	ERD25TJ271	C 270ohm J 1/4W
R317	ERD25TJ271	C 270ohm J 1/4W
R318	ERD25TJ222	C 2.2Kohm J 1/4W
R319	ERD25TJ272	C 2.7Kohm J 1/4W
R320	ERD25TJ391	C 390ohm J 1/4W
R321	ERD25TJ101	C 100ohm J 1/4W
R322	ERD25TJ101	C 100ohm J 1/4W
R323	ERD25TJ101	C 100ohm J 1/4W
R330	ERD25TJ221	C 220ohm J 1/4W
R331	ERD25TJ221	C 220ohm J 1/4W
R332	ERD25TJ682	C 6.8Kohm J 1/4W
R333	ERD25TJ103	C 10Kohm J 1/4W
R334	ERD25TJ331	C 330ohm J 1/4W
R335	ERD25TJ391	C 390ohm J 1/4W
R336	ERD25TJ151	C 150ohm J 1/4W
R337	ERD25TJ151	C 150ohm J 1/4W
R338	ERD25TJ561	C 560ohm J 1/4W
R339	ERD25TJ102	C 1Kohm J 1/4W
R340	ERD25TJ153	C 15Kohm J 1/4W
R341	ERD25TJ103	C 10Kohm J 1/4W
R342	ERD25TJ682	C 6.8Kohm J 1/4W
R343	ERD25TJ331	C 330ohm J 1/4W
R344	ERD25TJ331	C 330ohm J 1/4W
R345	ERD25TJ474	C 470Kohm J 1/4W
R351	EVLS3MA00B53	CONTROL B 5Kohm
R352	ERD25TJ272	C 2.7Kohm J 1/4W
R353	EVLS3MA00B13	CONTROL B 1Kohm
R354	ERG1ANJ153H	M 15Kohm J 1W
R355	ERC12GM272	S 2.7Kohm M 1/2W
R356	EVLS3MA00B53	CONTROL B 5Kohm
R357	ERD25TJ272	C 2.7Kohm J 1/4W
R358	EVLS3MA00B13	CONTROL B 1Kohm
R359	ERG1ANJ153H	M 15Kohm J 1W
R360	ERC12GM272	S 2.7Kohm M 1/2W
R361	EVLS3MA00B53	CONTROL B 5Kohm
R363	ERD25TJ272	C 2.7Kohm J 1/4W
R365	ERG1ANJ153H	M 15Kohm J 1W
R366	ERC12GM272	S 2.7Kohm M 1/2W
R367	ERC12GM105	S 1Mohm M 1/2W
R368	ERD25TJ471	C 470ohm J 1/4W
R401	EVHTAAF25B14	CONTROL B 10Kohm
R402	EVLVON00MB14	CONTROL B 10Kohm
R403	ERD25TJ682	C 6.8Kohm J 1/4W
R404	ERO25CKF1002	C 10Kohm F 1/4W
R405	ERO25CKF3301	C 3.3Kohm F 1/4W
R406	ERO25CKF3301	C 3.3Kohm F 1/4W
R407	ERD25TJ182	C 1.8Kohm J 1/4W
R408	ERD25TJ102	C 1Kohm J 1/4W
R409	ERD50TJ102	C 1Kohm J 1/2W
R410	ERD25FJ820	C 82ohm J 1/4W
R411	ERQ12AJ3R3P	F 3.3ohm J 1/2W
R412	ERD25TJ332	C 3.3Kohm J 1/4W
R413	ERX1ANJ2R2H	M 2.2ohm J 1W
R416	ERD50TJ681	C 680ohm J 1/2W
R417	ERD25TJ273	C 27Kohm J 1/4W

Ref. No.	Part No.	Description
R418	ERD25TJ823	C 82Kohm J 1/4W
R419	ERD25TJ100	C 10ohm J 1/4W
R501	ERD25TJ391	C 390ohm J 1/4W
R502	ERD25TJ564	C 560Kohm J 1/4W
R503	ERD25TJ123	C 12Kohm J 1/4W
R504	ERD25TJ223	C 22Kohm J 1/4W
R505	ERD25TJ123	C 12Kohm J 1/4W
R506	ERD25TJ222	C 2.2Kohm J 1/4W
R507	EVLVQN00MB23	CONTROL B 2Kohm
R508	ERD25TJ273	C 27Kohm J 1/4W
R509	ERG2ANJ103H	M 10Kohm J 2W
R510	ERD25TJ561	C 560ohm J 1/4W
R511	ERD25TJ271	C 270ohm J 1/4W
R512	ERG2ANJ562H	M 5.6Kohm J 2W
R513	ERG2ANJ152	M 1.5Kohm J 2W
R514	ERD50TJ561	C 560ohm J 1/2W
R515	ERG1ANJ122H	M 1.2Kohm J 1W
R516	ERQ12HKR39	F 0.39ohm K 1/2W
R517	ERQ2CJ1R0	F 1ohm J 2W
R518	ERO25CKF3301	M 3.3Kohm F 1/4W
R519	ERO25CKF4701	M 4.7Kohm F 1/4W
R520	ERD25TJ393	C 39Kohm J 1/4W
R521	ERD25TJ152	C 1.5Kohm J 1/4W
R522	ERD25TJ223	C 22Kohm J 1/4W
R523	ERG2ANJ223	M 22Kohm J 2W
R524	ERD25TJ152	C 1.5Kohm J 1/4W
R525	ERG2ANJ820H	M 82ohm J 2W
R526	ERD50TJ101	C 100ohm J 1/2W
R527	ERQ14AJ2R2P	F 2.2ohm J 1/4W
R529	ERD25TJ123	C 12Kohm J 1/4W
R530	ERD25TJ152	C 1.5Kohm J 1/4W
R531	ERD25TJ221	C 220ohm J 1/4W
R532	ERD25TJ391	C 390ohm J 1/4W
R533	ERD25TJ392	C 3.9Kohm J 1/4W
R534	ERQ12AJ471	F 470ohm J 1/2W
R550	EVMPUGS25197	CONTROL
R601	ERD25TJ122	C 1.2Kohm J 1/4W
R602	ERD25TJ102	C 1Kohm J 1/4W
R603	EVHTAAF25B14	CONTROL B 10Kohm
R604	ERD25TJ562	C 5.6Kohm J 1/4W
R605	EVHTAAF25B14	CONTROL B 10Kohm
R606	ERD25TJ394	C 390Kohm J 1/4W
R607	ERD25TJ102	C 1Kohm J 1/4W
R608	ERD25TJ222	C 2.2Kohm J 1/4W
R610	ERD25TJ122	C 1.2Kohm J 1/4W

Ref. No.	Part No.	Description
R611	ERD25TJ101	C 100ohm J 1/4W
R803	ERF10HMJ271	W 270ohm J 10W
R804	ERD25FJ123	C 12Kohm J 1/4W
R805	ERQ14AJ470P	F 47ohm J 1/4W
R806	ERD25TJ274	C 270Kohm J 1/4W
R807	ERD50TJ153	C 15Kohm J 1/2W
R808	ERO50CKF5602	M 56Kohm F 1/2W
R809	EVLS0MA00B53	CONTROL B 5Kohm
R810	ERO25CKF6801	M 6.8Kohm F 1/4W
R811	ERF20HMJ120Y	W 12ohm J 20W
R812	ERD25TJ122	C 1.2Kohm J 1/4W
R1001	ERC12GJ750	S 75ohm J 1/2W
R1002	ERC12GJ750	S 75ohm J 1/2W
R2001	ERD50TJ103	C 10Kohm J 1/2W
		CAPACITORS
C001	ECEA1CS221	E 220uF 16V
C002	ECEA1CS100	E 10uF 16V
C003	ECEA0JS102	E 1000uF 6.3V
C004	ECKDDL102ZE	Type DL/CT-110MA
C004	ECKDEL102MD	Type EL/CT-110MCA
C201	ECEA1HS010	E 1uF 50V
C202	ECEA1CS100	E 10uF 16V
C203	ECEA1CS330	E 33uF 16V
C204	ECEA50ZR22	E 0.22uF 50V
C205	ECEA1HSR47	E 0.47uF 50V
C206	ECQM2103KZ	P 0.01uF K 200V
C207	ECEA2CS100	E 10uF 160V
C208	ECEA2CS220	E 22uF 160V
C209	ECKD2H272KB2	C 2700pF K 500V
C210	ECEA1CS101	E 100uF 16V
C211	ECKD2H222KB2	C 2200pF K 500V
C212	ECQM1H103KZ	P 0.01uF K 50V
C301	ECKF1H151KB	C 150pF K 50V
C302	ECEA1CN100S	E 10uF 16V
C303	ECEA1HN010S	E 1uF 50V
C304	ECEA1ES4R7	E 4.7uF 25V
C305	ECQM1H153KZ	P 0.015uF K 50V
C306	ECEA1HS010	E 1uF 50V
C307	ECCF1H270J	C 27pF J 50V
C308	ECKF1H101KB	C 100pF K 50V
C309	ECEA1CS100	E 10uF 16V
C310	ECCF1H330JC	C 33pF J 50V
C320	ECEA1CS100	E 10uF 16V
C321	ECEA1CS330	E 33uF 16V

Ref. No.	Part No.	Description
C323	ECSZ16EF4R7E	T 4.7uF 16V
C324	ECEA1CS221	E 220uF 16V
C325	ECKF1H681KB	C 680pF K 50V
C351	ECKF1H331KB	C 330pF K 50V
C352	ECKF1H331KB	C 330pF K 50V
C353	ECKF1H331KB	C 330pF K 50V
C354	ECKD3D222KBN	C 2200pF K 2KV
C355	ECCF1H560J	C 56pF J 50V
C356	ECCF1H560J	C 56pF J 50V
C357	ECCF1H560J	C 56pF J 50V
C401	ECQM1H183KZ	P 0.018uF K 50V
C402	ECSZ16EF3R3V	T 3.3uF 16V
C403	ECSZ16HS3R3	T 3.3uF 16V
C404	ECEA1CN101S	E 100uF 16V
C405	ECEA25Z10	E 10uF 25V
C406	ECEA1ES221	E 220uF 25V
C407	ECEA1ES222	E 2200uF 25V
C408	ECEA16Z22	E 22uF 16V
C409	ECEA1CS101	E 100uF 16V
C411	ECKF1H103ZF	C 0.01uF Z 50V
C412	ECKF1H103ZF	C 0.01uF Z 50V
C501	ECEA1HS2R2	E 2.2uF 50V
C502	ECEA1CS100	E 10uF 16V
C503	ECQM1H104MZ	P 0.1uF M 50V
C504	ECQM1H123KZ	P 0.012uF K 50V
C505	ECQM1H123KZ	P 0.012uF K 50V
C506	ECEA1HS010	E 1uF 50V
C507	ECQP1472JZ	P 4700pF J 100V
C508	ECEA1CS470	E 47uF 16V
C509	ECKF1H331KB	C 330pF K 50V
C510	ECKD2H222KB2	C 2200pF K 500V
C511	ECEA160V33Z	E 33uF 160V
C516	ECQF2H274JZ	P 0.27uF J 200V
C517	ECEA1CN330S	E 33uF 16V
C518	ECEA1VS331	E 330uF 35V
C519	ECEA1VS220	E 22uF 35V
C520	ECEA1CS330	E 33uF 16V
C521	ECKF1H152KB	C 1500pF K 50V
C522	ECEA1HS100	E 10uF 50V
C523	ECQM1H563MZ	P 0.056uF M 50V
C524	ECKF1H102KB	C 1000pF K 50V
C525	ECEA0JS330	E 33uF 6.3V
C526	ECCD2H220K	C 22pF K 500V
C527	ECQM1H222JZ	P 2200pF J 50V
C528	ECKF1H331KB	C 330pF K 50V

Ref. No.	Part No.	Description
C531	ECKF1H121KB	C 120pF K 50V
C532	ECCF1H560J	C 56pF J 50V
C533	ECKD3D152JB8	C 1500pF J 2KV
C534	ECKD3D152JB8	C 1500pF J 2KV
C535	ECKD3D152JB8	C 1500pF J 2KV
C536	ECKD3D152JB8	C 1500pF J 2KV
C541	ECKD2H222KB2	C 2200pF K 500V
C543	ECKF1H681KB	C 680pF K 50V
C544	ECCF1H150JC	C 15pF J 50V
C601	ECCF1H330J	C 33pF J 50V
C602	ECKF1H103ZF	C 0.01uF Z 50V
C603	ECQM1H103KZ	P 0.01uF K 50V
C604	ECEA1CS331	E 330uF 16V
C605	ECCF1H820J	C 82pF J 50V
C606	ECCF1H220J	C 22pF J 50V
C607	ECV1ZW50X32	Trimmer
C608	ECCF1H330JC	C 33pF J 50V
C609	ECKF1H121KB	C 120pF K 50V
C610	ECQM1H823KZ	P 0.082uF K 50V
C611	ECEA50ZR22	E 0.22uF 50V
C612	ECEA1EN4R7S	E 4.7uF 25V
C613	ECEA50ZR22	E 0.22uF 50V
C614	ECEA1HSR47	E 0.47uF 50V
C615	ECKF1H152KB	C 1500pF K 50V
C801	ECKD2H103PE7	C 0.01uF P 500V
C802	ECKD2H103PE7	C 0.01uF P 500V
C803	ECKD2H103PE7	C 0.01uF P 500V
C805	ECET2PR331SW	E 330uF 180V
C806	ECEA2CS220	E 22uF 160V
C1001	ECKDDL102ZE	Type DL/CT-110MA
C1001	ECKDEL102MD	Type EL/CT-110MCA
	COILS	
L301	TLK817	Delay Line
L302	TLT101K999G	Peaking 100uH
L351	TLT271K999G	Peaking 270uH
L352	TLQ100K205C	Peaking 10uH
L353	TLQ100K205C	Peaking 10uH
L354	TLQ100K205C	Peaking 10uH
L501	TLY15349F	Deflection Yoke
L601	TLQ180K205C	Peaking 18uH
L602	TLQ330K205C	Peaking 33uH
L603	TLT542K999G	Peaking 5.4mH
L802	TLK159010N1	Degauss Coil

Ref. No.	Part No.	Description
L851	TLP6502P	Line Filter
	TRANSFORMERS	
T201	ETD19Z15AY	Audio/CT-110MA
T201	ETD19Z40AY	Audio/CT-110MCA
T202	ETA24Z21AY	Audio/CT-110MA
T202	ETA24Z25AY	Audio/CT-110MCA
T301	ETD19Z16AY	Video/CT-110MA
T301	ETD19Z34AY	Video/CT-110MCA
T501	TLH6436	H. Drive Trans.
T502	TLH8709	Pinc. Correction
T503	TLF14629F	Flyback Trans.
	DIODES	
D001	TVSRM1ZM	Diode
D002	TVSRD5.6EB	Zener Diode 5.6V
D202	MA150	Diode
D203	MA150	Diode
D301	MA150	Diode
D302	MA150	Diode
D303	MA150	Diode
D401	MA150	Dioce
D501	MA150	Diode
D502	MA150	Diode
D503	TVSERB24-04C	Diode
D504	TVSRH1	Diode
D505	TVSRD12EBM	Zener Diode 12V
D506	MA26WC	Diode
D507	MA26WC	Diode
D508	TVSRD12EBM	Zener Diode 12V
D510	MA150	Diode
D511	LN28RP	LED
D512	MA150	Diode
D513	TVSRD4.7EB2	Zener Diode 4.7V
D514	TVS1S954	Diode
D515	MA150	Diode
D801	TVSMI15RC	Diode
D802	TVSMI15SC	Diode
D803	ERPF5B0M080F	Posistor
D804	TVSRM1ZM	Diode
	TRANSISTORS	
Q001	2SC945A-P.Q	Video Amp
Q002	2SC1317-R.S	Video Amp
Q201	2SC1685-P.Q	Audio Amp
Q202	2SC1685-P.Q	Audio Amp
Q203	2SC1473-QNC	Audio Out
Q204	2SC1473-QNC	Audio Out
Q301	2SC945A-P.Q	Video Amp
Q302	2SC945A-P.Q	Video Amp
Q303	2SC945A-P.Q	Video Amp
Q304	2SC1317-R.S	Video Amp
Q351	2SC1473-QNC	Video Out (B)
Q352	2SC1473-QNC	Video Out (R)
Q353	2SC1473-QNC	Video Out (G)
Q401	2SD794(2)	V. Out-P.Q
Q402	2SD794(2)	V. Out-P.Q
Q501	2SC1505(1)	H. Drive
Q502	2SD1171	H. Out
Q503	2SC1383-R.S	Regulator
Q801	2SC1768	Regulator
Q802	2SC1473-QNC	Error Detector
	I.C.	
IC401	AN5435	H/V Osc. V Drive
IC601	TVSCN5310	Chroma
	FILTERS	
X601	TSS816M	Crystal
	SWITCHES	
S301	EVQR4AL13	Service SW
S801	EVVGU5F30A14	Switch Volume
S1001	TSE356	Impede. Change SW
S1002	TSE1459	Signal Select SW
	OTHERS	
	290KB22	Picture Tube
	EAS8P79GB	Speaker
	TBL173303	Rubber Foot
	TBM37292	Service Plate
	TBX1762500	Front Cont. Knobs
	TBX1764101	Volume Cont. Knob
	TBX1765300	Signal Selec Knob

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
	THT945-2	CRT Mount Screw		TXFKU110MA	Back/CT-110MA
	TJB17910	Terminal Board		TXFKU110MCA	Back/CT-110MCA
	TJC6319	Fuse Holder		XANT322	Neon Lamp
	TJS148180	BNC Connector		XBA1F08NU14A	Fuse 125V 0.8A
	TJS148290	Headphone Jack		XBA1F30NU14A	Fuse 125V 3A
	TJS168110	3P Mini-Connector		XZB75X65C04	Set Cover
	TJS188010	RCA Socket			
	TJS29770	VTR 8P Connector			
	TJS35090	CRT Socket			
	TKA61213	Metal Cabinet			
	TKE270501-1	Front Cabinet			
	TKK170288	Handle			
	TKK69568-1	Chassis Rail			
	TKP1716322-1	Door/CT-110MA			
	TKP1716323-1	Door/CT-110MCA			
	TKZ768202	CRT U Washer			
	TLC2036	Convergence Yoke			
	TML61089	Focus Rubber Cap			
	TMM1551	CRT Cushion			
	TMM15701	Spacer A			
	TMM15702	Spacer B			
	TMM17538	DY Wedge			
	TMM5433-1	Screw Grommet			
	TMM81571	Rubber Cushion			
	TNP12950ZA	Circuit Board C			
	TNP55997ZA	Circuit Board D			
	TNP61892BC	A Board/CT-110MA			
	TNP61892CD	A Board/CT-110MCA			
	TPC62033	Carton/CT-110MA			
	TPC62034	Carton/CT-110MCA			
	TPD159619	Cushion Front			
	TPD191171	Cushion Top(R)			
	TPD191172	Cushion Top(L)			
	TPD192177	Cushion Bottom(R)			
	TPD192178	Cushion Bottom(L)			
	TQB611617	Fan Bag/CT-110MA			
	TQB611618	Fan Bag/CT-110MCA			
	TSX8101-2	Power Supply Cord			
	TXAJT01112V	3P Coupl Kit-C05A			
	TXAJT02110M	12P Socket Kit			
	TXAJT02F5	3P Coupl Kit-C01A			
	TXAJT03110M	12P Plug Kit			
	TXAJT03112V	3P Coupl Kit-C03A			
	TXAJT04110M	3P Coupl Kit-C06A			
	TXFJT01110V	1P Tip Kit-C01C			

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Service Manual

Supplement

Color Monitor
Color Display

CT-110MA, CT-1010M, CT-1020M
PHA4100A, CT-160, DT-D1000G
BT-S700N, BT-S701N, BT-S702N
FT-H900T

Please use this supplement manual together with original service manual for each model mentioned below:

Substitution of Transistors

Following transistors used for each model may be substituted by new types.

Original	Substitute	Used in Models
2SC1383 V_{CBO} = 30V V_{CEO} = 25V	2SC1384 V_{CBO} = 60V V_{CEO} = 50V	CT-110MA, PHA4100A, CT-160, CT-1020M, BT-S700N
2SB641 $-V_{CBO}$ = 30V $-V_{CEO}$ = 25V	2SB642 $-V_{CBO}$ = 60V $-V_{CEO}$ = 50V	CT-160, DT-D1000G, BT-S700N, BT-S701N, BT-S702N
2SD638 V_{CBO} = 30V V_{CEO} = 25V	2SD639 V_{CBO} = 60V V_{CEO} = 50V	CT-1010M, BT-S700N, BT-S701N, BT-S702N
2SD636 V_{CBO} = 30V V_{CEO} = 25V	2SD637 V_{CBO} = 60V V_{CEO} = 50V	CT-1010M, CT-160, DT-D1000G, BT-S700N, BT-S701N BT-S702N, FT-H900T

Note: Differences between original and substitute transistors are only V_{CBO} and V_{CEO} (breakdowns voltage). Substitute transistors have higher V_{CBO} and V_{CEO} than original ones. Thus there is no problem.

Important: Reverse substitution cannot be done. I.E. if 2SC1384 is used in an original application, do not try to substitute with 2SC1383.

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