Personal System/2 Color Display 8512 Repair Center Maintenance Information

MP 356

Second Edition (June 1990)

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Preface

This manual supports the repair of the IBM 8512 Color Display (all models) in designated service repair centers by appropriately qualified personnel.

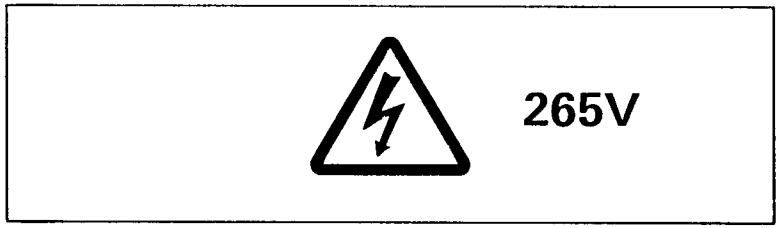
The manual contains maintenance information for the 8512 Color Graphics Monitors, Models 001, 002, 003, and 102. Check for applicability of the relevant sections of this manual as follows. The front sections are to be used for the repair of monitors with serial numbers starting with '23' or '55' (version 1), and the rear sections for the repair of monitors with serial numbers starting with '72' (version 2). Appendix A refers to the replacement of special parts unique to the IBM 8512 Model 102 (VLMF) monitor.

IBM reserve the right to change, modify, or discontinue the equipment without notice.

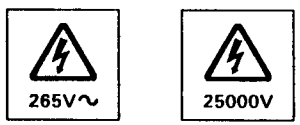
Safety Notices

The color display has the following safety labels attached.

This label is located on the underside of the rear cover, and means that only trained personnel should remove the cover and attempt repair of the display:



These labels are located inside the display, attached to the metal shield on the back of the CRT base card:



CAUTION: Heatsinks present risk of electrical shock. Test before touching.
ATTENTION: Les dissipateurs thermiques présentent un risque de décharge électrique. Vérifier l'absence de tension électrique avant de les toucher.

(Model 001 only) These labels are located inside the display, attached to the metal shield on the back of the CRT base card:

WARNING: This product includes critical mechanical and electrical parts which are essential for x-radiation safety. For continued safety replace critical components indicated in the service manual only with exact replacement parts given in the parts list. Operating high voltage for this product is 25 kV at minimum brightness. Refer to service manual for measurement procedures and proper service adjustments.

Safety

The 8512 Color Display, in common with all color displays, contain hazardous voltages and energies. Exercise the utmost care and attention when servicing a displat with power applied. It is *not* safe to touch any components, including heatsinks.

To avoid electrical shock, switch power off and disconnect the power plug before exchanging any field replaceable unit(s) (FRUs).

The power attachment cable plug (when supplied) is approved for use with this work station and meets the relevant testing laboratory, country, or test-house standards. For your safety, the plug must be connected to a correctly wired and grounded socket. An incorrectly wired socket can place a hazardous voltage on the accessible metal parts of the work station.

Cathode Ray Tubes (CRTs)

Cathode ray tubes present a hazard from flying glass as a result of implosion. To minimize this risk, the following guidelines should be followed.

1. Storage:

   a. Cathode ray tubes should be fully enclosed when received, transported, or otherwise moved from area to area.

      If they are shipped out in a carton, they should ideally be in the original carton or one of equivalent strength, and securely sealed to prevent accidental opening. In addition, the original, or equivalent, packing materials or forms, or both, should be placed inside the carton to give the tube proper support and protection.

   b. Follow the directions on the manufacturer's carton when CRTs are to be stacked. When in doubt, stack with the faceplate (viewing surface) down. They are not to be stacked more than two cartons high.

   c. CRT storage areas should be kept away from the normal flow of material handling equipment and pedestrian traffic. In addition, storage areas should be dry to ensure that the cartons do not absorb moisture and collapse.

2. **Ma**intenance and Installation:

   a. No one should install, adjust, maintain, replace, or handle high-vacuum tubes (such as a CRT), without first having reviewed these guidelines or received otherwise appropriate instructions or training.

   b. Ensure that all nonessential personnel vacate the immediate area whenever a CRT is being exchanged.

   c. When handling CRTs, the suggested safety equipment should be worn at all times. The suggested safety equipment is:

      1) Safety glasses
      2) Long-sleeved garment.

   d. High-vacuum tubes should not be permitted to remain out of their special cartons unless they are under test or inspection.

   e. Do not scratch or bump any part of the tube as this may weaken the glass and possibly cause it to implode.

   f. Before removing a high-vacuum tube, discharge all stored potential that may exist on the tube's anode button, base socket pins, and the capacitor in the high-voltage supply.

   CAUTION:
   A second capacitive charge can build up after the original discharge. It is therefore important to discharge each tube a second time immediately before removal.

   g. Do not handle CRTs by the neck alone. The neck is the weakest part of the tube and is easily broken. Always handle tubes with two hands.

   h. When inserting or removing tubes from equipment, they should be supported at the large end while carefully guiding the neck in or out of position.

   i. Do not place the tube on a table or bench where there is any possibility of the tube rolling. If it is necessary to place a tube anywhere except in its special carton, a piece of felt or other soft material should be placed under it to prevent scratching the glass.

3. **Dis**arming Cathode Ray Tubes

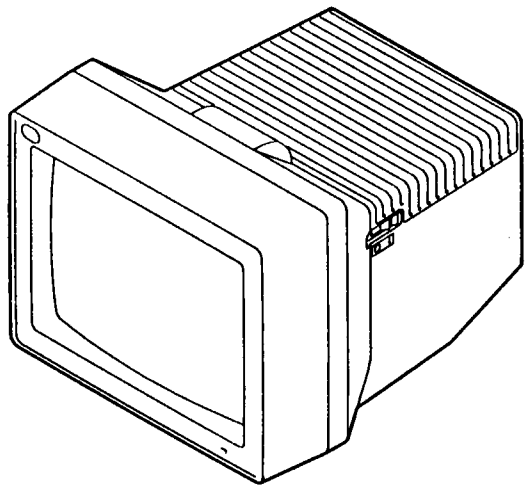
   It is not recommended to disarm cathode ray tubes.

4. Disposal of Cathode Ray Tubes

   Disposal should be in accordance with country, corporate, or local branch practices.

Contents

8512 Color Display



Safety Precautions

Warning

Refer to "Safety Notices" on page vi before removing any cables, or covers, or attempting any repair to the display.

Important Safety Notice

Components identified by the symbol ⚠ have special characteristics important for safety. When replacing any of these components, use only parts specified by the manufacturer.

Description

The IBM* Personal System/2* Color Display 8512 is a non-interlaced, infinite color, direct drive, analog display with externally selected vertical modes. The display has a power switch, power-on indicator, and controls for brightness and contrast. An optional tilt and swivel stand is available.

Models:

- Model 001: Low Voltage
- Model 002: High Voltage, Northern Hemisphere
- Model 003: High Voltage, Southern Hemisphere
- Model 102: High Voltage, Very Low Magnetic Field, Northern Hemisphere

Characteristics:

- Vertical addressability of 350, 400, or 480 lines (determined by polarity of vertical and horizontal sync signals)
- Self-test with a white screen test pattern
- 75-ohm direct-drive analog video input, 0.0 V dc – 0.7 V dc
- 356 mm (14-inch) cathode ray tube
- 0.41 mm stripe pitch (nominal)
- Etched, anti-glare dark face-plate
- Type P-22 phosphor
- Horizontal deflection rate of 31.5 kHz ± 0.5 kHz
- Horizontal blanking time of 5.7 µs
- Vertical deflection rate of 60 – 70 Hz, (50 – 70 Hz for 480 scan-line mode)
- Vertical blanking time of 0.88 ms
- Automatic degaussing
- 1.8 m (6 ft) signal cable with miniature 15-pin D-shell connector
- 1.8 m (6 ft) detachable power cable.

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Technical Information

Mains Voltage	90 – 137 V ac	Low voltage (Model 001)
	180 – 264 V ac	High voltage (Models 002, 003, 102)
Input Current	1 amp	Low voltage (Model 001)
	0.5 amp	High voltage (Models 002, 003, 102)
Data Area Dimensions	240x180 mm	All modes
Linearity	≤ ± 10%	
Horizontal Resolution	720 pels max	
White Color Coordinates	x = 0.313	y = 0.329

Specifications

Size:
- Width ..... 355 mm (13.97 in)
- Depth ..... 394 mm (15.51 in)
- Height (With Stand) ..... 370 mm (14.57 in)
- Height (Without Stand) ..... 304 mm (11.97 in)

Weight:
- With Stand ..... 15 kg (33 lb)
- Without Stand ..... 13.5 kg (30 lb)

Power Cable:
- Length ..... 1.8 m (6 ft)

Signal Cable:
- Length ..... 1.8 m (6 ft)

Operational:
- Temperature ..... 15°C to 32.2°C (60°F to 90°F)
- Humidity ..... 8% to 80%
- Altitude ..... 0 to 2134 m (7000 ft)
- Heat Output ..... 273 BTU/hr

Vertical Modes

The display continually checks the polarity of the synchronizing pulses from the display driver, and then selects the number of scan lines as follows:

Polarity HSync	Polarity VSync	Data Scan Lines	Data and Border Scan Lines
+	-	350	362
-	+	400	414
-	-	480	496

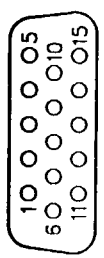
Signals

The display receives the video signals from a current source with a 150-ohm termination. The signal input impedance is 75 ohms. The video signal has a range of 0.0 – 0.7 V dc. The vertical synchronizing pulse width is 63.556 µs. The horizontal synchronizing pulse width is 3.813 µs. The self-test signal enables the full raster test.

The self-test pattern is available when the signal control cable **is disconnected** from the signal output socket of the system unit. The self-test pattern consists of a full white raster (extending beyond the display bezel at the top and bottom, and with a vertical black bar on the left-hand or right-hand edges, or both).

Signal connector

The pin numbers and signal assignments for the display signal connector are as follows:



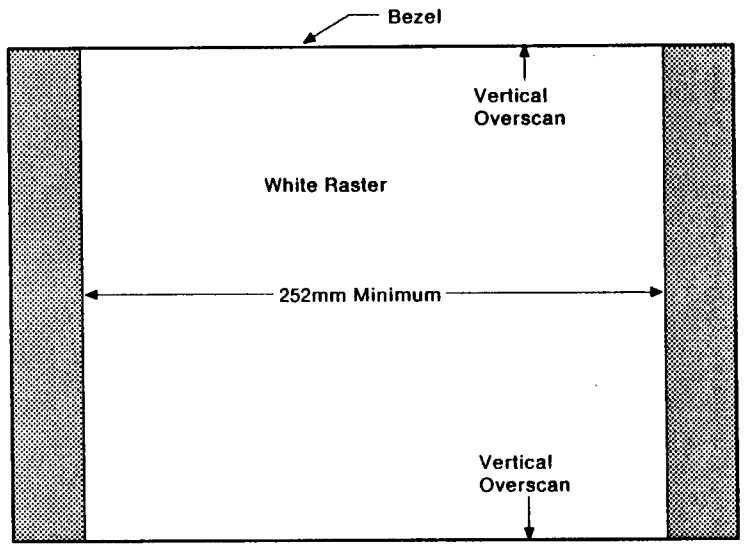
Display Side

Pin	Signal Name	Pin	Signal Name
1	Video Red	9	Reserved
2	Video Green	10	Ground
3	Video Blue	11	Monitor Sense (Ground)
4	Reserved	12	Monitor Sense (Open)
5	Self Test	13	Horizontal Sync.
6	Video Red Return	14	Vertical Sync.
7	Video Green Return	15	Reserved
8	Video Blue Return		

8512 Color Display – Version 1

Diagnostic Guide

The following procedures can be used with the display disconnected from the system unit, when the following test raster is displayed:



Note: White central raster with black bar(s) on right or left edge, or both.

Problem/Symptom	Failure Check/FRU Replacement
All problems.	Before replacing any FRUs, check all connections and associated items for continuity.
Raster missing and green LED not lit.	Replace special card assembly.
Raster missing, but green LED flashes during attempt to power on.	Replace special card assembly.

Problem/Symptom	Failure Check/FRU Replacement
Raster missing, but green LED lit.	Check if CRT heater is glowing: • **No** – install a replacement special card assembly, but if fault persists install a replacement CRT. • **Yes** – turn G2 potentiometer clockwise. If a raster appears, readjust the video gain, and cutoff potentiometer if possible, otherwise install a replacement special card assembly. If no raster appears, install a replacement CRT.
Raster visible but one or two colors missing.	Turn cutoff or gain controls, for the missing color(s), clockwise. If the color(s) reappear, then try to readjust the video gain and cutoff potentiometer if possible, otherwise install a replacement special card assembly. If the colors do not appear, then install a replacement CRT.
Raster visible but is too narrow, or does not fill the bezel vertically.	Install a replacement special card assembly.

If the raster is the correct size and color, additional checks must be carried out with the display attached to the test system, and with a crosshatch pattern displayed.

Problem/Symptom	Failure Check/FRU Replacement
No E-W pin cushion correction.	Turn RV 201 to check whether readjustment is possible, otherwise install a replacement special card assembly.
Data not centered horizontally.	Turn RV 200 to check whether readjustment is possible, otherwise install a replacement special card assembly. If the fault persists, install a replacement CRT.
Data will not sync horizontally.	Install a replacement interface cable. If the fault persists, install a replacement special card assembly.
Data has insufficient width.	Turn RV 202 to check whether readjustment is possible, otherwise install a replacement special card assembly.
Data will not sync vertically.	Install a replacement interface cable. If the fault persists, install a replacement special card assembly.
Data has insufficient height.	Turn RV 300 to check whether readjustment is possible, otherwise install a replacement special card assembly.
Data not centered vertically.	Turn RV 301 to check whether readjustment is possible, otherwise install a replacement special card assembly. If the fault persists, install a replacement CRT.
Vertical linearity poor.	Turn RV 302 to check whether readjustment is possible, otherwise install a replacement special card assembly.
Horizontal linearity poor.	Install a replacement special card assembly.
Color(s) missing.	Install a replacement interface cable. If the fault persists, install a replacement special card assembly. If the fault still persists, install a replacement CRT.
Maximum white point poor.	Make sure the brightness control is in the center detent position. Readjust RV 700, RV 701, and RV 702, to determine whether the correct white color can be obtained, otherwise install a replacement special card assembly.
Minimum white point poor.	Make sure the brightness control is in the center detent position. Readjust RV 800, RV 801, and RV 802, to determine whether the correct white color can be obtained, otherwise install a replacement special card assembly.
Convergence poor.	Install a replacement CRT.
Focus poor.	Turn the focus potentiometer to determine if readjustment is possible, otherwise install a replacement special card assembly. If the fault persists, install a replacement CRT.

If readjustment is required; see "Alignment Procedure" on page 9 for details.

Note: To meet required safety standards, repair of the special card assembly is *not* recommended.

The following components have been identified as critical to the Department of Health and Human Services (DHHS). Repair or replacement must not be attempted except by complete exchange of an IBM supplied FRU.

Deflection yoke

T201

C216

C223

C224

L200

L201

CR206

CR215

CR500

CR501

RV 100

R215

R216

Q500.

Alignment Procedure

Warning

Refer to "Safety Notices" on page vi before removing any cables, or covers, or attempting any repair to the display.

1. You need the following for these alignment procedures:
   - IBM Personal System/2 system unit with the Video Graphics Adapter (VGA) facility installed.
   - IBM Model 8503/8512/8513 Alignment Diskette, IBM part number 07F6788, shipped with this manual.
   - Alignment mask (a drawing showing details for the mask [IBM Part 8553351] is included at the back of this manual). You can either use this, or purchase the mask by quoting the part number.
   - Minolta** TV-Color Analyzer.

     Note: Each repair center should instigate a procedure to ensure that the Minolta TV Color Analyzer, used for setup, has been calibrated for the particular type of CRT being measured.
2. Ensure that the system unit is connected to the display.
3. Power-on the system unit and the display.
4. Allow 20 minutes warm-up time for the display before checking or adjusting any electrical specification or use.

   Note: Degaussing is always required when checking purity or convergence.
5. Set the brightness control (RV 600) to maximum.
6. Set the contrast control (RV 500) to maximum.
7. Turn the green, red, and blue cutoff potentiometers (RV 800, RV 801, and RV 802) on the video card fully clockwise.
8. Press the **F10** function key (on the PS/2 keyboard) to select a blank screen pattern on the display (0 V Video).

** Minolta is a trademark of the Minolta Corporation. For a complete list of trademarks, see page iii.

9. Turn the G2 potentiometer on the EHT transformer slowly clockwise until the first color appears. Turn the first associated cutoff potentiometer fully counterclockwise.
10. Continue turning the G2 potentiometer clockwise until the second color appears. Turn the second associated cutoff potentiometer fully counterclockwise.
11. Continue turning the G2 potentiometer clockwise until the third color appears.
12. Readjust the first and second cutoff potentiometers and G2 to obtain the following white luminance and chromaticity.

cd/m²	x	y	(CIE COORDS)
8+/-2.5	0.272+/-0.015	0.303+/-0.018	

Notes:

a. Turning the red cutoff potentiometer clockwise predominantly increases x.

b. Turning the green cutoff potentiometer clockwise predominantly increases y.

c. Turning the blue cutoff potentiometer clockwise predominantly decreases both x and y.

13. Set the brightness control to center detent. Turn the green, red, and blue gain potentiometers (RV 700, RV 701, and RV 702) to mid-position.
14. Press the **ALT** and **F1** keys (then release both keys) to select a linearity pattern (640x480 mode 0.7 V white crosshatch pattern). Adjust vertical linearity (RV 302) and vertical centering (RV 301) until the displayed horizontal lines are evenly spaced.
15. Press the **SHIFT** and **F5** keys (then release both keys) to select a geometry setting pattern (640x480 mode 0.7 V) and set the contrast control to a reasonable brightness of approximately 70 cd/m^2.
16. Adjust width (RV 202), height (RV 300), EWPCC (RV 201), horizontal centering (RV 200) and vertical centering (RV 301) until an image of the correct shape, size, and position is obtained in accordance with alignment mask IBM Part 8553351.
17. Set the contrast control (RV 500) to maximum.
18. Ensure the brightness control (RV 600) is at center detent.
19. Press the **F1** key then **F4** to select a white small square pattern (640x350 mode 0.7 V white) and by using the green, red, and blue gain potentiometers (RV 700, RV 701, and RV 702) only, set the center screen luminance and chromaticity with a Minolta TV-Color Analyzer to:

cd/m²	x	y	(CIE COORDS)
140+15/-0	0.313+/-0.010	0.329+/-0.010	

Notes:

a. Turning the red gain potentiometer clockwise predominantly increases x.

b. Turning the green gain potentiometer clockwise predominantly increases y.

c. Turning the blue gain potentiometer clockwise predominantly decreases both x and y.

Clockwise rotation of all gain potentiometers increases y (brightness).

20. Press the **CTRL** and **F4** keys (release both keys) then press **SHIFT** and **H** keys (then release both keys) to select a focus pattern (in this case, a display of "H"s) and adjust for the best focus.
21. Press the **SHIFT** and **F5** keys (then release both keys) to select a geometry pattern again (640x480 mode 0.7 V white crosshatch pattern) and set the center screen brightness to 70 cd/m^2 using the contrast control. Check the dimensions and adjust if necessary.

Parts Catalog

Part Number	Description
	For displays with a serial number beginning with 23 or 55 only. (*For displays with a serial number beginning with 72, refer to the 8512 Version 2, section of this manual.)*
75X8932	ITC Northern Hemisphere (CRT/Yoke assembly) with safety labels and degaussing coil / DAG strap assembly. (Models 001 and 002.)
75X8933	Special card assembly (Analog/CRT base cards) including brightness and contrast controls, power switch assembly with all safety labels. (Model 001.)
75X8934	Special card assembly (Analog/CRT base cards) including brightness and contrast controls, power switch assembly with all safety labels. (Model 002.)
75X8935	Front and rear cover set with all labels affixed.
75X9131	Control bridge.
75X9132	Signal cable.
75X8931	Feet (quantity 4).
68X3071	Power cable (Model 001).
61X8925	Tilt/swivel stand (optional).
72X7976	Packaging set with box and front/rear cushion.
61X8924	14-inch color display (Model 001) with packaging set.
61X8928	14-inch color display (Model 002) with packaging set.

Mechanical Assembly

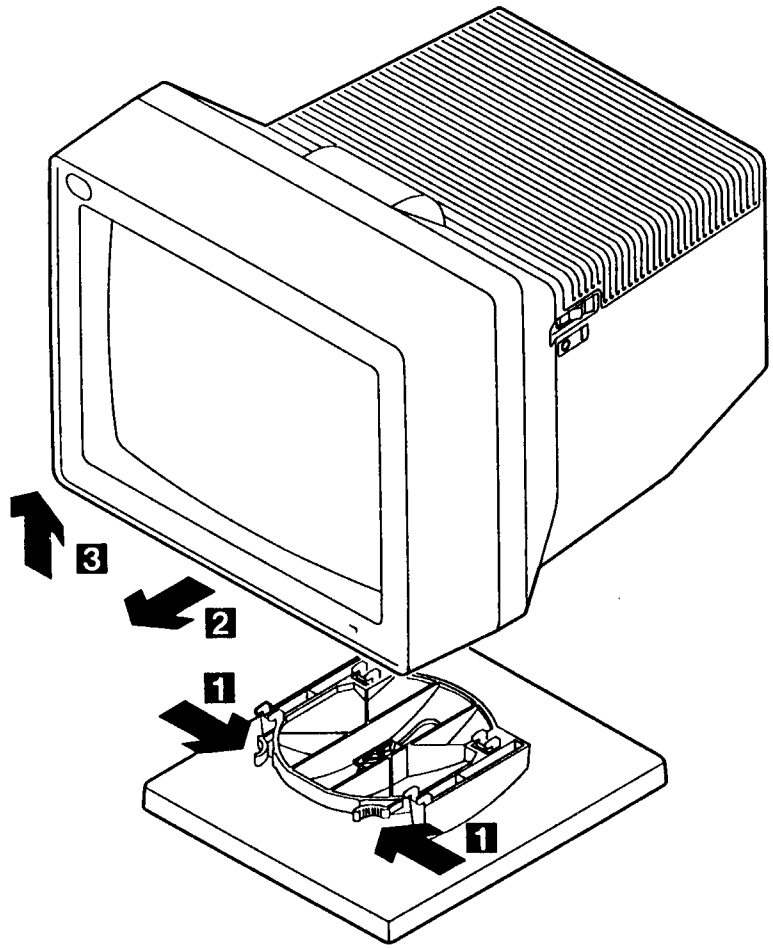


Figure 1. Removal of optional tilt/swivel table

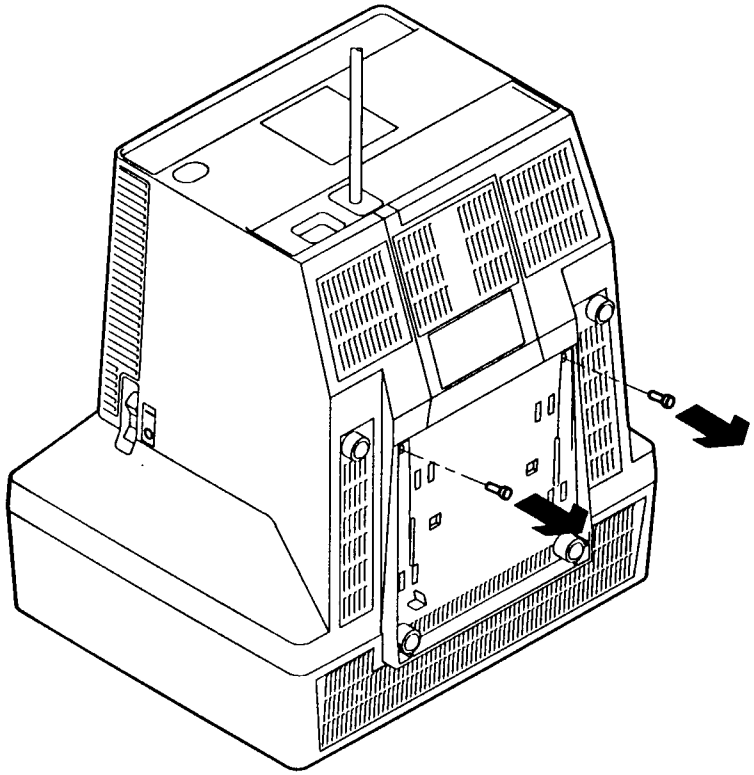


Figure 2 (Part 1 of 2). Removal of rear cover

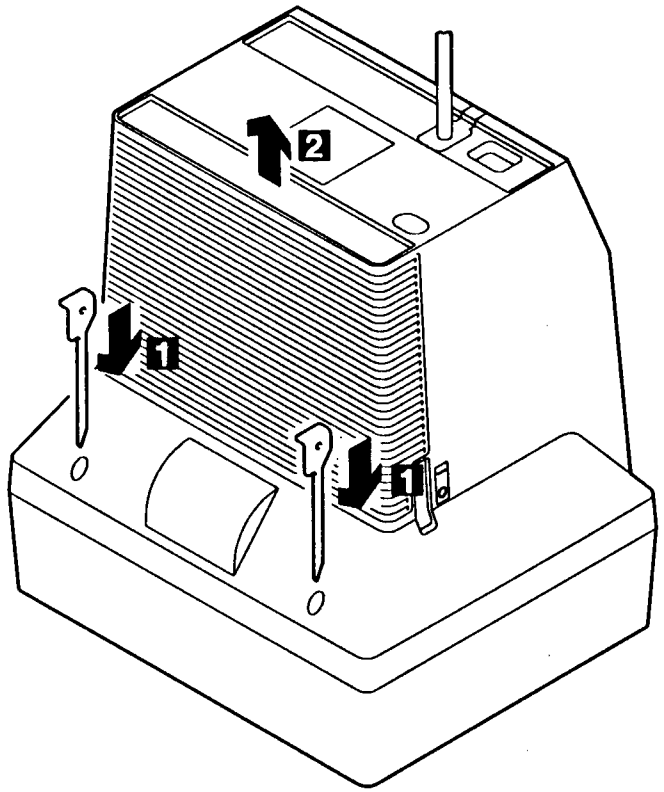


Figure 2 (Part 2 of 2). Removal of rear cover

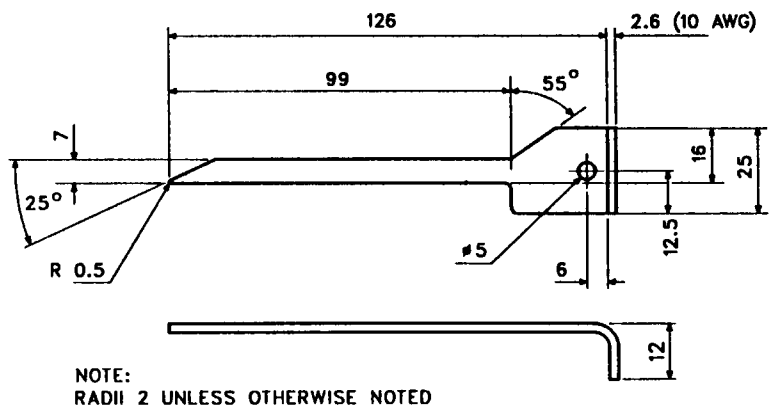


Figure 3. Removal tool

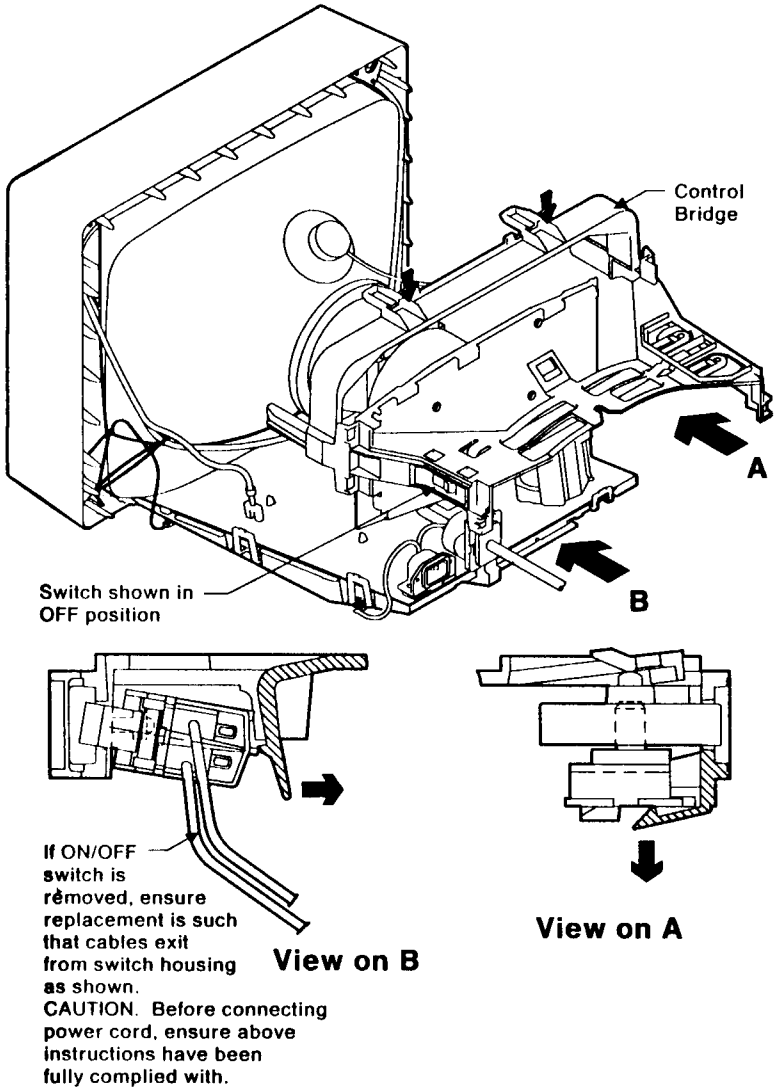


Figure 4 (Part 1 of 4). Removal of FRUs

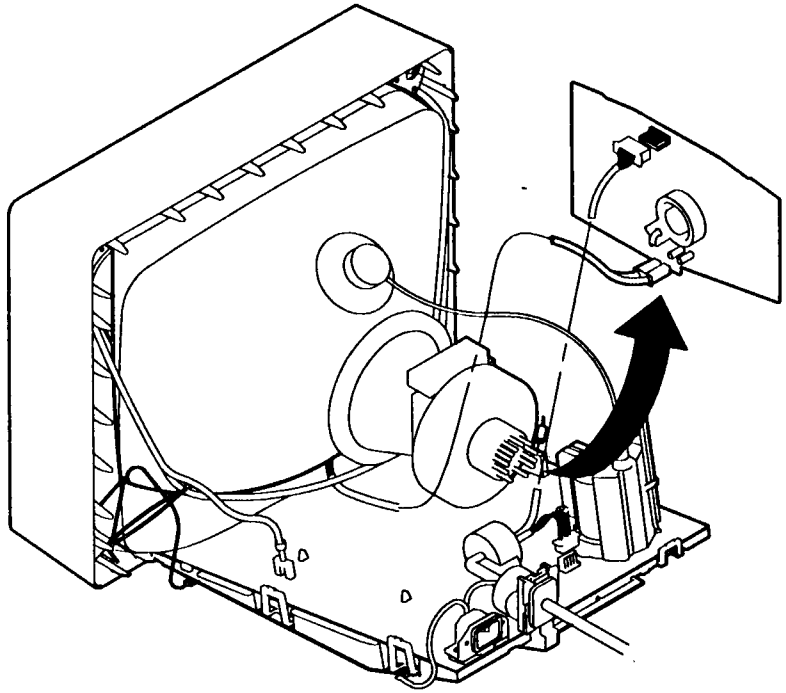


Figure 4 (Part 2 of 4). Removal of FRUs

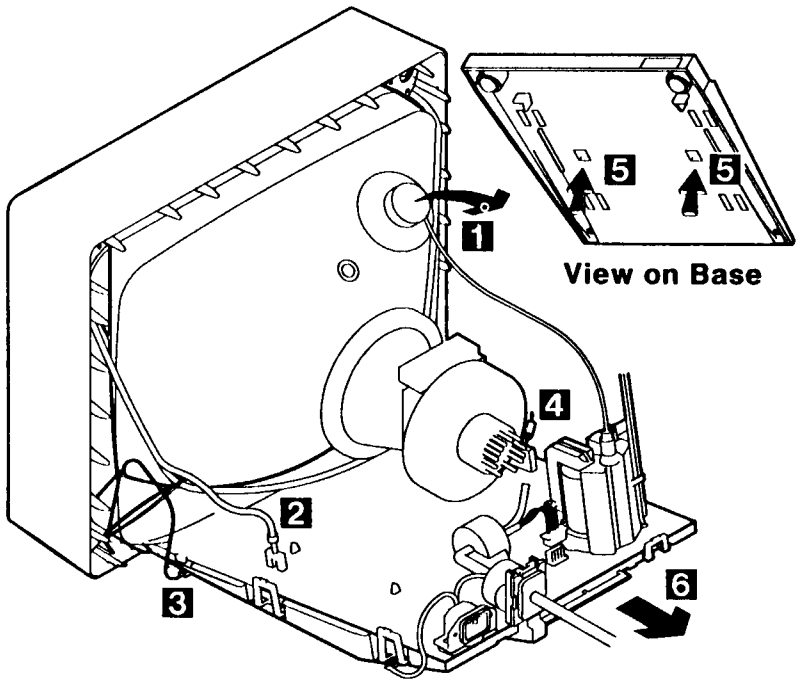


Figure 4 (Part 3 of 4). Removal of FRUs

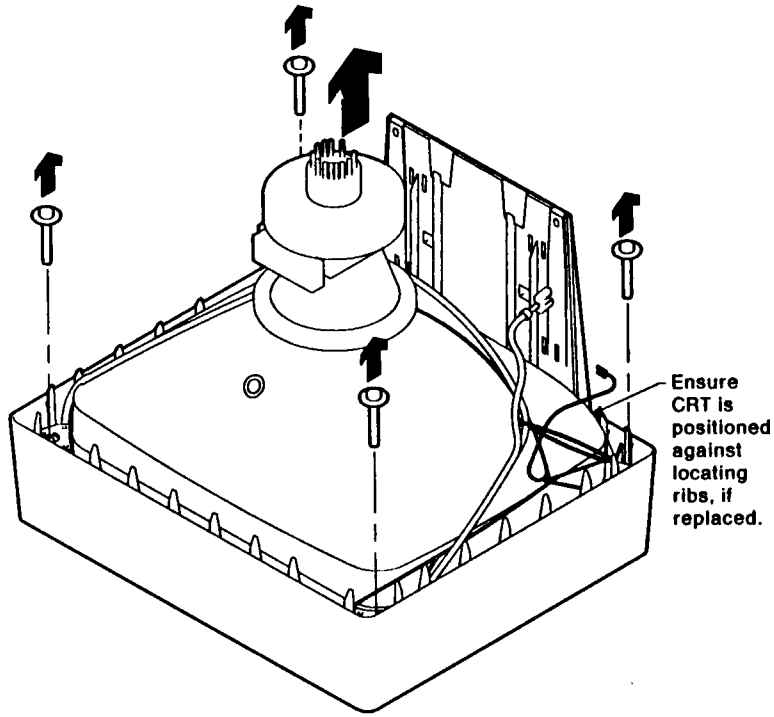


Figure 4 (Part 4 of 4). Removal of FRUs

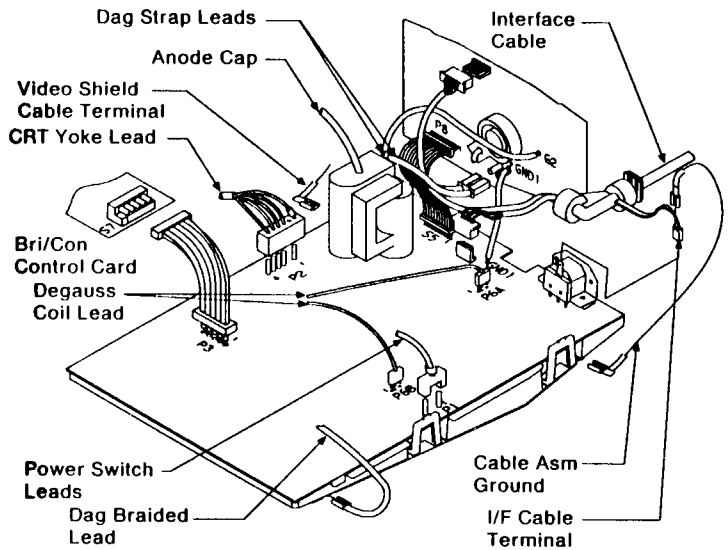


Figure 5. Cable Plugging

8512 Color Display – Version 2

Diagnostic Guide

Precautions for Adjustment and Repair

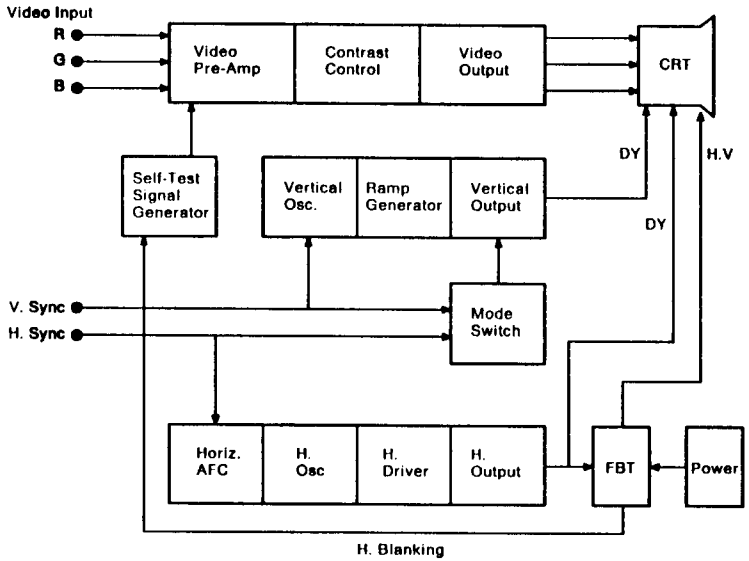
- Degaussing is always required when adjusting purity or convergence.
- Adjustment procedures given in this manual use the Minolta TV-Color Analyzer.
- Allow 20 minutes warm-up time for the display before checking or adjusting any electrical specification or function.
- Reform the signal cable after any repair work.

Caution for Servicing

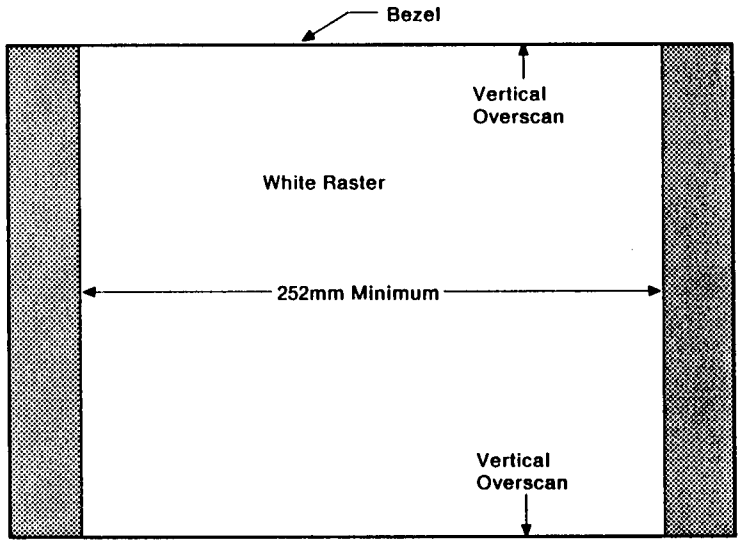
Care must be taken when servicing or replacing the CRT, high voltage sometimes remains on the anode of the CRT.

To prevent shock completely discharge high voltages before servicing or replacing the CRT. Discharge to the external conductive coating (aquadag) of the CRT.

Block Diagram



The following procedure may be used with the display disconnected from the system unit, when a test raster (shown below) is displayed.



Note: White central raster with black bar(s) on right or left edge, or both.

Problem/Symptom	Failure Check/FRU Replacement
All problems.	Before replacing any FRUs, check all connections and associated items for continuity.
Raster missing and green LED not lit.	Exchange the power supply. If problem persists exchange the main PC board.
Raster missing, but green LED flashes during attempt to power on.	Exchange the main PC board. If problem persists exchange the video amplifier assembly.
Raster missing, but green LED lit.	Check if CRT heater is glowing: • **NO** – Exchange the main PC board assembly. If problem persists exchange the CRT. • **YES** – Turn G2 potentiometer clockwise. If a raster appears readjust the video gain, and the cutoff potentiometer. Otherwise exchange the video amplifier assembly. If no raster appears, exchange the CRT.
Raster visible but one or two colors missing.	Turn cutoff or gain controls, for the missing color(s), clockwise. If the color(s) reappear, then try to readjust the video gain and cutoff potentiometer if possible, otherwise install a new video amplifier assembly. If the colors do not appear, then exchange the CRT.
Raster visible but is too narrow, or does not fill the bezel vertically.	Install a new main PC board assembly.

If the raster is the correct size and color, additional checks should be carried out when the display is attached to the test system, and with a crosshatch pattern displayed (press **F3** then press the **ALT** and **F3** keys, release both keys).

Problem/Symptom	Failure Check/FRU Replacement
No E-W pin cushion correction.	Turn R551 to check whether readjustment is possible, otherwise install a new main PC board.
Data not centered horizontally.	Turn R546 to check whether readjustment is possible, otherwise exchange the main PC board.
Data will not sync horizontally.	Check the signal cable for bent or broken pins. If any pins are broken exchange the interface cable. Turn R508 to check whether readjustment is possible, otherwise exchange the main PC board.
Data has insufficient width.	Turn L504 with a non-metallic tool to check if readjustment is possible. Otherwise exchange the main PC board assembly.
Data will not sync vertically.	Check the signal cable for bent or broken pins. If any pins are broken exchange the interface cable. Turn R407 to check whether readjustment is possible, otherwise exchange the main PC board.
Data has insufficient height.	Turn R415 to check whether readjustment is possible, otherwise exchange the main PC board.
Data not centered vertically.	Turn R462 to check whether readjustment is possible, otherwise exchange the main PC board.
Vertical linearity poor.	Turn R417 to check whether readjustment is possible, otherwise exchange the main PC board.
Horizontal linearity poor.	Turn L505 with a non-metallic tool to check if readjustment is possible. Otherwise exchange the main PC board assembly.
Color(s) missing.	Check the signal cable for bent or broken pins. If any pins are broken, exchange the interface cable. If the fault persists, install a new video amplifier assembly. If the fault still persists, install a new main PC board assembly. If the fault still persists, exchange the CRT.

Problem/Symptom	Failure Check/FRU Replacement
Maximum white color point is poor.	Make sure the brightness control is in the center detent position. Readjust R107, R207, and R307, to determine whether the correct white color can be obtained, otherwise install a new video amplifier assembly. If the fault still persists, install a new main PC board.
Minimum white color point is poor.	Make sure the brightness control is in the center detent position. Readjust R809, R819, and R829, to determine whether the correct white color can be obtained, otherwise install a new video amplifier assembly. If the fault still persists, install a new main PC board.
Convergence poor.	Exchange the CRT.
Focus poor.	Turn the focus potentiometer to determine if readjustment is possible, otherwise install a new main PC board. If the fault persists, install a new CRT.
Colors change or flicker.	Install a new signal interface cable. Then proceed as for 'Missing colors' above.

If readjustment is required; see "Alignment Procedure" on page 28 for details.

Note: To meet required safety standards, repair of the special card assembly is *not* recommended.

The following components have been identified as critical to the Department of Health and Human Services (DHHS). Repair or replacement must not be attempted except by complete exchange of an IBM supplied FRU.

C515

C516

C518

C538

D351

D501

D502

Deflection yoke

L501

L505

Q350

R520

R521

R522

R539

T502

T503.

Alignment Procedure

You may need to remove the display covers to make some of the adjustments; see Cover and FRU removal procedures on page 37 for details.

Warning

Refer to "Safety Notices" on page vi before removing any cables, or covers, or attempting any repair to the display.

You need the following for these adjustment procedures:

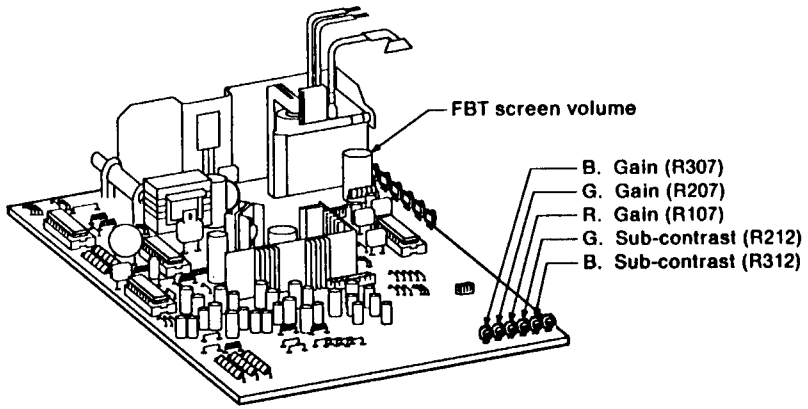
- IBM Personal System/2 system unit with the Video Graphics Adapter (VGA) facility installed.
- IBM Model 8503/8512/8513 Alignment Diskette, IBM part number 07F6788, shipped with this manual.
- Alignment mask (a drawing showing details for the mask [IBM Part 8553351] is included at the back of this manual.) You can either use this, or purchase the mask by quoting the part number.
- Minolta TV-Color Analyzer.

  Note: Each repair center should instigate a procedure to ensure that the Minolta TV Color Analyzer, used for setup, has been calibrated for the particular type of CRT being measured.

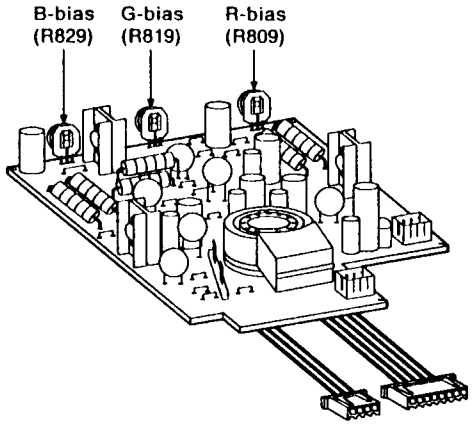
1. Ensure that the system unit is connected to the display.
2. Power on the system unit and the display.
3. Allow 20 minutes warm-up time for the display before checking or adjusting any electrical specification or function.

   Note: Degaussing is always required when checking purity and convergence.
4. Insert the diskette in the system unit.
5. Type, 'TEST.EXE.'

Focus and Cut-Off Adjustment



1. Set the BRIGHTNESS control (R 547) to center detent.
2. Set the SUB-BRIGHTNESS control (R 549) to maximum brightness.
3. Set the CONTRAST control (R 370) to maximum.
4. Set the BLUE and GREEN SUB-CONTRAST controls (R 312 and R212) to center position.
5. Set the RED GAIN, GREEN GAIN, and BLUE GAIN, potentiometers (R 107, R 207, and R 307) to maximum.



6 Set the RED BIAS, GREEN BIAS, and BLUE BIAS, potentiometers (R 809, R 819, and R 829) to minimum, (fully clockwise).

7 Press the **F3** function key (on the PS/2 keyboard). Then press the **ALT** and **F5** keys (then release both keys).

8 Adjust the FOCUS potentiometer on the FBT (T502), to obtain the sharpest image.

9 Press the **F1** function key, then **F10**.

10 Increase the SCREEN potentiometer on the FBT (T502), to make the background just visible.

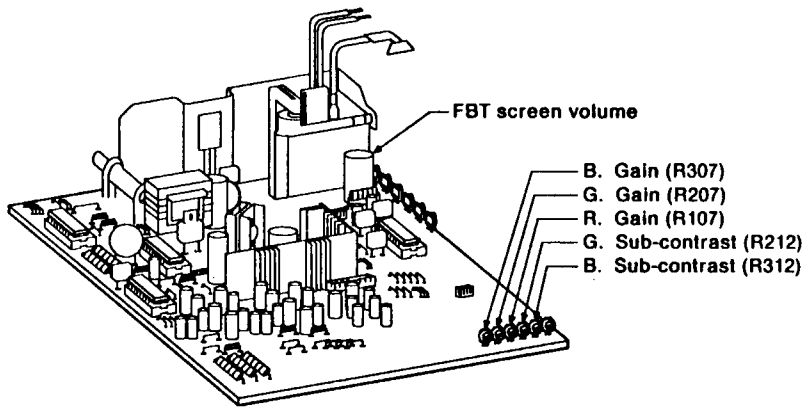
11 Adjust the RED BIAS, GREEN BIAS, and BLUE BIAS, potentiometers (R 809, R 819, and R 829) to make the screen white.

12 Adjust the SCREEN potentiometer on the FBT (T502), to make the background just invisible.

13 Press the **F3** function key (on the PS/2 keyboard). Then press the **SHIFT** and **F3** keys (then release both keys).

14 Ensure that the 2nd. square (block 01) is visible and the background raster is invisible.

White Color Point and Brightness Adjustment.



1 Press the **F3** function key, then **F7**.

2 Set up the Minolta TV-Color Analyzer, and adjust the BLUE GAIN potentiometer (R 307) to obtain 10 cd/m^2.

3 Press the **F3** function key, then press the **ALT** and **F9** keys (then release both keys).

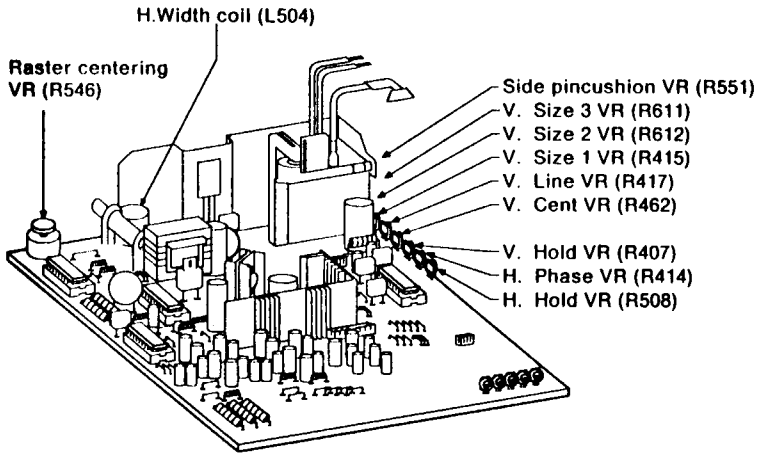
4 Adjust the RED GAIN potentiometer (R 107) to obtain x = 0.313, (using the Minolta TV-Color Analyzer).

5 Adjust the GREEN GAIN potentiometer (R 207) to obtain y = 0.329, (using the Minolta TV-Color Analyzer).

6 Set the CONTRAST control (R 370) to obtain 17 cd/m^2, and recheck the 'x' and 'y' readings.

7 Set the CONTRAST control (R 370) to maximum and check the reading on the Minolta TV-Color Analyzer is greater than 103 cd/m^2.

Geometry Adjustments



Pincushion

1 Press the **F2** function key, then press the **ALT** and **F5** keys (then release both keys).

2 Adjust the SIDE-PINCUSHION potentiometer (R 551) to obtain a geometrically regular square. (Horizontal tolerance = 3.5 mm, vertical tolerance = 2.5 mm.)

3 Repeat in **F1** and **F3** modes.

Horizontal Centering

1 Press the **F2** function key.

2 Adjust the 'H.PHASE' potentiometer (R 414) to obtain a 1.5 mm gap between the data and the raster at the right-hand edge of the screen.

3 Adjust the 'H.CENT' potentiometer (R 546) to centralize the pattern horizontally on the screen.

4 Repeat in **F1** and **F3** modes.

Vertical Linearity

1 Press the **F2** function key, then press the **ALT** and **F3** keys (then release both keys).

2 Adjust the 'V.LINE' potentiometer (R 417) to centralize the pattern vertically on the screen.

3 Check the vertical size is 180 mm.

Horizontal Width

1 Press the **F2** function key, then press the **ALT** and **F9** keys (then release both keys).

2 Adjust the 'WIDTH' adjustment (L 504) to obtain a horizontal width of 240 mm.

3 Repeat in **F1** and **F3** modes.

Vertical Centering

1 Press the **F2** function key, then press the **ALT** and **F1** keys (then release both keys).

2 Adjust the 'V.CENT' potentiometer (R 462) to centralize the pattern vertically on the screen.

3 Repeat in **F1** and **F3** modes.

Horizontal Hold

1 Press the **CTRL** and **F3** keys (then release both keys).

2 Adjust the 'H.HOLD' potentiometer (R 508) until the horizontal sync is stabilized.

Vertical Size

1 Press the **F3** function key, then press the **ALT** and **F1** keys (then release both keys).

2 Adjust the 'V.SIZE 3' potentiometer (R 611) to obtain a height of 180 mm.

3 Press the **F2** function key, then press the **ALT** and **F1** keys (then release both keys).

4 Adjust the 'V.SIZE 2' potentiometer (R 612) to obtain a height of 180 mm.

5 Press the **F1** function key, then press the **ALT** and **F1** keys (then release both keys).

6 Adjust the 'V.SIZE 1' potentiometer (R 415) to obtain a height of 180 mm.

Parts Catalog

Part Number	Description
	Version 2 displays (serial number beginning with 72 only). *(For displays with a serial numbers beginning with 23, or 55, refer to the 8512 Version 1 section, of this manual.)*
61X8924	Display assembly, Model 001 (110/120 Volt).
61X8928	Display assembly, Model 002 (220/240 Volt, Northern Hemisphere).
61X8927	Display assembly, Model 003 (220/240 Volt, Southern Hemisphere).
61X8892	Power switch.
61X8895	Power-On indicator.
61X8893	Contrast and brightness control assembly (see Note 1 on page 36).
07F6824	Contrast and brightness control assembly (see Note 2 on page 36).
61X8884	Video amplifier assembly (see Note 1 on page 36).
07F6823	Video amplifier assembly (see Note 2 on page 36).
61X8885	Main PC board assembly (see Note 1 on page 36).
07F6822	Main PC board assembly (see Note 2 on page 36).
61X8931	Power supply with cord, Model 001.
61X8883	Power supply, Models 002 and 003.
61X8886	CRT/Yoke assembly, Models 001 and 002.
61X8887	CRT/Yoke assembly, Model 003.
61X8888	Signal cable assembly.
61X8891	Display Miscellaneous hardware kit:
	Rubber feet (quantity 4).
	Fasteners and washers.
61X8932	Cover set complete, Model 001.
61X8889	Cover set complete, Model 002.
61X8890	Cover set complete, Model 003.
61X8925	Tilt/swivel stand.
72X7976	Shipping material (display).

Part Number	Description
72X7977	Shipping carton.
72X7957	Shipping cushion, front.
72X7958	Shipping cushion, back.
72X7959	Shipping bag.
72X7978	Shipping material (stand).
72X7979	Shipping carton.
72X7967	Shipping cushions (quantity 2).
72X7968	Shipping bag.

Notes:

1. For display serial numbers below:
   - 747171 (Model 001) ★
   - 2217781 (Model 002)
   - 1519863 (Model 003).

   ★ Also for Model 001 serial numbers 747171 to 842645 that have 'A-31M' marked on the main PC board assembly.
2. For display serial numbers including and above:
   - 842646 (Model 001) ★
   - 2224665 (Model 002)
   - 1519863 (Model 003).

   ★ Also for Model 001 serial numbers 747171 to 842645 that have 'A-31M-01' marked on the main PC board assembly.

Mechanical Assembly

Cover and FRU Removal Procedures

Warning

Refer to "Safety Notices" on page vi before removing any cables, or covers, or attempting any repair to the display.

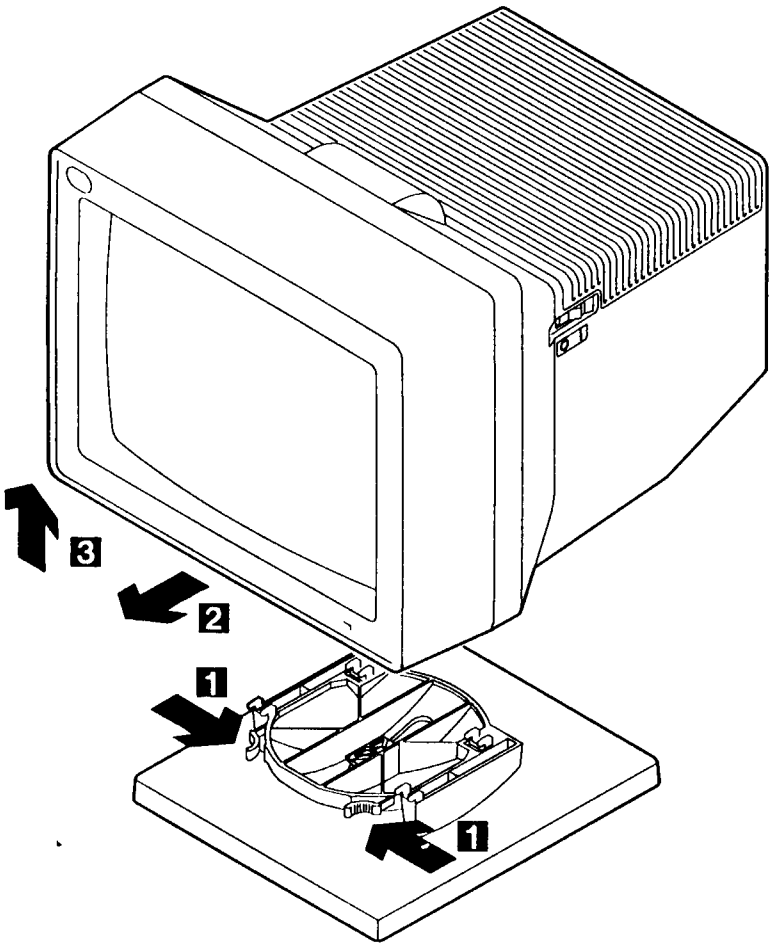
Important

When replacing the power supply, make sure that the green/black 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.

Important Safety Notice

Components identified by the symbol ⚠ have special characteristics important for safety. When replacing any of these components, use only parts specified by the manufacturer.

Removing the Tilt and Swivel Assembly



Warning:

1. Power off the display, system unit, and any attached devices.
2. Remove all power plugs from the power supply sockets.

Proceed as follows:

1 Place the display on a flat surface ensuring that there is sufficient space to place the display down when it is removed from the tilt and swivel assembly.

2 Press the two release clips **1**.

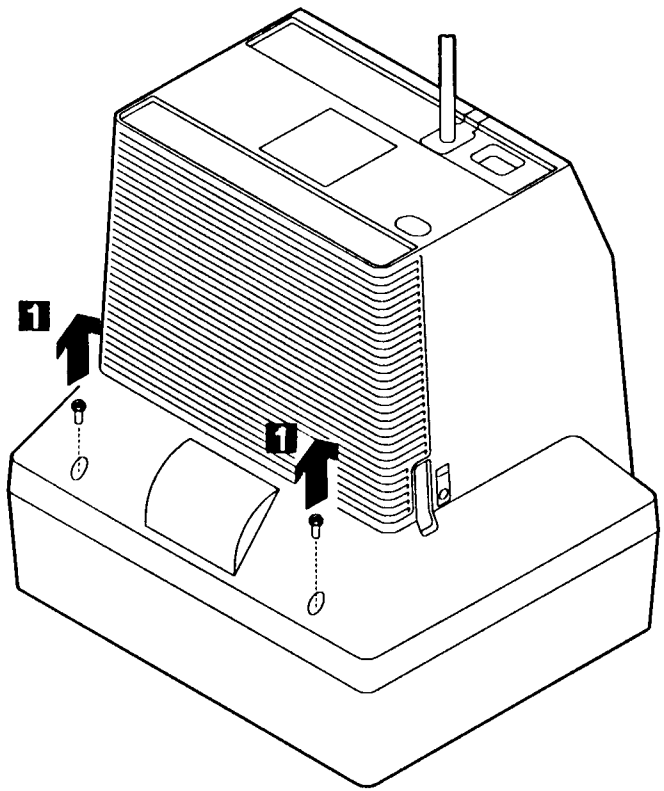
3 Pull the display forward from the tilt and swivel assembly **2**.

4 Lift the display from the tilt and swivel assembly **3** and place it on a flat surface.

Installing the Tilt and Swivel Assembly

Install using the above instructions in reverse order.

Removing the Rear Cover

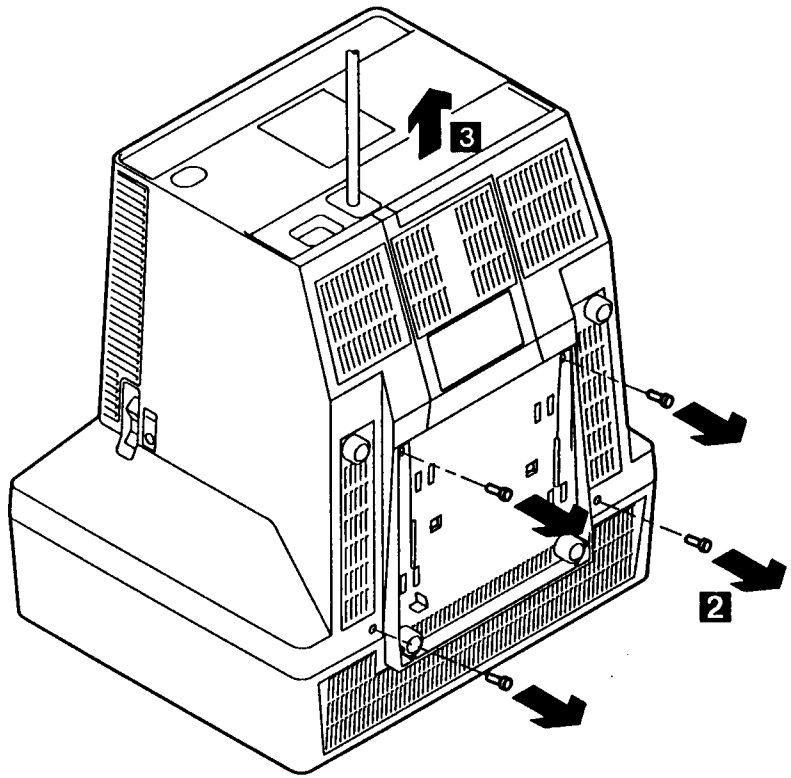


1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the two screws 1 using a special torx driver.

3 Remove the four screws 2 using a cross-head driver.

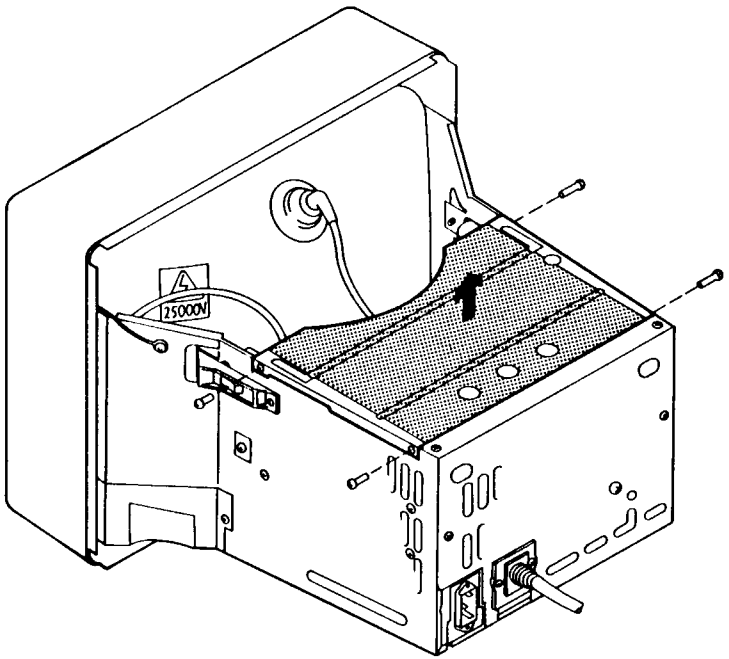
4 Lift the cover from the assembly 3.



Installing the Rear Cover

Install using the above instructions in reverse order.

Removing the Top Plate



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

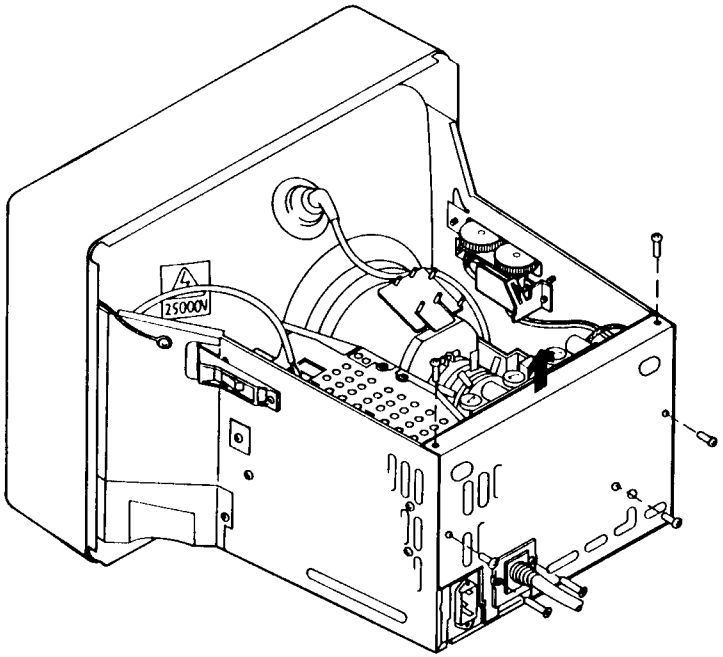
3 Remove the four fixing screws.

4 Remove the top plate.

Installing the Top Plate

Install using the above instructions in reverse order.

Removing the Rear Plate



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

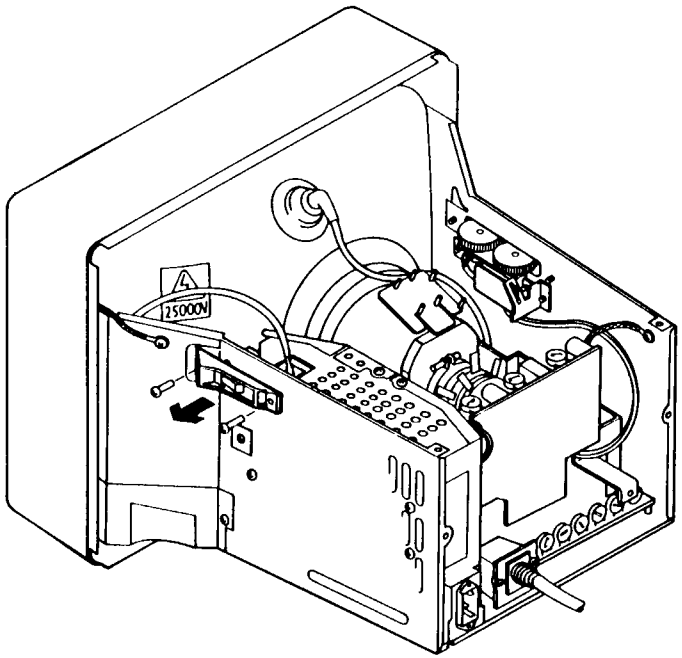
4 Remove the seven fixing screws.

5 Remove the rear plate.

Installing the Rear Plate

Install using the above instructions in reverse order.

Removing the Switch Bezel



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

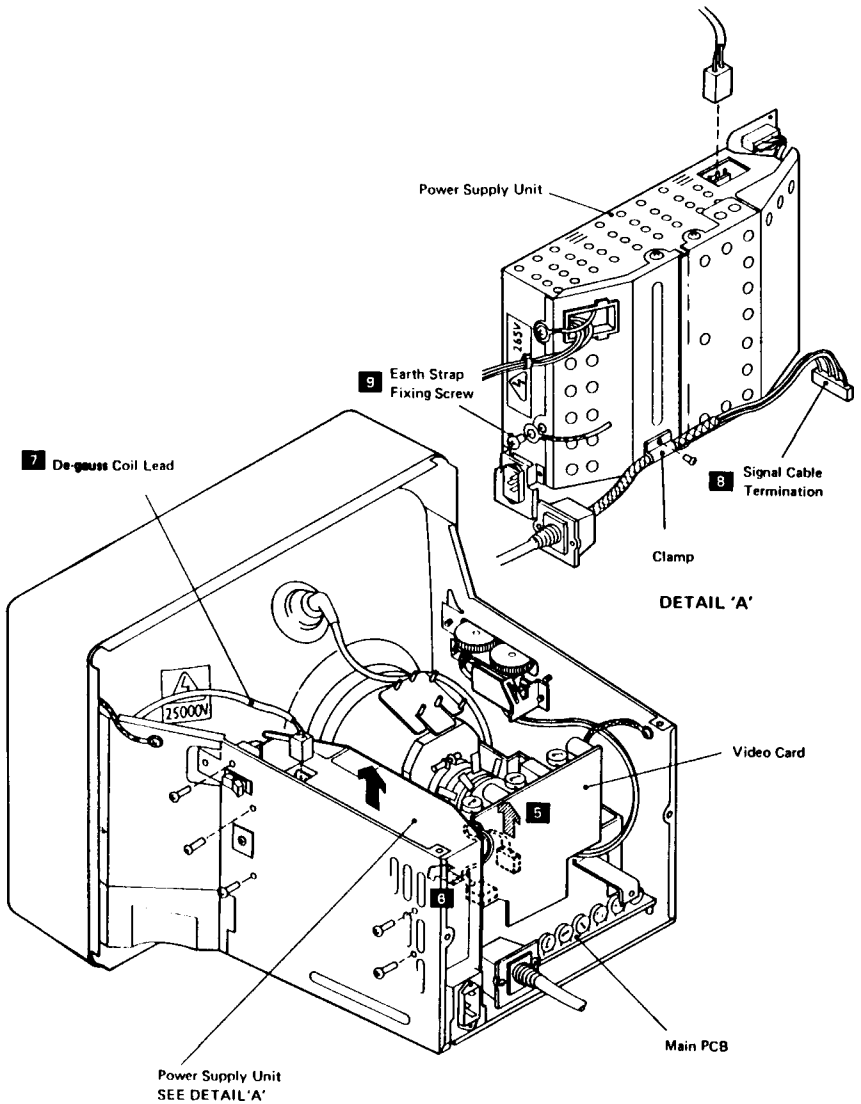
5 Remove the two fixing screws.

6 Remove the switch bezel.

Installing the Switch Bezel

Install using the above instructions in reverse order.

Removing the Power Supply and Signal Cable



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

5 Remove the dc output connector from the main PCB (connector H, 5).

6 Remove the dc output connector from the video card (connector J, 6).

7 Remove the degaussing coil connector (7).

8 Remove the signal cable connector from the main PCB (connector A, 8).

9 Remove the video card left-hand earth strap fixing screw (9).

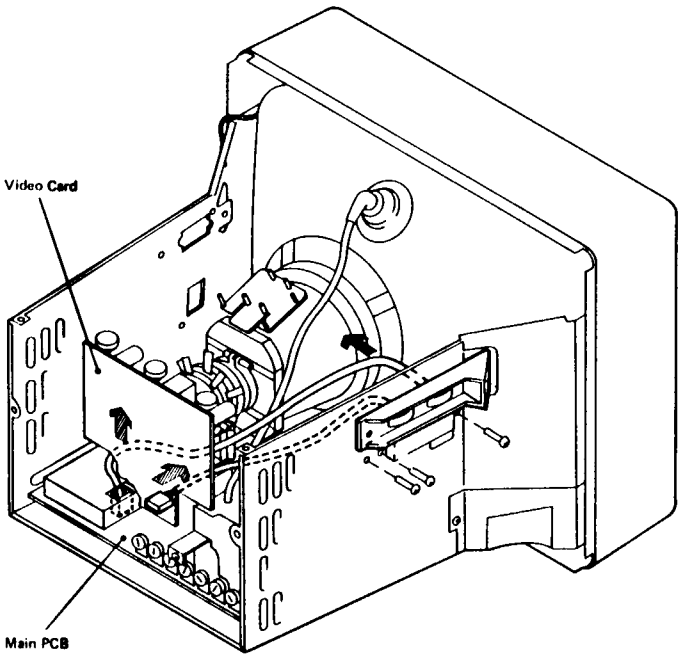
10 Remove the five power supply unit fixing screws.

11 Lift the power supply unit away from the main chassis, unscrew the signal cable clamp fixing screw, and remove the power supply unit.

Installing the Power Supply and Signal Cable

Install using the above instructions in reverse order.

Removing the Brightness/Contrast Assembly



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

5 Remove the contrast connector from the main PCB (connector B).

6 Remove the brightness connector from the video card (connector E).

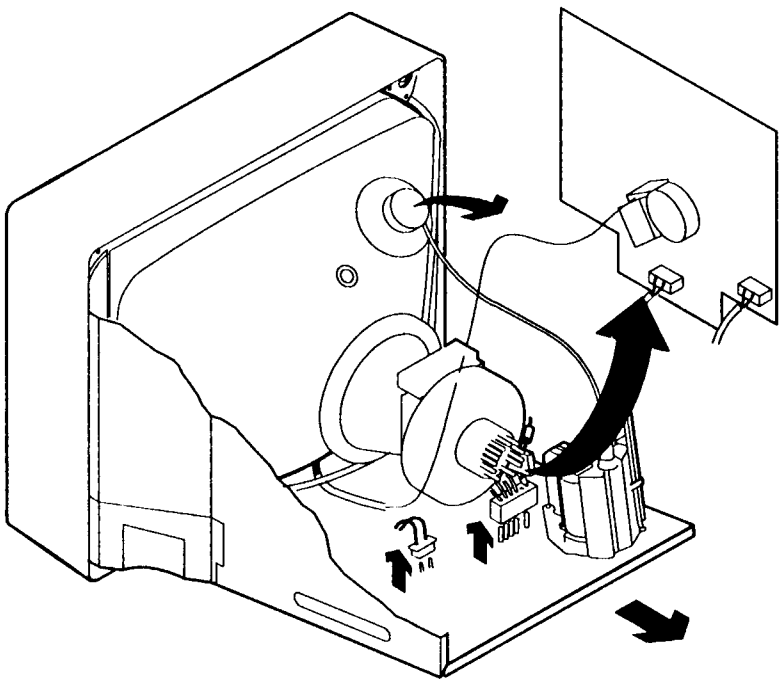
7 Remove the three fixing screws (do not remove the brightness/contrast assembly bezel).

8 Remove the brightness/contrast assembly.

Installing the Brightness/Contrast Assembly

Install using the above instructions in reverse order.

Removing the Main Printed Circuit Board and Video Card



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

5 **Warning: EHT voltages may be present, discharge anode cap to ground. (Care must be taken, high voltages may remain for a number of days even if the display is switched off). It is recommended that the action is repeated.**

6 Take the anode cap from the CRT.

7 Remove the SIG CA connector from the main PCB (connector A).

For cable connector locations, see page 60.

8 Remove the DC connector from the main PCB (connector H).

9 Remove the LED connector from the main PCB (connector L).

10 Remove the contrast connector from the main PCB (connector B).

11 Remove the yoke connector from the main PCB (connector Y).

12 Remove the brightness connector from the video card (connector E).

13 Remove the DAG connector from the video card (connector GND).

14 Remove the DC connector from the video card (connector J).

15

Warning

Refer to "Safety Notices" on page vi, before attempting to break the fixing compound that holds the video card to the CRT.

Remove the video card from the CRT.

16 Remove the main PCB from the bottom plate guides.

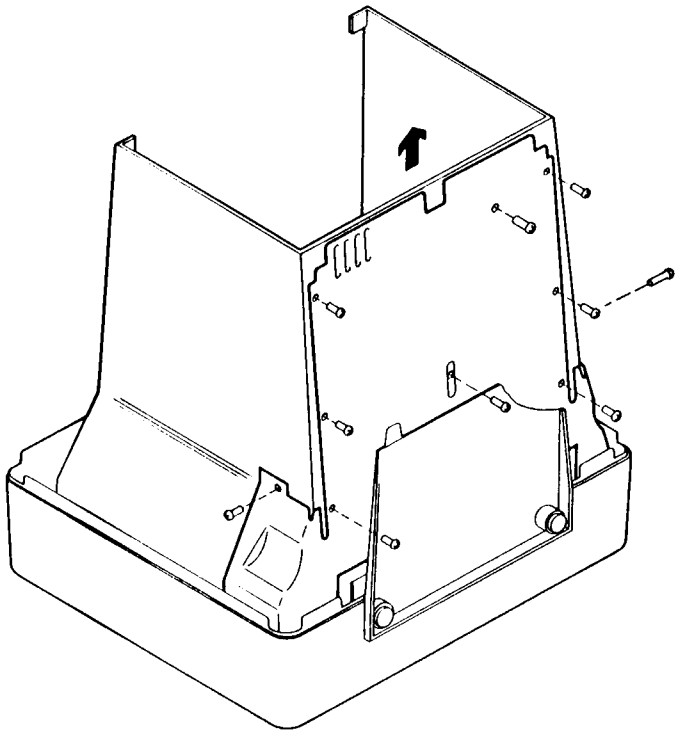
Installing the Main Printed Circuit Board and Video Card

Warning

Refer to "Safety Notices" on page vi before attempting any of the steps to install the main printed circuit board or video card.

Install using the above instructions in reverse order.

Removing the Bottom Plate



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

5 Remove the main printed circuit board and video card as described on page 52.

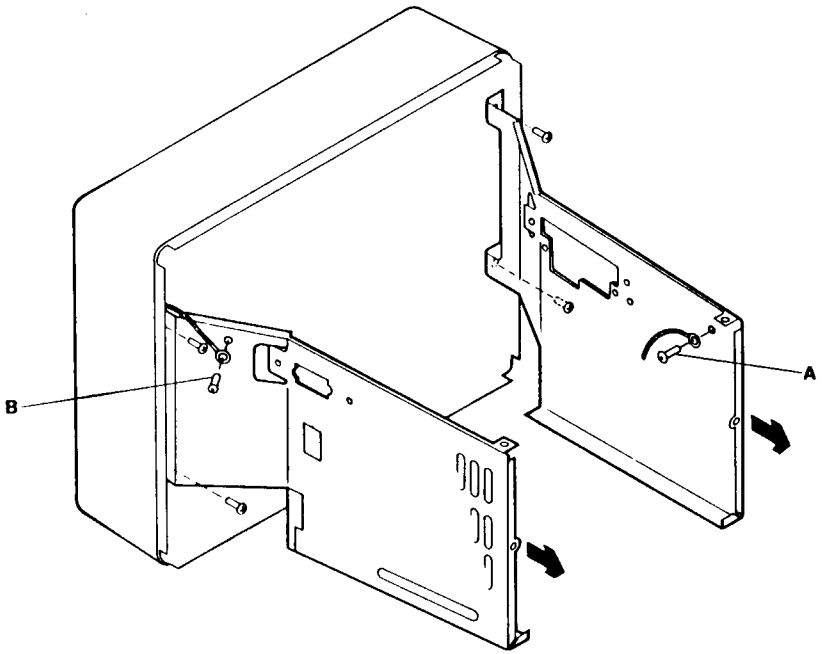
6 Remove the ten bottom plate fixing screws.

7 Remove the bottom plate.

Installing the Bottom Plate

Install using the above instructions in reverse order.

Removing the Side Plates



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

5 Remove the two video card earth-strap fixing screws (**A** and **B**).

6 Remove the main printed circuit board and video card as described on page 52.

7 Remove the bottom plate as described on page 54.

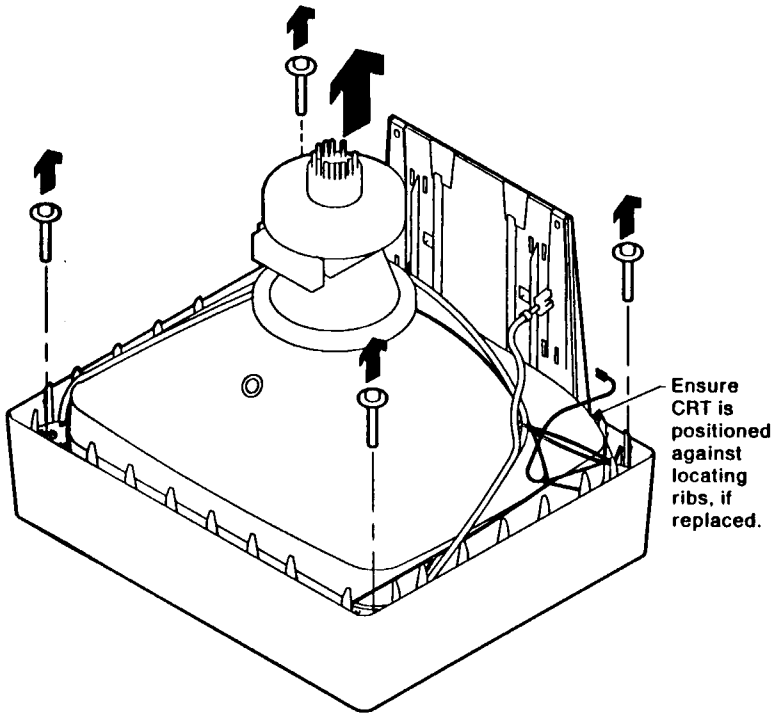
8 Remove the four side plate fixing screws.

9 Remove the side plates.

Installing the Side Plates

Install using the above instructions in reverse order.

Removing the CRT



1 Remove the tilt and swivel assembly as described on pages 38 and 39.

2 Remove the rear cover as described on page 40.

3 Remove the top plate as described on page 42.

4 Remove the rear plate as described on page 44.

5 Remove the main printed circuit board and video card as described on page 52.

6 Remove the bottom plate as described on page 54.

7 Removing the side plates as described on page 56.

8 Remove the four CRT fixing screws.

9 Remove the CRT.

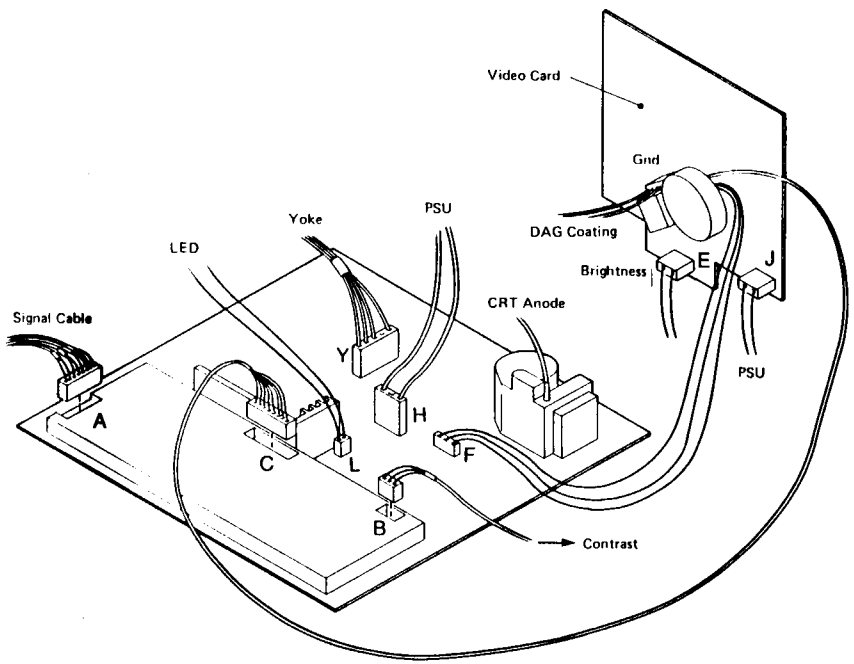
Installing the CRT

Warning

Refer to "Safety Notices" on page vi before attempting any of the steps to install the CRT.

Install using the above instructions in reverse order.

Cable Connections



Appendix A. 8512 Color Display Model 102 (VLMF)

Introduction

This information will enable personnel servicing the IBM 8512 to identify a Model 102 Very Low Magnetic Field (VLMF) display, determine the cause of failure, and order and replace the part.

Identification

The 8512 Model 102 is identified by:

1. The label fixed to the back cover of the 8512 VLMF machine.
2. The presence of the parts shown in the following diagram:

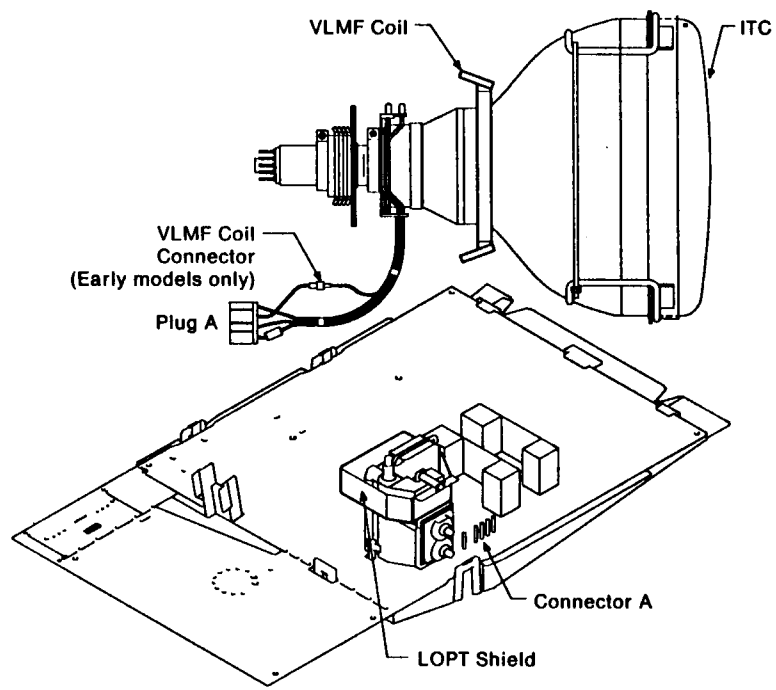


Figure 6. VLMF parts.

Safety

Before servicing the 8512 Model 102 read the Safety Instructions see "Safety Notices" on page vi.

Problem Determination

The procedures documented in the front of this manual should be used to identify failing parts (Version 1).

Note: For Model 102 displays, the voltage at P11.1, should be set to 87 volts with respect to ground.

Parts Catalog

For continued VLMF performance on a Model 102 display, a special Card Assembly, and Integrated Tube Component (ITC), are fitted. Also, the Model 102 is fitted with a unique cover set, metal coated on the inside.
The parts shown in the table below **must** be used if either the Card Assembly or the ITC require replacement.

Part Number	Description
07F6594	Cover set
07F6591	ITC plus 3 cable ties
07F6592	Special card assembly
5420242	Cable tie

The card assembly and cover set should be fitted using the procedures detailed in the front of this manual.

ITC Replacement Procedure

- Replacement ITCs (IBM part 07F6591) are supplied, Figure 7 on page 64 shows these parts.
- The ITC should be fitted to the front cover as described in the front of this manual.
- Fit the bridge to the bezel.
- Remove the tape shown in Figure 7 on page 64, and position the black insulated wire on the bridge.
- Use the cable ties supplied with the ITC to secure the insulated wire link to the bridge, Figure 8 on page 64 shows this.
- Some displays have an in-line connector in the blue wire of the ITC yoke lead. For the correct operation of the display, these connectors *must* be plugged together.
- When either the Card Assembly or the ITC is replaced, the display must be tested to ensure that the VLMF performance has not been degraded. (See, "Test Procedures" on page 65.)

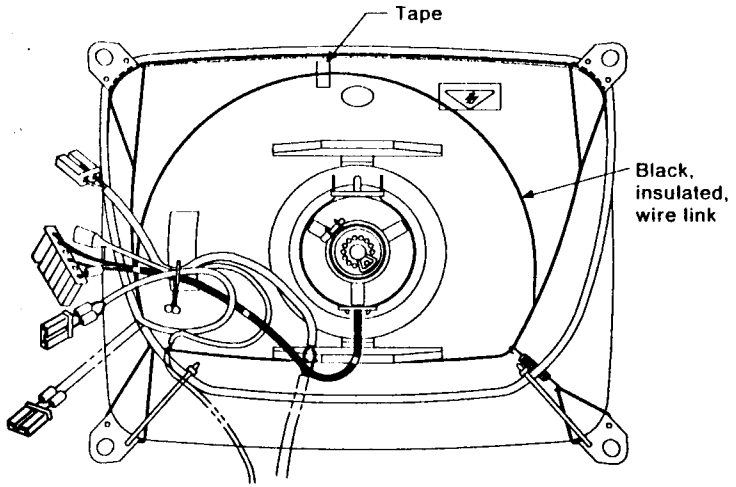


Figure 7. Replacement ITC (Supplied as shown)

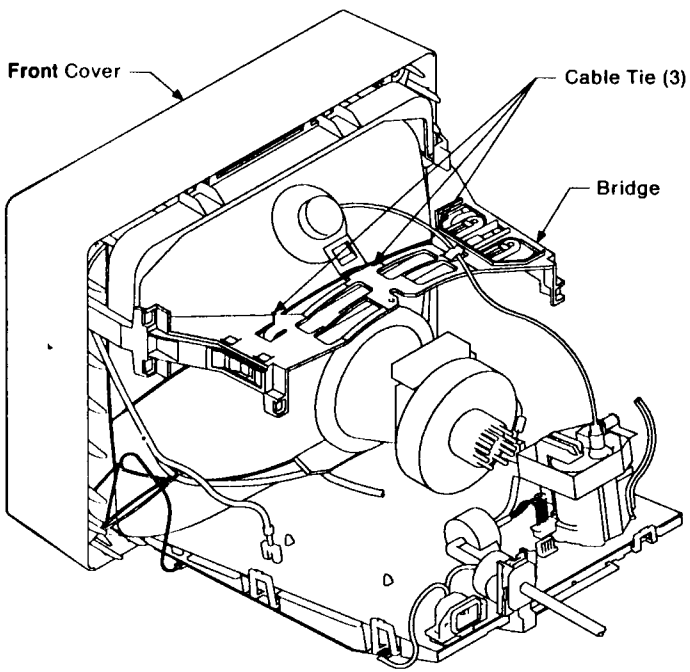


Figure 8. ITC cable ties

Test Procedures

Before performing this test, the display must be adjusted as described in the alignment procedure in the front of this manual.

The Combinova** Magnetic Field Meter 1000, or its equivalent, is required to complete these procedures.

1. Position the display on the turntable so that point "A", in Figure 9 on page 66, is directly above the center of the turntable.
2. Switch on the display, then show any test pattern containing text or graphics. Allow the display to warm up for five minutes, before continuing.
3. Position the Combinova Magnetic Field Meter 1000, so that the center of the measuring head, is positioned 300 mm in front of the center of the screen (Figure 9 on page 66 shows this position).

   Note on the use of the Combinova Magnetic Field Meter 1000

   Measurements should be made, with the meter set to 'External Sync Mode', and the measuring head pointing toward the display. For more information on the operation of the meter, refer to the operating instructions.
4. Take a measurement of dB/dT, and B, at Test Point 1.
5. Reposition the meter to take a reading at Test Point 2, so that the center of the measuring head is positioned 310 mm in front of the center of the screen on the z-axis (see Figure 10 on page 67).
6. Move the Combinova Magnetic Field Meter 1000 vertically upward 460 mm, so that it is positioned as shown in Figure 10 on page 67.
7. Rotate the turntable 202.5 degrees counterclockwise.
8. Take a measurement of dB/dT, and B, at this position. (Test Point 2.)
9. Check that the values obtained for dB/dT do not exceed 20 mT/sec, or for B, do not exceed 80 nT.

** Combinova is a trademark of Combinova AB. For a complete list of trademarks, see page iii.

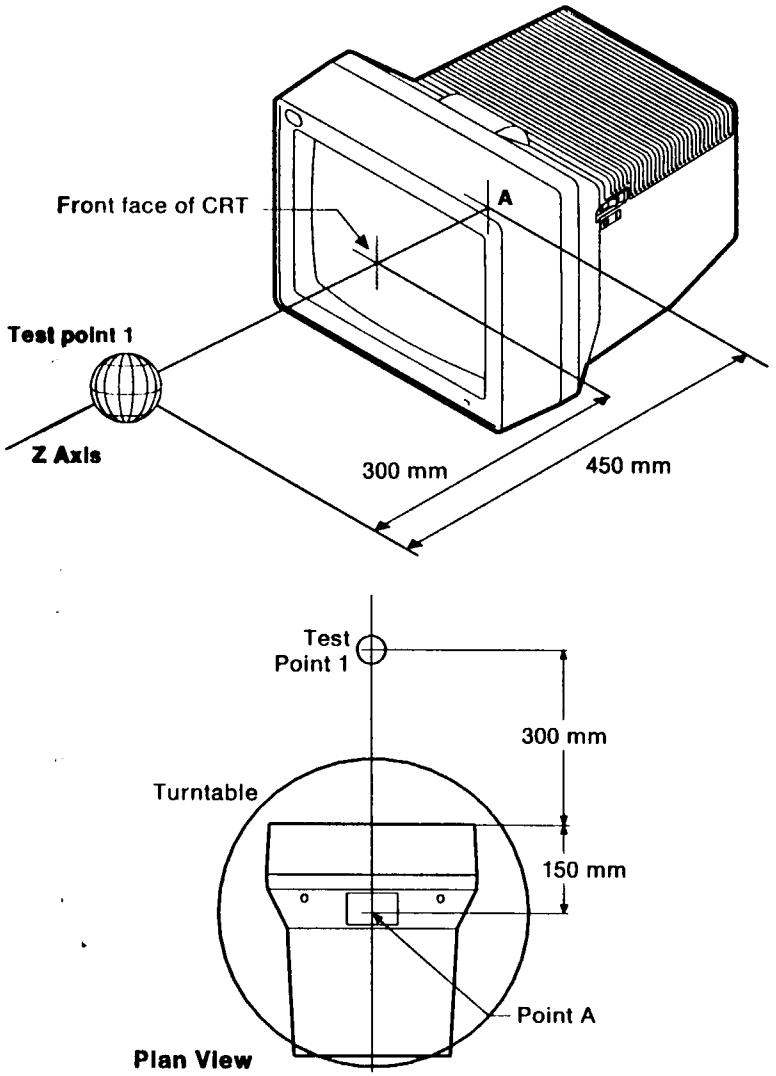


Figure 9. Test Point 1.

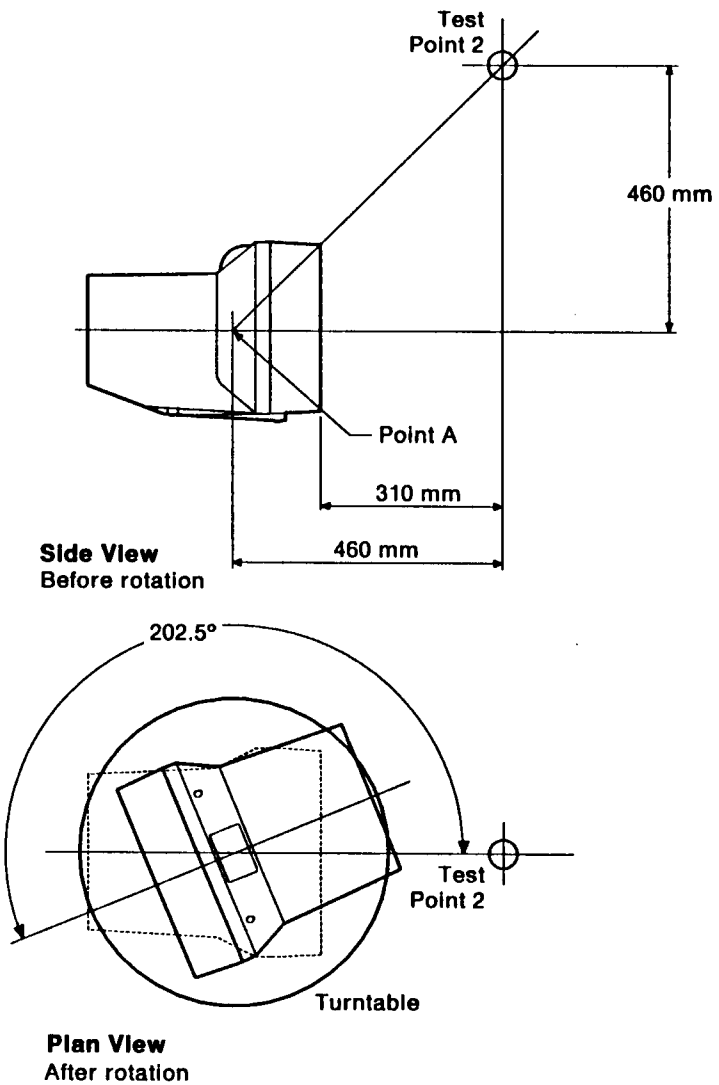


Figure 10. Test Point 2.

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