

VR320 Monitor Service Guide

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Digital Equipment Corporation

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About This Manual

This guide describes how to service your VR320 monitor.

Guide Organization

This guide covers the following topics:

- Chapter 1 provides a general overview of the product and includes a list of spare parts.
- Chapter 2 describes the troubleshooting procedures.
- Chapter 3 provides the removing and replacing procedures for the Field Replaceable Units (FRUs).
- Chapter 4 describes the alignment procedures.
- Chapter 5 describes the procedures to change the refresh rate of the monitor.
- Appendix A describes the alignment screens.
- Appendix B describes related documentation.

Audience

The procedures in this guide are for service technicians trained only by Digital Equipment Corporation.

Conventions

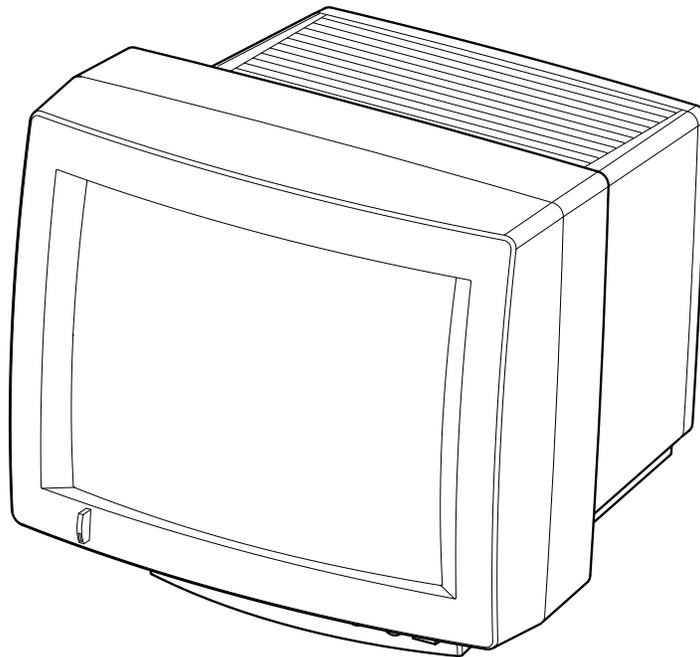
Warning	Provides information to prevent personal injury.
Caution	Provides information to prevent damage to the equipment.
Note	Provides general information you should be aware of.
PN	Part number.

1

Overview

1.1 Product Description

The VR320 color monitor (Figure 1-1) has a direct viewed, 485 mm, antiglare CRT with contrast enhancement. The built-in tilt-swivel assembly lets the user adjust the screen for viewing comfort. When connected to a host system, the monitor can display information sent to the host system and information the host system sends to it.



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Figure 1-1 VR320 Color Monitor

1.1.1 Refresh Rate

The monitor operates at a refresh rate of either 66 Hz or 72 Hz. It is preset for the system as ordered. If you change the monitor to another system, check the refresh rate of the new system and then set the switch on the deflection module and the jumper on the power supply module to match the new system. Refer to Chapter 5.

1.1.2 Model Variations

Table 1-1 lists the different VR320 models and their refresh rates.

Table 1-1 Refresh Rates of Monitor Models

Model	Pixels x Lines	Refresh Rate	Applicable Area
VR320-CA	1280 x 1024	66 Hz	Northern Hemisphere
VR320-C4	1280 x 1024	66 Hz	Southern Hemisphere
VR320-DA	1280 x 1024	72 Hz	Northern Hemisphere
VR320-D4	1280 x 1024	72 Hz	Southern Hemisphere

1.2 Tools and Equipment

You need the following tools and equipment to service the VR320 monitor:

Table 1-2 Tools and Equipment

Tools and Equipment	Part Number
Terminal Technician Tool Kit	29-27340-01
Static protection kit	29-26246-00
Anode discharge tool	29-24717-00
Metric measuring tape	29-25342-00
Safety goggles	29-16141-00
Gloves	29-16146-00

1.3 Recommended Spare Parts

The following are the recommended spare parts for the VR320 monitor:

Table 1-3 VR320 Recommended Spare Parts

Spares	Part Number
Power supply module	54-19621-01
Deflection module	54-19301-01
Video casting assembly	70-27010-01
Interconnect cable	70-27000-01
CRT/chassis assembly	70-27429-03
CRT/chassis assembly	70-27429-04

2

Troubleshooting

This chapter describes how to troubleshoot a VR320 monitor problem through fault isolation.

2.1 Before You Start

The following information will help you troubleshoot the monitor easily and effectively:

WARNING

If you smell burning components, press the monitor power switch to off and disconnect the power cord.

- If you are going to service a display quality type of problem, tell the customer to let the monitor warm up for at least 20 minutes, if possible, before you arrive and begin the troubleshooting procedures.
- Magnetic fields affect monitor performance and can give a false indication of a monitor failure. Place the monitor away from any electromagnetic devices, such as printers and terminals, or away from large magnetized objects, such as filing cabinets and steel beams in walls.

NOTE

Any time you replace a video casting assembly, deflection module, or power supply module, perform all the necessary adjustments. Refer to Chapter 3.

2.2 Troubleshooting Procedures

These procedures assume that only one assembly has failed or only one problem exists. Always troubleshoot the most obvious symptom first. However, one symptom may indicate multiple failures. Problems may come from either the host system or the monitor.

2-2 Troubleshooting

Troubleshoot the VR320 monitor as follows:

1. Ask the operator to describe the problem. The operator often is the most knowledgeable person.
2. Identify the problem. The screen display often indicates which problem is occurring.
3. Isolate the problem. Refer to the troubleshooting tables to find the suggested solutions.
4. Display the host system alignment test patterns to make sure that no other problem exists. Refer to the host system service guide for displaying test patterns.

2.3 Troubleshooting Tables

The troubleshooting tables list the possible cause in order of probability. This troubleshooting information applies to the following types of video problems your VR320 monitor may exhibit:

- A blank screen, without video or raster (Table 2-1)
- A blank screen, without video, but raster present (Table 2-2)
- Loss of synchronization (Table 2-3)
- Color problems (Table 2-4)
- Poor display quality: color, brightness, geometry, or focus (Table 2-5)

Use the troubleshooting tables as follows:

1. Note the general symptom of the problem.
2. Check the Symptom column for a match.
3. Check the conditions in the Possible Cause column in the order given.
4. Perform the action in the Suggested Solution column in the order given.

NOTE

Any time you replace a video casting assembly, deflection module, or power supply module, perform all the necessary adjustments. Refer to Chapter 3.

Table 2-1 Blank Screen, No Video or Raster

Symptom	Possible Cause	Suggested Solution
Blank screen, no video or raster. Power to the monitor is on (power switch is in), but power indicator is off.	Power cord is not connected.	Connect the power cord to the power source or monitor.
	Low or no power at wall outlet.	Use another power source. If the problem continues, call the facilities person.
	Power supply module is faulty.	Replace the power supply module (Section 3.2.4).
	Deflection module is faulty.	Replace the deflection module (Section 3.2.2).
No video or raster, but power indicator is on.	Video module is faulty.	Replace the video casting assembly (Section 3.2.6).
	Brightness or contrast control is set too low.	Adjust the brightness and contrast controls.
	Internal cabling is loose or faulty.	Check all cabling connected to the deflection module and the video casting assembly, including the CRT socket. If necessary, secure the cables.
	Cutoff is set improperly.	Perform the cutoff alignment procedures (Section 4.4).
	Deflection module is faulty.	Replace the deflection module (Section 3.2.2).
	Video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.6).
	Power supply module is faulty.	Replace the power supply module (Section 3.2.4).
CRT/chassis assembly is faulty.	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.	

Table 2-2 Blank Screen, No Video but Raster Present

Symptom	Possible Cause	Suggested Solution
No video or cursor is visible even when the contrast control is at maximum; however, raster is visible by adjusting the brightness control.	Host screen saver is activated.	Press any key to reactivate the display.
	Power to the host system is not on.	Turn power to the host system on.
	External signal cables are disconnected.	Connect the signal cables at the monitor and the host.
	Signal cable is faulty.	Replace the signal cable. Refer to the host system documentation.
	Host system is not supplying video signals to the monitor.	Connect the monitor to a known working host system with the same refresh rate (Chapter 5) and verify the problem before replacing any monitor modules.
	Host system is faulty.	Repair the host system.
	Internal cabling is loose or faulty.	Check all cabling connected to the deflection module and the video casting assembly. If necessary, secure the cables.
	Video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.6).
	Deflection module is faulty.	Replace the deflection module (Section 3.2.2).
CRT/chassis assembly is faulty	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.	

Table 2-3 Loss of Synchronization

Symptom	Possible Cause	Suggested Solution
VR320 video display with 4-bar color pattern is out of sync.	Incorrect refresh rate setting.	Check the refresh rate of the host system and verify that the monitor refresh rate matches the host system.
	Video cables are faulty or improperly connected.	<p>If green is not present, connect the video cables.</p> <p>After connecting the video cables and green is still not present, swap the red and green video cables at both the monitor and host system.</p> <p>If the display is now green and in sync, replace the video cable.</p> <p>After connecting the video cables and green is still not present, swap the red and green video cables at the monitor. If the display is now green and in sync, repair the host system.</p> <p>After swapping the red and green video cables and the display is green but out of sync, go to the next probable cause.</p>
	If green is present, the problem is with the monitor or host system.	<p>If another VR320 monitor is available, swap the monitors and see if the problem continues.</p> <p>If the problem continues, repair the host system. If the problem does not occur, the problem is in the monitor.</p> <p>If another VR320 monitor is not available, replace the deflection module (Section 3.2.2).</p>

Table 2-3 (Cont.) Loss of Synchronization

Symptom	Possible Cause	Suggested Solution
	Deflection module is faulty.	Replace the deflection module (Section 3.2.2).
	If the problem continues, the video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.6).
	If the problem still continues, the host system is faulty.	Repair the host system.

NOTE

Make sure the monitor has warmed up for at least 20 minutes before you use Table 2-4. Refer to Appendix A for the color patterns.

Table 2-4 Color Problems

Symptom	Possible Cause	Suggested Solution
Wrong color display. When 4-color bar pattern is displays, the primary colors are not in their proper sequence.	Video cables are crossed.	Swap the video cables.
Red or blue color is missing. Missing color is restored when red and blue cables are swapped at both the monitor and host system. Color that was present is now missing.	Signal cable is faulty.	Replace the signal cable. Check that the cables are installed in the correct connectors.
Red or blue color is missing. Missing color is restored when red and blue cables are swapped at the monitor.	Host system is faulty.	Repair the host system.

Table 2-4 (Cont.) Color Problems

Symptom	Possible Cause	Suggested Solution
Green color is missing, but video is in sync.	Swap red and green video cables at the monitor. If green is still missing, the problem is in the monitor.	Repair the monitor.
	If green is restored, the problem is in the host system.	Repair the host system.
	Video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.6).
	CRT/bezel/chassis assembly is faulty.	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.

Table 2-5 Poor Display Quality: Color, Brightness, Geometry, or Focus

Symptom	Possible Cause	Suggested Solution
Poor centering.	Centering controls on top of the monitor or on the deflection module are set incorrectly.	Adjust the centering controls on top the monitor and check the deflection adjustments. Refer to Chapter 4.
Poor geometry, and/or linearity.	Monitor is out of adjustment.	Perform appropriate adjustments. Refer to Chapter 4.
	Deflection module assembly is faulty.	Replace the deflection module assembly (Section 3.2.2) and perform all deflection adjustments.
Poor color purity. Different colors can be seen when an all-red pattern displays.	Monitor needs to be degaussed.	Press the degauss button to correct color distortions.
	Local magnetic fields.	Remove any electromechanical devices from the vicinity of the monitor, or move the monitor to another location.
	CRT/chassis assembly is faulty.	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.
Poor light output (using the all-white diagnostic pattern)	Brightness or contrast controls set too low.	Adjust the brightness and contrast controls.
	Video casting assembly is out of adjustment.	Perform the color adjustments. Refer to Chapter 4.
	Host system is not supplying correct signal levels.	Repair the host system.
	Video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.6).

Table 2-5 (Cont.) Poor Display Quality: Color, Brightness, Geometry, or Focus

Symptom	Possible Cause	Suggested Solution
	CRT wearout	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.
Poor color balance.	Video casting assembly is out of adjustment.	Perform all color adjustments. Refer to Chapter 4.
	Signal levels from the host system are not properly balanced.	Repair the host system.
	Video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.7).
	CRT/chassis assembly is faulty.	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.
Display is not clear or sharp.	Focus is out of adjustment.	Perform focus adjustment. Refer to Chapter 4.
	Cutoff and Gain settings are too high.	Readjust the cutoff and gain settings. Refer to Chapter 4.
	Internal cabling is loose or faulty.	Check all cabling connected to the deflection module and the video casting assembly. If necessary, secure the cables.
	Power supply module is faulty.	Replace the power supply module (Section 3.2.4).
	Video casting assembly is faulty.	Replace the video casting assembly (Section 3.2.7).
	Deflection module assembly is faulty.	Replace the deflection module assembly (Section 3.2.2) and perform all deflection adjustments.

Table 2-5 (Cont.) Poor Display Quality: Color, Brightness, Geometry, or Focus

Symptom	Possible Cause	Suggested Solution
Display characters seem to flicker or swim.	CRT/chassis assembly is faulty	Replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.
	AC electromagnetic interference from adjacent power lines or appliances	If possible, remove electromagnetic devices from the vicinity of the monitor, or move the monitor to another location.
	Power supply module is faulty.	Replace the power supply module (Section 3.2.4).
	Deflection module is faulty.	Replace the deflection module (Section 3.2.2).

NOTE

If the monitor cannot be internally degaussed and the problem is not caused by external magnetic fields, replace the CRT/chassis assembly (Section 3.2.7) only after trying all the other solutions.)

3

Removing and Replacing FRUs

This chapter describes how to remove and replace the VR320 monitor field replaceable units (FRUs).

3.1 Procedures

Perform all the removal and replacement procedures from the rear of the monitor. Tilt the monitor from the back to the front allowing easier access to the FRUs.

NOTE

If you twist the monitor while applying the tilt pressure, the monitor moves easily.

The procedures describe how to remove FRUs. To install each FRU, reverse the removal procedure. Before removing any FRUs, you must remove the rear cover and the top cover.

WARNING

Turn power to the monitor off and remove the power cord before disconnecting or replacing any FRU.

NOTE

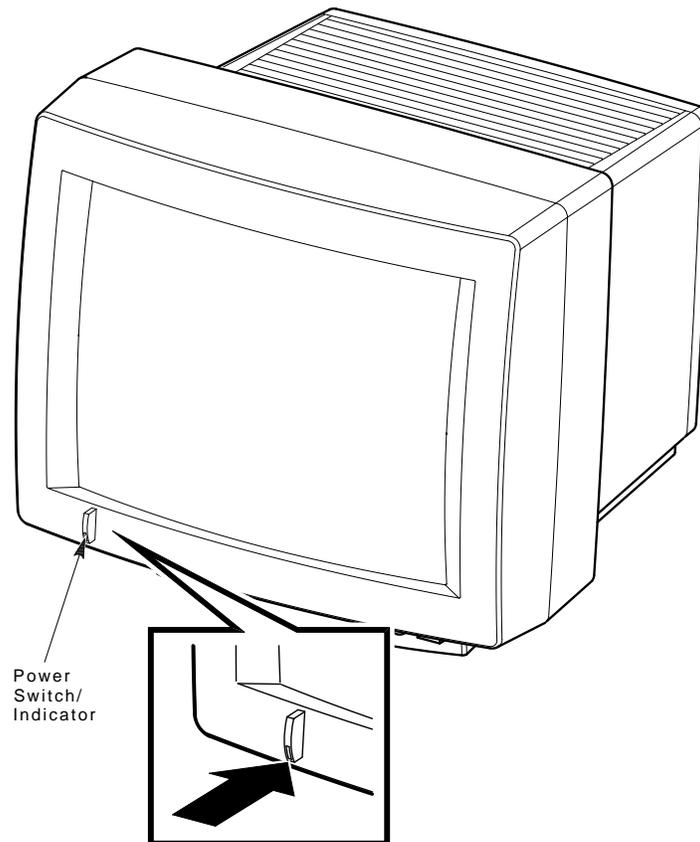
Any time you replace a video casting assembly, deflection module, or power supply module, perform all the necessary adjustments.

3-2 Removing and Replacing FRUs

3.1.1 Rear Cover Removal

Remove the rear cover as follows:

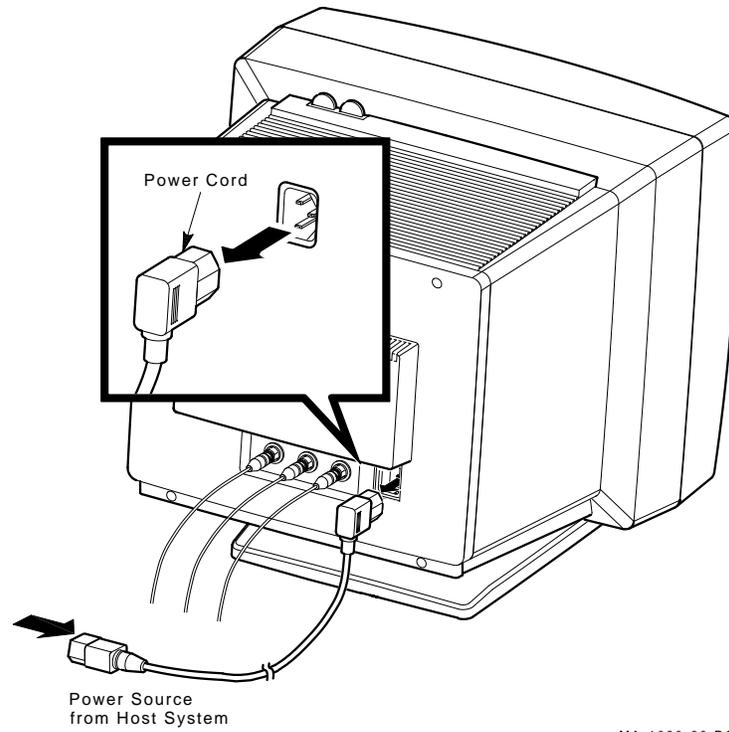
1. Turn power to the monitor off (Figure 3-1).



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Figure 3-1 Power Switch/Indicator

2. Unplug the power cord from the power source first, then from the monitor (Figure 3-2).

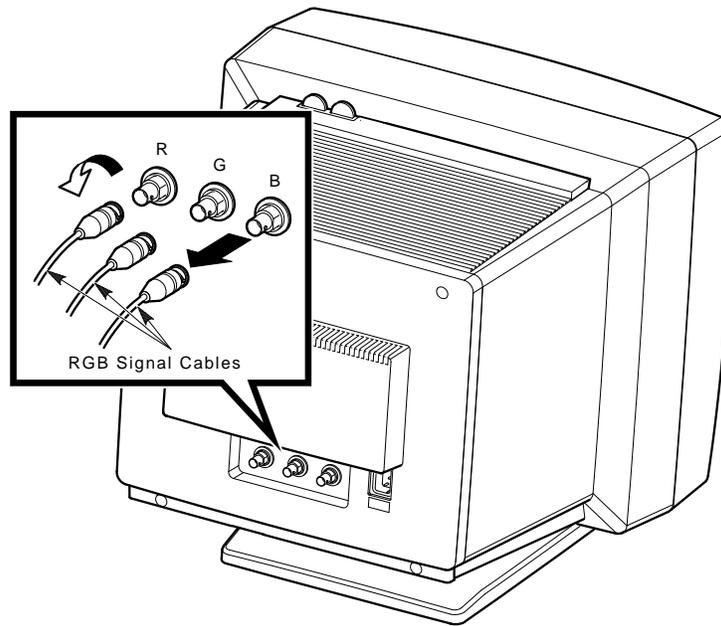


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Figure 3-2 Removing the Power Cord

3-4 Removing and Replacing FRUs

3. Remove the three signal cables from the rear of the monitor (Sample, Figure 3-3). Push each connector in and turn it left until the signal cable is released from the connector.



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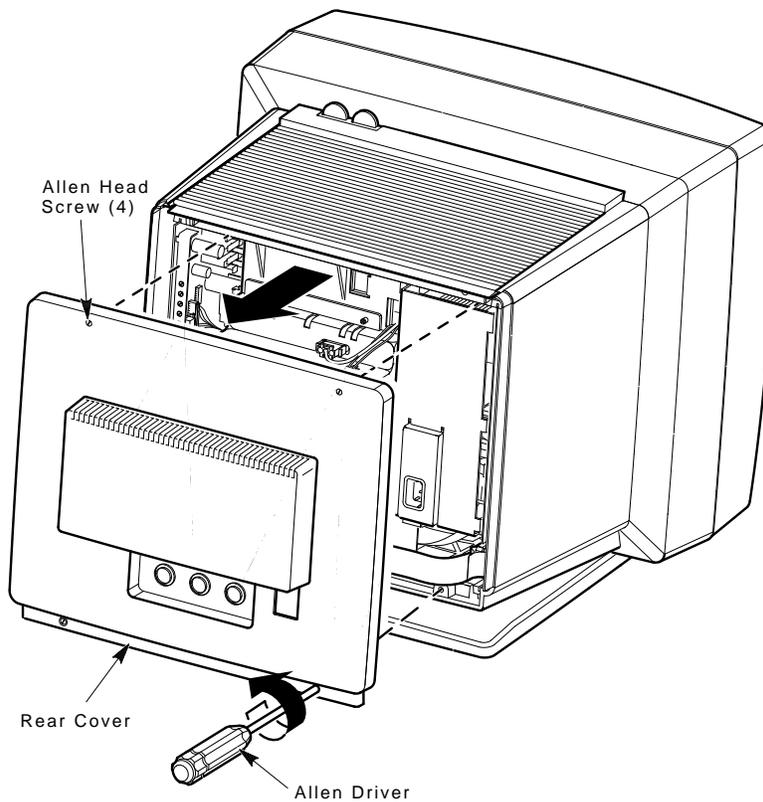
Figure 3-3 Removing the Signal Cables

4. Use a 9/32 Allen driver to *loosen* the four captive screws that hold the rear cover to the CRT/chassis assembly (Figure 3-4).

NOTE

The rear cover is difficult to pull.

5. Remove the rear cover by pulling hard on the cover.



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Figure 3-4 Removing the Rear Cover

3-6 Removing and Replacing FRUs

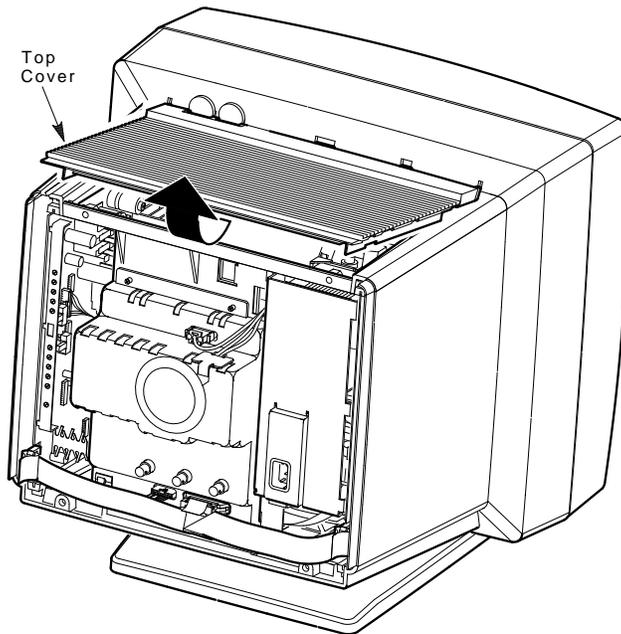
3.1.2 Top Cover Removal

Remove the top cover as follows:

NOTE

You may hear the fingerstock make a crackling noise when you tilt the cover.

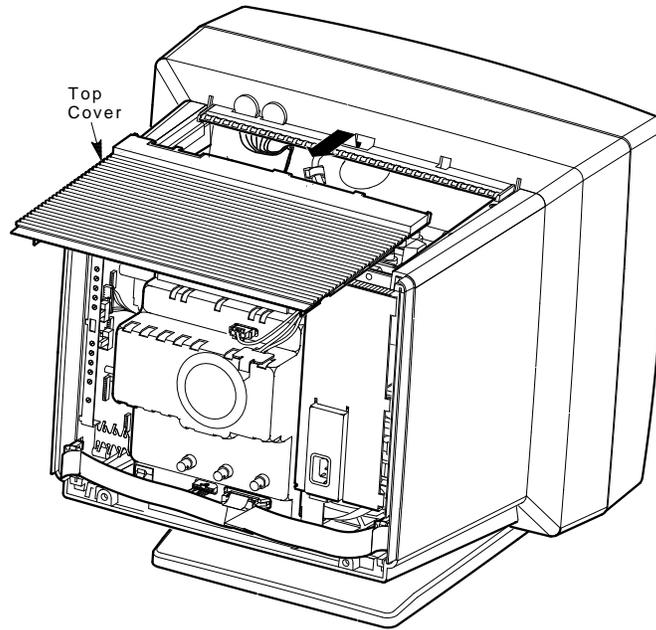
1. Remove the rear cover (Section 3.1.1).
2. Tilt the top cover up (Figure 3-5).



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Figure 3-5 Tilting the Top Cover

3. Slide the top cover toward the back of the monitor (Figure 3-6).



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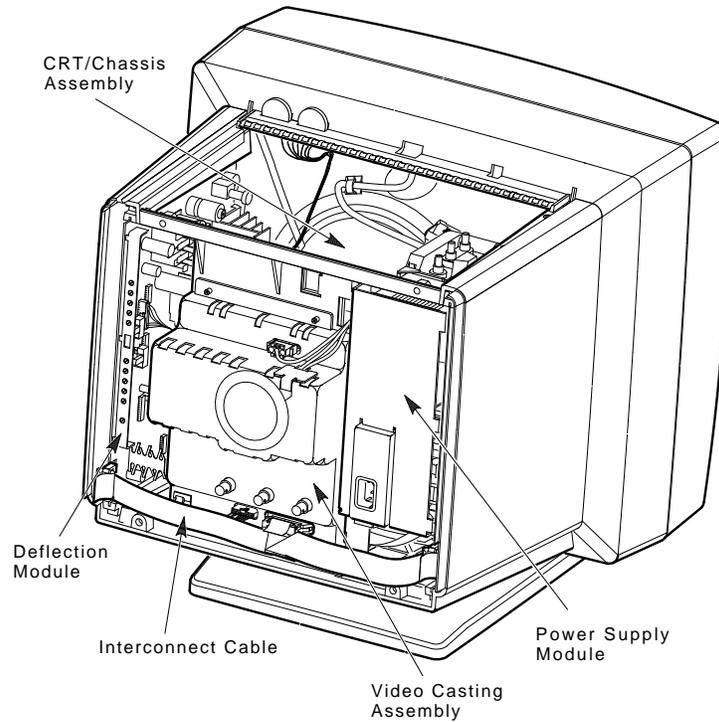
Figure 3-6 Removing the Top Cover

3.2 Field Replaceable Units (FRUs)

The FRUs in the VR320 monitor are shown in Figure 3-7. Before replacing any FRUs, see Section 3.1.

WARNING

Turn the power to the monitor off and remove the power cord before disconnecting or replacing any FRU.



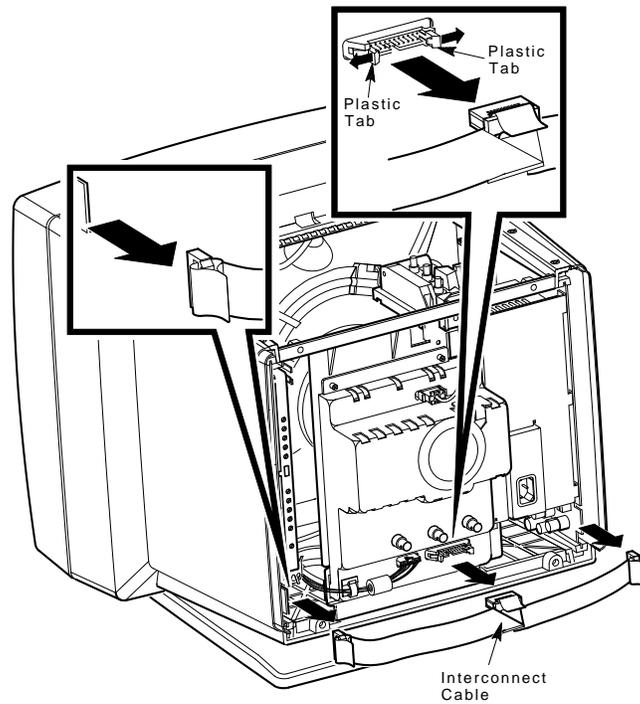
MA-1045-89.DG

Figure 3-7 VR320 Field Replaceable Units

3.2.1 Interconnect Cable Removal

Remove the interconnect cable as follows:

1. Remove the rear cover (Section 3.1.1) and the top cover (Section 3.1.2).
2. Disconnect the interconnect cable (P1) from the power supply module by pulling the connector off the module (J1).
3. Disconnect the interconnect cable (P2) from the connector (J2) on the video casting assembly by pressing the plastic tabs outward and then removing the cable.
4. Disconnect the interconnect cable (P3) from the connector (J3) on the deflection module by pulling the connector off the module (Figure 3-8).



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Figure 3-8 Removing the Interconnect Cable

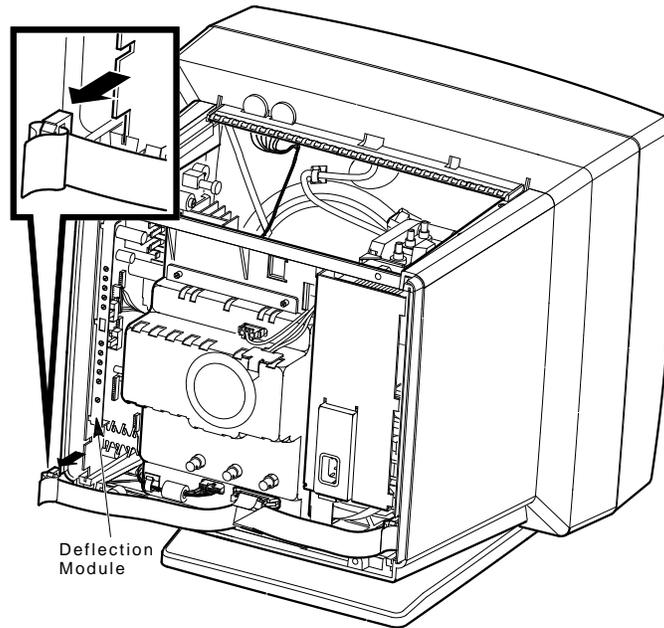
3.2.2 Deflection Module

CAUTION

Use an anti-static protection kit (PN 29-26246-00) when handling the deflection module.

Remove the deflection module as follows:

1. Remove the rear cover (Section 3.1.1) and the top cover (Section 3.1.2).
2. Disconnect the interconnect cable (P3) from the deflection module (J3) (Figure 3-9).



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Figure 3-9 Removing the Cable from the Deflection Module

3. Disconnect the 4-wire, 9-pin yoke cable (P11) ❶ by pressing the tabs on the connector (J11) (Figure 3-10).
4. Disconnect the 6-wire, 9-pin flat raster control cable (P6) ❷ by pressing the tab on top of the connector (J6).
5. Disconnect the 1-wire, 2-pin dynamic focus cable (P8) ❸ by pressing the tabson the connector (J8).

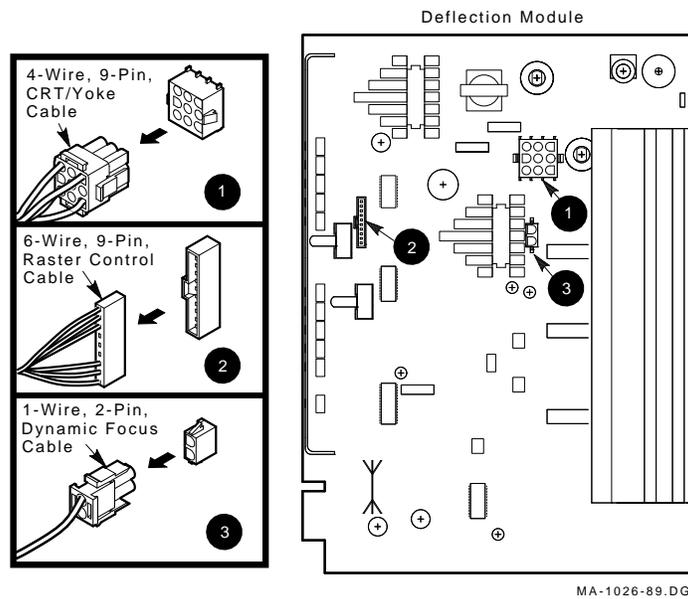


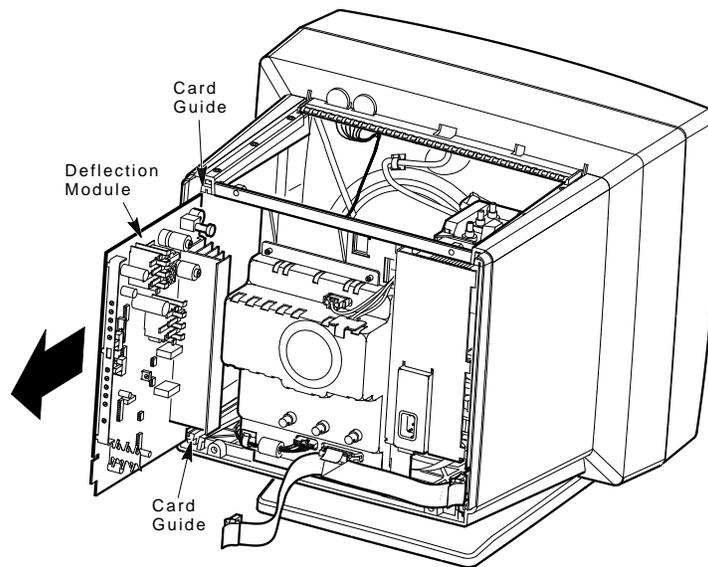
Figure 3-10 Disconnecting Cables from the Deflection Module

3-12 Removing and Replacing FRUs

NOTE

Make sure that none of the cables to the video casting assembly interfere with the removal of the deflection module.

6. Slide the deflection module out of the card guides (Figure 3-11).



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Figure 3-11 Removing the Deflection Module

NOTE

Before you replace the deflection module, make sure that the 66/72 Hz refresh switch ❶ near the left side of the module (Figure 3-12) is set correctly for your system. Check the setting on the module you are replacing and move the switch if needed as follows:

Refresh Rate	Switch Position
66 Hz	Down
72 Hz	Up

If the refresh rate is changed, check the power supply board refresh jumper setting (Section 3.2.5).

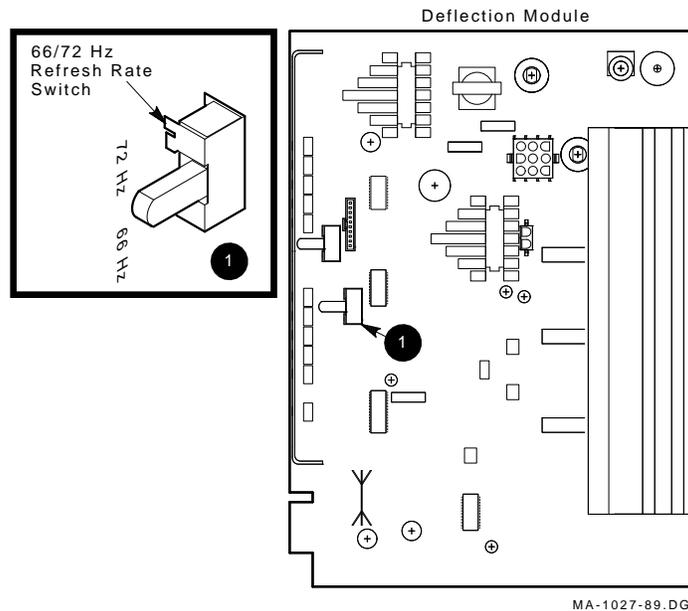


Figure 3-12 Refresh Rate Switch on the Deflection Module

NOTE

Before replacing the deflection module, hold and guide the 4-wire, 9-pin cable with one hand and replace the module in the card guides with the other hand.

3.2.3 Discharging the CRT

You must discharge the CRT before removing the following FRUs:

- Power supply module
- Video casting assembly
- CRT/chassis assembly

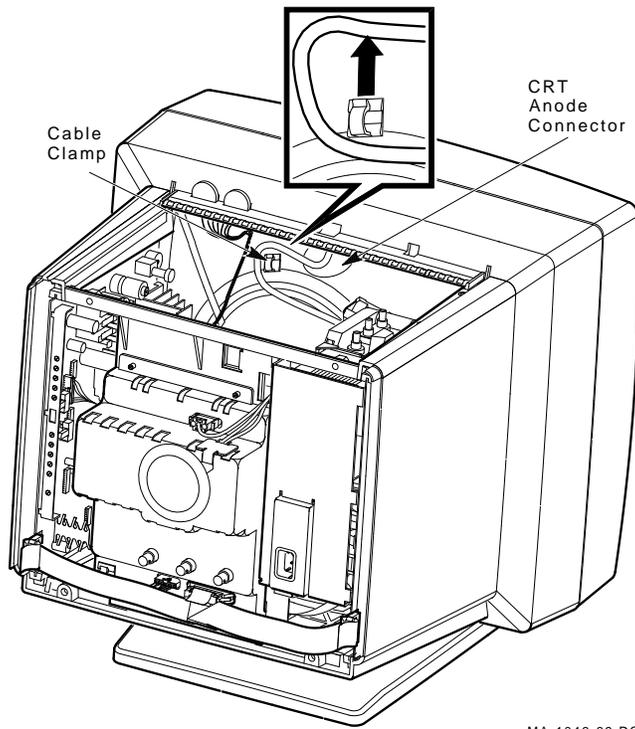
Discharging the CRT is a process that drains to ground any voltages that remain in the CRT and in the extra-high tension (EHT) cable after turning power off.

WARNING

The following steps expose you to the CRT anode, which may store a high voltage.

Discharge the CRT as follows:

1. Remove the rear cover (Section 3.1.1).
2. Remove the top cover (Section 3.1.2).
3. Remove the CRT anode cable from the cable clamp (Figure 3-13).



MA-1046-89.DG

Figure 3-13 Removing the CRT Anode Cable from the Clamp

3-16 Removing and Replacing FRUs

4. Attach the clip end of the anode discharge tool (PN 29-24717-00) to the metal on the power supply or the video casting assembly (Figure 3-14). (Do not put the clip on the painted surface of the monitor.)

WARNING

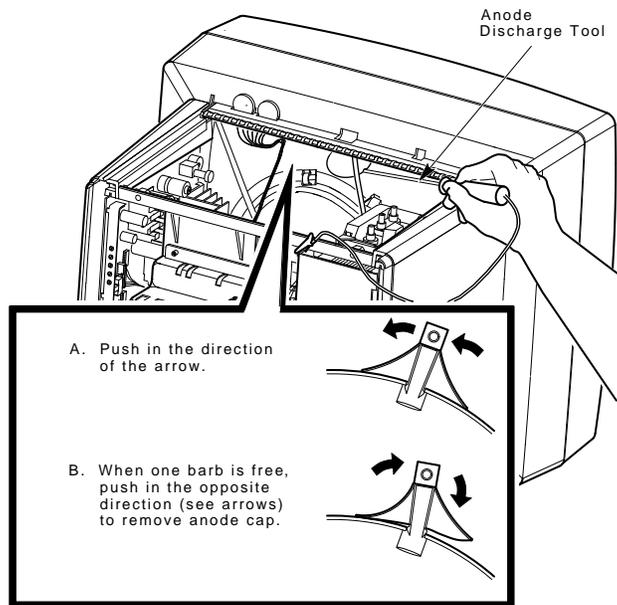
Keep your free hand away from any part of the monitor during the anode discharge process.

5. Using one hand, carefully slip the anode discharge tool under the CRT anode connector cup until it touches the connector prongs. Maintain contact for at least 10 seconds.

CAUTION

When you use the anode discharge tool, do not tap the CRT. Avoid scratching or marring the CRT glass when you insert or remove the tool.

6. Using one hand, remove the CRT anode cap by pushing it in one direction until one barb is free, then push it in the opposite direction (Figure 3-14).



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Figure 3-14 Discharging and Removing the CRT Anode

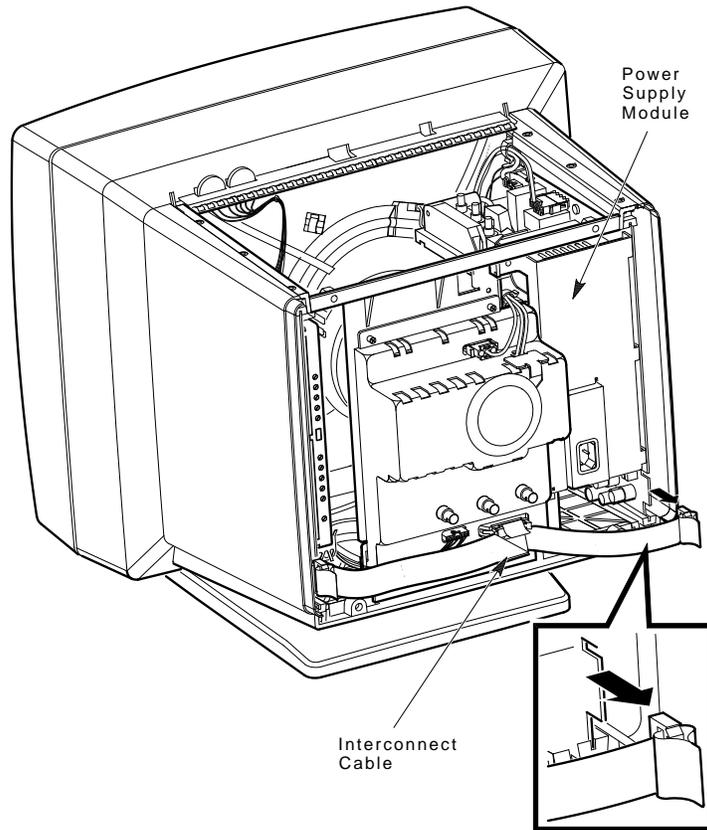
3.2.4 Power Supply Module Removal

Remove the power supply module as follows:

WARNING

You must discharge the CRT (Section 3.2.3) before removing the power supply module.

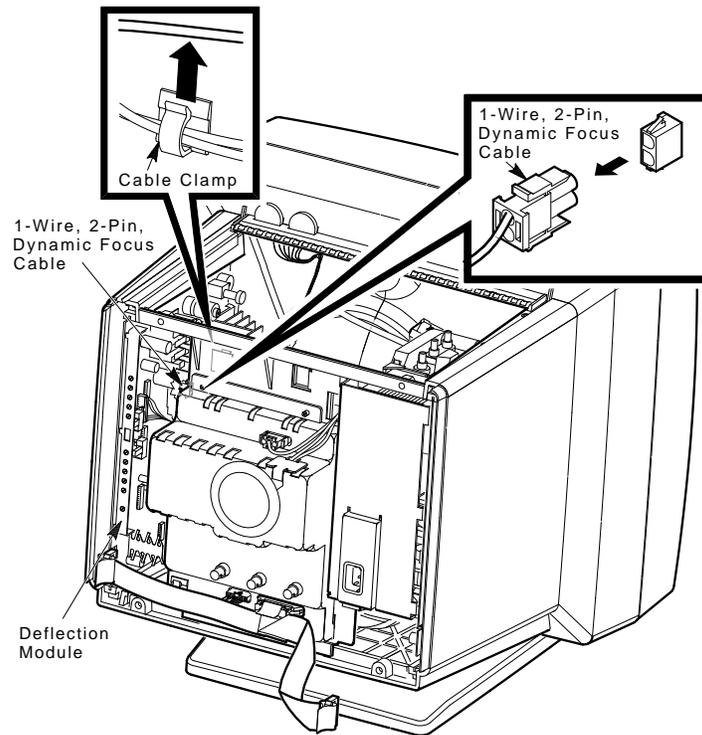
1. Remove the rear cover (Section 3.1.1) and the top cover (Section 3.1.2).
2. Disconnect the interconnect cable (P1) at the power supply (J1) (Figure 3-15).



MA-1037-89.DG

Figure 3-15 Removing the Interconnect Cable from the Power Supply

3. Disconnect the 1-wire, 2-pin dynamic focus cable (P8) from the deflection module by pressing the tabs on the connector (J8) (Figure 3-16).
4. Remove the 1-wire, 2-pin dynamic focus cable from the cable clamp on the inside wall of the video area.
5. Move the 1-wire, 2-pin dynamic focus cable over the yoke to the power supply side.



MA-1049-89.DG

Figure 3-16 Removing the Dynamic Focus Cable

3-20 Removing and Replacing FRUs

6. Disconnect the 4-wire, 4-pin degauss cable (P10) ❶ from the power supply module by pressing the tabs on the connector (J10) (Figure 3-17).

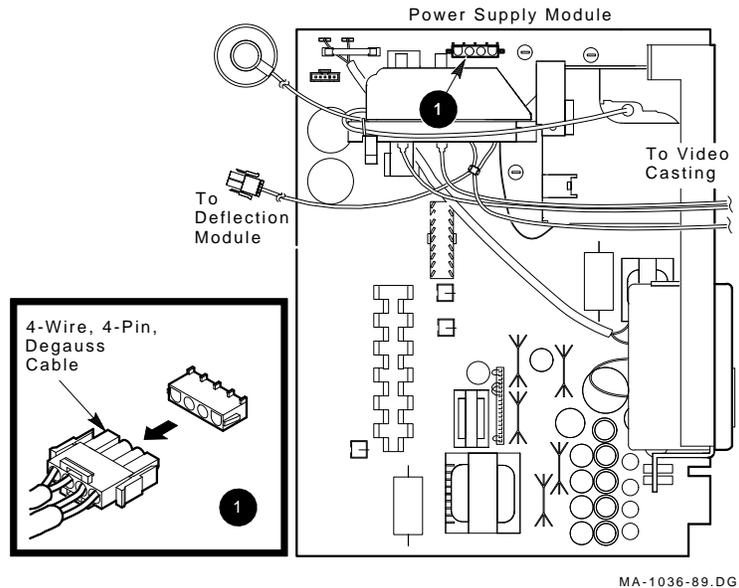
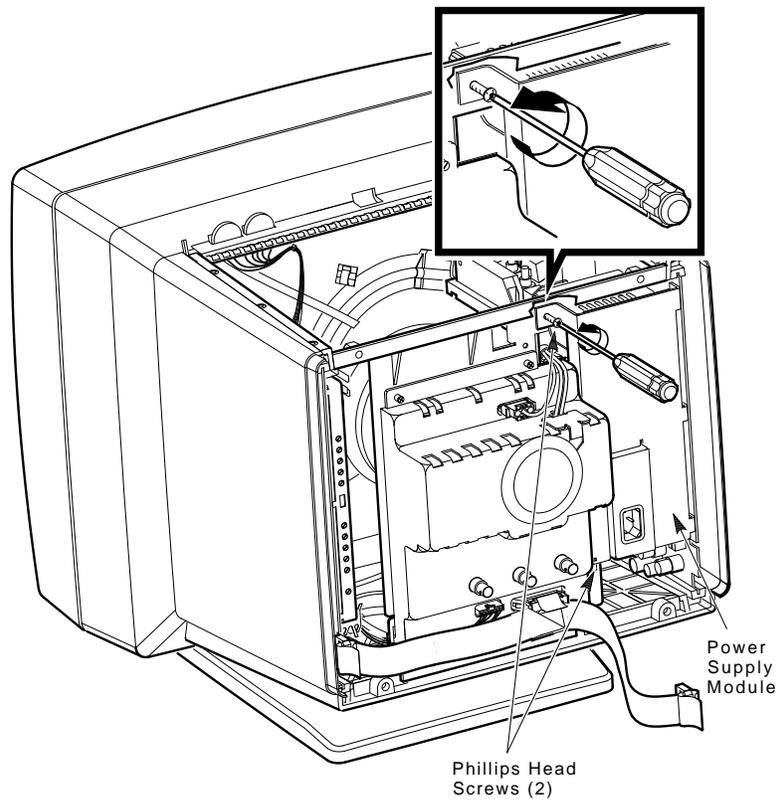


Figure 3-17 Removing the Degauss Cable from the Power Supply

7. Loosen the two screws on the power supply module (Figure 3-18).

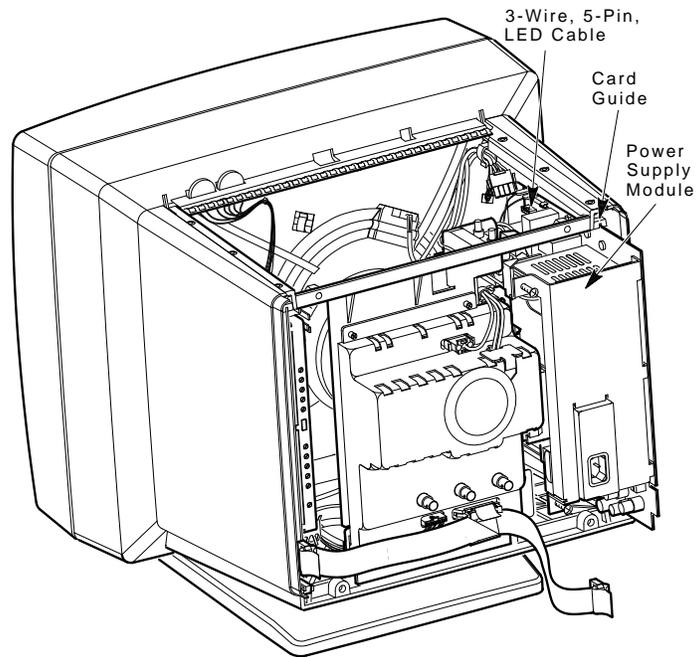


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Figure 3-18 Loosening the Power Supply Screws

3-22 Removing and Replacing FRUs

8. Slide the power supply partially out to expose the 3-wire, 5-pin LED cable (Figure 3-19).



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Figure 3-19 Sliding the Power Supply Out (Partially)

9. Disconnect the 3-wire, 5-pin LED cable ❶ from the power supply module by pressing the tab on top of the connector (Figure 3-20).

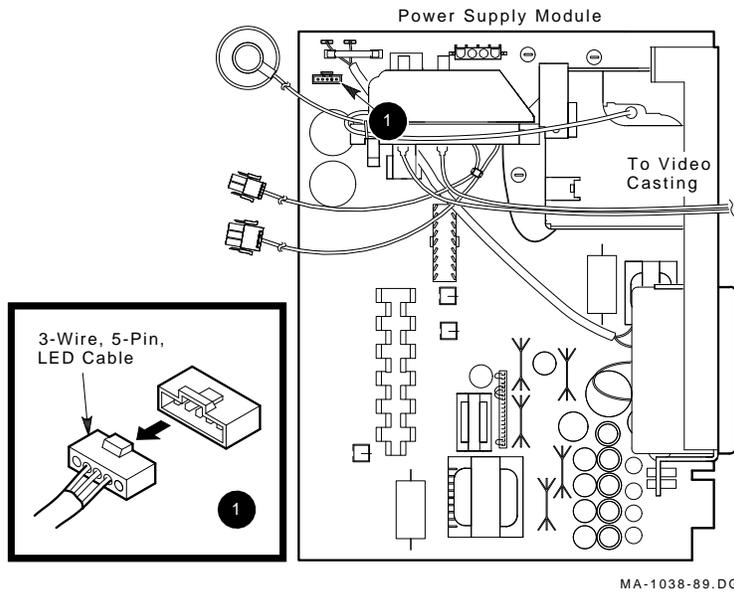


Figure 3-20 Removing the LED Cable from the Power Supply

3-24 Removing and Replacing FRUs

10. Remove the 1-wire, 3-pin focus pack cable and the two focus cables from the cable clamp on the upper right side of the video casting assembly (Figure 3-21).
11. Disconnect the 1-wire, 3-pin focus pack (P7) cable from the top of the video casting by pressing the tabs on the connector (J7).

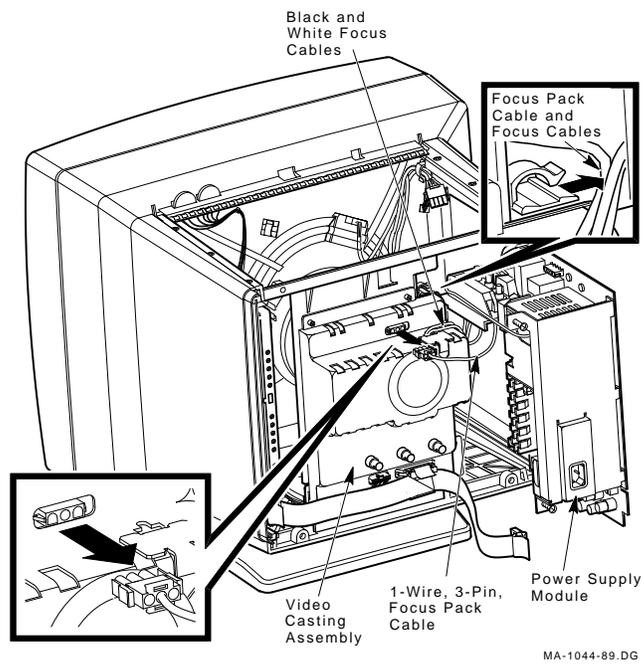
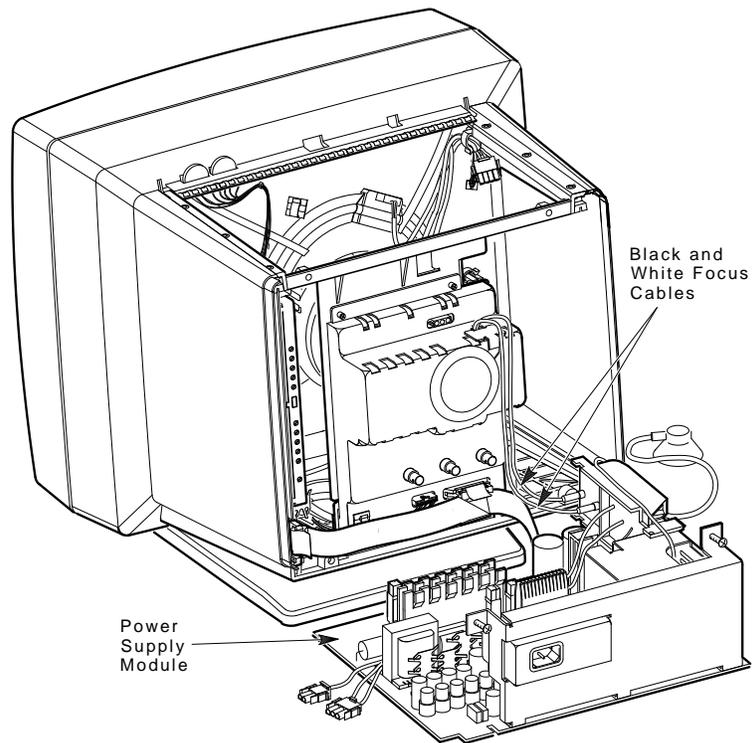


Figure 3-21 Disconnecting the Focus Pack and Focus Cables

12. Carefully slide the power supply module (with the two focus cables still attached) out of the card guide (Figure 3-22).
13. Place the power supply on a flat surface close to the monitor.



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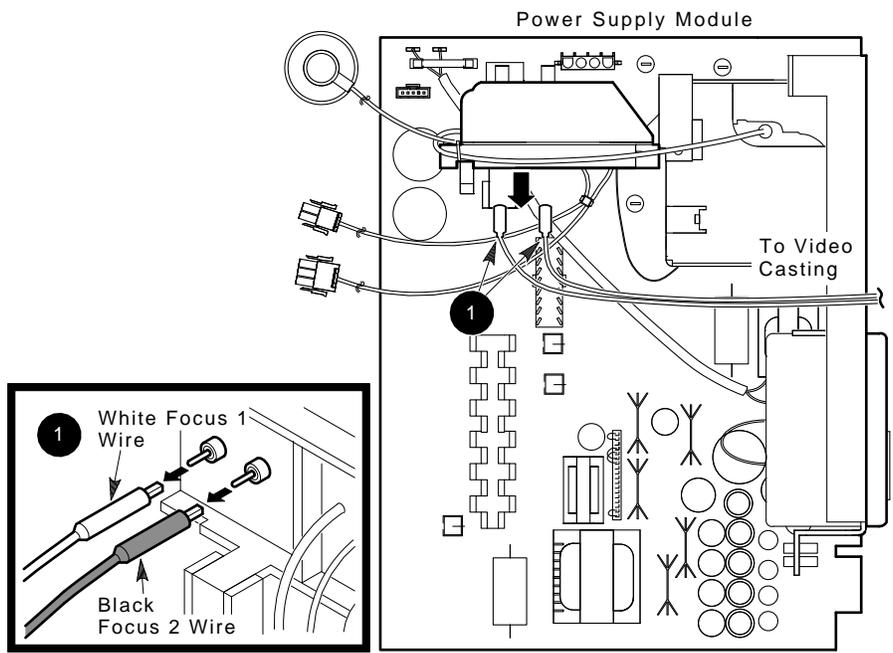
Figure 3-22 Removing the Power Supply

3-26 Removing and Replacing FRUs

14. Disconnect the white wire for focus 1 and the black wire for focus 2 from the focus pack (Figure 3-23).

NOTE

Carefully guide the power supply cabling when removing and replacing the power supply.



MA-1039-89.DG

Figure 3-23 Removing the Focus Wires

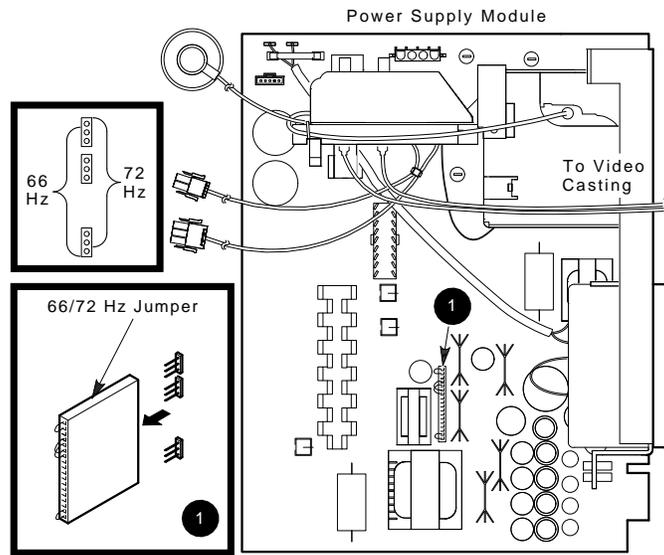
3.2.5 Power Supply Module Replacement

NOTE

Before replacing the power supply, verify that the 66/72 Hz refresh rate jumper (Figure 3-24) is set correctly for your system.

Refresh Rate	Move Jumper to Cover
66 Hz	Bottom pins (Top pin is free.)
72 Hz	Top pins (Bottom pin is free.)

If the refresh rate is changed, check the setting of the deflection module refresh switch, (Figure 3-12.)



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Figure 3-24 Refresh Rate Jumper on the Power Supply

3-28 Removing and Replacing FRUs

Replace the power supply module as follows:

1. Pull back the rubber boot on the white wire for focus 1 to expose the connector (Figure 3-25).
2. Connect the white wire for focus 1 until you see it snap into place.
3. Push forward the focus 1 boot sleeve.
4. Pull back the rubber boot on the black wire for focus 2 to expose the connector.
5. Connect the black wire for focus 2 until you see it snap into place.
6. Push forward the focus 2 boot sleeve.

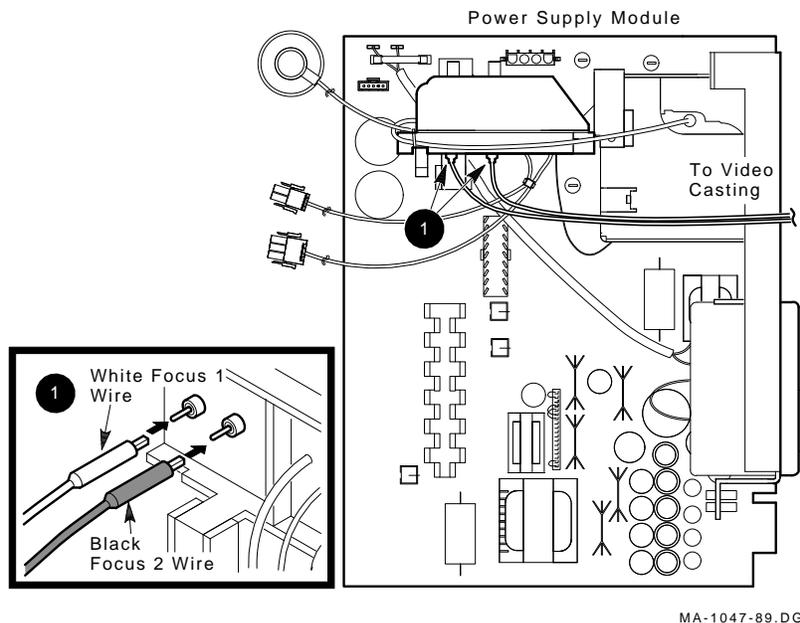


Figure 3-25 Attaching the Focus Wires to the Power Supply

7. Connect the 3-pin, 1-wire cable (P7) to J7 of the video casting assembly.
8. Place the anode cable and dynamic focus cable in front of the power supply before inserting the power supply in the card guides.
9. Slide the power supply in the card guides approximately 1/4 of the way.
10. Place the focus 1 and focus 2 wires and the dynamic focus cable in the cable clamp to the right of the video casting assembly.
11. Put the dynamic focus cable into the clamp on the rear wall of the monitor behind the video casting assembly.
12. Connect the 5-pin, 3-wire LED cable.

NOTE

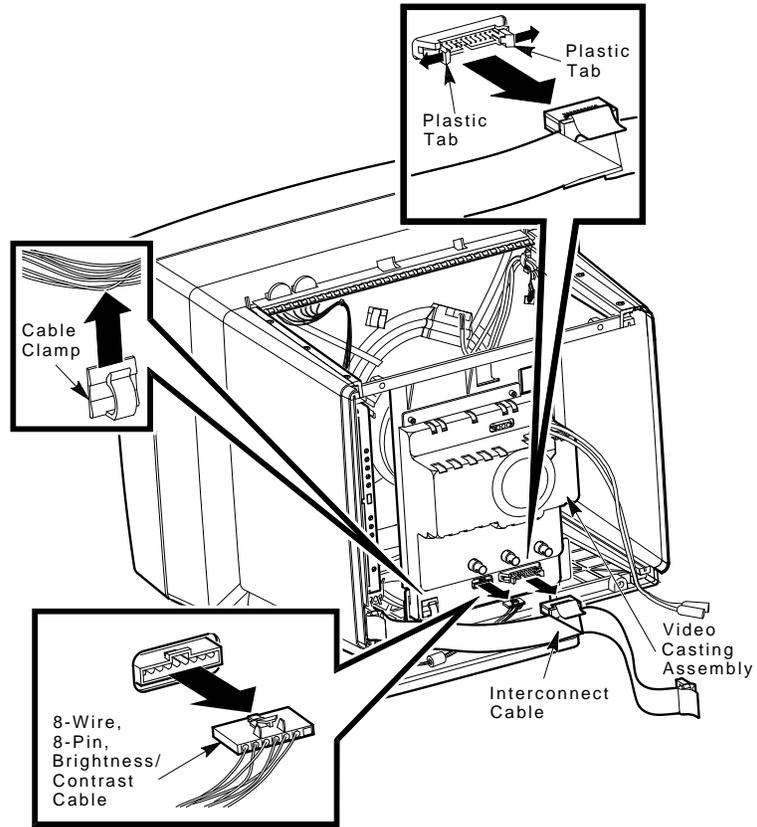
Handle the anode cable carefully and guide it when sliding the power supply in the card guides.

13. Carefully slide the power supply in the card guides.
14. Connect the 4-pin, 4-wire power switch cable (P4) to J4.
15. Attach the 2-pin, 1-wire dynamic focus wire to the deflection module.
16. Connect the interconnect cable to the power supply (see Figure 3-15).
17. Connect the anode cable (P11) to the CRT and place the anode cable into the cable clamp that is on the tube.
18. Tighten the screws on the power supply.

3.2.6 Video Casting Assembly

Remove the video casting assembly as follows:

1. Remove the rear cover (Section 3.1.1).
2. Remove the top cover (Section 3.1.2).
3. Discharge the CRT anode (Section 3.2.3).
4. Remove the power supply (Section 3.2.4).
5. Disconnect the interconnect cable (P2) at the video casting assembly (J2) by pressing the plastic tabs outward and then removing the cable (Figure 3-26).
6. Disconnect the 8-wire, 8-pin brightness/contrast/degauss cable (P5) by pressing the tab on top of the connector (J5).
7. Remove the 8-wire, 8-pin brightness/contrast/degauss cable from the cable clamp on the bottom of the video casting assembly.

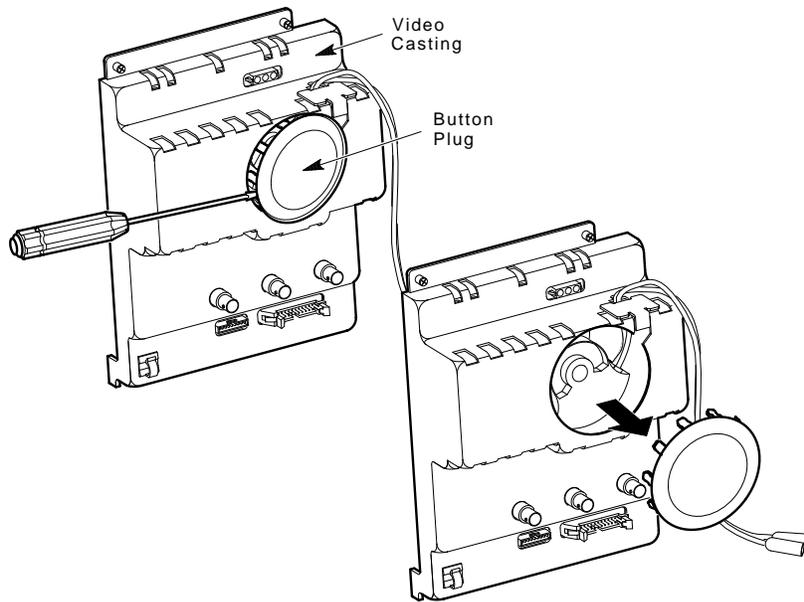


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Figure 3-26 Removing Cables from the Video Casting

3-32 Removing and Replacing FRUs

8. Pry the button plug off the video casting assembly with a flat-blade screwdriver (Figure 3-27).



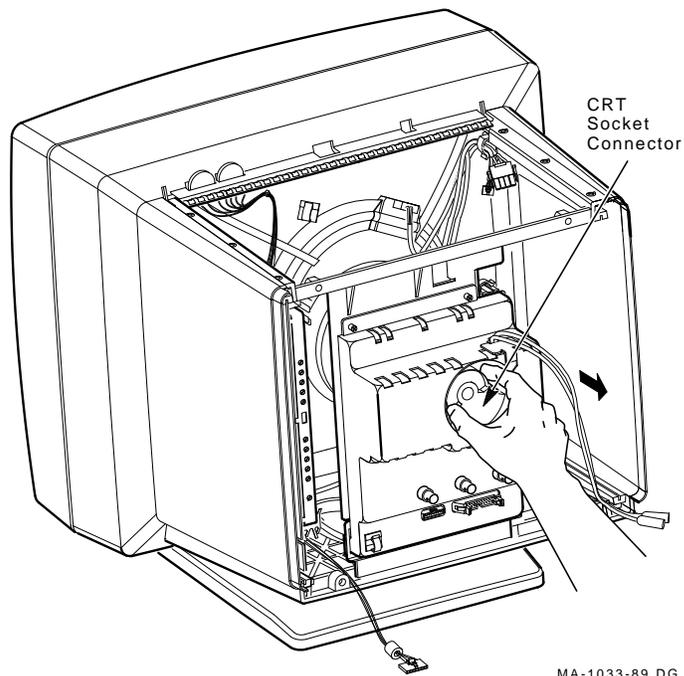
MA-1032-89.DG

Figure 3-27 Removing the Plug from the Video Casting

9. Reach in and pull the CRT socket connector straight toward you and off the pins (Figure 3-28).

CAUTION

Use care not to bend the pins when you disconnect the CRT socket from the neck of the CRT.

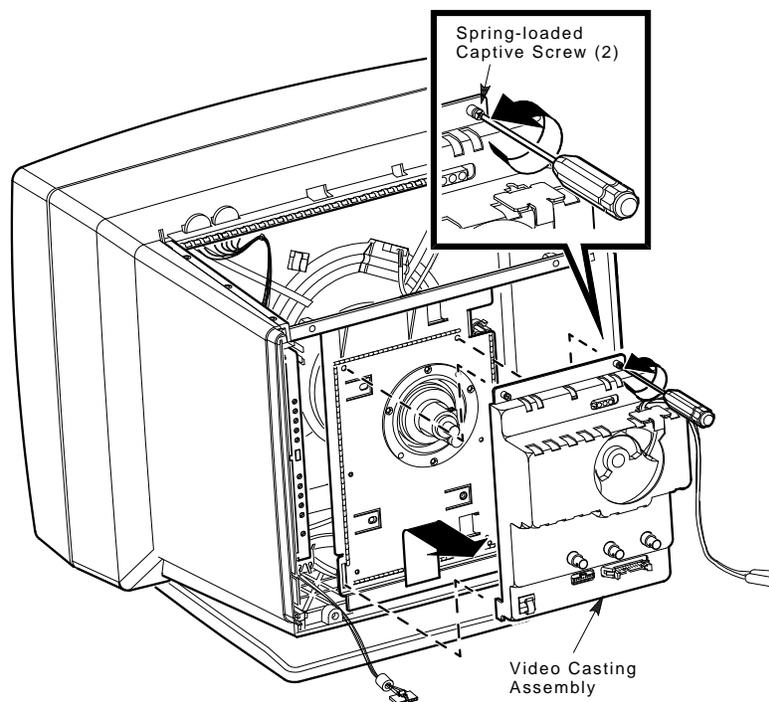


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Figure 3-28 Removing the CRT Socket Connector

3-34 Removing and Replacing FRUs

10. Loosen the two spring-loaded captive screws until they spring out towards you (Figure 3-29). The screws hold the video casting assembly to the chassis.
11. Gently pull the top of the video casting assembly toward you.
12. Gently lift the video enclosure assembly up and out of the chassis.



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Figure 3-29 Removing the Video Casting

CAUTION

When you install the video casting assembly, carefully, but firmly, push the CRT socket connector onto the CRT neck until it stops. Use care not to bend the pins during this procedure.

When replacing FRUs, install the video casting assembly before installing the power supply.

3.2.7 CRT/Chassis Assembly

Remove the CRT/chassis assembly as follows:

1. Remove the rear cover (Section 3.1.1).
2. Remove the top cover (Section 3.1.2).
3. Remove the deflection module (Section 3.2.2)

WARNING

You must discharge the CRT (Section 3.2.3) before removing the following FRUs.

4. Remove the power supply module (Section 3.2.4).
5. Remove the video casting assembly (Section 3.2.6).

3.3 CRT Disposal (Trained Service Personnel Only)

This section describes how to safely dispose of the monitor CRT. CRTs are glass vacuum tubes. Because air pressure outside the tube is greater than air pressure inside, there is always the possibility of accidental implosion.

WARNING

You must handle CRTs very carefully to avoid accidental implosion and shattering glass. Use the following guidelines and disposal procedure to remove and dispose of a CRT. These guidelines and procedure are Digital policy for all CRTs more than 7.6 cm (3 in) in diameter.

NOTE

This procedure supersedes all other tech tips about replacing and disposing of CRTs. This procedure is for Digital personnel only and is not intended for use by OEM and self-maintenance customers.

Location

Work in areas where risks and exposure are limited to trained Digital personnel. Only Digital personnel should be in the area during CRT removal and replacement.

Handling a CRT

- Never handle the CRT by the neck. Always use two hands and hold the CRT by the sides near the face.
- Keep the CRT away from your body during handling.
- Do not let the neck strike anything.
- Do not rest the CRT on its neck.
- Do not let the CRT touch any tools, such as screwdrivers and soldering irons.

Stocking and Storage

All CRTs must be kept in a closed container or mounted in the device cabinetry.

CRT Disposal

Use the following procedure to safely dispose of CRTs. Always perform this procedure at a Digital facility.

WARNING

Do not dispose of any CRT until it is rendered inoperative and safe to dispose.

Never perform the following disposal procedure at the customer site. Return the defective CRT to the local Digital facility for disposal.

At the Digital facility you must:

- Clear the area of nonessential personnel.
- Have a second person in the area in case of emergency.
- Wear safety goggles (PN 29-16141-00).
- Wear gloves (PN 29-16146-00).
- Use pliers.

WARNING

To avoid injury to your eyes or hands, always wear goggles and gloves when you work with a CRT. Never handle pieces of phosphor-coated glass without wearing protective gloves.

Before you perform the following procedure, remove the FRUs listed in Section 3.2.7.

1. Place the old CRT/chassis assembly and the packing material in the container from which you removed the new CRT/chassis assembly.
2. Using pliers, slowly crush, **but do not snap**, the evacuation point (Figure 3-30). Do not move or disturb the CRT until the hissing sound of in-rushing air has stopped.

CAUTION

Use care not to break the unprotected glass area of the CRT neck that surrounds the evacuation point.

NOTE

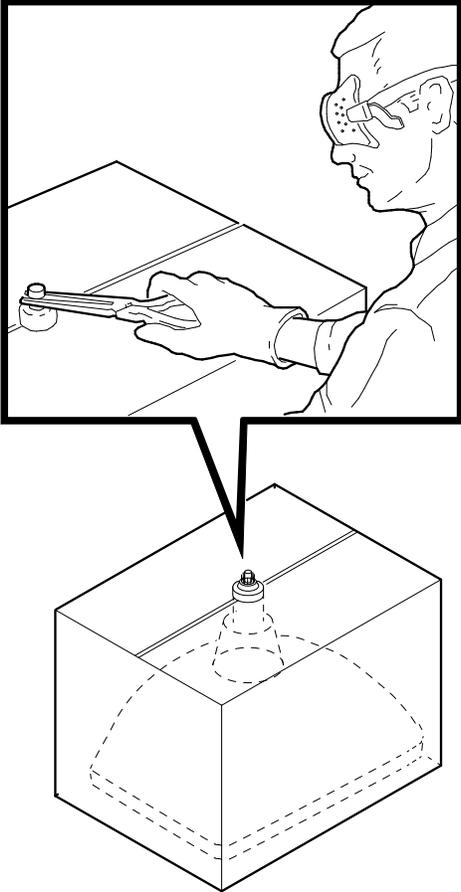
The evacuation point is a protrusion that extends from the circular area defined by the CRT neck pins. The glass protrusion is sometimes encased in a protective plastic cap, and more force is required to crush it.

3. Seal the carton with packing tape and dispose of it in the Digital site trash receptacle.

NOTE

The safe "gassing" of the CRT is necessary to prevent liability and safety problems that may arise from accidental CRT implosion.

3-38 Removing and Replacing FRUs



MA-X0667-88

Figure 3-30 Crushing the Evacuation Point

4

Aligning the Video Monitor

4.1 Introduction

This chapter describes how to align the monitor. You do not have to perform every adjustment procedure each time you align the monitor; however, you should check all adjustments in the order shown because many adjustments affect each other. If a setting is already correct, you can skip that adjustment and go on to the next one.

See Section 4.1.1 to prepare the monitor for adjustments. You must use the screen alignment test patterns to make all adjustments. Refer to your host system documentation to set up test patterns.

Use a metric measuring tape (PN 29-25342) to measure the dimensions of the screen display. To avoid scratching the screen with the tape's metal clip, start the measurement at 10 cm. Use a video alignment tool to make all adjustments except when noted. Make sure all adjustments are made under these conditions.

4.1.1 Before You Start

NOTE

If a customer calls with a display quality type of problem, ask the customer to leave the monitor on until you arrive. Then, after removing the rear enclosure, only a five minute warm-up is needed.

NOTE

Before you start any adjustment procedures, be sure the power supply module and the deflection module are configured for the correct refresh rate setting (66 Hz or 72 Hz) for your system. See Chapter 3 for the locations of the refresh rate jumper and switch.

4-2 Aligning the Video Monitor

Clean the Monitor

To clean the monitor, use a soft tissue or cloth and a non-abrasive, non-flammable glass cleaner, or use Digital's video screen cleaner, PN VT3XX-SC.

Prepare the Monitor

Before you perform adjustments, prepare the monitor as follows:

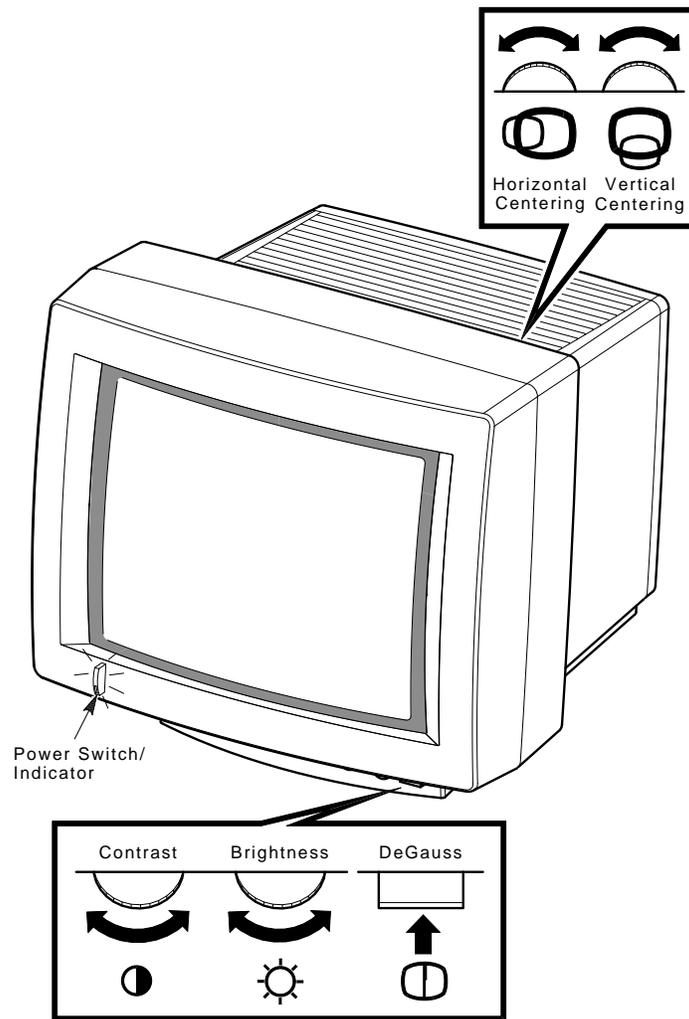
1. Place the monitor on a nonconductive surface.
2. Remove the rear cover (Section 3.1.1)
3. Remove the top cover (Section 3.1.2).
4. Connect the video cables.
5. Connect the power cord.
6. Turn power to the monitor on. Wait for a video display on the screen.
7. Verify that the user controls on the top of the monitor are at the center position of the thumbwheels.
8. Slide the deflection module out 1/2 inch to read the labels for the adjustment potentiometers.
9. Rotate the monitor so the adjustments are on the right and the screen to view the test pattern is on the left.

4.1.2 Displaying Screen Tests

The procedures in this chapter refer to the circle-crosshatch pattern and the central rectangle patterns which are described in Appendix A. Display them on the screen as needed by using the procedures for the host system. Refer to the host system service guide for accessing the diagnostic screen patterns.

4.2 Monitor Adjustments

Let the monitor warm up for at least 20 minutes before performing any adjustments. The warm-up time ensures that the electron guns are at a stable temperature before you do any adjustments. The user adjustments are shown in Figure 4-1.



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Figure 4-1 User Adjustments

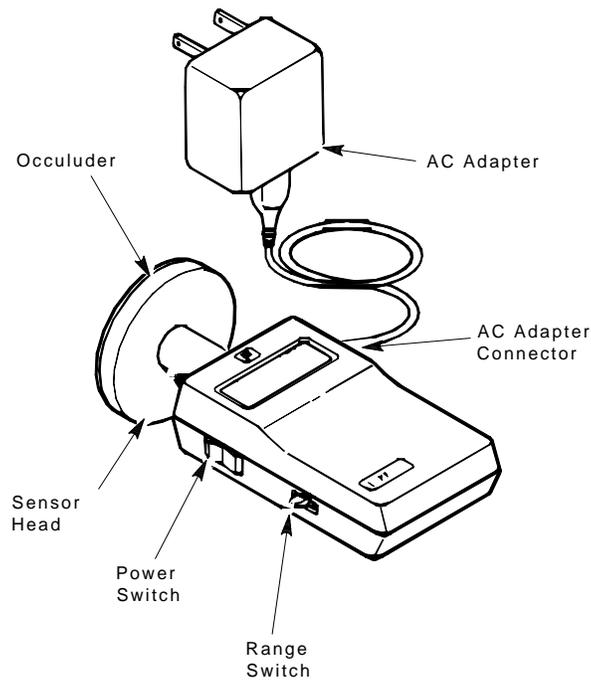
4.3 Using the Radiance Meter

Use the radiance meter as follows:

1. Remove the protective cap from the radiance meter sensor head and connect the occluder to the radiance meter (Figure 4-2).

CAUTION

Avoid excessive force when tightening the occluder or you may damage the radiance meter. Do not touch the exposed filter after the protective cap is removed.



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Figure 4-2 Radiance Meter

2. Connect the ac line adapter to the radiance meter and plug it into a wall outlet. Ensure that the radiance meter is in calibration.
3. Turn on the power switch.

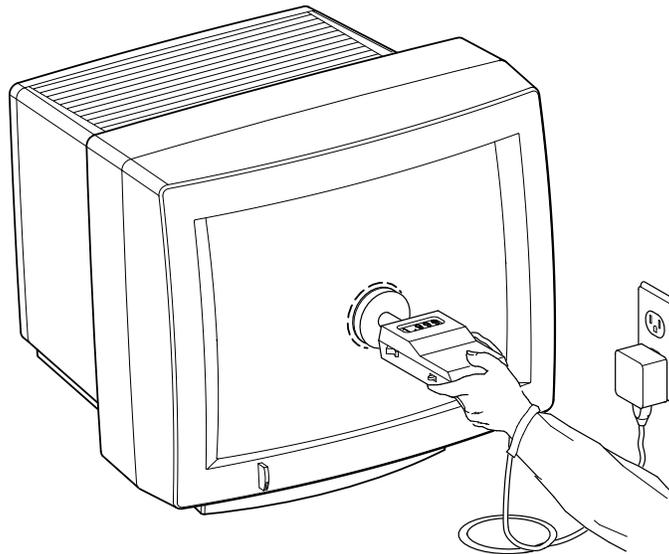
NOTE

Do not use the POWER ON W/BACKLIGHT position when you are using the radiance meter with batteries.

4. Set the range switch to the second position from the top (1.999).
5. Place the occluder firmly against the center of the screen (Figure 4-3). Use a red china pencil and draw a circle around the occluder.

NOTE

You must take all meter readings with the meter centered in this arc or circle.

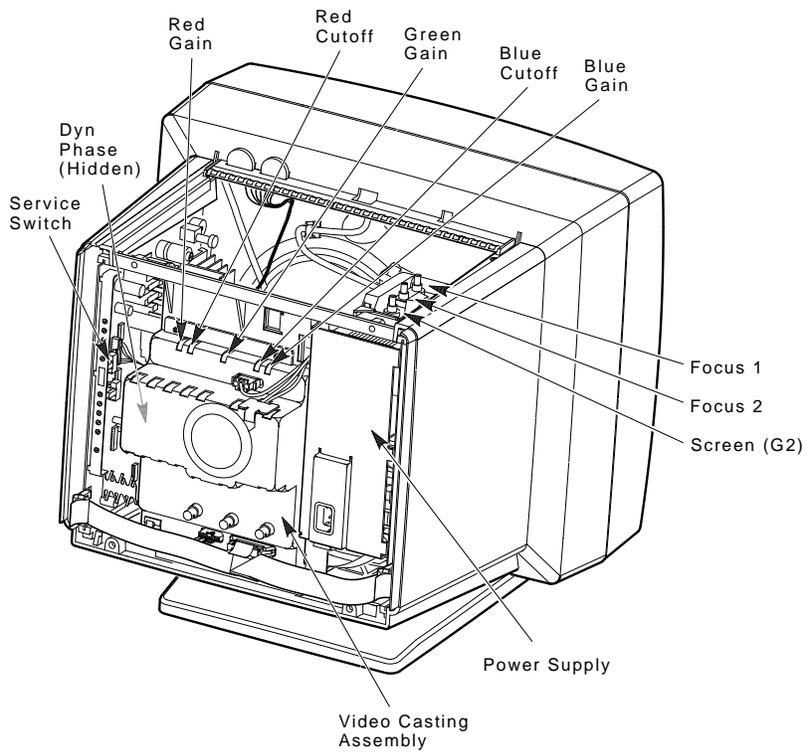


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Figure 4-3 Using the Radiance Meter

4.4 Color Adjustments

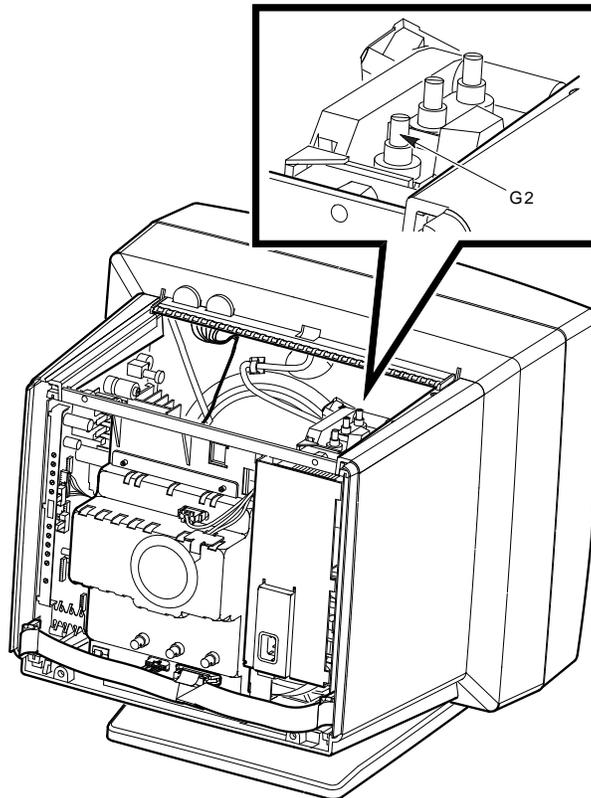
Figure 4-4 shows the location of the controls used to make the color adjustments.



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Figure 4-4 Color Adjustment Controls

1. Set the G2, or SCREEN, to minimum (counterclockwise) (Figure 4-5).



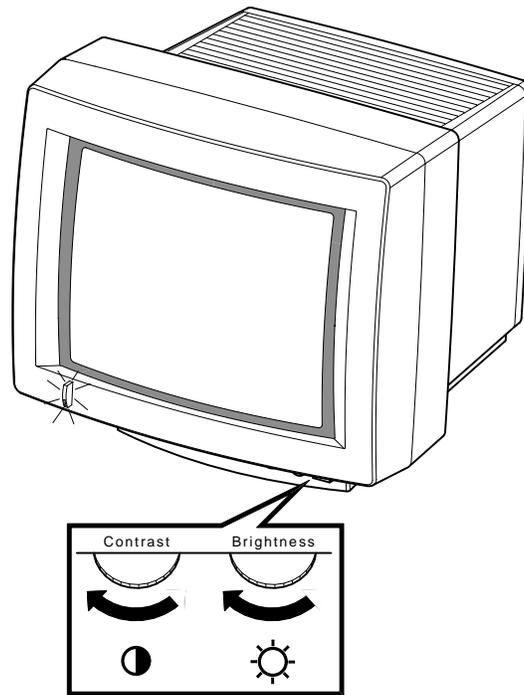
MA-1051-89.DG

Figure 4-5 G2 Adjustment

2. Set the following controls on the video enclosure assembly to minimum (counterclockwise):
 - Red cutoff (R.CUTOFF or RC)
 - Blue cutoff (B.CUTOFF or BC)
 - Red gain (R.GAIN or RG)
 - Green gain (G.GAIN or GG)
 - Blue gain (B.GAIN or BG)

4-8 Aligning the Video Monitor

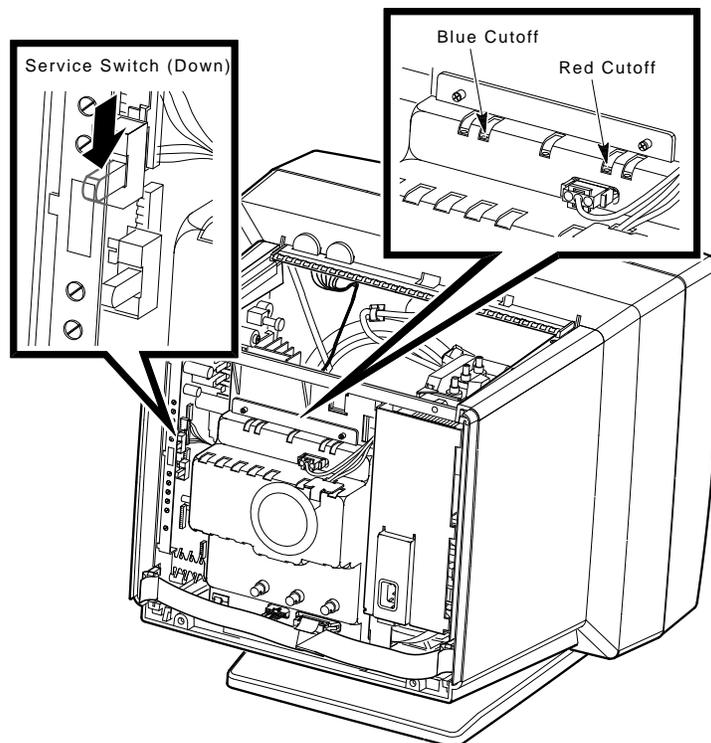
3. Use the blank raster pattern for the following steps.
4. Set the brightness and contrast controls (Figure 4-6) to maximum (clockwise).



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Figure 4-6 Brightness and Contrast Controls

5. Slowly turn the G2, or SCREEN, (Figure 4-5) clockwise until the radiance meter shows a value of .002 to .004; the raster is not visible.
6. Set brightness to minimum (counter-clockwise).
7. The screen should be totally blank; if not, repeat steps 1 through 6.
8. Set the service switch (Figure 4-7) on the deflection module to SERVICE (down position).



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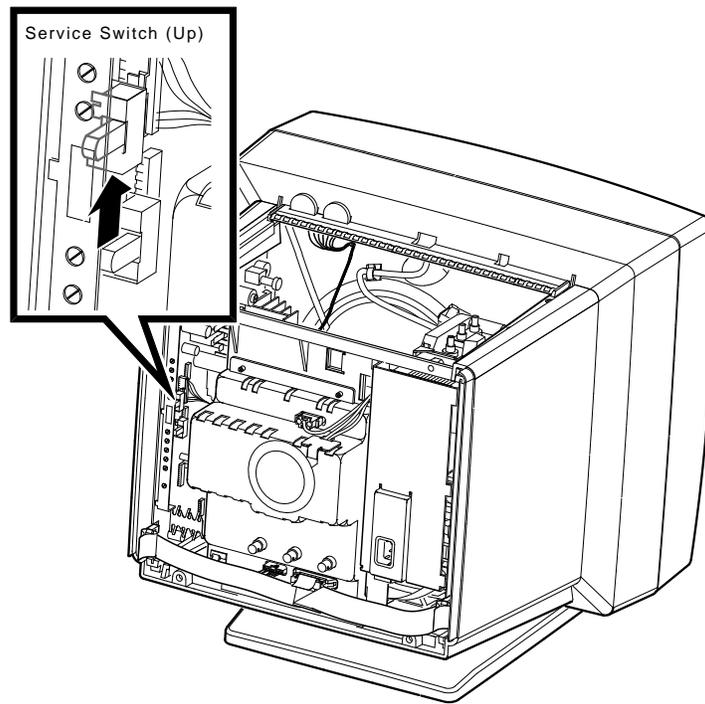
Figure 4-7 Service Switch and Blue and Red Cutoff

4-10 Aligning the Video Monitor

NOTE

Cutoff is the point of operation in a CRT where current does not flow. Adjust and ensure that the cutoff controls are set equally.

9. To adjust the green cutoff, turn the brightness control until a horizontal green line is visible in the middle of the screen. Turn the brightness control *just until the green line disappears*. Do not turn the control too far.
10. To adjust the red cutoff, turn the red cutoff (R.CUTOFF) on the video enclosure assembly until a horizontal red line is visible in the middle of the screen. Turn the cutoff *just until the red line disappears*. Do not turn the control too far.
11. To adjust the blue cutoff, turn the blue cutoff (B.CUTOFF) on the video enclosure assembly until a horizontal blue line is visible in the middle of the screen. Turn the cutoff *just until the blue line disappears*. Do not turn the control too far.
12. Set the service switch (Figure 4-8) to its normal position (up position). Turn the brightness and contrast to normal viewing settings.



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Figure 4-8 Setting Service Switch to Normal Position

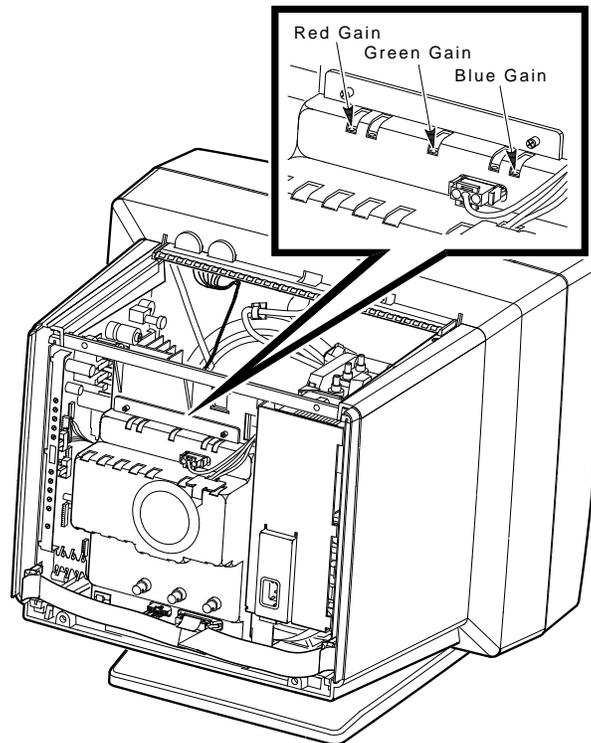
4-12 Aligning the Video Monitor

13. Use the red, green, and blue central rectangle patterns for the gain adjustments.

14. To adjust gain, use the radiance meter (Section 4.3). Adjust the gain controls (Figure 4-9) for the following values:

Red screen	R.GAIN	.095
Green screen	G.GAIN	.120
Blue screen	B.GAIN	.110

To verify that the color adjustments are correct, display the 4-bar or 8-bar color pattern (Appendix A) from the host. Turn the contrast down slowly. All colors should fade equally. If one or more colors seem to dominate, repeat steps 1-13 with attention to the sensitive adjustments in steps 5, 9, 10, and 11.

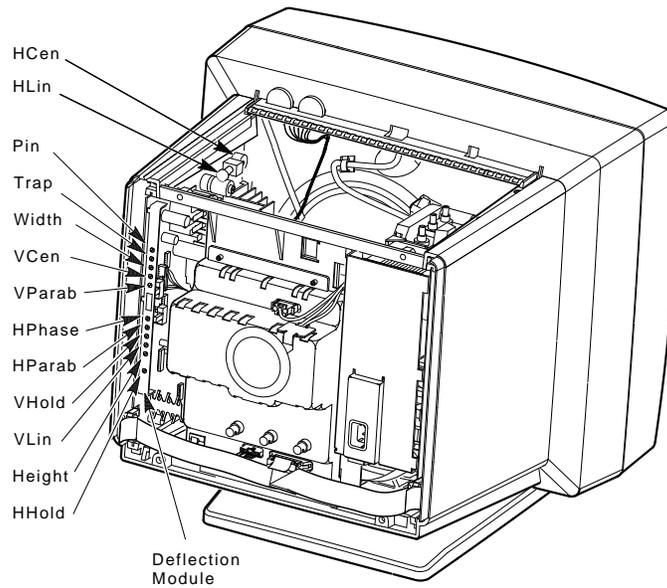


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Figure 4-9 Blue, Green, and Red Gain Controls

4.5 Deflection Adjustments

Figure 4-10 shows the location of the controls used to make the deflection adjustments. Pull the deflection module out slightly to see the labels on the controls.



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Figure 4-10 Location of Deflection Adjustments

4-14 Aligning the Video Monitor

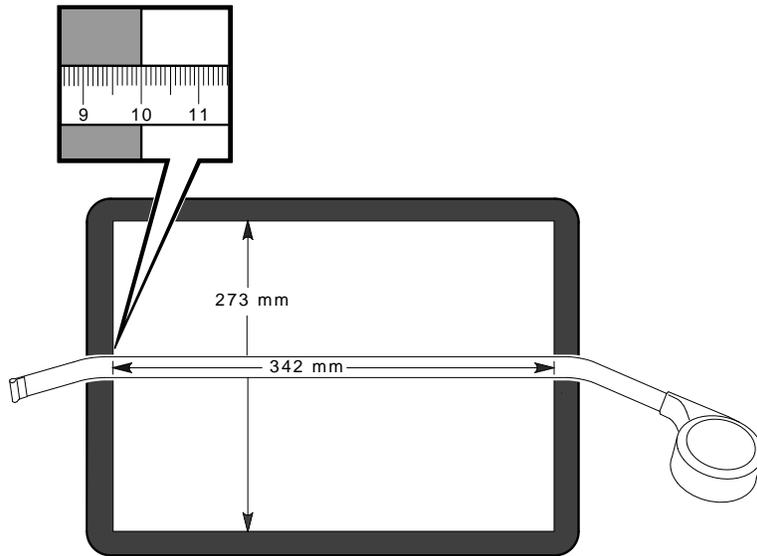
This section covers the following adjustments:

- Vertical linearity (VLIN)
- Vertical centering (VCEN)
- Vertical height (HEIGHT)
- Horizontal linearity (HLIN)
- Horizontal phase (HPHASE)
- Horizontal centering (HCEN)
- Horizontal width (WIDTH)
- Side pincushioning (PIN)
- Trapezoid (TRAP)
- Dynamic focus (FOCUS1, FOCUS2, DYN PHASE, HPARAB, and VPARAB)

For these adjustments, select the circle-crosshatch pattern or the all-white pattern from your host system. Before starting the deflection adjustments, place the horizontal centering and the vertical centering user controls at the mid-point position.

NOTE

In the following steps, use a metric measuring tape (PN 29-25342) to measure the dimensions of the screen display. To avoid scratching the screen with the tape's metal clip, start the measurement at 10 cm on the measuring tape. See Figure 4-11.



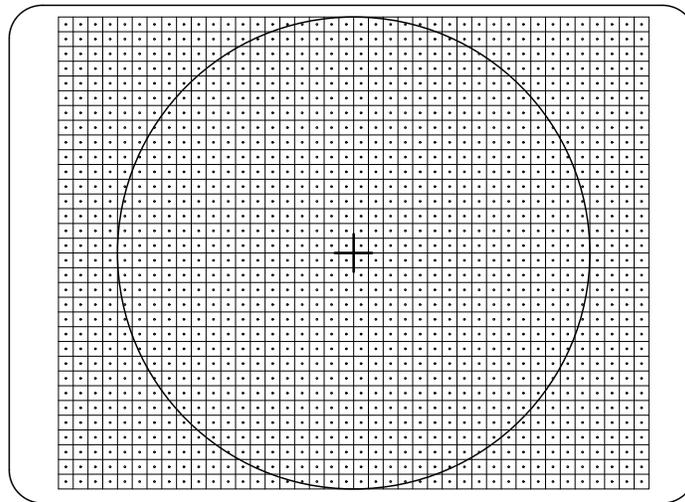
MA-1256-89.DG

Figure 4-11 Using the Metric Measuring Tape

4.5.1 Vertical Linearity (VLIN)

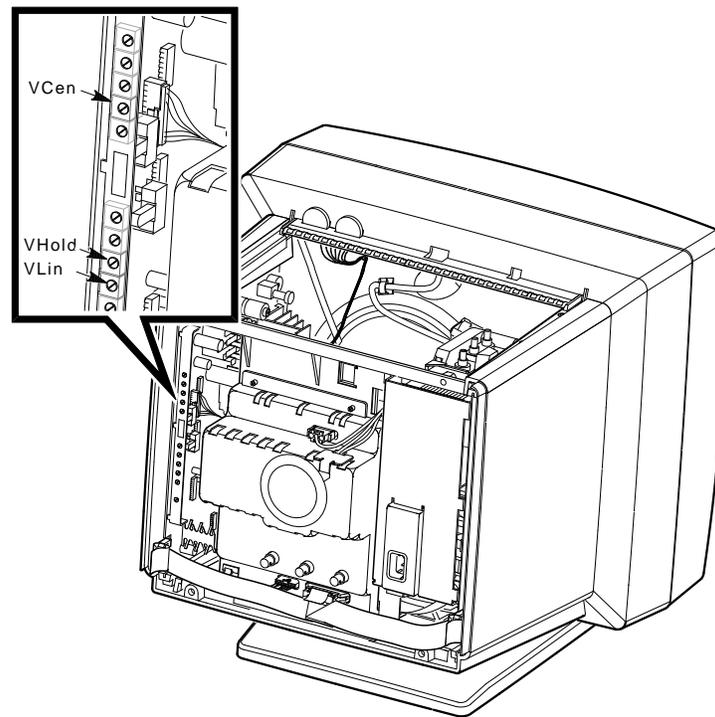
Check and adjust vertical linearity as follows:

1. Verify that the horizontal and vertical centering user controls on the top of the monitor are in the center position of the thumbwheels.
2. Display the circle-crosshatch pattern (Figure 4-12).
3. Check to see if 3 or 4 rows at the top of the screen are of equal height with 3 or 4 rows at the bottom of the screen. If not, go to the next step.
4. Turn the VLIN adjustment (Figure 4-13) until the squares seem to be of equal height on the screen.



MA-X0889-88

Figure 4-12 Circle-Crosshatch Pattern



MA-0246-90.DG

Figure 4-13 VCEN, VHOLD, and VLIN Controls

4.5.2 Vertical Centering (VCEN)

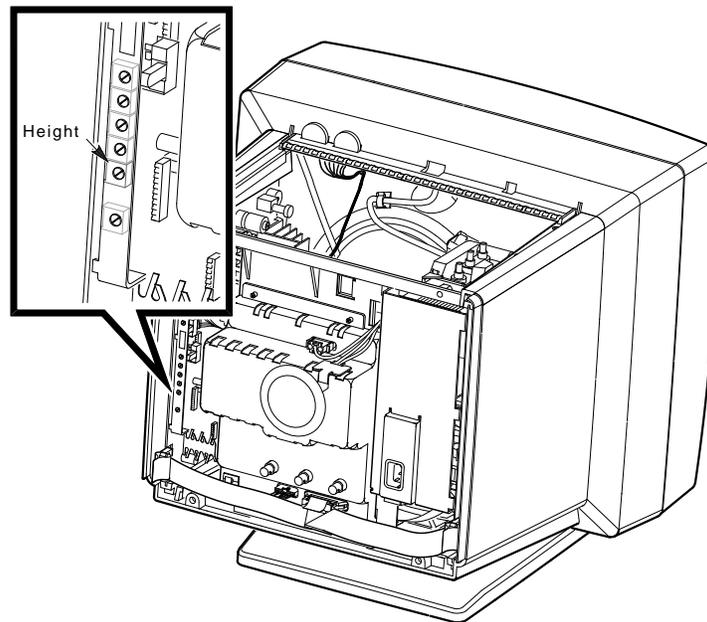
Check and adjust the vertical centering as follows:

1. Verify that the vertical centering user control is at the mid-point position.
2. Display the circle-crosshatch screen.
3. If the screen display appears equally centered between the top and bottom bezel, it is normal. If the display does not appear equally centered, go to the next step.
4. Turn the VCEN control (Figure 4-13) until the display appears equally centered between the top and bottom bezel.

4.5.3 Height (HEIGHT)

Check and adjust the vertical height as follows:

1. Check the circle-crosshatch pattern for a vertical height of 273 mm
2. If necessary, adjust the HEIGHT control (Figure 4-14) until the display height is 273 mm (± 2.0 mm).



MA-1356-89.DG

Figure 4-14 Vertical Height Control

4.5.4 Horizontal Phase, Horizontal Linearity, and Horizontal Centering (HPHASE, HLIN, HCEN)

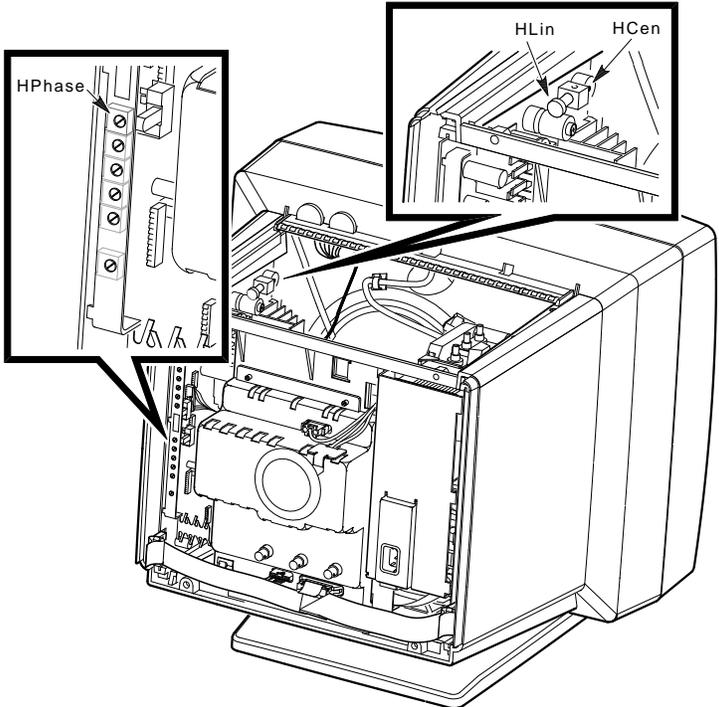
Check and adjust the video display horizontal centering as follows:

NOTE

Refer to the troubleshooting chart in Chapter 2 for solutions to screen display problems.

1. Verify that the user controls at the top of the monitor are at the center position of the thumbwheels.
2. Display the circle-crosshatch pattern.
3. Turn the brightness control until the raster is visible. You may have to decrease the contrast control to see the raster.
4. Check the circle-crosshatch pattern to see if it appears centered on the raster.
5. If necessary, adjust the HPHASE control (Figure 4-15) to center the pattern on the raster.
6. Decrease the brightness just until the raster disappears.
7. Adjust HLIN for maximum width of the circle-crosshatch pattern.
8. Readjust HLIN *slightly* until all the squares are of equal width across the screen.
9. Set contrast to minimum and brightness to maximum.
10. Adjust HCEN (Figure 4-15) until the raster (or active area) is centered within the bezel. (The orientation of HCEN may differ on some units from that shown in Figure 4-15.)
11. If the HCEN adjustment is not sufficient to center the active area, then adjust the HPHASE so that the active area is centered within the bezel.

4-20 Aligning the Video Monitor



MA-1357-89.DG

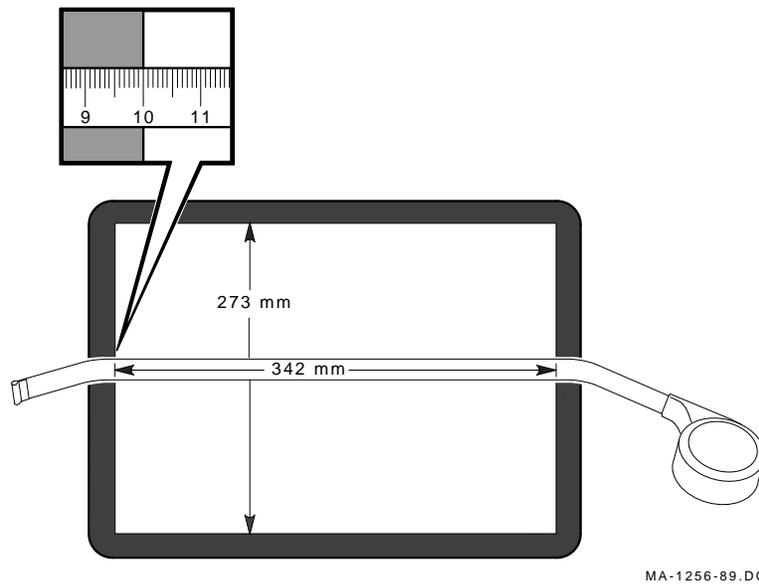
Figure 4-15 HPHASE, HLIN, and HCEN Controls

4.5.5 Horizontal Width (WIDTH)

Check and adjust the horizontal width as follows:

NOTE

In the following steps, use a metric measuring tape (PN 29-25342) to measure the dimensions of the screen display. To avoid scratching the screen with the tape's metal clip, start the measurement at 10 cm on the measuring tape (Figure 4-16).

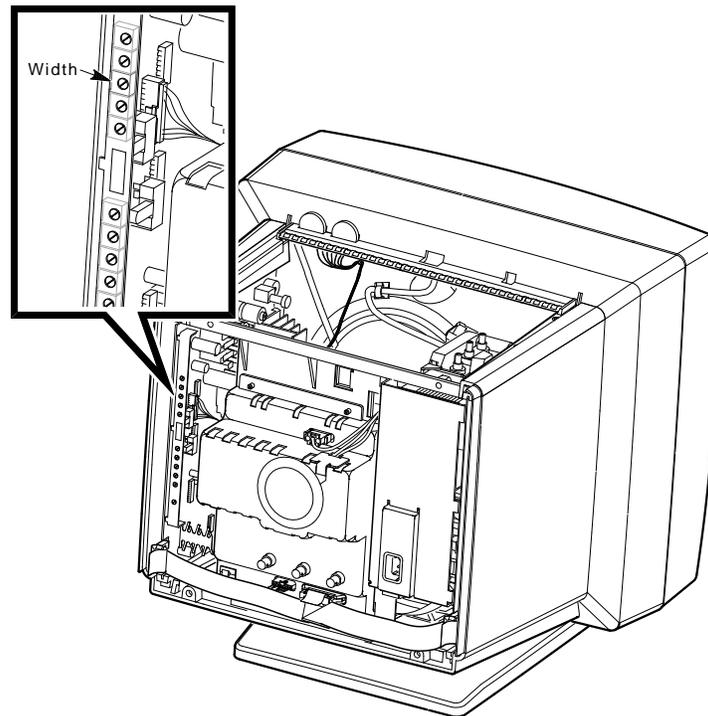


MA-1256-89.DG

Figure 4-16 Measuring the Width of the Viewing Area

4-22 Aligning the Video Monitor

1. Check the circle-crosshatch pattern for a width of 342 mm (± 2.0 mm).
2. If necessary, adjust the WIDTH control (Figure 4-17) until the display width is 342 mm (± 2.0 mm).

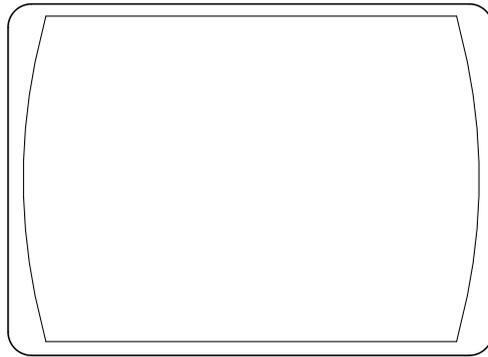


MA-1358-89.DG

Figure 4-17 Horizontal Width Control

4.5.20 Side Pincushioning (PIN)

When the sides of a video display bow, the effect is known as pincushioning or barreling, depending on whether the sides bow in or out. See Figure 4-18 and Figure 4-19.



MA-X0925-88

Figure 4-18 Video Area on Screen Bowed Out



MA-X0673-88

Figure 4-19 Video Area on Screen Bowed In

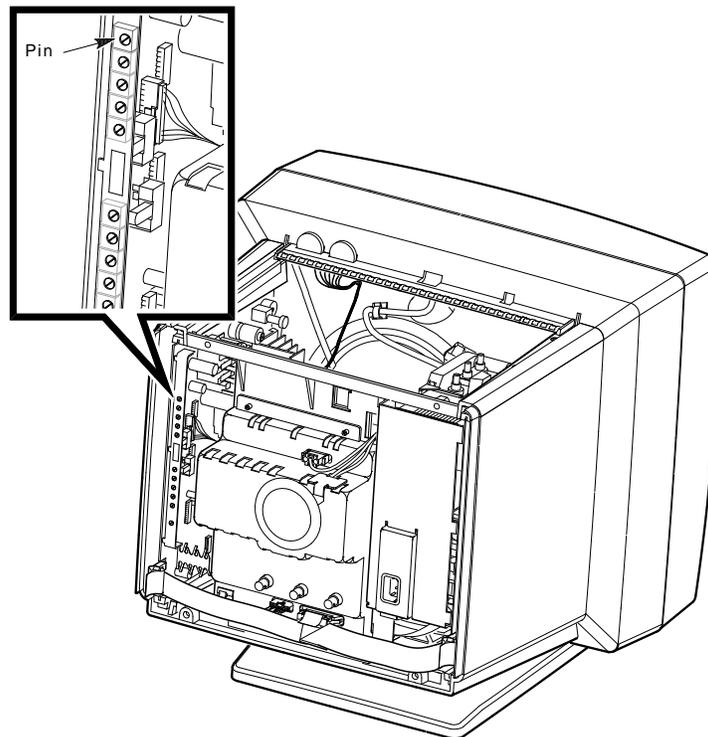
4-24 Aligning the Video Monitor

Check and adjust side pincushioning as follows:

1. Display the circle-crosshatch pattern.
2. Adjust the PIN control (Figure 4-20) until the sides of the display are straight.

NOTE

Adjusting the PIN control may affect the width adjustment. Recheck the display for correct width (Section 4.5.5).



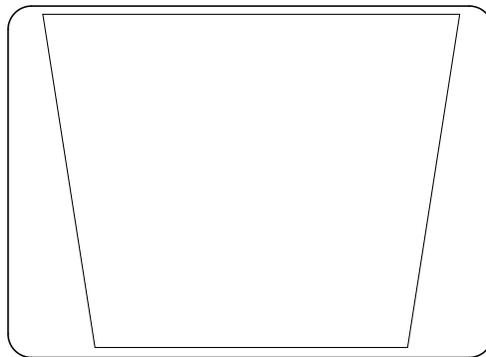
MA-1029-89.DG

Figure 4-20 Pincushion Adjustment (PIN)

4.5.7 Trapezoid (TRAP)

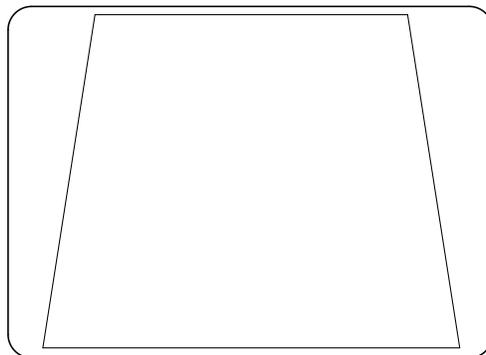
Check and adjust the screen display as follows:

1. Display the circle-crosshatch screen.
2. Be sure the screen does not form a trapezoid (Figure 4-21) or (Figure 4-22).



MA-X0927-88

Figure 4-21 Screen Wider at Top

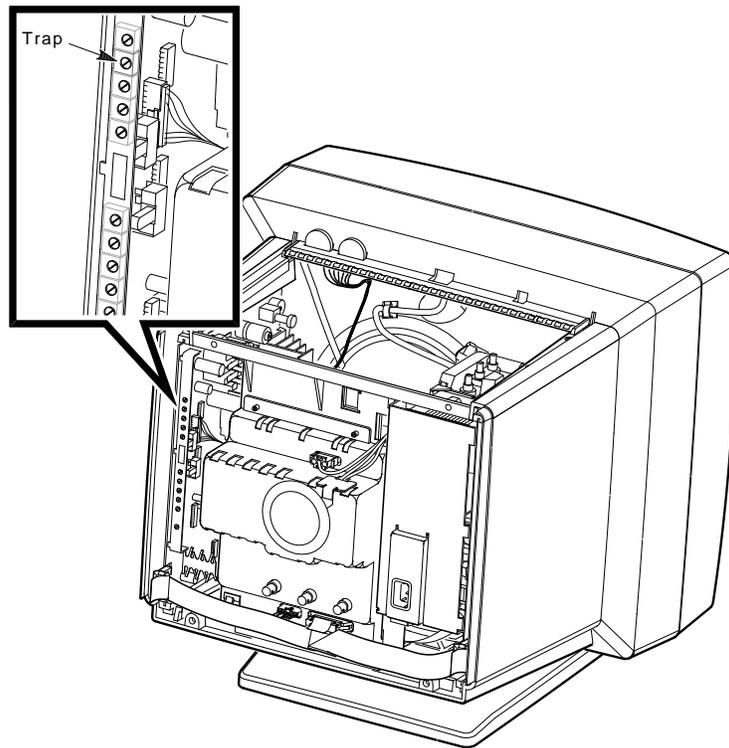


MA-X0928-88

Figure 4-22 Screen Wider at Bottom

4-26 Aligning the Video Monitor

3. Adjust the TRAP control (Figure 4-23) so that the top and bottom of the screen display (on the same side) are the same distance from the bezel edge.

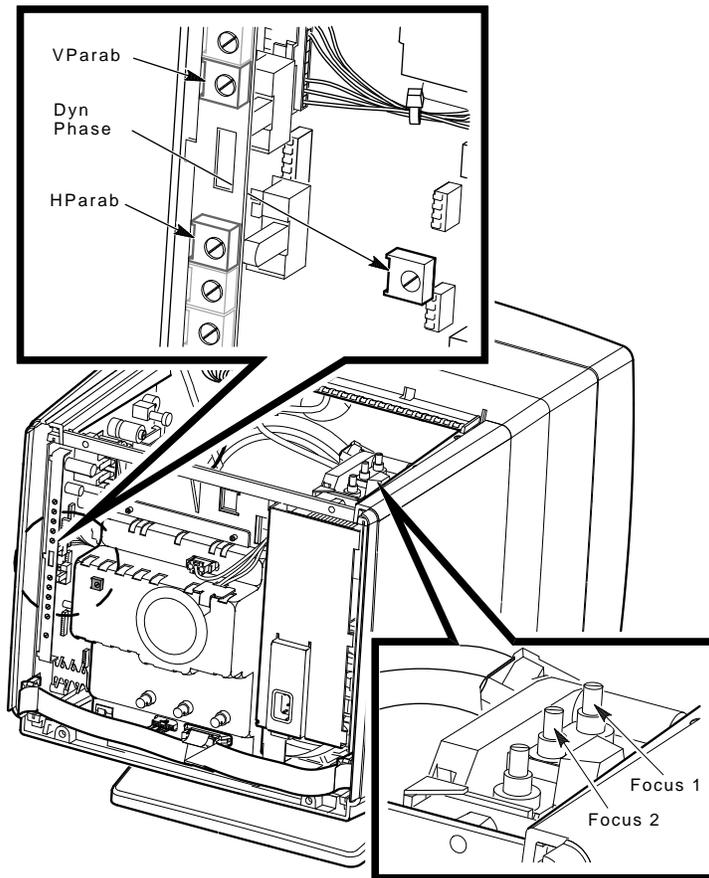


MA-1048-89.DG

Figure 4-23 Trapezoid Adjustment (TRAP)

4.5.8 Focus (FOCUS1, FOCUS2, DYN PHASE, HPARAB, VPARAB)

Figure 4-24 shows the locations of the focus adjustment controls on the power supply and the deflection module.



MA-1050-89.DG

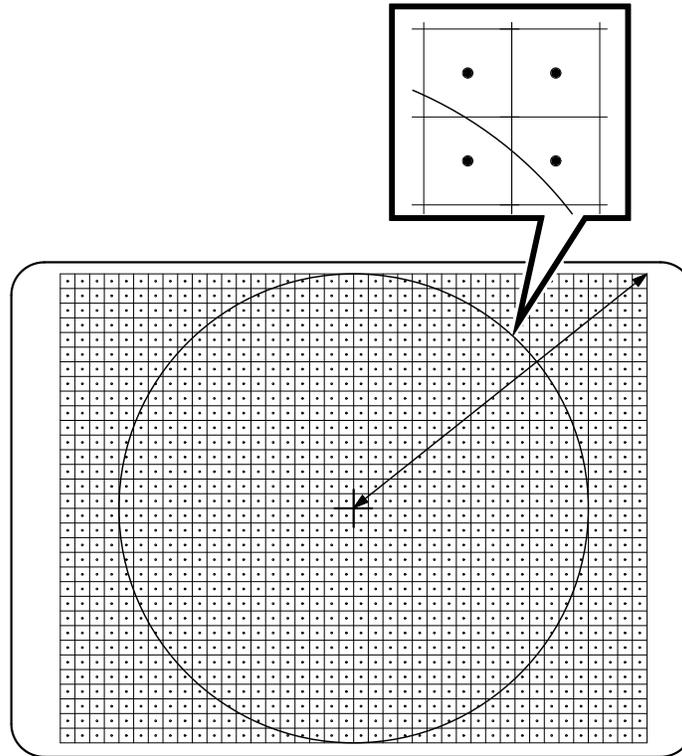
Figure 4-24 Focus Adjustment Controls

Preparation

NOTE

Make sure the screen is clean. A dirty screen can distort a focused display. Use a soft tissue or cloth and a non-abrasive, non-flammable glass cleaner, or use Digital's video screen cleaner (PN VT3XX-SC).

1. Perform the color adjustments (Section 4.4).
2. Display the circle-crosshatch screen (Figure 4-25).



MA-X0891-88

Figure 4-25 Circle-Crosshatch Screen

Dynamic Focus

Check and adjust the focus as follows:

1. Choose an intersection on the crosshatch pattern that is halfway between the center and the top right corner of the screen display (Figure 4-25).
2. Examine the intersecting lines for sharpness.
3. If necessary, alternating between the controls, adjust the FOCUS2 control (Figure 4-24) for the sharpest vertical line and adjust the FOCUS1 control for the sharpest horizontal line.
4. Examine the screen for sharpness of the entire display. If the display is satisfactory, the focus adjustment is complete.

NOTE

If the display is not satisfactory (screen center and corners are not sharp), proceed to the next steps.

5. Adjust the vertical dynamic focus (VPARAB) (Figure 4-24) until the top middle and bottom middle are sharp.
6. Adjust the horizontal dynamic focus (HPARAB) until the corners are sharp.
7. Repeat this procedure from step 1. If necessary, continue with the dynamic phase adjustment.

Dynamic Phase

1. Examine the screen for sharpness.
2. If the right or left edge is not in focus, while the opposite edge is in focus, adjust dynamic phase (DYN PHASE) until both edges are in focus.
3. Repeat this procedure from the Dynamic Focus adjustment.

5

Changing Refresh Rates

This chapter describes how to change the monitor refresh rate.

5.1 Refresh Rates of VR320 Monitors

Table 5–1 lists the different VR320 models and their refresh rates.

Table 5–1 Refresh Rates of Monitor Models

Model	Pixels x Lines	Refresh Rate	Applicable Area
VR320-CA	1280 x 1024	66 Hz	Northern Hemisphere
VR320-C4	1280 x 1024	66 Hz	Southern Hemisphere
VR320-DA	1280 x 1024	72 Hz	Northern Hemisphere
VR320-D4	1280 x 1024	72 Hz	Southern Hemisphere

5.2 Changing the Refresh Rate

If you change the monitor refresh rate to meet the needs of a different system from the one ordered, use the following procedure:

1. Change the refresh switch on the deflection module (Figure 3–12).
2. Change the refresh jumper on the power supply module (Figure 3–24).
3. If necessary, adjust the VHOLD, VLIN and VCEN controls until the display height is 273 mm (Figure 4–13).
4. If necessary, adjust the HEIGHT (Section 4.5.3), HPHASE, HLIN, and HCEN controls (Section 4.5.4).
5. If necessary, adjust the WIDTH (Section 4.5.5), PIN (Figure 4–20), and TRAP (Section 4.5.7) controls.
6. If necessary, adjust the focus (Section 4.5.8).

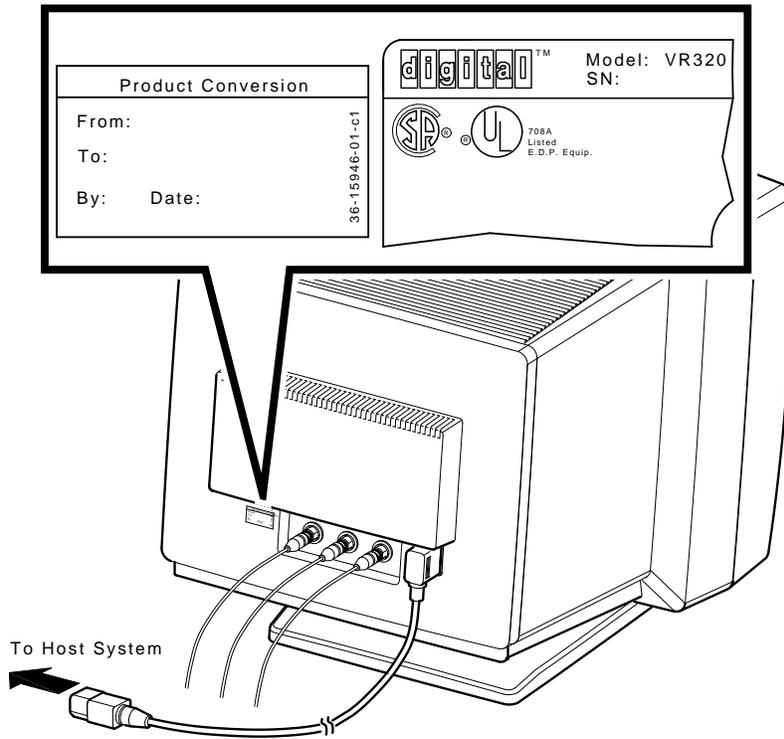
5.3 Product Variation Label

After you changing the refresh rate and test the system, add the following information to the product variation label:

Table 5-2 Product Variation Label Information

Label Entry	Information
From	The model designation from the original serial tag.
To	The new model designation of the completed product.
By	The character site code for the facility where the conversion was done, as listed in the Digital telephone directory.
Date	The date when the conversion was implemented.

Attach the product variation label to the back of the monitor a shown in Figure 5-1.



MA-0153-90.DG

Figure 5-1 Product Variation Label

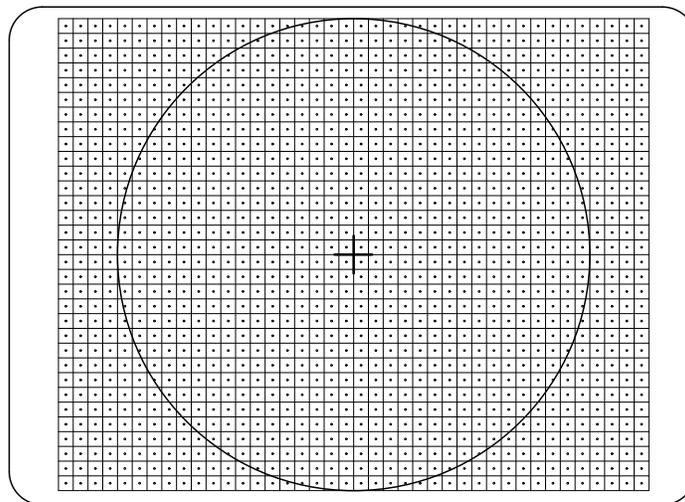
A

Alignment Screens

This appendix describes the screen patterns used to diagnose color and deflection problems, as well as to perform deflection, color checks and adjustments.

A.1 Circle-Crosshatch Pattern

Use the circle-crosshatch pattern (Figure A-1) for all alignment tests. Use this pattern as a reference for customers who work primarily with graphic applications.



MA-X0889-88

Figure A-1 Circle-Crosshatch Pattern

A.2 All-White Pattern

Use the all-white pattern (Figure A-2) to check for the correct setting of the horizontal and vertical controls.

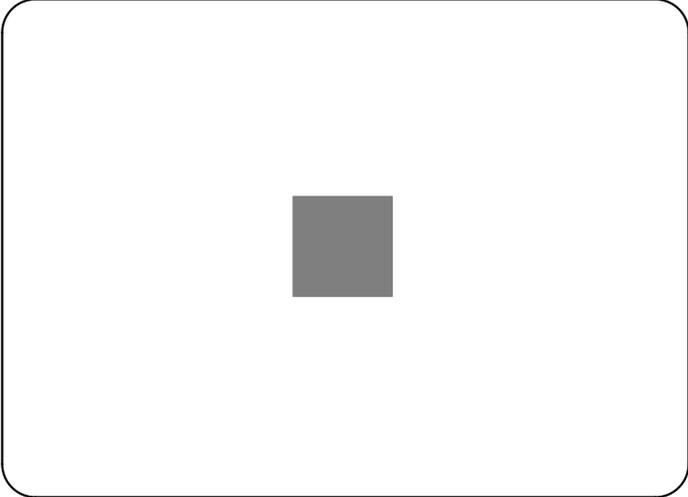


MA-1254-89.DG

Figure A-2 All-White Pattern

A.3 Central Rectangle Pattern

Use the red, green, and blue central rectangle pattern (Figure A-3) when performing the gain adjustments.

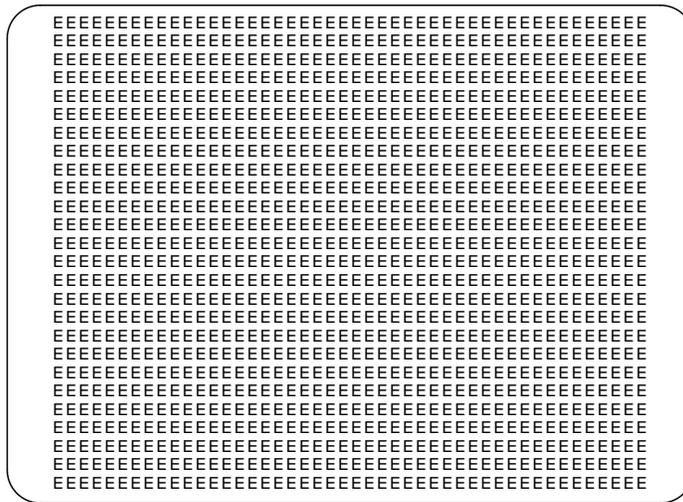


MA-X0928-88

Figure A-3 Central Rectangle Pattern

A.4 All Es Pattern

Use the screen of Es (Figure A-4) as a secondary reference for customers who work primarily with text.



MA-X0938-88

Figure A-4 All Es Pattern

A.5 Color Bars I Pattern

Use this 4-bar color pattern (Figure A-5) to check for the presence of all colors, and to check if the colors are in the correct order.

BLUE	RED	GREEN	WHITE
------	-----	-------	-------

MA-X0935-88

Figure A-5 Color Bars I Pattern

A.6 Color Bars II Pattern

Use this 8-bar color pattern (Figure A-6) to check for the presence of all colors, and to check if the colors are in the correct order.

BLACK	BLUE	RED	MAGENTA	GREEN	CYAN	YELLOW	WHITE
-------	------	-----	---------	-------	------	--------	-------

MA-X0936-88

Figure A-6 Color Bars II Pattern

B

VR320 Documentation

The following additional VR320 documents can be ordered from Digital. Some of the documents are available in several languages. Please contact your sales representative for availability and more information.

Installing and Using the VR320 Color Monitor
EK-VR320-IN

This guide provides users with the information needed to install, operate and maintain the VR320 monitor. The manual also describes all controls and indicators.

VR320 Color Monitor IPB
EK-VR320-IP

This document provides a detailed parts breakdown of the VR320 field replaceable units. The document does not contain part numbers for components on the printed circuit modules. However, these components are listed in the *Field Maintenance Print Set*.

VR320 Field Maintenance Print Set
MP-03005-01

This document provides a field maintenance set of electrical and mechanical schematic diagrams for the VR320 color monitor.

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